WATER USAGE & UNREGULATED WATER TRADES IN AUSTRALIA

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WATER SHORTAGE & OVERUSE OF WATER

Environmental Problem

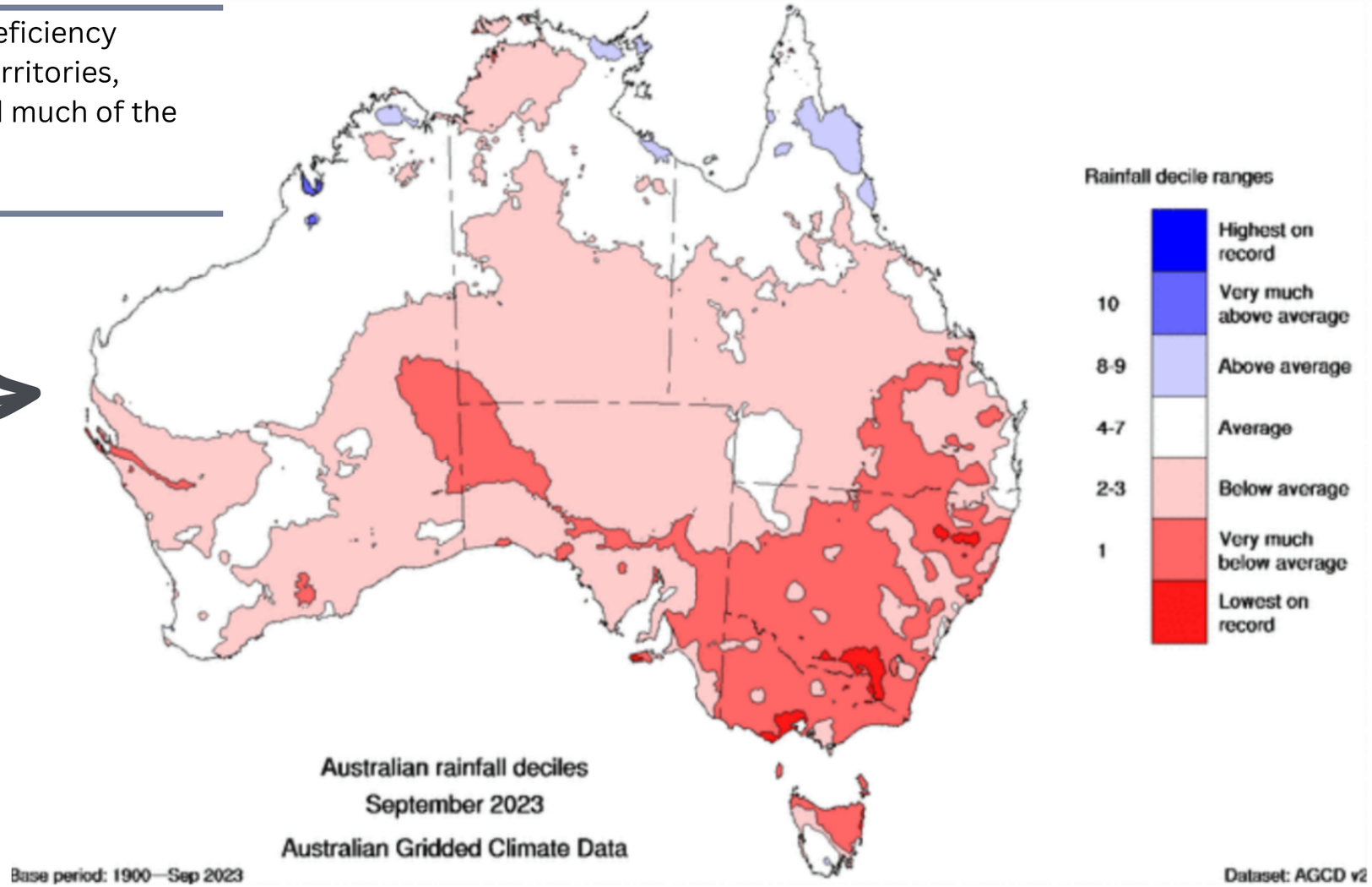
Overview

Scope, severity, and Impact:
Australia being one of the driest continents has agriculture that largely depends on irrigation.

Moreover, rainfall has consistently decreased by 10% over the last 10 years (Bureau of Meteorology, 2019).

The overextraction of water has led to ecological degradation, reduced river flows and declining groundwater levels.

Since May 2023, areas of rainfall deficiency have developed in all states and territories, especially in Western Australia and much of the south-east of Australia.
(Walsh; Westwood; Gupta, 2023)



(Bureau of Meteorology, 2023)

Hypothesis #1: Overusing of water in Australia is ocurring.

UNREGULATED WATER TRADES

Social and Governance Problem

Overview

Scope, severity, and Impact:
Unregulated water trades can cause transparency issues and potential misuse by powerful players.

This can lead to unequal distribution of water resources. It also creates mistrust amongst water users that can affect small farmers.

Hypothesis #2: Most unregulated water trades occur in ground water rather than in surface water.

