Murray-Darling Basin water market catchment dataset 2021

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Contents

Tables

Figures

MDB water market catchment dataset

The MDB water market catchment dataset is a comprehensive dataset detailing both supply and demand factors across the Murray Darling Basin (MDB). The dataset is used by ABARES for research and modelling objectives, and underpins the ABARES Water Trade Model. The dataset has been made available as part of best practice research methodology, and to provide transparency into ABARES modelling. The dataset will also support additional research by other users.

The dataset has been designed with a research objective in mind with assumptions and adjustments made to support that goal, which may not align with a reporting objective. The dataset provides consistent timeseries for key variables across the MDB with certain assumptions made to preserve the timeseries charachteristic of the data.

ABARES has worked with colleagues in the Australian Bureau of Statistics (ABS), Bureau of Meteorology (BOM), Murray-Darling Basin Authority (MDBA) and each of the state water agencies to compile a unique and comprehensive dataset detailing water availability, market outcomes, irrigation activity, climatic conditions and commodity prices for a consistent set of catchment regions in the MDB.

The MDB water market catchment dataset includes a water supply file and an irrigation activity file. To supplement the datasets, metadata that describes each variable, sources and other salient information is also provided. This report provides a summary of the scope and coverage, and the methods used to construct the data.

ABARES is continually improving the quality and scope of the MDB water market catchment dataset. While extensive care has been exercised in preparing this dataset, it remains subject to further refinement in the future, particularly where data has been estimated or imputed.

1.1   Scope and Coverage

The MDB water market catchment dataset covers the period of July 2000 to June 2021 and includes catchment regions in the MDB. The MDB is split into northern (nMDB) and southern (sMDB) (Figure 1). The nMDB covers QLD and northern NSW, while the sMDB covers southern NSW, ACT, Vic. and SA.

In preparing the data, ABARES focussed on providing consistent time series data for key catchments and irrigation activities in the basin. Supply data has been collected for all MDB regions in NSW, Vic. and SA, but was not collected for QLD regions. Irrigation activity data has been compiled for all catchments within the basin.

The list of regions in the Basin is outlined in Table 1, as well as if they are included in the demand and supply dataset.

Figure 1 Map of the MDB regions

Table 1 List of regions in the MDB

Region	MDB	Dataset
NSW Barwon Darling	nMDB	Irrigation activity
NSW Border Rivers	nMDB	Irrigation activity, Supply
NSW Gwydir	nMDB	Irrigation activity, Supply
NSW Lachlan	nMDB	Irrigation activity, Supply
NSW Macquarie-Castlereagh	nMDB	Irrigation activity, Supply
NSW Namoi	nMDB	Irrigation activity, Supply
QLD Border Rivers	nMDB	Irrigation activity
QLD Condamine-Balonne	nMDB	Irrigation activity
QLD Moonie	nMDB	Irrigation activity
QLD Warrego-Paroo	nMDB	Irrigation activity
ACT	sMDB	Irrigation activity
NSW Lower Darling	sMDB	Irrigation activity, Supply
Eastern Mt Lofty	sMDB	Irrigation activity
NSW Murray Above (Above Barmah Choke)	sMDB	Irrigation activity, Supply
NSW Murray Below (Below Barmah Choke)	sMDB	Irrigation activity, Supply
NSW Murrumbidgee	sMDB	Irrigation activity, Supply

SA Adelaide and Mt Lofty	sMDB	Irrigation activity
SA Murray	sMDB	Irrigation activity, Supply
VIC Goulburn-Broken	sMDB	Irrigation activity, Supply
VIC Loddon-Campaspe	sMDB	Irrigation activity, Supply
VIC Murray Above (Above Barmah Choke)	sMDB	Irrigation activity, Supply
VIC Murray Below (Below Barmah Choke)	sMDB	Irrigation activity, Supply
VIC Ovens	sMDB	Irrigation activity
VIC Werribee	sMDB	Irrigation activity
VIC Wimmera-Avon	sMDB	Irrigation activity

1.2   Data construction

The MDB water market catchment dataset offers several improvements over previous datasets released by ABARES. For example, the supply file includes additional variables, such as forfeited water (split by during year, and end of year), which allows for more accurate estimations of total water supply. The irrigation activity file provides a time series of catchment level data, which is the result of close collaboration with the ABS.

The construction of the MDB water market catchment dataset involved considerable effort, given the large number of data sources and various inconsistencies between them. A number of data imputations, assumptions and regression estimations were required, in addition to filling gaps through external data sources in order to generate time series data for a consistent set of regional and industry definitions.

