dry tropics partnership for healthy waters

Dry Tropics Partnership for Healthy Waters
Waterways Report Card 2023

TECHNICAL REPORT

PART 2: Climate and Land Use

Reporting on data collected 2021 - 2022

JULY 2023 | Dry Tropics Partnership for Healthy Waters (DTPHW)

Written by Adam Shand and Dinny Taylor

9 Climate and Land Use in The Townsville Dry Tropics Region

Environmental stressors such as extreme climate and intensive land use are an influential factor for every indicator measured in the Technical Report. This section presents a summary of the relevant stressors over the 2021–2022 reporting period. For a detailed assessment and explorations of trends for each stressor over an extended period see Appendix B.

9.1 Urban Environment (Land Use)

Land use data[4] describes what the dominant use for the land is, with nationally consistent descriptions set by the Australian Land Use and Management (ALUM) Classification system (Department of Agriculture, Fisheries and Forestry 2023). Land use in the Dry Tropics is summarised in Table 16 and visualised in Figure 4.

Table 16. Total area and percentage of region for land use classes in the Dry Tropics region in 1999 and 2021 at the primary level.

Land Use	2021		2016		1999	
	%	km²	%	km²	%	km²
Conservation and Natural Environments	35.5	1030.98	35.1	1026.13	28.6	835.63
Intensive Uses	10.2	296.54	9.90	290.35	8.3	243.40
P. f. Dryland Agriculture and Plantations	0.1	1.74	0.1	3.17	0.1	2.63
P. f. Irrigated Agriculture and Plantations	1.2	33.44	1.2	35.75	1.1	31.75
P. f. Relatively Natural Environments	47.3	1375.00	47.8	1397.60	56.0	1636.67
Water	5.8	169.12	5.8	169.67	5.9	172.76

[4] All land use data was downloaded from QSpatial's [Catalogue] (Queensland Government 2023).