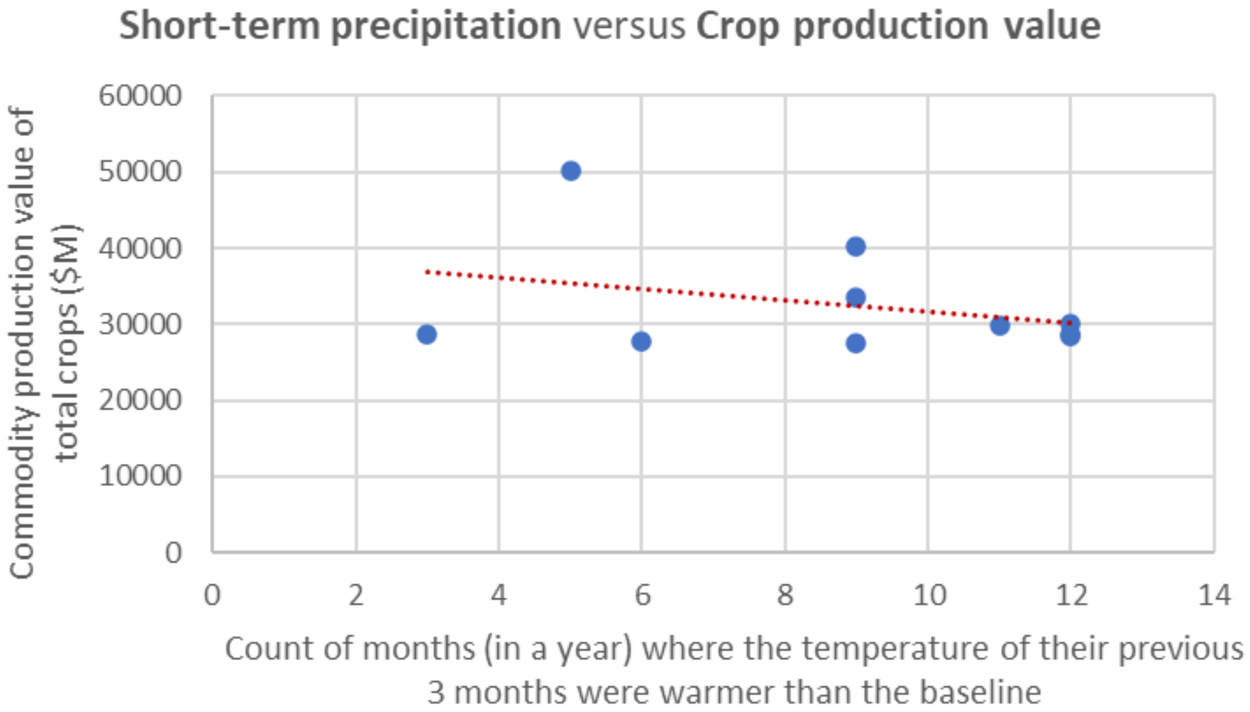
Data Cleaning and Transformations

- Renamed column names to appropriate titles.
- Subset the relevant columns for analysis.
- Extract only the year values for certain analysis.
- Converted dates into pandas datetime for certain analysis.
- Replaced NAs with 0 in numerical columns, including those for year, water source and water use data, and commodity production values.

