Climate Change: why farmers need to plan now – with an emphasis on data and information in the MDB

Australian Grape & Wine Industry Briefing

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Outline

- Overview of pain points, challenges and context
- Involves – integrity, standards and quality of analysis being produced
- Illustration of above, based on selected examples – without prejudice. Only tip of iceberg - there are many others. i.e. examples shown are only to provide context
- Big issues going forward - climate change, need to improve literacy and need for point of truth data on water and land use

Challenges

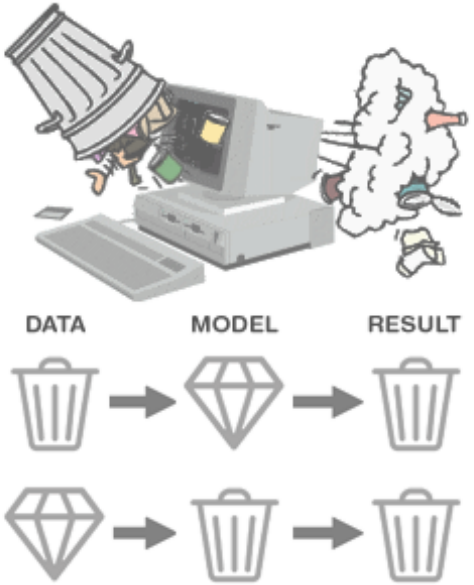
- Frame conditions changing rapidly - 'Business-as-usual' investments and practices in agriculture unlikely to deliver sustainable solutions
- Number of pain points
  - Water security
  - Rising prices for inputs including electricity
  - More hot days
  - Risk management
  - Data integrity
- Big challenge –
  - Address causes in order to be successful and contribute on a sustainable basis
  - How to be in control of your own future
  - Structural re-adjustment – is happening and has been happening for a long time. Expect BIG changes in future. ⇨ Need support to ensure changes are strategic and proactive, rather than reactionary

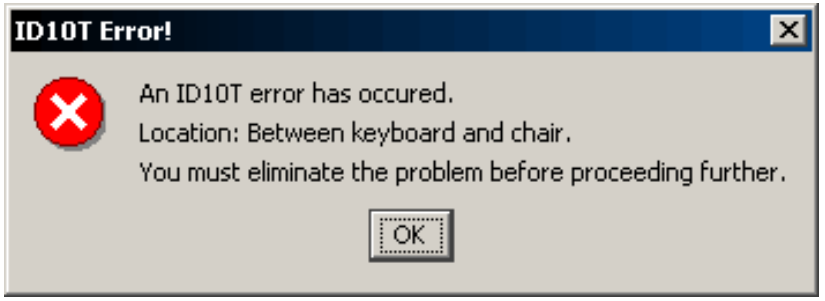
Concern

- Assessment of numerous reports related to agriculture and water reveals potential lack of integrity, context standards (?) and depth of analysis
- Raises a number of questions
  - Context – has the full story or sufficient context been presented
- In past, not enough emphasise is being placed on providing user friendly tools to help land managers make informed decisions and appreciate/integrate risk management
- Data issues are key

Concern

"Data don't make any sense,
we will have to resort to statistics."





Data integrity issues

- Since 2007-08 there have been in excess of $40 bil in Entitlement Trades in Aust.
- Out of the $40 bil total $20 bil occurred in one year and it wasn't in the MDB!

$20 Billion in 2009-10 for entitlement trades?

Drainage division	(All)		
Region	(All)		
Select Resource Type	(All)		
	Values		
YearCalculated	Sum of Net Price	Count of Trades	Ave per trade
2007-08	$ 361,079,718	3,829	$ 94,301.31
2008-09	$ 1,138,350,967	5,578	$ 204,078.70
2009-10	$ 20,601,494,170	7,296	$ 2,823,669.71
2010-11	$ 845,811,093	6,386	$ 132,447.71
2011-12	$ 946,264,707	6,803	$ 139,095.21
2012-13	$ 1,084,974,362	6,603	$ 164,315.37
2013-14	$ 1,048,602,196	6,710	$ 156,274.54
2014-15	$ 2,330,867,309	8,918	$ 261,366.60
2015-16	$ 1,736,321,789	9,432	$ 184,088.40
2016-17	$ 1,543,141,363	9,752	$ 158,238.45
2017-18	$ 1,612,358,570	10,367	$ 155,527.98
2018-19	$ 1,458,080,160	11,396	$ 127,946.66
2019-20	$ 5,403,943,485	9,596	$ 563,145.42
2020-21	$ 51,029,046	503	$ 101,449.40
Grand Total	**$ 40,162,318,933.99**	**103169**	$ 389,286.69
Average	$ 2,868,737,067	7369	$ 376,139

- So 50% of total entitlement trades since 2007-08 occurred in 2009-10 at ave per entitlement of $2.82 mil per trade?
- May suggest integrity issue in dB?
- Note: full 2020-21 data not included in this analysis

Where is the issue?

Entitlement trades - Western Australia
Source: BoM Water Information Dashboard
Accessed 3 March 2021

	dest_state	Values			
	Western Australia				
EOFY	net_price $	No of trades	Ave $ per trade	Year as % of Total trades
2008	289,150.00	14	20,653.57	0.00%
2009	17,037,381.00	108	157,753.53	0.09%
2010	18,573,311,540.00	148	125,495,348.24	99.80%
2011	2,230,188.00	120	18,584.90	0.01%
2012	1,102,914.00	114	9,674.68	0.01%
2013	990,192.00	138	7,175.30	0.01%
2014	432,576.00	190	2,276.72	0.00%
2015	2,408,135.00	162	14,865.03	0.01%
2016	440,891.00	171	2,578.31	0.00%
2017	1,752,804.00	148	11,843.27	0.01%
2018	1,368,110.00	220	6,218.68	0.01%
2019	6,708,209.00	261	25,701.95	0.04%
2020	2,195,365.00	305	7,197.92	0.01%
Grand Total	**18,610,267,455.00**	**2,099**	**8,866,254.15**	**100.00%**

Where is the issue?

- WA accounted for $18.6 Bil in 2009-10

Entitlement trades - Western Australia
Source: BoM Water Information Dashboard
Accessed 3 March 2021

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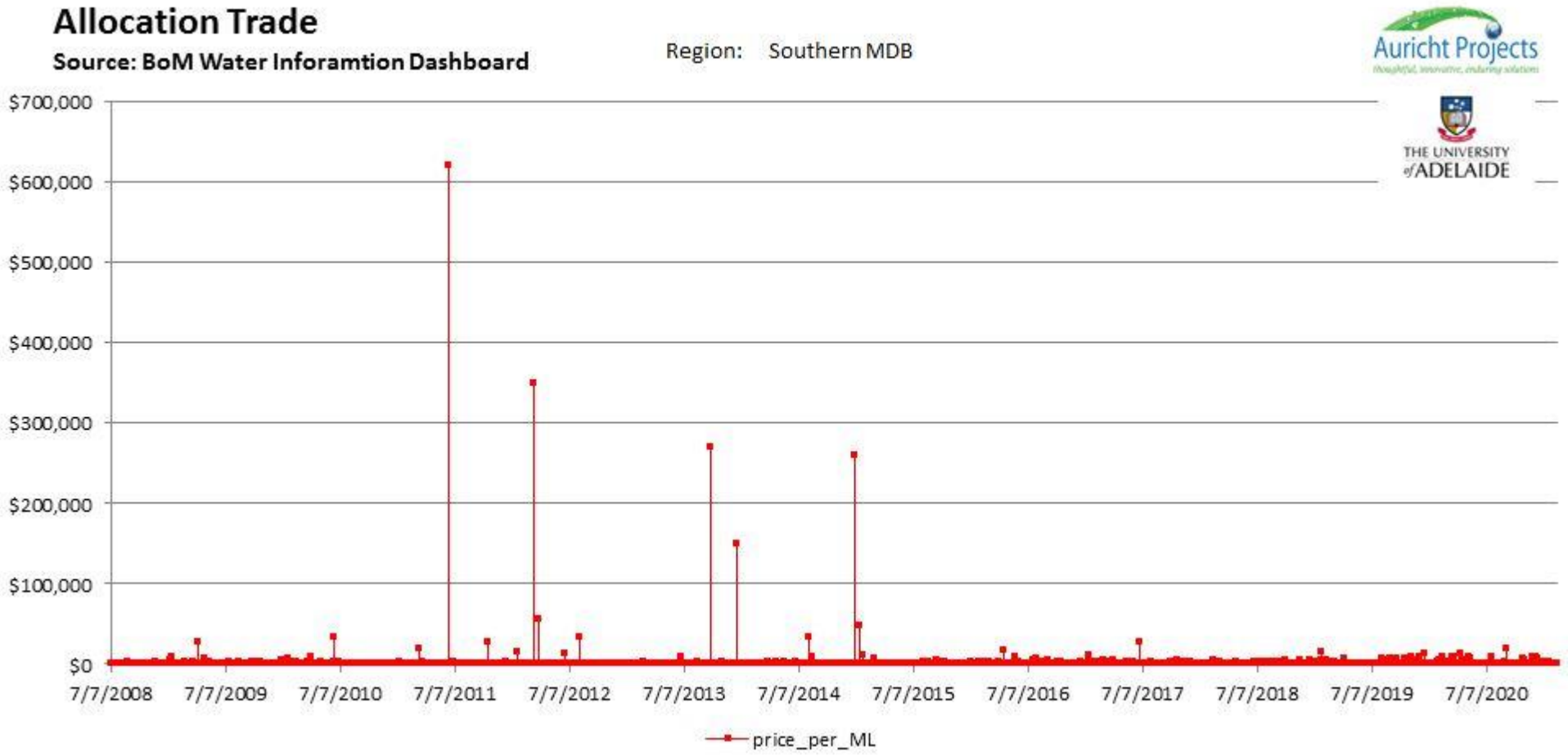
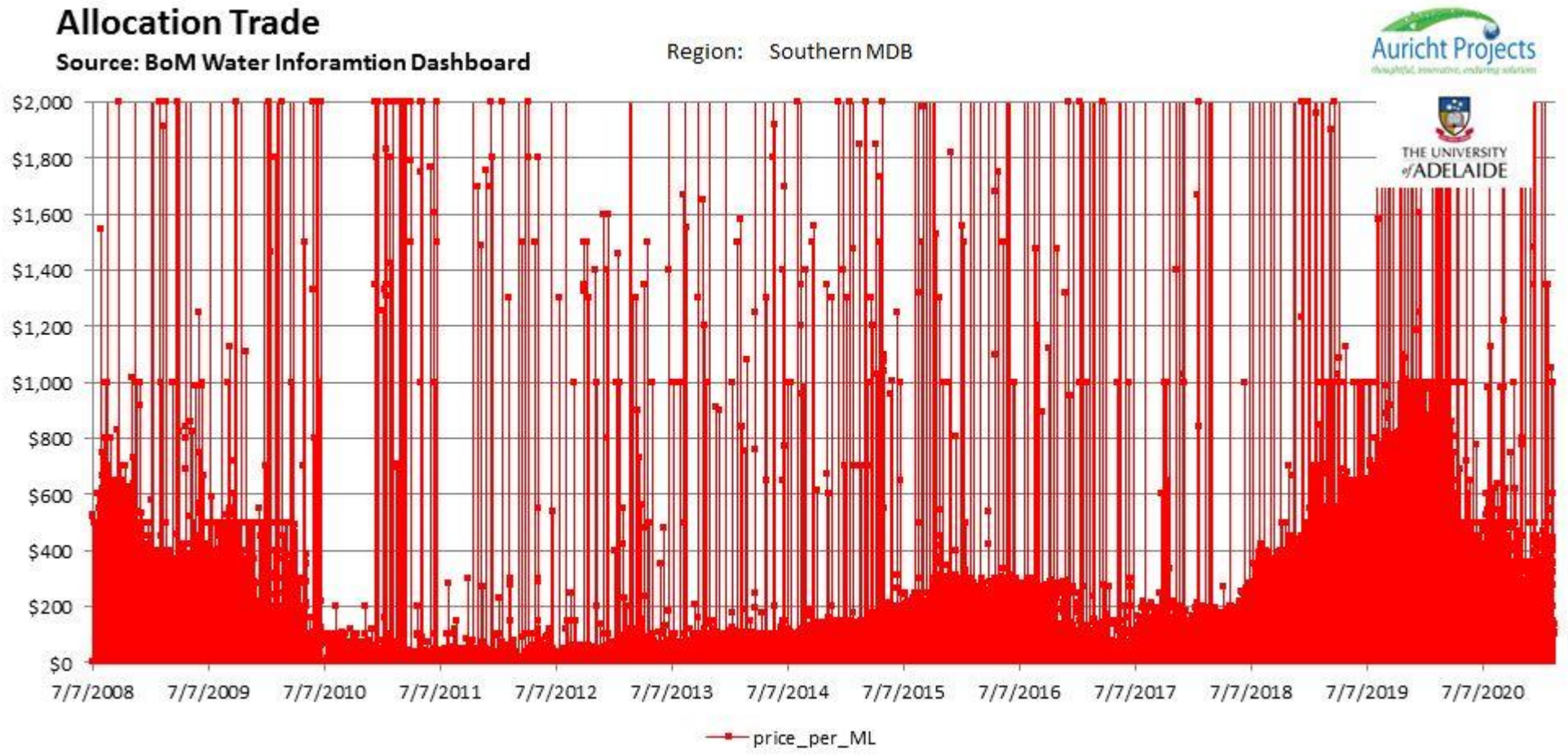
BoM Allocation Trade dB

- Also issues
- Lot's of outliers and $0 trades

BoM Allocation Trade dB



BoM Allocation Trade dB



Daily trade $/ML & 30 day rolling ave and median $/ML
Commercial trades >=$5 and <=$2k / ML

Excludes water for fodder

Internal: Not for distribution

Source: BoM 2020

Region:

Southern MDB

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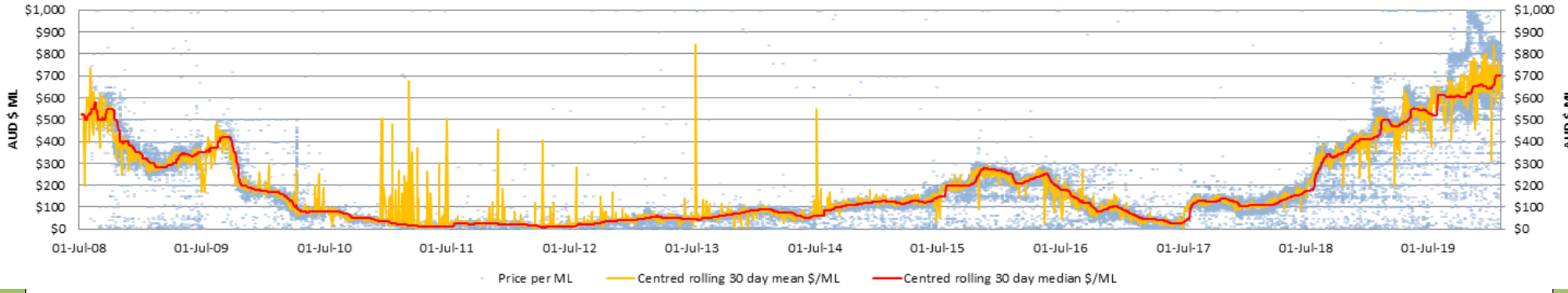
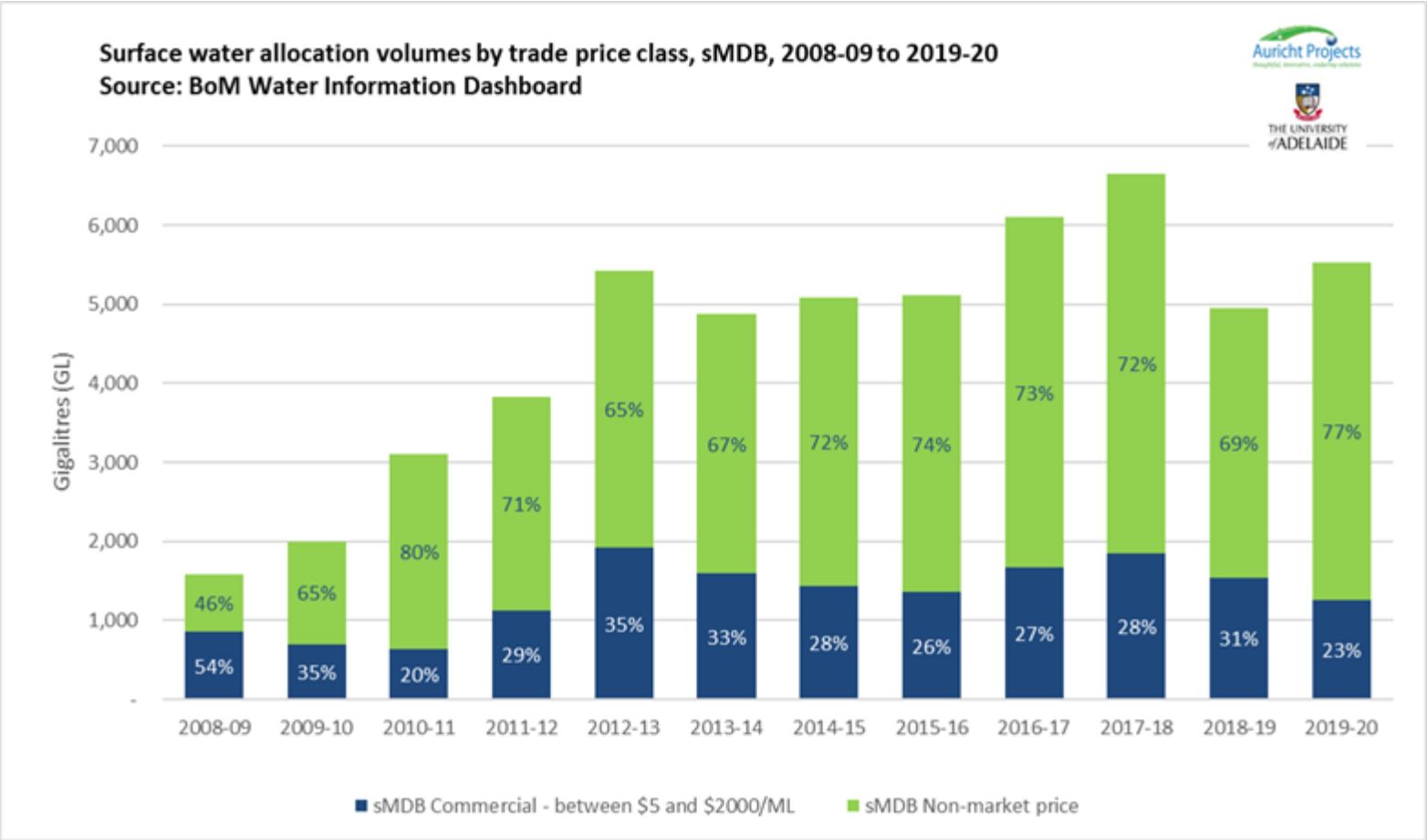
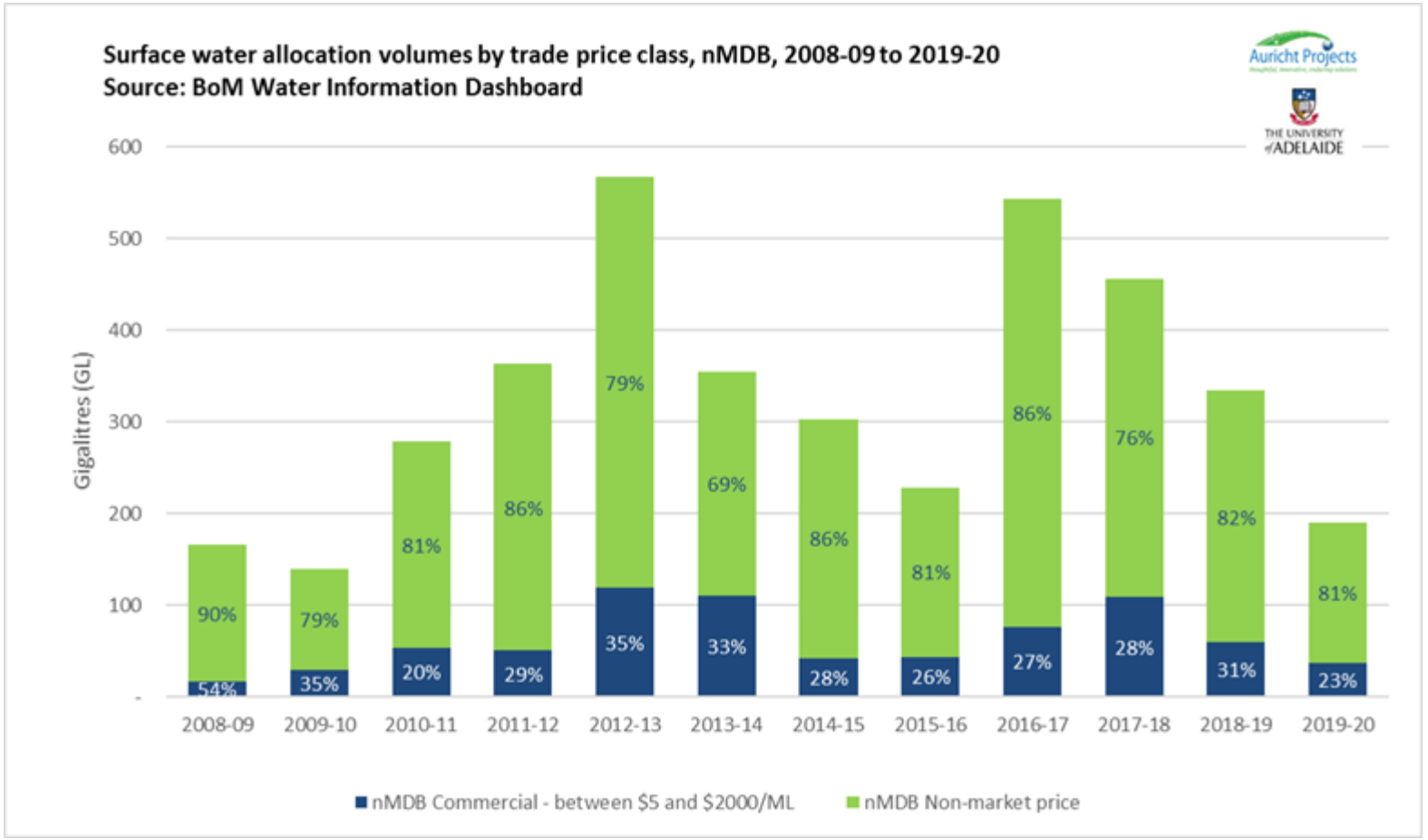


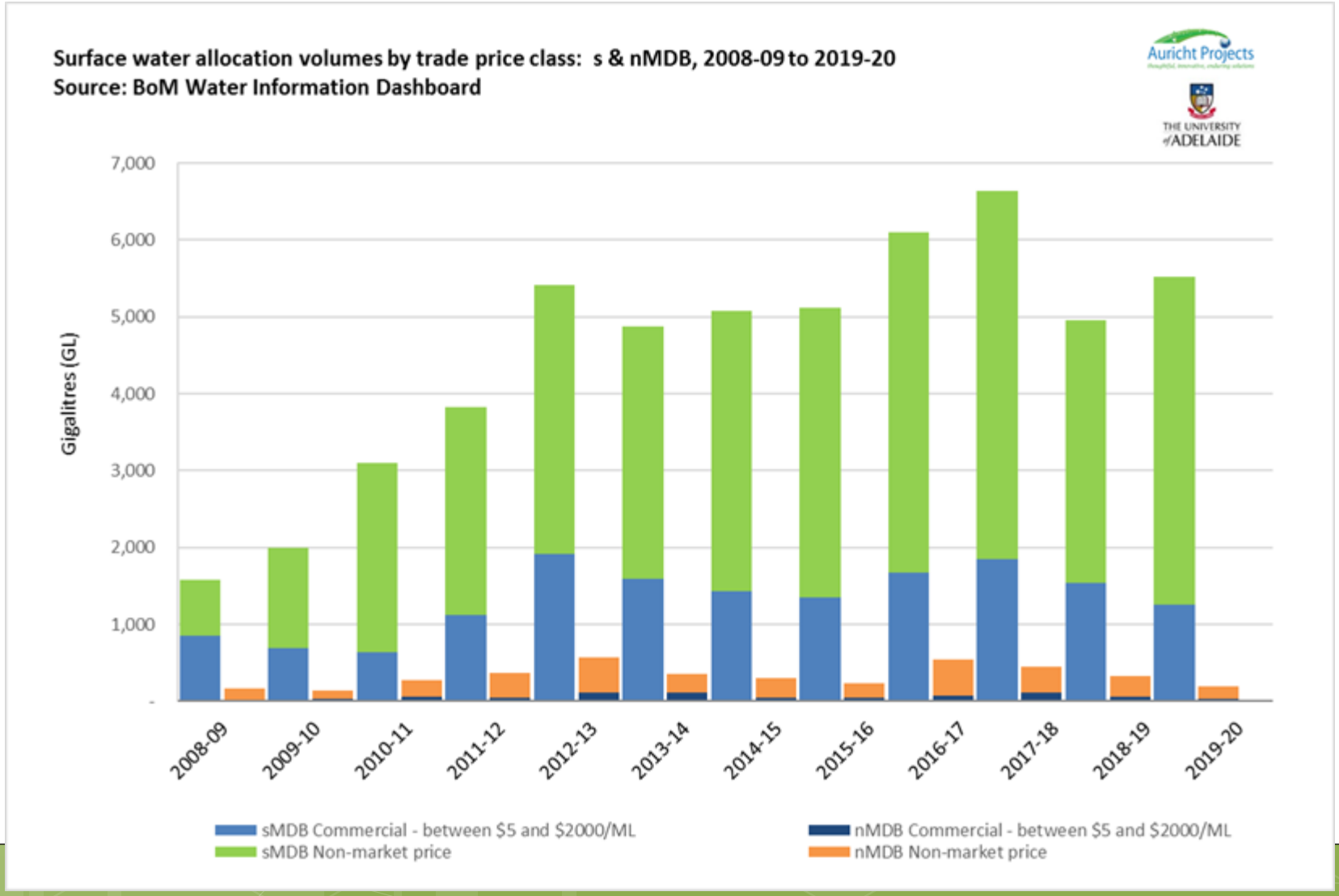
Commercial v's non-commercial sMDB



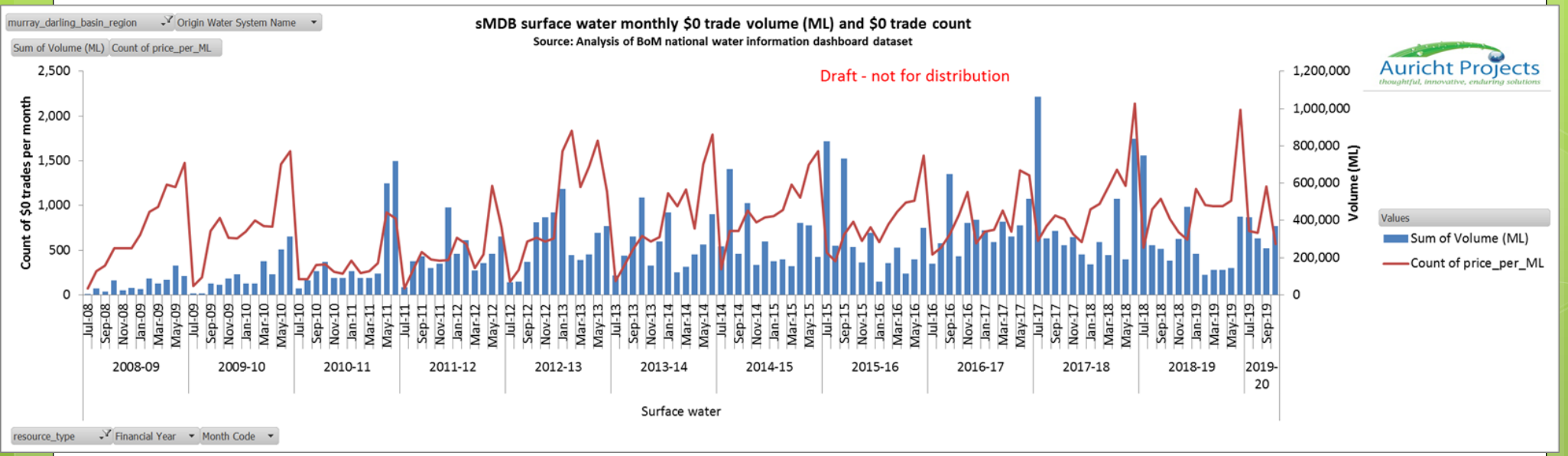
Commercial v's non-commercial nMDB



Commercial v's non-commercial MDB



$0 trades



http://www.auricht.com/data/mdb/$0_Trade_animation_Feb_09_Feb_19_mixed_1.gif

Comment

- Above issues in water trade have led some to question whether it is really a market!

Integrity

- If you're working in agriculture and using public domain water trade datasets you need to be careful and the understand context and potential impact of outliers
- As such if working with water trade data there is a need to establish a number of business rules in order to clean data and stratify into a commercial dB to analysis

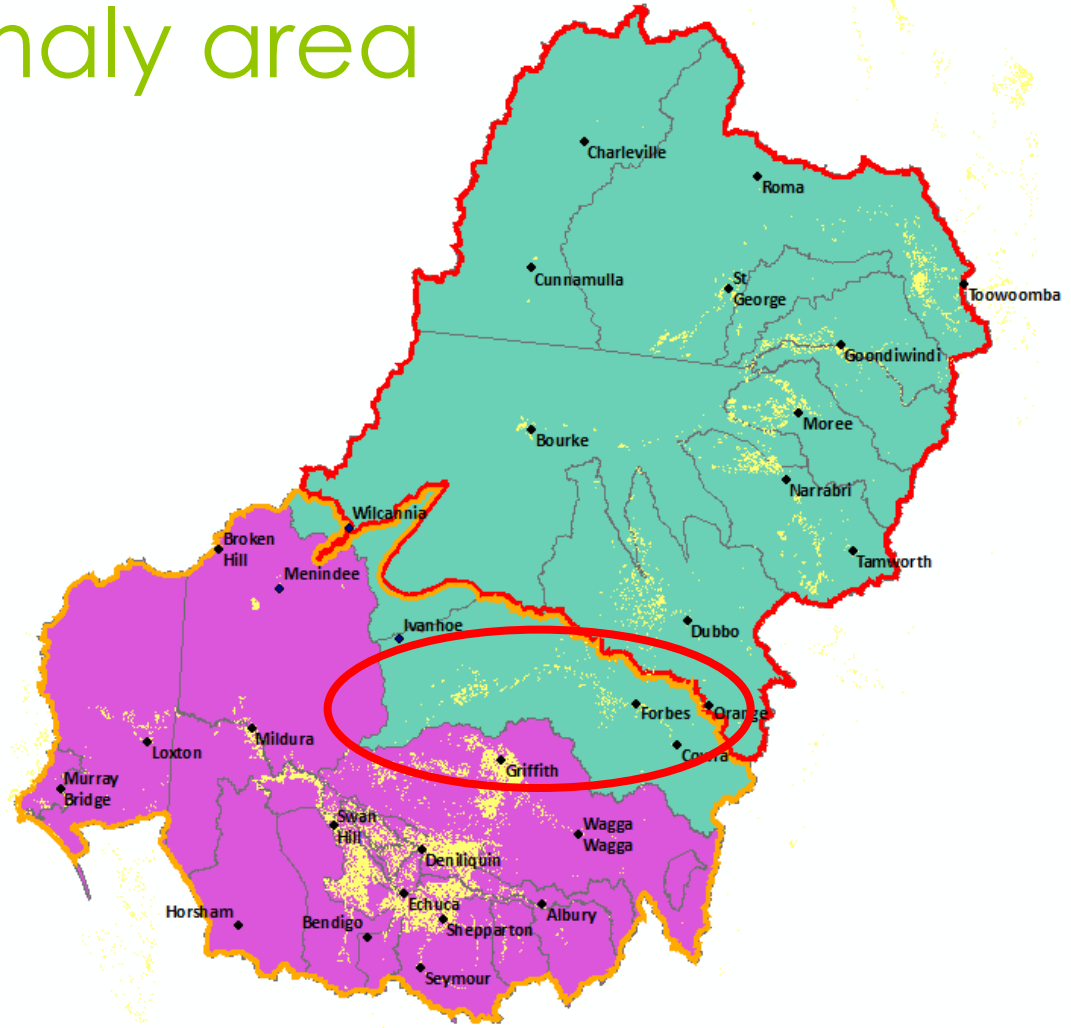
Example of other standards not being consistent

Spatial footprint – north/south issues

- MDBA and BoM

- ABARES (Sus Yields, CSIRO)