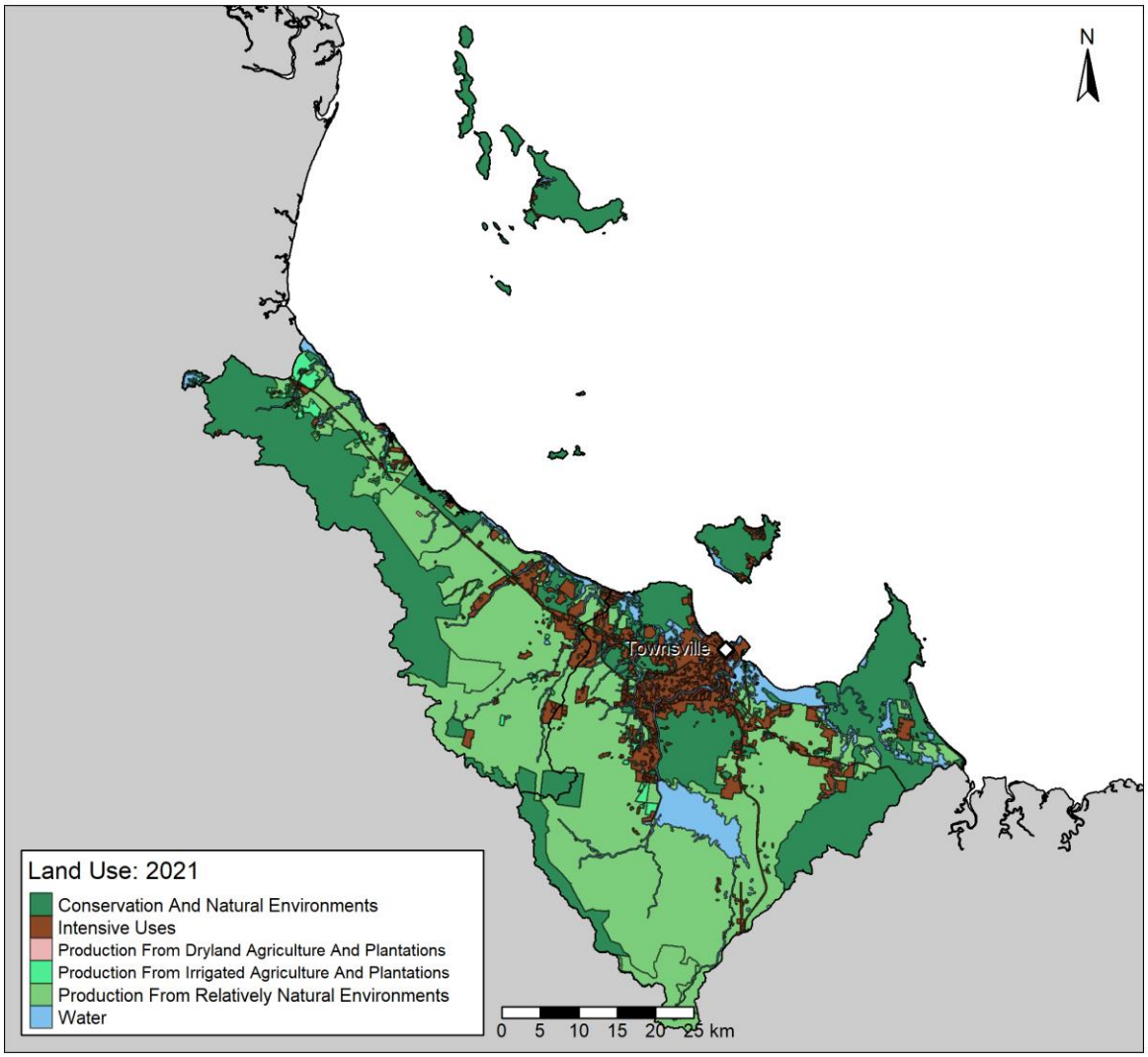

Figure 4. Land use categories in the Dry Tropics region in 2021 shown at the primary level.

9.2 Climate

A changing climate and extreme weather can have a major impact on the health of the environment both globally and within the Townsville Dry Tropics region. These forces directly and indirectly put pressure on local waterways and can influence the results presented in this report (IPCC 2022, United Nations 2023). Between 1st July 2021 and 30th June 2022, the Dry Tropics region recorded a wide range of weather events. There were no major flooding events, cyclones, or changes to the prevailing La Niña conditions (Bureau of Meterology 2023, Climate Council 2021). However, multiple heatwaves were experienced, periods of both extremely high and low monthly rainfall figures were recorded, average sea-surface water temperature was above average, and the chance of coral bleaching was above average (Bureau of Meterology 2023, NOAA 2023). The key influences are explored below.

9.2.1 Rainfall

Monthly rainfall[5] across the Dry Tropics region was unevenly distributed, with monthly percentile rainfall in the Ross and Black basins ranging from "very much below average" (1st – 10th percentiles) to the "highest 1%" (99th percentile) on record (Table 17).

Table 17. Monthly rainfall percentiles in the Ross Basin and Black Basin grouped into seven categories.

Basin	2021						2022						Annual
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Ross													
Black													

■ = Lowest 1% | ■ = Very much below average | ■ = Below Average | ■ = Average | ■ = Above Average | ■ = Very much above average | ■ = Highest 1%

Total annual rainfall was 1166mm in the Ross Basin, and 1383mm in the Black Basin (Table 18).

Table 18. Annual rainfall summary statistics for the Ross Basin and Black Basin.

Basin	Annual Rainfall	Long-term mean (ltm)	Anomaly (+/- ltm)	Percentage of the ltm
Ross	1166mm	1029mm	+137mm	113%
Black	1383mm	1326mm	+57mm	104%

Annual rainfall was the greatest in the hinterlands of the Black Basin with up to 2000mm, while the least amount of rainfall was recorded on the southern plateau of the Ross Basin with only 800 to 1000mm. A large area of the Black Basin received less rain that usual, while the southern end of the Black Basin and centre of the Dry Tropics region received more rain than usual (Figure 5).

[5] All rainfall data was downloaded from the BOM's [Australian Water Outlook] portal (Bureau of Meteorology 2022).