WATER SHORTAGE

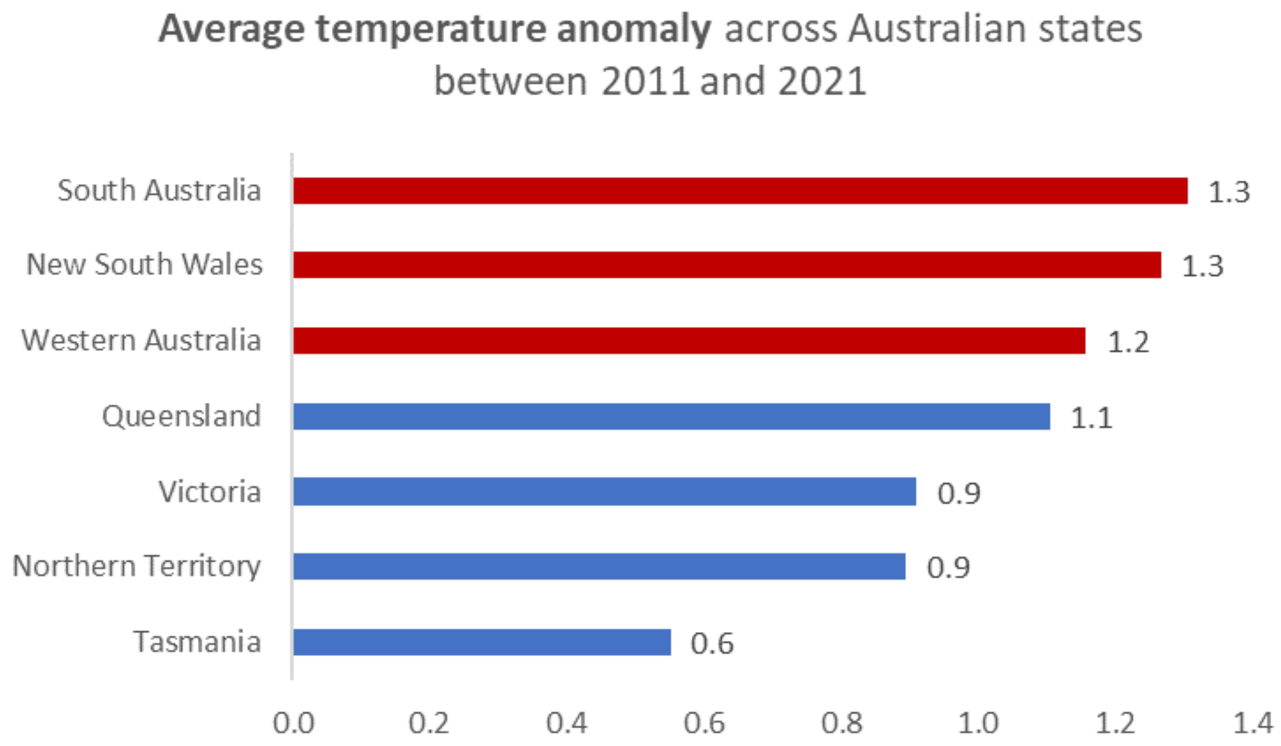
Due to the effects of climate change

Short-term Precipitation - Temperature Anomaly



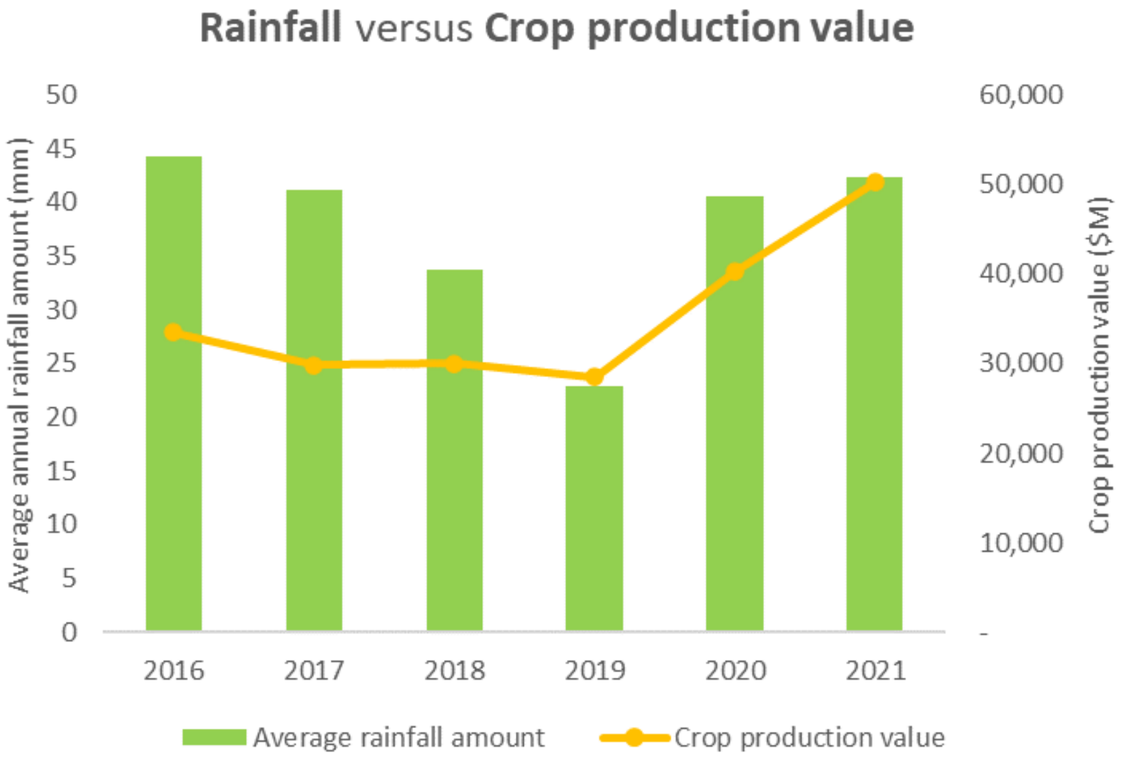
There is a **negative linear relationship** between **temperature anomaly** and **crop production value**

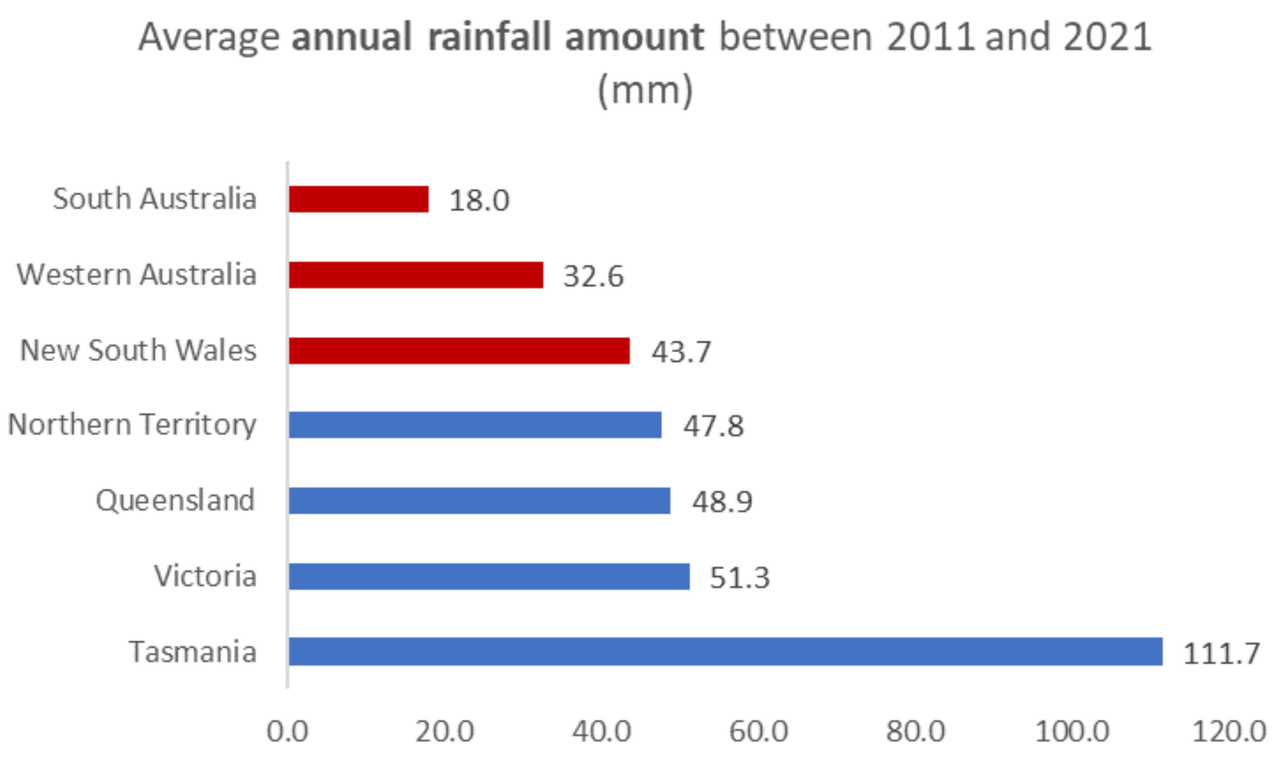
Short-term Precipitation - Temperature Anomaly



South Australia, New South Wales, Western Australia are suffering the **highest temperature change**

Short-term Precipitation - Rainfall





Changes in rainfall seems to be **positively associated** with **changes in crop production value**

South Australia, Western Australia, New South Wales are also the **driest** states

Short-term Precipitation

Average temperature anomaly by season

	AUTUMN			WINTER			SPRING			SUMMER		
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
New South Wales	0.44	0.91	0.69	0.55	1.17	1.13	1.88	2.07	1.77	1.45	2.26	0.88
Tasmania	0.46	0.10	0.14	0.39	0.40	0.35	0.65	0.77	0.87	1.31	1.22	-0.05
Victoria	0.48	0.69	0.45	0.39	0.68	0.52	1.23	1.59	1.37	1.59	1.61	0.32
South Australia	0.68	1.17	0.76	0.37	1.39	1.41	2.00	2.10	1.48	1.77	1.76	0.76
Western Australia	0.77	1.38	0.91	0.71	1.45	1.69	1.59	1.89	1.25	1.20	0.38	0.64
Northern Territory	0.96	0.96	0.49	0.53	1.52	1.02	1.63	1.31	0.82	0.46	0.35	0.68
Queensland	0.68	0.95	0.72	0.68	1.40	1.20	1.50	1.41	1.38	1.14	1.26	0.92