The MDB water market catchment dataset draws from various sources, which are further detailed in the metadata spreadsheets accompanying this product. The construction of rainfall, commodity prices, allocations and carryover volume variables use the same methods as detailed in Gupta et al. 2018. All deflation adjustments use the Consumer Price Index as reported by the ABS (ABS 2021a).

1.2.1   Irrigation activity

The irrigation activity dataset has been split into an 'area and water use' dataset and a 'production and value' dataset due to differences in the scope of the underlying data. Each of the variables included in the irrigation activity datasets is listed in Table 2 and Table 3. The area and water use dataset has been built from unit-record data collected through various agricultural censuses and surveys and provides irrigation activity data for catchment regions between 2010–11 and 2017–18. For the period 2005–06 to 2010–11 and from 2018–19 onwards, ABARES apportioned Natural Resource Management (NRM) level data to catchment regions, using methods previously described in Gupta et al. 2018. The apportioning method was further calibrated using data sourced from the ABS for 2010–11 to 2012–13.

Table 2 Water demand data – Area and Water use

Variable	Description	Units
Area watered	Area of irrigation by region and industry	Ha
L_meta	Metadata for Area_watered	Value
Volume applied	Volume of irrigated water applied	ML
W_meta	Metadata for Volume_applied	Value
Tree_br	Number of bearing almond trees	No.
Tree_nbr	Number of non-bearing almond trees	No.
K_Almonds	The total number of bearing trees as a proportion of total almond trees	%
K_meta	Metadata for K_Almonds	Value

The production and value dataset has also been built from unit-record data for catchment regions between 2005–06 and 2017–18 for selected commodities. For Almonds, Cotton, Grapevines and Rice, a custom dataset was created from ABS unit-record data for 2010-11 to 2017-18. For all other commodities, and from 2018–19 onwards, ABARES apportioned NRM level data to catchment regions.

Table 3 Water demand data – Production and Value

Variable	Description	Units
Production	Volume of irrigated production. For Almonds, Cotton, Grapevines, Other broadacre, Other cereals, Pastures – Hay and Rice, production is reported in tonnes. For Dairy, production is reported in Litres. For all other commodities, production is reported as an index value.	Various
Units_Q	Indicates the unit of measurement for production	Text
Q_meta	Metadata for Production	Value
Commodity price	Commodity prices ($2019–20). For commodities Almonds, Cotton, Grapevines, Other broadacre, Other cereals, Pastures – Hay and Rice, prices are reported in $/t. For Other broadacre and Other cereals, canola and wheat indicator prices are used respectively. For Dairy, prices are reported in c/L. For all other commodities, prices are reported as an index value.	Various
Units_Y	Indicates the unit of measurement for commodity prices ($/t, c/L, Index)	Text
GVIAP	Dollar value of irrigated agricultural production ($2019–20)	$
G_meta	Metadata for GVIAP	Value

Table 4 and Table 5 list the irrigation activities considered, which are based on ABS industry classifications. A significant feature of the MDB water market catchment dataset is that it separately reports data for the almonds industry, which is elsewhere part of the combined fruit and nut category reported by the ABS.

Table 4 shows the irrigation activities for the area and water use data. Revisions have made to the irrigation activities reported based on updates made by the ABS (ABS 2021b). The All other crops category is the aggregation of the previously reported Other broadacre, Other cereals and Other crops categories. The Pastures – Grazing category is the aggregation of previously reported Pastures for grazing and Dairy categories. See the metadata for additional information on how these series were constructed (Table 6).

Table 5 shows the irrigation activities for the production and value data. The key differences are the reporting of disaggregated Other cereals and Other broadacre categories, as well as Dairy and Pastures – Grazing categories (which continue to be reported by the ABS for production and value).

Table 4 List of irrigation activities – Area and Water use

All other crops	Pastures - Grazing
Almonds	Pastures - Hay
Cotton	Rice
Fruit	Vegetables
Grapevines	

Table 5 List of irrigation activities – Production and Value

Almonds	Other cereals
Cotton	Pastures – Hay
Dairy	Pastures - Grazing
Fruit	Rice
Grapevines	Vegetables
Other broadacre	

For regions within the MDB where data was missing (for example, due to ABS confidentiality constraints) ABARES has estimated values. ABARES has used a variety of methods to impute missing data, as listed in Table 6. All imputed data points are marked in additional columns in the dataset (denoted with the "*meta*" suffix) and remain subject to further refinement.