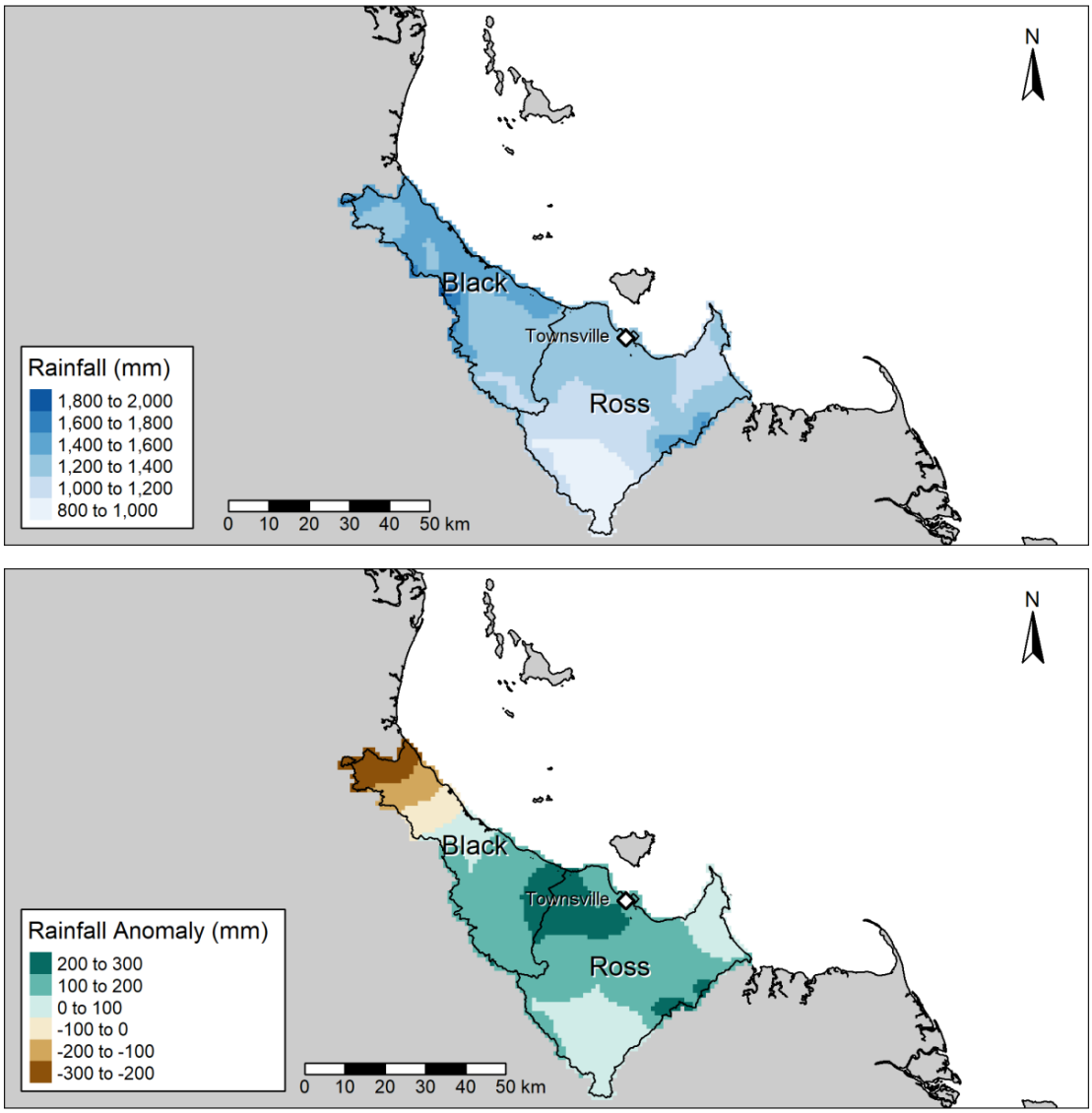

Figure 5. Total annual rainfall and rainfall anomaly in the Ross and Black Basin.