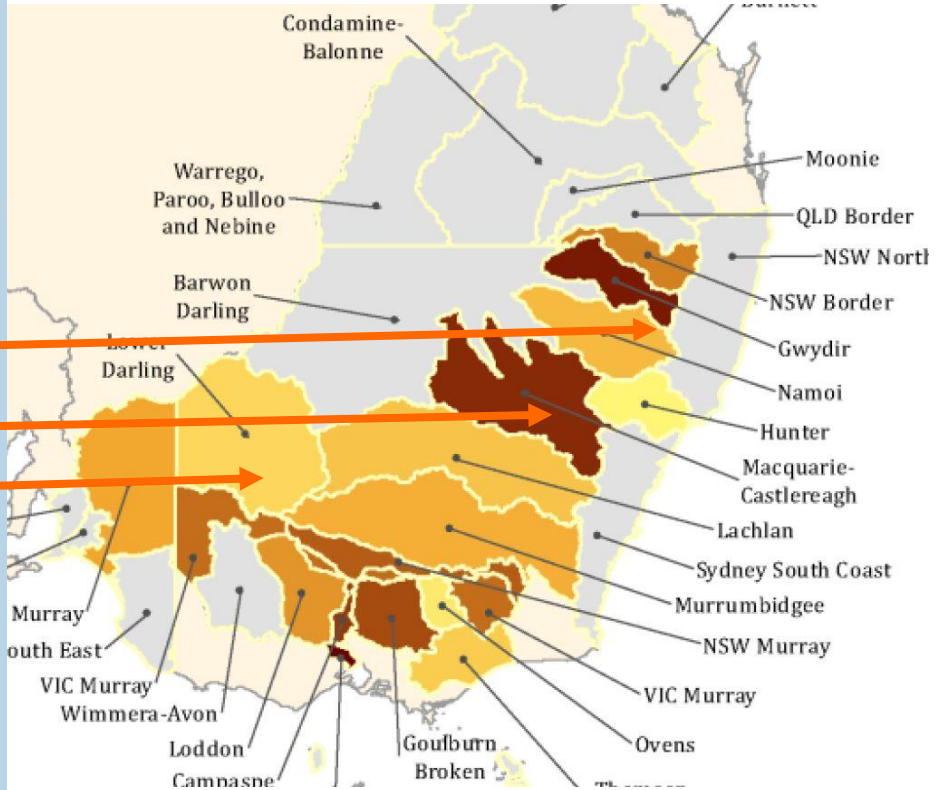
Major irrigation activity occurs in anomaly area



- Has potential to impact on analysis

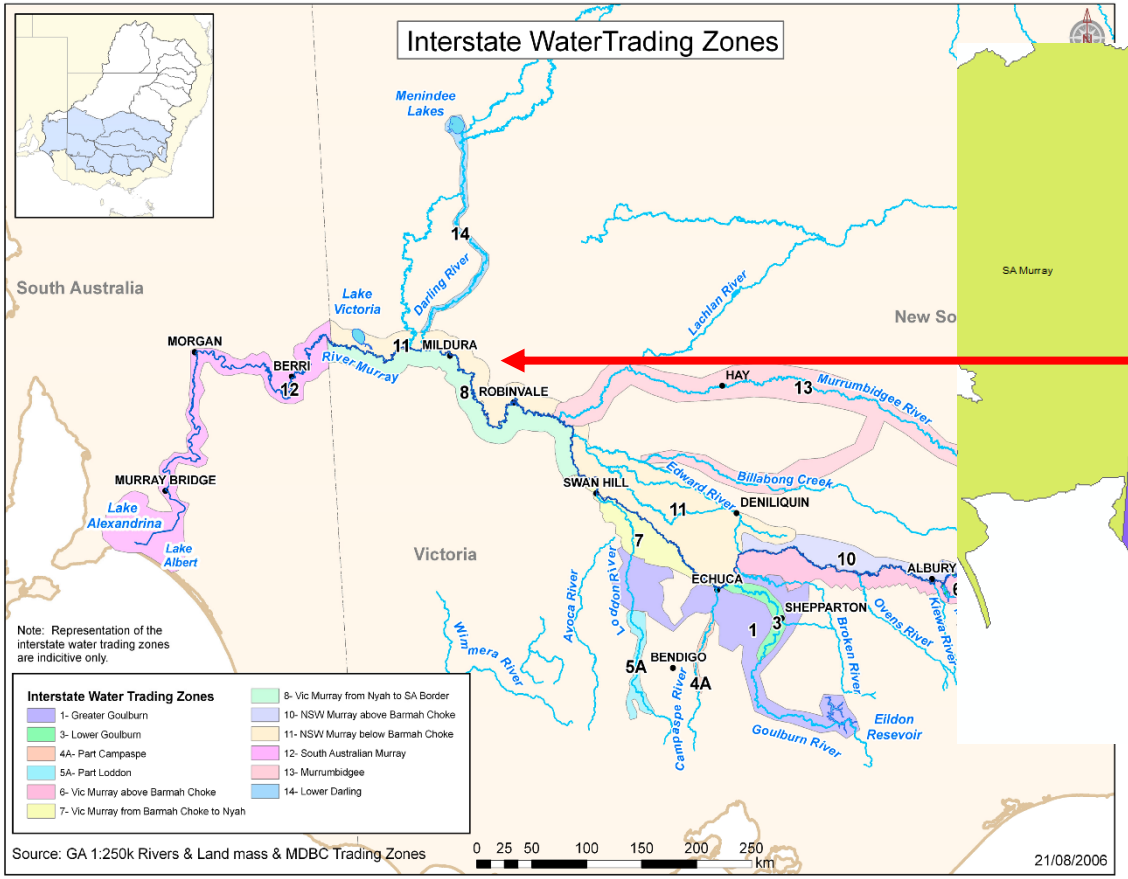
Same issue with water systems

Same issue with water systems



Same names but different boundaries

Trade zones – issue Lower Darling and NSW Below



- Has potential to impact on analysis / statistics

Consequences

- Potential major ramifications – it is understood that:
  - Social and economic assessment and ACCC report extensively used ABARES boundaries in their supply and demand analysis
  - BoM, MDBA and States use a different zonation when reporting trade information that doesn't appear consistent with ABARES boundaries?
  - This may have implications for ABARES assessment when dealing with issues in Lower Darling and NSW Murray Below etc
  - Rigour and consistency between data reported in different reports and other dBs

Risk Management and strategic planning

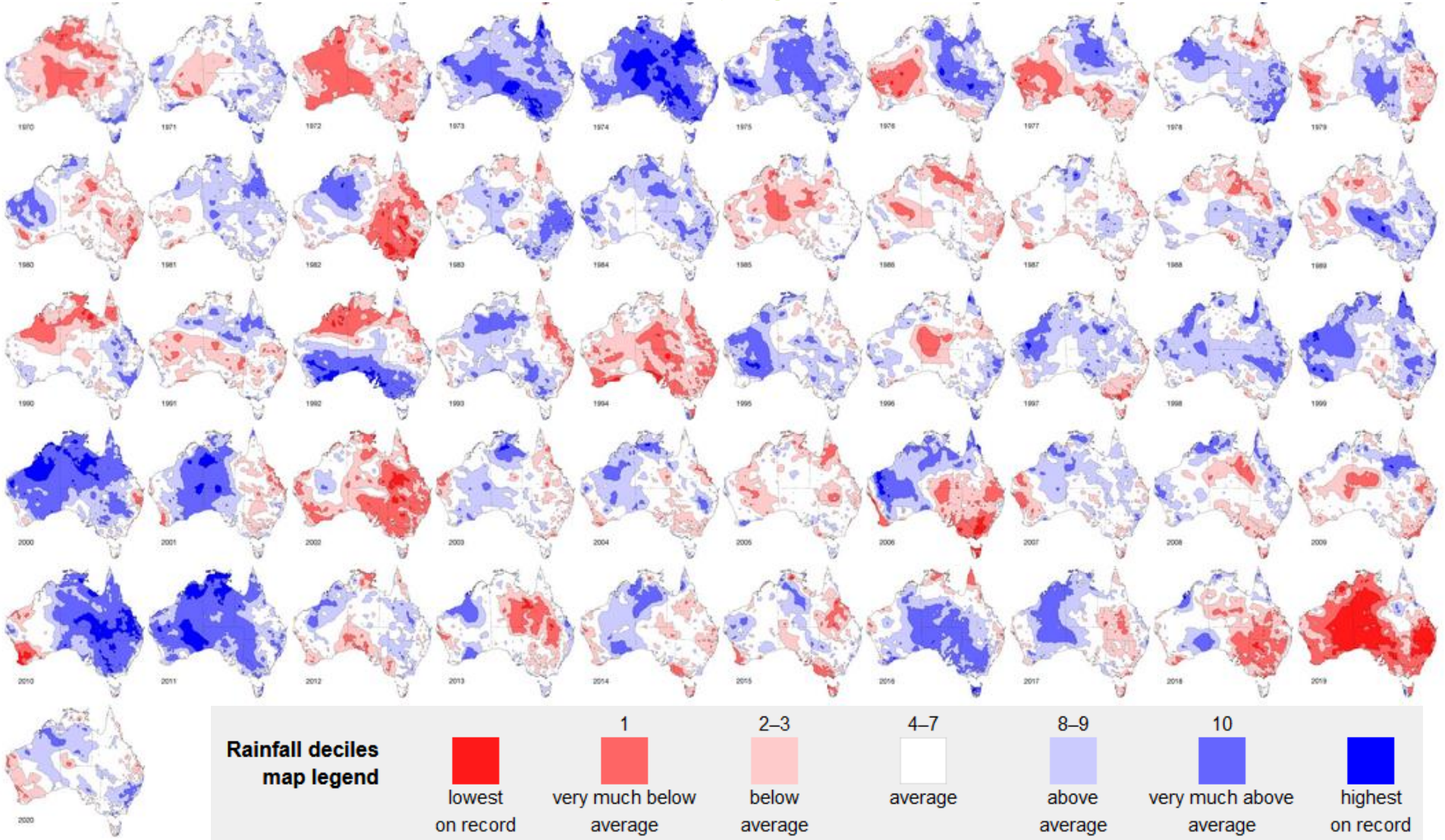
- Will be a big issue going forward – largely due to climate
- Research reveals
  - more hot days
  - Changing spatial and temporal rainfall – but not necessarily less rainfall in all areas
  - Decreasing runoff
  - Reduced inflows
  - Changing land use pattern – demand both temporarily and spatially with possible delivery risk and supply shortfalls in MDB

Rainfall and temperature

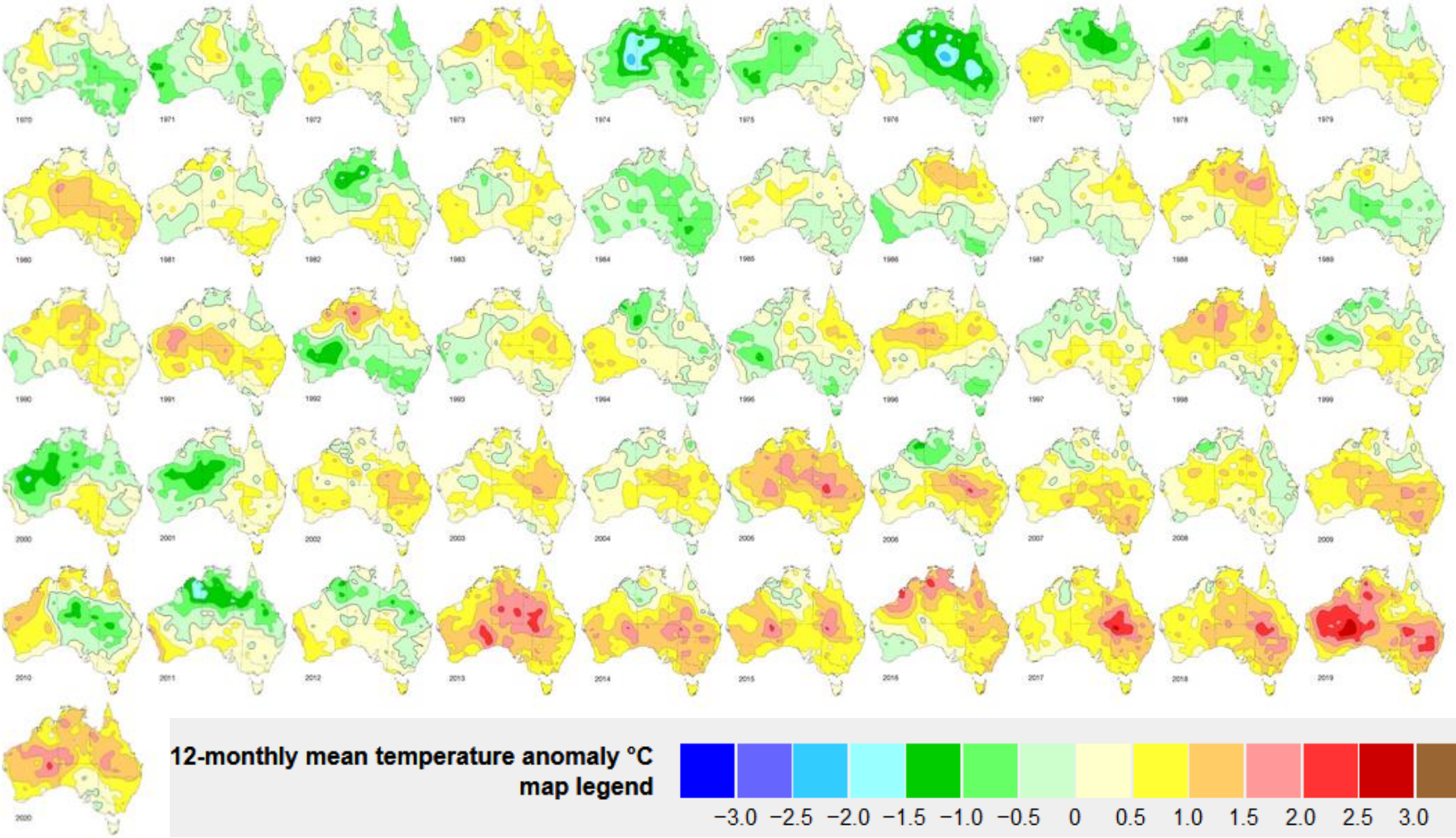
- Long-term trend does not reflect the conditions that have occurred over the last 30 years

- See also these links for:
  - Rainfall http://www.bom.gov.au/climate/history/rainfall/
  - Temperature http://www.bom.gov.au/climate/history/temperature/