Table 6 Data construction methodologies, marked in the meta columns in the demand file

Value	Description
1	ABS unit-level data constructed by ABARES
2	Catchment data apportioned by ABARES using ABS NRM data
3	Missing values filled with a linear interpolation
4	Missing values filled with ABARES regression results
5	Data obtained from external sources (e.g. MDBA)
6	Missing data that was not filled using other methods
7	ABARES estimate
8	Aggregated category, where sub-categories have different sources
9	Aggregated category, where at least one of the sub-categories has missing data

1.2.2   Supply

The supply file was compiled using data from the MDBA, state water agencies (NSW Department of Planning, Industry and Environment, Goulburn-Murray Water, Northern Victorian Resource Manager and the South Australian Department for Environment and Water), BOM and the Department of Agriculture, Water and the Environment (DAWE). Water price data has been

compiled and cleaned by ABARES using the GAM price cleaning method described in Sanders et al. 2019.

Each of the variables included in the supply file are briefly described in Table 7, which contains data for catchments in the MDB from 2000–01 to 2020–21.

For 2020–21, data for water forfeits has not yet been published by NSW and has been estimated by ABARES based on the carryover rules applied in that state.

The volume of entitlements on issue reported in the supply file is based on 2020-21 data. As a result, some structural changes over the past two decades (such as the introduction of low reliability entitlements in Victoria) are smoothed over, as the data is intended to support modelling and analysis of forward-looking scenarios.

Table 7 Water supply data

Name	Description	Units	Source
Rainfall	The annual average volume of rainfall recorded across catchments. June and July are excluded from annual calculation.	mm	BOM
Entitlement volumes	Water entitlements are an ongoing right to access a share of water. They are equal to a nominal volume of water for different types of reliability, and are able to be traded or held for potential use.	ML	State water availability reports
Allocation percentages	The percentage for each entitlement type that is able to be accessed during a water year or a particular period. For combined regions (i.e. Vic. Goulburn-Broken) allocation percentages are derived by calculating the combined regional allocation volume, divided by the combined regional entitlement volume.	%	State water allocation announcements
Uncontrolled flow usage	Uncontrolled flow events occur when there is a water flow that is not able to be controlled, and is greater than the amount allocated for consumption or environmental needs. During this time anyone is allowed to access the water. The volume accessed for use is considered the uncontrolled flow usage.	ML	New South Wales Available Water Determination ('AWD') Reports
Allocation volume	A water allocation is the right to access a volume of water during a water year. It is equal to the entitlement volume multiplied by allocation percentages for each entitlement type.	ML	State water allocation announcements, state water availability reports, NSW AWD reports
Within year forfeits	Water users can sometimes lose water from evaporation or other causes. When this occurs the volume lost is considered a within year forfeit.	ML	Victorian unused water reports, NSW General Purpose accounting and AWD reports
End of year forfeits	End of year forfeits are equal to the total volume of water that has not been used in the water year or carried over into the next year.	ML	VIC Unused water reports, NSW General Purpose accounting, and AWD reports
Carryover from previous year	The total volume of allocation water individual water right holders have held in storage to carry over from the previous year.	ML	NSW Department of Primary Industries, Northern VIC Resource Manager, South Australia Department for Environment and Water, Vic. Water Register

Environmental buyback entitlement volumes	Total volume of entitlements purchased for the environment by the Commonwealth Environmental Water Holder (CEWH).	ML	DAWE
On-Farm Infrastructure programs entitlement volumes	Total volume of entitlements recovered for the environment through on-farm infrastructure programs.	ML	DAWE
Off-Farm Infrastructure program entitlement volumes	Total volume of entitlements recovered for the environment through off-farm infrastructure programs.	ML	DAWE
Delta	The sum of entitlement volumes recovered for the environment from buybacks and on-farm infrastructure programs as a proportion of the total volume of entitlements.	%	ABARES estimate
Price of water allocations	Average annual real ($2019–20) allocation price. June and July are excluded from annual calculation.	$/ML	BOM national water register. Data was cleaned using ABARES price cleaning scripts.
Net allocation water trade from CEWH to irrigators	Total volume of water sold from the CEWH to irrigators.		CEWH
Net allocation water trade (excluding environmental trade)	Total volume of allocation water traded into a catchment region subtracted by the total volume of water traded out of it.	ML	MDBA provisions, Victorian Water Register
Water used for irrigation	ABARES estimate for total water use for irrigation by catchment by year	ML	ABARES estimate

References

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