Average rainfall amount by season

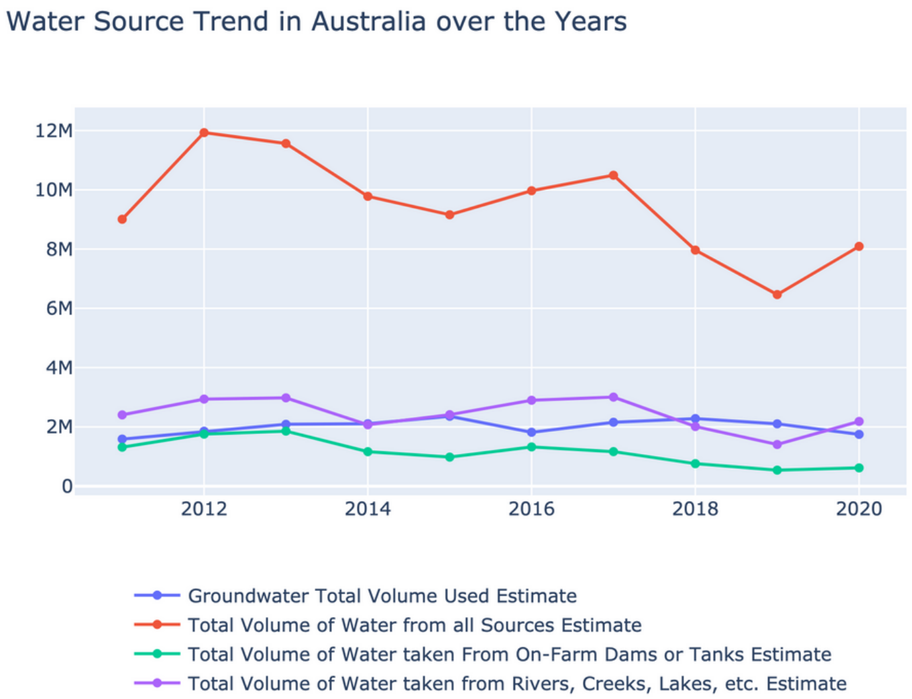
	AUTUMN			WINTER			SPRING			SUMMER		
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
New South Wales	69.9	32.5	30.8	46.5	28.8	31.3	33.0	34.3	52.5	51.2	58.6	54.7
Tasmania	99.4	93.9	143	126	165	158	122	116	92.6	107	72.8	66.5
Victoria	41.8	44.5	57.2	63.8	65.1	62.8	54.9	49.1	49.1	73.1	47.0	38.0
South Australia	21.7	14.2	17.6	18.3	14.4	14.0	13.4	13.5	20.4	21.8	22.2	23.8
Western Australia	52.9	18.2	20.6	20.3	16.6	12.7	7.5	13.6	25.7	85.2	86.7	69.7
Northern Territory	96.7	24.1	9.9	4.2	3.3	1.6	6.3	16.8	50.3	42	141	112
Queensland	117	25.4	18.1	19.4	14.5	9.6	11.7	24.4	41.9	47.0	121	111

- Appropriate **water reservation** and **allocation** based on **season** and **location** will be required to maintain sufficient irrigation, e.g. hotter months lead to evapotranspiration
- **Climate changes** also affect **water reservoirs** (either natural or artificial sources) in the **long-term**, i.e. groundwater level will be lower if drought occurs more than 6 months