9.2.2 Air Temperature

Mean monthly air temperature[6] was consistently equal to or greater than average every month of the reporting period across both the Ross and Black basins. For five months of the year each basin recorded their "highest 1%" air temperature on record (Table 19).

[6] All air temperature data was downloaded from BOM's [Gridded Climatology Data] portal (Bureau of Meteorology 2022)

Table 19. Monthly air temperature percentiles in the Ross Basin and Black Basin grouped into seven categories.

Basin	2021						2022						Annual
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Ross													
Black													

■ = Lowest 1% | ■ = Very much below average | ■ = Below Average | ■ = Average | ■ = Above Average | ■ = Very much above average | ■ = Highest 1%

The mean annual air temperature was 25.4°C in the Ross Basin, and 24.9°C in the Black Basin (Table 18).

Table 20. Annual air temperature summary statistics for the Ross Basin and Black Basin.

Basin	Annual Air Temperature	Long-term mean (ltm)	Anomaly (+/- ltm)	Percentage of the ltm
Ross	25.4°C	24.0°C	+1.4°C	106%
Black	24.9°C	23.5°C	+1.4°C	106%

Maximum mean annual temperatures of more than 26°C were recorded in both basins and a minimum mean temperature of ~22°C in the Ross Basin and ~21°C in the Black Basin was recorded. (Figure 6). All areas within the Dry Tropics regions recorded mean temperatures above the long-term mean, with a difference of ~1.30°C to ~1.50°C throughout, particularly in the most northern reaches of the Black Basin (Figure 6).

