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Funded through the Murray–Darling Water and Environment Research Program

Summary of datasets for classification of river reaches in the Murray-Darling Basin and changes in the flow regime over the past few decades

Project RQ6: Enhancing low flow prediction to support water resources planning. Deliverable T2.6.2

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Important disclaimer

This document summarises the MD-WERP Deliverable T2.6.2 – Classification of river reaches, and spatial dataset of river reaches classified by regulation, flow continuity, and dominant hydrological processes.

These datasets are to be used as contextual information for understanding why our rivers system models have poor predictive performance for low flows. The models have no information on the status of the groundwater conditions for the reach, or a memory of the antecedent conditions within the channel. This may not be a problem when the conditions under which predictions are made are the same as those under which the model was calibrated but may become a problem if the hydrological regime is changing beyond the conditions experienced during calibration. Further analysis of these datasets will guide the modifications necessary to existing model structures to provide better predictions of future low flows. Examples include: where stream reaches are changing from gaining to losing, then the groundwater level may need to be an input into the loss function used in the river model to compensate; or if stream reaches are changing from perennial to intermittent, a bed and bank storage term may be necessary to enable the river to dry out and re-wet in accordance with the observations. These datasets have utility outside of RQ6 (both within MD-WERP and externally) so they have been made publicly available.

The three datasets are publicly available through the CSIRO Data Access Portal (DAP).

- Crosbie R, Wang B, Kim S, Mateo C and Vaze J (2022) Surface water groundwater interactions of stream reaches in the Murray Darling Basin within the network of the AWRA R river systems model. v1. CSIRO. Data Collection. https://doi.org/10.25919/x453-3g36.
- Crosbie R, Wang B, Kim S, Mateo C and Vaze J (2022) A classification of flow continuity of stream reaches in the Murray Darling Basin within the network of the AWRA-R river systems model. v1. CSIRO. Data Collection. https://doi.org/10.25919/a3w2-j922.
- Crosbie R, Wang B, Kim S, Mateo C and Vaze J (2022) Regulated and unregulated stream reaches in the Murray Darling Basin within the network of the AWRA-R river systems model. v1. CSIRO. Data Collection. https://doi.org/10.25919/yf2k-my72.

The key findings have been drafted as a two-page factsheet (see next pages) and are currently being written as two journal papers. These findings will guide the algorithm development in Years 2 and 3 of the project.

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Changes in the flow regime of Murray-Darling Basin river reaches over the past few decades

This work is the result of defining a classification scheme for flow regulation, flow continuity and surface water – groundwater interactions for the river reaches within the Murray–Darling Basin (MDB) and applying this though time at ~500 gauges/reaches within the network modelled by the river system models for the MDB Flow continuity

The analysis of flow continuity was performed on a rolling 10-year basis from 1873 to 2020. The river reaches were classified as either:

- ***Perennial streams*** that have continuous flow for minimum of three out of five years (i.e. flow may cease in 2 out of 5 years)
- ***Ephemeral streams*** that have flow events that do not exceed continuous 30 days duration in above three out of five years (can have multiple short events per year)
- ***Intermittent streams*** are everything else not classified as perennial or ephemeral.

The results show that there has been a considerable increase in the proportion of intermittent streams in the MDB over recent decades, particularly in the northern Basin. Figure 1 shows a comparison between the 10-year periods 1991-2000 and 2011-2020, which shows the proportion of perennial streams in the northern Basin has fallen from 56% to 18% through this time, and 69% down to 61% in the southern Basin.