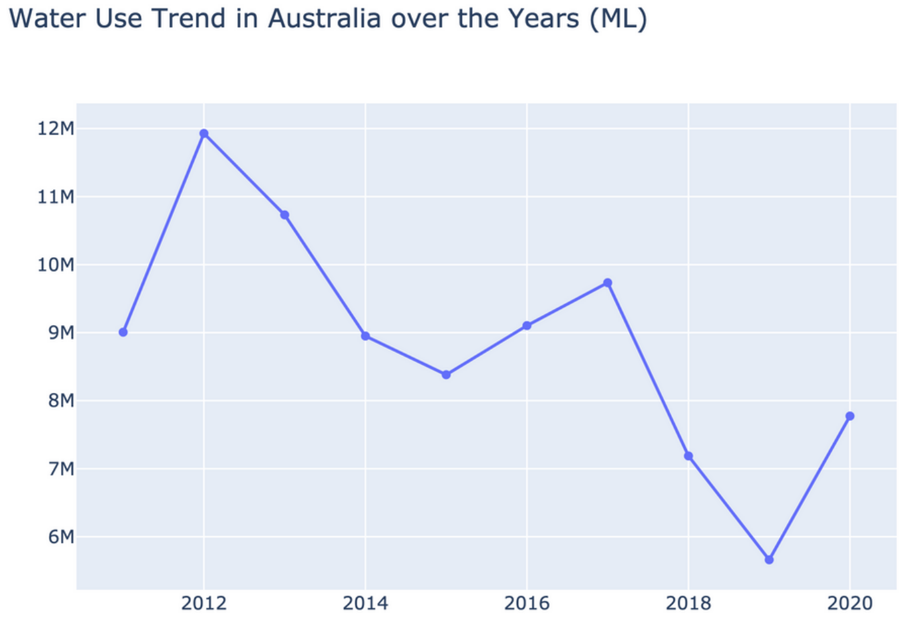
WATER SHORTAGE & OVERUSE OF WATER

Environmental Problem

Water Source and Use Trend in Australia over the Years

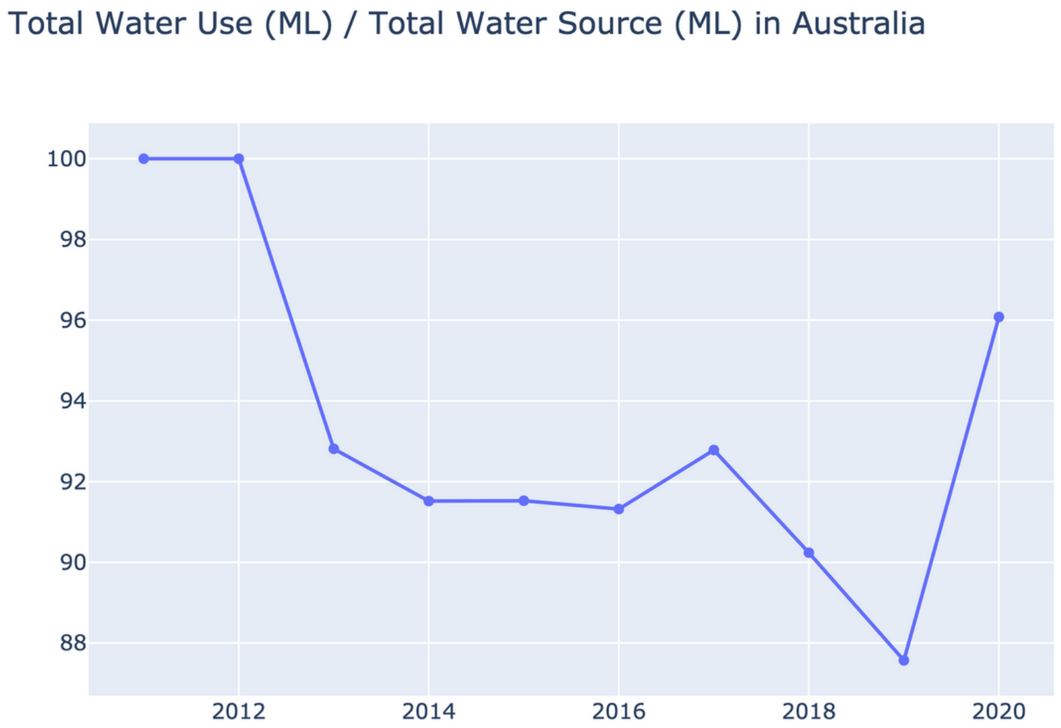


Most of the water is sourced from Rivers, Creeks, and Lakes.



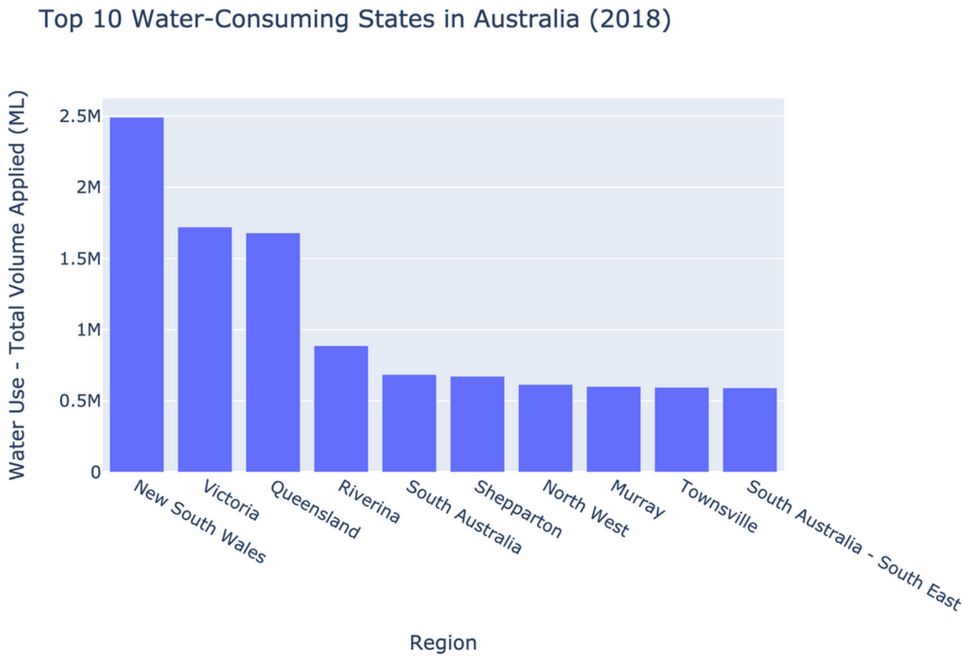
The water use in Australia has shown a decrease over the years.

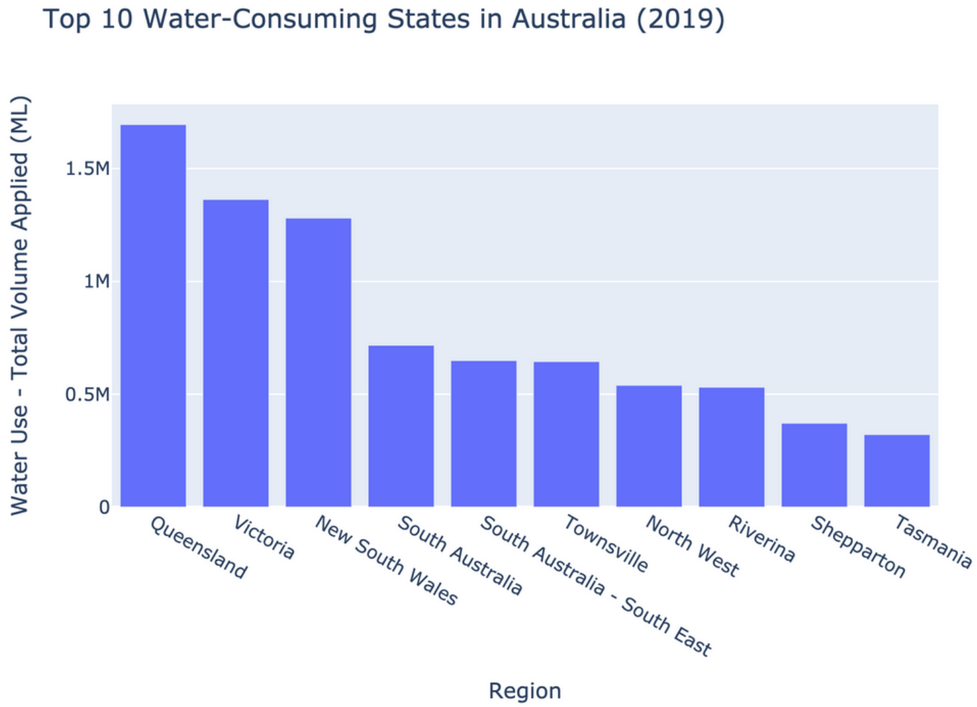
Water Utilization Trend in Australia over the Years