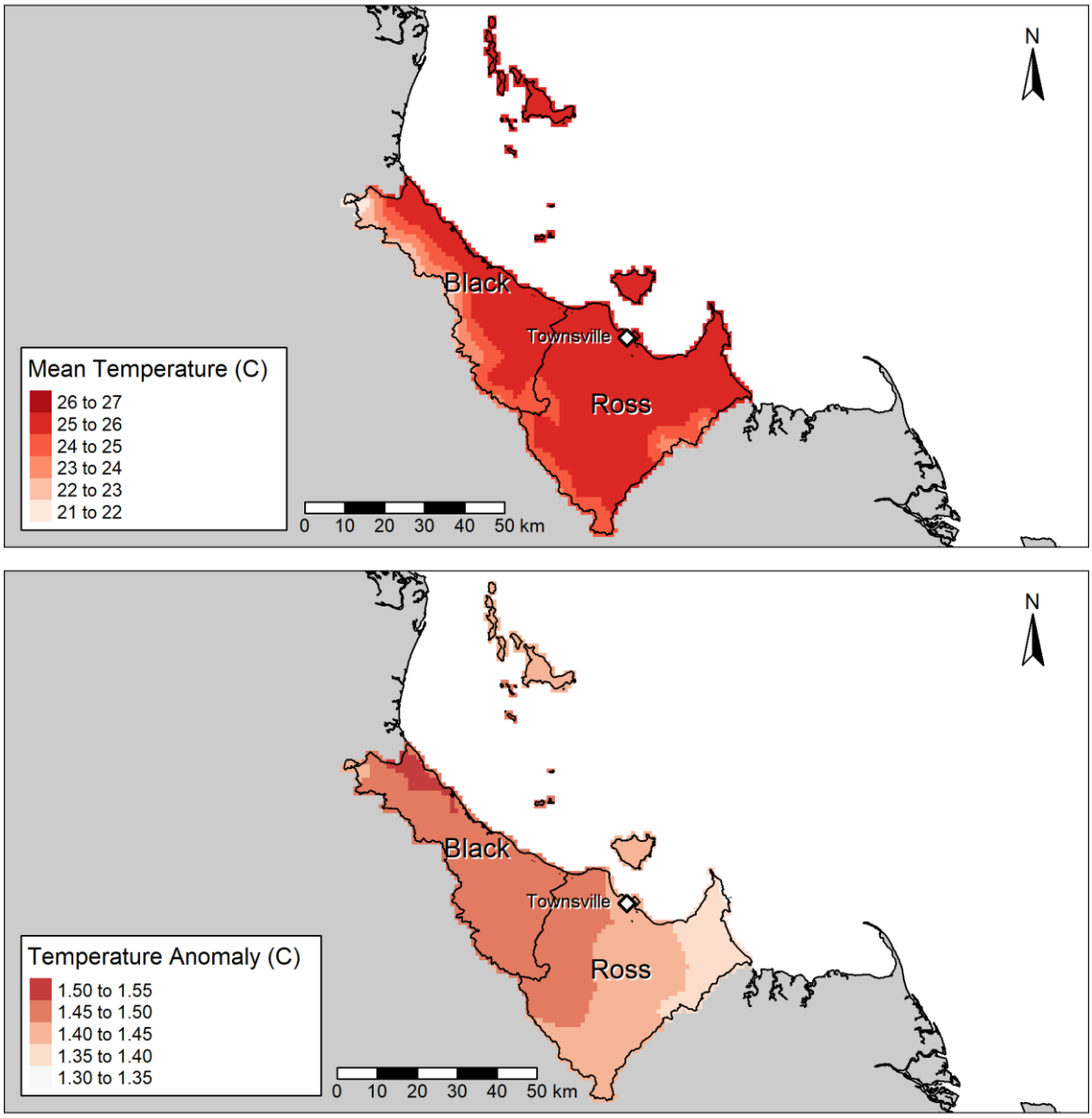

Figure 6. Total annual air temperature and air temperature anomaly in the Ross and Black Basin.

9.2.3 Sea Surface Temperature

Monthly sea surface temperature[7] in the Dry Tropics marine region was "very much above average" or the "highest 1%" on record for ten months of the year. February and September were the only two months of the year where monthly sea surface temperature remained "average" or "above average" respectively (Table 21).

[7] All sea surface temperature data was downloaded from NOAA's [Coral Reef Watch] portal (NOAA 2023)

Table 21. Monthly air temperature percentiles in the Ross Basin and Black Basin grouped into seven categories.

Region	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Annual
Dry Tropics													

■ = Lowest 1% | ■ = Very much below average | ■ = Below Average | ■ = Average | ■ = Above Average | ■ = Very much above average | ■ = Highest 1%

The mean annual sea surface temperature in the Dry Tropics marine region was 27.1°C and represents an increase from last year in the Dry Tropics marine region (Appendix G, Table 22).

Table 22. Annual sea surface temperature summary statistics for the Dry Tropics marine region.

Region	**Annual Sea Surface Temperature**	**Long-term mean (ltm)**	**Anomaly (+/- ltm)**	**Percentage of the ltm**
Dry Tropics	27.1°C	26.3°C	+0.8°C	103%

The highest temperatures were recorded in the northern most reaches of the marine region and gradually decreased southward. Annual sea surface temperature anomalies further highlighted that lower temperatures recorded approximately 30km offshore were not a frequent occurrence (Figure 7).