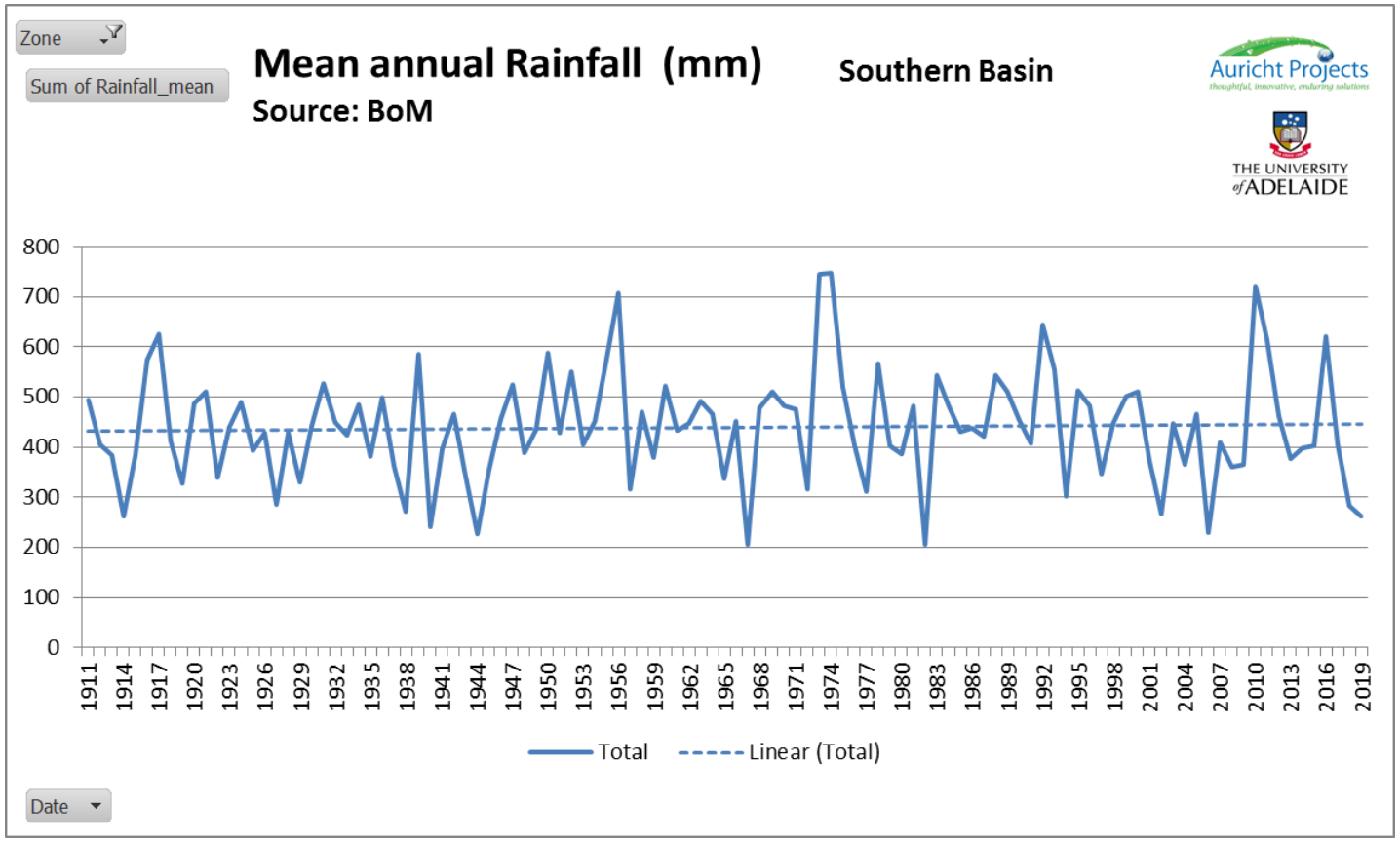
Rainfall since 1970



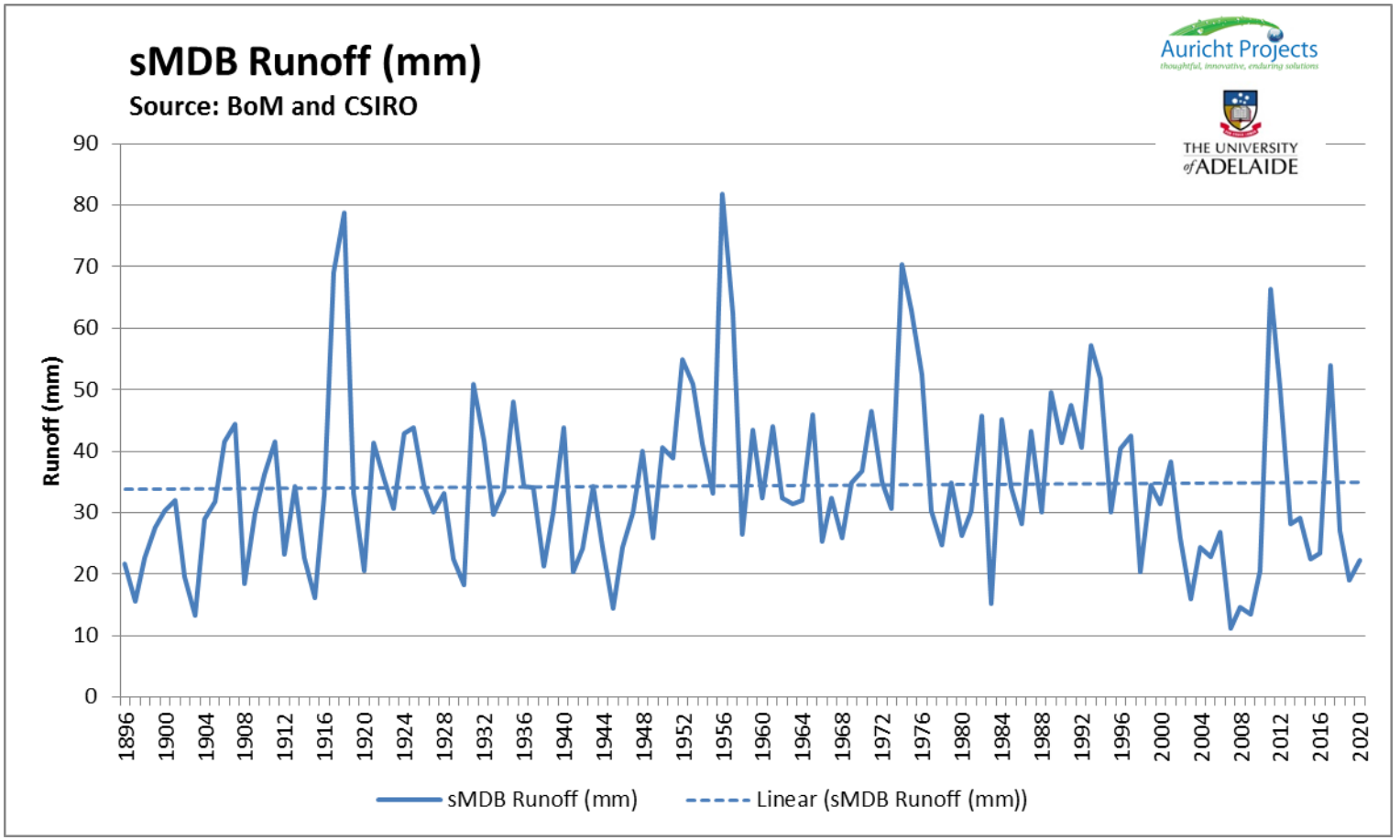
Temperature since 1970



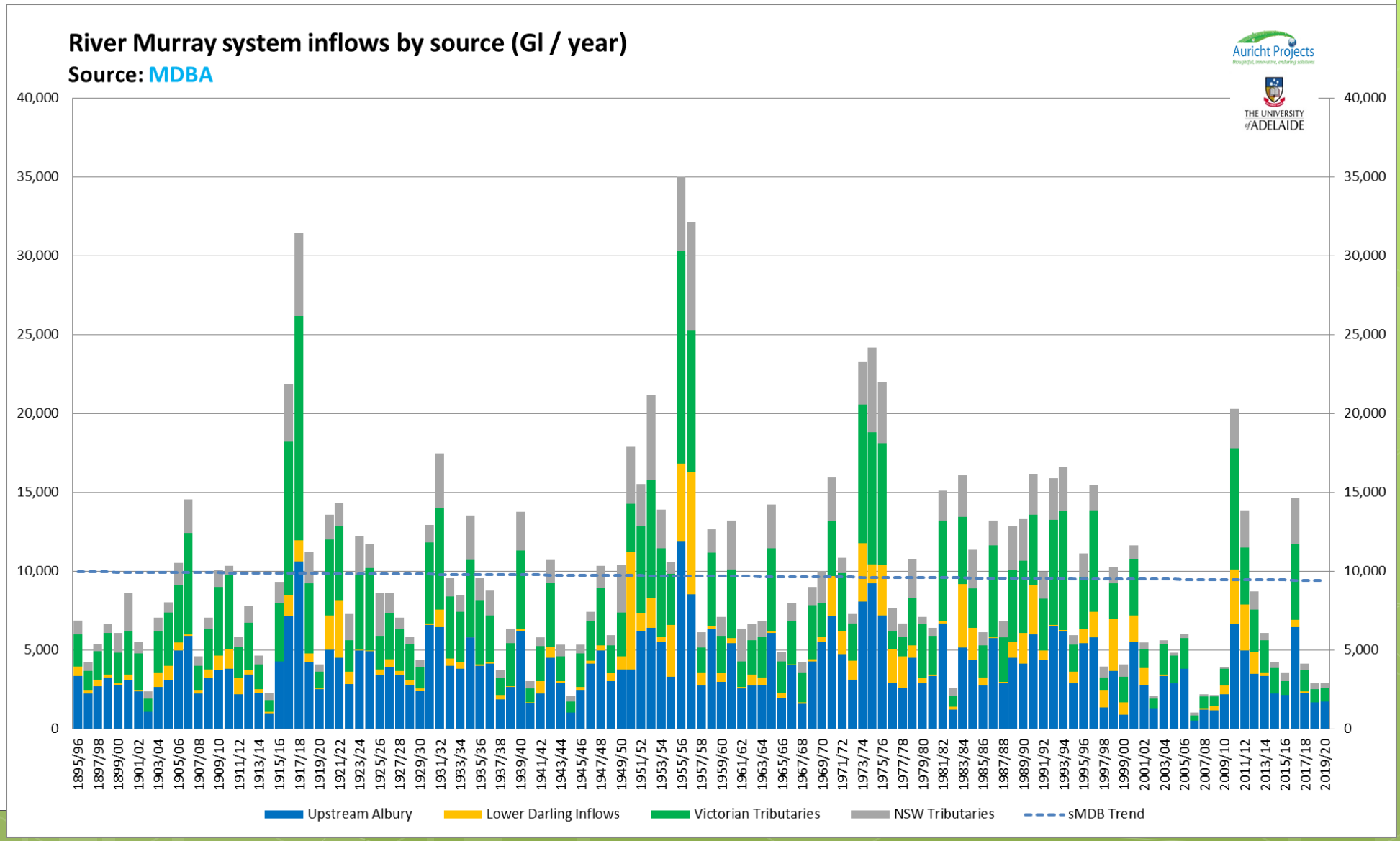
sMDB Long-term rainfall



sMDB Long-term run-off



Inflows


River Murray system inflows by source (Gl / year)
Source: MDBA
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40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
1895/96
1897/98
1899/00
1901/02
1903/04
1905/06
1907/08
1909/10
1911/12
1913/14
1915/16
1917/18
1919/20
1921/22
1923/24
1925/26
1927/28
1929/30
1931/32
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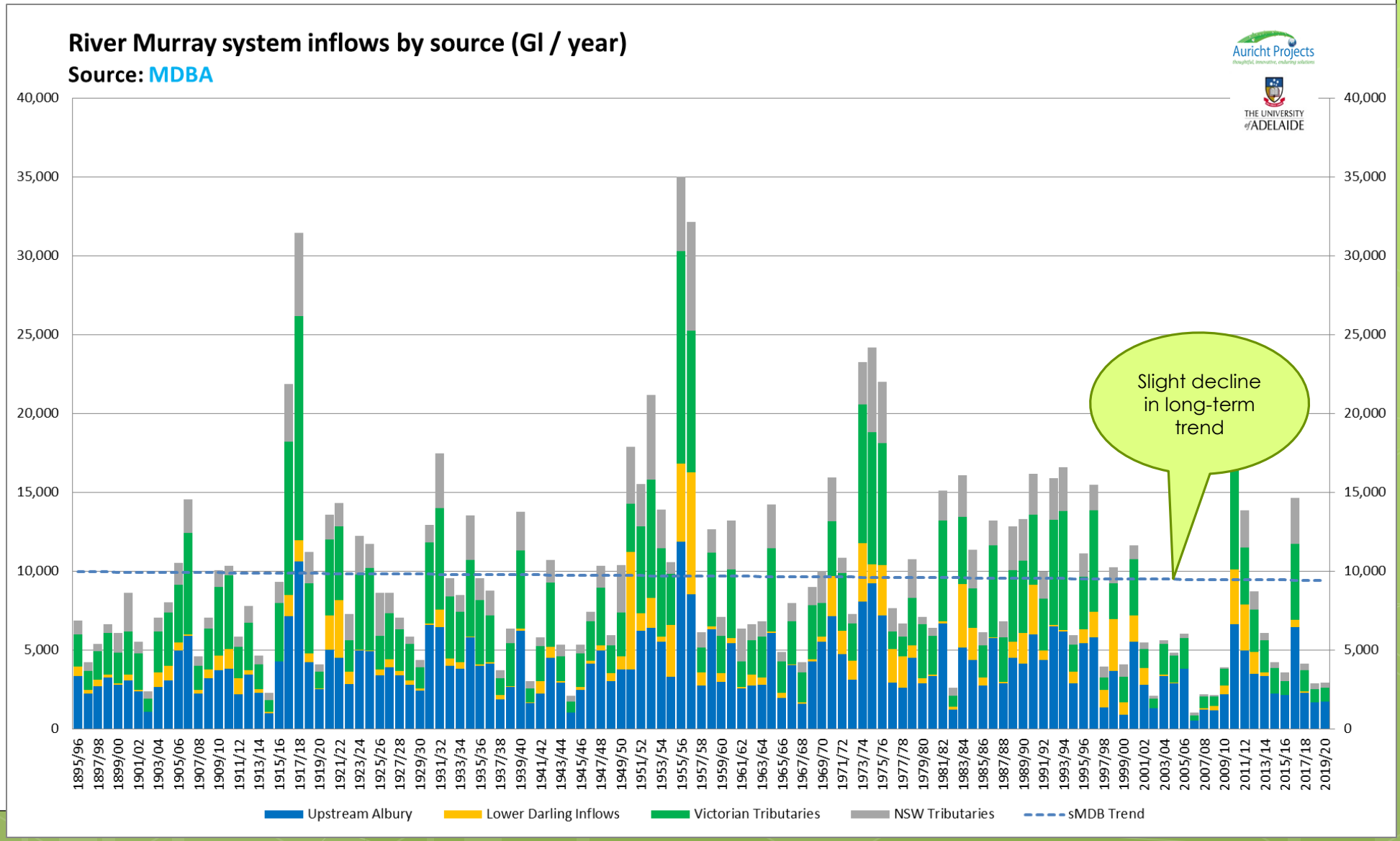
2003/04
2005/06
2007/08
2009/10
2011/12
2013/14
2015/16
2017/18
2019/20
Upstream Albury
Lower Darling Inflows
Victorian Tributaries
NSW Tributaries
sMDB Trend

Inflows


River Murray system inflows by source (Gl / year)
Source: MDBA
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Slight decline in long-term trend
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
1895/96
1897/98
1899/00
1901/02
1903/04
1905/06
1907/08
1909/10
1911/12
1913/14
1915/16
1917/18
1919/20
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2009/10
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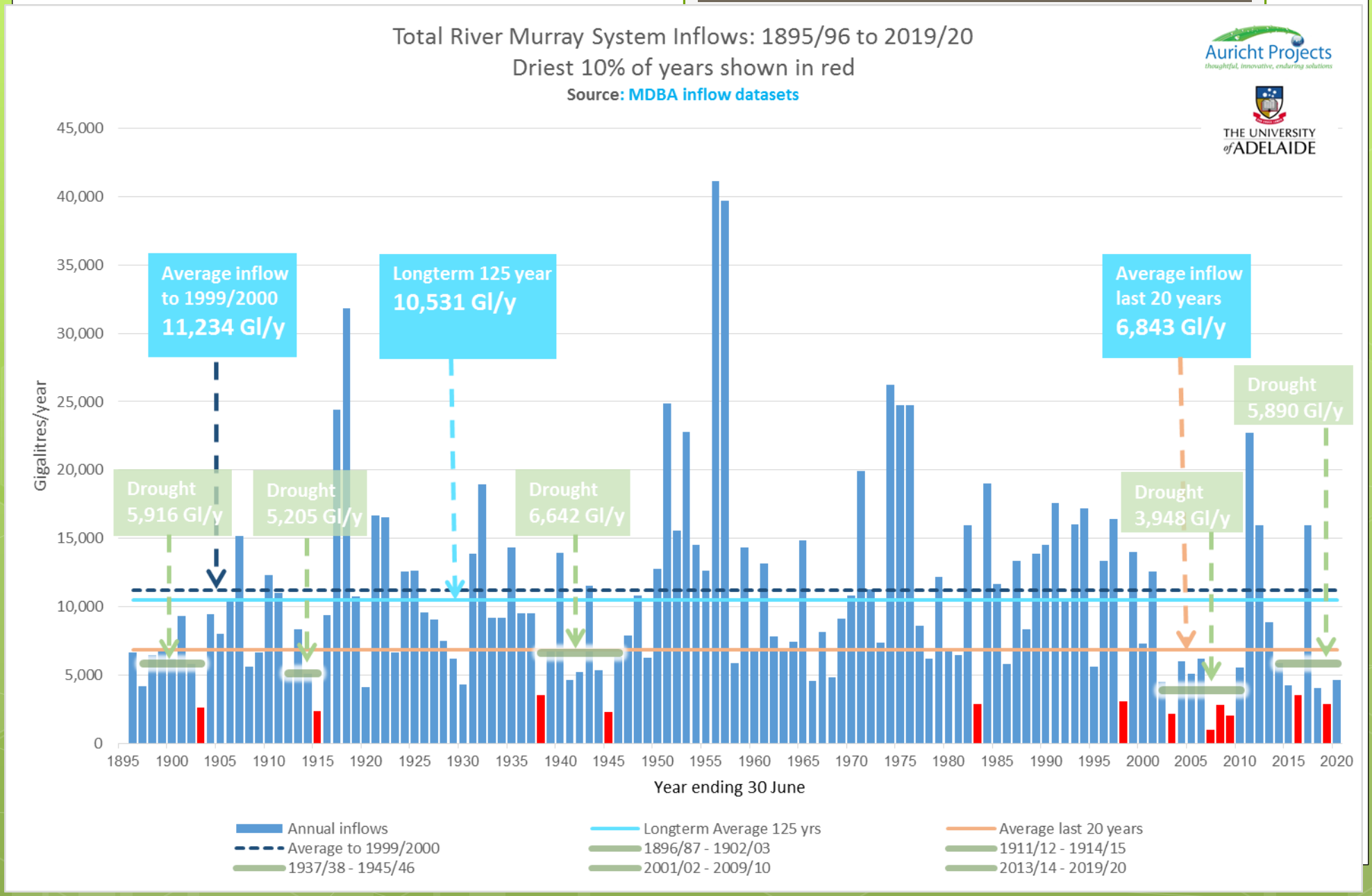
2013/14
2015/16
2017/18
2019/20
Upstream Albury
Lower Darling Inflows
Victorian Tributaries
NSW Tributaries
sMDB Trend