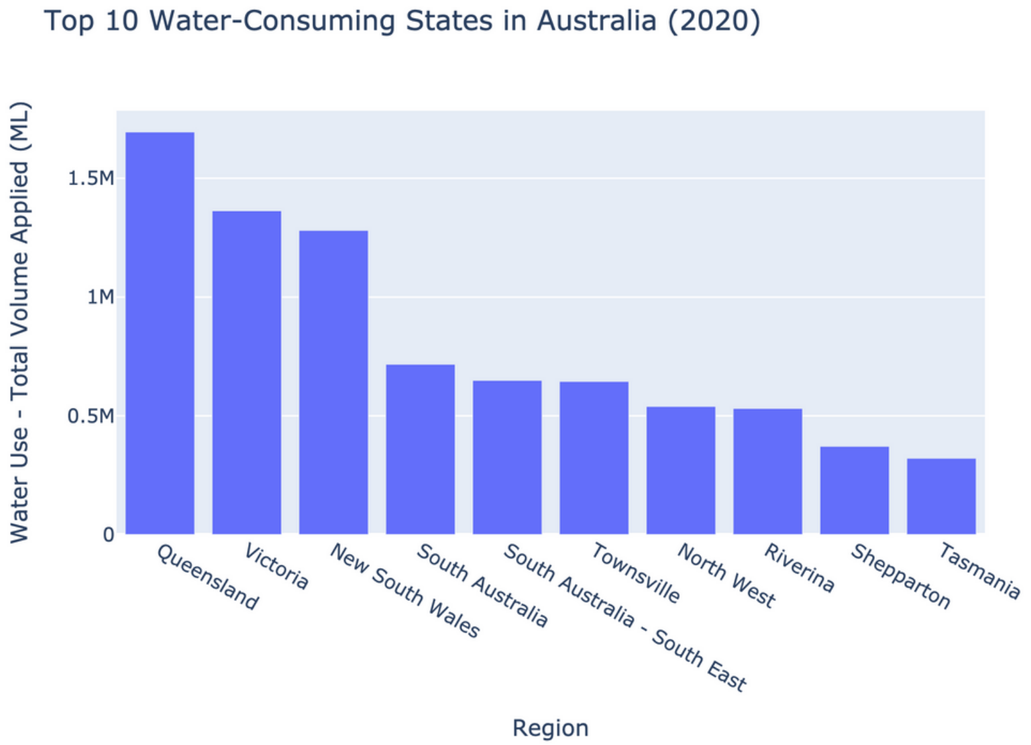
The annual water use from 2011 to 2020 exceeded 90%, with the exception of 2019, which recorded 87.57%. Even though there is no specific measure of water overuse it is evident that water utilization consistently remains above 85% each year.

Top 10 Water-Consuming States in Australia over the Years (2018-2020)





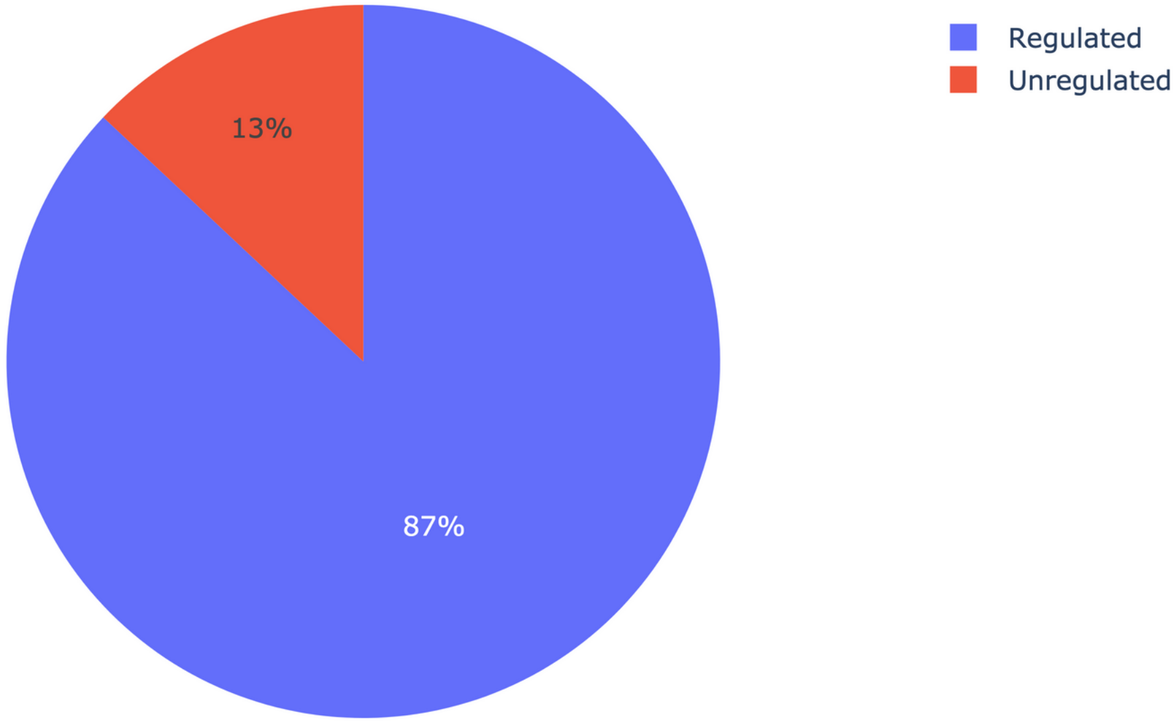
Top 10 Water-Consuming States in Australia over the Years (2018-2020)