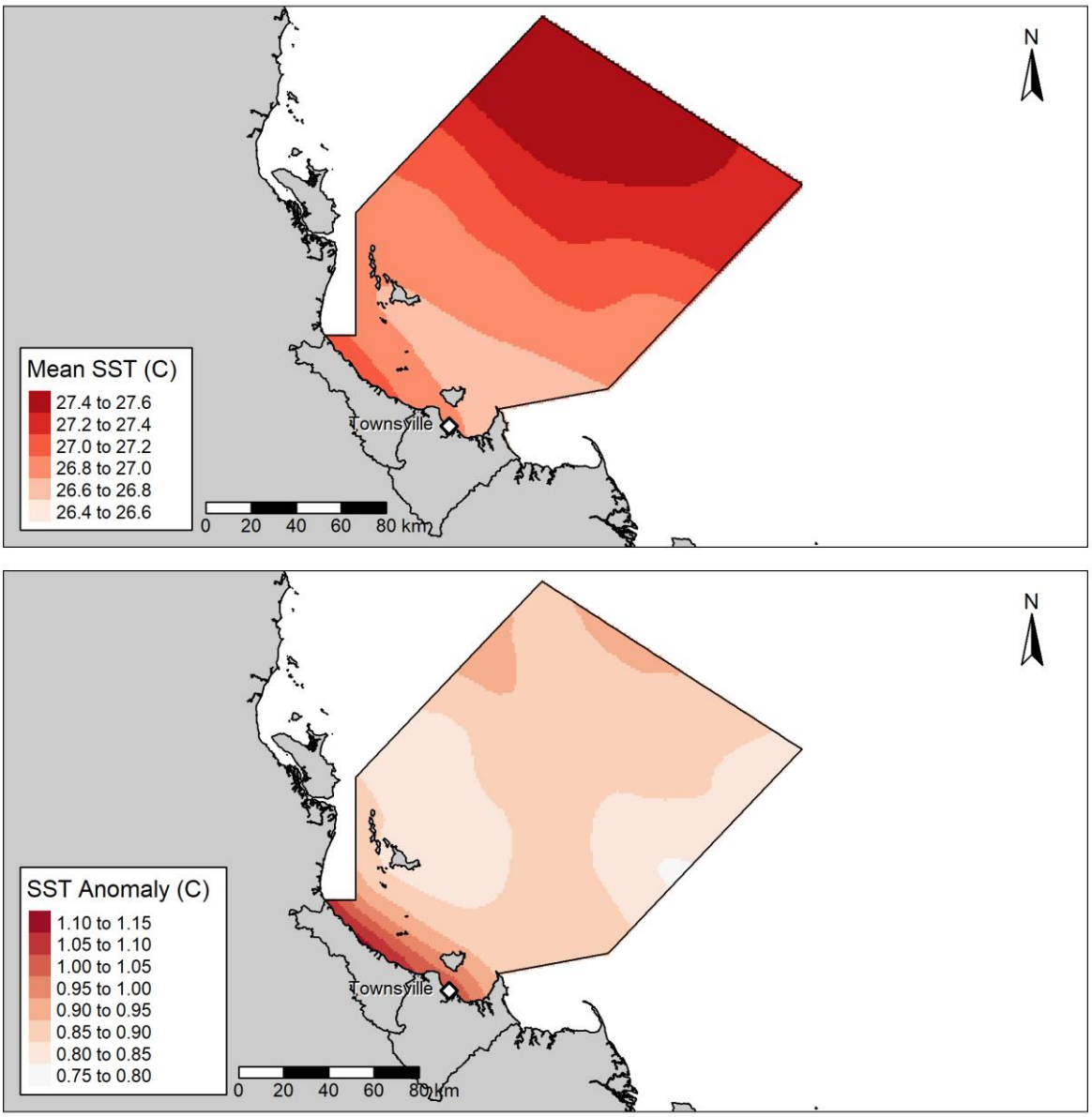

Figure 7. Total annual sea surface temperature and sea surface temperature anomaly in the Dry Tropic marine region.

9.2.4 Coral Bleaching (Degree Heating Weeks)

Mass coral bleaching has been linked to prolonged periods of heat stress (Glynn and D'Croz 1990). NOAA's Coral Reef Watch degree heating week (DHW) dataset provides a measure of this heat stress and acts as a proxy to coral bleaching[8] (NOAA 2023). In 2021–2022, coral bleaching risk in the Dry Tropics marine region ranged from "possible" to "highly likely", with no region showing low risk. DHWs ranged from 4 to 6, up to >8 and highly likely bleaching risk (>8 DHWs) was predominantly recorded in the coastal waters, and at the eastern edge of the region (Figure 8). The greater number of DHWs inshore aligns with the records of increased annual sea surface temperature and increased annual sea surface temperature anomalies in the same location (Sea Surface Temperature, Figure 7).

