Great Barrier Reef

Report Card 2012 and 2013

Reef Water Quality Protection Plan

Results

Australian Government

Queensland Government

Management practice

The Management practice targets in the Reef Water Quality Protection Plan 2009 (Reef Plan) were:

- 80 per cent of landholders in agricultural enterprises (sugarcane, horticulture, dairy, cotton and grains) will have adopted improved soil, nutrient and chemical management practices by 2013
- 50 per cent of landholders in the grazing sector will have adopted improved pasture and riparian management practices.

Reef Plan made significant progress towards meeting these targets in 2013 with 49 per cent of sugarcane growers, 59 per cent of horticulture producers, 39 per cent of grain growers, 30 per cent of graziers and 74 per cent of dairy producers adopting improved practices.

When the targets were set in 2009, they were based on the best available evidence and designed to be ambitious. Since then, scientific knowledge and monitoring and modelling information has advanced significantly and the targets have been refined in Reef Plan 2013.

Two different metrics are used to describe farm management improvements. For each industry in each region, the number of landholders that are estimated (i.e. there is reasonable evidence) to have adopted an improved management practice, at some level, are reported. This is expressed as a percentage of the overall population of landholders in that region which has implications when reporting progress. For example, the Fitzroy and Burdekin regions are of similar size and dominated by grazing beef cattle. However, cattle businesses in the Burdekin are generally more extensive and the region is characterised by a relatively low number of large farms.

Below the management *practice* adoption estimate, a graph describes how overall farm management *systems* are changing over time. Farm management *systems* are made up of a complex suite of farm management practices, and achieving a farm management system change will typically involve the adoption of multiple new practices. Paddock to Reef modelling of estimated mean annual pollutant load reductions is based on estimated changes to farm management systems, with off-farm water quality impacts decreasing as management systems progress from D and C towards B and A systems.

Factors affecting agricultural industries in 2012 and 2013

Changing management practice can be a long and complex process that requires new or expanded knowledge and skills, and sometimes significant capital investment. An agricultural business' capacity to afford such an investment is typically closely related to climatic and market forces beyond the landholder's control. Recent challenges for landholders are briefly summarised below.

Sugarcane
Ongoing impacts from Cyclone Yasi in 2011 continued for areas of northern Queensland. Ex-Tropical Cyclone Oswald caused severe crop losses, and ongoing difficulties, in the Burnett Mary region in early 2013.

Production in most areas was significantly less in 2011-2012 due to excessive wet weather, with the exception of the Burdekin region where production was close to average. The sugar price for the 2011 harvest was significantly higher than it had been for several years, somewhat offsetting the lower yields. The situation reversed in the 2012 harvest season with most areas, apart from the Burdekin, recording near average yields. The price received for sugar was lower than the previous harvest, but still favourable.

Horticulture
The 2011-2012 and 2012-2013 years were characterised by a return to more typical production conditions for the majority of producers in most areas. The notable exception was ex-Tropical Cyclone Oswald which severely impacted producers in the Fitzroy and Burnett Mary regions. Avocado producers in the Wet Topics also suffered decreased production due to the impacts of sequential very wet seasons.

Dairy
The period from 2011 to 2013 was very difficult for most dairy producers. Producers have been faced with severe wet season flooding (Cyclone Yasi and ex-Tropical Cyclone Oswald) and extremely dry conditions either side of ex-Tropical Cyclone Oswald in January 2013. This resulted in feed shortages and high animal health costs; at the same time farm gate prices have steadily declined due to heavy discounting of fresh milk prices by major retailers. Since the commencement of Reef Plan 2009, 99 dairy producers have exited the industry, largely due to financial pressure and natural disasters.

Grains
The 2011-2012 year was good for the majority of grain growers. Both summer and winter crop areas and yields were average or better, tempered however by the very poor price received. The 2012-2013 summer season was very favourable in most areas, with average market conditions.

Grazing
Whilst seasonal conditions were very good for many graziers in 2011 and 2012, many other producers also suffered from the impacts of flooding, with ex-Tropical Cyclone Oswald causing severe problems in the Fitzroy and Burnett Mary regions. All regions were negatively affected by low commodity prices in 2011 and 2012. In most of the extensive grazing lands of the Great Barrier Reef catchment, many graziers suffered a feed shortage following a poor wet season in 2012-2013, and the situation is still desperate in most of this area.

Great Barrier Reef-wide

Grazing

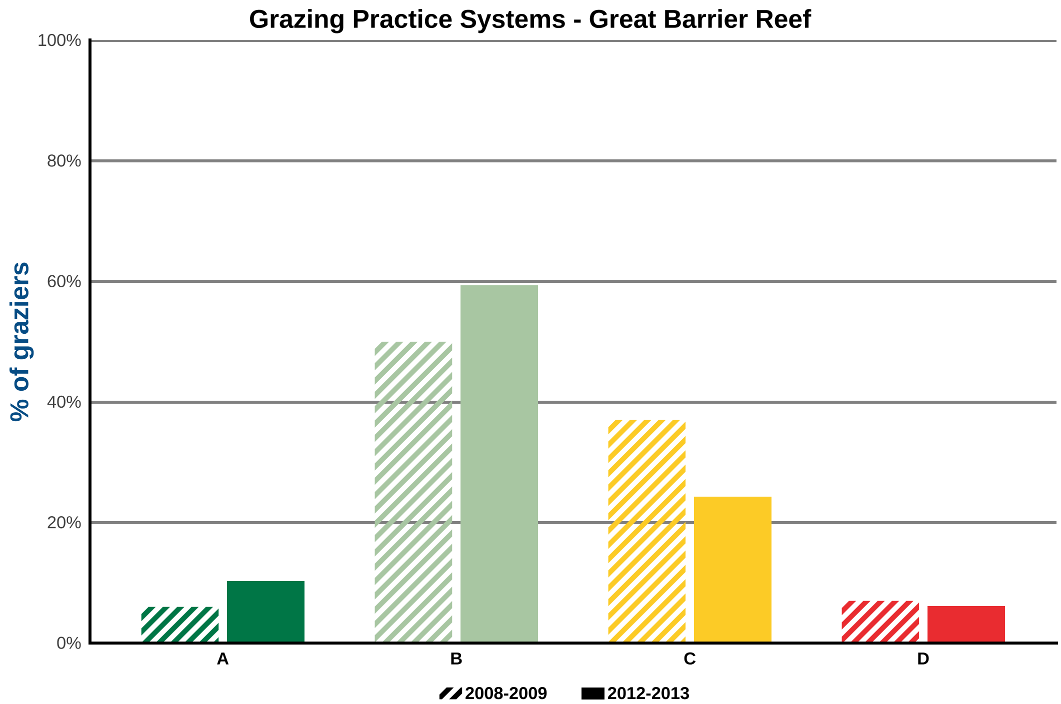
30%

Moderate

Target: 50 per cent by 2013.
From 2009 to 2013, 30 per cent of graziers (2,548) are known to have adopted improved land management practices, up from 24 per cent (2,043) to June 2012. The greatest adoption of improved practices by June 2013 was in the Mackay Whitsunday region (69 per cent).

There are 8,545 graziers managing 322,891 square kilometres of land across the Great Barrier Reef catchment.

By June 2013, 70 per cent of graziers were using (A or B) management systems that are likely to maintain land in good to very good condition or improve land in lesser condition, up from 65 per cent in June 2012.



Major sources of adoption of improved practices during the period from 2008-2009 to 2012-2013 were:

- Regional Natural Resource Management bodies, through the Reef Rescue program, facilitated management system improvements by providing incentives and training to 1,433 grazing businesses.
- Extension services provided by the Queensland Government influenced management practice improvements in at least 448 grazing businesses.
- The Australian Government's FarmReady program has been an important contributor to services in the grazing industry, through subsidising the cost (with a cap) of training provided by registered private consultants and training firms. An estimated 591 graziers adopted improved practices through training directly relevant to Reef Plan objectives with the support of the Australian Government's FarmReady program.

Sugarcane

49%

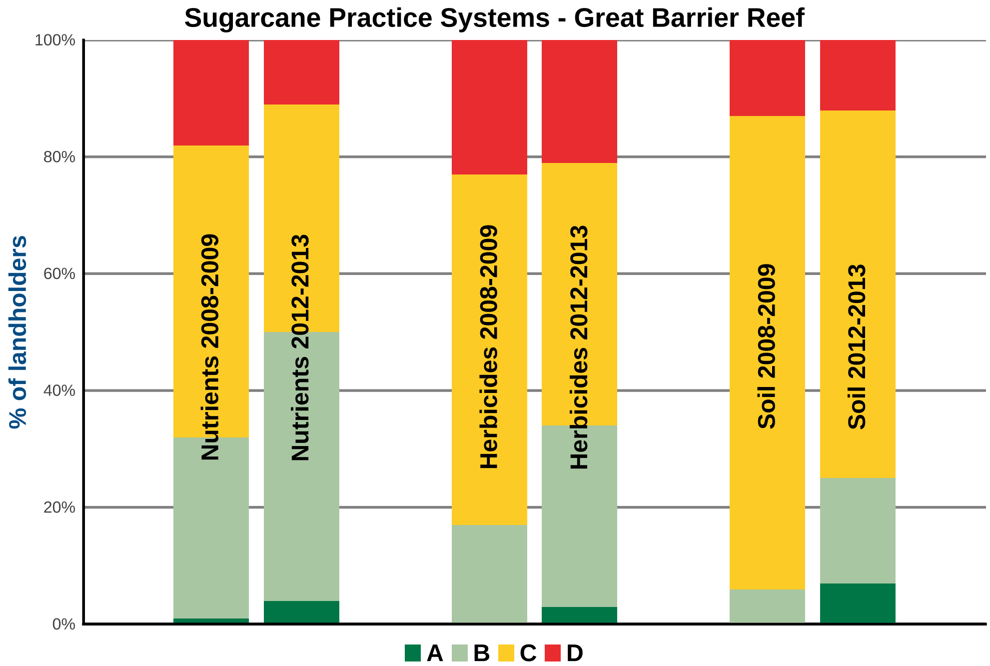
Moderate

Target: 80 per cent by 2013.

From 2009 to 2013, 49 per cent of sugarcane growers (1,857) are known to have adopted improved land management practices, up from 41 per cent (1,559) to June 2012. The greatest adoption of improved practices by June 2013 was in the Burdekin and Burnett Mary regions (55 per cent).

There are 3,777 sugarcane growers managing 4,032 square kilometres of land across the Great Barrier Reef catchment.

By June 2013, cutting-edge (A) or best management (B) practice systems were used by 50 per cent of sugarcane growers for nutrients, 34 per cent for herbicides and 25 per cent for soil. This was up from 47 per cent for nutrients, 31 per cent for herbicides and 22per cent for soil in June 2012.



Major sources of adoption during the period from 2008-2009 to 2012-2013 were:

- Regional Natural Resource Management bodies, through the Reef Rescue program, directly facilitated management system improvements in 1,810 sugarcane growing businesses, and over 185,000 hectares of sugarcane farming land.
- A total of 1,098 businesses improved nutrient management systems through grants and extension funded by the Reef Rescue program.
- A total of 761 businesses improved herbicide management systems.
- A total of 865 sugarcane businesses improved soil management systems.

Horticulture

59%

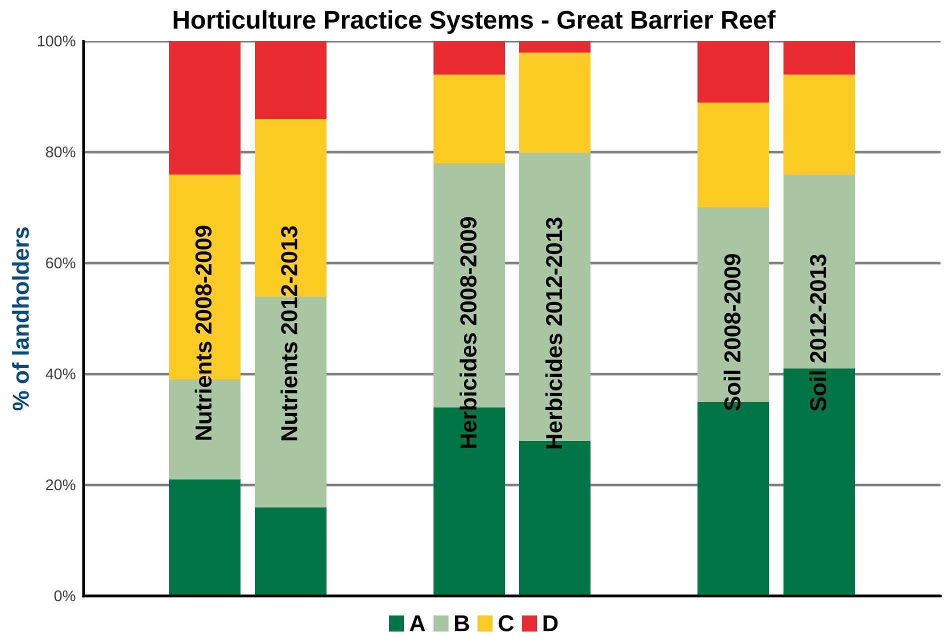
Moderate

Target: 80 per cent by 2013.
From 2009 to 2013, 59 per cent of horticulture producers (568) are known to have adopted improved land management practices, up from 50 per cent (482) to June 2012. The adoption rate varied across regions and ranged from moderate to good.

There are 970 horticulture producers managing 595 square kilometres of land across the Great Barrier Reef catchment.

By June 2013, cutting-edge (A) or best management (B) systems were used by 53 per cent of horticulture producers for nutrients, 80 per cent for herbicides and 76 per cent for soil.

All 568 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 (FMS) program. Of these, 198 completed nutrient management projects, 72 completed herbicide management projects, 144 completed soil management projects and 69 completed irrigation and stormwater runoff projects.



Industry-wide management system adoption is estimated using the proportions established through the Growcom FMS in each region, and expressed as the percentage of growers with A, B, C or D management systems.

It is important to note that the level of grower participation in the program has increased year by year. As the proportion of the grower population represented in the program increases, so the distribution of A, B, C or D management systems changes over time as a reflection of the larger and more representative sample size. Early participants in the program have often been relatively progressive landholders, and this is apparent in terms of relatively high proportions of A and B in the management system distribution in early years. Increasing program participation over time can have the effect of diluting the percentage of growers in the A and B categories over time. This is not to be seen as a regression of farm management systems.

Dairy

74%
Good

Target: 80 per cent by 2013.
From 2009 to 2013, 74 per cent of dairy producers (154) are known to have adopted improved land management practices, up from 59 per cent (123) to June 2012.

There are 207 dairy producers across the Great Barrier Reef catchment, with the vast majority in the Burnett Mary and Wet Tropics regions.

Evidenced drivers of management practice change included:

- 96 producers completed and acted upon Soil and Nutrient Management Plans facilitated by the Queensland Dairyfarmers' Organisation (QDO) Dairying Better n' Better program
- 58 producers completed on-farm projects with the assistance of Reef Rescue Water Quality grants facilitated by Burnett Mary Regional Group (26) and Terrain Natural Resource Management (32)
- 78 producers implemented improved practices as a result of engagement with the Queensland Government's Rural Water Use Efficiency (RWUE) program's On Farm System Assessment initiative. The RWUE program's Financial Assistance Scheme assisted a further 37 producers to adopt improved management practices.

Cape York

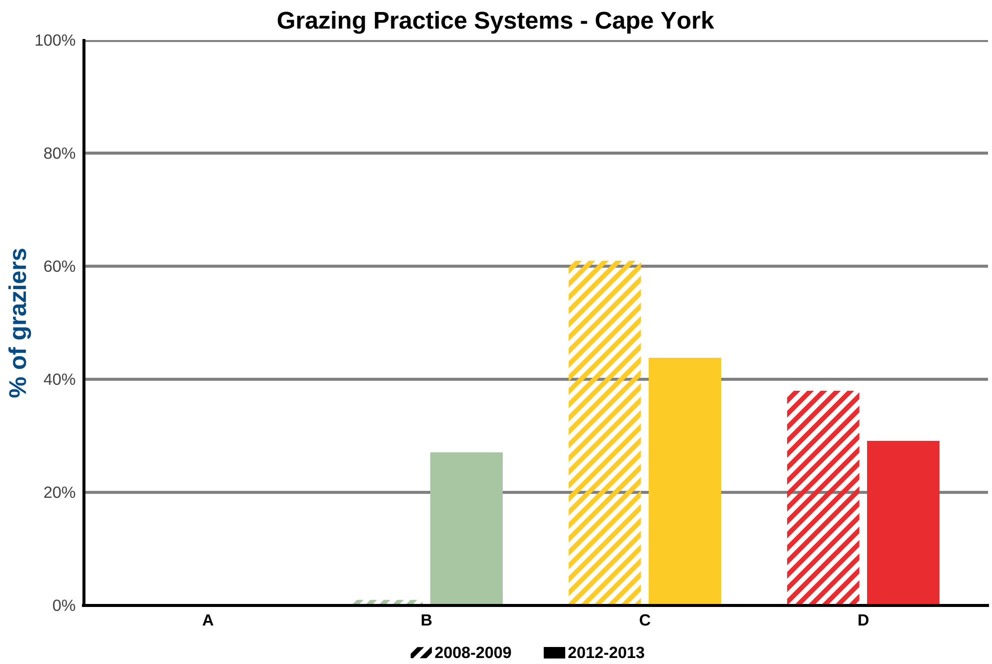
Grazing

48%
Good

Target: 50 per cent by 2013.
From 2009 to 2013, 48 per cent of graziers (23) are known to have adopted improved land management practices, up from 44 per cent (21) to June 2012.

Management practice adoption efforts in the Cape York region have focused upon the Normanby River catchment. There are 48 graziers managing 21,618 square kilometres of land in the Normanby catchment.

By June 2013, 27 per cent of graziers were using B practice systems that are likely to maintain land in good condition or improve land in lesser condition.



All 23 graziers who implemented improved practices were supported by the Reef Rescue program, facilitated by Cape York Sustainable Futures. Of these, 13 graziers completed Savannah Plan training (through the Queensland Government) and 19 graziers implemented fencing and watering improvements to help manage riparian and frontage country, or to manage gullied areas.

Wet Tropics

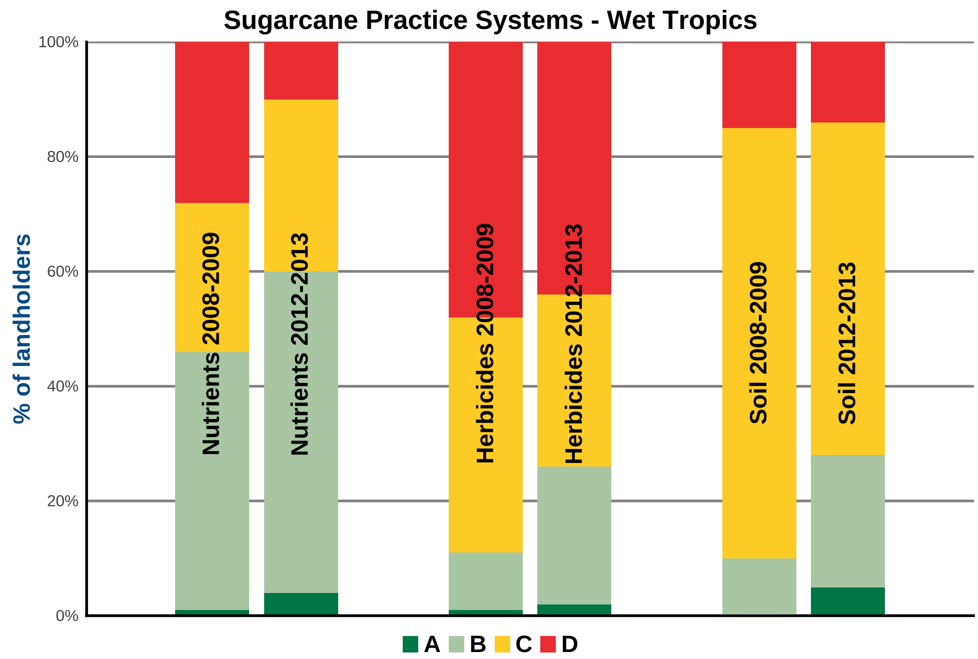
Sugarcane

45%
Moderate

Target: 80 per cent by 2013.
From 2009 to 2013, 45 per cent of sugarcane growers (604) are known to have adopted improved land management practices, up from 39 per cent (523) to June 2012.

There are 1,343 growers managing 1,364 square kilometres of land in the Wet Tropics region.

By June 2013, cutting-edge (A) or best management (B) practice systems were used by 61 per cent of sugarcane growers for nutrients, 26 per cent for herbicides and 27 per cent for soil. This was up from 57 per cent for nutrients, 20 per cent for herbicides and 23 per cent for soil in June 2012.



Of the 604 growers who implemented improved practices, 348 completed Reef Rescue Water Quality Grants projects facilitated by Terrain Natural Resource Management, including:

- 245 growers implemented improved nutrient management practices
- 218 growers implemented improved herbicide management practices
- 246 growers implemented improved soil management practices.

Approximately 212 growers were 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 regulations. A further 44 growers are estimated to have improved management through Queensland Government extension services. The Reef Rescue program improved management practices on over 20,000 hectares of sugarcane farm land in the Wet Tropics region from 2009 to 2013.

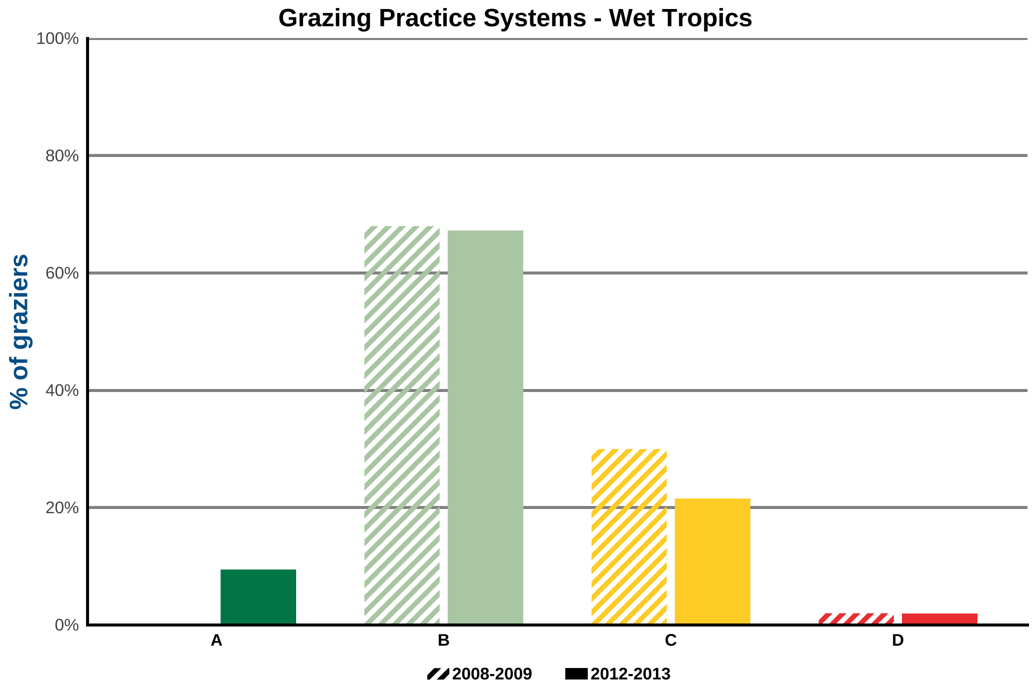
Grazing

23%
Poor

Target: 50 per cent by 2013.
From 2009 to 2013, 23 per cent of graziers (213) are known to have adopted improved land management practices, up from 19 per cent (176) to June 2012. The grazing industry in the Wet Tropics region has not been a high priority area for Reef Plan due to scale and relatively high year-round groundcover levels.

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

By June 2013, 77 per cent 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, up from 73 per cent in June 2012.



A total of 187 graziers who implemented improved practices completed Reef Rescue Water Quality Grants projects facilitated by Terrain Natural Resource Management. The Reef Rescue program directly supported a further 25 graziers to complete relevant capacity building through Queensland Government extension services.

Horticulture

50%

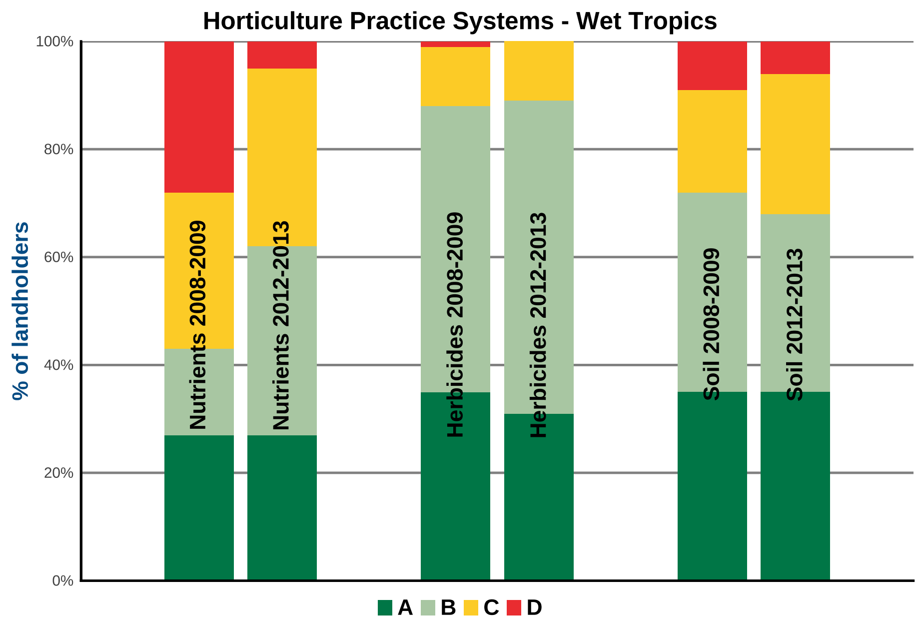
Moderate

Target: 80 per cent by 2013.
From 2009 to 2013, 50 per cent of horticulture producers (164) are known to have adopted improved land management practices, up from 45 per cent (147) to June 2012.

There are 330 horticulture producers managing 198 square kilometres of land in the Wet Tropics region. Bananas are the dominant sector, with 250 growers accounting for nearly 60 per cent of this total area.

By June 2013, cutting-edge (A) or best management (B) systems were used by 62 per cent of horticulture producers for nutrients, 88 per cent for herbicides and 68 per cent for soil.

All 164 horticulture producers who implemented improved land management practices from 2009 to 2013 did so with the support of Reef Rescue Water Quality Grants, facilitated by Terrain Natural Resource Management and the Growcom Farm Management System (FMS) program. Of these, 94 completed nutrient management projects, three completed herbicide management projects and 94 completed soil management projects.



Industry-wide management system adoption is estimated using the proportions established through the Growcom FMS in each region, and expressed as the percentage of growers with A, B, C or D management systems.

It is important to note that the level of grower participation in the program has increased year by year. As the proportion of the grower population represented in the program increases, so the distribution of A, B, C or D management systems changes over time as a reflection of the larger and more representative sample size. Early participants in the program have often been relatively progressive landholders, and this is apparent in terms of relatively high proportions of A and B in the management system distribution in early years. Increasing program participation over time can have the effect of diluting the percentage of growers in the A and B categories over time. This is not to be seen as a regression of farm management systems.

Burdekin

Grazing

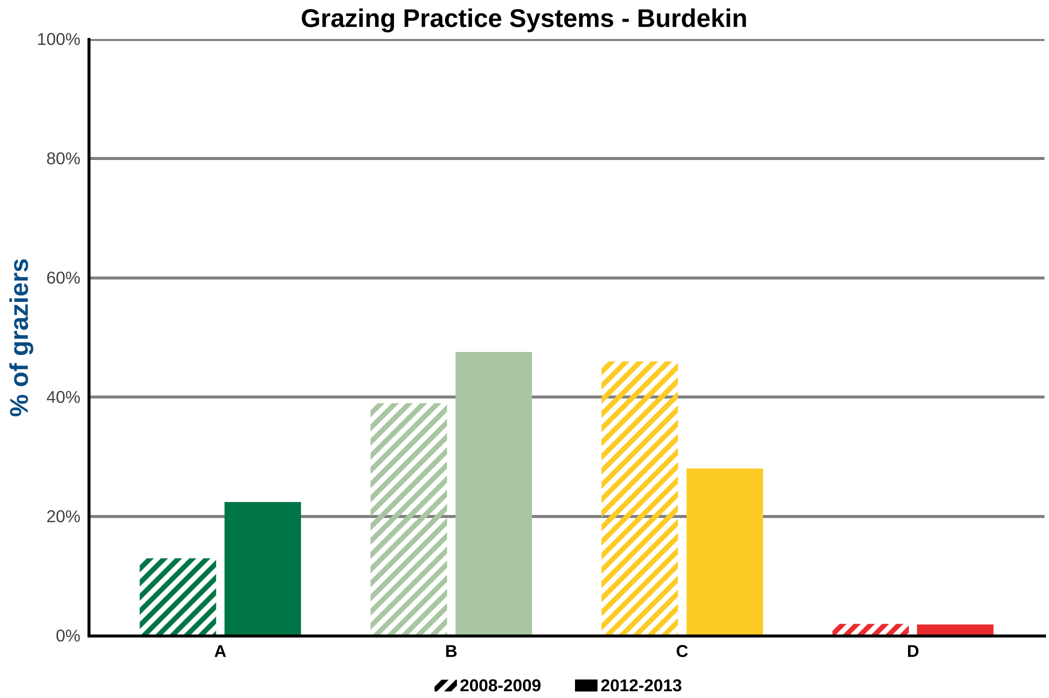
54%

Very Good

Target: 50 per cent by 2013.
From 2009 to June 2013, 54 per cent of graziers (533) are known to have adopted improved land management practices, up from 39 per cent (381) to June 2012. The Burdekin region was one of two regions that exceeded the target.

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

By June 2013, 70 per cent 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, up from 62 per cent in June 2012.



A total of 253 of the graziers who implemented improved practices completed Reef Rescue Water Quality Grants projects facilitated by NQ Dry Tropics. The Australian Government's FarmReady program supported 116 graziers (through provision of relevant training through AgForward and private sector consultants). Queensland Government extension projects resulted in management practice improvements in a further 164 grazing businesses.

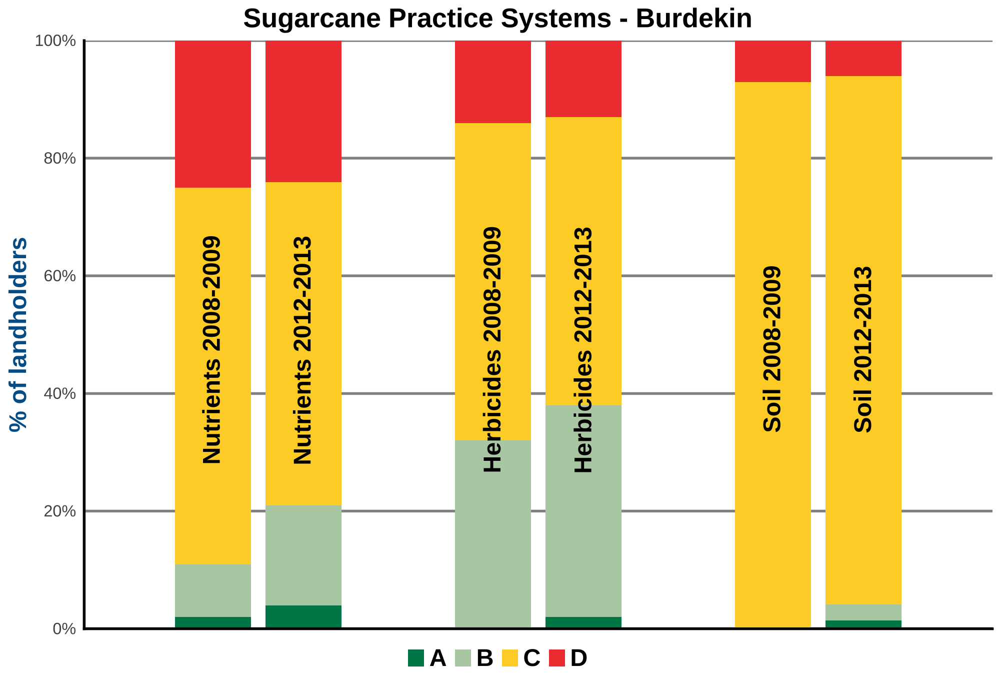
Sugarcane

Target: 80 per cent by 2013.
From 2009 to 2013, 55 per cent of sugarcane growers (306) are known to have adopted improved land management practices, up from 41 per cent (228) to June 2012.

55%
Moderate

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

By June 2013, cutting-edge (A) or best management (B) practice systems were used by 21 per cent of sugarcane growers for nutrients, 38 per cent for herbicides and 4.1 per cent for soil. This was up from 20 per cent for nutrients, 37 per cent for herbicides and 3.6 per cent for soil in June 2012.



The 306 growers who implemented improved practices completed Reef Rescue Water Quality Grants projects facilitated by NQ Dry Tropics. Of these, 166 improved nutrient management, 94 improved herbicide management, 78 improved soil management and 32 improved irrigation management. The Reef Rescue program improved management practices on over 65,000 hectares of sugarcane farm land in the Burdekin region from 2009 to 2013.

Horticulture

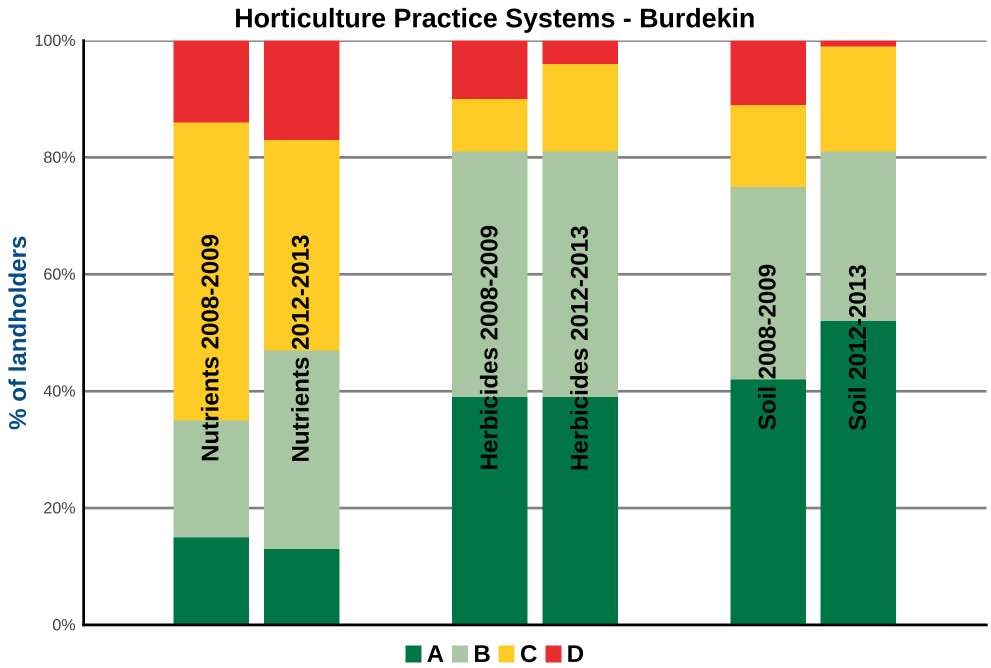
63%
Good

Target: 80 per cent by 2013.
From 2009 to 2013, 63 per cent of horticulture producers (120) are known to have adopted improved land management practices, up from 57 per cent (109) to June 2012.

There are 192 growers managing 135 square kilometres of land in the Burdekin region.

By June 2013, cutting-edge (A) or best management (B) practice systems were used by 47 per cent of horticulture producers for nutrients, 80 per cent for herbicides and 81 per cent for soil. This was up from 45 per cent for nutrients, 80 per cent for herbicides and 77 per cent for soil in June 2012.

All 120 horticulture producers who implemented improved practices did so with the support of Reef Rescue Water Quality Grants, facilitated by NQ Dry Tropics and the Growcom Farm Management System (FMS) program. Of these, 64 completed nutrient management projects, 21 completed herbicide management projects and 26 completed soil management projects.



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Mackay Whitsunday

Sugarcane

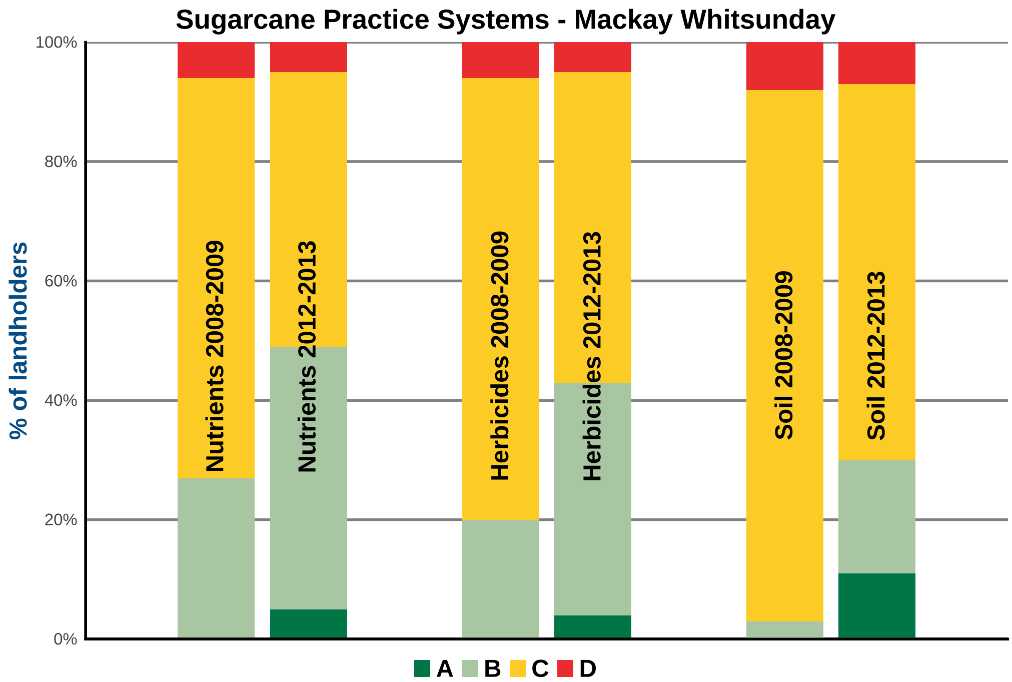
49%

Moderate

Target: 80 per cent by 2013.
From 2009 to 2013, 49 per cent of sugarcane growers (673) are known to have adopted improved land management practices, up from 42 per cent (577) to June 2012.

There are 1,380 growers managing 1,362 square kilometres of land in the Mackay Whitsunday region.

By June 2013, cutting-edge (A) or best management (B) practice systems were used by 49 per cent of sugarcane growers for nutrients, 43 per cent for herbicides and 29 per cent for soil. This was up from 45 per cent for nutrients, 40 per cent for herbicides and 27 per cent for soil in June 2012.



All 673 growers implemented improved practices with the support of Reef Rescue Water Quality Grants facilitated by Reef Catchments. A total of 351 growers completed nutrient management projects, 337 completed herbicide management projects and 408 completed soil management projects. The Reef Rescue program improved management practices on over 81,000 hectares of sugarcane farm land in the Mackay Whitsunday region between 2009 and 2013.

Grazing

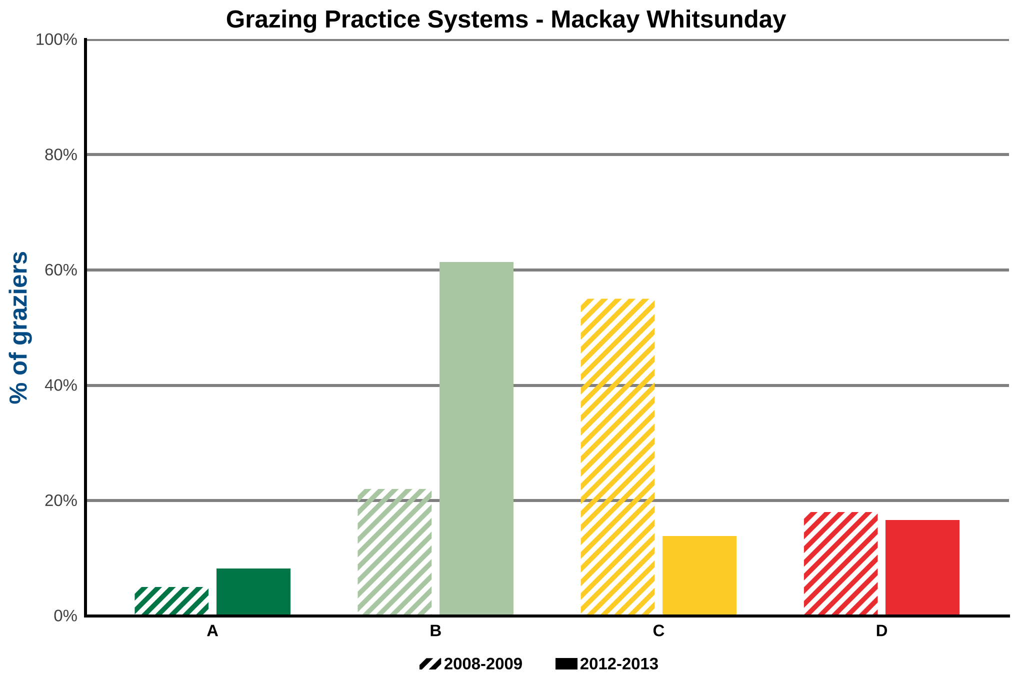
69%

Very Good

Target: 50 per cent by 2013.
From 2009 to 2013, 69 per cent of graziers (287) are known to have adopted improved land management practices, up from 50 per cent (207) to June 2012. The Mackay Whitsunday region was one of two regions to exceed the target.

There are 416 graziers managing 3,038 square kilometres of land in the Mackay Whitsunday region.

By June 2013, 70 per cent 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, up from 62 per cent in June 2012.



A total of 252 of the graziers who implemented improved practices completed Reef Rescue Water Quality Grants projects facilitated by Reef Catchments. The rest completed relevant training through private sector consultants, supported by the FarmReady program.