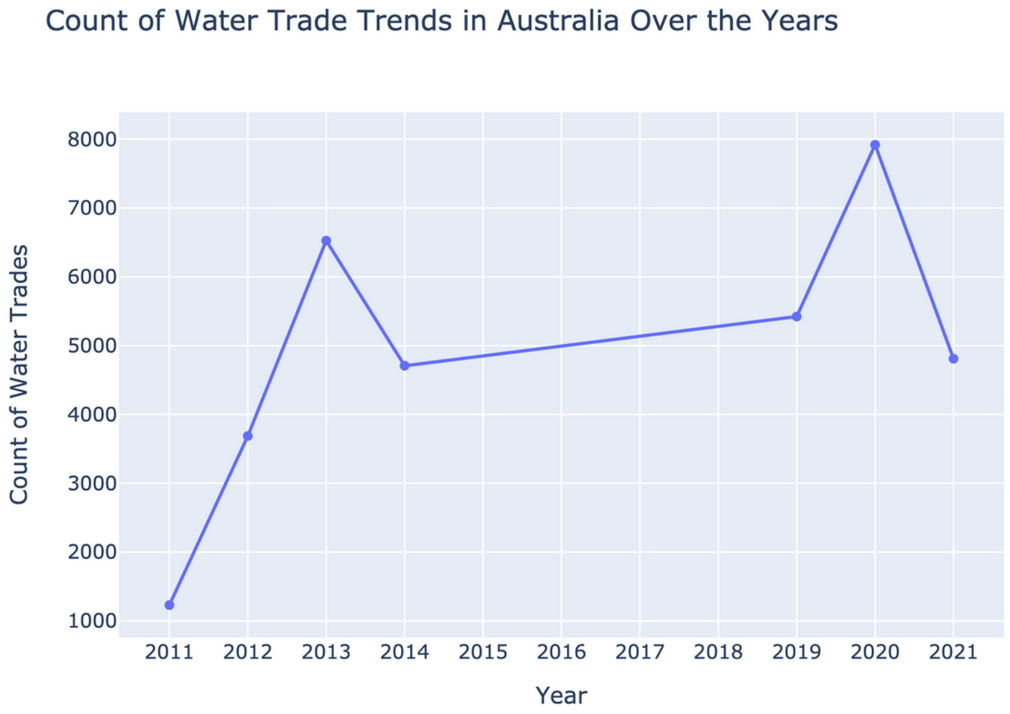
NSW, Victoria, and Queensland are the states that consumed the most water annually from 2018-2020.

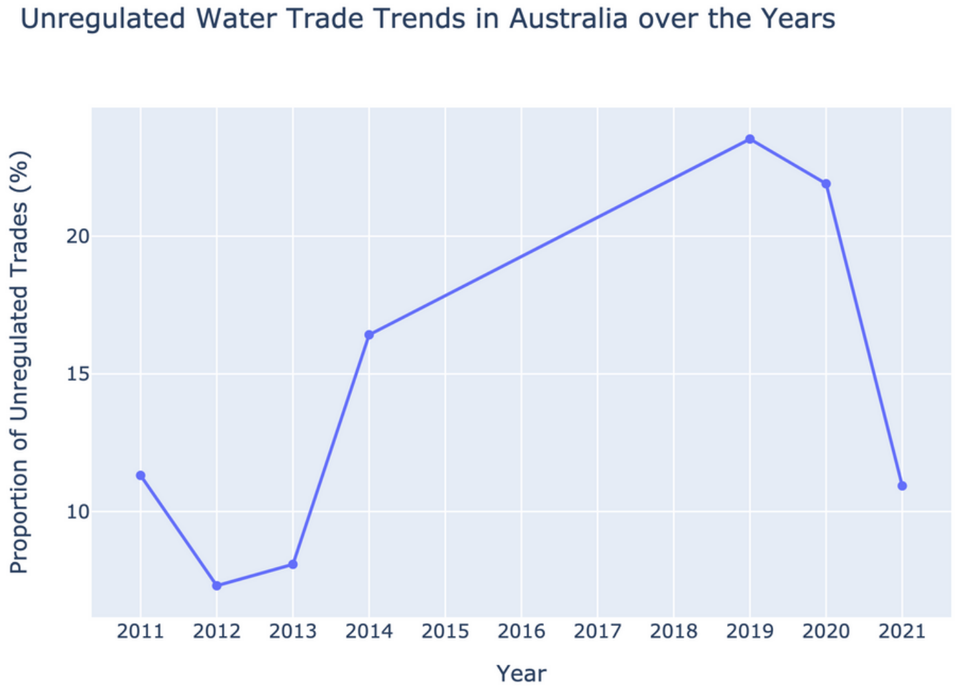
SOCIETAL AND GOVERNMENTAL - UNREGULATED WATER TRADES

Proportion of Regulated vs Unregulated Water Trades in Australia (2011 - 2021)