Inflows and dry periods

- Note averages in following are based on mean


Total River Murray System Inflows: 1895/96 to 2019/20
Driest 10% of years shown in red
Source: MDBA inflow datasets
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Average inflow to 1999/2000 11,234 Gl/y
Longterm 125 year 10,531 Gl/y
Average inflow last 20 years 6,843 Gl/y
Drought 5,916 Gl/y
Drought 5,205 Gl/y
Drought 6,642 Gl/y
Drought 3,948 Gl/y
Drought 5,890 Gl/y
Gigalitres/year
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
1895 1900 1905 1910 1915 1920 1925 1930 1935 1940 1945 1950 1955 1960 1965 1970 1975 1980 1985 1990 1995 2000 2005 2010 2015 2020
Year ending 30 June
Annual inflows
Longterm Average 125 yrs
Average last 20 years
Average to 1999/2000
1896/87 - 1902/03
1911/12 - 1914/15
1937/38 - 1945/46
2001/02 - 2009/10
2013/14 - 2019/20

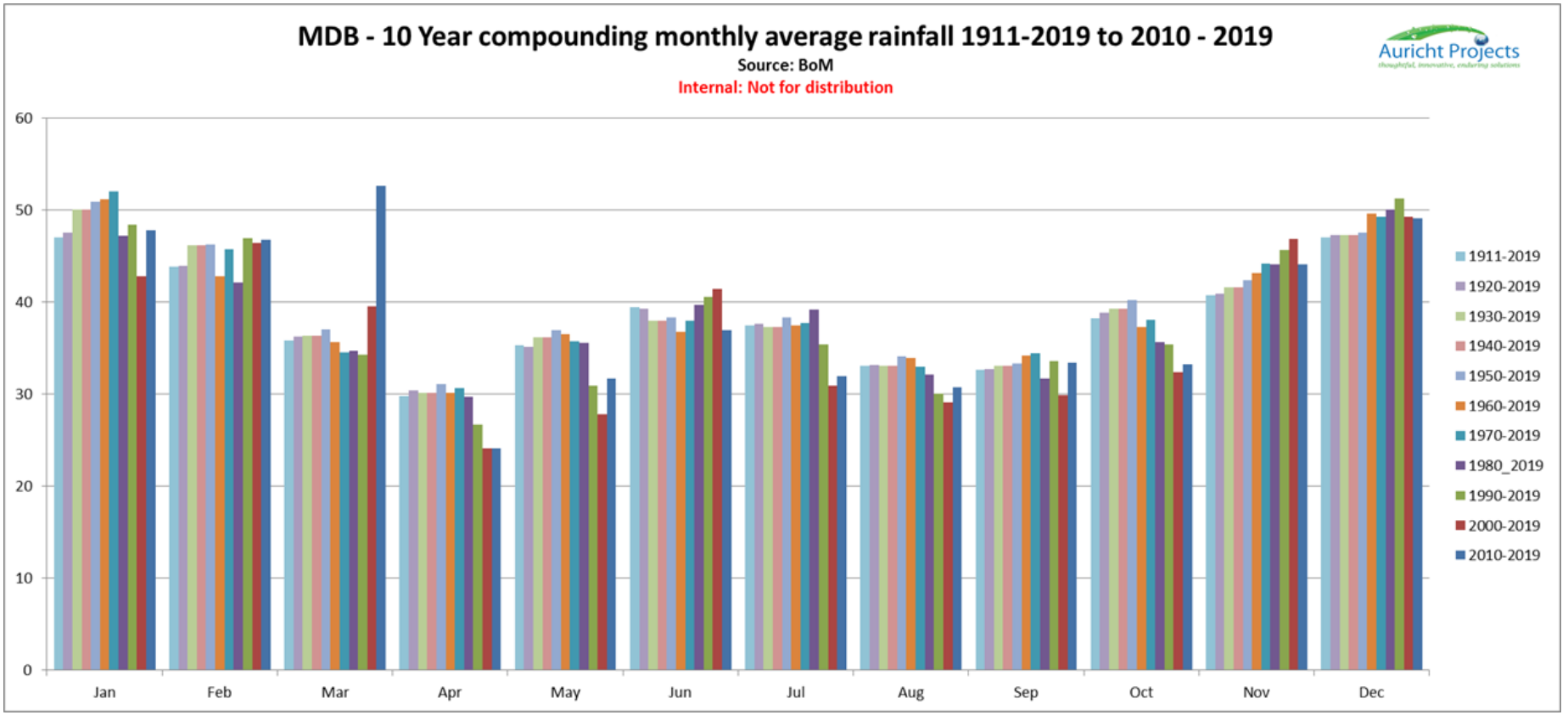
Issue

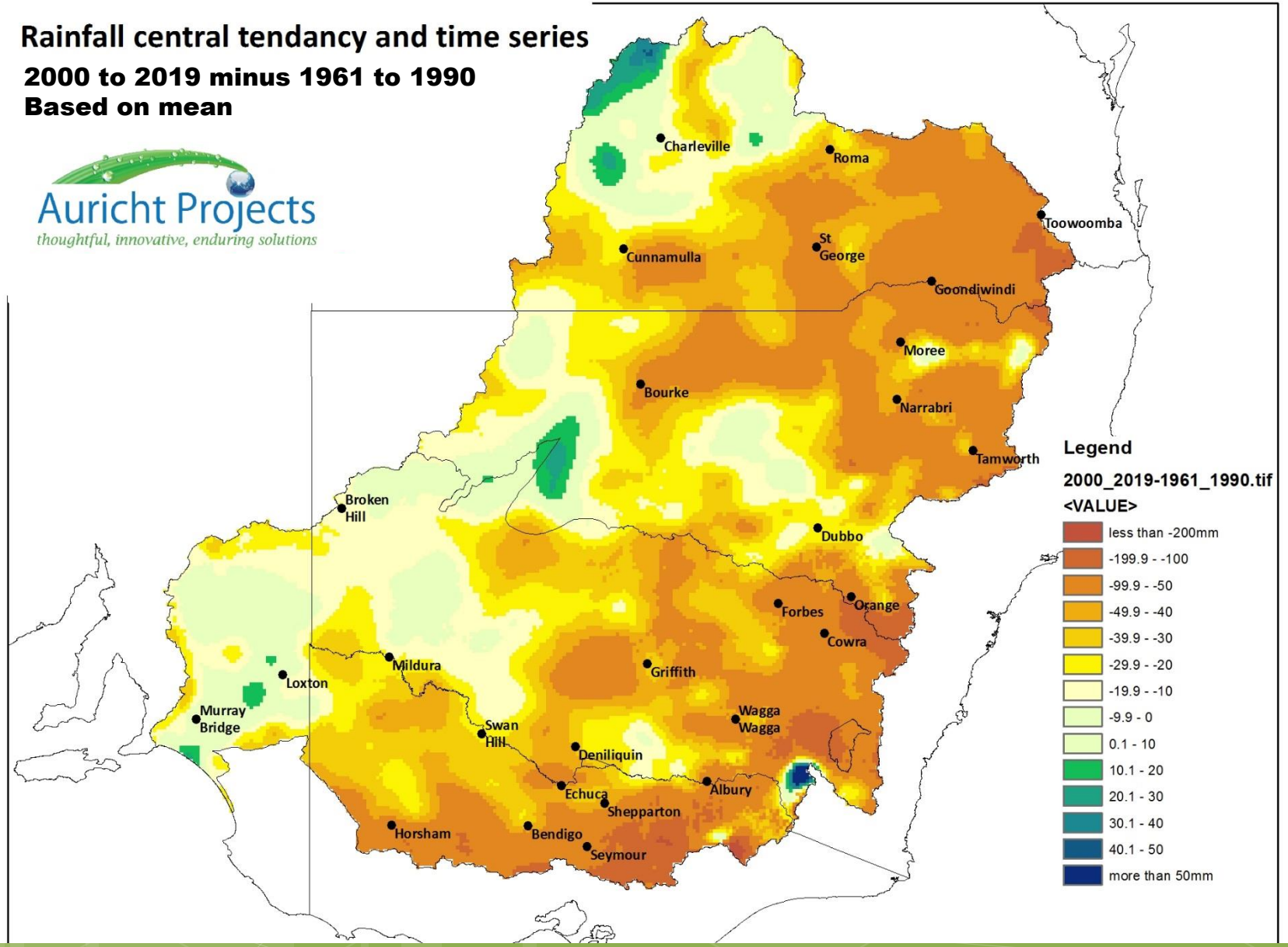
- Increasing frequency and magnitude of low inflows periods during last 20 years relative to the last 125 years
- How to understand causes and impacts / ramifications

Causes

- Changing spatial and temporal rainfall
- Increasing temperatures

- Increasing summer rainfall
- Decreasing autumn – early winter rainfall




Rainfall central tendancy and time series
2000 to 2019 minus 1961 to 1990
Based on mean
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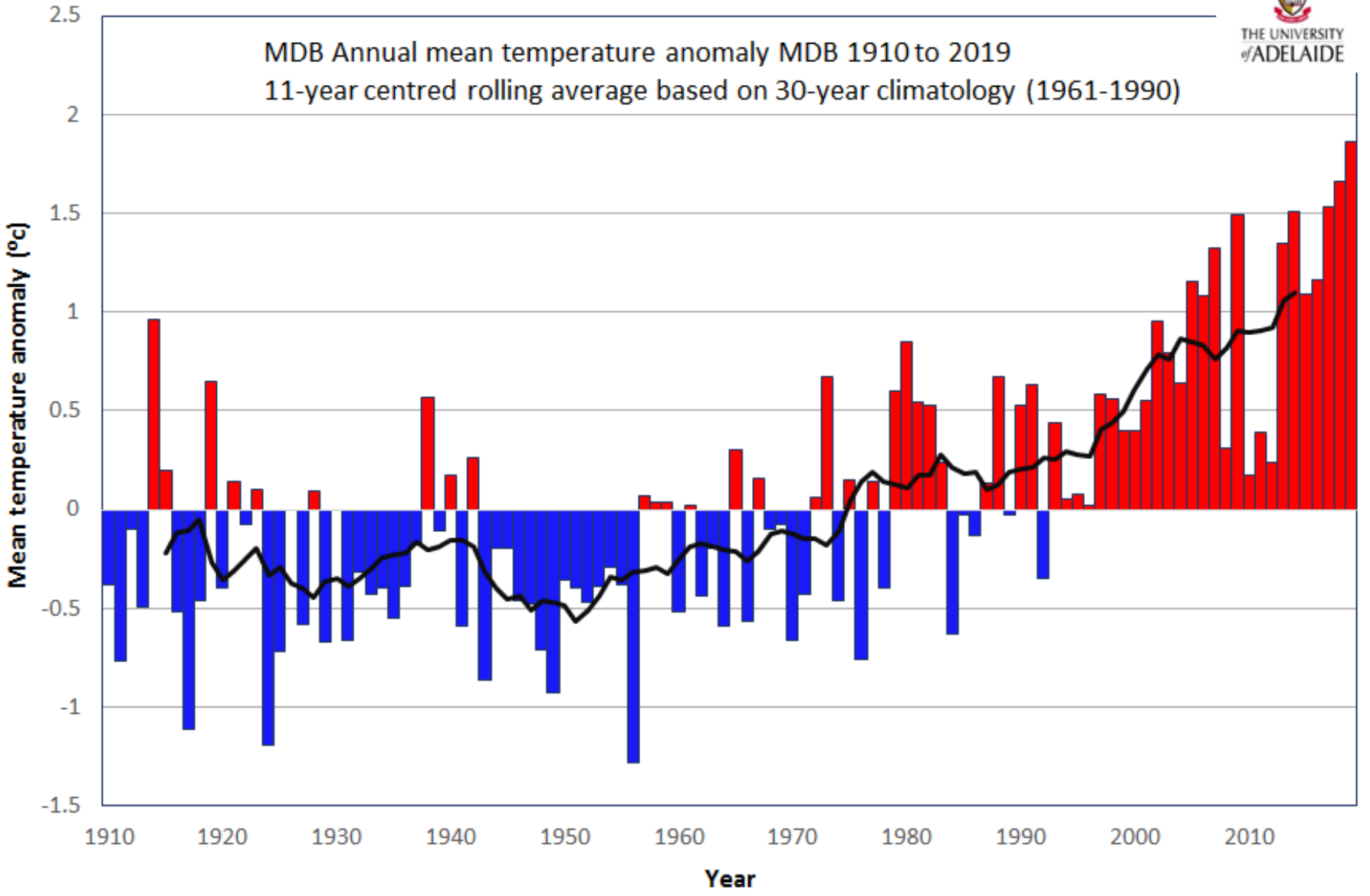
Charleville
Roma
Toowoomba
St George
Cunnamulla
Goondiwindi
Moree
Bourke
Narrabri
Tamworth
Broken Hill
Dubbo
Forbes
Orange
Cowra
Mildura
Griffith
Loxton
Murray Bridge
Swan Hill
Wagga Wagga
Deniliquin
Albury
Echuca
Shepparton
Horsham
Bendigo
Seymour
Legend
2000_2019-1961_1990.tif
<VALUE>
less than -200mm
-199.9 - -100
-99.9 - -50
-49.9 - -40
-39.9 - -30
-29.9 - -20
-19.9 - -10
-9.9 - 0
0.1 - 10
10.1 - 20
20.1 - 30
30.1 - 40
40.1 - 50
more than 50mm