Horticulture

66%

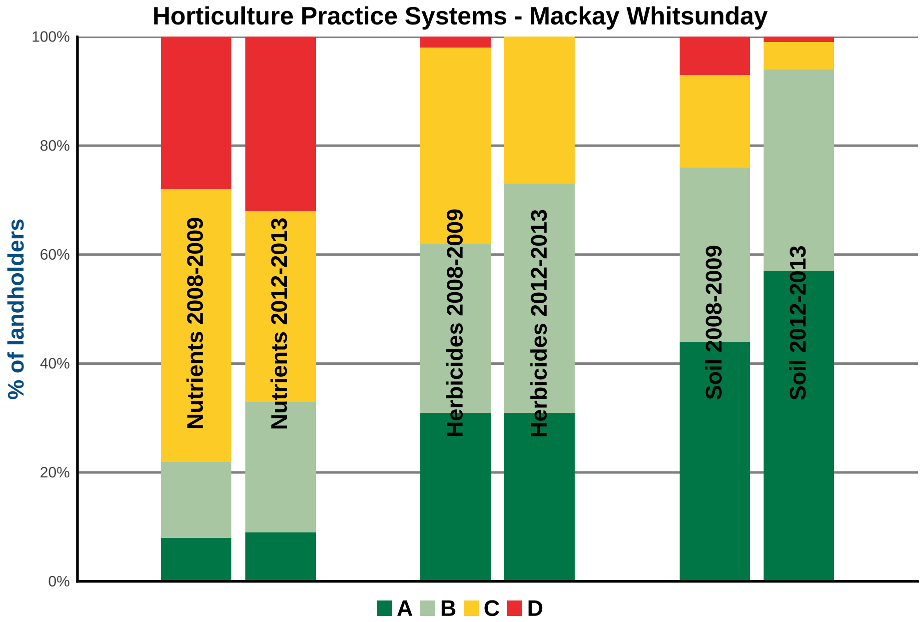
Good

Target: 80 per cent by 2013.
From 2009 to 2013, 66 per cent of horticulture producers (21) are known to have adopted improved land management practices, up from 59 per cent (19) to June 2012.

There are 33 horticulture producers managing 24 square kilometres of land in the Mackay Whitsunday region.

By June 2013, cutting-edge (A) or best management (B) practice systems were used by 32 per cent of horticulture producers for nutrients, 73 per cent for herbicides and 93 per cent for soil. This was up from 30 per cent for nutrients, 71 per cent for herbicides and 92 per cent for soil in June 2012.

All 21 horticulture producers who implemented improved practices did so with the support of Reef Rescue Water Quality Grants, facilitated by Reef Catchments and the Growcom Farm Management System (FMS) program. Of these, nine completed nutrient management projects, six completed herbicide management projects and 13 completed soil management projects.



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Fitzroy

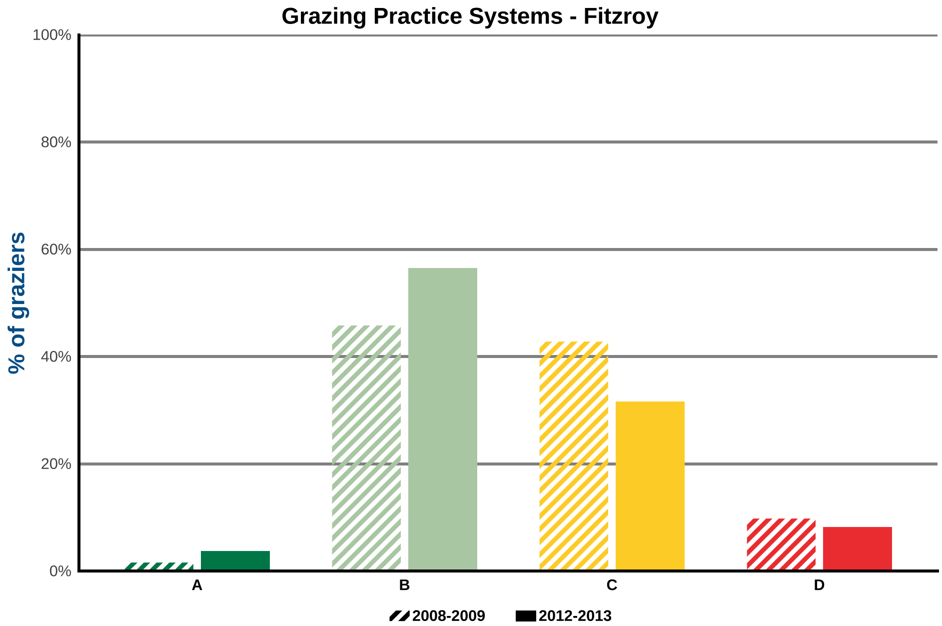
Grazing

28%
Moderate

Target: 50 per cent by 2013.
From 2009 to 2013, 28 per cent of graziers (1,008) are known to have adopted improved land management practices, up from 23 per cent (854) to June 2012.

There are 3,666 graziers managing 126,880 square kilometres of land in the Fitzroy region.

By June 2013, 60 per cent 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, up from 56 per cent in June 2012.



Of the 1,008 graziers who implemented improved practices, 433 completed Reef Rescue Water Quality Grants projects facilitated by the Fitzroy Basin Association. A further 362 graziers completed relevant training through AgForward, private sector consultants (supported by the FarmReady program) and the Queensland Government (supported by the Reef Rescue program). Approximately 137 graziers adopted improved management practices through participation in targeted extension projects implemented by the Queensland Government and the Fitzroy Basin Association.

Horticulture

42%

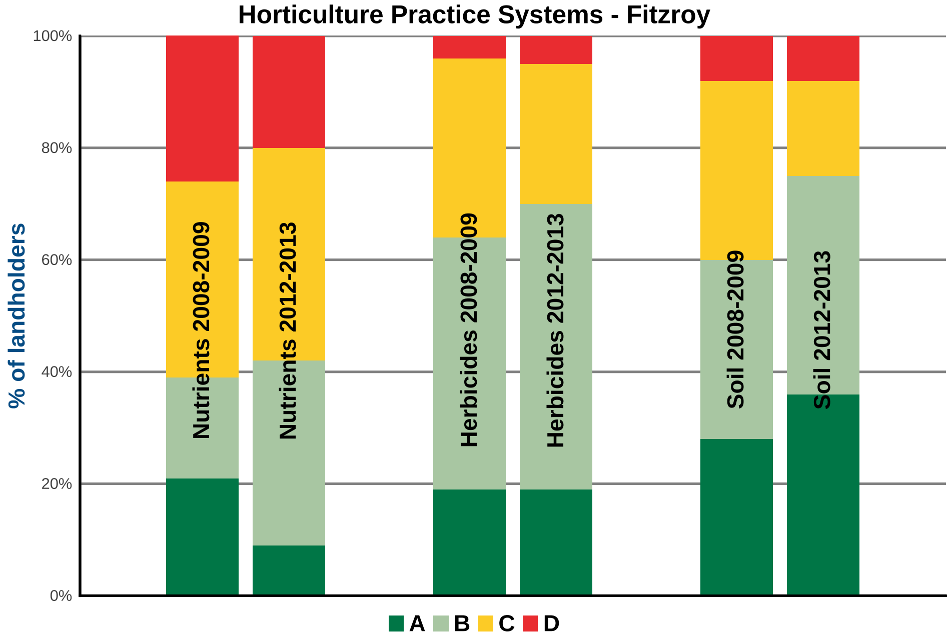
Moderate

Target: 80 per cent by 2013.
From 2009 to 2013, 42 per cent of horticulture producers (44) are known to have adopted improved land management practices, up from 32 per cent (34) to June 2012.

There are 106 horticulture producers managing 76 square kilometres of land in the Fitzroy region.

By June 2013, cutting-edge (A) or best management (B) systems were used by 42 per cent of horticulture producers for nutrients, 69 per cent for herbicides and 75 per cent for soil. This was up from 42 per cent for nutrients, 68 per cent for herbicides and 72 per cent for soil in June 2012.

All 44 producers who implemented improved practices did so with the support of Reef Rescue Water Quality Grants, facilitated by the Fitzroy Basin Association and the Growcom Farm Management System (FMS) program. A total of 19 completed nutrient management projects, 22 completed herbicide management projects and 21 completed soil management projects.



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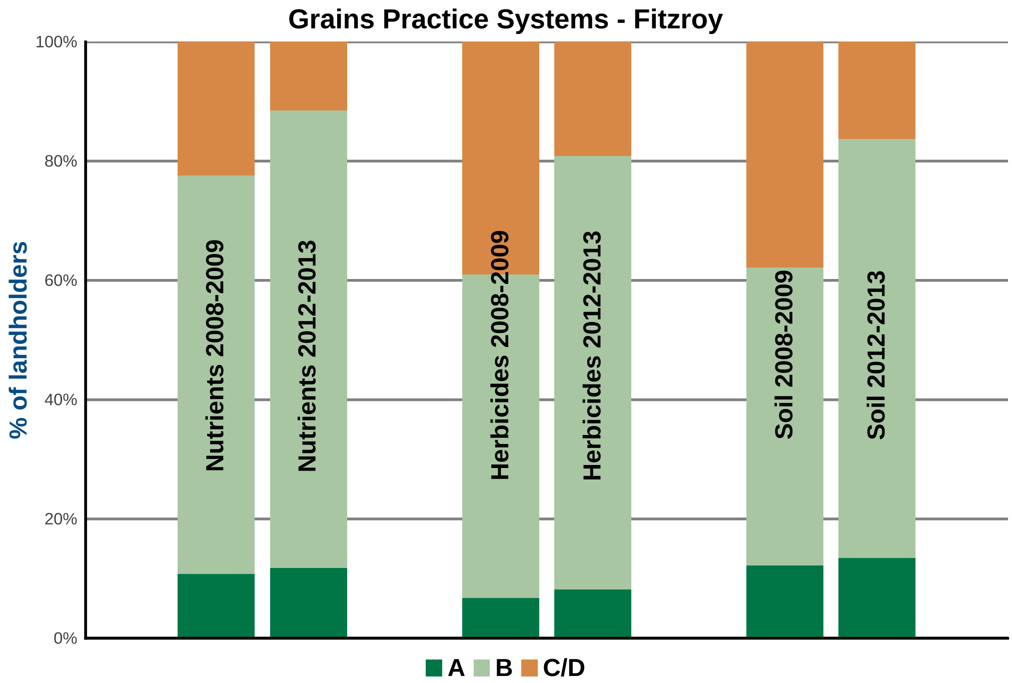
Grains

39%
Poor

Target: 80 per cent by 2013.
From 2009 to 2013, 39 per cent of grain growers (235) are known to have adopted improved land management practices, up from 27 per cent (161) to June 2012. It should be noted the majority of growers in the industry were already at or very close to best practice status at the commencement of Reef Plan 2009.

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

By June 2013, cutting-edge (A) or best management (B) systems were used by 89 per cent of grain growers for nutrients, 81 per cent for herbicides and 84 per cent for soil. This was up from 87 per cent for nutrients, 74 per cent for herbicides and 76 per cent for soil in June 2012.



All 235 growers who implemented improved practices did so with the support of the Reef Rescue program. This included 70 growers who improved nutrient management practices, 130 growers that improved soil management practices and 213 growers who improved herbicide management practices.

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 conservative estimate of improved practices.

Burnett Mary

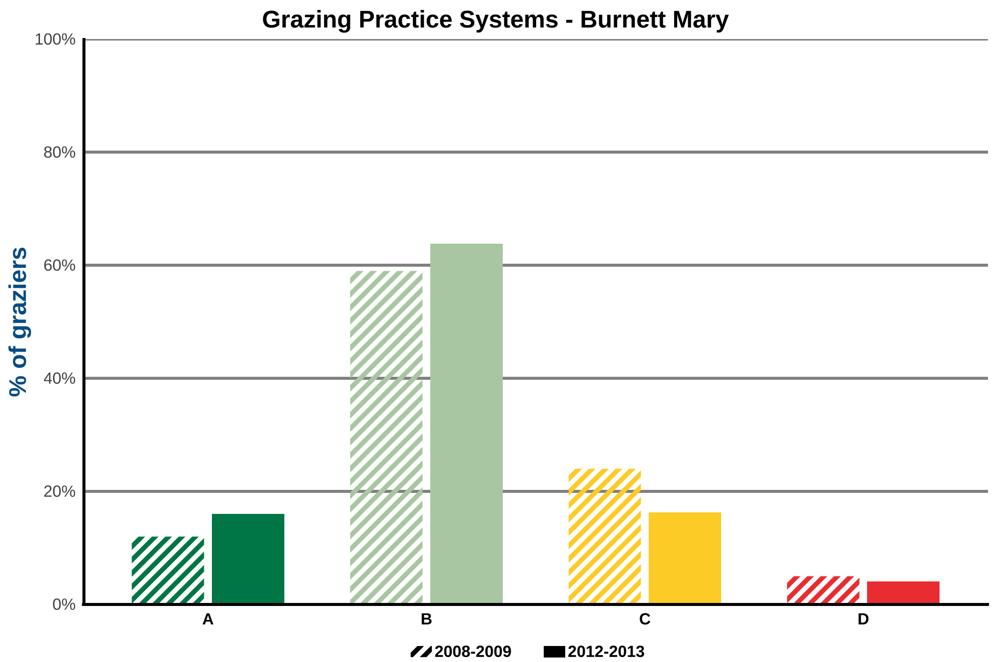
Grazing

19%
Poor

Target: 50 per cent by 2013.
From 2009 to 2013, 19 per cent of graziers (484) are known to have adopted improved land management practices, up from 16 per cent (404) to June 2012.

There are 2,495 graziers managing 28,618 square kilometres of land in the Burnett Mary region.

By June 2013, 80 per cent of graziers were using (A or B) systems that are likely to maintain land in good to very good condition or improve land in lesser condition, up from 77 per cent in June 2012.



Of the 484 graziers who implemented improved practices, 285 completed Reef Rescue Water Quality Grants projects facilitated by the Burnett Catchment Care Association, Mary River Catchment Coordinating Committee, and the Burnett Mary Regional Group. A total of 77 graziers completed relevant training through AgForward, private sector consultants (supported by the FarmReady program) and the Queensland Government. Another 122 graziers adopted improved management practices through participation in targeted extension projects implemented by Burnett Catchment Care Association and the Queensland Government (supported by the Reef Rescue program).

Sugarcane

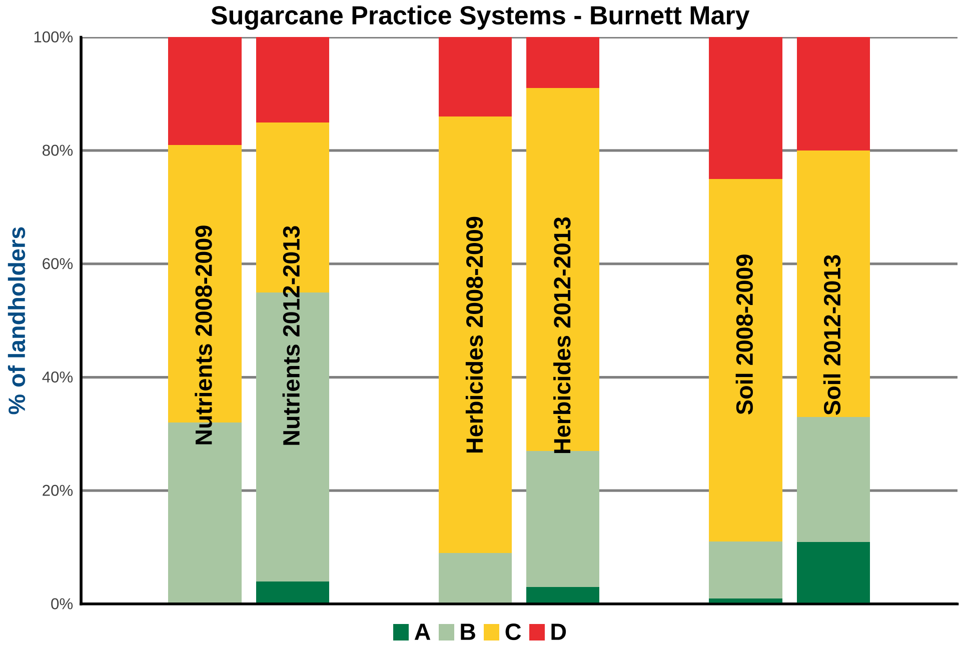
55%

Moderate

Target: 80 per cent by 2013.
From 2009 to 2013, 55 per cent of sugarcane growers (275) are known to have adopted improved land management practices, up from 47 per cent (232) to June 2012.

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

By June 2013, cutting-edge (A) or best management (B) systems were used by 54 per cent of sugarcane growers for nutrients, 28 per cent for herbicides and 32 per cent for soil. This was up from 54 per cent for nutrients, 26 per cent for herbicides and 31 per cent for soil in June 2012.



All 275 growers who implemented improved practices completed Reef Rescue Water Quality Grants projects facilitated by the Burnett Mary Regional Group. Of these, 112 improved nutrient management practices, 102 improved herbicide management practices and 111 improved soil management practices. The Reef Rescue Program directly improved management practices on 18,000 hectares of sugarcane farm land in the Burnett Mary region between 2009 and 2013.

Horticulture

50%

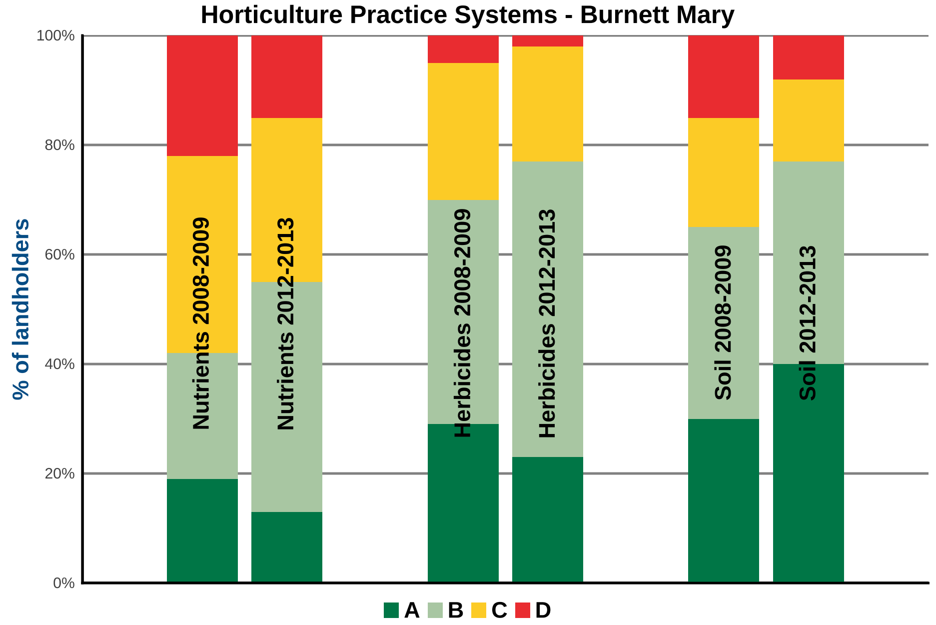
Moderate

Target: 80 per cent by 2013.
From 2009 to 2013, 55 per cent of sugarcane growers (275) are known to have adopted improved land management practices, up from 47 per cent (232) to June 2012.

There are 280 horticulture producers managing 160 square kilometres of land in the Burnett Mary region.

By June 2013, cutting-edge (A) or best management (B) systems were used by 55 per cent of horticulture producers for nutrients, 76 per cent for herbicides and 76 per cent for soil. This was up from 54 per cent for nutrients, 75 per cent for herbicides and 76 per cent for soil in June 2012.

All 140 horticulture producers who implemented improved practices did so with the support of Reef Rescue Water Quality Grants, facilitated by the Burnett Mary Regional Group and the Growcom Farm Management System (FMS) program. Of these, 75 completed nutrient management projects, 44 completed soil management projects and 29 completed herbicide management projects.



Industry-wide management system adoption is estimated using the proportions established through the Growcom FMS in each region, and expressed as the percentage of growers with A, B, C or D management systems.

It is important to note that the level of grower participation in the program has increased year by year. As the proportion of the grower population represented in the program increases, so the distribution of A, B, C or D management systems changes over time as a reflection of the larger and more representative sample size. Early participants in the program have often been relatively progressive landholders, and this is apparent in terms of relatively high proportions of A and B in the management system distribution in early years. Increasing program participation over time can have the effect of diluting the percentage of growers in the A and B categories over time. This is not to be seen as a regression of farm management systems.

Groundcover

The Groundcover target in the Reef Water Quality Protection Plan 2009 (Reef Plan) was:
"A minimum of 50 per cent late dry season groundcover on dry tropical grazing land by 2013."

The groundcover target was consistently exceeded throughout the five years of Reef Plan 2009 with mean groundcover levels for the Great Barrier Reef catchment area above 80 per cent in all years. Annual rainfall was consistently above average during this time which contributed significantly to the growth and maintenance of groundcover on grazing lands.

Great Barrier Reef-wide

84%

Very good

Target: 50 per cent by 2013.
Late dry season mean groundcover across grazing lands was high (86 per cent by June 2012 and 84 per cent by June 2013), well above the Reef Plan target of 50 per cent, mostly due to high rainfall over recent years. The 26-year mean groundcover was 78 per cent.

It is important to note that averaging groundcover across whole catchments can mask localised areas of lower cover, particularly in large catchments with a strong rainfall gradient (e.g. Burdekin or Fitzroy). Mean groundcover is, therefore, indicative of general levels of cover within the reporting catchment. It is important to consider the spatial distribution of cover when accounting for its impact on sediment generation. Future reporting will focus on improved ways of representing spatial and temporal variability in groundcover.

Recent studies have shown that subsurface processes such as gullying and streambank erosion contribute large proportions of the sediment measured in the reef's receiving waters. However, maintaining groundcover is still extremely important for reducing hillslope erosion, slowing runoff and increasing infiltration and water storage in the catchment areas of gullies and streambanks.

All reporting regions had mean groundcover levels well above the target in 2012 and 2013. These ranged from a low of 82 per cent in the Burdekin to a high of 94 per cent in the Wet Tropics by June 2013.

Groundcover results for the Great Barrier Reef catchment and regions

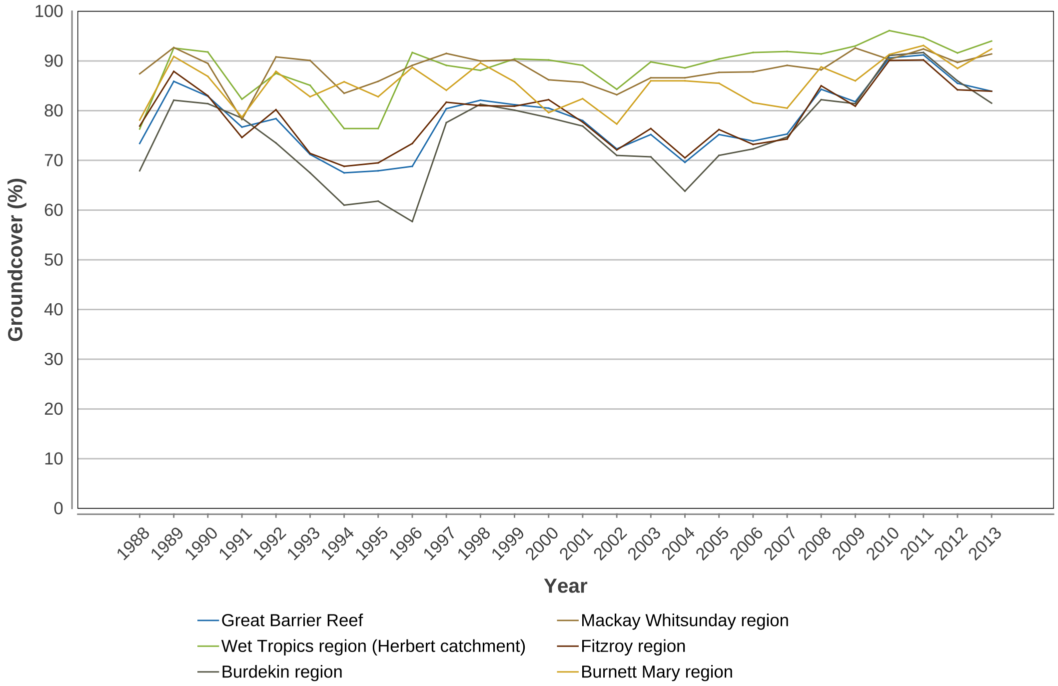
Region	26-year mean groundcover (%)	2012 mean groundcover (%)	2013 mean groundcover (%)	Area with less than 50% groundcover averaged over past 26 years (%)	Area with less than 50% groundcover in 2012 (%)	Area with less than 50% groundcover in 2013 (%)
Wet Tropics – Herbert catchment only	89	92	94	0.9	0.3	0.2
Mackay Whitsunday	88	90	91	1.2	0.6	1.1
Burdekin	76	86	82	7.9	0.4	1.1
Fitzroy	79	84	84	3.3	0.5	0.7
Burnett Mary	85	89	92	0.9	0.3	0.2
Total Great Barrier Reef	78	86	84	4.9	0.4	0.8

Groundcover changes over time

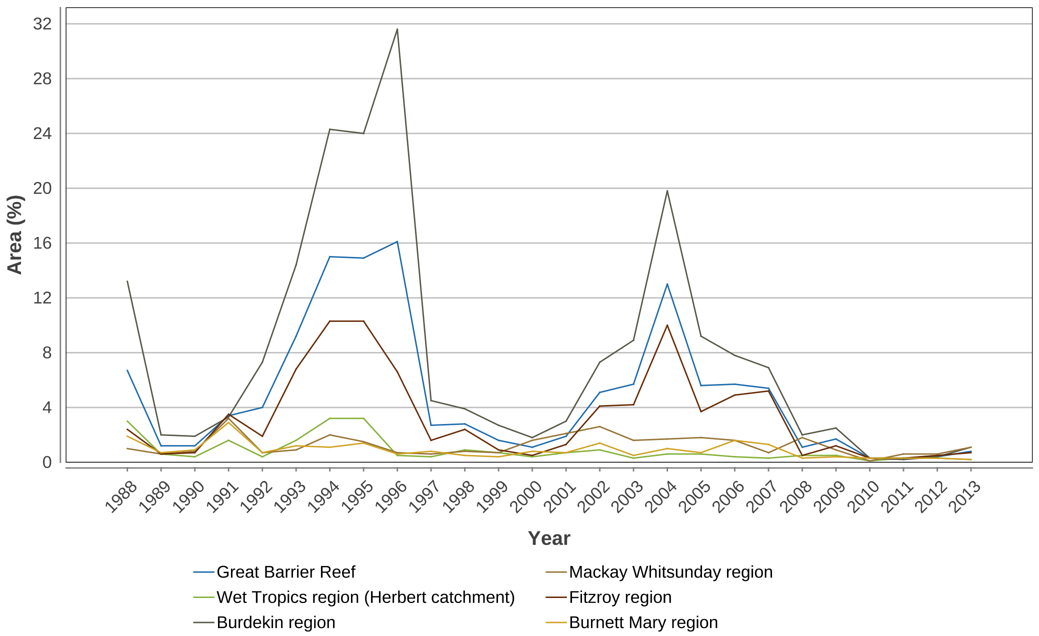
The 2012 and 2013 mean groundcover levels exceeded the long-term (26-year) mean of 78 per cent. This resulted in a very low proportion of the catchment's grazing land being below 50 per cent groundcover (0.4 per cent by June 2012 and 0.8 per cent by June 2013). This corresponds with generally above mean annual rainfall in the past five years. The 26-year mean of 4.9 per cent of the area being below 50 per cent groundcover was inflated by some particularly high years in the mid-1990s when significant areas were affected by severe drought. The years with the lowest groundcover were 1994 to 1996, and 2004. During these years, groundcover was less than 70 per cent and the percentage of area with mean groundcover below 50 per cent ranged from 13 to 16 per cent. There was also low mean annual rainfall in the preceding years.

The 2012 and 2013 mean groundcover levels across the Great Barrier Reef catchment were slightly lower than the highest levels over the past 26 years. Mean annual rainfall in 2013 was below the 26-year mean for all regions with the exception of the Burnett Mary region. Large parts of western Queensland were drought declared during 2013 including some areas of the Burdekin and Fitzroy regions. Generally drier conditions across the Great Barrier Reef catchment area led to reductions in mean groundcover levels, although the localised effects may have been more pronounced for some areas.

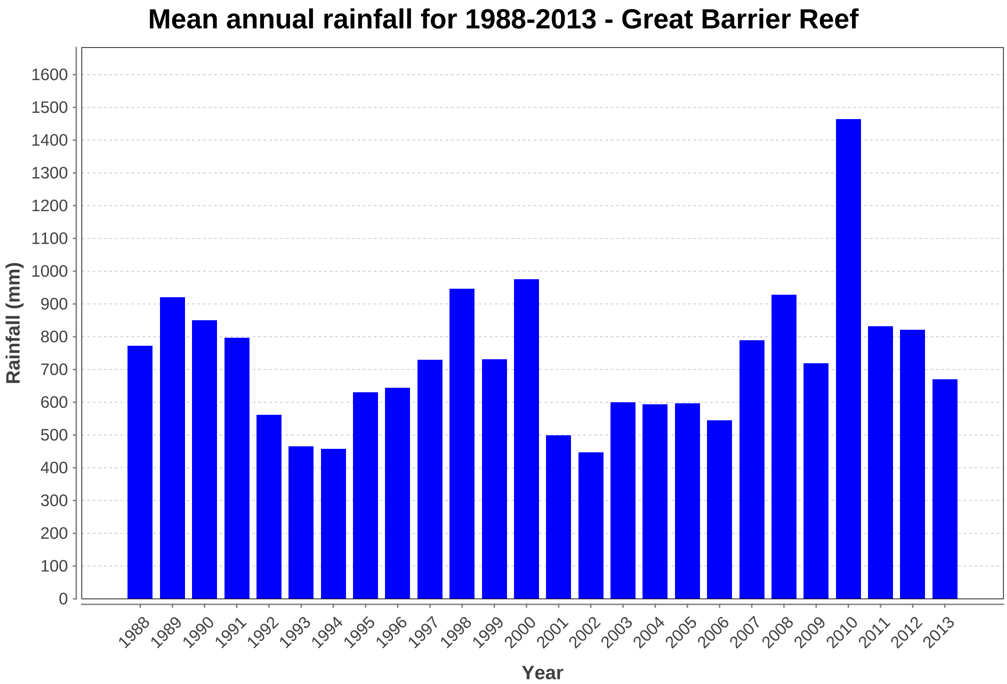
Mean late dry season groundcover in the Great Barrier Reef for 1988-2013



Percentage of the reporting area with groundcover below 50 per cent in the Great Barrier Reef for 1988-2013



Regions with high mean annual rainfall generally have consistently high levels of groundcover. For example, the Mackay Whitsunday, Wet Tropics and Burnett Mary regions had mean groundcover greater than 85 per cent over the past 26 years. In addition, the area with mean groundcover below 50 per cent for these regions has been below 1.2 per cent for the entire monitoring period. In comparison, regions with lower, more variable annual rainfall (e.g. Fitzroy and Burdekin) show greater variability in groundcover. In the Burdekin region for example, the mean annual rainfall in 1994 was 457 millimetres and mean groundcover was 61 per cent. This contrasts with 2010 when mean annual rainfall was 1292 millimetres and mean groundcover levels were 91 per cent.



Mean annual rainfall for 1988-2013 - Great Barrier Reef
Rainfall (mm)
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Year

Wet Tropics (Herbert catchment)

Target: 50 per cent by 2013.
Late dry season mean groundcover for the grazing lands of the Herbert catchment was high (92 per cent by June 2012 and 94 per cent by June 2013). The 26-year mean groundcover was 89 per cent.

94%
Very good

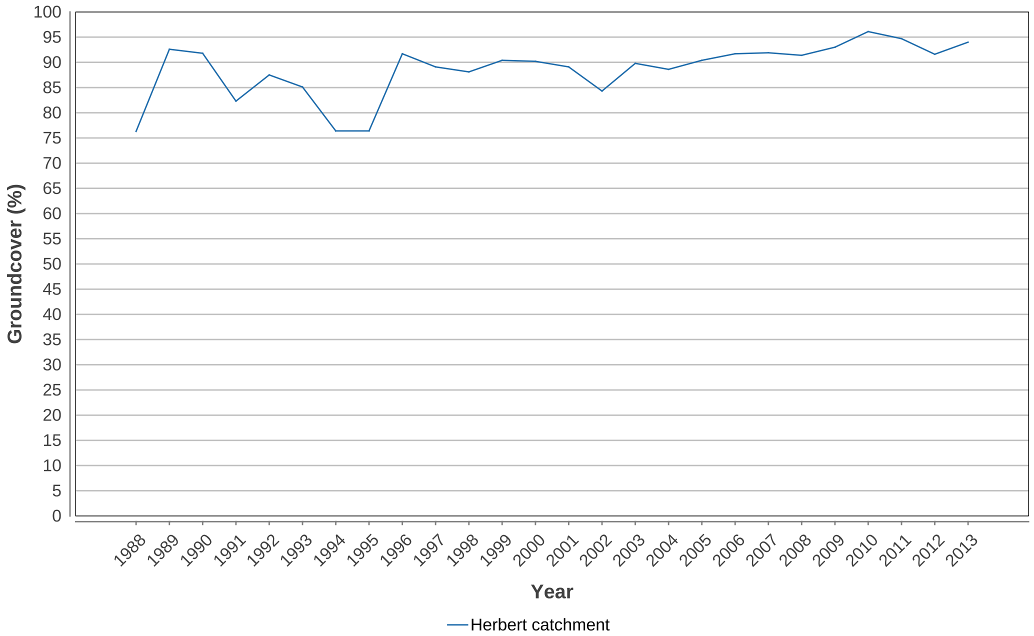
Groundcover results for the Herbert catchment (Wet Tropics region)

Catchment	26-year mean groundcover (%)	2012 mean groundcover (%)	2013 mean groundcover (%)	Area with less than 50% groundcover averaged over past 26 years (%)	Area with less than 50% groundcover in 2012 (%)	Area with less than 50% groundcover in 2013 (%)
Herbert (Wet Tropics region)	89	92	94	0.9	0.3	0.2

Groundcover changes over time

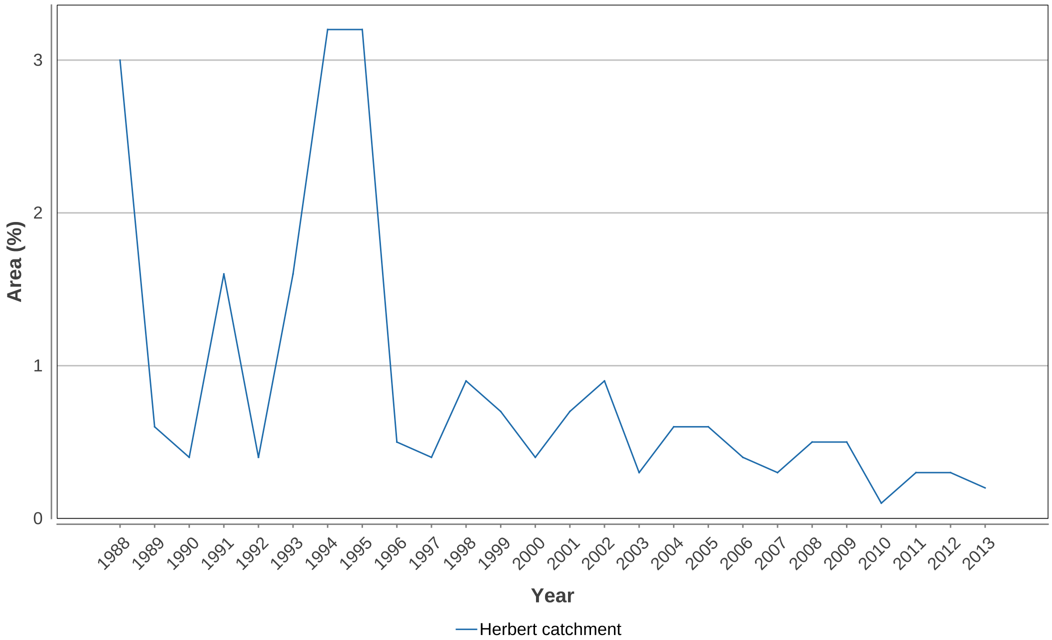
The Herbert catchment had consistently high mean groundcover from 1988 to 2013 with a mean groundcover level of 89 per cent and a consistently low proportion of grazing lands under the target of 50 per cent groundcover. The minimum mean groundcover for the monitoring period was 76 per cent in 1988.

Mean late dry season groundcover in the Wet Tropics region (Herbert catchment) for 1988-2013



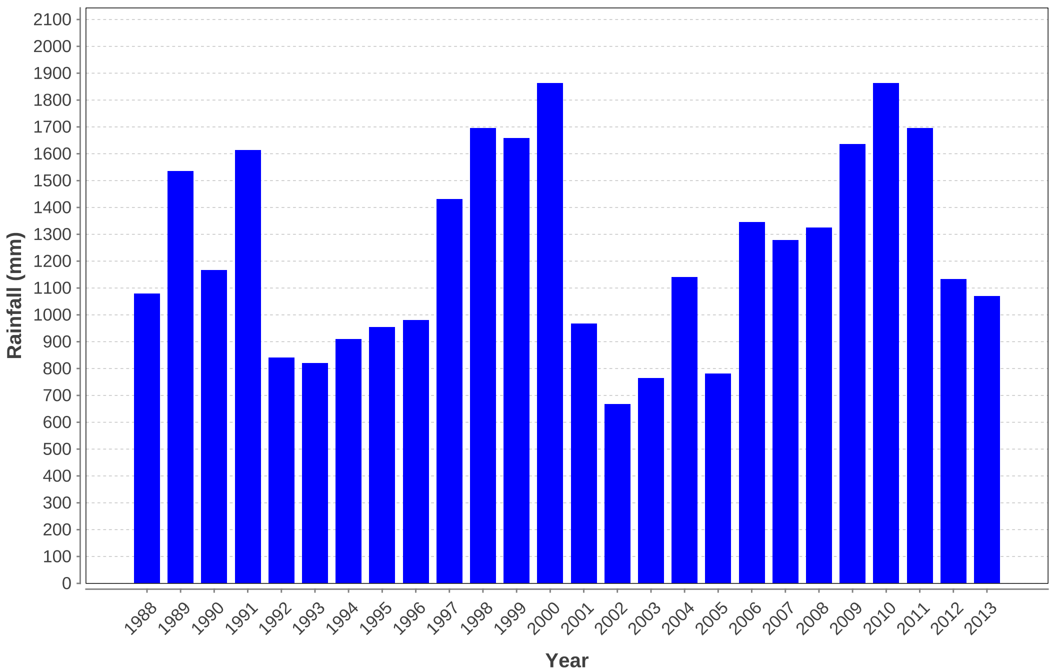
The highest percentage of area with groundcover below 50 per cent was 3.2 per cent in 1994 and 1995.

Percentage of the reporting area with groundcover below 50 per cent in the Wet Tropics region (Herbert catchment) for 1988-2013



The Herbert catchment is the second wettest of the areas reported (1239 millimetres mean annual rainfall).

Mean annual rainfall for 1988-2013 - Wet Tropics region



Burdekin

82%
Very good

Target: 50 per cent by 2013.

Late dry season mean groundcover for grazing lands of the Burdekin region was high (86 per cent by June 2012 and 82 per cent by June 2013). This is mostly due to high rainfall over recent years. The 26-year mean groundcover was 76 per cent.

Mean groundcover in the Burdekin region is mainly influenced by the Burdekin catchment which constitutes 94 per cent of the reporting area.

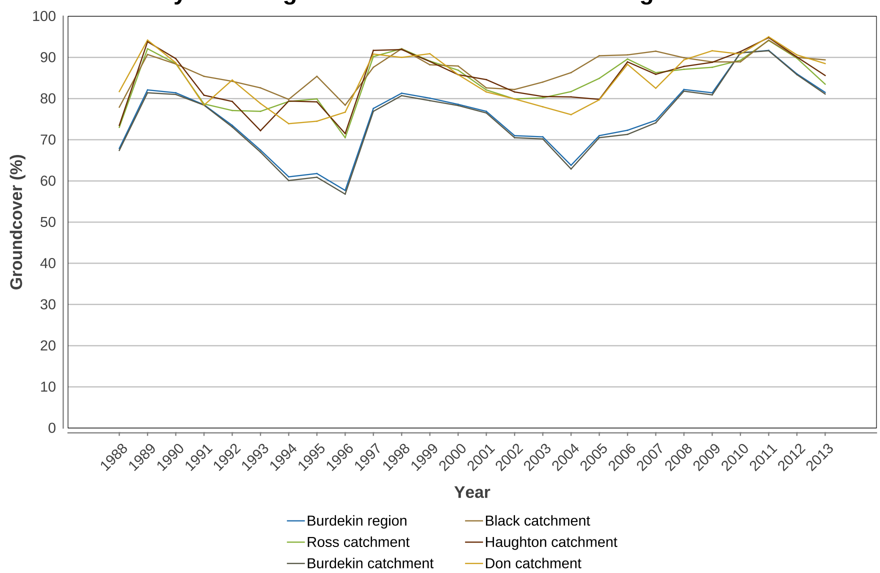
Groundcover results for the Burdekin region and catchments

Catchment/ region	26-year mean groundcover (%)	2012 mean groundcover (%)	2013 mean groundcover (%)	Area with less than 50% groundcover averaged over past 26 years (%)	Area with less than 50% groundcover in 2012 (%)	Area with less than 50% groundcover in 2013 (%)
Black	87	90	89	1.6	0.4	0.7
Burdekin	75	86	81	8.2	0.4	1.1
Don	85	91	89	1.8	0.1	0.3
Haughton	85	90	86	2.1	0.3	0.8
Ross	84	90	84	3.2	0.7	2.7
Burdekin region	76	86	82	7.9	0.4	1.1

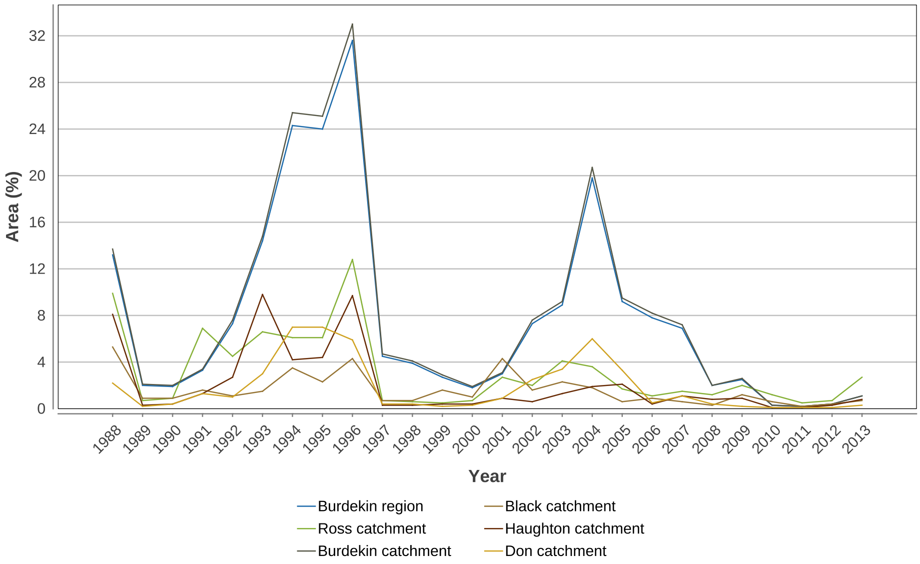
Groundcover changes over time

Groundcover in the Burdekin region is highly variable over time. For example, in 1996 mean late dry season groundcover was 58 per cent while the following year it was 78 per cent. The area with groundcover less than 50 per cent also varies greatly. Increases in the area with less than 50 per cent groundcover correspond to low mean late dry season groundcover and below mean annual rainfall. For example, in 1996, 31.6 per cent of the reporting area had groundcover less than 50 per cent.