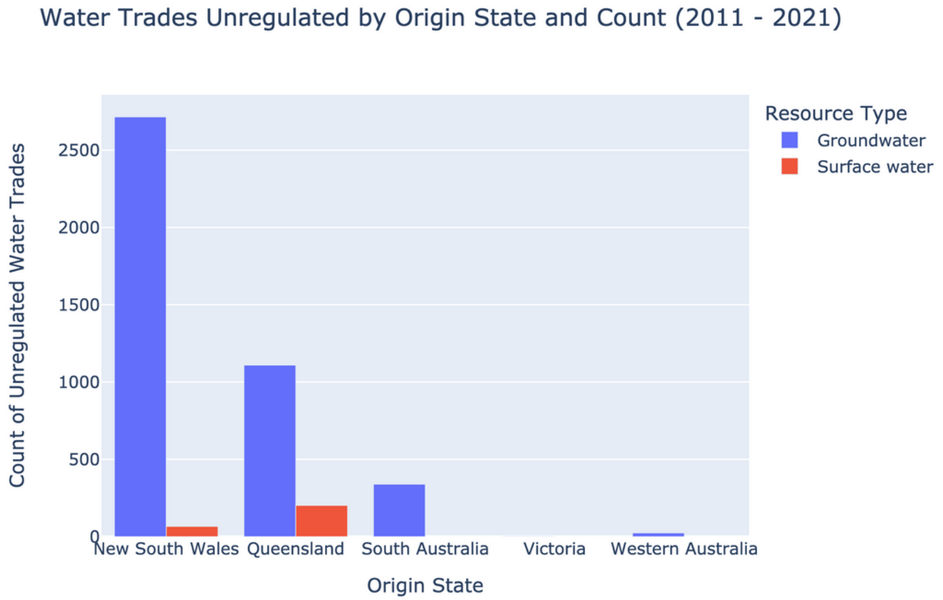


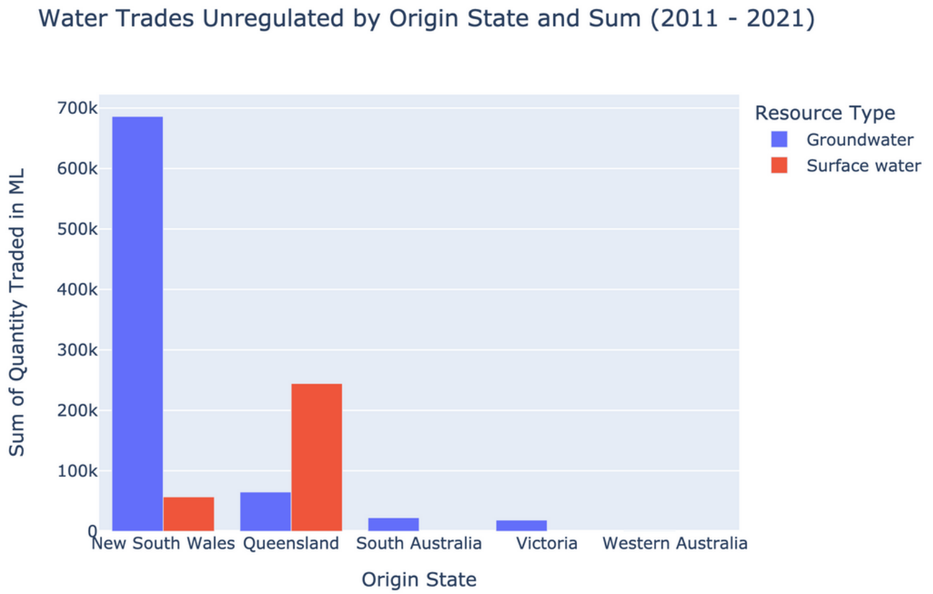
Total: 34303 Water Trades

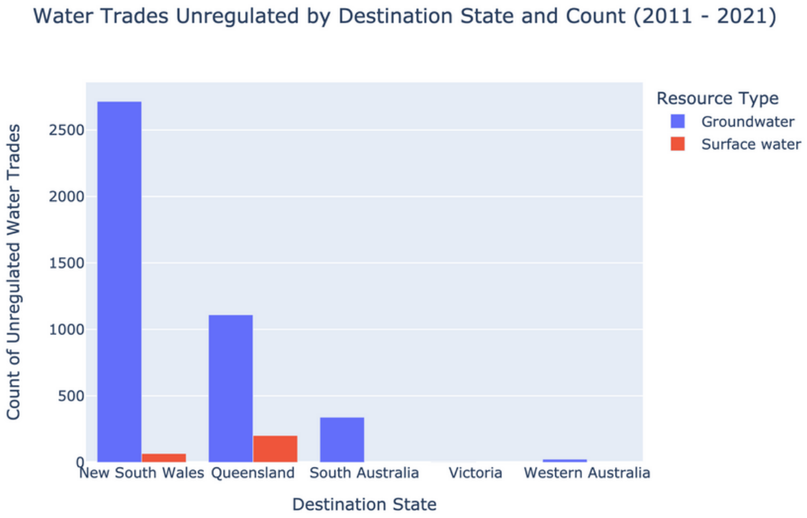


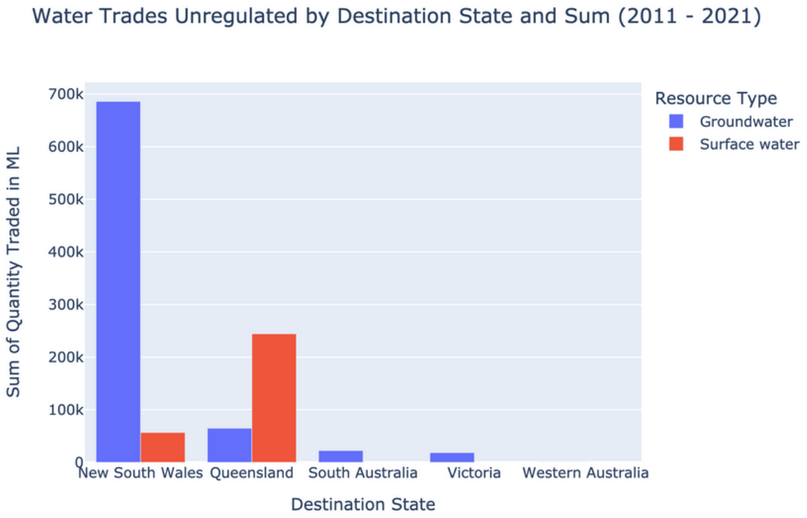


Increasing overall trend for count of water trades and proportion of unregulated trades over the years.









Large-volume of trades occur in Queensland for surface water.

Solution (Recommendations to the Department of Agriculture, Fisheries and Forestry)

Problem 1 – Water Shortage & Overuse of Water

- Implement Efficient Irrigation Systems (e.g. drip irrigation to reduce water waste).
- Incentivize Sustainable Practices for farmers who incorporate sustainable water-efficient practices.
- Community Engagement: Engage with local communities to save water.
- Monitor water usage through sensors to detect over-extraction in real-time .

Problem 2 – Unregulated Water Trades

- A centralized digital platform that records all water trades, ensuring transparency of the transaction and easy access to data.
- Community and Stakeholder engagement, including small farmers, to ensure their concerns are addressed in the water trade policies.
- Implement volume limit on trading to prevent monopolization.

References

Bureau of Meteorology (2019) Recent rainfall, drought and southern Australia's long-term rainfall decline. Available at: http://www.bom.gov.au/climate/updates/articles/a010-southern-rainfall-decline.shtml (Accessed: 22 October 2023).

Walsh, J., Westwood, T. and Gupta, M. (2023) Murray-Darling Basin Water Market Catchment Dataset 2021, Murray-Darling Basin water market catchment dataset 2021 - DAFF. Available at: https://www.agriculture.gov.au/abares/research-topics/water/mdb-water-market-dataset (Accessed: 22 October 2023).