Temperature

- Major changes since 1990's

Temperature anomalies - MDB

Source: BoM

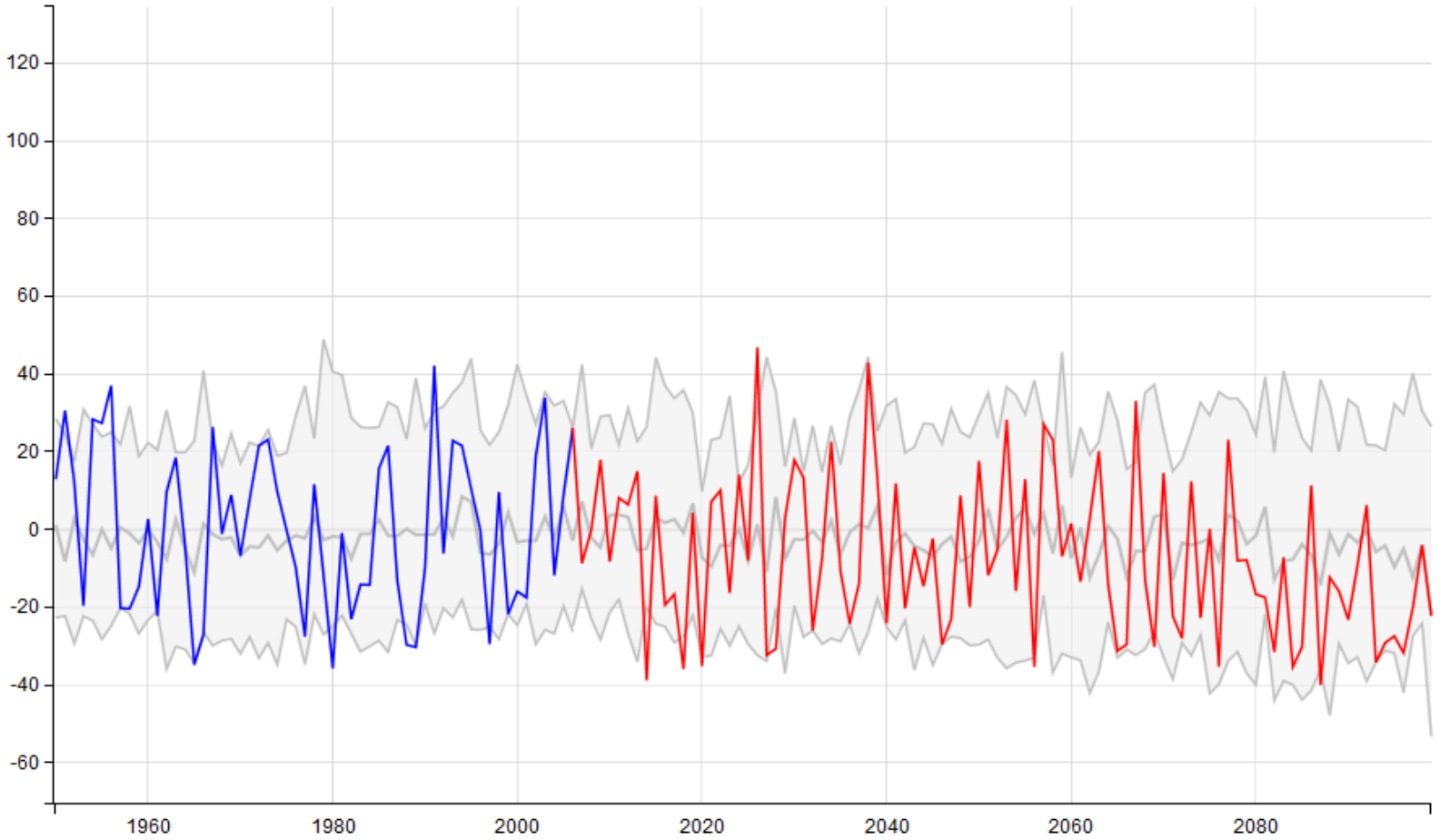


What about the future

- Rainfall

TIME SERIES EXPLORER

INTERMEDIATE



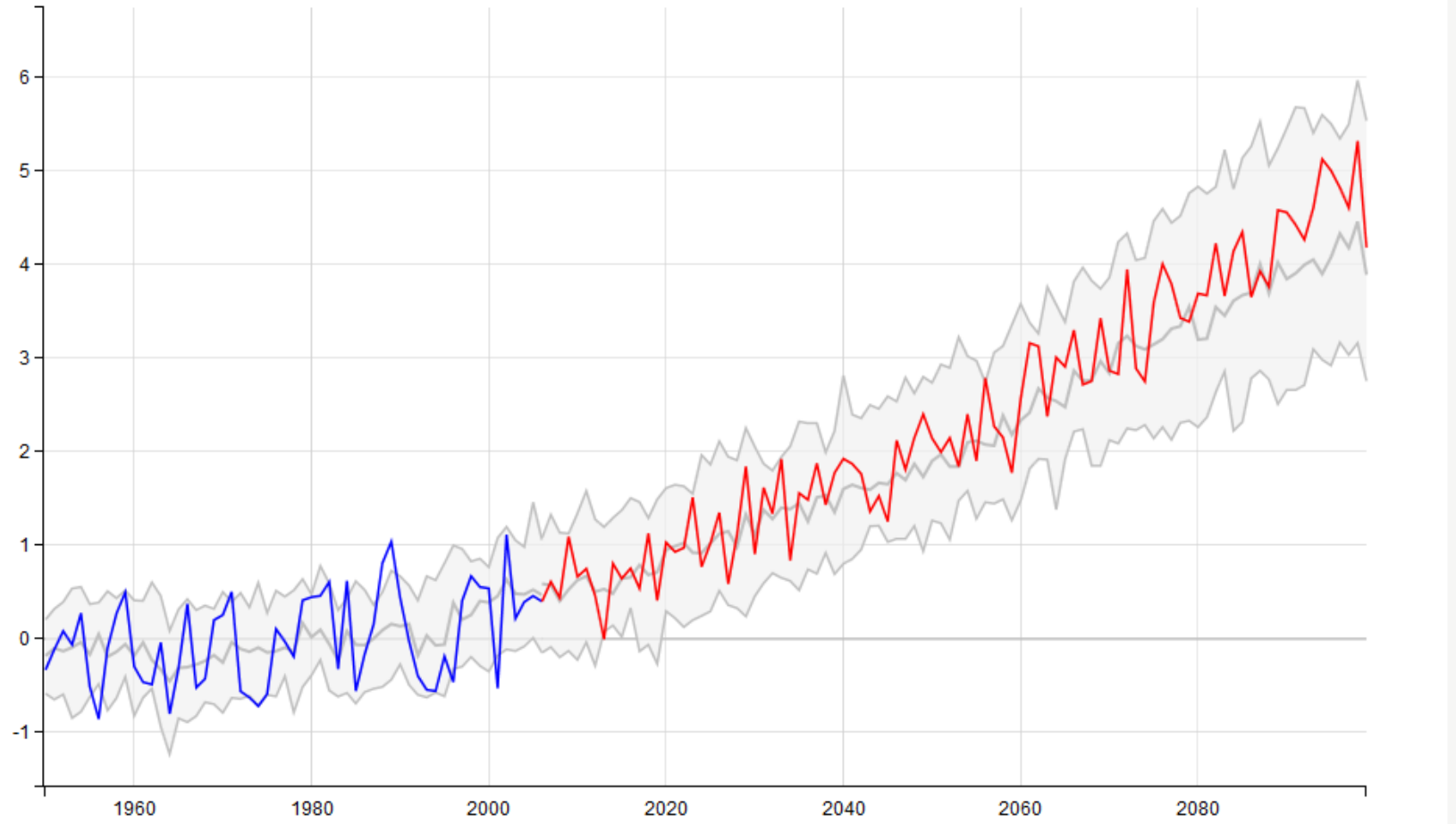
Configure Data

REGION	Murray Basin	VARIABLE	Rainfall	MODEL	ACCESS1-0
EMISSIONS SCENARIO	RCP 8.5	SEASON	Annual		

Temperature – future climate

TIME SERIES EXPLORER

INTERMEDIATE



Configure Data

REGION: Murray Basin

VARIABLE: Temperature

MODEL: ACCESS1-0

EMISSIONS SCENARIO: RCP 8.5

SEASON: Annual

Implications

- Compressed growing seasons
- Changed irrigation regimes – potential delivery/supply issues
- Seasons moving forward
- More hot days – increasing heat stress and yield impacts
- No frost impacts in Riverland or Sunraysia predicted
- Good data avail in Wine Climate Atlas and other sources – BoM, CSIRO, State agencies
- Modelling reveals decreasing water use efficiency but likely less water available
- Scope for more work on yield impacts and collaborative co-designed research
- From an industry and community perspective reduced yields also mean less levies and regional wealth therefore potential strategic significance and impact to regional economies

Victorian Dept Agric Yield modelling

- 5 – 10 % declines in 2030
- 5 – 25% declines in 2050

Point scale – Yield Decline

	Baseline yield (t/ha)	% yield decline 2030	2050	2070
Citrus – Wash. navel	53	-5	-23	-30
Wine - Shiraz	25	-10	-25	-33
Wine – Pinot gris	34	-8	-20	-28
Dried – Sun muscat	11	-8	-26	-35
Table – Crims. seedless	28	+1	-5	-9
Almonds - Nonpariel	3.5	-10	-19	-21

Source: Craig Beverly

Point scale – Growing season days

	Baseline	2030	2050	2070	Change	Days/yr decline
Citrus – Wash navel	281	253	222	210	71	1.2
Wine – Shiraz	191	178	159	148	43	0.8
Wine – Pinot gris	157	145	132	124	33	0.6
Dried- S Muscat	176	165	149	139	37	0.7
Table – C Seedless	186	174	155	146	40	0.7
Almonds – NP	221	208	189	179	42	0.8

Source: Craig Beverly

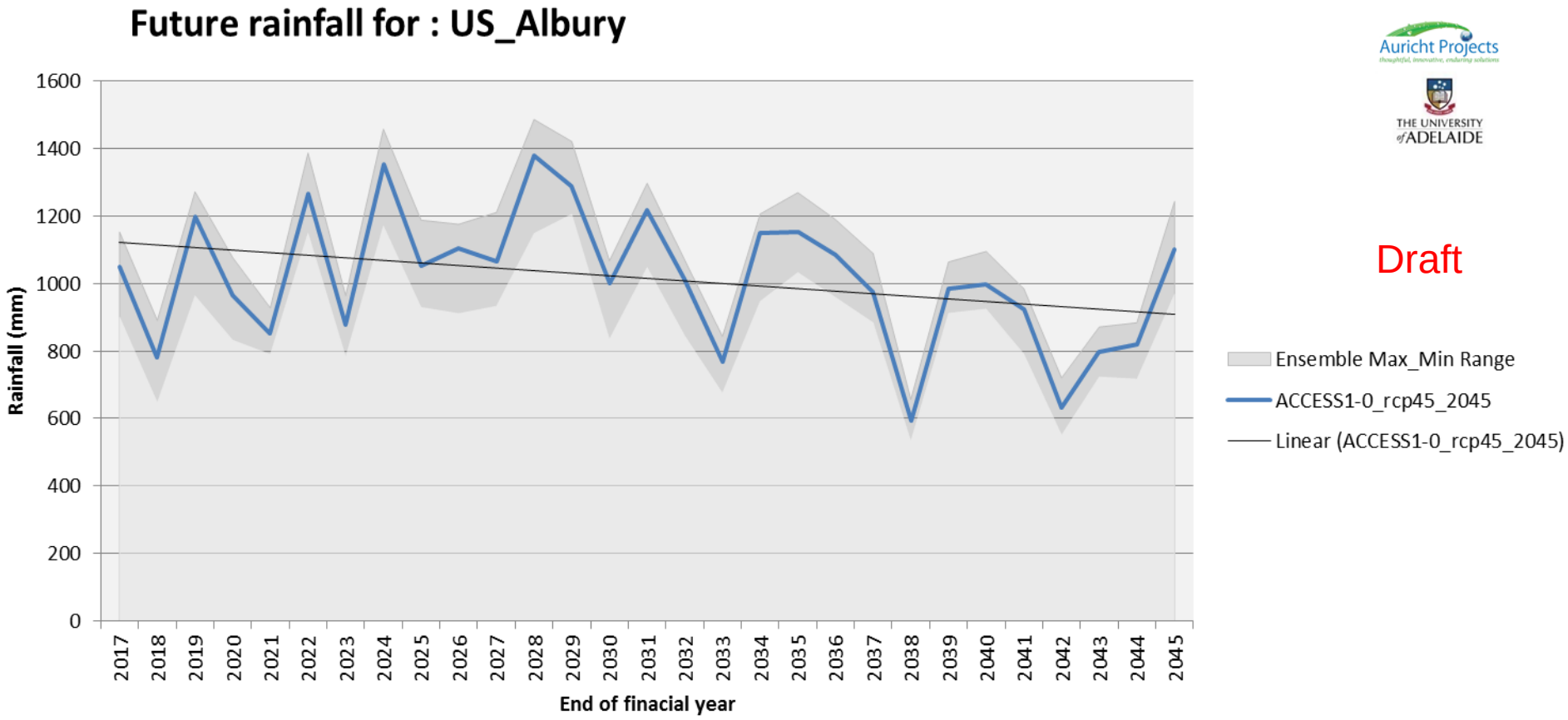
Requirement

- Need to be able to quantify states of nature and frequency to inform risk and planning
- How many good, average, bad seasons over the next 10 – 20 years. I.e. not just an average for 2030 or 2050

Impact of changing conditions

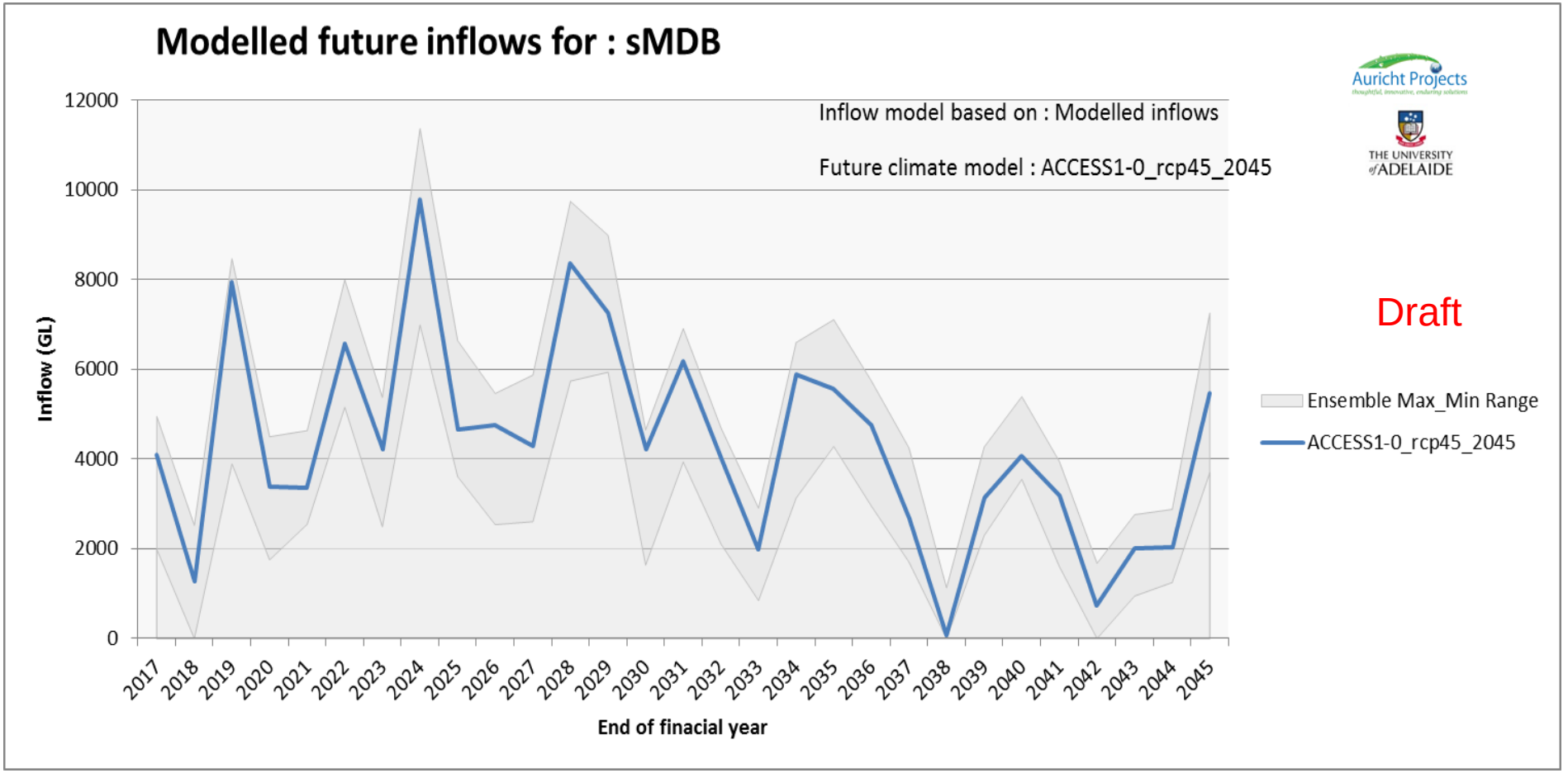
- Impacts from catchment to Basin level
- Draft outputs