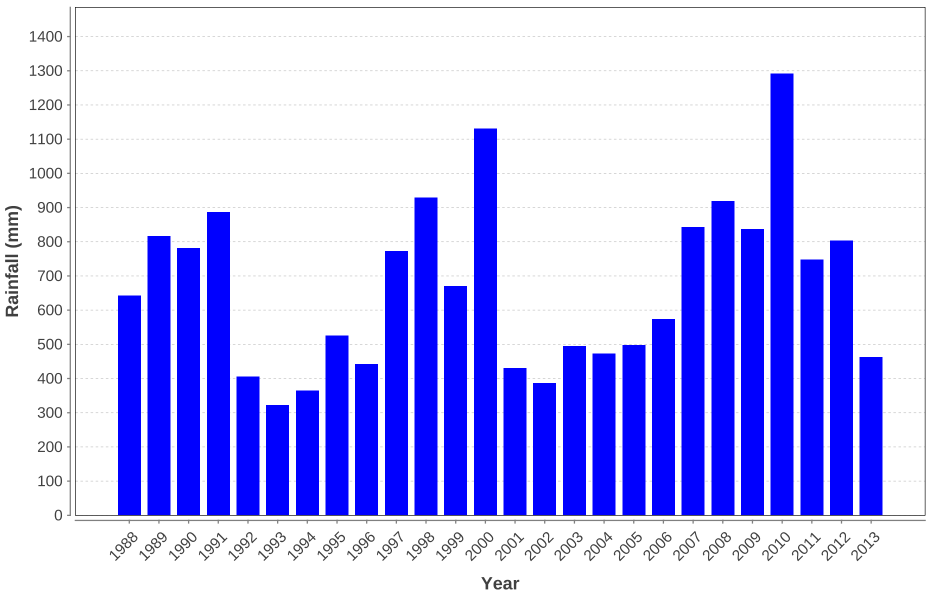
Mean late dry season groundcover in the Burdekin region for 1988-2013



Percentage of the reporting area with groundcover below 50 per cent in the Burdekin region for 1988-2013



Mean annual rainfall for 1988-2013 - Burdekin region



Mackay Whitsunday

91%

Very good

Target: 50 per cent by 2013.

Late dry season mean groundcover for the grazing lands of the Mackay Whitsunday region was high (90 per cent by June 2012 and 91 per cent by June 2013). The 26-year mean groundcover was 88 per cent.

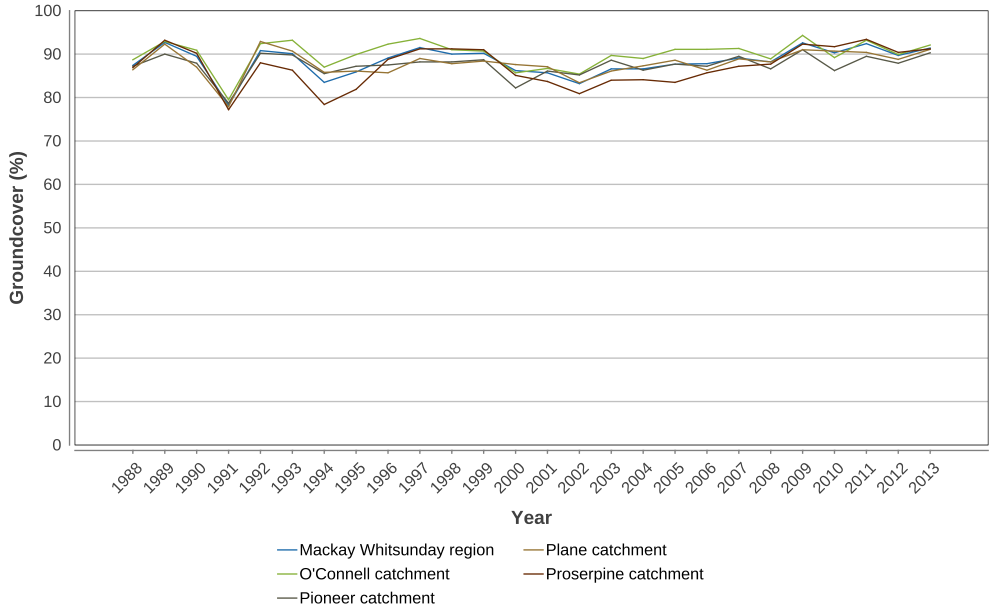
Groundcover results for the Mackay Whitsunday region and catchments

Catchment/ region	26-year mean groundcover (%)	2012 mean groundcover (%)	2013 mean groundcover (%)	Area with less than 50% groundcover averaged over past 26 years (%)	Area with less than 50% groundcover in 2012 (%)	Area with less than 50% groundcover in 2013 (%)
O'Connell	90	90	92	0.7	0.5	0.7
Pioneer	87	88	90	1.1	0.9	1.1
Plane Creek	88	89	91	1.4	0.7	1.6
Proserpine	87	90	91	1.7	0.6	1.2
Mackay Whitsunday region	88	90	91	1.2	0.6	1.1

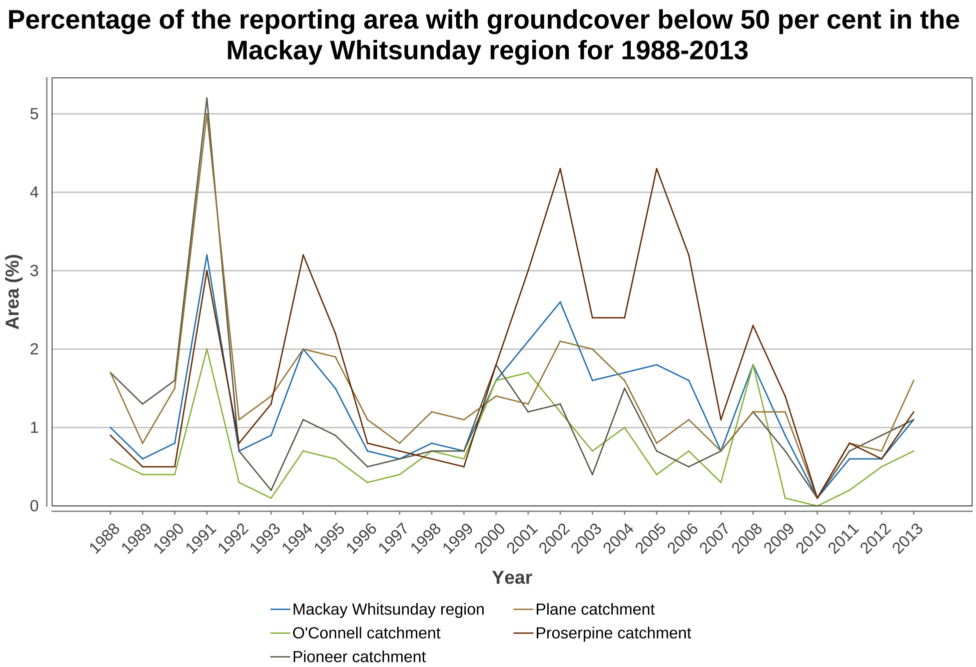
Groundcover changes over time

During the past 26 years, the Mackay Whitsunday region has had consistently high mean groundcover levels with the lowest being 78 per cent in 1991 and the highest being 93 per cent in 1989. Mean groundcover levels in the past five years have been consistently above 90 per cent.

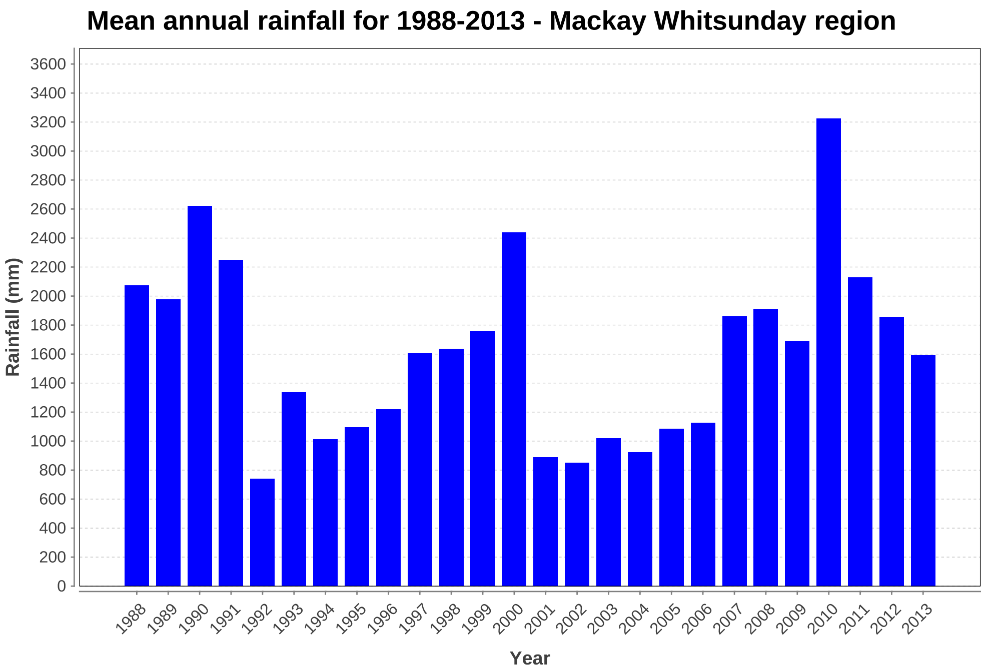
Mean late dry season groundcover in the Mackay Whitsunday region for 1988-2013



The greatest area with groundcover less than 50 per cent was 3.2 per cent in 1991.



The Mackay Whitsunday region is the wettest of the regions reported (1611 millimetres mean annual rainfall).



Fitzroy

Target: 50 per cent by 2013.

Late dry season mean groundcover for the grazing lands of the Fitzroy region was high (84 per cent by both June 2012 and June 2013). The 26-year mean groundcover was 79 per cent.

84%
Very good

Mean groundcover in the Fitzroy region is mainly influenced by the Fitzroy catchment which constitutes 95 per cent of the reporting area.

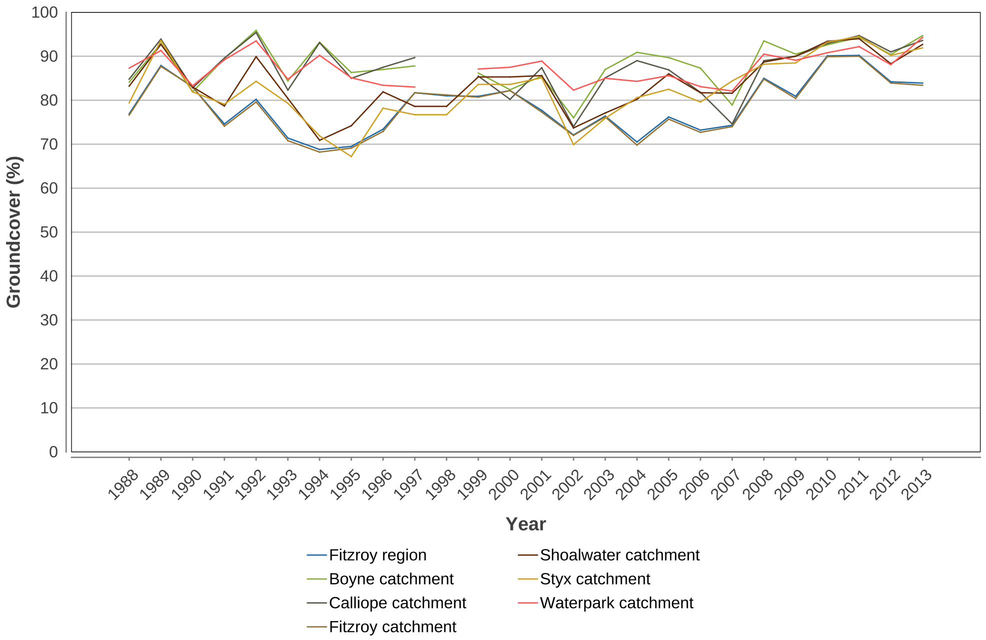
Groundcover results for Fitzroy region and catchments

Catchment/ region	26-year mean groundcover (%)	2012 mean groundcover (%)	2013 mean groundcover (%)	Area with less than 50% groundcover averaged over past 26 years (%)	Area with less than 50% groundcover in 2012 (%)	Area with less than 50% groundcover in 2013 (%)
Boyne	85	90	95	0.4	0.2	0.2
Calliope	84	91	94	0.6	0.4	0.4
Fitzroy	78	84	83	3.4	0.5	0.7
Shoalwater	84	88	93	1.6	0.5	0.1
Styx	82	90	92	2.6	0.2	0.1
Water Park	84	88	94	0.9	0.5	0.3
Fitzroy region	79	84	84	3.3	0.5	0.7

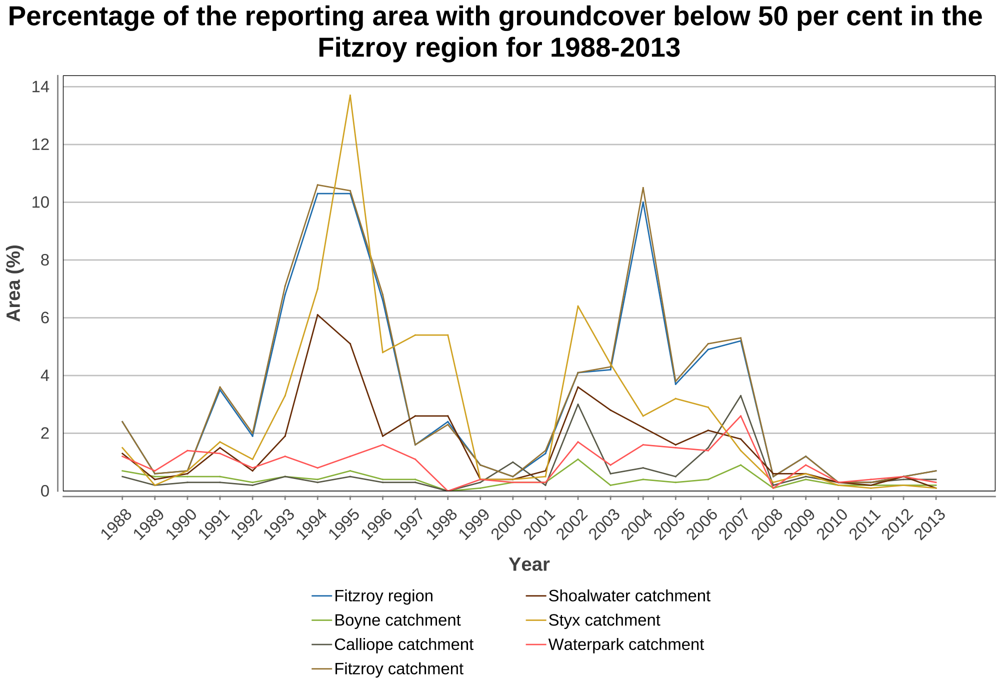
Groundcover changes over time

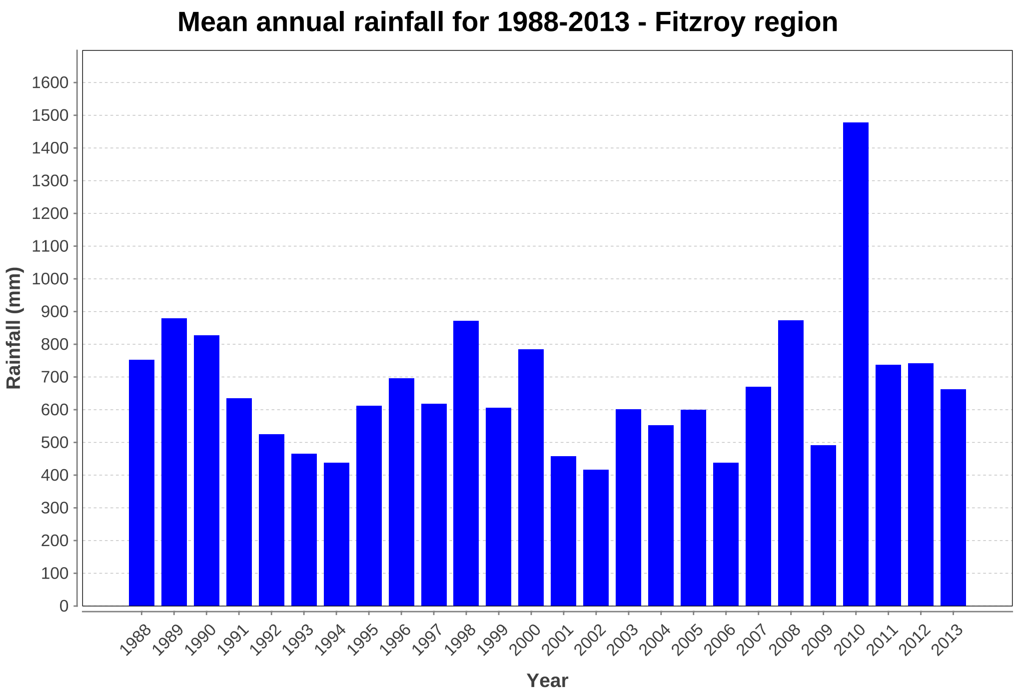
Mean annual late dry season groundcover in the Fitzroy region fluctuates considerably over time. For example, groundcover was as low as 69 per cent in 1994 whilst the highest groundcover level was 90 per cent in 2011.

Mean late dry season groundcover in the Fitzroy region for 1988-2013



Declines in mean groundcover correspond with increases in the area with groundcover under 50 per cent. These declines also correspond to below mean rainfall in preceding years. For example, in both 1994 and 1995, the area with groundcover below 50 per cent was 10.3 per cent and mean annual rainfall had been declining since 1989. Mean annual rainfall was well below average between 1992 and 1995. The mean annual rainfall in 1994 was 437 millimetres, more than 200 millimetres lower than the region's mean annual rainfall of 670 millimetres over the past 26 years.





Burnett Mary

92%

Very good

Target: 50 per cent by 2013.

Late dry season mean groundcover for grazing lands of the Burnett Mary region was high (89 per cent by June 2012 and 92 per cent by June 2013). The 26-year mean groundcover was 85 per cent.

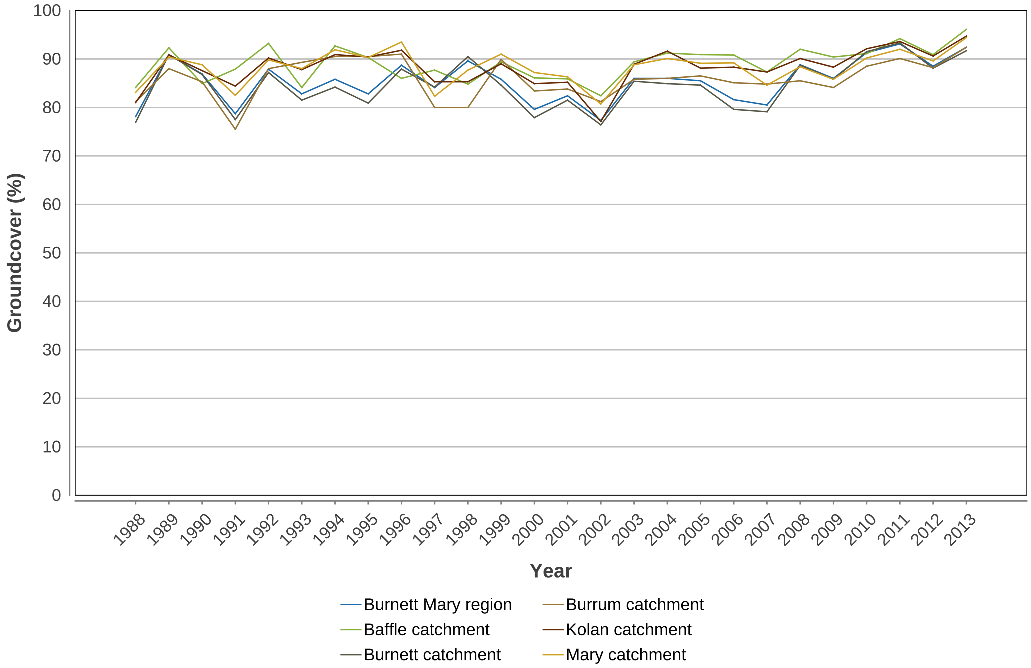
Groundcover results for the Burnett Mary region and catchments

Catchment/ region	26-year mean groundcover (%)	2012 mean groundcover (%)	2013 mean groundcover (%)	Area with less than 50% groundcover averaged over past 26 years (%)	Area with less than 50% groundcover in 2012 (%)	Area with less than 50% groundcover in 2013 (%)
Baffle	89	91	96	0.5	0.4	0.3
Burnett	85	88	92	0.9	0.2	0.2
Burrum	86	88	92	3.3	1.4	1.7
Kolan	88	91	95	0.5	0.2	0.3
Mary	88	90	94	0.4	0.1	0.1
Burnett Mary region	85	89	92	0.9	0.3	0.2

Groundcover changes over time

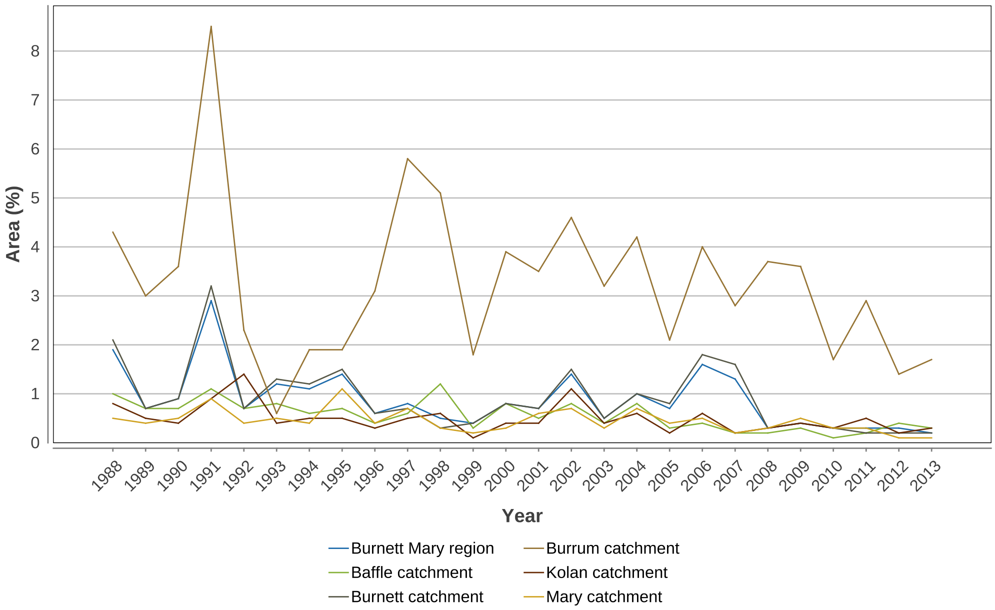
Over the past 26 years, the Burnett Mary region has had a consistently high mean annual groundcover of 85 per cent with a minimum of 77 per cent in 2002. The highest level of groundcover was 93 per cent in 2011.

Mean late dry season groundcover in the Burnett Mary region for 1988-2013



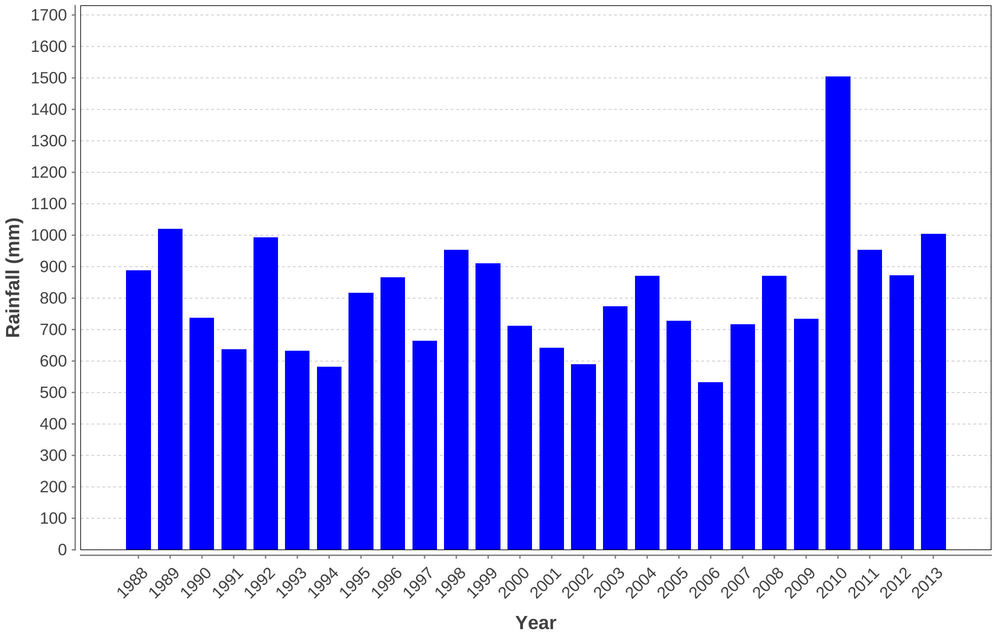
The greatest area with groundcover less than 50 per cent was 2.9 per cent in 1991. For all other years in the 26-year period, the area with groundcover less than 50 per cent has been below two per cent.

Percentage of the reporting area with groundcover below 50 per cent in the Burnett Mary region for 1988-2013



Mean annual rainfall for the Burnett Mary region over the period 1988 to 2013 is 816 millimetres. Mean annual rainfall has been well above average since 2010 and this has resulted in very good mean groundcover levels for the region over the past five years.

Mean annual rainfall for 1988-2013 - Burnett Mary region



Catchment pollutant loads

The Catchment pollutant loads targets in Reef Water Quality Protection Plan 2009 (Reef Plan) were:

- A minimum 50 per cent reduction in nitrogen and phosphorus loads at the end-of-catchments by 2013.
- A minimum 50 per cent reduction in pesticides at the end-of-catchments by 2013.
- A minimum 20 per cent reduction in sediment load at the end-of-catchments by 2020.

Reef Plan was over half way towards the sediment and pesticide targets by June 2013. However, progress towards the nitrogen and phosphorus targets fell well short.

There has been very good progress towards the sediment target with a reduction of 11 per cent by June 2013. The greatest sediment reduction was from the Burdekin region (16 per cent). Moderate progress was made towards the pesticide target with a reduction of 28 per cent by June 2013. The greatest reduction was from the Mackay Whitsunday region (42 per cent).

There was poor progress towards the phosphorus target with a 13 per cent reduction by June 2013. The greatest reduction was from the Wet Tropics region (19 per cent). Progress towards the nitrogen target was very poor with a 10 per cent reduction by June 2013. The greatest reduction was from the Mackay Whitsunday region (17 per cent).

When the targets were set in 2009, they were based on the best available evidence and designed to be ambitious. Since then, scientific knowledge, monitoring and modelling information has advanced significantly and it is recognised that the targets, in particular the nitrogen target, were always going to be difficult to meet. The targets have been refined in Reef Plan 2013. However, it is acknowledged that the nitrogen target may not be achievable using best practice alone and new thinking and approaches will be required.

Great Barrier Reef

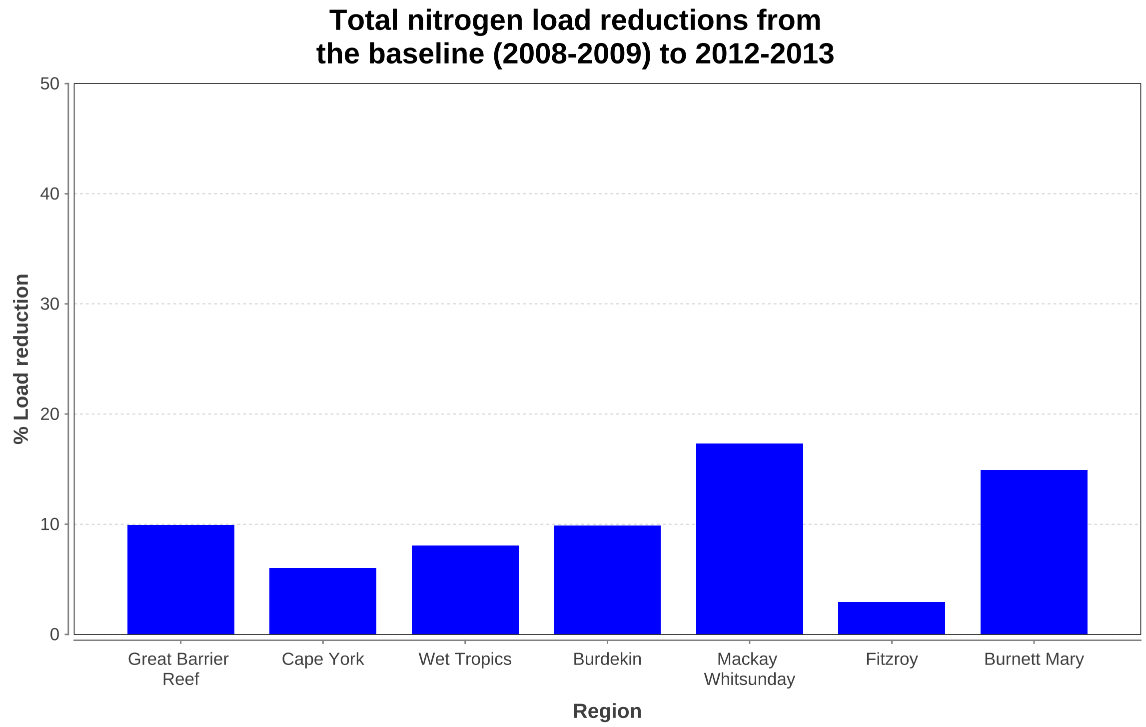
Catchment modelling has been used to estimate the long term annual load reductions due to the adoption of improved management practices. The model is run over a fixed climate period to account for climate variability.

Nitrogen

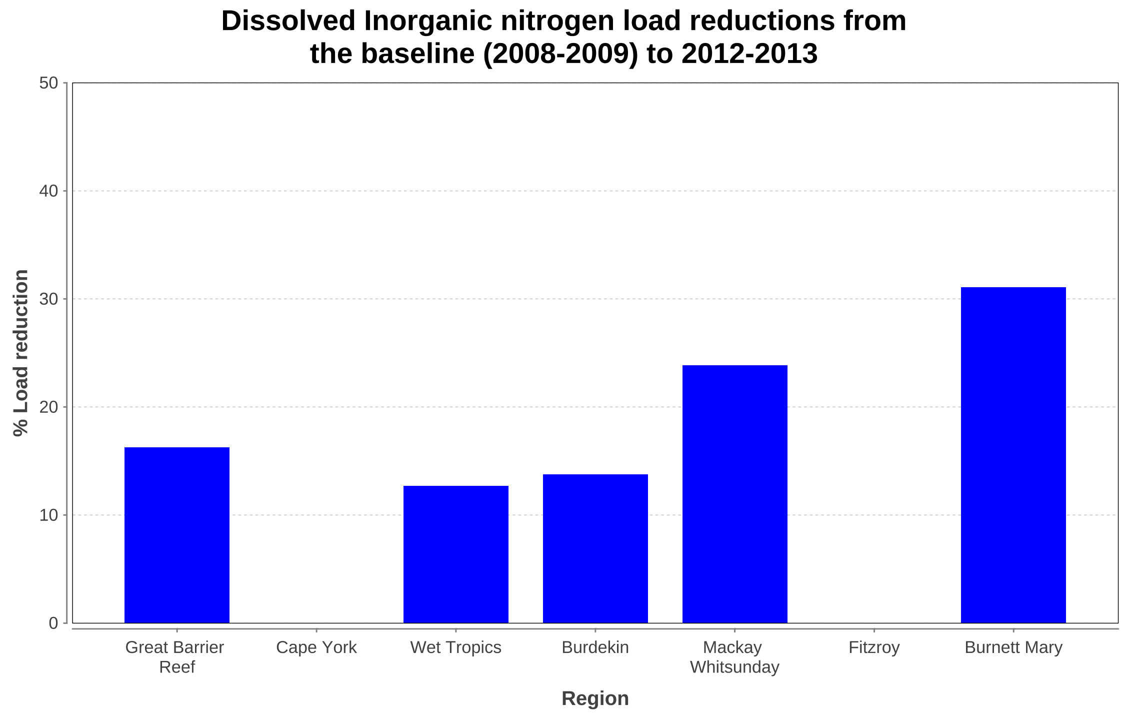
10%

Very poor

Target: 50 per cent by 2013.
The estimated annual average total nitrogen load leaving catchments reduced by 10 per cent (1646 tonnes) by June 2013, up from eight per cent (1279 tonnes) by June 2012. The greatest reduction (17 per cent) was from the Mackay Whitsunday region with 302 tonnes by June 2013.



- Agricultural fertiliser use is a key source of dissolved inorganic nitrogen. The estimated annual average dissolved inorganic nitrogen load leaving catchments reduced by 16 per cent (856 tonnes) by June 2013, up from 14 per cent (719 tonnes) by June 2012.
- The greatest per cent dissolved inorganic nitrogen load reduction (31 per cent) by June 2013 was in the Burnett Mary region with 134 tonnes.



Note: Dissolved inorganic nitrogen reductions are only modelled for regions with significant sugarcane areas.

Phosphorus

13%
Poor

Target: 50 per cent by 2013.
Grazing lands are the key source of phosphorus. The estimated average annual total phosphorus load leaving catchments reduced by 13 per cent (444 tonnes) by June 2013, up from eight per cent (290 tonnes) by June 2012. The greatest reduction was from the Wet Tropics region with 19 per cent (189 tonnes) by June 2013.

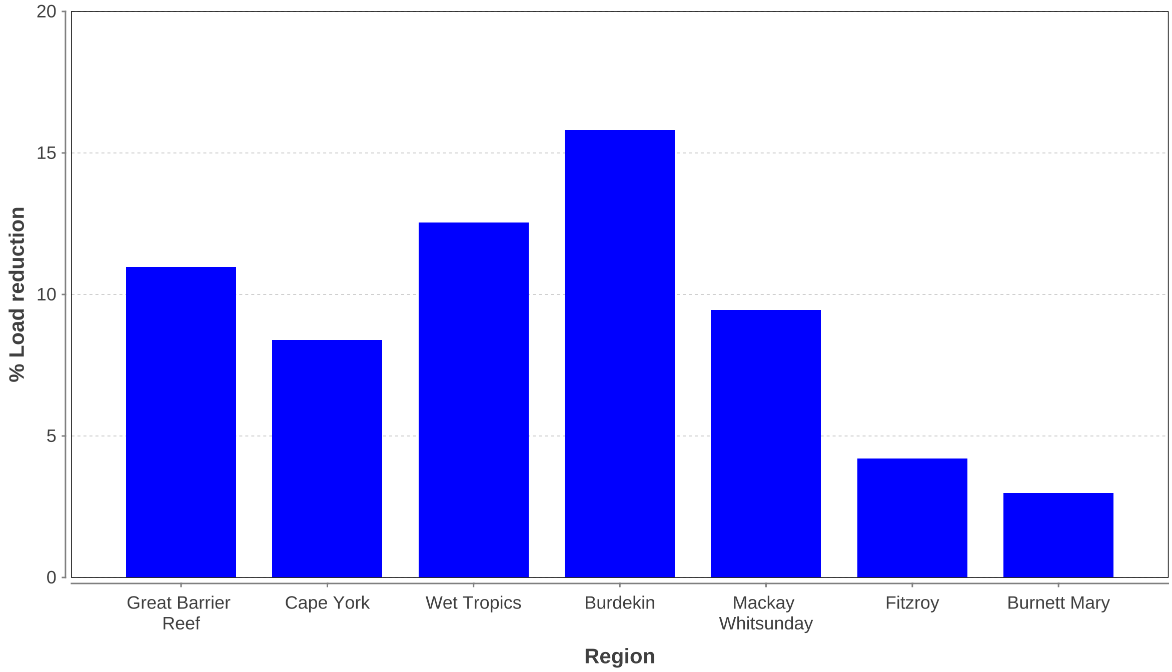
Sediment

11%
Very good

Target: 20 per cent by 2020.
The estimated average annual suspended sediment load leaving catchments reduced by 11 per cent (615,100 tonnes) by June 2013, up from eight per cent (424,100 tonnes) by June 2012. This is more than halfway towards the Reef Plan 2009 sediment target. The greatest reduction was from the Burdekin region with 16 per cent (399,000 tonnes) by June 2013.

The regions contributing the highest total suspended sediment loads by June 2013 were the two largest catchments which are dominated by grazing - the Burdekin and the Fitzroy.

Total suspended solids load reductions from the baseline (2008-2009) to 2012-2013



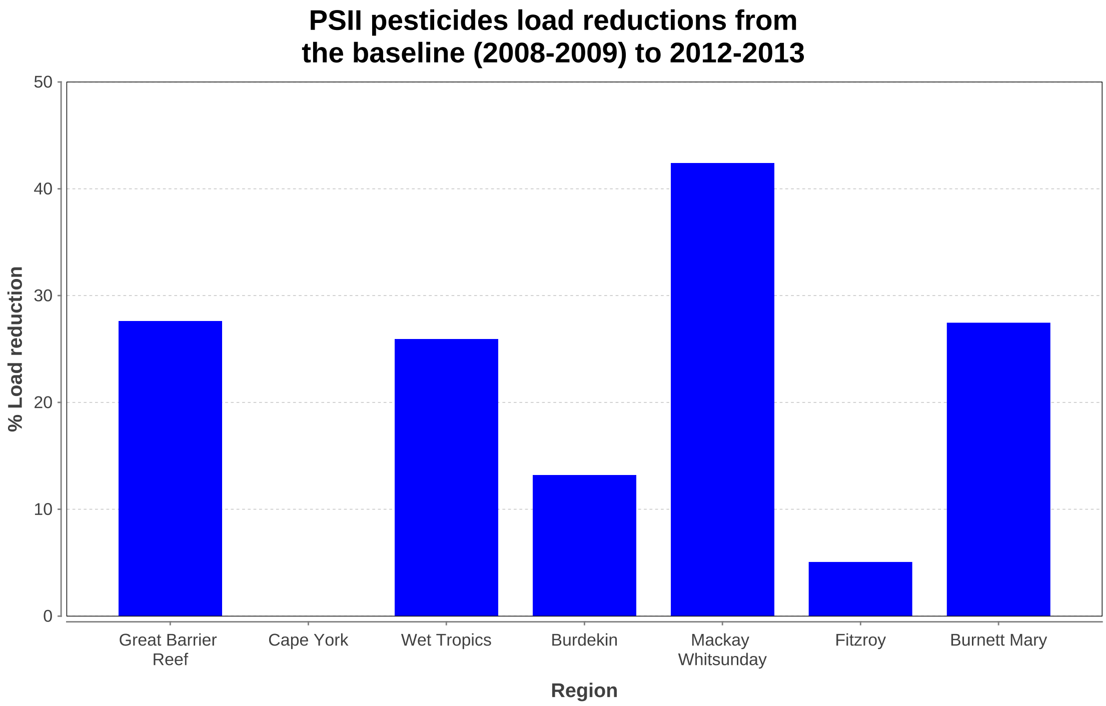
Pesticides

28%

Moderate

Target: 50 per cent by 2013.

Agricultural lands are a key source of pesticide runoff, particularly from areas of intensive sugarcane. The estimated annual average pesticide load leaving catchments reduced by 28 per cent (4626 kilograms) by June 2013, up from 20 per cent (3267 kilograms) by June 2012. This is more than halfway towards the Reef Plan 2009 target. The greatest reduction was from the Mackay Whitsunday region with 42 per cent (1672 kilograms) by June 2013. The large reductions can be attributed to the shift from C class management to B and A class management practices over the past three years.



Note: No pesticide management data is available for Cape York.

Cape York

Nitrogen

6%

Very poor

Target: 50 per cent by 2013.
The estimated annual average total nitrogen load leaving catchments reduced by six per cent (16 tonnes) by June 2013, up from five per cent (13 tonnes) by June 2012.

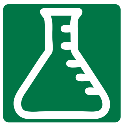
Phosphorus

7%

Very poor

Target: 50 per cent by 2013.
The estimated annual average total phosphorus load leaving catchments reduced by seven per cent (13 tonnes) by June 2013, up from five per cent (9 tonnes) by June 2012.