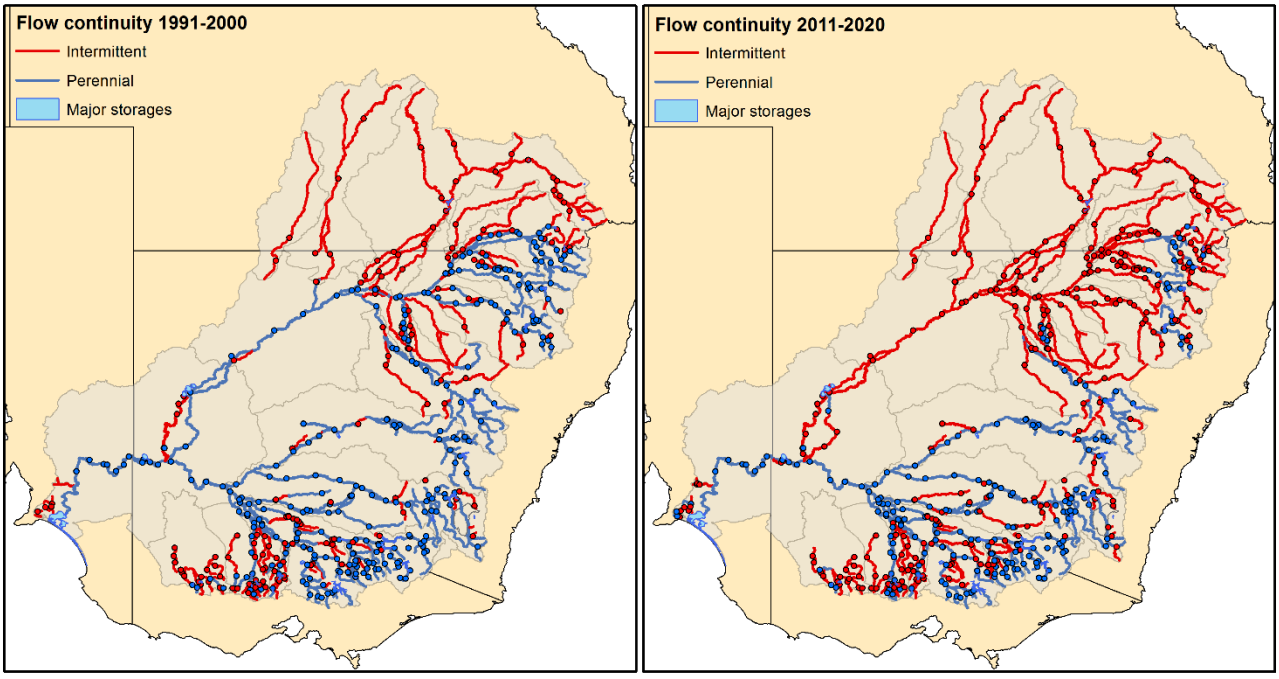

Figure 1 Comparison of the flow continuity classification for the 10-year periods 1991-2000 and 2011-2020. [No streams were classified as ephemeral.]

Surface water – groundwater interactions

River reaches were classified by the proportion of groundwater bores predicting losing conditions within a river reach annually from 1970 to 2019. At the bore scale, losing conditions were defined where groundwater level is more than 1 m below the stream stage and gaining conditions are where groundwater level is more than 1 m above the stream stage. (The ±1 m is to account for any accumulated errors in the calculation). Over the past 20 years, most of the reaches in the Northern Basin are mostly or always losing. In the Southern Basin, many reaches have an increasing trend in the proportion of bores predicting losing conditions (Figure 2).