Impact of changing conditions



SMDB level future inflows – Draft outputs

SMDB level future inflows – Draft outputs

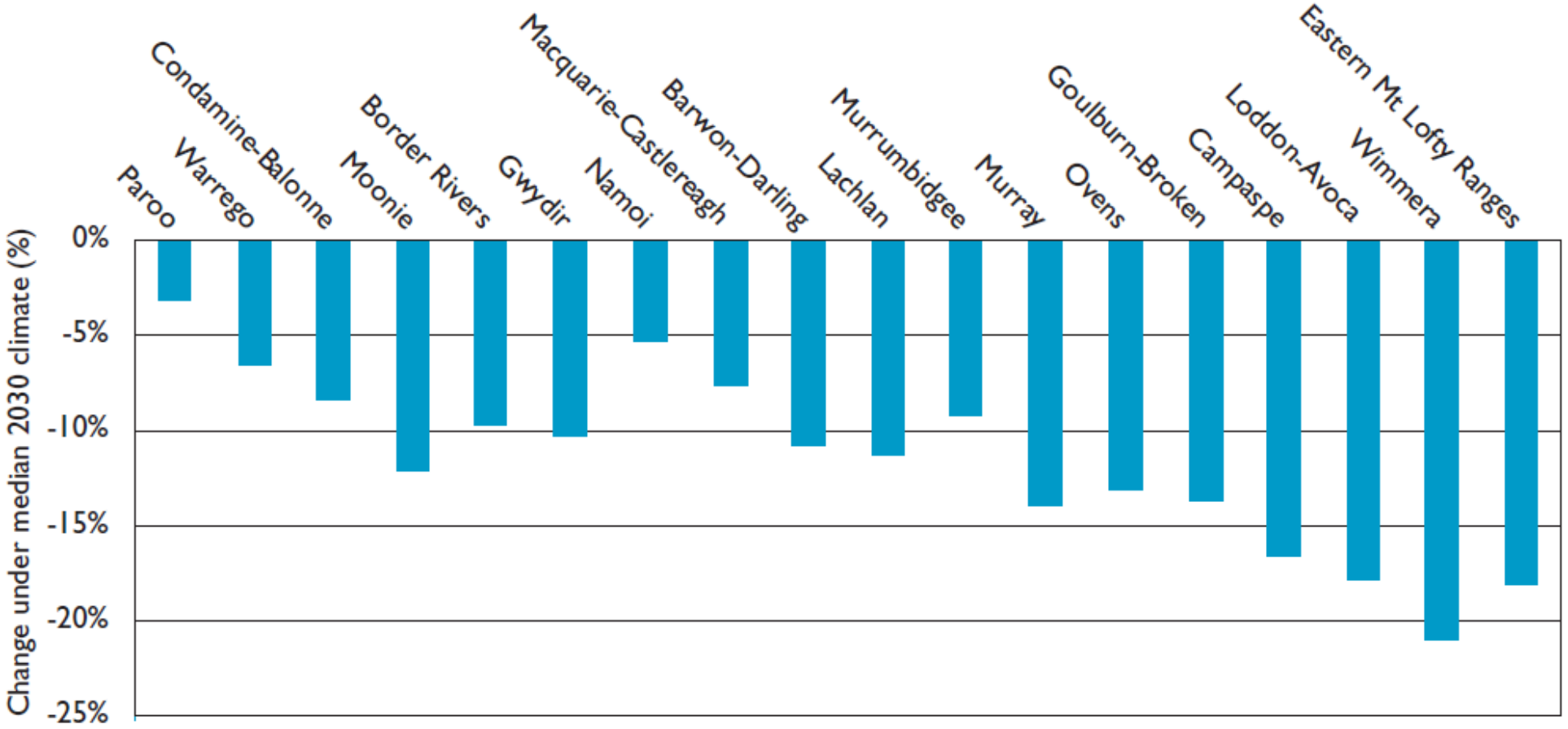


Impact on inflows

- Earlier work from CSIRO 2008 at catchment level

Impact on inflows

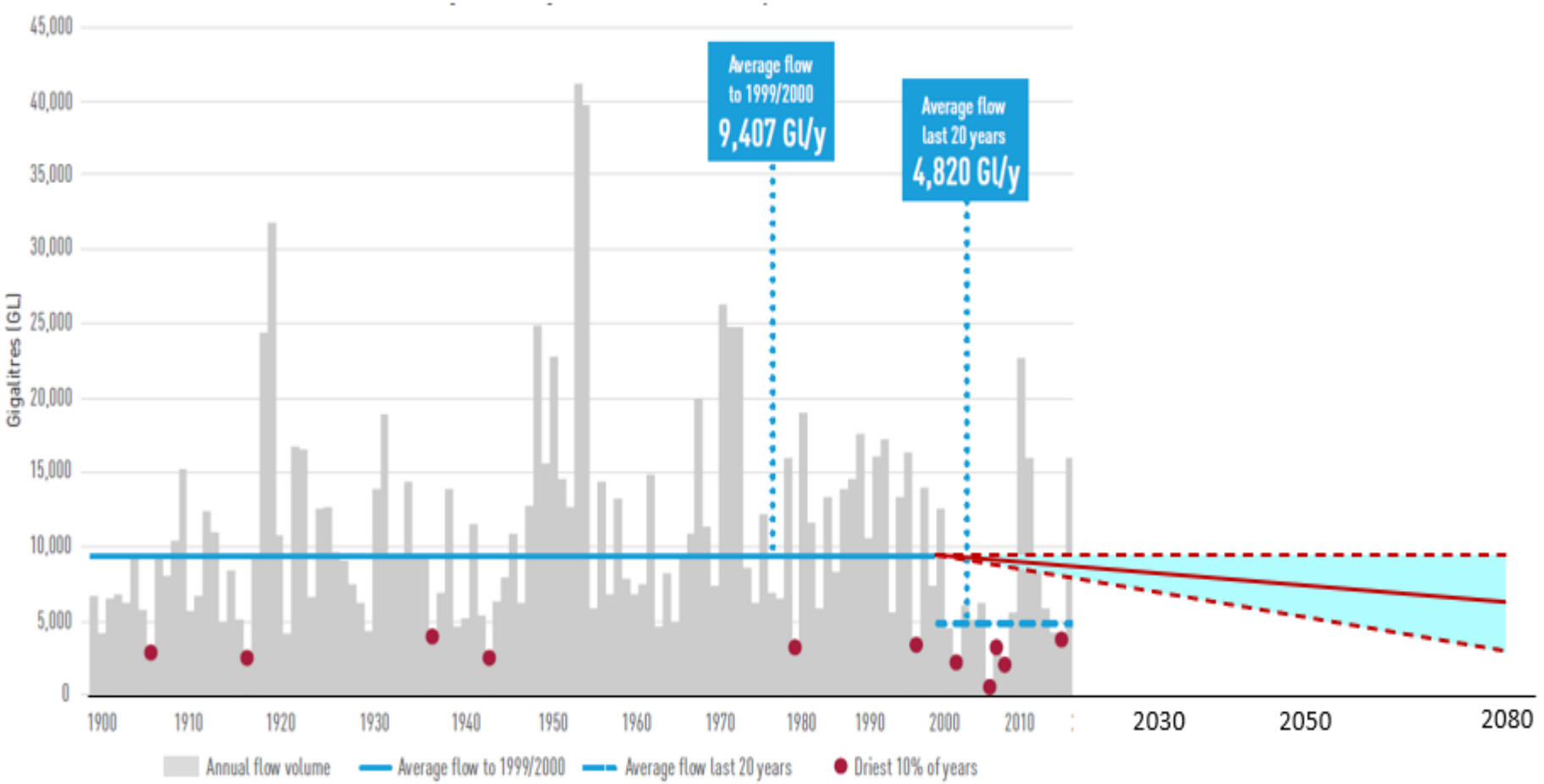
Percentage changes in average surface water availability by region under the median 2030 climate



Impact on inflows

- Recent CSIRO work
- Note – averages in following based on median

Impact on inflows

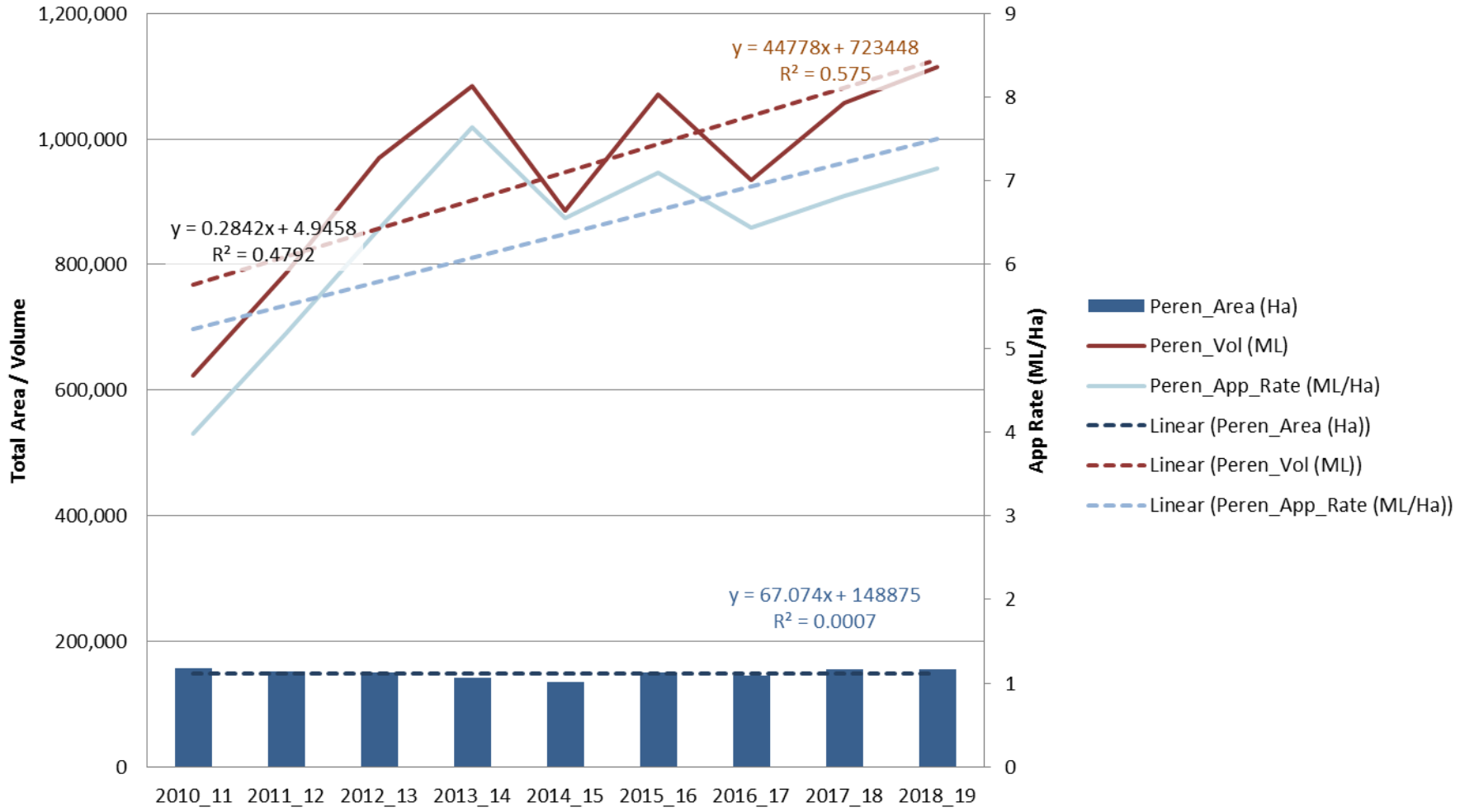


What else is happening

- Perennial footprint area similar over time since 2010-11
- Application rates increasing – especially for perennial
- As such volumes trending up for perennials
- Less water avail for commercial use due to buy backs etc therefore more competition in market
- More people competing for available water ⇨ driving prices higher in years of lower allocation / availability. Only going to get worse as new (and extensive) plantations mature
- People and businesses are adapting ⇨ increased focus on technology, understanding of end-to-end processes (and where gains etc can be made), or getting out

Water System:
Southern Basin

Perennials: Area, Volume and Application Rate



ABC NEWS

End of fruit cropping along lower Darling River a 'big loss' for industry, as growers pushed to brink

ABC Broken Hill / By Christopher Testa, Declan Gooch and Saskia Mabin

Posted Sun 29 Sep 2019 at 10:46am

The final citrus and grape harvest is under way at Alan Whyte's property. *(ABC Rural: Saskia Mabin)*

Share

The end of irrigated horticulture on the lower Darling River will cost the citrus industry decades of technical expertise, according to the country's largest citrus exporter.

Fruit growers on the lower Darling have begun turning off the water to their permanent plantings — killing their trees — as they harvest what will be the final

Key points:

- Six citrus growing families have

ABC NEWS

Fruit growers on the lower Darling have begun turning off the water to their permanent plantings — killing their trees — as they harvest what will be the final

Key points:

- Six citrus growing families have

What can be done about it?

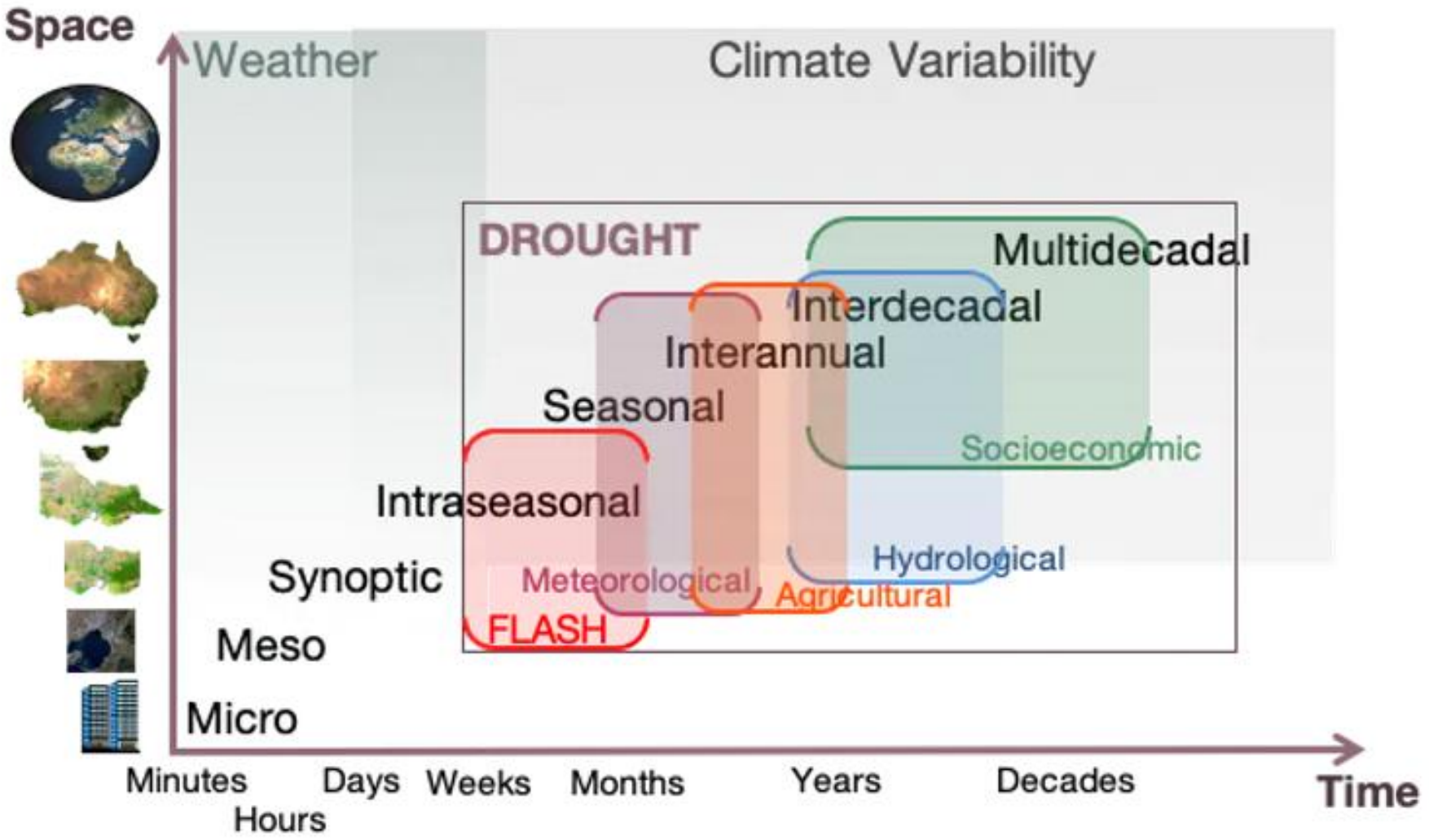
- Improve water and climate literacy
- Quantify risk and uncertainty (based on states of nature)
- Better planning at a range of scales – farm to national; and, hours, days, weeks, to months, years, decades and 2100
- Use of new tools, technology (e.g. sap sensors and remote sensing imagery) plus improved data analysis and insights to help develop strategic and tactical responses. Many are available
- Look out for AgTech groups with solutions looking for problems
- Be conscious of your data rights

How farmers around the world are making decisions based on weather and climate information

As climate change threatens food production, climate information services are helping farmers in Africa and South Asia make better decisions in the short and long-term to adapt to changing growing conditions.

	Type of information	Vehicles for delivering information	Farmer decisions affected
WEATHER Days to weeks	 • Observed rainfall and temperature • Daily forecasts up to one week ahead of time • Alerts on pests and diseases • Early warning of extreme weather events	 • Mobile phones • Radio • Television	 • Timing of planting and harvest • Timing of fertilizer, pesticide, and irrigation application • Protecting lives and property from extreme events
CLIMATE VARIABILITY Months to Years	• Probabilities for seasonal rainfall and temperature conditions • Seasonal climate variables targeted to particular agricultural risks (dry spells, rainy season start date, etc) • Historical variability of climate variables	• Workshops with experts • Conversations with agricultural extension agents (farm educators)	• Selecting crops and varieties • Livestock stocking rates and feeding strategies • Intensity of input use (fertilizer, pesticides) • Labor or marketing contracts • Intensifying and diversifying crops • Diversifying sources of income
CLIMATE CHANGE Decades or longer	 • Projections of future rainfall and temperature • Historical trends in rainfall and temperature • Historical changes in extreme events	 • Workshops with researchers, agricultural extension agents, and meteorological services.	 • Major capital investments (buying or expanding landholding, irrigation systems, farm equipment etc) • Changing farming system or livelihood strategy • Deciding whether or not to farm

Source: CGIAR



The different types of drought, showing how long they last and the size of the area they affect. Ailie Gallant, Author provided

Lots of new dynamic tools and data

- Wine Australia Climate Atlas (good info but static)
- Climate services for Agriculture ($15 mil)
  - https://www.agriculture.gov.au/ag-farm-food/drought/future-drought-fund/climate-services
- Drought Resilience Self-Assessment Tool ($10 mil)
  - https://www.agriculture.gov.au/ag-farm-food/drought/future-drought-fund/drought-resilience-self-assessment-tool
- MDB Water Information Portal
  - https://mdbwip.bom.gov.au/#4.4/-31.5/147
- Also lots of other inter-active climate tools available that cover much of the wine growing area