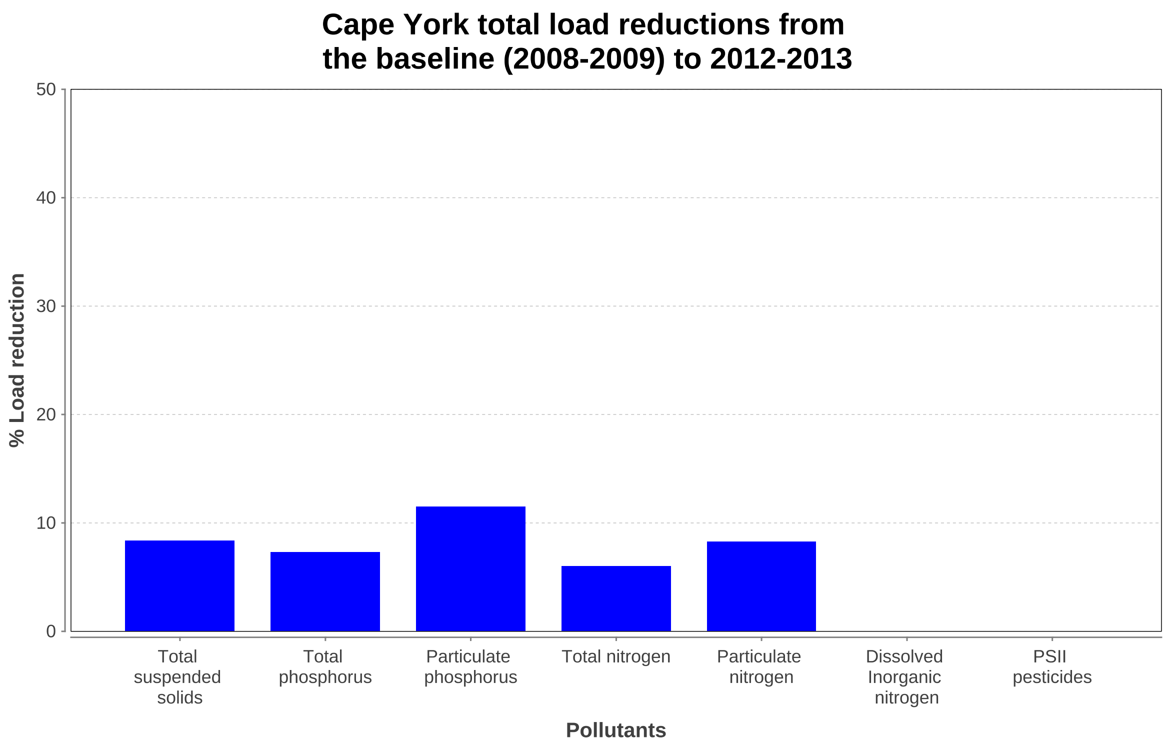
Sediment



8%

Very good

Target: 20 per cent by 2020.
The estimated annual average suspended sediment load leaving catchments reduced by nine per cent (15,500 tonnes) by June 2013, up from eight per cent (13,500 tonnes) by June 2012.



Note:

- Dissolved inorganic nitrogen reductions are only modelled for regions with significant sugarcane areas.
- No pesticide management data is available for Cape York.
- Land management changes in the horticulture industry have not been modelled.

Wet Tropics

Nitrogen

8%
Very poor

Target: 50 per cent by 2013.
The estimated annual average total nitrogen load leaving catchments reduced by eight per cent (512 tonnes) by June 2013, up from five per cent (325 tonnes) by June 2012. Agricultural fertiliser use is a key source of dissolved inorganic nitrogen. The estimated annual average dissolved inorganic nitrogen load leaving catchments reduced by 13 per cent (257 tonnes) by June 2013.

Phosphorus

19%
Poor

Target: 50 per cent by 2013.
Agricultural fertiliser use is a key source of phosphorus. The estimated annual average total phosphorus load leaving catchments reduced by 19 per cent (189 tonnes) by June 2013, up from 10 per cent (98 tonnes) by June 2012.

Pesticides

26%
Moderate

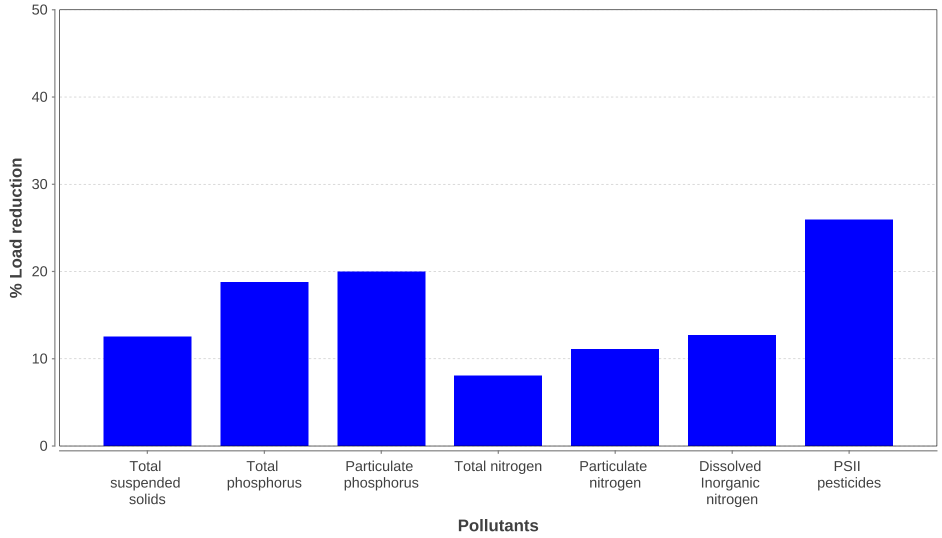
Target: 50 per cent by 2013.
The estimated annual average pesticide load leaving catchments reduced by 26 per cent (2230 kilograms) by June 2013, up from 14 per cent (1205 kilograms) by June 2012.

Sediment

13%
Very good

Target: 20 per cent by 2020.
The estimated annual average suspended sediment load leaving catchments reduced by 13 per cent (96,400 tonnes) by June 2013, up from six per cent (45,300 tonnes) by June 2012. The large reduction is attributable to the increase in A class management practice area for 2013.

Wet Tropics total load reductions from the baseline (2008-2009) to 2012-2013



Note: Land management changes in the horticulture and dairy industries have not been modelled.

Burdekin

Nitrogen

10%

Very poor

Target: 50 per cent by 2013.
The estimated annual average total nitrogen load leaving catchments reduced by 10 per cent (574 tonnes) by June 2013, up from eight per cent (474 tonnes) by June 2012. Agricultural fertiliser use is a key source of dissolved inorganic nitrogen. The estimated annual average dissolved inorganic nitrogen load leaving catchments reduced by 14 per cent (261 tonnes) by June 2013.

Phosphorus

11%

Very poor

Target: 50 per cent by 2013.
Agricultural fertiliser use is a key source of phosphorus. The estimated annual average total phosphorus load leaving catchments reduced by 11 per cent (148 tonnes) by June 2013, up from eight per cent (108 tonnes) by June 2012.

Pesticides

13%

Poor

Target: 50 per cent by 2013.
The estimated annual average pesticide load leaving catchments reduced by 13 per cent (276 kilograms) by June 2013, up from 12 per cent (241 kilograms) by June 2012.

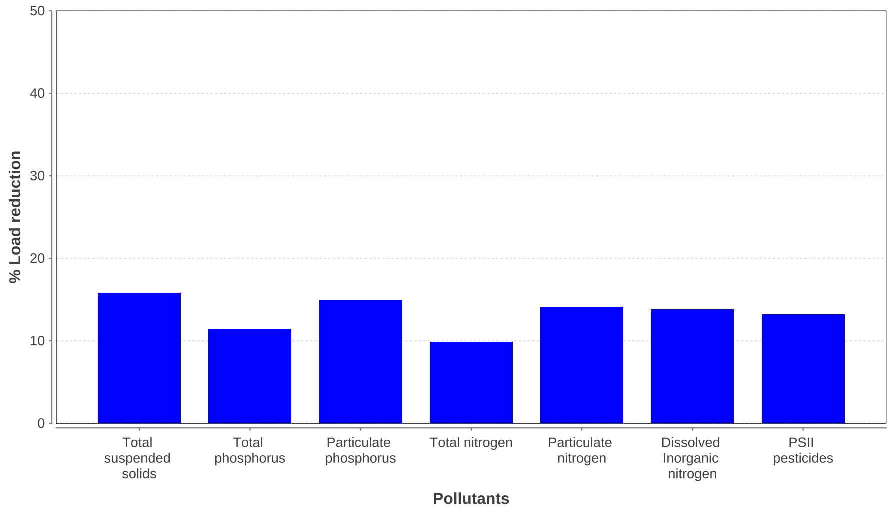
Sediment

16%

Very good

Target: 20 per cent by 2020.
The estimated annual average suspended sediment load leaving catchments reduced by 16 per cent (399,000 tonnes) by June 2013, up from 11 per cent (287,300 tonnes) by June 2012. Reporting of investment in riparian fencing projects has added to the reductions.

Burdekin total load reductions from the baseline (2008-2009) to 2012-2013



Note: Land management changes in the horticulture industry have not been modelled.

Mackay Whitsunday

Nitrogen

17%
Poor

Target: 50 per cent by 2013.
The estimated annual average total nitrogen load leaving catchments reduced by 17 per cent (302 tonnes) by June 2013, up from 15 per cent (265 tonnes) by June 2012. Agricultural fertiliser use is a key source of dissolved inorganic nitrogen. The estimated annual average dissolved inorganic nitrogen load leaving catchments reduced by 24 per cent (204 tonnes) by June 2013.

Phosphorus

14%
Poor

Target: 50 per cent by 2013.
Agricultural fertiliser use is a key source of phosphorus. The estimated annual average total phosphorus load leaving catchments reduced by 14 per cent (35 tonnes) by June 2013, up from 13 per cent (31 tonnes) by June 2012.

Pesticides

42%
Good

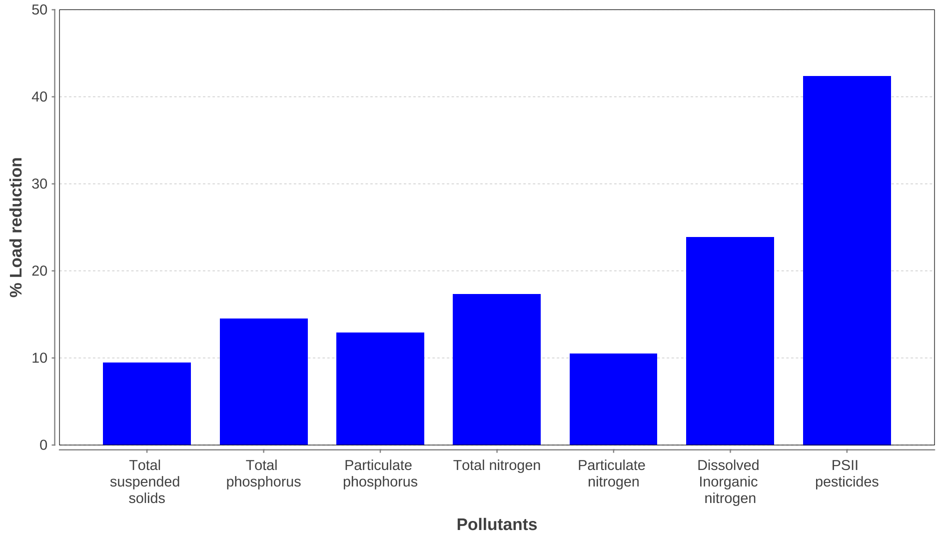
Target: 50 per cent by 2013.
The estimated annual average pesticide load leaving catchments reduced by 42 per cent (1672 kilograms) by June 2013, up from 37 per cent (1446 kilograms) by June 2012.

Sediment

9%
Very good

Target: 20 per cent by 2020.
The estimated annual average suspended sediment load leaving catchments reduced by nine per cent (33,600 tonnes) by June 2013, up from seven per cent (24,300 tonnes) by June 2012. Reporting of investment in riparian fencing projects has added to the reductions.

Mackay Whitsunday total load reductions from the baseline (2008-2009) to 2012-2013



Note: Land management changes in the horticulture industry have not been modelled.

Fitzroy

Nitrogen

3%

Very poor

Target: 50 per cent by 2013.

The estimated annual average total nitrogen load leaving catchments reduced by three per cent (30 tonnes) by June 2013, up from two per cent (21 tonnes) by June 2012.

Phosphorus

6%

Very poor

Target: 50 per cent by 2013.

The estimated annual average total phosphorus load leaving catchments reduced by six per cent (37 tonnes) by June 2013, up from four per cent (27 tonnes) by June 2012.

Pesticides

5%

Very poor

Target: 50 per cent by 2013.

The estimated annual average pesticide load leaving catchments reduced by five per cent (29 kilograms) by June 2013, up from four per cent (23 kilograms) by June 2012. This does not include pesticide reductions from improved grazing practices.

Sediment

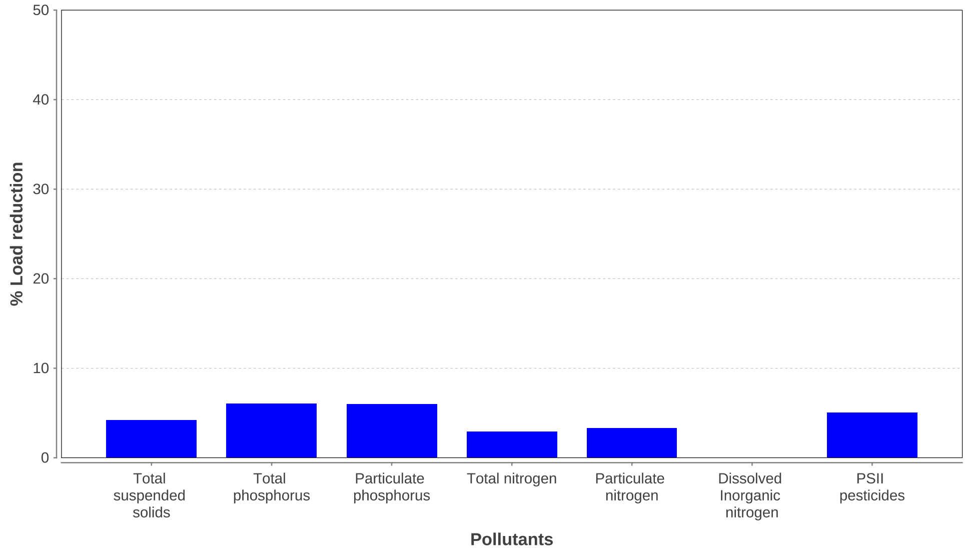
4%

Poor

Target: 20 per cent by 2020.

The estimated annual average suspended sediment load leaving catchments reduced by four per cent (59,700 tonnes) by June 2013, up from three per cent (44,800 tonnes) by June 2012.

Fitzroy total load reductions from the baseline (2008-2009) to 2012-2013



Note:

- Dissolved inorganic nitrogen reductions are only modelled for regions with significant sugarcane areas.
- Land management changes in the horticulture and grains industry have not been modelled.

Burnett Mary

Nitrogen

15%
Poor

Target: 50 per cent by 2013.
The estimated annual average total nitrogen load leaving catchments reduced by 15 per cent (212 tonnes) by June 2013, up from 13 per cent (181 tonnes) by June 2012. Agricultural fertiliser use is a key source of dissolved inorganic nitrogen. The estimated annual average dissolved inorganic nitrogen load leaving catchments reduced by 31 per cent (134 tonnes) by June 2013, up from 28 per cent (122 tonnes) by June 2012.

Phosphorus

10%
Very poor

Target: 50 per cent by 2013.
Agricultural fertiliser use is a key source of phosphorus. The estimated annual average total phosphorus load leaving catchments reduced by 10 per cent (22 tonnes) by June 2013, up from eight per cent (17 tonnes) by June 2012.

Pesticides

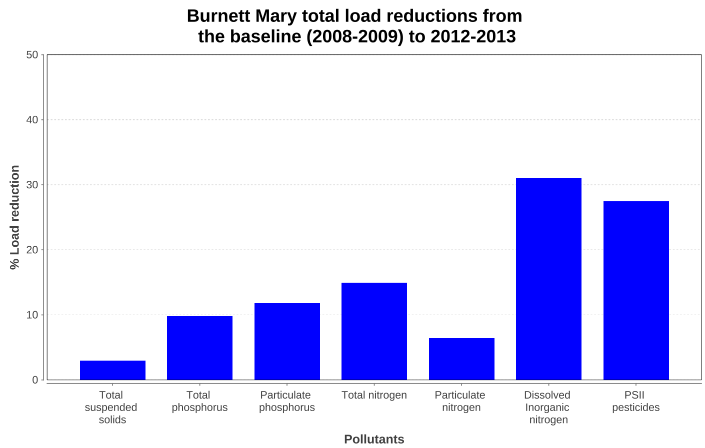
28%
Moderate

Target: 50 per cent by 2013.
The estimated annual average pesticide load leaving catchments reduced by 28 per cent (420 kilograms) by June 2013, up from 23 per cent (352 kilograms) by June 2012.

Sediment

3%
Very poor

Target: 20 per cent by 2020.
The estimated annual average suspended sediment load leaving catchments reduced by three per cent (10,900 tonnes) by June 2013, up from two per cent (8,800 tonnes) by June 2012.



Note: Land management changes in the horticulture industry have not been modelled.

Marine

The immediate goal in the Reef Water Quality Protection Plan 2009 (Reef Plan) was:
"To halt and reverse the decline in water quality entering the reef by 2013."

The long-term goal was:
"To ensure that by 2020 the quality of water entering the reef from adjacent catchments has no detrimental impact on the health and resilience of the Great Barrier Reef."

Improvements in land management practices will take time to translate into improved marine condition as there are significant time lags between implementation and measurable outcomes in these natural systems. Inshore marine condition is also strongly influenced by episodic events such as tropical cyclones and floods which have impacted all regions in recent years.

It should be noted that the marine results focus mainly on the inshore area of the Great Barrier Reef. Water quality at mid and outer shelf sites is generally good to very good overall because it is less influenced by river discharges.

Introduction
The Great Barrier Reef receives runoff from 35 major catchments which drain 424,000 square kilometres of coastal Queensland. The reef region is relatively sparsely populated; however, there have been extensive changes in land-use since European settlement in areas adjacent to the coast (Furnas, 2003; GBRMPA, 2012). Increasing pressure from human activities continues to have an adverse impact on the quality of water entering the reef lagoon, particularly during the wet season, even though some progress has been made in addressing this issue through Reef Plan. Flood waters deliver loads of nutrients and sediments to the reef that are well above natural levels and many times higher than in non-flood waters (Waters et al., 2014). Pesticides, which are manufactured chemicals with no natural level, are detected year-round in reef waters (Gallen et al., 2013). The main source of excess nutrients, fine sediments and pesticides from reef catchments is diffuse-source pollution from agriculture (The State of Queensland, 2013). Pollutant loads and the actions taken to reduce them are documented elsewhere in this report.

Disturbances affecting the Great Barrier Reef
The health and resilience of the reef is affected by a range of short-term acute and longer term chronic disturbances, including:

- catchment runoff
- floods
- cyclones
- crown-of-thorns starfish outbreaks
- elevated sea surface temperatures.

A resilient coral community has high rates of recruitment and growth that compensate for losses resulting from the combination of acute disturbances (e.g. cyclones) and chronic environmental stressors (e.g. poor water quality). Over time, chronic stress may decrease the resilience of the reef ecosystem, by slowing or inhibiting recovery from acute disturbances. 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 acute disturbances in close succession usually have a combined negative effect on reef resilience that is greater than the effect of each disturbance in isolation. Importantly, reducing one stress will often help the ecosystem recover from or resist the impact of other pressures. For example, improving water quality is expected to improve the resilience of corals to the effects of climate change.

Between 2006 and 2012, repeated disturbances had a considerable and widespread impact on the water quality and ecosystem status of the inshore area, as seen by the near loss of some seagrasses communities following the cyclones and floods in 2011. There are signs of recovery at some locations after a couple of years of less extreme weather events. However, marine ecosystem health remains vulnerable and it may take many years for complex communities to re-establish.

The Strategic Assessment Report (GBRMPA, 2013) and Outlook Report (GBRMPA, 2014 in press) concluded that the overall outlook for the reef is 'poor', and the health of the reef ecosystem is declining in inshore areas south of Cooktown. For example, coral cover on mid-shelf reefs along the developed coast of the central and southern Great Barrier Reef has declined to less than 50 per cent of what it was in 1985, while coral cover in the northern Great Barrier Reef has not shown the same consistent downward trend (De'ath et al., 2012). Outbreaks of the coral-eating crown-of-thorns starfish are one of the main causes of the decline in coral cover reef-wide, and the link between outbreaks and the level of nutrients in flood waters has been greatly strengthened (Fabricius et al., 2010; Furnas et al., 2013).

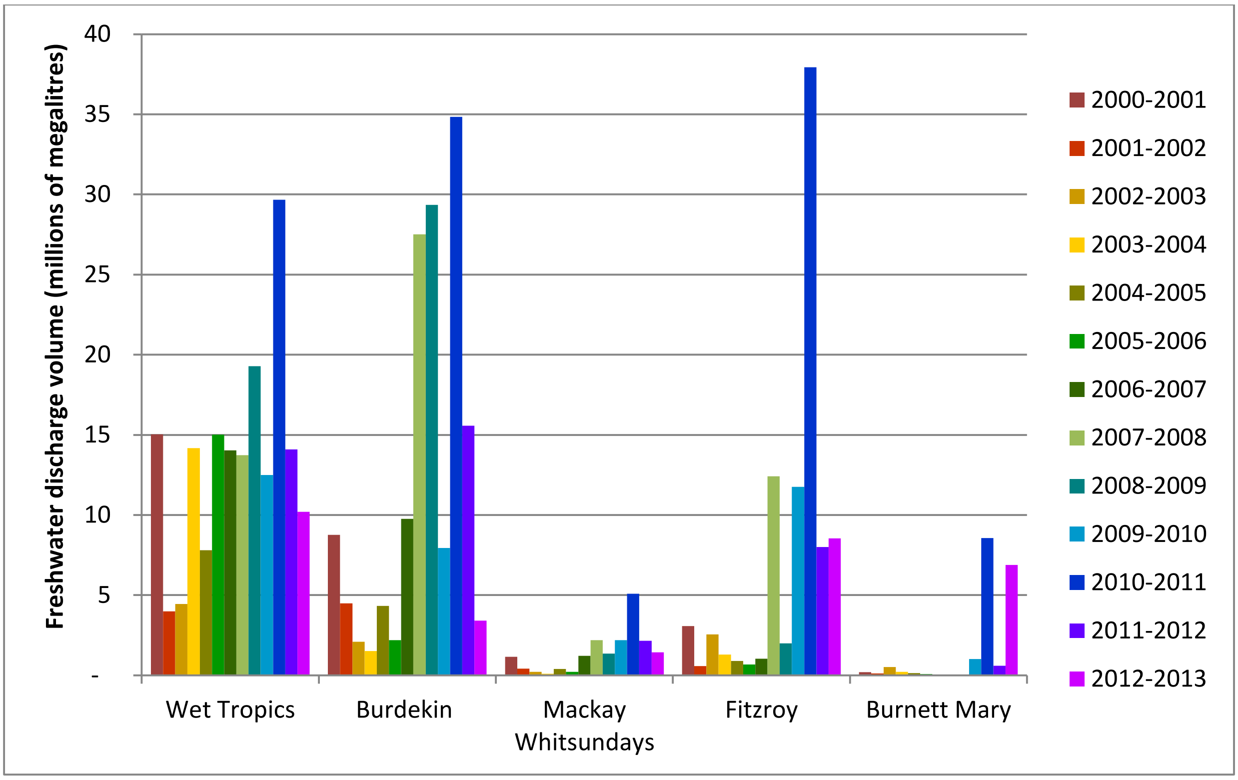
The area at highest risk from degraded water quality and its flow-on effects is the inshore region (Alvanez-Romero et al., 2013), which makes up approximately eight per cent of the Great Barrier Reef Marine Park. Inshore seagrass and coral reef ecosystems support significant ecological communities and the inshore region is the area most used by recreational visitors, commercial tourism operators and some commercial fisheries. Current management interventions are having a positive effect on water quality; however, it will take time and continued improvements in land management practices for the marine ecosystem to recover and return to good health.

Impacts of catchment runoff

Reef ecosystems and the catchments are part of a dynamic, interconnected system and the relationship between land use, water quality and ecosystem health indicators (e.g. coral cover and seagrass abundance) is relatively well understood. Nutrient enrichment, turbidity, sedimentation and pesticides all affect the resilience of the reef, degrading coral reefs and seagrass meadows at local and regional scales (reviewed in Brodie et al., 2012; The State of Queensland, 2013). Pollutants may also interact to have a combined negative effect on reef resilience that is greater than the effect of each pollutant in isolation. For example, the reduced light and excess nutrients found in turbid flood plumes combine to increase the level of stress on seagrasses (Collier et al., 2012; McKenzie et al., 2013) and differences in tolerance between species of coral to nutrient enrichment and sedimentation can lead to tissue death and changes in community composition (Fabricius, 2005; Fabricius, 2011; Weber et al., 2012). Since 2009, there has been a steady decline in key pollutant loads entering the reef lagoon. However, a sustained and greater effort will be needed to achieve the Reef Plan goal of no detrimental impact on the health and resilience of the reef.

Floods

In the summer of 2011-2012, discharge from many rivers in the central and southern areas of the reef was more than three times above the median discharge. The highest discharge was from the Burdekin and Fitzroy Rivers, and all rivers in the Mackay Whitsunday region (the Pioneer River had the highest proportional discharge at 3.8 times above the median). However, flows from all rivers were well below those in the 2010-2011 wet season, which was the second wettest since records began. River discharge was below the long-term median in the Cape York region and close to median levels in the Wet Tropics region.



Combined annual discharge from major rivers in each region, 2002–2013. Source: Data supplied by the Queensland Department of Natural Resources and Mines, compiled by the Australian Institute of Marine Science and McKenzie et al.

In the summer of 2012-2013, ex-Tropical Cyclone Oswald delivered above average rainfall to the entire reef catchment. This system tracked down the coast and flooded many rivers from Cairns to Bundaberg. All rivers from the Fitzroy in Rockhampton to around Maryborough suffered moderate to major flooding, and severe flooding occurred in the Burnett catchment. The Calliope, Boyne and Burnett Rivers also had above median discharge in 2012-2013.

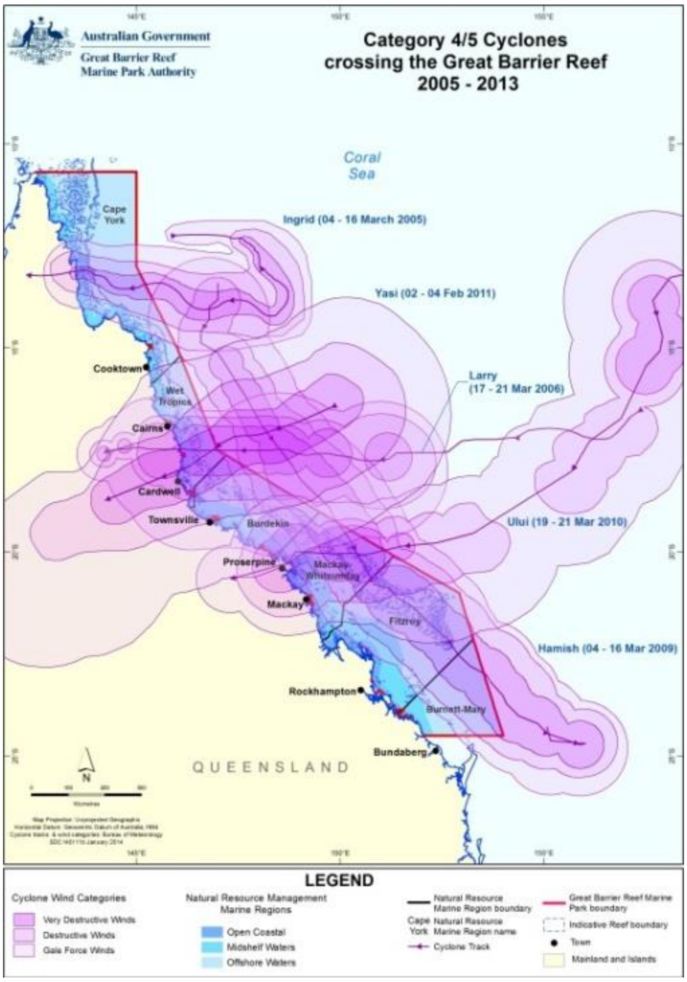
In particular, the southern third of the Great Barrier Reef Marine Park (i.e. from the Whitsunday islands to Seventeen Seventy) was exposed to a large volume of low salinity flood waters, which is likely to have contributed to localised coral bleaching and mortality on shallow, inshore reefs in the area. In addition to large volumes of freshwater, wet season floods deliver the majority of nutrient, sediment and pesticide loads to the reef lagoon.

Cyclones

Three small (Category 1 or 2) cyclones traversed parts of the reef between 2011-2012 and 2012-2013. The most significant impacts were associated with the Category 1 Cyclone Oswald, largely after it was downgraded to a significant rain depression. The Great Barrier Reef Marine Park Authority's Integrated Eye on the Reef monitoring network recorded some damage to reefs from Cairns to the Capricorn Bunker Group following ex-Tropical Cyclone Oswald, which traversed down the reef from north to south between 23 and 29 January 2013. The high winds and heavy rainfall associated with this event had the greatest effect on coral reefs and seagrass meadows in southern areas. These effects included physical damage from waves, as well as exposure to low salinity, high sediments and turbidity from the flood plumes.

Since 2005, many areas of the reef have been affected by cyclonic activity including very destructive category 4 or above cyclones. For example, about 13 per cent of the reef, representing a 300 kilometre stretch from Cairns to Townsville, was exposed to Tropical Cyclone Yasi's destructive or very destructive winds in February 2011.

Cyclones may cause extreme physical damage to reef structure and other benthic communities, such as seagrass meadows. The combined paths of all cyclones since 2005 have exposed 3889 reefs (80 per cent of the Great Barrier Reef Marine Park) to gale force winds or above. Most of the affected reefs were outside the inshore area, which is a relatively small proportion of the whole Great Barrier Reef Marine Park. Recent estimates attribute 48 per cent of total coral mortality recorded between 1985 and 2012 to cyclones and storms (De'ath et al., 2012). There have been no large-scale assessments of the impacts on seagrass communities, but localised monitoring after Cyclone Yasi suggests cyclones play a significant role in the redistribution of marine sediments by scouring the seafloor and removing benthic communities such as seagrass (http://www.gbrmpa.gov.au/__data/assets/pdf_file/0016/14308/GBRMPA-ExtremeWeatherAndtheGBR-2010-11.pdf). The effect of multiple severe cyclones and floods on ecosystem health is still evident today (McKenzie et. al., 2013; Thompson et al., 2013). The extensive loss of seagrass across much of the southern part of the reef resulted in a large number of dugong and turtle deaths and the population of dugongs in the southern area of the reef is at a record low (http://www.gbrmpa.gov.au/outlook-for-the-reef/extreme-weather/dugong-and-turtle-strandings).



Extent of the Great Barrier Reef affected by Category 4 or 5 cyclones in the eight year period 2005-2013. Map: courtesy of the Spatial Data Centre, Great Barrier Reef Marine Park Authority.

Crown-of-thorns starfish

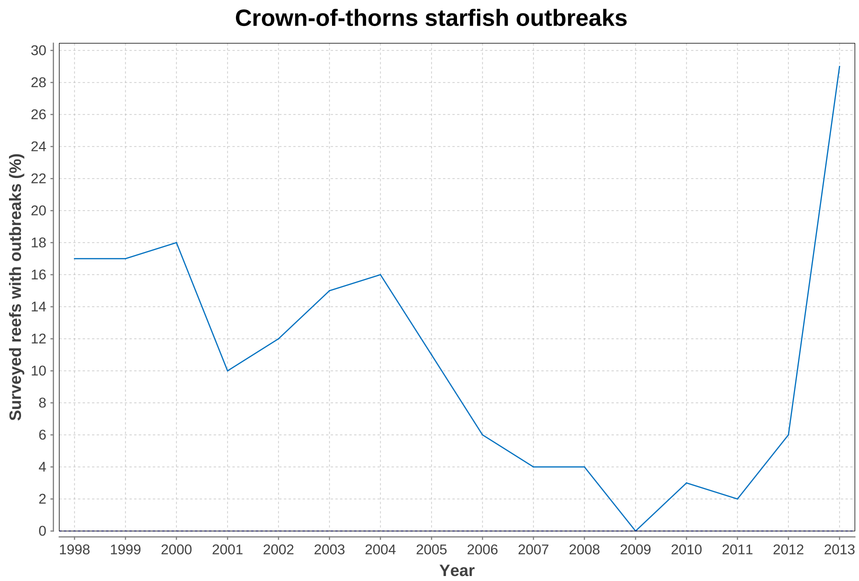
Crown-of-thorns starfish have had a major impact on the reef with an analysis of long-term monitoring data showing the starfish has been responsible for 42 per cent of coral cover loss since 1985 (De'ath et al. 2012). Most outbreaks occur on mid-shelf reefs, beginning along the narrow northern shelf between Cairns and Lizard Island (the 'initiation zone') and then moving to southern reefs 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 past three decades, which is explained by the high density of coral and the regional oceanography.

In 2012-2013, crown-of-thorns starfish were recorded at outbreak densities on 30 per cent of reefs monitored by the Long Term (Reef) Monitoring Program. Densities in the 'initiation zone' were at the highest levels since 1986 (Miller and Sweatman, 2013).

An active outbreak of crown-of-thorns starfish occurs 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 15 starfish per hectare when coral cover is moderate to high (Moran and De'ath, 1992). However, many of the inshore and mid-shelf reefs that were affected by multiple severe weather events in recent years have lower coral cover and, therefore, reduced capacity to cope with these levels of starfish.

There are three previously documented outbreaks of crown-of-thorns starfish in the reef since the 1960s (1961-1968, 1978-1991 and 1993-2005), with the latest, ongoing outbreak commencing in 2011 (http://www.aims.gov.au/docs/research/biodiversity-ecology/threats/cots-animation.html). The onset of the current outbreak is believed to be associated with the poor quality of water entering the reef following the floods and severe weather events in 2009 to 2011 (Brodie et al., 2005; Fabricius et al., 2010).

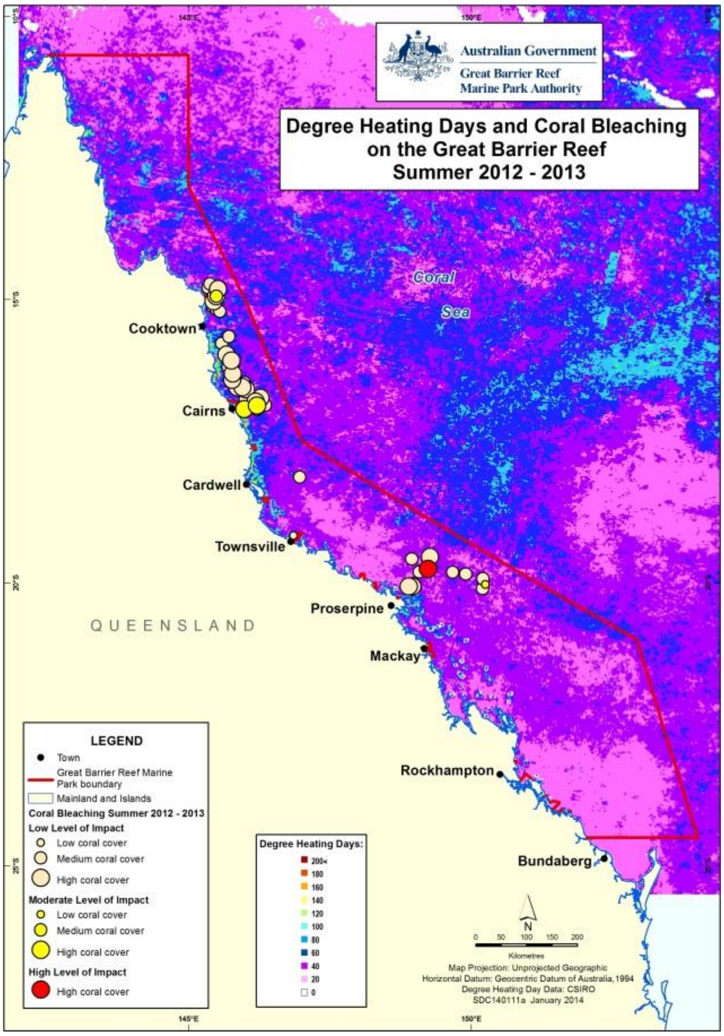
The Australian Government is committed to protecting coral cover at high value tourism sites from crown-of-thorns starfish through a diver injection control program. The control program has been underway since 2012 and is a collaborative effort involving the government, tourist operators including the Association of Marine Park Tourism Operators, researchers and volunteers. Monitoring will ascertain whether coral cover and diversity can be maintained at these sites.



Elevated sea surface temperatures

Coral bleaching across the reef in 2011-2012 and 2012-2013 was generally low to moderate, though a single instance of a high level of impact was observed in the Mackay Whitsunday region in 2012-2013. Most of the bleached areas were in the Wet Tropics and the Mackay Whitsunday regions (GBRMPA, 2014). Over the summer, the accumulated heat stress was between 20 to 40 degree heating days on average.

Coral bleaching commonly occurs when accumulated temperature stress, measured as degree heating days over the summer months, exceeds a threshold of about 60 to 100 degree heating days (Maynard, 2010). An increase in the long-term average temperature of reef waters is narrowing the gap between a regular summer and a coral bleaching season. For example, the frequency of mass bleaching events has increased over the last two decades, corresponding with higher seawater temperatures (Johnson and Marshall, 2007; Lough, 2007). Major coral bleaching events caused by unusually warm water temperatures had not been recorded in the Great Barrier Reef Marine Park before a major episode in 1998 that was part of a global event. Similar conditions returned in 2002 and to a lesser extent in 2006, and have caused substantial loss of coral cover (De'ath et. al., 2012). Prolonged exposure to elevated seawater temperatures may also increase the susceptibility of corals to disease (Bruno et. al., 2007).



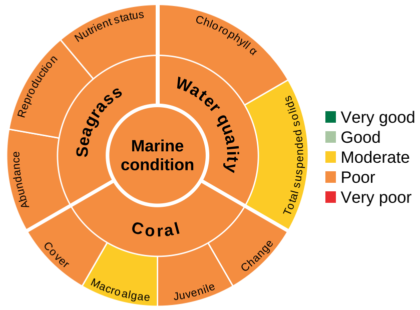
Water temperature as degree heating days and areas where coral bleaching occurred.

Influence of climate change

The intensity of disturbances to the reef is set to increase under future climate change scenarios (Hoegh-Guldberg 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 extent and persistence of damage to the 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, 2009). This has important implications for the future management of the Great Barrier Reef and run-off entering the reef lagoon. For example, modelling suggests that the upper thermal bleaching limit of corals is correlated with exposure to dissolved inorganic nitrogen and that reducing the output of dissolved inorganic nitrogen may enhance the resilience of inshore corals (Woodridge, 2009).

The future is not easily forecast, but there is strong evidence that halting and reversing the decline of water quality in the Great Barrier Reef lagoon will increase the natural resilience of reef ecosystems to these future challenges.

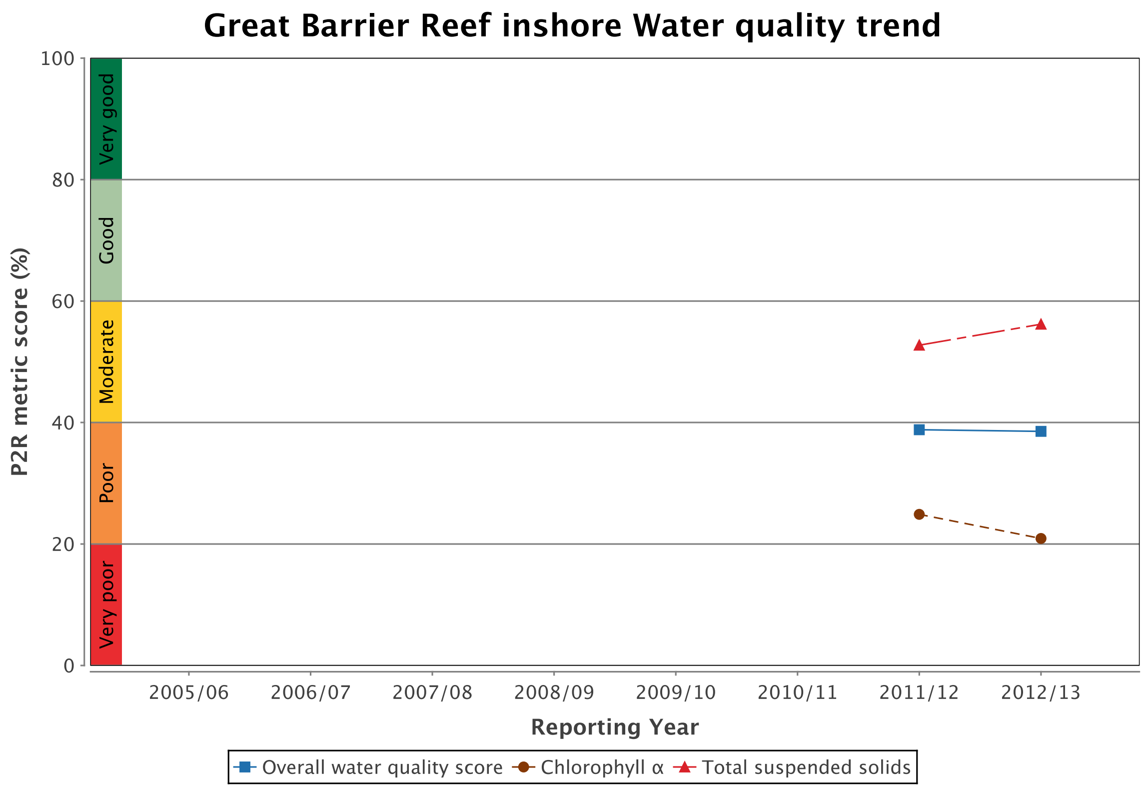
Great Barrier Reef-wide



The overall condition of the inshore reef remained poor in 2011-2012 and 2012-2013. Inshore water quality was poor in 2011-2012 and 2012-2013 and varied from moderate to poor depending on the region. Inshore seagrass showed signs of recovery in some regions and improved from very poor in 2011-2012 to poor in 2012-2013. Inshore coral reefs remained in poor condition in 2012-2013 with reefs in the Wet Tropics region declining from moderate to poor and reefs in the Fitzroy region declining from poor to very poor. However, there was improved coral recruitment in the Wet Tropics and Burdekin regions in 2012-2013. Pesticides were detected year round at all sites in the reef in 2011-2012 and 2012-2013, except for Cape York.