[8] All degree heating week data was downloaded from NOAA's [Coral Reef Watch] portal (NOAA 2023)

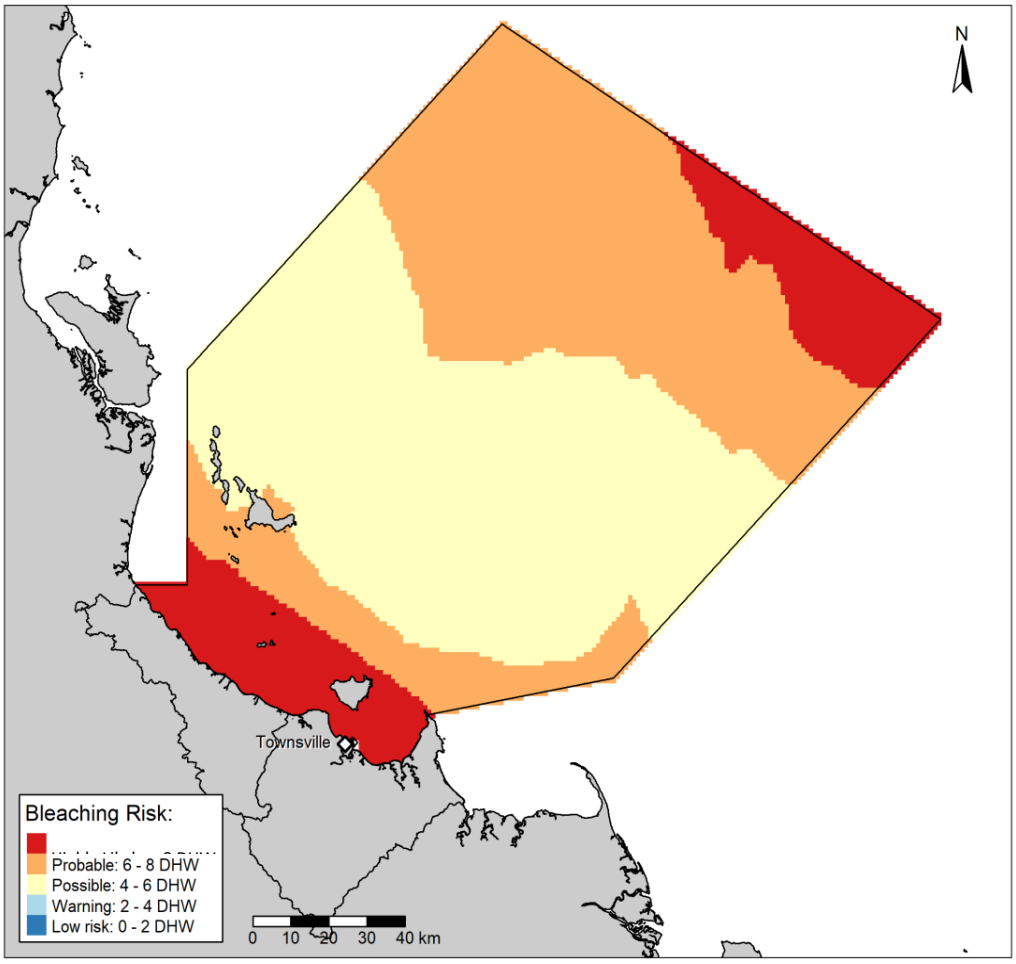

Figure 8. Total annual degree heating weeks (bleaching events) in the Dry Tropic marine region.

9.3 Climate and Land Use Summary

For the 2021–2022 report period, the Dry Tropics region experienced a variety of climatic conditions. Overall, the region could be described as rainier than usual, and hotter than usual. The updated land use category data showed an increase in both intensive and conservation land uses. Key points are summarised below:

- The major change in land use was a decrease in production from relatively natural environments, followed by an increase in conservation and natural environments, and an increase in intensive uses.
- Total annual rainfall in both basins was average, although slightly exceeded the long-term mean. However, monthly rainfall showed significant fluctuation ranging from “very much below average” to the “highest 1%” on record.
- Monthly air temperature across both basins was consistently equal to or greater than average and exceeded the long-term mean. For five months of the year each basin recorded their “highest 1%” air temperature on record for the month.
- The annual sea surface temperature was 27.1°C and exceed the long-term mean. Monthly average sea surface temperature was “very much above average” or the “highest 1%” on record for ten months of the year.

- The heat stress risk of coral bleaching ranged from “possible” to “highly likely” throughout the marine environment.