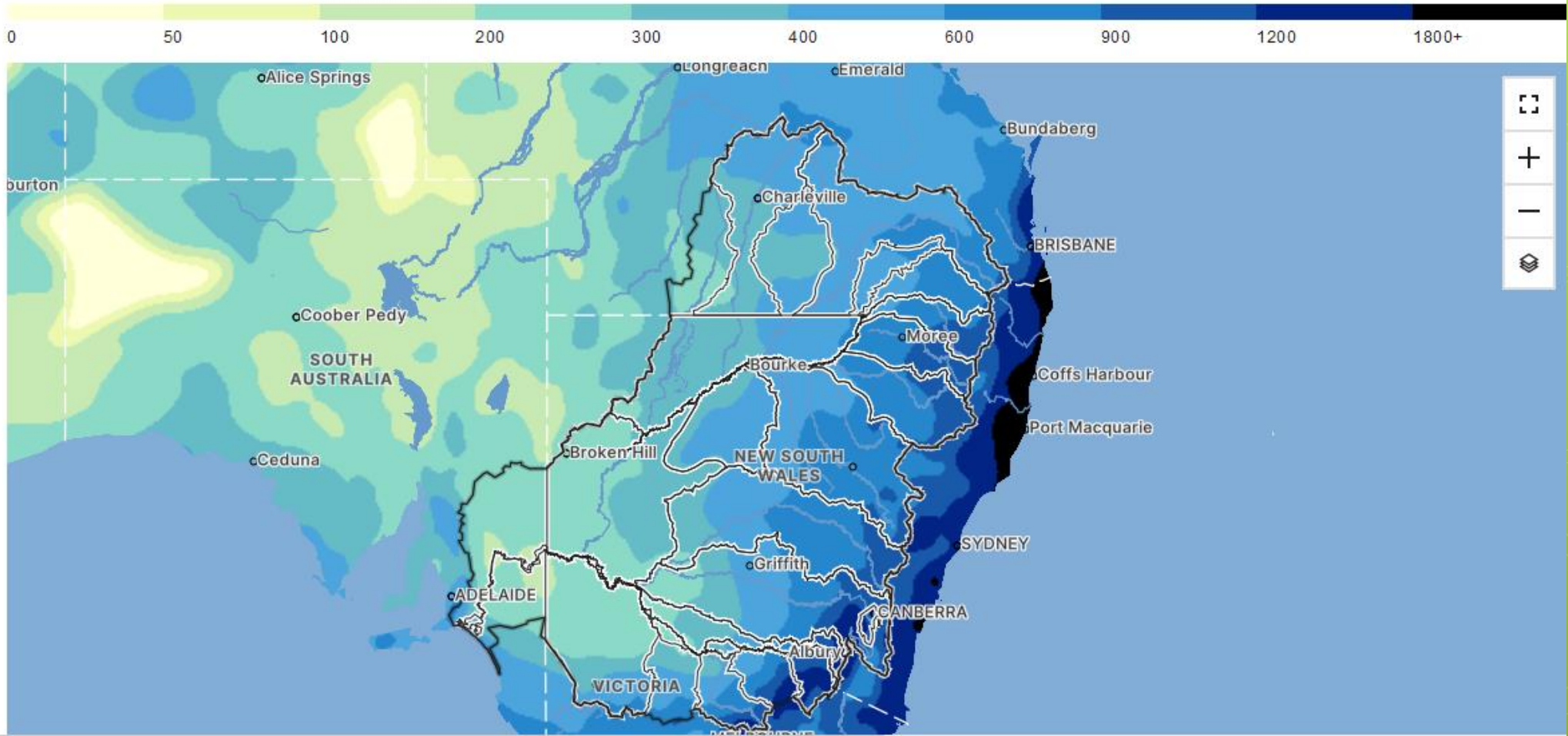
BoM MDB Water Portal

Select a Basin catchment

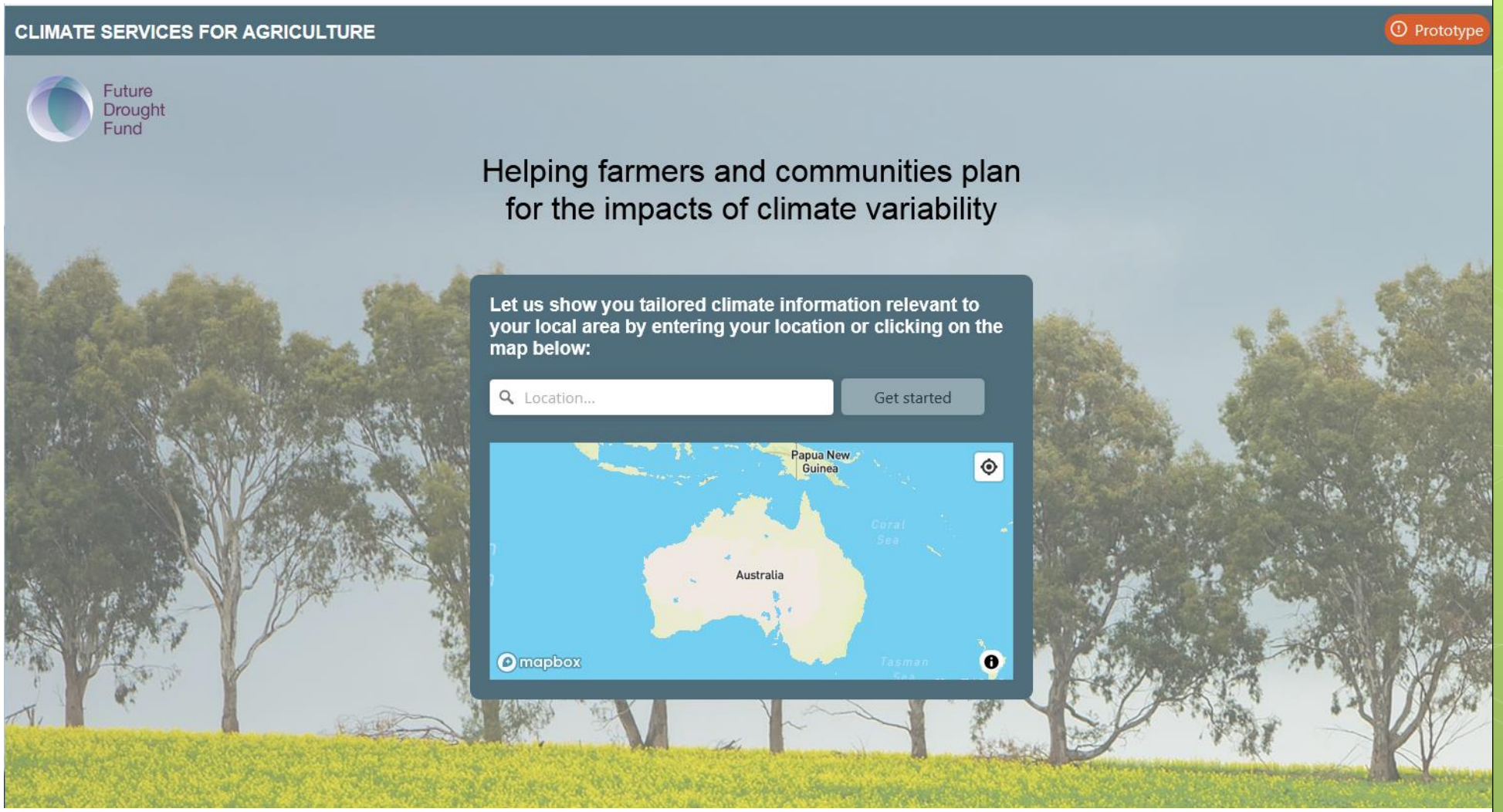
Select an option

Storages | Rainfall | More weather and water...

Rainfall totals (mm) - change



DAWE Climate Services for Agric


CLIMATE SERVICES FOR AGRICULTURE
Prototype
Future Drought Fund
Helping farmers and communities plan for the impacts of climate variability
Let us show you tailored climate information relevant to your local area by entering your location or clicking on the map below:
Location...
Get started
Papua New Guinea
Coral Sea
Australia
Tasman Sea
mapbox

DR SAT Prototype

Maze

t.maze.co/44240647?guerilla=true

Apps

DR SAT

Drought Resilience Self-Assessment Tool

Australia's farming community has a long history of adapting to change and building resilience to climate variability. However, the changing intensity and frequency of drought is a challenge that requires additional support. DR SAT aims to empower farmers with options to continue to strengthen their resilience and that of their communities. This includes aspects of environmental, financial, personal and social resilience.

Through the tool you are able to:

- **View remote-sensed aspects** of your farm that can influence environmental resilience e.g. ground cover.
- **Complete a self-assessment** that can help you to understand factors that can influence your resilience.
- View projected **climate impacts** for your farm under different scenarios.
- Set and track personalised **pathways** that may help to improve aspects of resilience.

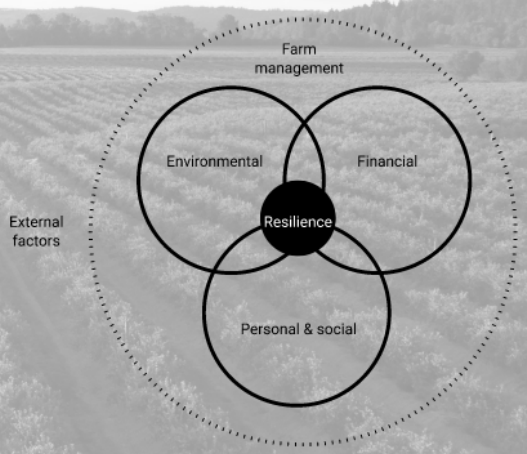
Get started

Already have an account? Log in

What is resilience?

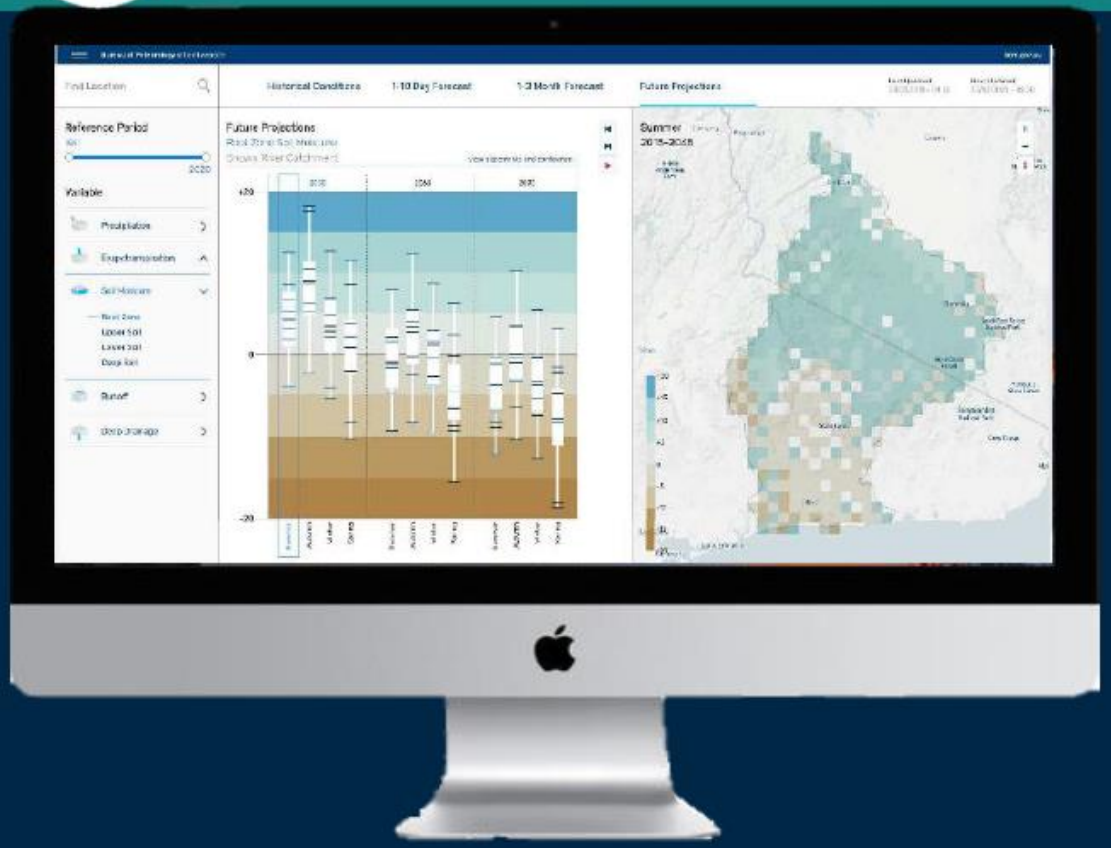
Resilience is having enough resources to adapt to changes over time, whilst also being able to absorb short-term shocks. Resilience includes interconnected environmental, financial, and personal & social resources. External factors can influence these resources but farm management decides how resources can be used and/or built upon.

DR SAT's focus is on proactively building resilience to drought and extreme weather under a changing climate. However, resilience can also apply to any long term stress or short term shock. For example, market changes, family or health challenges and so on. Many of the options to build resilience may be relevant no matter what the future holds.



Service Specifications

Future **projections**



Parameters include:

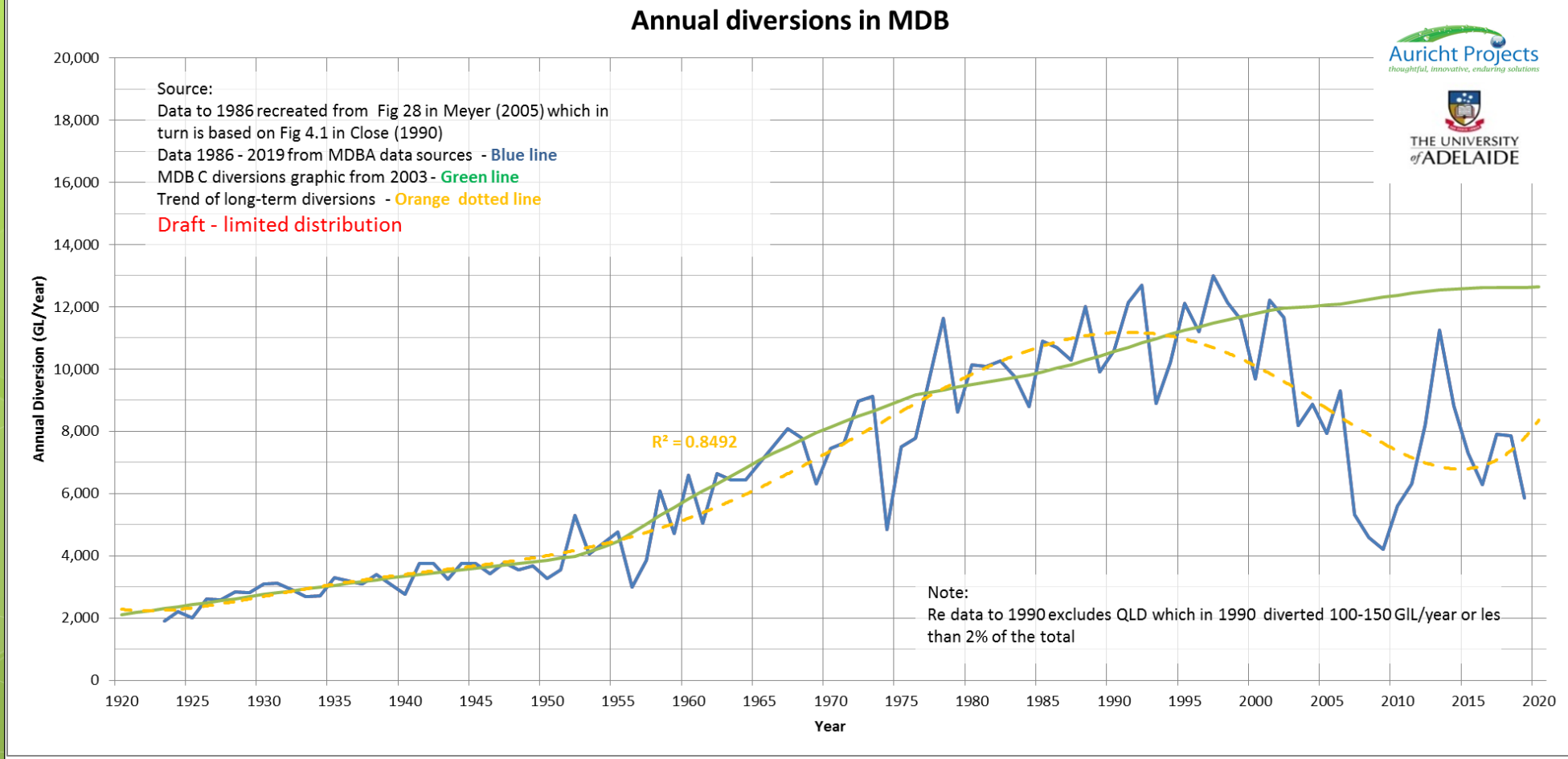
- Rainfall
- Tmax
- Tmin
- Solar Radiation
- Surface wind
- Soil moisture (output from AWRA-L)
- Runoff (gridded) (output from AWRA-L)
- PET (output from AWRA-L)

Ensemble members:

- Daily, 5x5 km for periof 1960 – 2100
- Multiple scenarios: RCP45, RCP85
- Multiple BC methods
- Multiple HMs*

*in some regions

Supply and demand dynamics



Thanks

- Questions & Discussion
- Also feel free to contact me on
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  - 0417 817 579
  - www.auricht.com