Water quality

Inshore water quality (assessed by remote sensing of chlorophyll *a* and suspended solids) remained poor in 2011-2012 and 2012-2013. There was a slight improvement in water quality since the record flooding in 2010-2011; however, the overall poor score reflects the cumulative impact of above-average flows from many rivers over multiple years and the continued re-suspension of finer sediment by wind and waves. Concentrations of chlorophyll *a* and total suspended solids were rated poor and moderate respectively in 2011-2012 and 2012-2013.

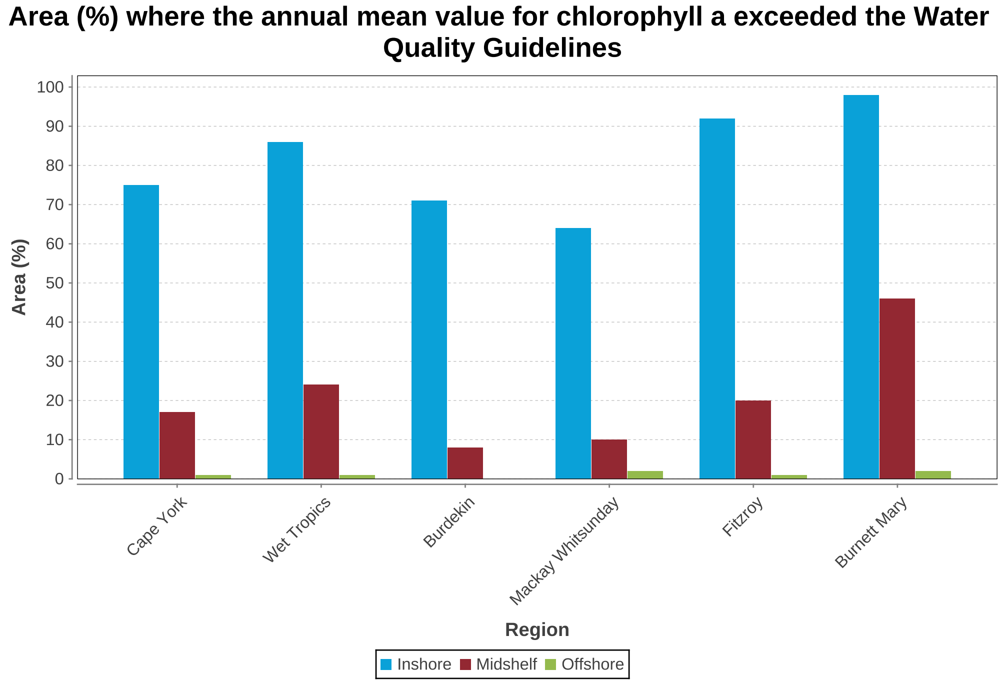


Trend in the Water Quality Index from 2011-2012 to 2012-2013. The Water Quality Index is also separated into component scores for concentrations of chlorophyll a and total suspended solids. Trend data is only shown for these two years because a major change in the remote sensing algorithms mean the historical data is no longer directly comparable. The full historical time-series will be reprocessed for the next report card.

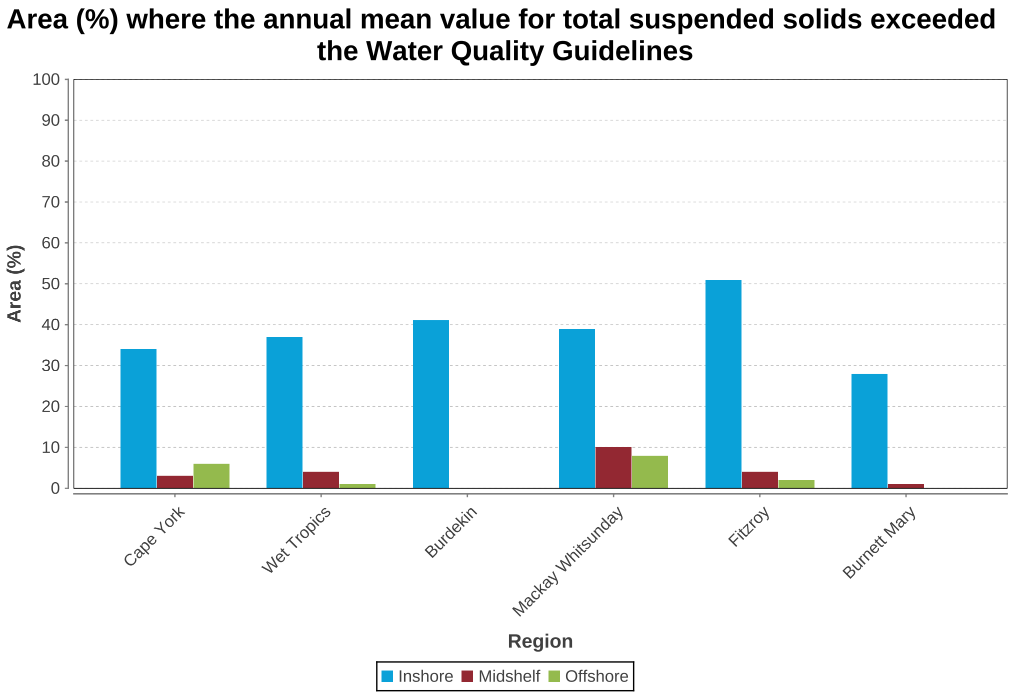
In 2011-2012 and 2012-2013, remote sensing of water quality showed a clear gradient of improvement from inshore areas, that are more frequently exposed to flood waters, to offshore areas, that are more distant from terrestrial inputs. The inshore area of all regions had annual mean chlorophyll *a* concentrations that exceeded the Great Barrier Reef Water Quality Guidelines and the area that exceeded the guidelines approached 100 per cent of some areas during the year, for both years (from 64 per cent in the Mackay Whitsunday to 98 per cent in the Burnett Mary in 2012-2013) (GBRMPA, 2013). While some exceedance of the guideline is expected during the wet season, these high concentrations are indicative of high nutrient loading from the catchments.

Concentrations of suspended solids also exceeded the Great Barrier Reef Water Quality Guidelines during the year for both years, particularly in the Fitzroy region, which reflects the greater input from continued flooding in recent years and re-suspension of finer sediment particles by wind and wave action (from 28 per cent in the Burnett Mary to 51 per cent in the Fitzroy in 2012-2013).

Note the remote sensing data in the following figures for Cape York and the Burnett Mary regions is not validated with any field data, unlike the other regions. In the other four regions, more detailed, site specific water quality information is available which is assessed against the Great Barrier Reef Water Quality Guidelines (see regional summaries for detail).



Relative area (%) of the inshore and midshelf water bodies where the annual mean value for chlorophyll a exceeded the Water Quality Guidelines from 1 May 2012 to 30 April 2013.

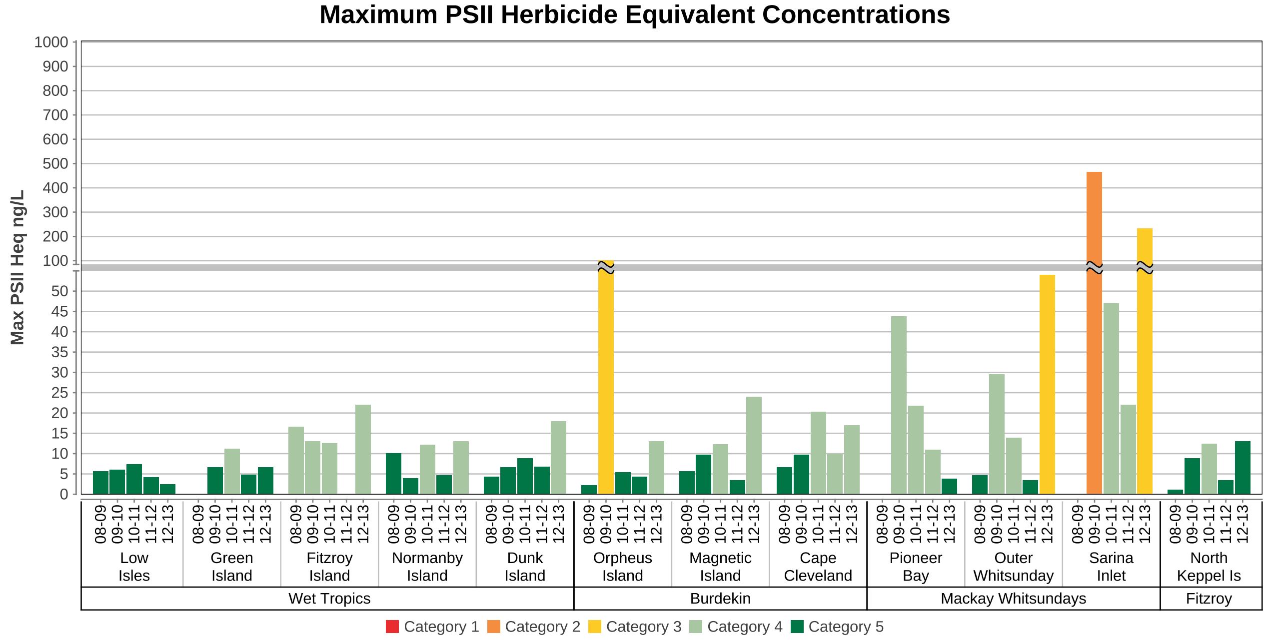


Relative area (%) of the inshore, midshelf and offshore water bodies where the annual mean value for total suspended sediment exceeded the Water Quality Guidelines from 1 May 2012 to 30 April 2013.

Pesticides

Pesticides were detected at all sites in 2011-2012 and 2012-2013 with high variability in the profiles and concentrations between regions and seasons. The most frequently detected pesticides in inshore waters are those that combine to inhibit photosynthesis (PSII) in plants (e.g., diuron, atrazine, hexazinone, simazine and tebuthiuron). An index has been developed using PSII herbicide equivalent concentrations to assess the potential combined toxicity of these pesticides relative to the Great Barrier Reef Water Quality Guidelines. The PSII herbicide equivalent concentration incorporates the relative potency and abundance of individual PSII herbicides compared to a reference PSII herbicide, diuron. Recent research indicates that persistent concentrations of pesticides below guideline levels may have a longer-term, chronic impact on some marine organisms. The five categories of the index reflect some of the published effects on photosynthesis at levels of pesticides below guideline levels, where category 5 is no impact and category 1 corresponds to the greatest impact and is equivalent to the Water Quality Guidelines.

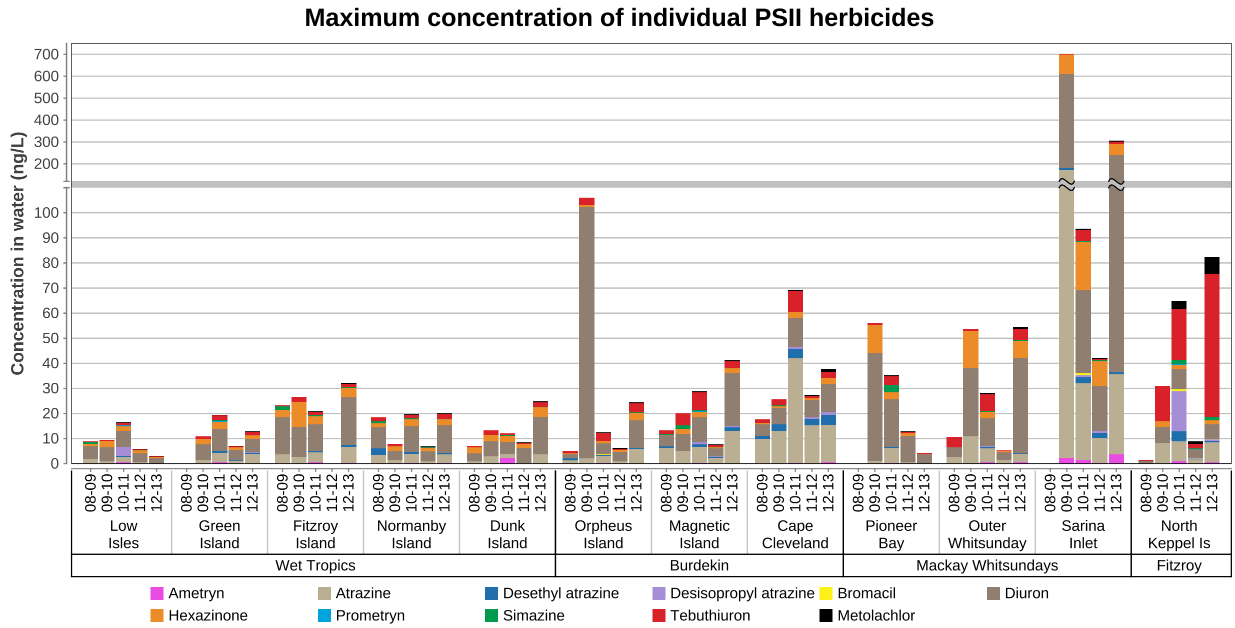
Elevated PSII herbicide equivalent concentrations generally coincided with periods of high flow from the major rivers in the wet season. Biologically relevant concentrations of PSII herbicides (Category 4 and above) were present in eight of the 12 routinely monitored sites in the Wet Tropics, Burdekin and Mackay Whitsundays regions. No PSII herbicide equivalent concentrations were detected above guideline levels (Category 1) at any monitoring sites. In 2012-2013, the highest PSII herbicide equivalent concentration (Category 3 - known to affect photosynthesis in diatoms and seagrasses) was detected in the Mackay Whitsunday region at sites with seagrass meadows and inshore coral reefs nearby. Flood waters from the Tully, Herbert, Burdekin and Mary rivers also had concentrations of PSII herbicides (Category 3 and 4) that suppress photosynthesis in marine species, mostly attributed to the presence of diuron.



Maximum PSII herbicide equivalent concentrations at all sites monitored in the reef in 2012-2013.

Herbicide equivalent concentrations provide a single reporting parameter for PSII herbicides with a similar mode of action on photosynthesis. However, they may obscure differences in the abundance of individual herbicides detected in different regions because they also consider the potency of each herbicide. For example, a herbicide detected at a high concentration may have a low potency (with respect to the reference diuron) and thus the contribution to the overall PSII inhibition is very small. Hence the concentrations of individual herbicides are also presented below. The types of pesticides detected in each region are often related to the land management activities in adjacent catchments.

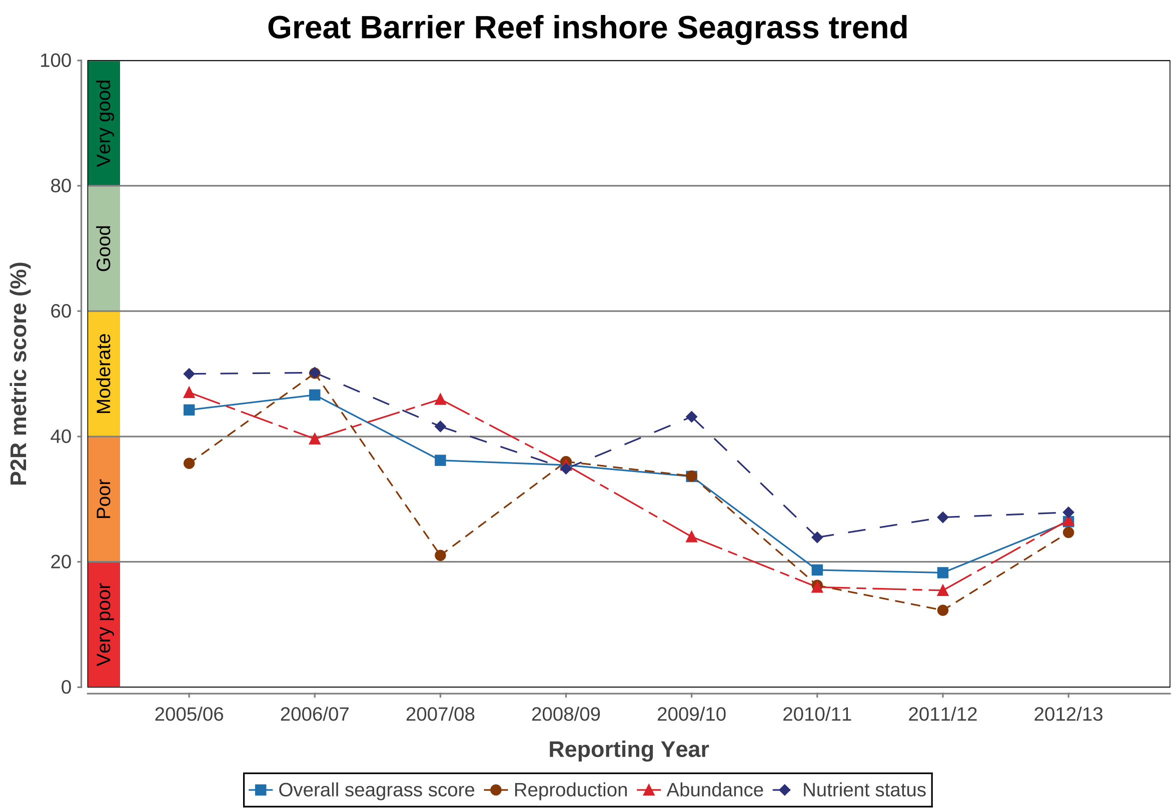
The most prevalent pesticide detected across the reef in 2012-2013 was diuron (heavily used in the sugarcane industry), which was the main contributor to the PSII herbicide equivalent index. Diuron was detected at the majority of sites in the Wet Tropics, Burdekin and Mackay Whitsunday regions and in greater abundance than in 2011-2012. Atrazine, tebuthiuron and hexazinone were also frequently detected. Tebuthiuron was the only pesticide that exceeded the Great Barrier Reef Water Quality Guidelines, at a routine monitoring site at North Keppel Island in the Fitzroy region. Tebuthiuron is used in the grazing industry and is typically found at elevated concentrations in this region, due to the high proportion of land used for grazing activities. A range of other pesticides were detected across the reef including terbutryn, galaxolie and the insecticide imidacloprid.



Maximum concentration of individual PSII herbicides at all sites monitored across the reef in 2012-2013 compared to the previous four years.

Seagrass

The overall reef-wide condition of inshore seagrass meadows improved from very poor in 2011-2012 to poor in 2012-2013. Seagrass abundance and reproductive effort were very poor in 2011-2012 and poor in 2012-2013, while nutrient status remained consistently poor. However, there are differences between habitats and regions over time (refer to regional sections).



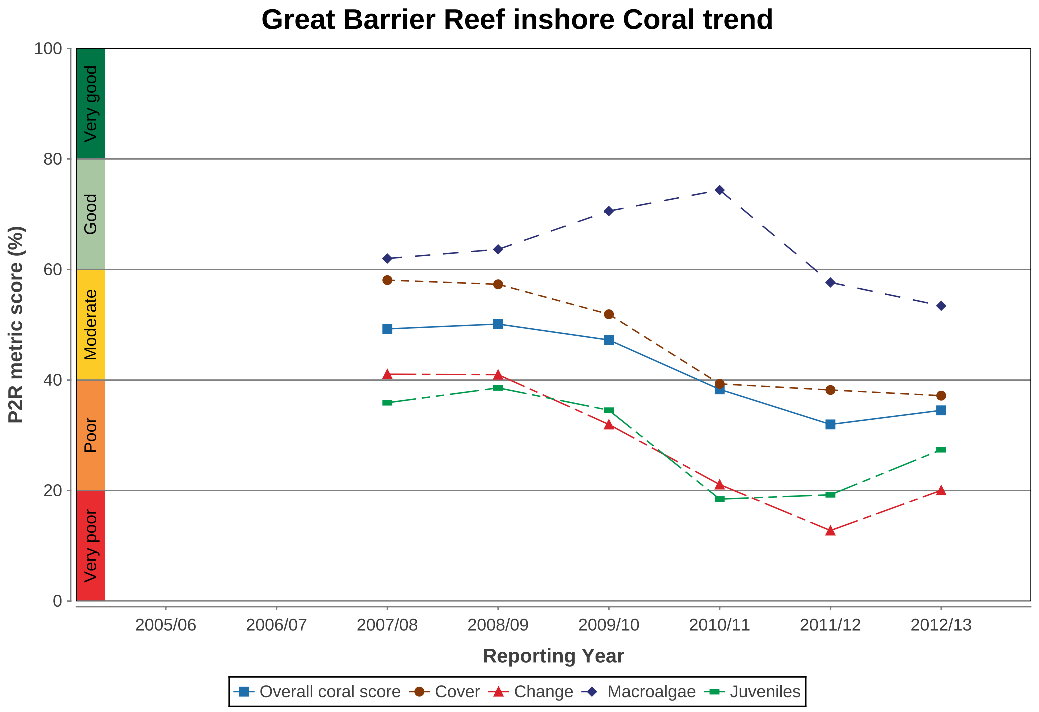
The reef-wide abundance of intertidal seagrasses improved from very poor in 2011-2012 to poor in 2012-2013. However, abundance remained very poor in the Wet Tropics, Mackay Whitsunday and Burnett Mary regions due to the continuation of a number of stressors including above median discharges from adjacent river systems. Seagrass in these regions also had very poor reproductive effort, which may affect the capacity of local meadows to recover from previous environmental disturbances. Consistently poor scores for nutrient content of seagrass tissue at sites in all habitats reflects the cumulative impact of poor water quality.

Seagrass abundance differed according to habitat type. The greatest fluctuations occurred in estuarine habitats, most often in response to prevailing climatic conditions but also due to localised weather events such as pulses of nutrient-rich, sediment-laden flood waters and cyclonic activity. Seagrass abundance in coastal habitats has been relatively stable over the past decade; however, there are signs of a continual decline since 2009. Abundance at inshore reef and subtidal habitats has been in a constant state of decline since monitoring began in 2005-2006. However, there appears to be some localised signs of recovery in 2012-2013. Recovery was mainly fast-growing pioneer species and it may take many years for meadows to fully recover their more complex foundational community structure.

The impact of the slow recovery of seagrass on populations of dugongs and turtles remains variable. The rate of dugong and turtle strandings, which increased significantly after the 2011 floods, has returned to normal for dugongs (though from a much lower population base). However, the rate of turtle deaths (turtles are more sedentary in their behaviour) has remained higher than the historical stranding rates prior to 2011 (http://www.gbrmpa.gov.au/outlook-for-the-reef/extreme-weather/dugong-and-turtle-strandings). Further information on seagrass abundance is presented in the regional sections.

Coral

Inshore coral reefs remained in poor condition overall in 2011-2012 and 2012-2013, and the level of cover from competing macroalgae was moderate in both years. The density of hard coral juveniles and the rate of change in coral cover were very poor in 2011-2012 and poor in 2012-2013. However, there are differences between regions over time (refer to regional sections).

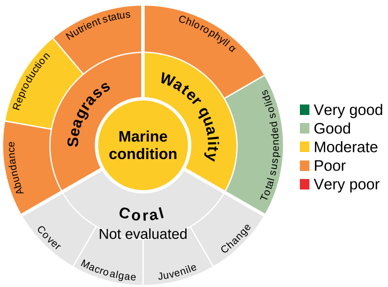


In 2011-2012, the overall condition of inshore coral reefs continued to decline which reflected further loss of coral cover, the low recovery potential of reefs and increases in macroalgae. Reef-wide coral cover in 2011-2012 was at its lowest point since surveys began in 2005 due to a combination of impacts associated with tropical cyclones, outbreaks of crown-of thorns starfish, broad-scale flooding and coral disease.

In several regions, the incidence of coral disease was related to the discharge from local rivers. The associated increase in turbidity and the proportion of fine-grained sediments is likely to have had a negative impact on coral recruitment and growth by smothering and limiting the amount of available light. Macroalgae, which competes with the coral for space and can supress recovery, was at its worst level overall in 2012-2013, reflecting localised poor water quality from the continued input of pollutants. The density of juveniles and the rate of change in coral cover increased marginally in 2012-2013 and were rated as poor overall, up from very poor in 2011-2012. However, in general, the low levels of coral cover coupled with low densities of juveniles may indicate a lack of resilience of coral communities at many inshore reefs. The combination of acute disturbances and elevated stress from poor water quality are driving changes in the composition and condition of inshore reefs.

While coral data collection began in 2005, the coral trend is calculated as the average rate of increase in coral cover compared to modelled predictions over the preceding three years, so the trend graphs start in 2007-2008. Further information on the cover of hard corals, macroalgae and density of hard coral juveniles is shown in the relevant regional section.

Cape York

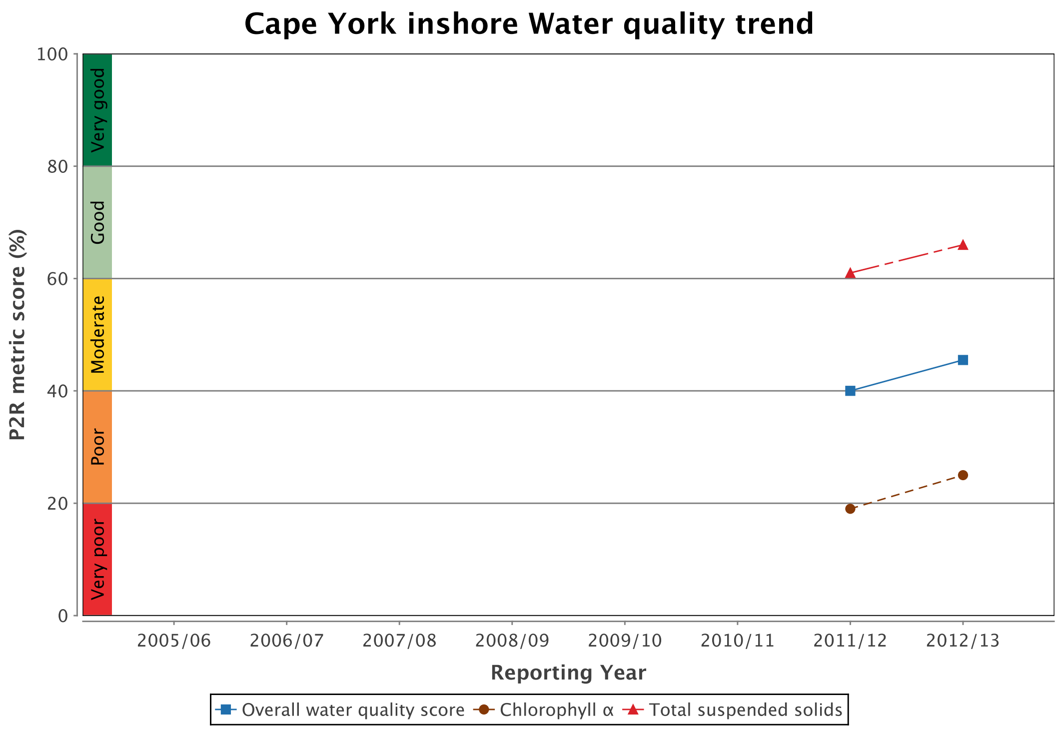


The overall marine condition adjacent to Cape York improved from poor in 2010-2011 to moderate in 2011-2012 and 2012-2013. Inshore water quality also improved from poor in 2010-2011 to moderate in 2011-2012 and 2012-2013. The one southern seagrass bed monitored improved from very poor in 2011-2012 to poor in 2012-2013. No coral monitoring occurs in the inshore waters of Cape York region under the Marine Monitoring Program. However, some sites monitored in the southern section by the Australian Institute of Marine Science indicated that coral communities in Cape York were in relatively good condition.

Water quality

There is no comprehensive, ongoing *in situ* water quality monitoring in the Cape York region. Estimates of chlorophyll *a* and total suspended solids are derived from remote sensing only, which requires further field validation and, hence, estimates have relatively low reliability compared to those for other regions. In 2012-2013, a first step was made towards addressing this issue, with researchers completing an intensive field campaign in Princess Charlotte Bay.

Inshore water quality in Cape York (assessed by remote sensing) was moderate in 2011-2012 and 2012-2013, and has varied from poor to moderate since 2005-2006, with no clear correlation with freshwater discharge. The two water quality indicators, chlorophyll *a* and suspended solids, varied similarly over time until 2010-2011, when the difference between scores increased and chlorophyll *a* scored consistently lower than suspended solids.



Trend in the Water Quality Index from 20112012 to 20122013. The Water Quality Index is also separated into component scores for concentrations of chlorophyll a and total suspended solids. Trend data is only shown for these two years, because a major change in the remote sensing algorithms mean the historical data is no longer directly comparable. The full historical time-series will be reprocessed for the next report card.

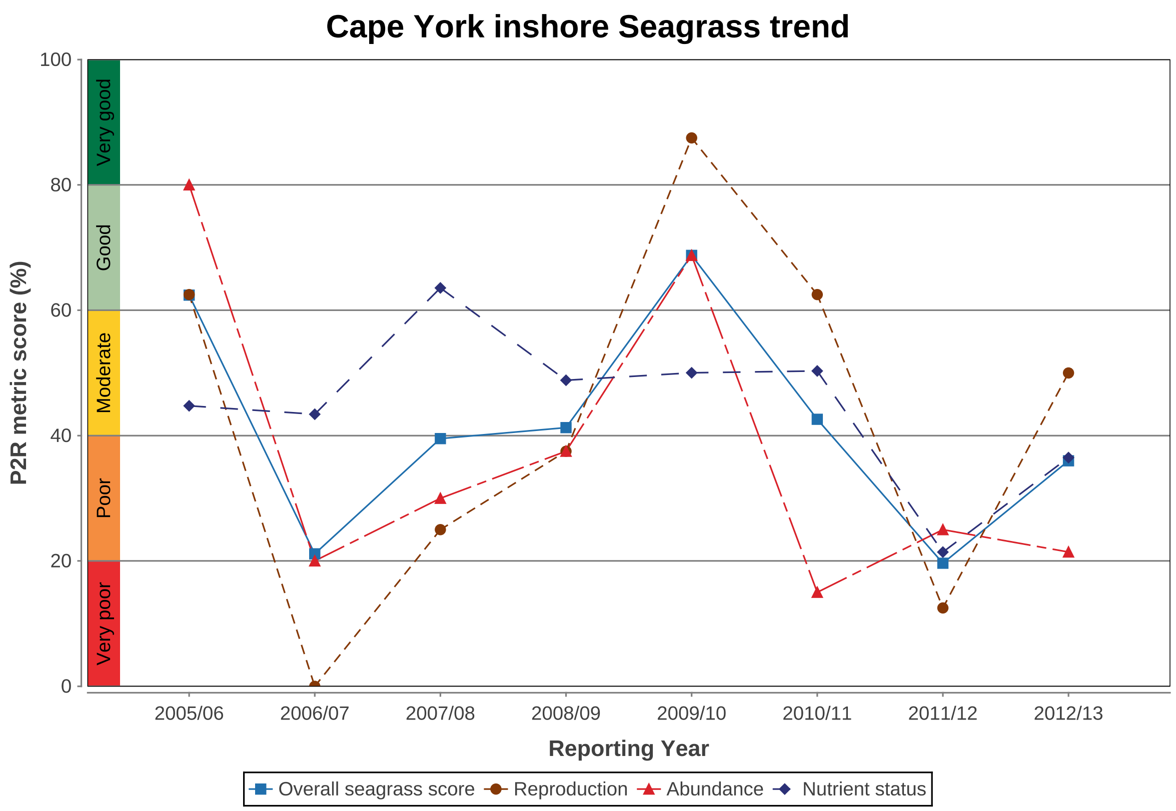
Chlorophyll *a* was rated as very poor in 2011-2012 and poor in 2012-2013. Concentrations exceeded the Great Barrier Reef Water Quality Guidelines for 93 per cent of the inshore area in the dry season in 2012-2013. However, in the wet season, the guidelines were exceeded for 46 per cent of the inshore area, mainly around river mouths and bays. Total suspended solids were rated as good in 2011-2012 and 2012-2013. Concentrations exceeded the guidelines for 50 and 17 per cent of the inshore area in the dry and wet seasons, respectively, in 2012-2013.

No pesticides were detected in flood plumes in 2011-2012 and no routine monitoring of pesticides occurred in 2012-2013.

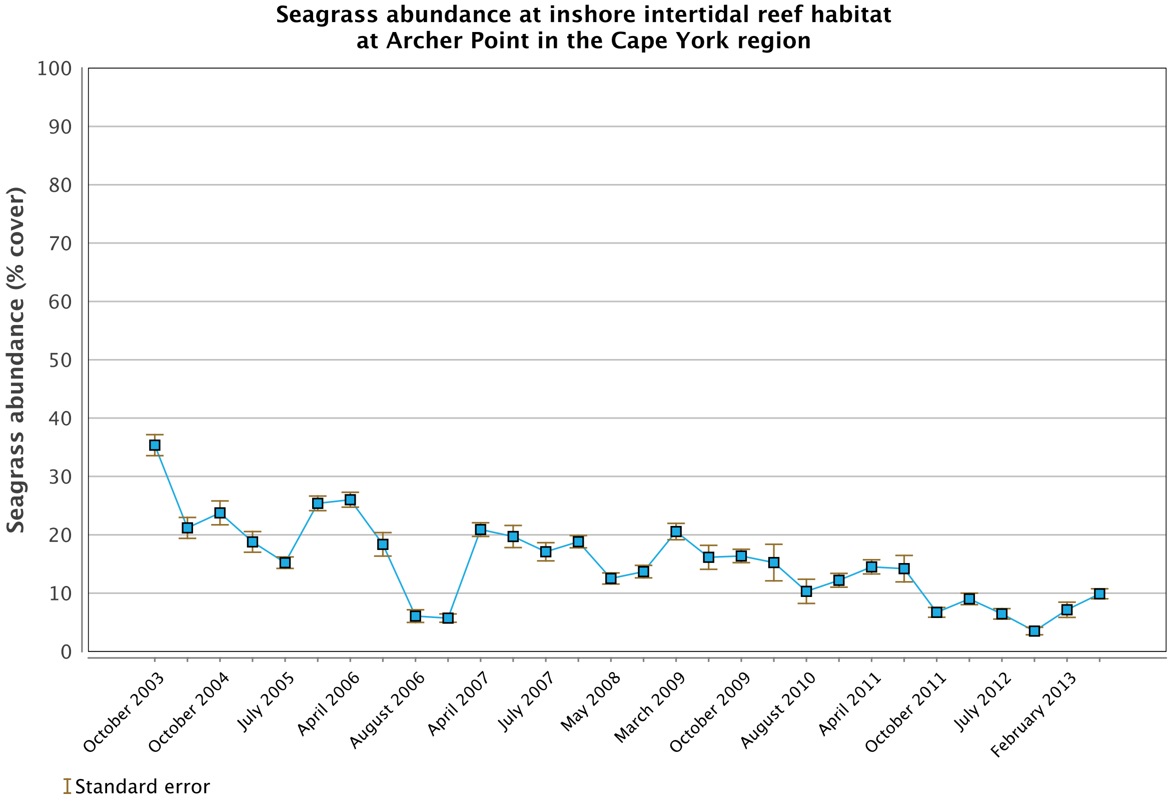
The marine environment in the Cape York region is relatively pristine compared to other regions. However, increasing pressure for development and the associated impacts on water quality in the region mean that Cape York is a high priority for intensifying monitoring efforts.

Seagrass

The condition of inshore seagrass in the Cape York region improved from very poor in 2011-2012 to poor in 2012-2013 and has been highly variable since 2005-2006. This is due to assessment being based on only one sampling site, a complex and highly variable environment and the effect of significant rain events and cyclones on seagrass abundance and reproductive effort. Although additional monitoring sites were established across the Cape York region in 2012-2013, for the purpose of consistency and interpretation of long-term trends, the new sites have been excluded from this Report Card. As the pre-existing long-term monitoring sites do not adequately capture the spatial variability of the region, Cape York seagrass data was not used in the reef-wide assessment of seagrass condition.



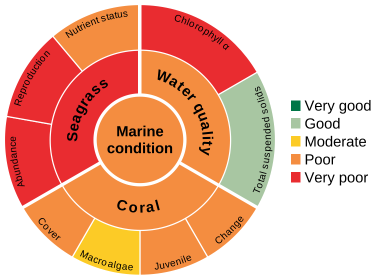
Seagrass was monitored at one fringing reef location in the southern part of the Cape York region, Archer Point, which supports a diverse range of species. The environment is characterised by fluctuating temperature and salinity, and the growth of seagrass is primarily influenced by physical disturbance from waves and swell and associated sediment movement. Seagrass abundance was poor in 2011-2012 and 2012-2013, up from very poor in 2010-2011. Reproductive effort improved from very poor in 2011-2012 to moderate in 2012-2013, indicating communities may have a relatively high potential for recovery from environmental disturbances compared to seagrass in other regions. Nutrient ratios of seagrass tissue were again rated as poor in both 2011-2012 and 2012-2013, reflecting local water quality conditions.



Coral

No coral monitoring occurs in the inshore waters of the Cape York region under the Marine Monitoring Program; however, some sites in the southern section are monitored by the Australian Institute of Marine Science as part of the Long Term (Reef) Monitoring Program. An Australian Institute of Marine Science report published in 2012 indicated that coral communities in Cape York were healthy, having recovered to early 1980s condition following impacts of cyclones, crown-of-thorns starfish and bleaching over the intervening years. This was the only region in the reef where this was the case.

Wet Tropics



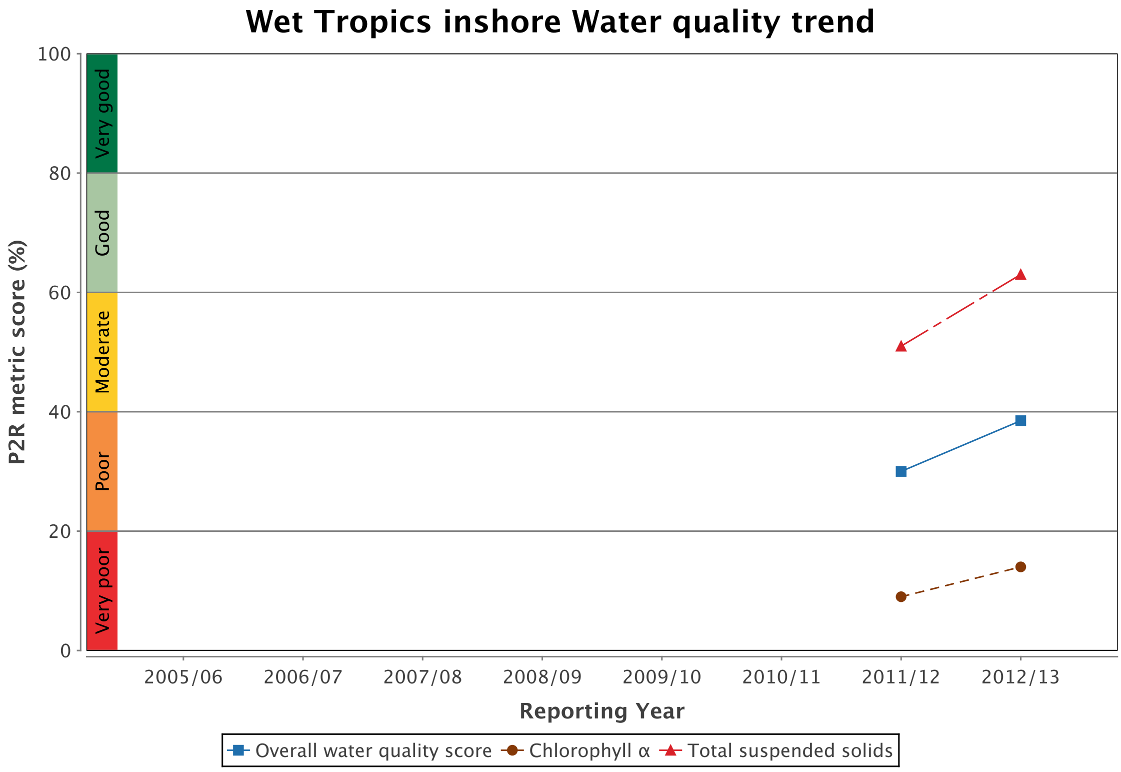
The Wet Tropics' overall inshore marine condition remained poor in 2011-2012 and 2012-2013. Inshore water quality remained poor and seagrass meadows declined from poor in 2010-2011 to very poor in 2011-2012 and 2012-2013. Coral reefs were in poor condition having declined from moderate in 2011.

Water quality

Inshore water quality (assessed by remote sensing of chlorophyll *a* and suspended solids) in the Wet Tropics region remained poor in 2011-2012 and 2012-2013. Scores for chlorophyll *a* were consistently worse than those for suspended solids in all monitoring years.

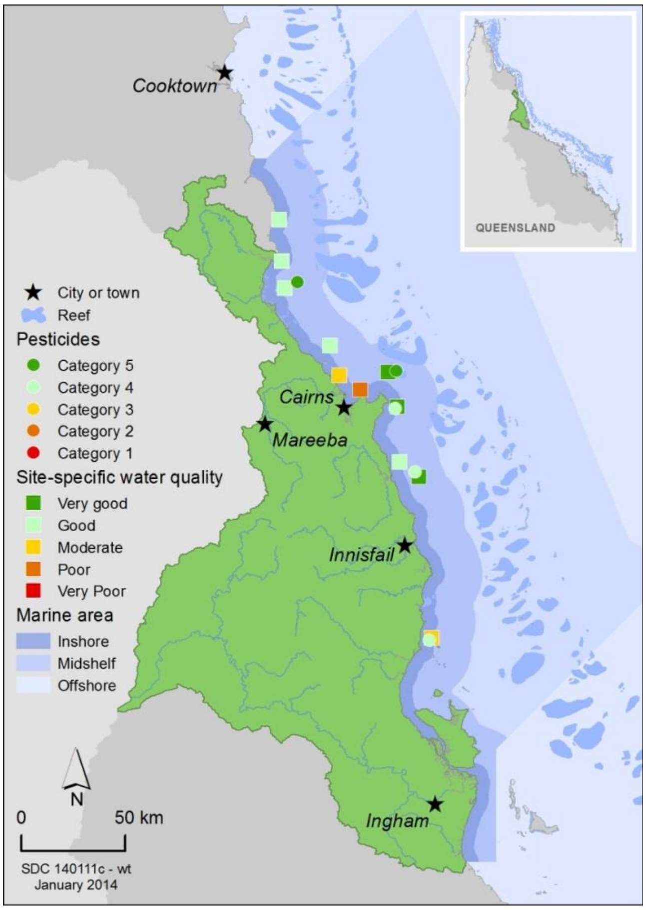
Chlorophyll *a* was rated as very poor in both 2011-2012 and 2012-2013. Concentrations exceeded the Great Barrier Reef Water Quality Guidelines for 95 and 53 per cent of the inshore area in the dry and wet season, respectively, in 2012-2013. Total suspended solids were rated as moderate in 2011-2012 and good in 2012-2013; however, concentrations exceeded the guidelines for 54 and 20 per cent of the inshore area in the dry and wet seasons, respectively, in 2012-2013.