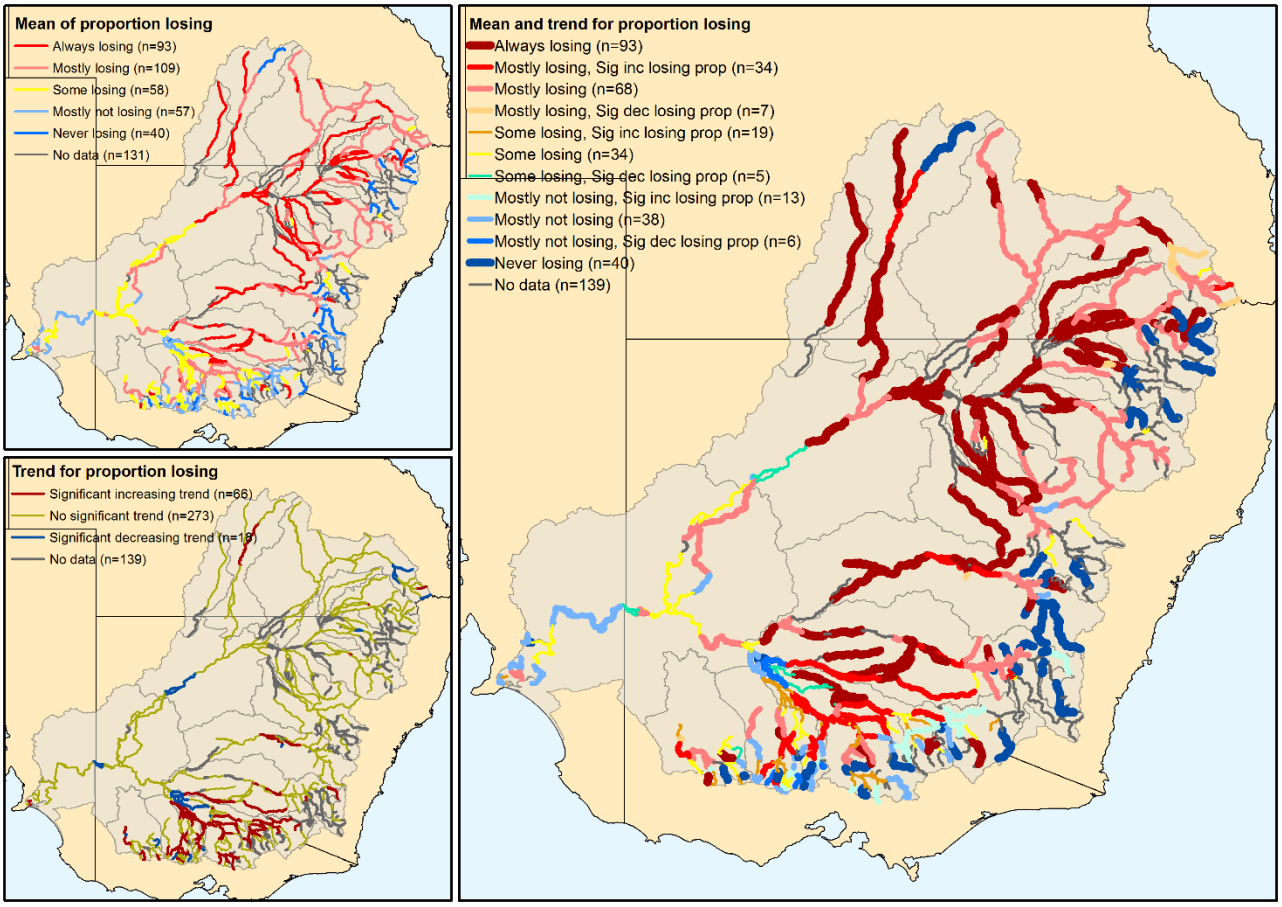

Figure 2 Summary of the proportion of bores predicting losing conditions over the period 2000-2019 showing the mean, the trend and a combined map of mean and trend.

Next steps

The analysis of changes in flow regime over the past few decades indicate that the flow regime is not static in time. Both the decreasing perenniality of flow and increasing losing conditions will lead to less reliable low flows that cannot be explained by flow regulation alone. These analyses demonstrate the hydrological processes missing from the current generation of river system models that will need to be overcome to allow better prediction of low flows into the future.

More information

The datasets used in this analysis are available from the CSIRO Data Access Portal:

- Flow regulation - https://doi.org/10.25919/yf2k-my72
- Flow connectivity - https://doi.org/10.25919/a3w2-j922
- Surface water – groundwater interactions - https://doi.org/10.25919/x453-3g36

Reference – Russell Crosbie, Jai Vaze, Shaun Kim, Cherry Mateo, Bill Wang, 2022. Changes in the flow regime of Murray-Darling Basin river reaches over the past few decades. Factsheet RQ6, Water and Environment Research Program (WERP).

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