Water quality across the region showed a clear gradient of improvement from inshore areas more frequently exposed to flood waters to offshore areas.



Trend in the Water Quality Index from 2011-2012 to 2012-2013. The Water Quality Index is also separated into component scores for concentrations of chlorophyll a and total suspended solids. Trend data is only shown for these two years, because a major change in the remote sensing algorithms mean the historical data is no longer directly comparable. The full historical time-series will be reprocessed for the next report card.

This onshore-offshore gradient was supported by long-term assessments of water quality at specific sites, with variability between sites reflecting local hydrodynamic conditions and biophysical processes. Site-specific water quality was rated as either good or very good at eight out of 11 sites in the region, three of which are located in the midshelf water body. However, water quality at the three sites close to river mouths draining from highly developed catchments was rated as moderate or poor due to high concentrations of particulate phosphorus, chlorophyll and turbidity/water clarity that exceeded the Great Barrier Reef Marine Park Water Quality Guidelines in 2011-2012 and 2012-2013. These site-specific water quality scores are calculated using a long-term integrated assessment of four indicators of water quality relative to the Great Barrier Reef Water Quality Guidelines (GBRMPA 2010) (see Marine methods for more detail).

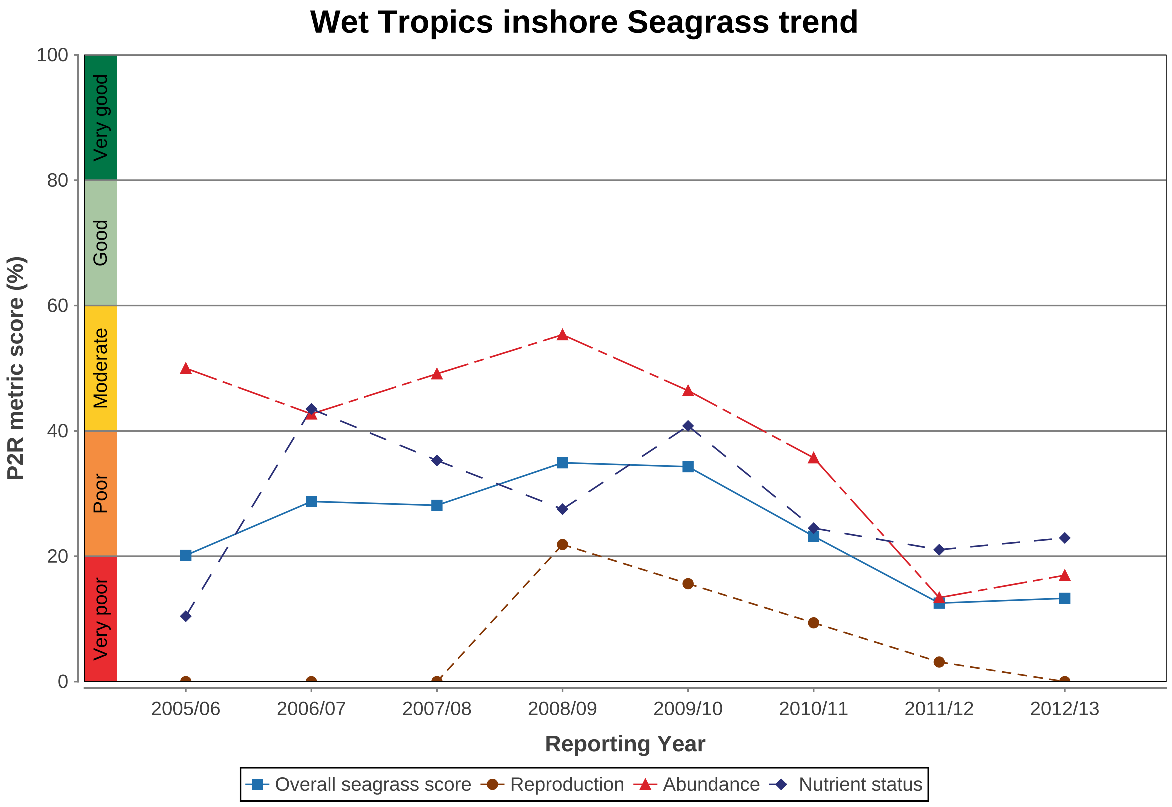


Scores for site-specific water quality and pesticides at fixed monitoring sites in the Wet Tropics region.

Concentrations of photosystem II (PSII) herbicides were above those known to affect photosynthesis in diatoms (Category 4) at Fitzroy, Normanby and Dunk Islands. The highest PSII herbicide equivalent concentration in flood waters (Category 3) was detected in grab samples collected near the Tully River mouth following a flow event, and lower concentrations (Category 4) were detected in flood waters from the Herbert River. The range of pesticides detected in the Wet Tropics region in 2012-2013 included diuron, atrazine (and its breakdown products), hexazinone, simazine, tebuthiuron, metolachlor, terbutryn, ametryn, galaxolide, imidacloprid and imazapic. Diuron was present at the highest concentrations. When compared to 2011-2012, diuron and atrazine were detected in greater abundance, by average factors of 2.2 and 8.4, respectively.

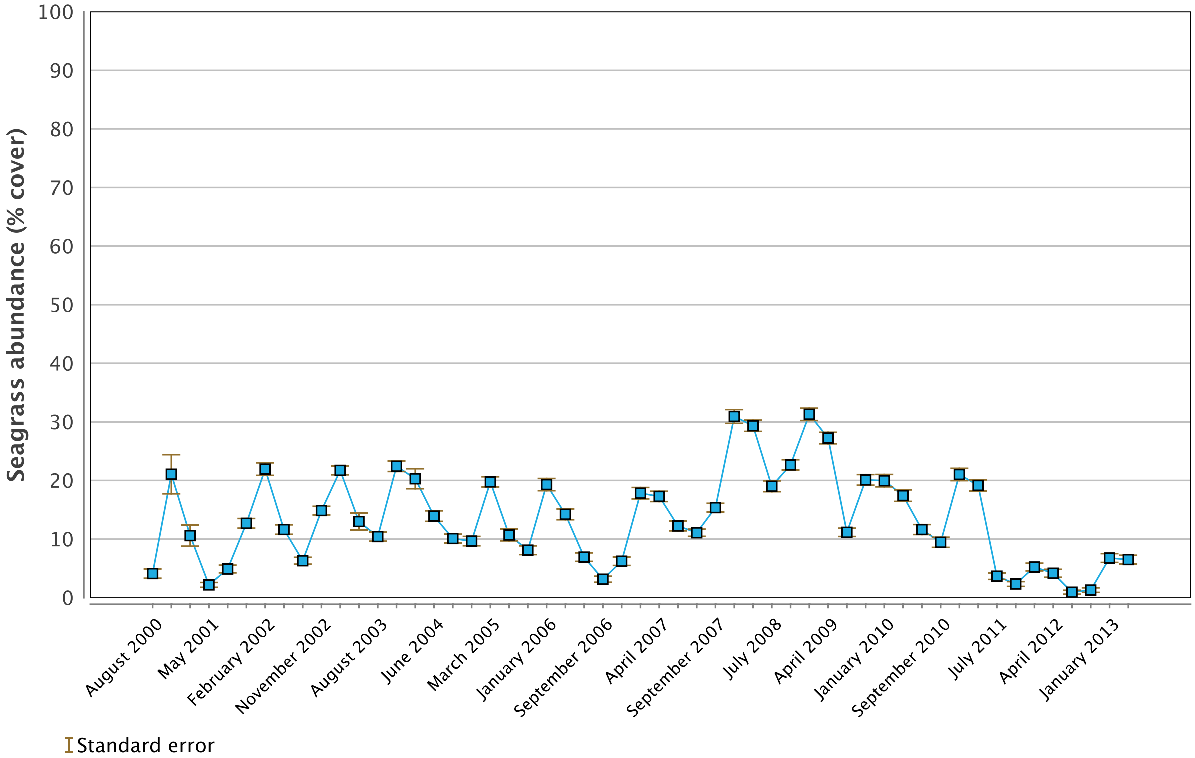
Seagrass

The overall condition of inshore seagrass in the Wet Tropics region remained very poor in 2011-2012 and 2012-2013, and has generally been poor since 2005-2006. This is due to complex interactions between the three indicators of seagrass condition: abundance, reproductive effort and nutrient status which are highly variable between years and habitats.

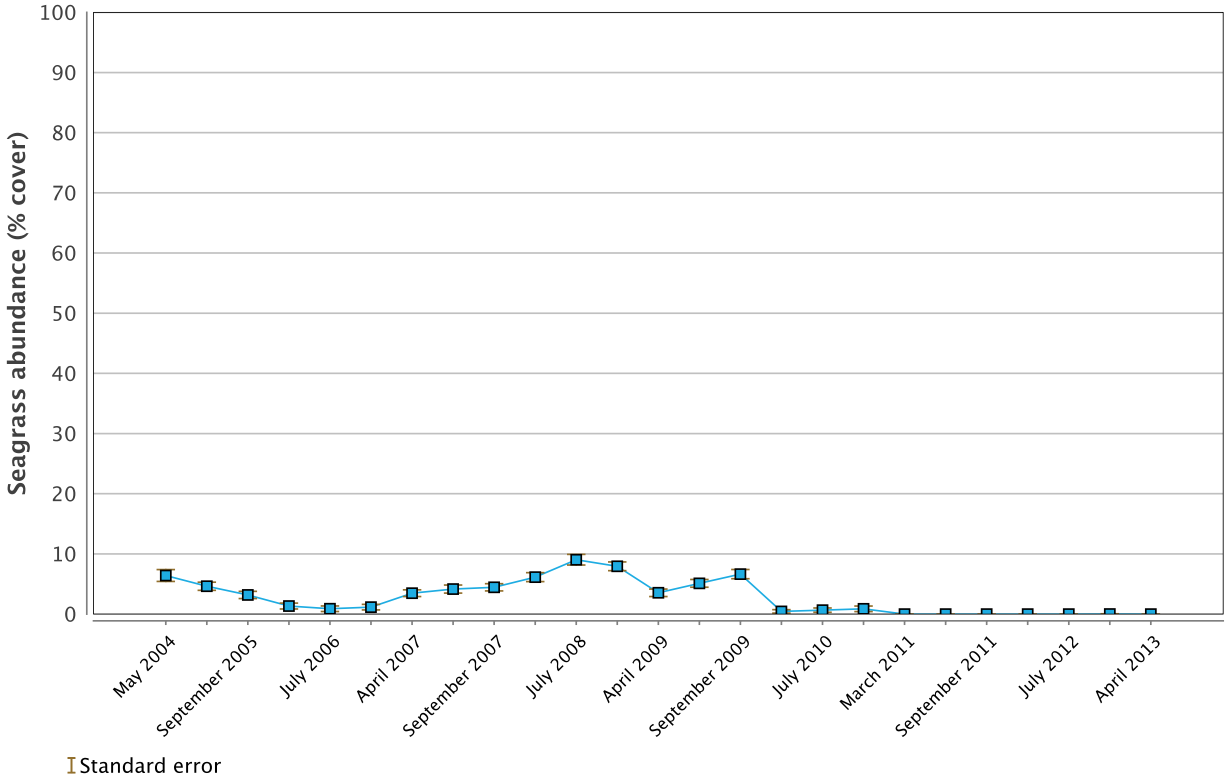


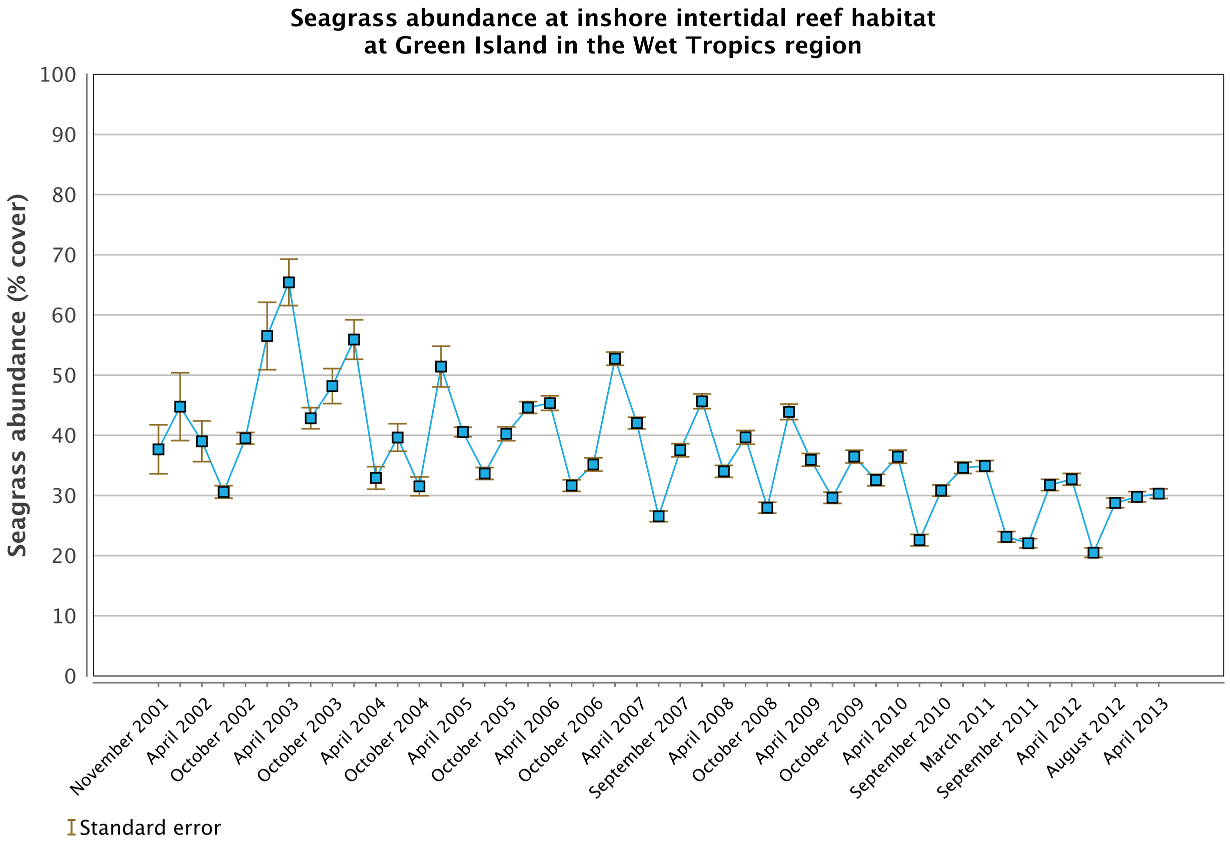
Dominant influences on seagrass communities in the Wet Tropics region include elevated temperatures, seasonal run-off and disturbance from wave action and associated sediment movement. The abundance of inshore seagrass in both coastal and reef habitats in the Wet Tropics remained very poor overall, although there were localised increases in the abundance of fast-growing pioneer species at some sites. Reproductive effort across the region remained very poor in 2012-2013 and there is little evidence of recovery of meadows that were directly affected by Cyclone Yasi in 2011. The very low abundance coupled with very low reproductive effort of seagrass in the region indicates that meadows will be at risk from further impacts and will take many years to fully recover even if conditions were optimum. Leaf tissue nutrient ratios were rated poor overall, indicative of poor water quality.

Seagrass abundance at inshore intertidal coastal habitat at Yule Point in the Wet Tropics region



Seagrass abundance at inshore intertidal coastal habitat at Lugger Bay in the Wet Tropics region





Seagrass abundance at inshore intertidal reef habitat
at Green Island in the Wet Tropics region
Seagrass abundance (% cover)
100
90
80
70
60
50
40
30
20
10
0
November 2001
April 2002
October 2002
April 2003
October 2003
April 2004
October 2004
April 2005
October 2005
April 2006
October 2006
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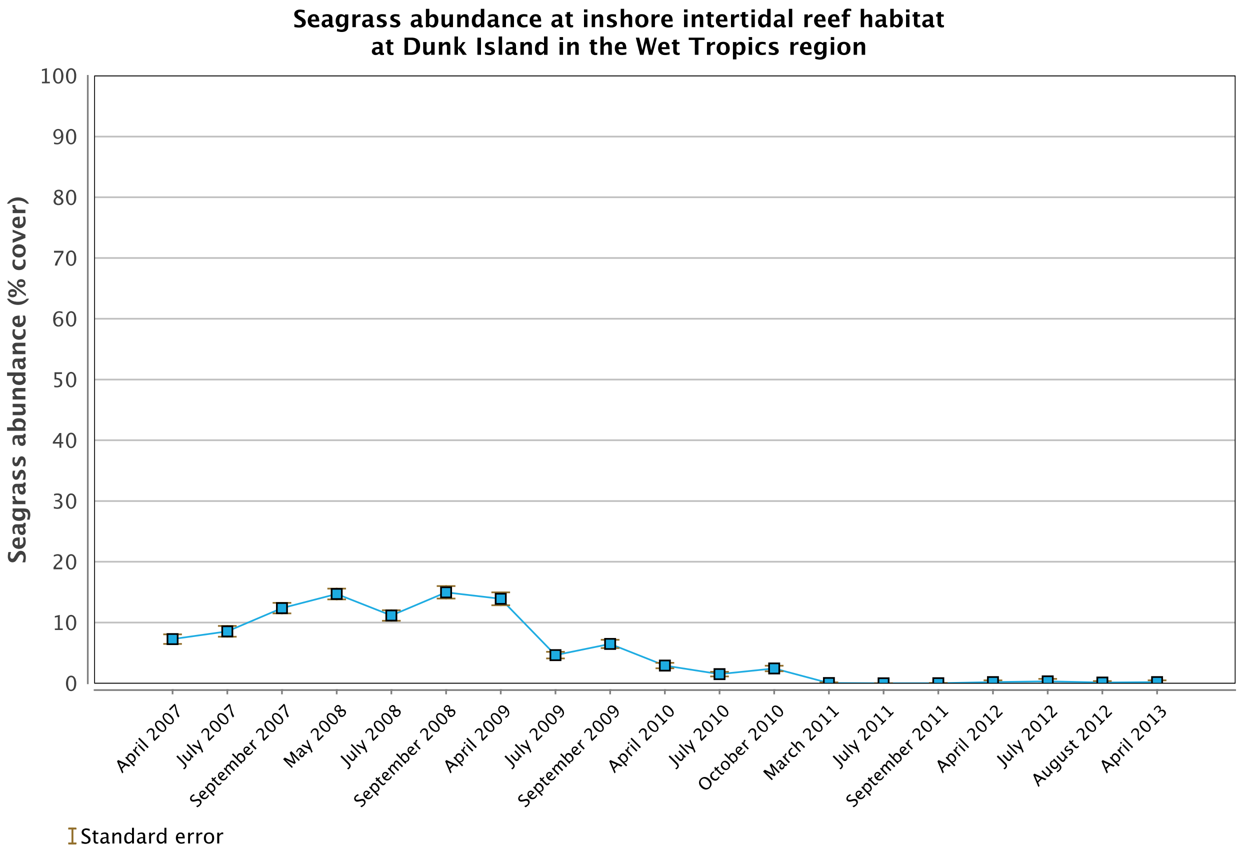
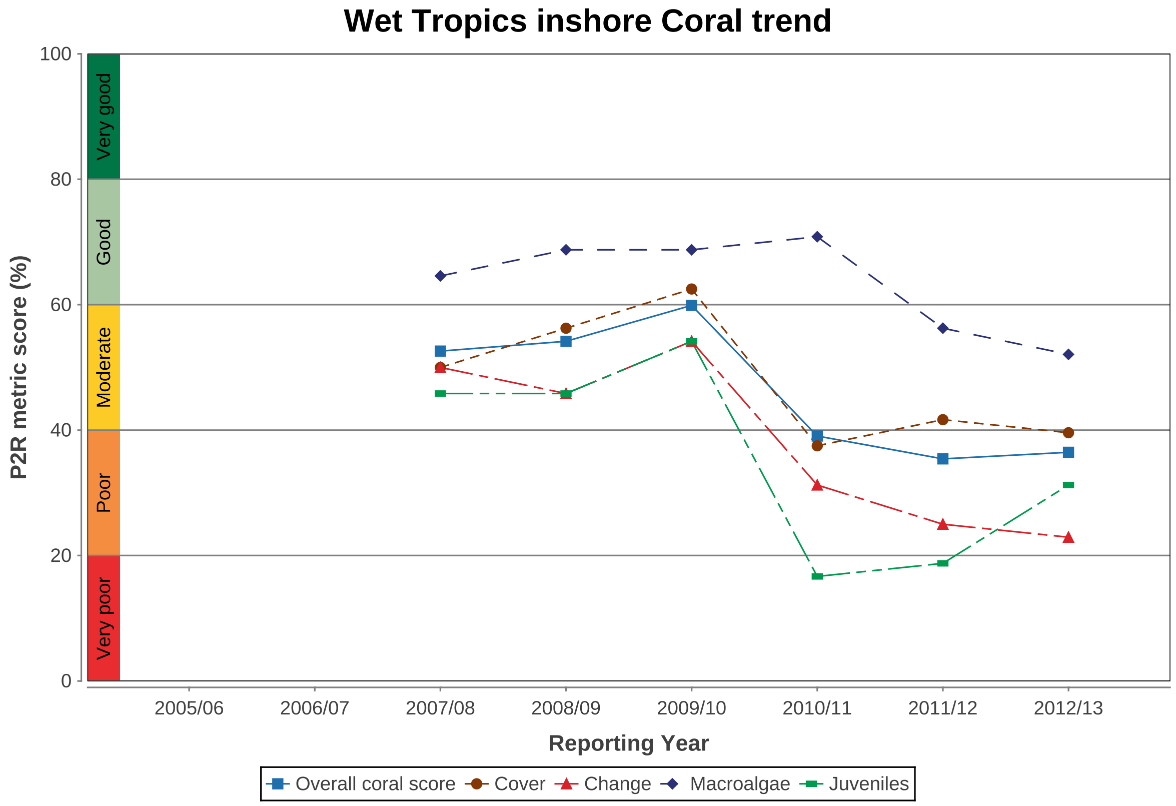
March 2011
September 2011
April 2012
August 2012
April 2013
Standard error



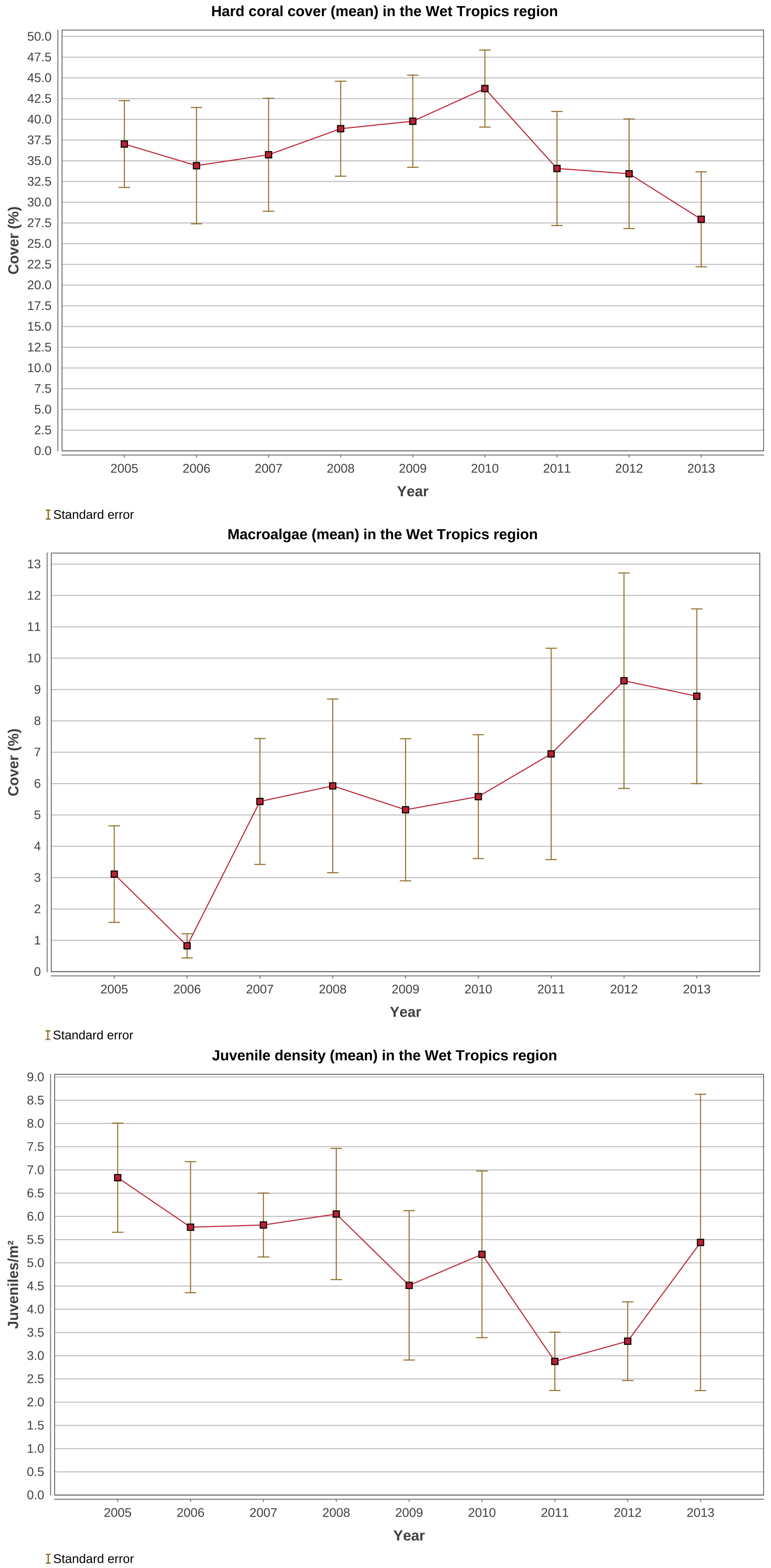
Seagrass abundance at inshore intertidal reef habitat
at Dunk Island in the Wet Tropics region
Seagrass abundance (% cover)
100
90
80
70
60
50
40
30
20
10
0
April 2007
July 2007
September 2007
May 2008
July 2008
September 2008
April 2009
July 2009
September 2009
April 2010
July 2010
October 2010
March 2011
July 2011
September 2011
April 2012
July 2012
August 2012
April 2013
Standard error

Coral

The overall condition of inshore coral reefs in the Wet Tropics was poor in 2011-2012 and 2012-2013, and the underlying scores decreased markedly from 2009-2010. In the northern Wet Tropics, coral reef communities declined to poor condition in the Barron Daintree area and remained in moderate condition in the Johnstone Russell-Mulgrave area, while those in the more southerly Herbert Tully area remained in poor condition.

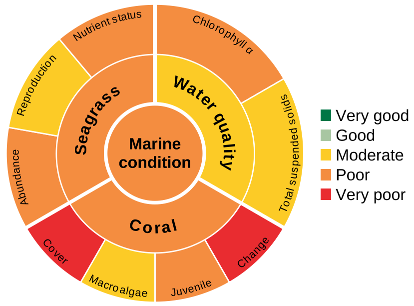


In the more northerly reefs of the Barron-Daintree and Johnson Russell-Mulgrave areas, high levels of coral disease in 2010 and 2011 resulted in slow rates of coral cover increase that, in combination with an increase in crown-of-thorns starfish outbreaks, have reduced coral cover. The density of juvenile corals also declined to low levels in these sub-regions. Coral cover remained very low in southerly reefs in the Herbert Tully area, following severe reductions caused by Cyclone Yasi in 2011. However, an increase in the number of juvenile corals indicates some level of recovery. There has been an increase in the cover of macroalgae in all sub-regions, which contributed to the overall poor condition assessment of reefs in the Wet Tropics.



Average cover of hard corals, cover of macroalgae and density of hard coral juveniles in the Wet Tropics region from 2005 to 2013.

Burdekin

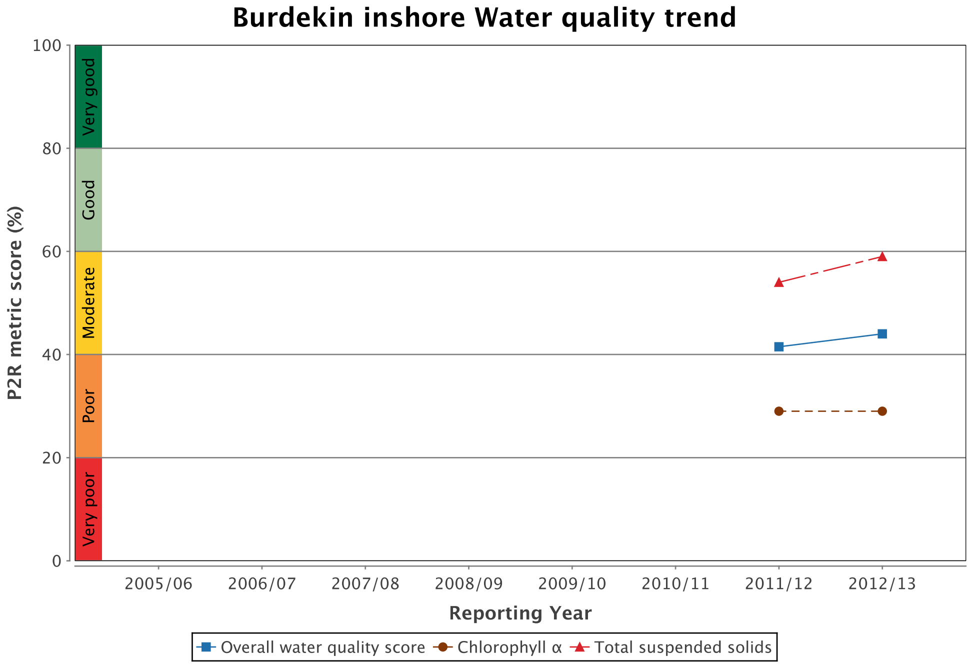


The Burdekin's overall inshore marine condition remained poor in 2011-2012 and 2012-2013. Inshore water quality remained moderate in 2011-2012 and 2012-2013, while inshore seagrass meadows improved from very poor in 2011-2012 to poor in 2012-2013. Coral reefs remained in poor condition in both 2011-2012 and 2012-2013.

Water quality

Inshore water quality (assessed by remote sensing of chlorophyll *a* and suspended solids) in the Burdekin region remained moderate in 2011-2012 and 2012-2013. Chlorophyll *a* and suspended solids remained poor and moderate, respectively, in both years. Scores for these two indicators have varied since 2005 with the initial pattern of higher scores for chlorophyll *a* and lower scores for suspended solids reversing in later years.

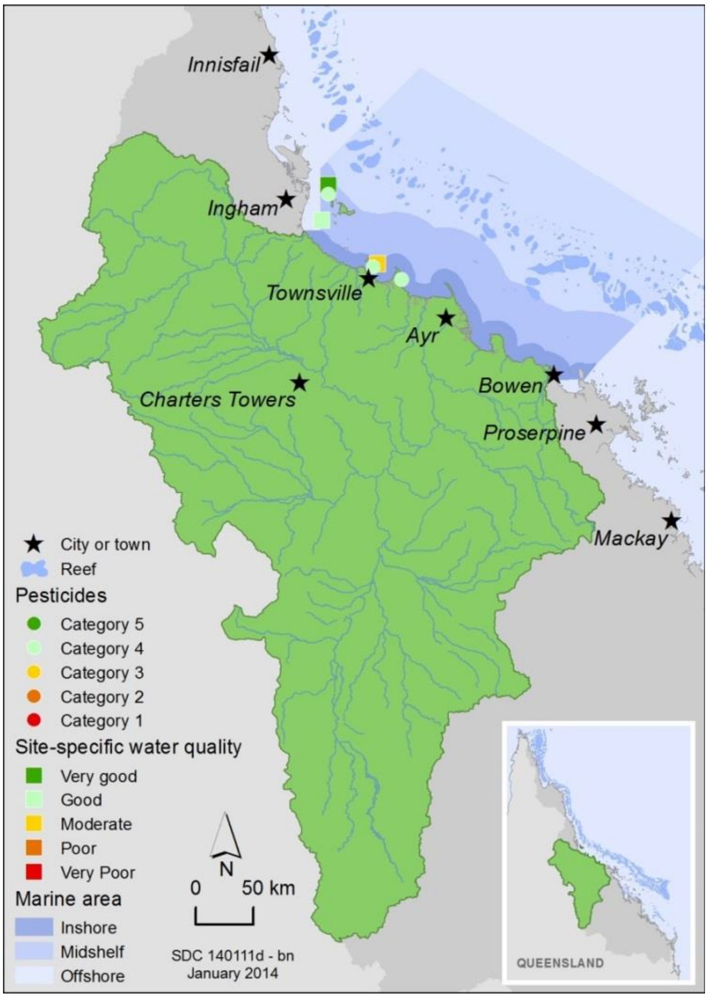
Concentrations of chlorophyll *a* exceeded the Great Barrier Reef Water Quality Guidelines for 85 and 61 per cent of the inshore area in the dry and wet season, respectively, in 2012-2013. Concentrations of total suspended solids exceeded the guidelines for 47 and 36 per cent of the inshore area in the dry and wet seasons, respectively, in 2012-2013.



Trend in the Water Quality Index from 2011-2012 to 2012-2013. The Water Quality Index is also separated into component scores for concentrations of chlorophyll a and total suspended solids. Trend data is only shown for these two years, because a major change in the remote sensing algorithms mean the historical data is no longer directly comparable. The full historical time-series will be reprocessed for the next report card.

Water quality across the region showed a clear gradient of improvement from inshore areas more frequently exposed to flood waters to offshore areas. This gradient was supported by long-term assessments of water quality at specific sites, with variability between sites reflecting local hydrodynamic conditions and biophysical processes.

Site-specific water quality was good and very good at the two mid-shelf sites and moderate at Magnetic Island in the inshore region. The water quality scores for this region have been stable over the past four years, with a period of slight increases in suspended solids, particulate nitrogen and particulate phosphorus in 2011-2012. The site-specific water quality scores are a long-term integrated assessment of four water quality indicators relative to the Great Barrier Reef Water Quality Guidelines (GBRMPA 2010) - see the Marine methods for more information.



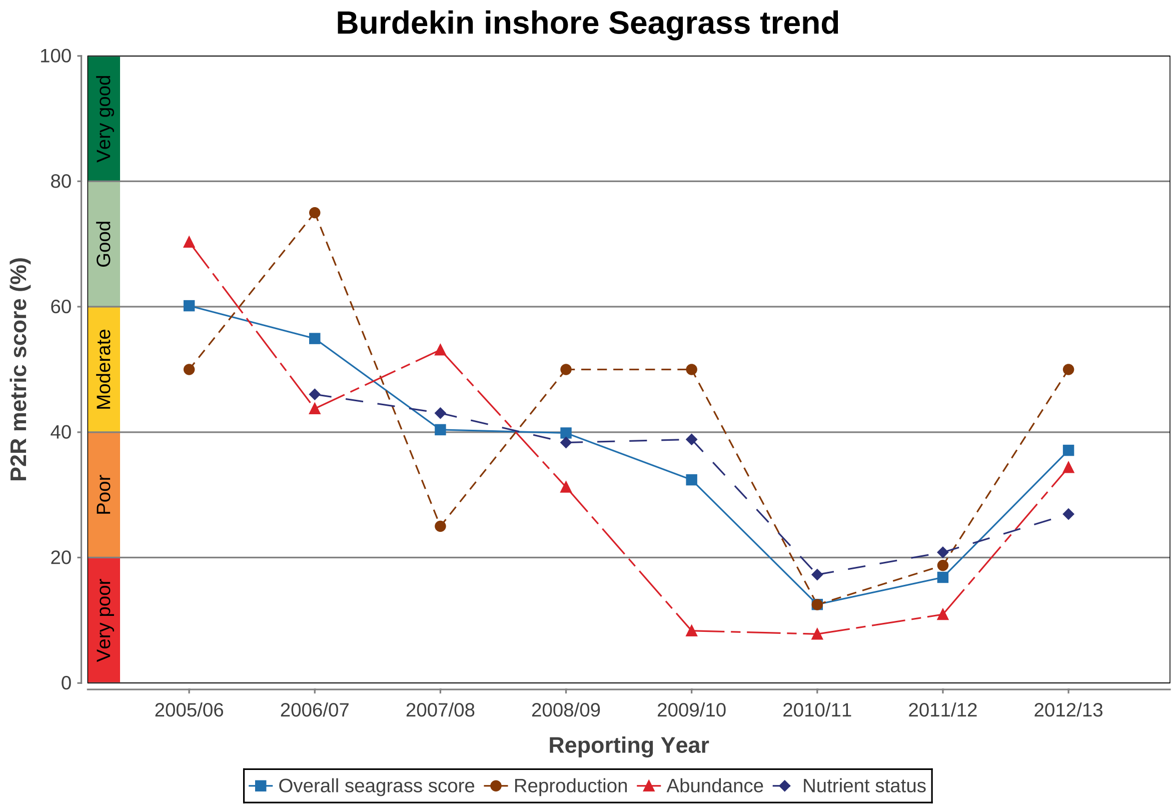
Scores for site-specific water quality and pesticides at fixed monitoring sites in the Burdekin region.

In 2012-2013, concentrations of photosystem II (PSII) herbicides at Orpheus and Magnetic Islands increased from 2011-2012 levels to be above those known to affect photosynthesis in diatoms (Category 4) and this level was maintained at Cape Cleveland in both years. The highest PSII herbicide equivalent concentrations (Category 3) were detected in grab samples of flood waters near Palm Island, approximately 36 kilometres from the mouth of Ross River and 130 kilometres from the mouth of the Burdekin River.

A range of pesticides was detected in the Burdekin region including atrazine and its breakdown products, diuron, hexazinone, simazine, tebuthiuron, metolachlor, terbutryn, ametryn and imidacloprid. Routine monitoring showed spatial variability in the abundance of pesticides, with atrazine concentrations typically exceeding diuron concentrations at Cape Cleveland, while diuron was present at higher concentrations at Magnetic and Orpheus Islands.

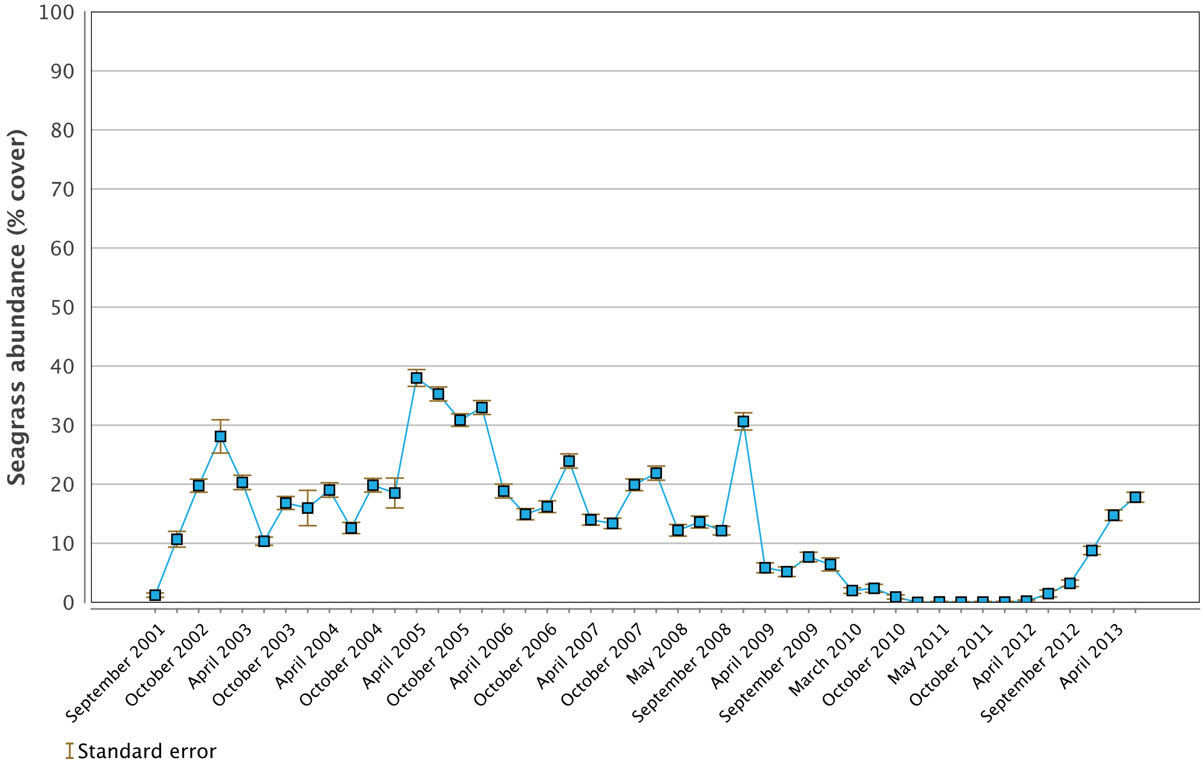
Seagrass

The overall condition of inshore seagrass in the Burdekin region improved from very poor in 2011-2012 to poor in 2012-2013. The improvement in condition was largely a result of increases in abundance and reproductive effort, indicating localised recovery from Cyclone Yasi.

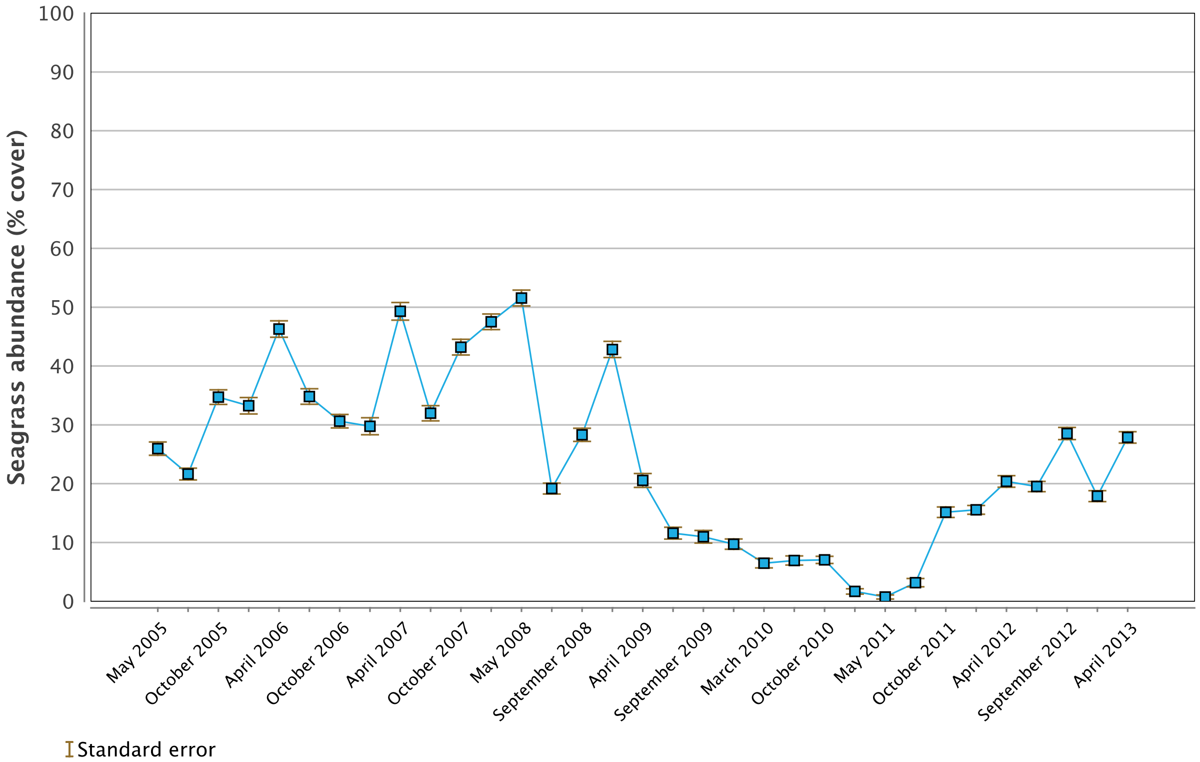


Seagrass monitoring was conducted in coastal and reef habitats primarily influenced by wind-driven turbidity and pulsed delivery of nutrients and sediment. Seagrass abundance across the region improved from very poor in 2011-2012 to poor in 2012-2013 and is at its highest levels for the past four years. Reproductive effort also improved from very poor in 2011-2012 to moderate in 2012-2013, suggesting an improved capacity to recover from future disturbances. The nutrient content of seagrass tissue was poor in both monitoring seasons and indicated nutrient enrichment in coastal and reef habitats, which reflected local water quality conditions.

Seagrass abundance at inshore intertidal coastal habitat at Bushland and Shelly Beaches in the Burdekin region

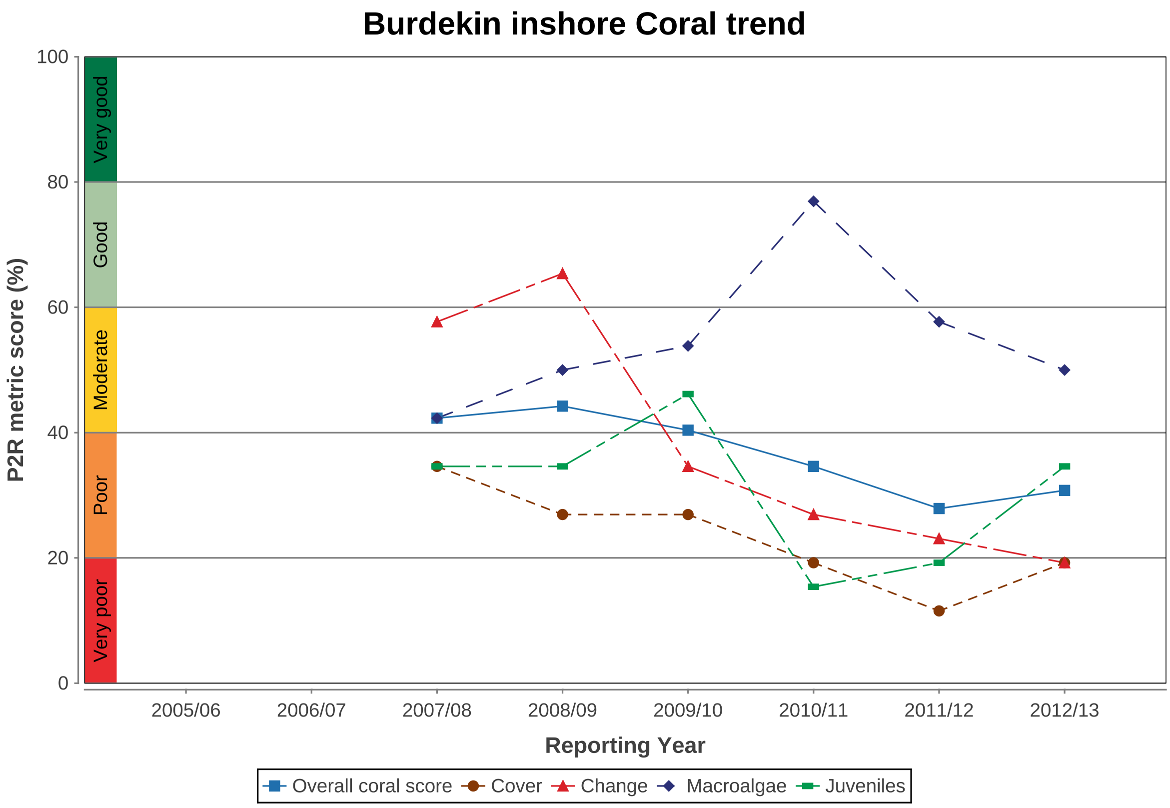


Seagrass abundance at inshore intertidal reef habitat at Magnetic Island in the Burdekin region

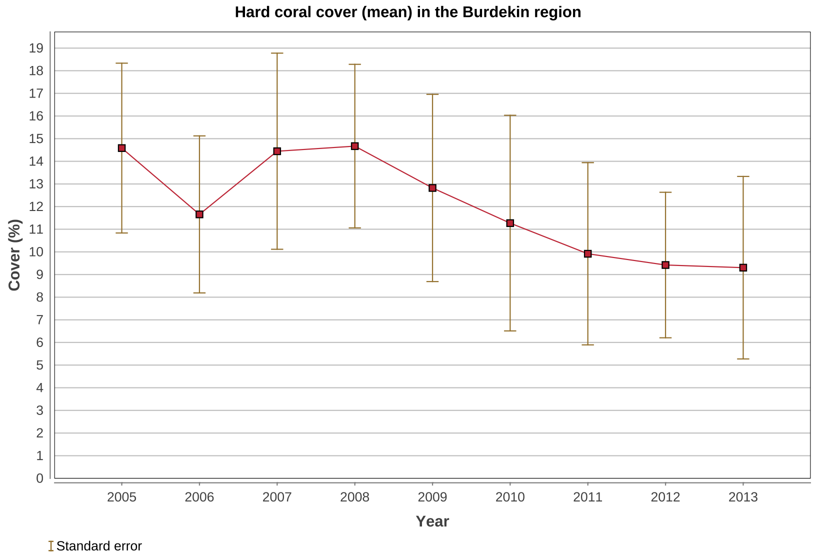


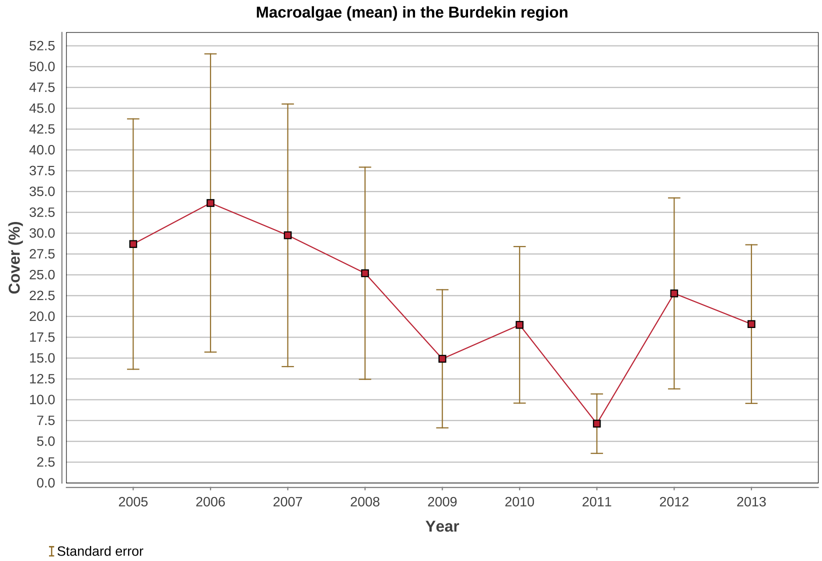
Coral

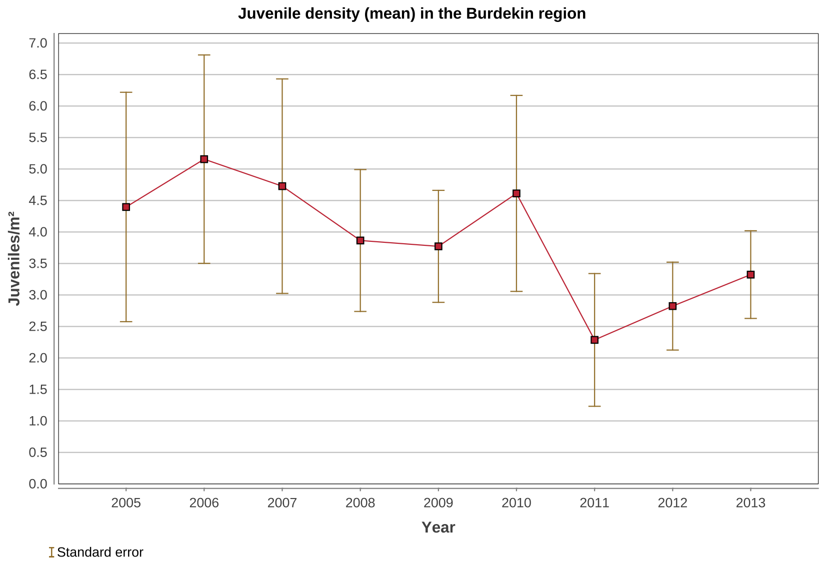
The overall condition of inshore coral reefs in the Burdekin remained poor in 2011-2012 and 2012-2013, gradually declining from moderate since 2008-2009.



Coral cover across the Burdekin region remains very poor and has not recovered from the impact of coral bleaching in 1998 and 2002 and Cyclones Larry (2006) and Yasi (2010). In addition to the direct influence of these events on coral cover, it appears the loss of corals has substantially limited the supply of larvae and, hence, the rate at which coral communities can recover. Numbers of juveniles increased from very poor in 2011-2012 to poor in 2012-2013. However, relatively high levels of macroalgae and disease coinciding with periods of above-median discharge from the Burdekin River indicate that environmental conditions may be compounding the effects of previous disturbances and suppressing the recovery of coral communities.

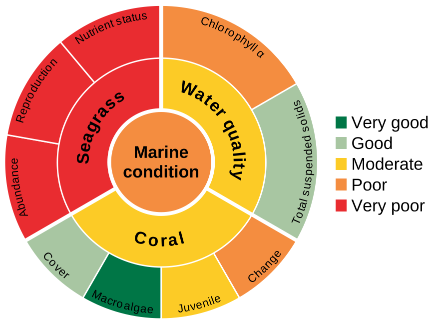






Average cover of hard corals, cover of macroalgae and density of hard coral juveniles in the Burdekin region from 2005 to 2013.

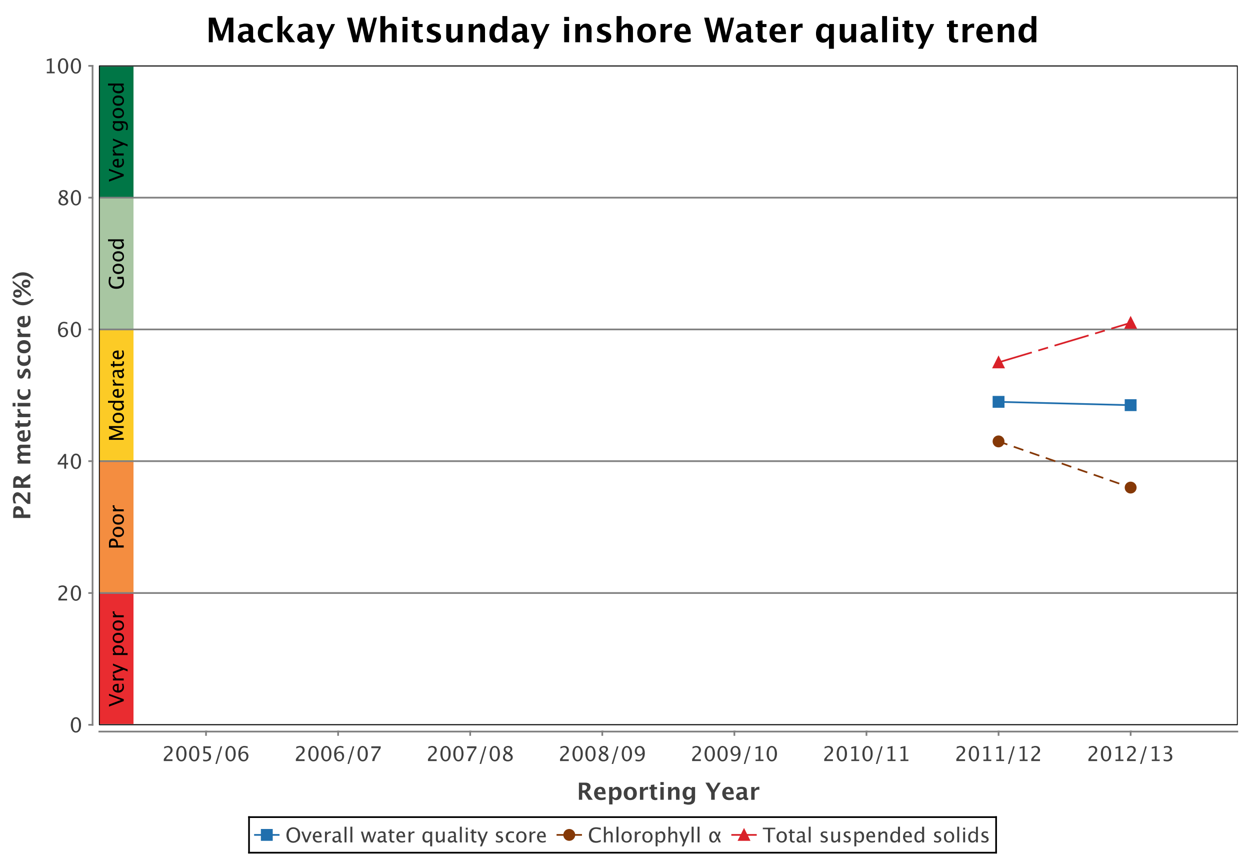
Mackay Whitsunday



The Mackay Whitsunday's overall inshore marine condition remained poor in 2011-2012 and 2012-2013. Inshore water quality improved from poor in 2010-2011 to moderate in 2011-2012 and 2012-2013. Inshore seagrass meadows remained very poor in 2011-2012 and 2012-2013, and coral reefs remained in moderate condition in 2011-2012 and 2012-2013.

Water quality

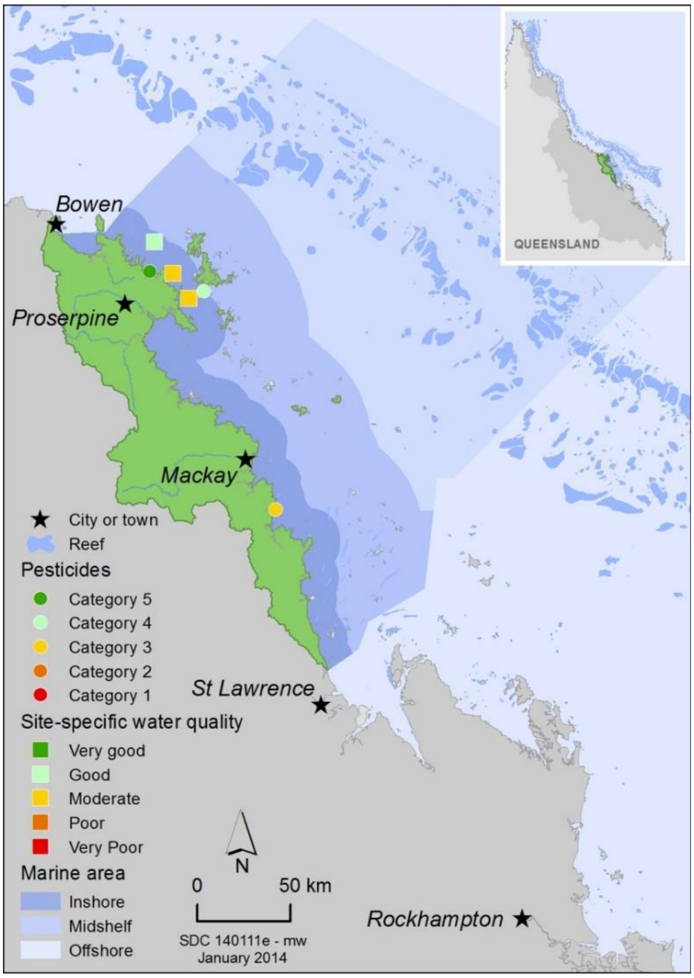
Inshore water quality (assessed by remote sensing of chlorophyll *a* and suspended solids) was moderate in 2011-2012 and 2012-2013. Chlorophyll *a* declined from moderate in 2011-2012 to poor in 2012-2013. Concentrations exceeded the Great Barrier Reef Water Quality Guidelines for 95 and 45 per cent of the inshore area in the dry and wet season, respectively, in 2012-2013. Total suspended solids were rated as moderate in 2011-2012. They were rated as good in 2012-2013 with concentrations exceeding the guidelines for 54 and 31 per cent of the inshore area in the dry and wet season, respectively.



Trend in the Water Quality Index from 2011-2012 to 2012-2013. The Water Quality Index is also separated into component scores for concentrations of chlorophyll a and total suspended solids. Trend data is only shown for these two years, because a major change in the remote sensing algorithms mean the historical data is no longer directly comparable. The full historical time-series will be reprocessed for the next report card.

Water quality across the region showed a clear gradient of improvement from inshore areas more frequently exposed to flood waters to offshore areas. This gradient was supported by long-term assessments of water quality at specific sites with variability between sites reflecting local hydrodynamic conditions and biophysical processes.

Site-specific water quality was moderate at Daydream and Pine Islands, and good at Double Cone Island in 2012-2013. All indicators of water clarity – suspended solids, Secchi depth and turbidity - exceeded the Great Barrier Reef Water Quality Guidelines in 2011-2012 and 2012-2013, especially at Pine and Daydream Islands which are more frequently exposed to flood plumes. The water quality scores are a long-term integrated assessment of four indicators of water quality relative to the Great Barrier Reef Water Quality Guidelines (GBRMPA, 2010) - see the Marine methods.

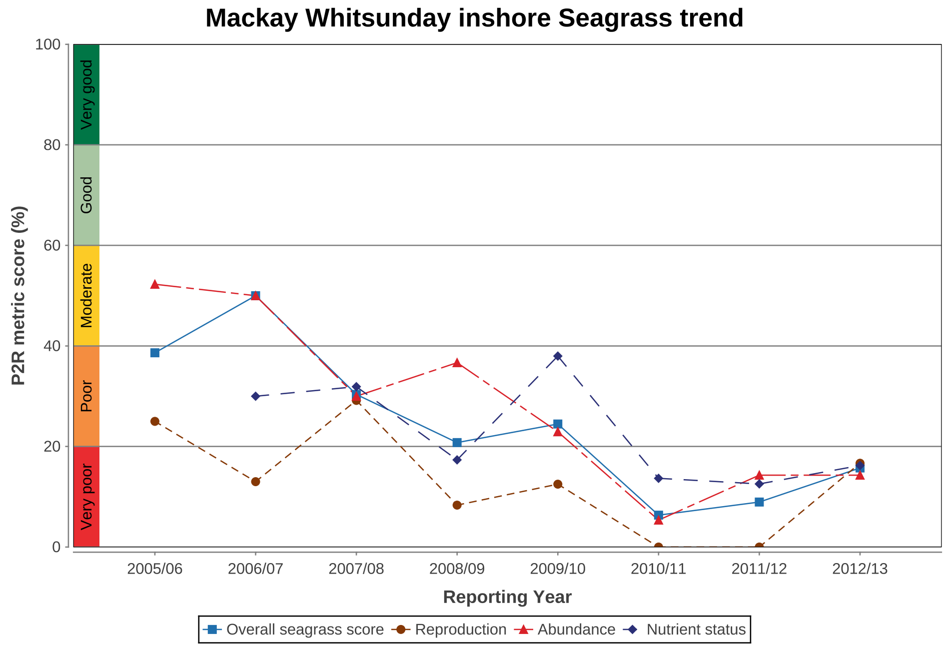


Scores for site-specific water quality and pesticides at fixed monitoring sites in the Mackay Whitsunday region.

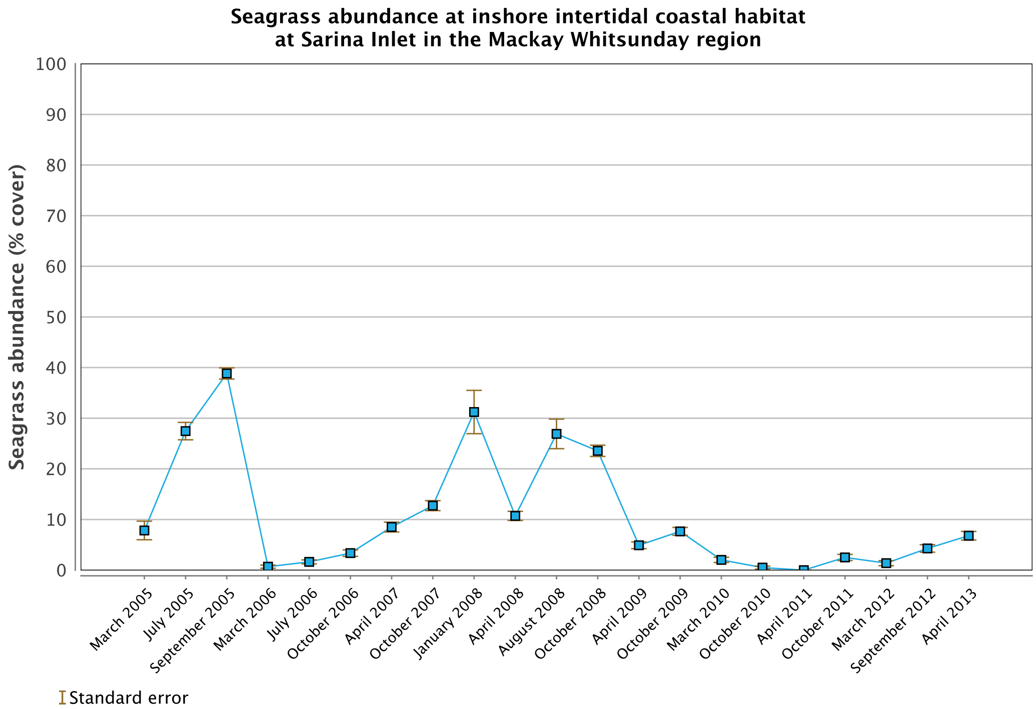
Concentrations of photosystem II (PSII) herbicides were above those known to affect photosynthesis in diatoms (Category 4) at the Outer Whitsunday site and above those known to affect seagrass (Category 3) at Sarina Inlet. Sarina Inlet generally had the highest concentrations of most PSII herbicides compared to all other sites in reef, which reflected the proximity of the site to flows from Plane Creek (Rhode et al., 2008). The range of pesticides detected in the Mackay Whitsunday region included atrazine and its breakdown products, diuron, hexazinone, simazine, tebuthiuron, metolachlor, terbutryn, ametryn, galaxolide and imidacloprid. Diuron was present at the highest concentrations.

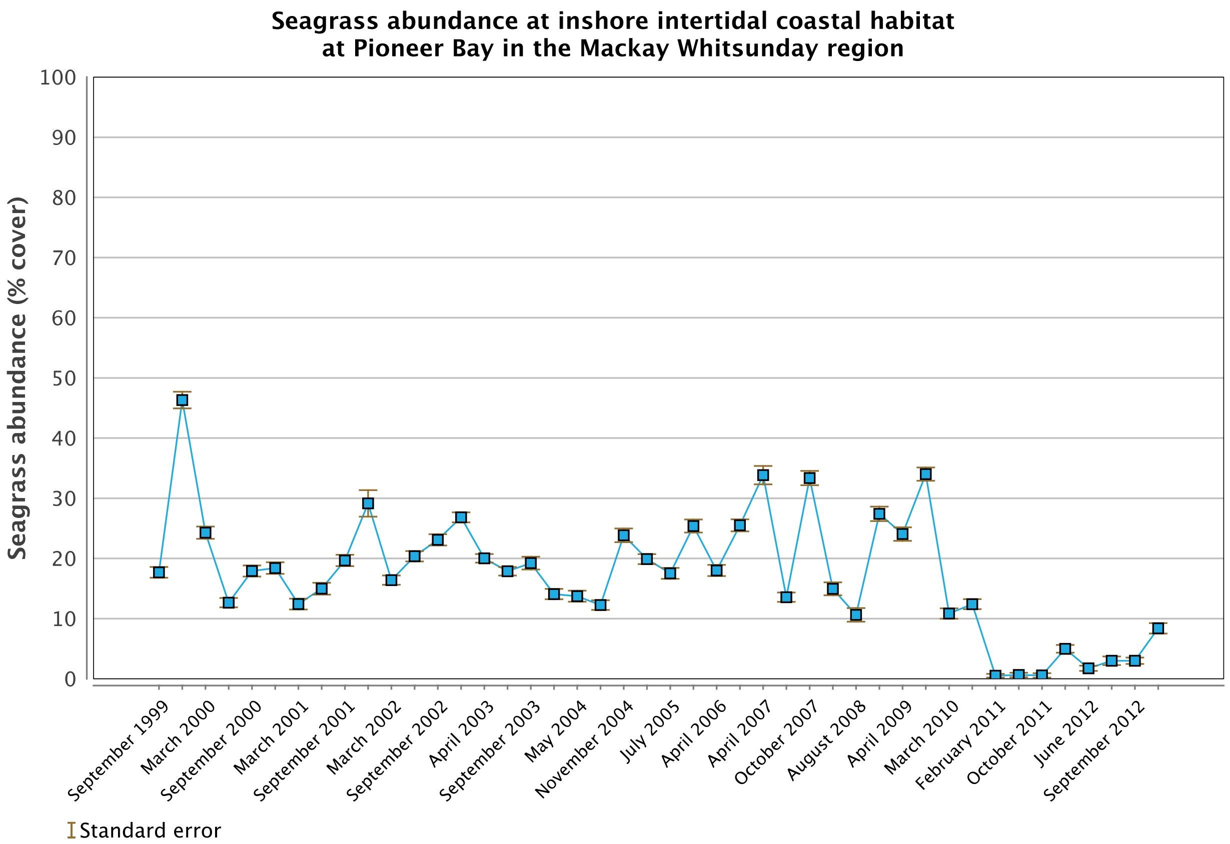
Seagrass

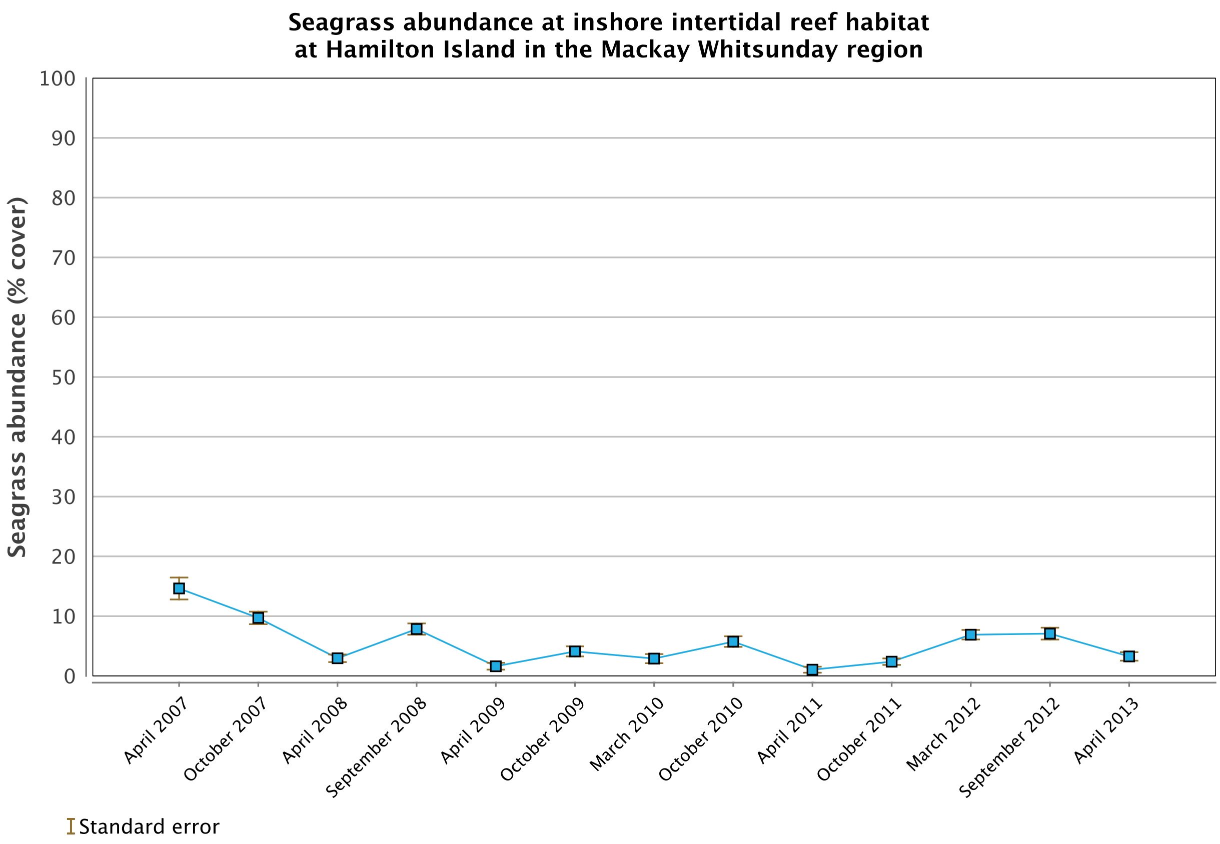
The overall condition of inshore seagrass in the Mackay Whitsunday region remained very poor in 2011-2012 and 2012-2013, having progressively declined since monitoring began in 2005-2006. The very poor rating for seagrass overall is a result of very poor abundance, reproductive effort and increased nutrient enrichment of seagrass tissue across all habitats.



Seagrass meadows were monitored at coastal, estuarine and fringing reef locations in the Mackay Whitsunday region. Key environmental drivers of seagrass communities in this region include a high tidal range, exposure at very low tides and variable catchment run-off. There were modest increases in abundance and reproductive effort at some sites. However, the very poor nutrient status of seagrass tissue reflected local water quality conditions and together with the very poor rating of other indicators of seagrass condition, raises concerns about the ability of local seagrass meadows to recover from previous environmental disturbances.

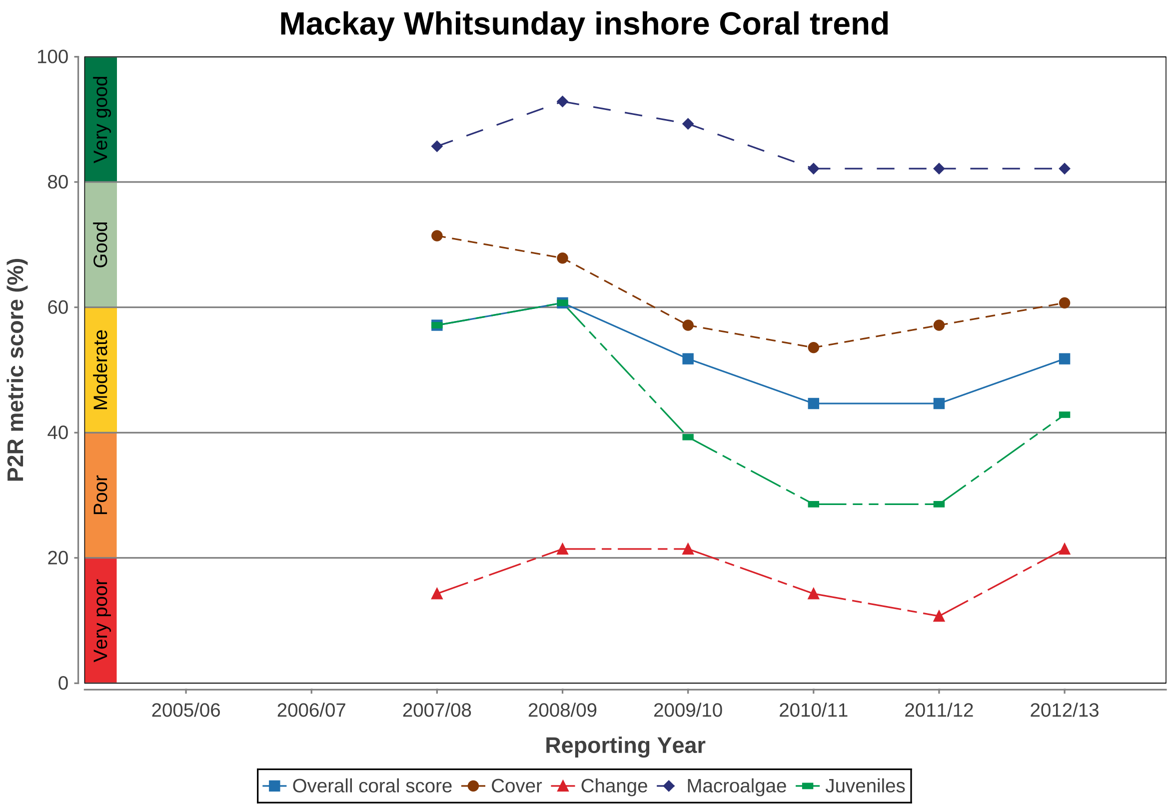



Seagrass abundance at inshore intertidal coastal habitat
at Pioneer Bay in the Mackay Whitsunday region
Seagrass abundance (% cover)
100
90
80
70
60
50
40
30
20
10
0
September 1999
March 2000
September 2000
March 2001
September 2001
March 2002
September 2002
April 2003
September 2003
May 2004
November 2004
July 2005
April 2006
April 2007
October 2007
August 2008
April 2009
March 2010
February 2011
October 2011
June 2012
September 2012
Standard error

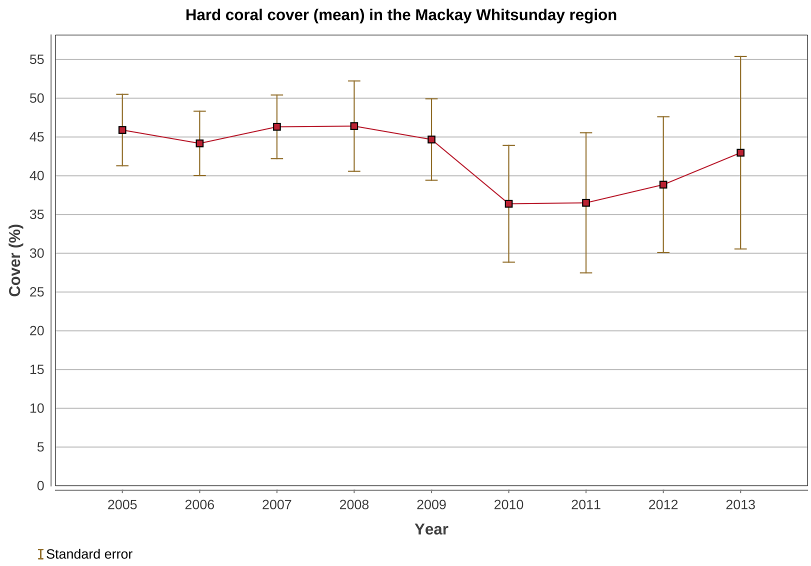

Seagrass abundance at inshore intertidal reef habitat
at Hamilton Island in the Mackay Whitsunday region
Seagrass abundance (% cover)
100
90
80
70
60
50
40
30
20
10
0
April 2007
October 2007
April 2008
September 2008
April 2009
October 2009
March 2010
October 2010
April 2011
October 2011
March 2012
September 2012
April 2013
Standard error

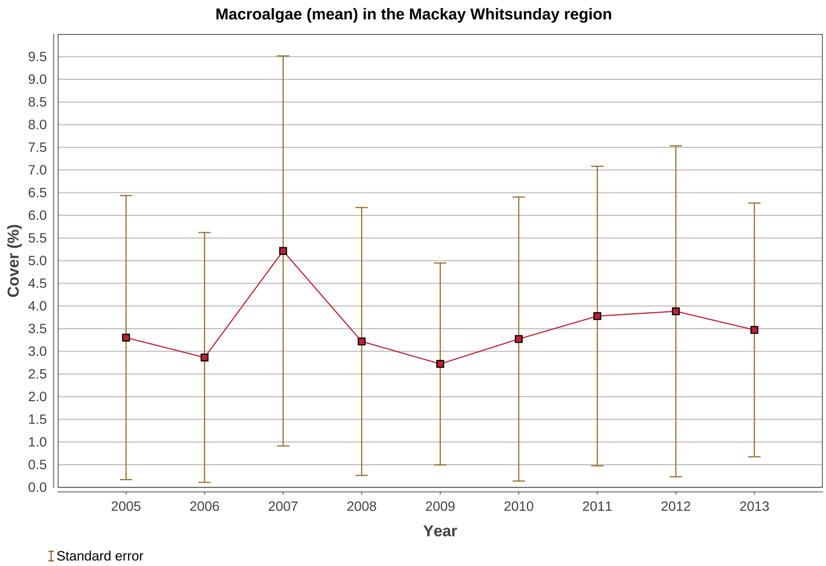
Coral

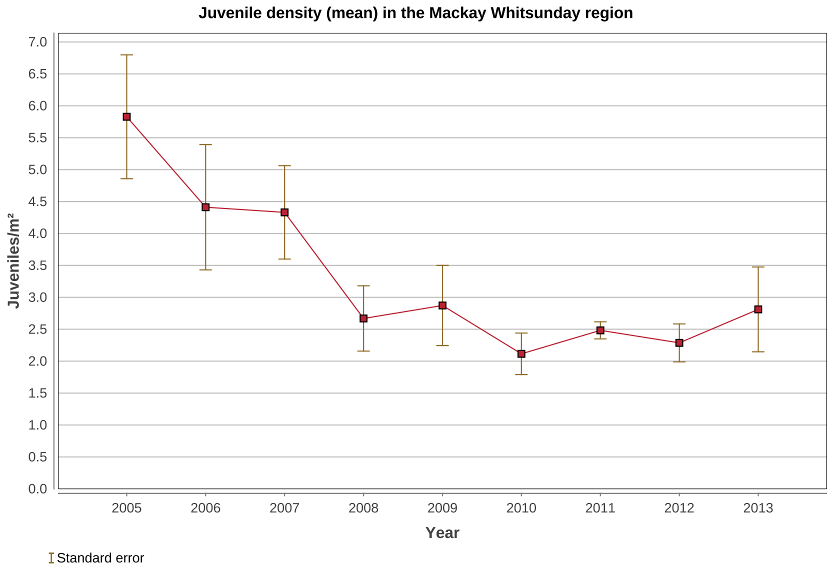
The overall condition of inshore coral reefs in the Mackay Whitsunday region was moderate in 2011-2012 and 2012-2013, and has remained moderate since 2007-2008.



Coral cover, the density of juveniles and change in coral cover all improved in 2012-2013 compared to 2011-2012. Macroalgae cover remained very good. However, the positive indicators of coral condition such as low macroalgae cover and good coral cover were balanced against slow rates of increase in hard coral cover since Cyclone Ului in 2010 and moderate numbers of juveniles, which have been low for several years.

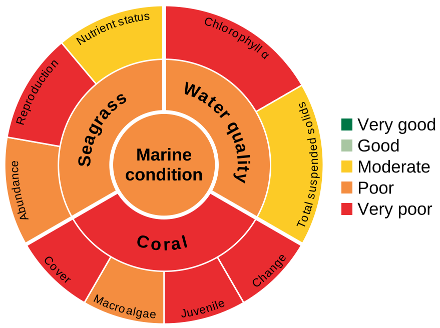






Average cover of hard corals, cover of macroalgae and density of hard coral juveniles in the Mackay Whitsunday region from 2005 to 2013.

Fitzroy

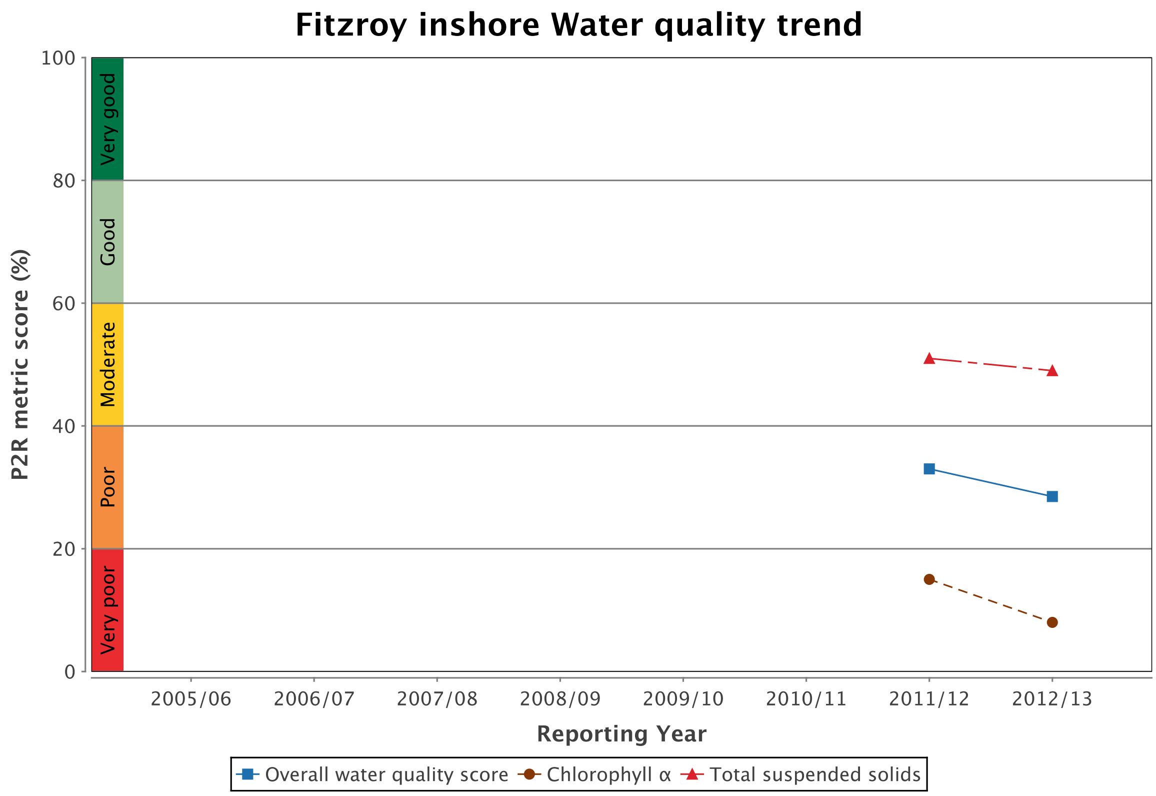


The Fitzroy's overall inshore marine condition remained poor in 2011-2012 and 2012-2013. Inshore water quality and inshore seagrass meadows also remained poor in 2011-2012 and 2012-2013. Coral reefs declined from poor in 2010-2011 to very poor in 2011-2012 and 2012-2013.

Water quality

Inshore water quality (assessed by remote sensing of chlorophyll *a* and suspended solids) in the Fitzroy region remained poor in 2011-2012 and 2012-2013. Changes in inshore water quality have been driven by relatively larger fluctuations in chlorophyll *a* compared to total suspended solids.

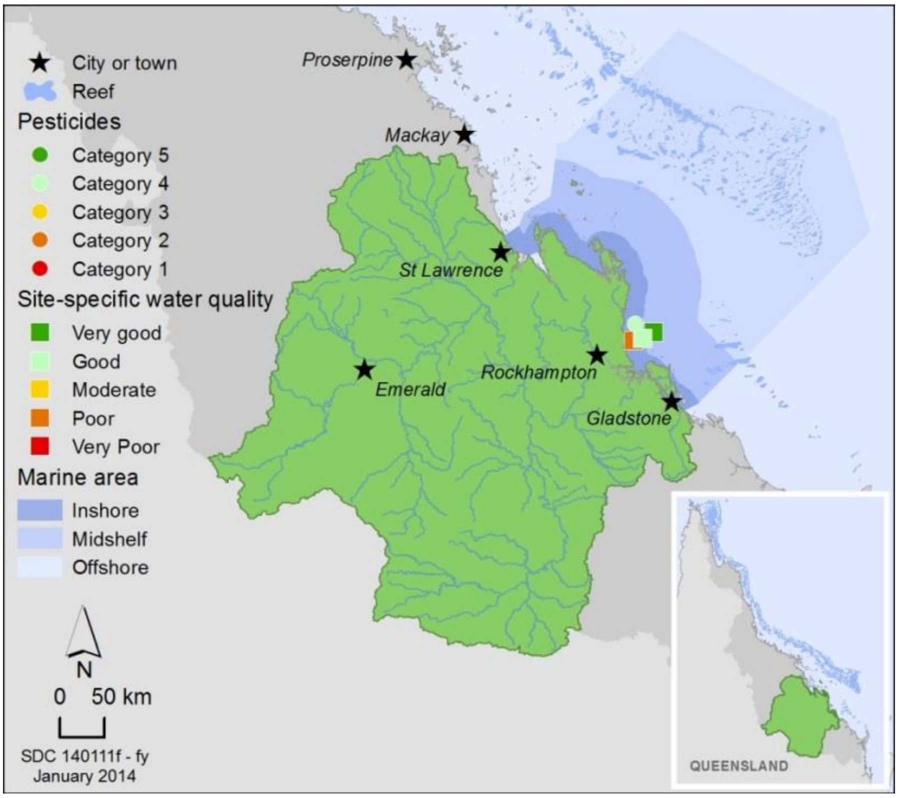
Chlorophyll *a* was rated as very poor in both 2011-2012 and 2012-2013. In 2012-2013, concentrations exceeded the Great Barrier Reef Marine Park Water Quality Guidelines for 97 and 85 per cent of the inshore area in the dry and wet season, respectively. Total suspended solids were rated as moderate in 2011-2012 and 201-2013. However, concentrations exceeded the guidelines for 53 and 55 per cent of the inshore area in the dry and wet season, respectively, in 2012-2013.



Trend in the Water Quality Index from 2011-2012 to 20122013. The Water Quality Index is also separated into component scores for concentrations of chlorophyll a and total suspended solids. Trend data is only shown for these two years, because a major change in the remote sensing algorithms mean the historical data is no longer directly comparable. The full historical time-series will be reprocessed for the next report card.

Water quality across the region showed a clear gradient of improvement from inshore areas more frequently exposed to flood waters to offshore areas. This gradient was supported by long-term assessments of water quality at specific sites, with variability between sites reflecting local hydrodynamic conditions and biophysical processes.

Site-specific water quality was poor at Pelican Island, good at Humpy Island and very good at Barren Island, reflecting increasing distance away from river influence. At Pelican Island, the Great Barrier Reef Water Quality Guidelines were generally exceeded for all variables except for particulate nitrogen in 2011-2012 and 2012-2013. The water quality scores are a long-term integrative assessment based on four indicators of water quality relative to the Great Barrier Reef Water Quality Guidelines (GBRMPA, 2010) – see the Marine methods for more information.

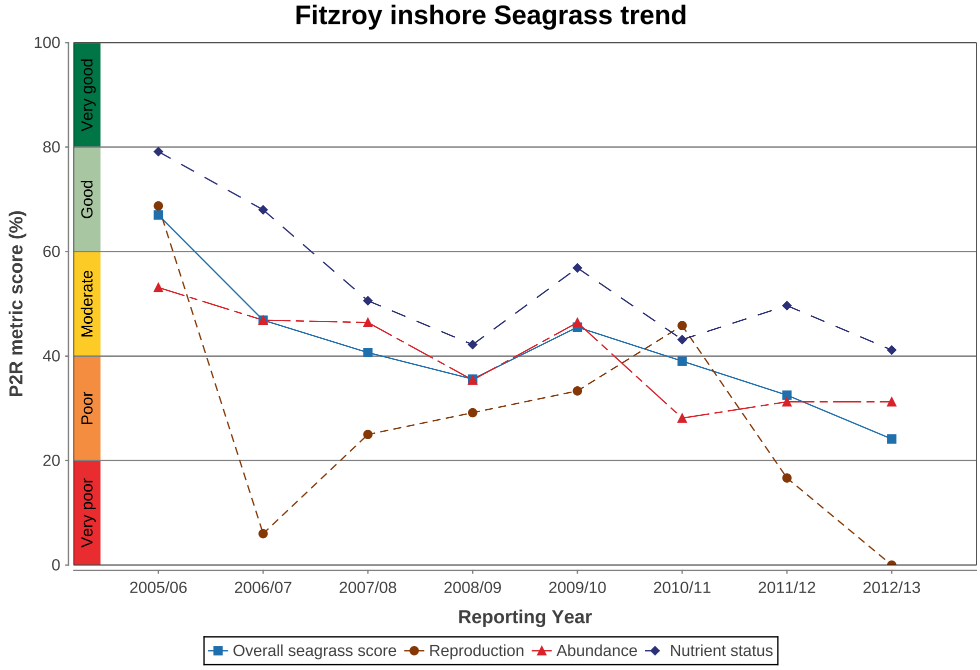


Scores for site-specific water quality and pesticides at fixed monitoring sites in the Fitzroy region.

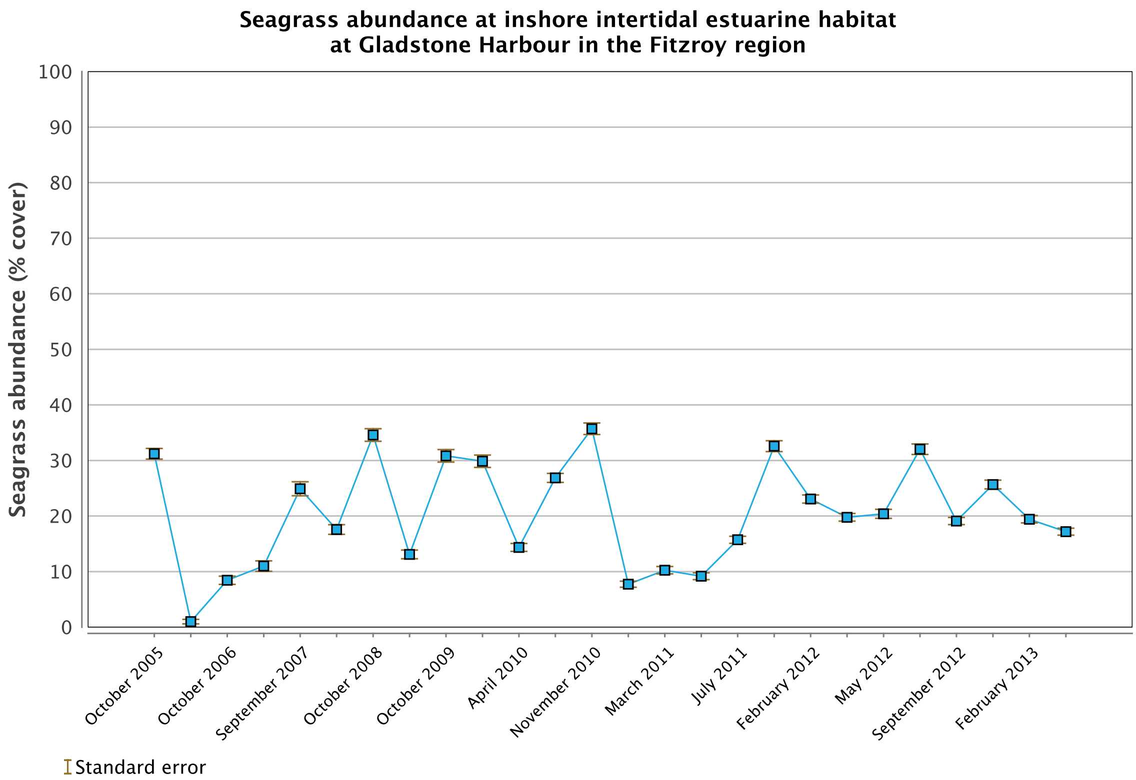
Concentrations of photosystem II (PSII) herbicides were above those known to affect photosynthesis in diatoms (Category 4) at North Keppel Island. However, when the concentration of individual pesticides was examined at North Keppel Island, only tebuthiuron exceeded the Great Barrier Reef Water Quality Guidelines and the ANZECC and ARMCANZ Interim Working Level for marine waters. The range of pesticides detected in the Fitzroy region included atrazine and its breakdown products, diuron, hexazinone, simazine, ametryn, prometryn, metolachlor and tebuthiuron.

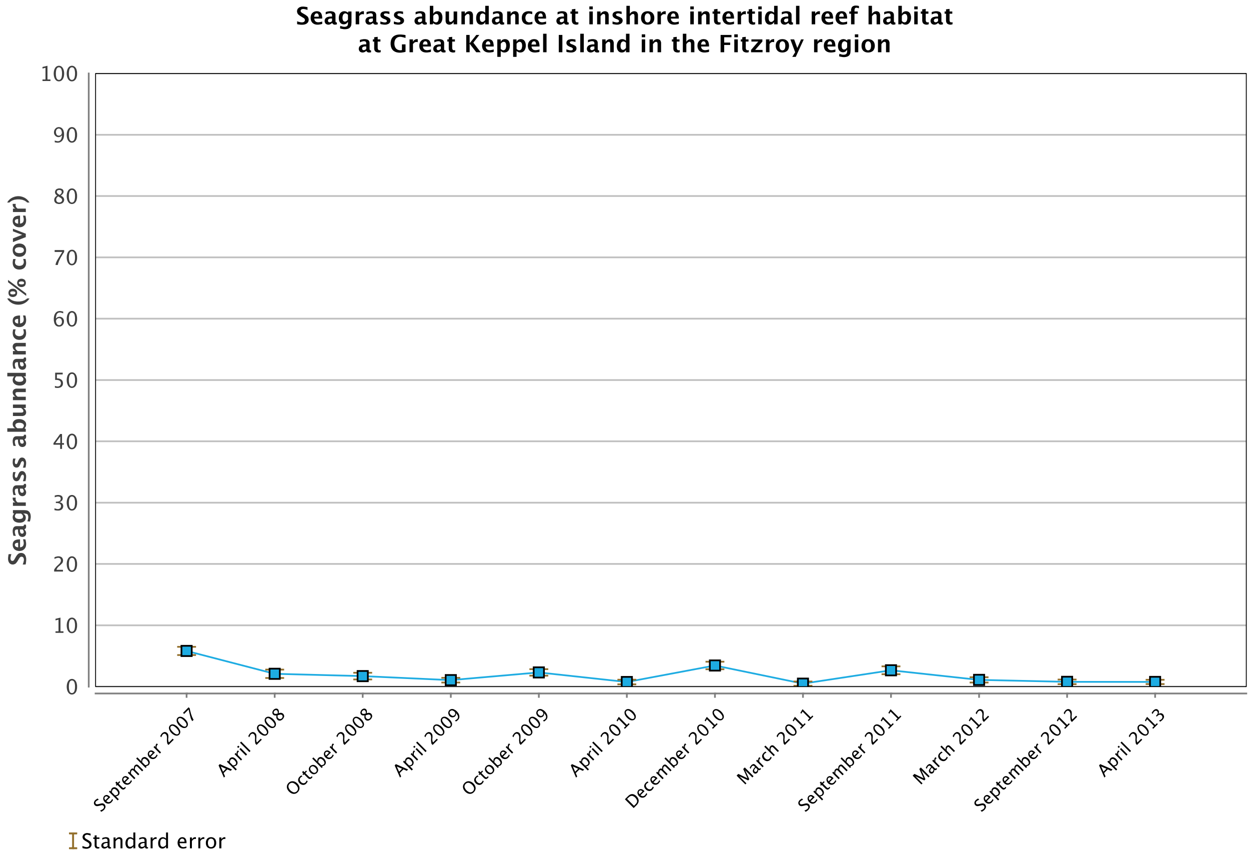
Seagrass

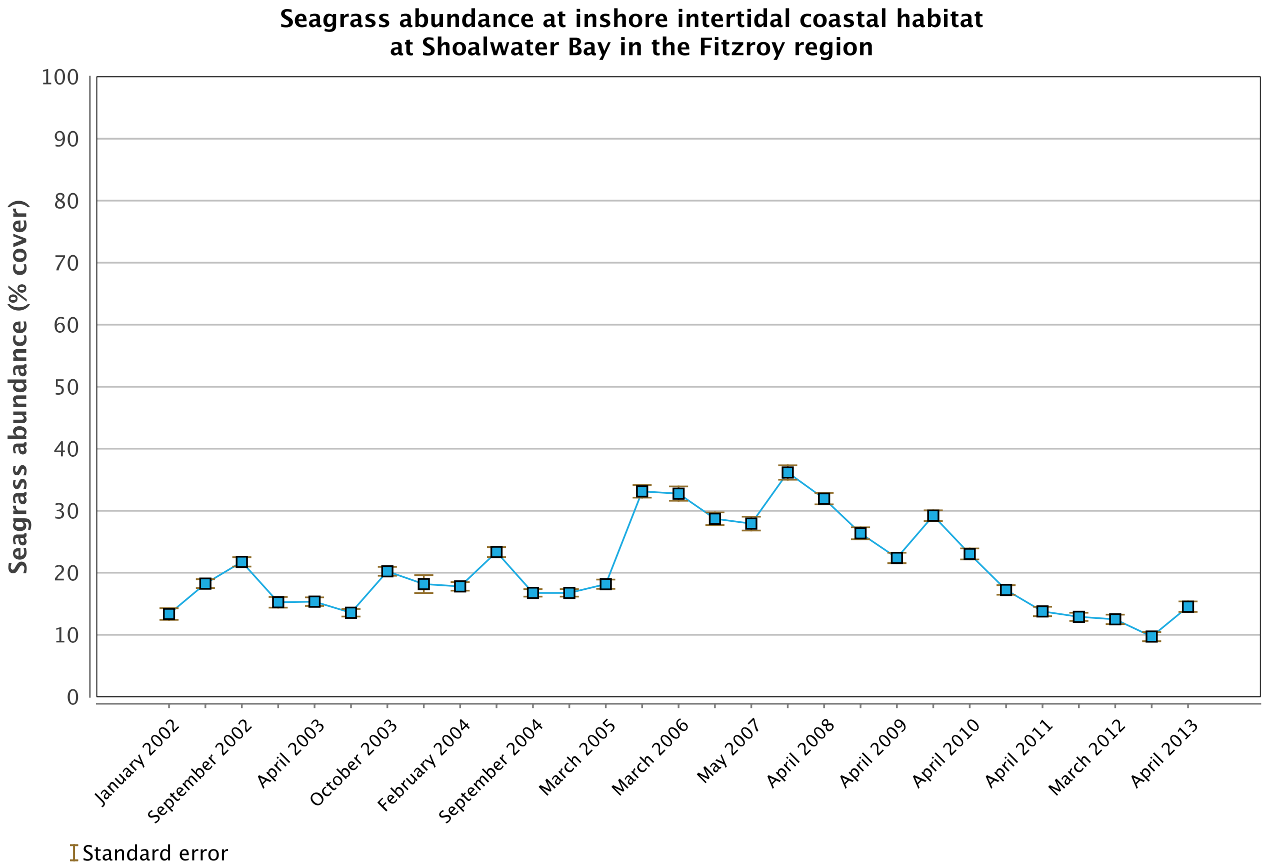
The condition of inshore seagrass in the Fitzroy region remained poor in 2011-2012 and 2012-2013, driven largely by a decline in seagrass reproduction to very poor.



Seagrass meadows were monitored at coastal, estuarine and fringing reef locations in the Fitzroy region. Key environmental drivers in the region include exposure at very low tide and high turbidity. Seagrass abundance remained relatively stable across habitats and was rated poor overall in 2011-2012 and 2012-2013. Reproductive effort was very poor, suggesting a low capacity to recover from disturbance. The nutrient status of seagrass tissue was moderate overall and variations between habitats reflected differences in nutrient and light availability.

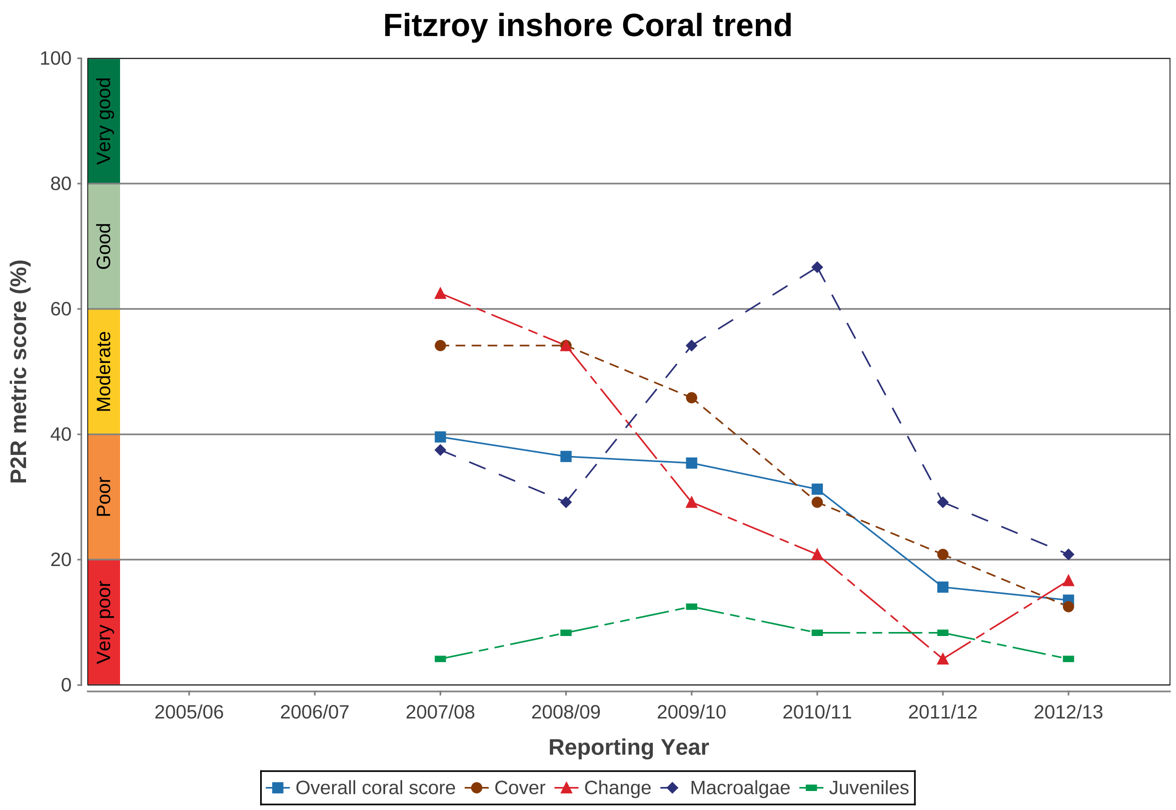



Seagrass abundance at inshore intertidal reef habitat
at Great Keppel Island in the Fitzroy region
Seagrass abundance (% cover)
100
90
80
70
60
50
40
30
20
10
0
September 2007
April 2008
October 2008
April 2009
October 2009
April 2010
December 2010
March 2011
September 2011
March 2012
September 2012
April 2013
Standard error

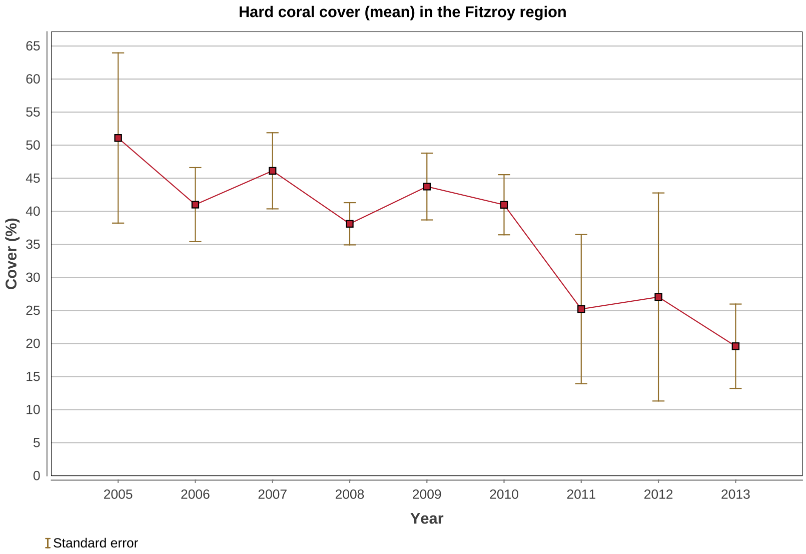

Seagrass abundance at inshore intertidal coastal habitat
at Shoalwater Bay in the Fitzroy region
Seagrass abundance (% cover)
100
90
80
70
60
50
40
30
20
10
0
January 2002
September 2002
April 2003
October 2003
February 2004
September 2004
March 2005
March 2006
May 2007
April 2008
April 2009
April 2010
April 2011
March 2012
April 2013
Standard error

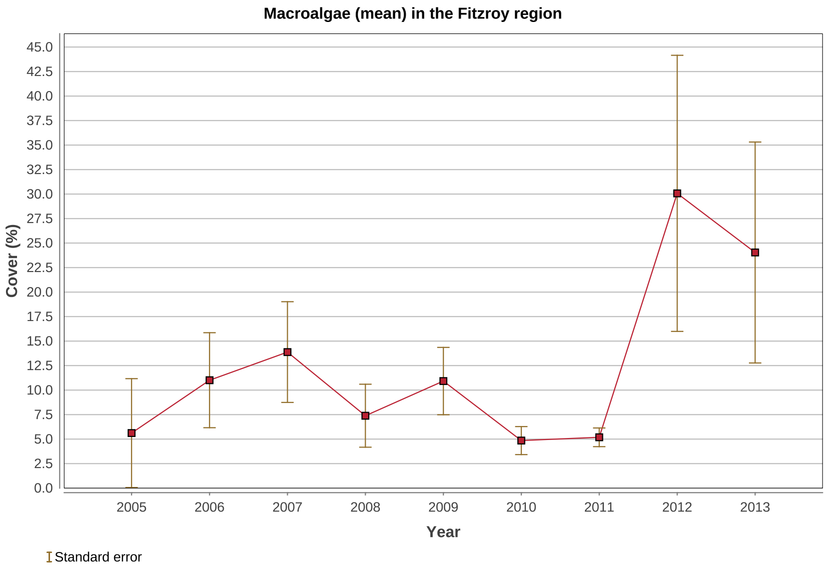
Coral

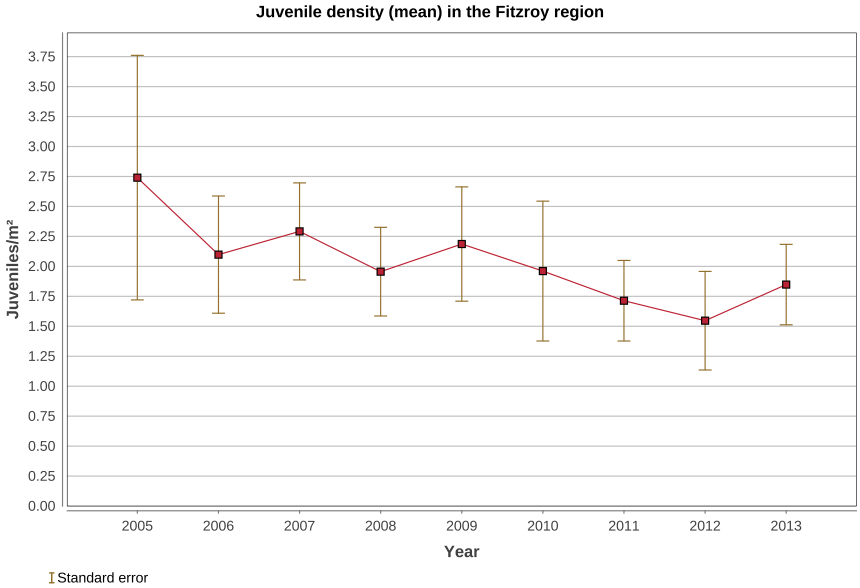
The overall condition of inshore coral reefs in the Fitzroy region declined from poor in 2010-2011 to very poor in 2011-2012 and 2012-2013. The influence of flooding on water quality has contributed to the decline in coral reef condition.



Coral cover declined to very poor across the Fitzroy region in 2012-2013. The rate of change in coral cover and the density of juveniles were both very poor in 2011-2012 and 2012-2013, while macroalgae remained poor. Exposure to low salinity flood waters from the Fitzroy River in 2011 caused a marked reduction in coral cover and juvenile densities down to at least two metres depth on reefs inshore of Great Keppel Island. Elsewhere, recovery from coral bleaching in 2006 and periodic storms has been compromised by a persistent bloom of macroalgae, high levels of disease and low densities of juvenile corals, all linked to the influence of flooding.

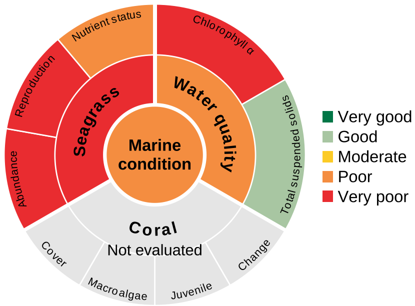






Average cover of hard corals, cover of macroalgae and density of hard coral juveniles in the Fitzroy region from 2005 to 2013.

Burnett Mary



The Burnett Mary's overall marine condition remained poor in 2011-2012 and 2012-2013. Inshore water quality declined from moderate in 2010-2011 to poor in 2011-2012 and 2012-2013. The condition of seagrass remained very poor. No coral monitoring occurs in the Burnett Mary region under the Marine Monitoring Program.

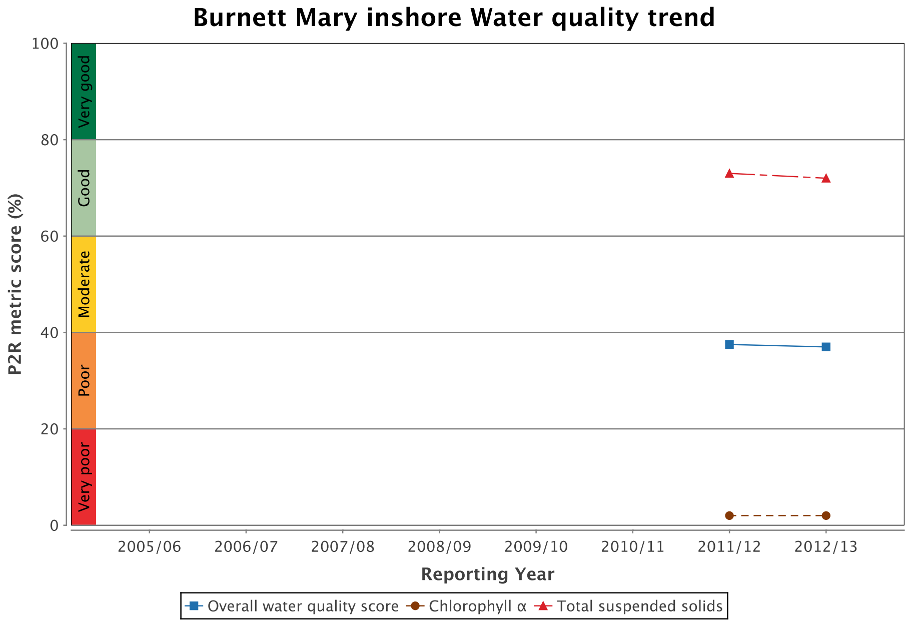
Water quality

There is no comprehensive, ongoing *in situ* water quality monitoring in the Burnett Mary region. Estimates of chlorophyll *a* and total suspended solids are derived from remote sensing only, which requires further field validation and, hence, estimates have relatively low reliability compared to those for other regions.

Inshore water quality (assessed by remote sensing of chlorophyll *a* and suspended solids) in the Burnett Mary region was poor in 2011-2012 and 2012-2013. The continued decline was driven by relatively large changes in chlorophyll *a*, while total suspended solids remained stable, which is a consequence of the recent large-scale flood events.

Chlorophyll *a* was rated as very poor in both 2011-2012 and 2012-2013. Concentrations exceeded the Great Barrier Reef Marine Park Water Quality Guidelines for 99 and 97 percent of the inshore area in the dry and wet season, respectively, in 2012-2013. Total suspended solids were rated as good in both 2011-2012 and 2012-2013. However, concentrations exceeded the guidelines for 27 and 36 per cent of the inshore area in the dry and wet season, respectively, in 2012-2013.

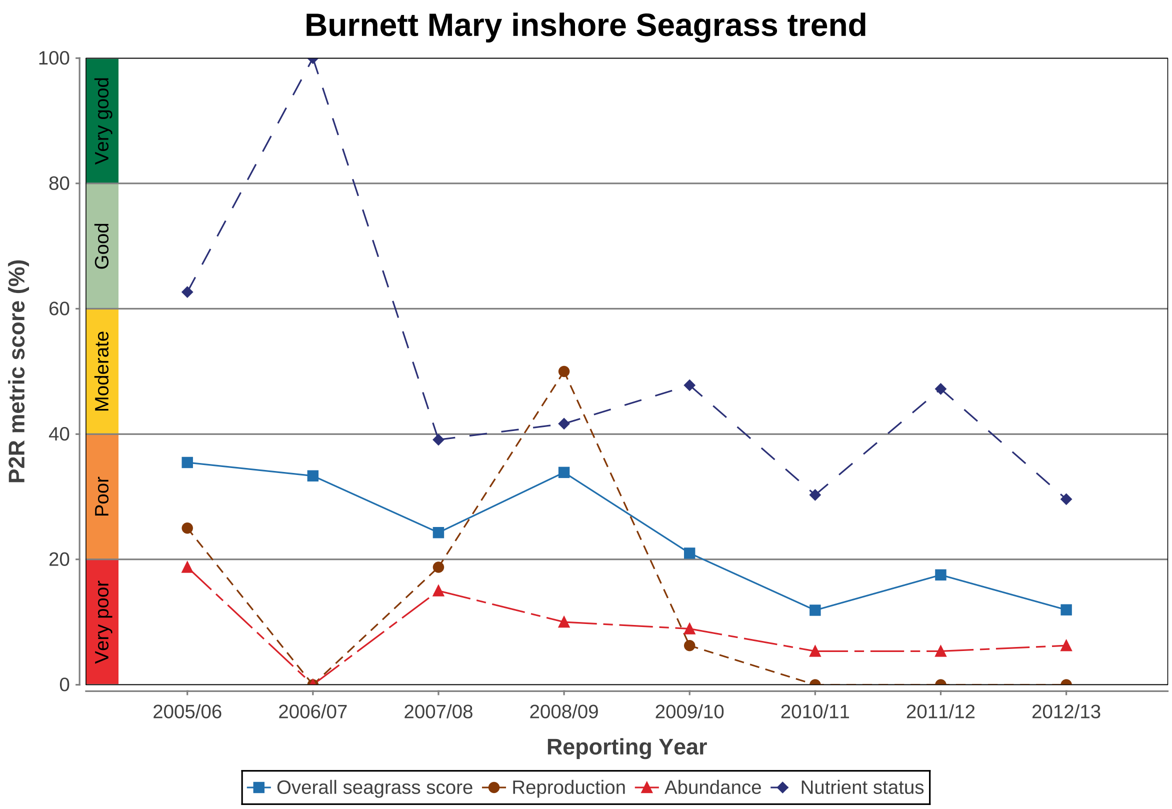
There is no routine monitoring of pesticides in the Burnett Mary.



Trend in the Water Quality Index from 2011-2012 to 2012-2013. The Water Quality Index is also separated into component scores for concentrations of chlorophyll a and total suspended solids. Trend data is only shown for these two years, because a major change in the remote sensing algorithms mean the historical data is no longer directly comparable. The full historical time-series will be reprocessed for the next report card.

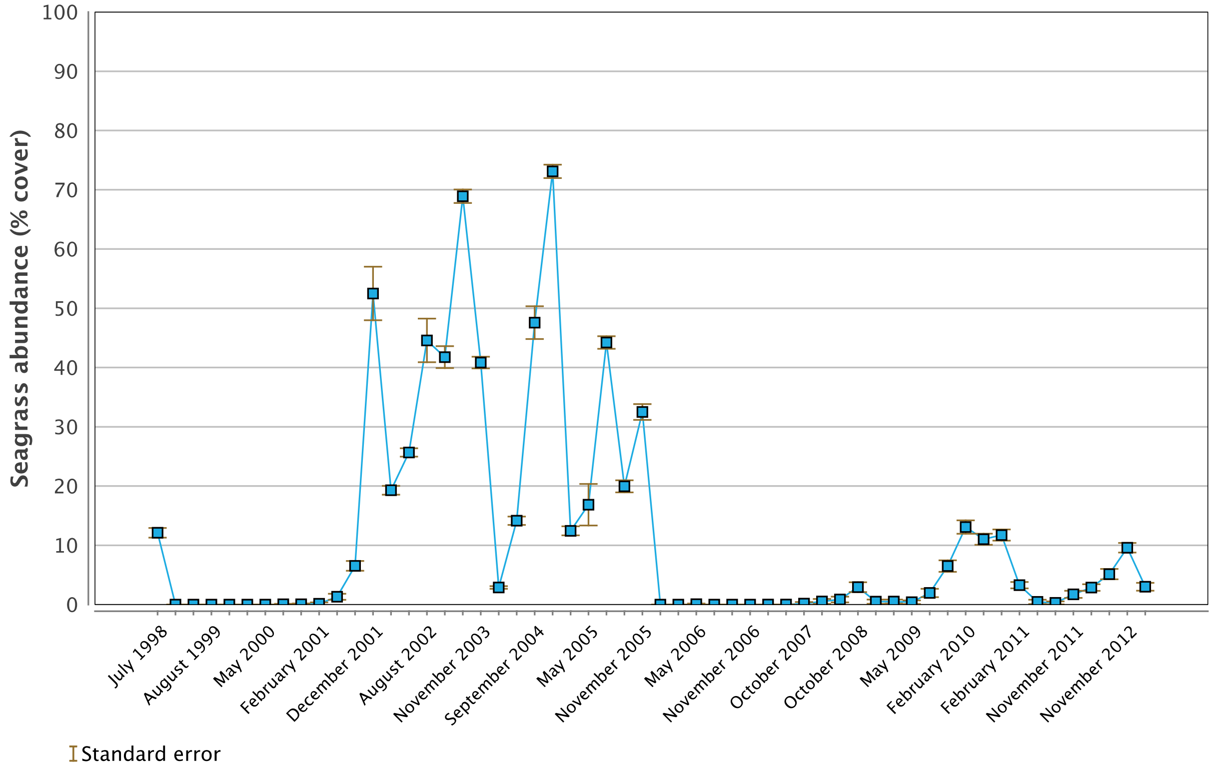
Seagrass

The overall condition of inshore seagrass in the Burnett Mary region remained very poor in 2011-2012 and 2012-2013, reflecting very poor abundance and reproductive effort of seagrass meadows. Seagrass condition has generally been declining since 2005-2006; however, the indicators driving the condition assessment have varied over the monitoring period.

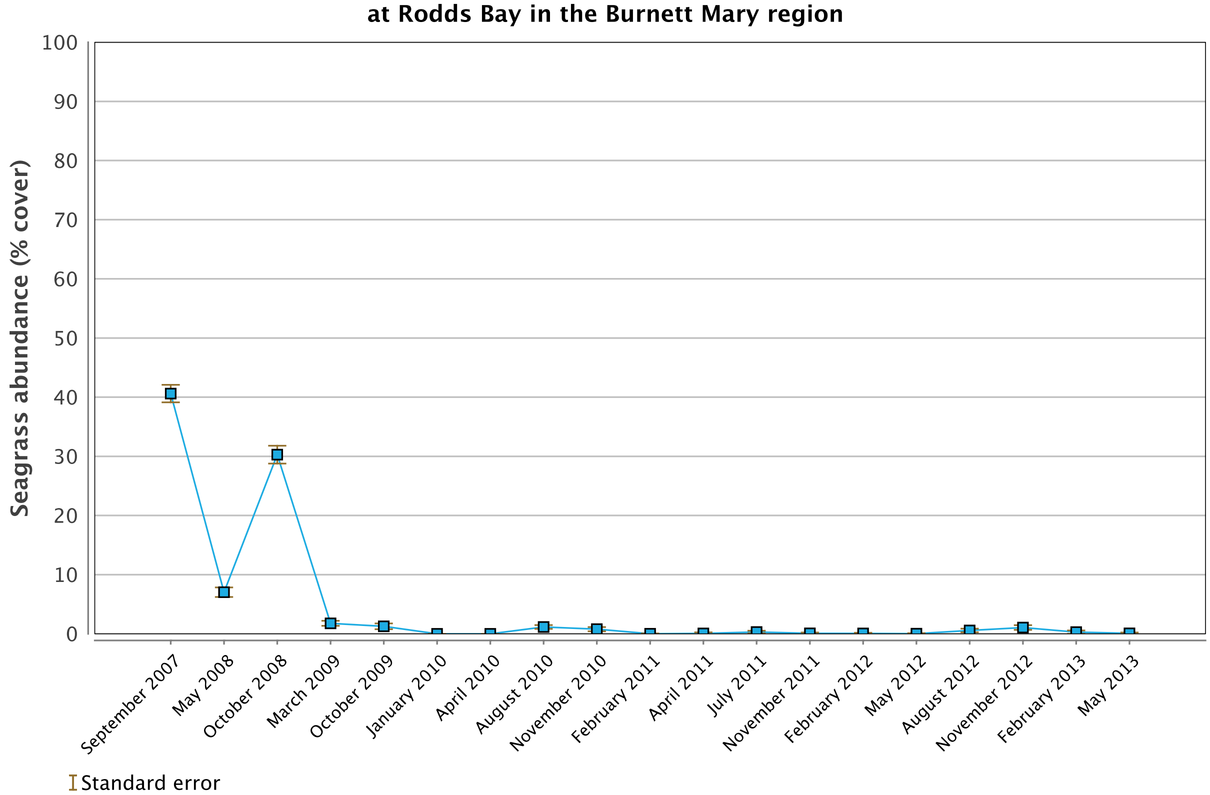


Seagrass is monitored at estuarine sites at Rodds Bay and Urangan, in the north and south of the Burnett Mary region, respectively. The primary environmental drivers of community composition at these sites are fluctuating temperatures, catchment run-off and high turbidity. Seagrass abundance and reproductive effort were very poor throughout the region in 2011-2012 and 2012-2013, which may indicate a reduced capacity of local meadows to recover from environmental disturbances. The nutrient concentrations of seagrass tissue declined from moderate in 2011-2012 to poor in 2012-2013, which is indicative of poor water quality following repeated flood events in the region.

Seagrass abundance at inshore intertidal estuarine habitat at Urangan in the Burnett Mary region



Seagrass abundance at inshore intertidal estuarine habitat at Rodds Bay in the Burnett Mary region



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