An Australian Government Initiative

Funded through the Murray–Darling Water
and Environment Research Program

An assessment of impact of landscape farm dams and climate change on catchment runoff

This summary report presents research from a project undertaken as part of the Murray–Darling Water and Environment Research Program. The research was completed in 2023-2024 using remote sensing and the data obtained is informing discussions the MDBA is having with the States about ground truthing this research.

Farm dams are important sources of water across the Murray–Darling Basin. Our research has developed new datasets to understand how farm dams have changed over time and used these data to model the extent to which streamflow is modified by farm dams under current and future climates.

What are landscape farm dams and why are they important?

Private farm water storages are critical to securing supply of water for agricultural and domestic uses in areas where reticulated supply is unavailable. Agricultural use of water from farm water storages can include the provision of water for livestock and to support irrigation activities. Therefore, the existence of farm dams helps support regional economies and communities.

A range of different private farm water storages exist across the Murray–Darling Basin. Ring tanks and off-stream storages are filled by water pumped or diverted directly from rivers and streams under licence. Landscape farm dams intercept runoff from their local catchment that would otherwise flow into the Basin's rivers and streams. Therefore, to fully understand the water available within the Murray–Darling Basin, insight is needed into the amount of water intercepted by landscape farm dams.

Understanding how the number of landscape farm dams has changed over time

Our research has used the most recent estimates of the number of landscape farm dams and analysis of remote sensing imagery to estimate how the number and volume of farm dams in the Murray–Darling Basin has increased over time (Figures 1 & 2). Our data set shows that the highest densities of farm dams are in the south-eastern parts of the Murray–Darling Basin. Since 1990, the total volume that could be held in landscape farm dams is estimated to have grown from 500 GL to 2500 GL. The growth in the volume of farm dams slowed considerably in recent years.

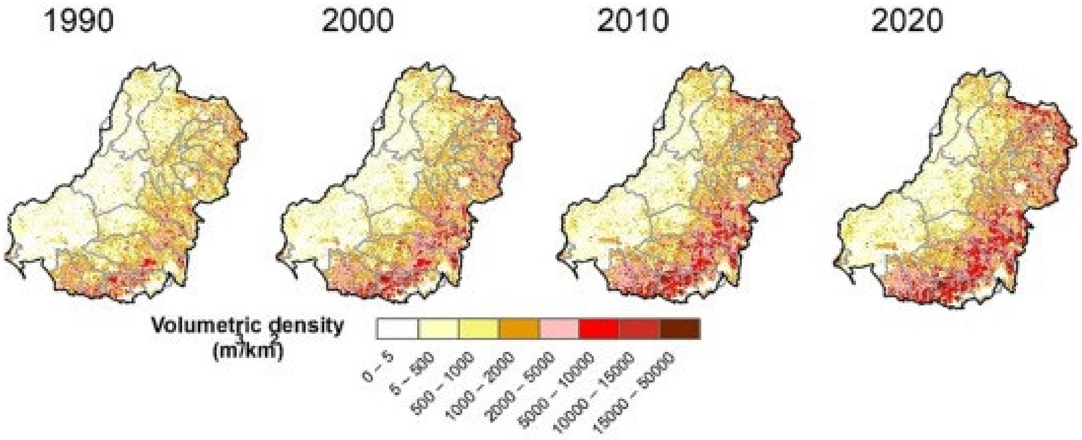

Figure 1 Spatial distribution of landscape farm dam density in the Murray–Darling Basin

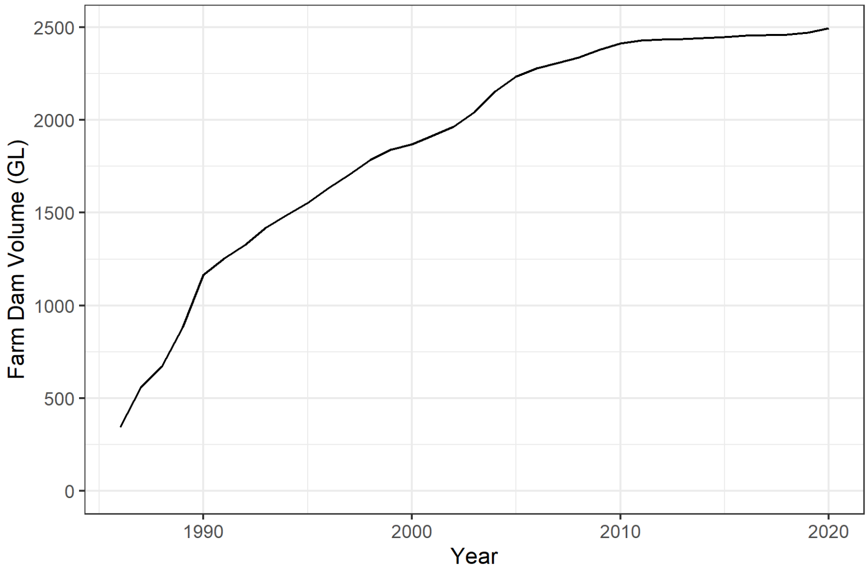

Figure 2 Total volume of landscape farm dam storage in the Murray–Darling Basin

Landscape farm dam impacts on streamflow and runoff

Hydrological models that describe the transformation of rainfall into streamflow typically do not explicitly consider the impacts of landscape farm dams. Our research has used a hydrological model that does describe the impact of farm dams, and the new data describing how farm dams have changed over time, to investigate their impacts under the historical and future climate. Modelling was undertaken for 133 catchments (Figure 3) across the Murray–Darling Basin that have high quality streamflow and rainfall datasets.

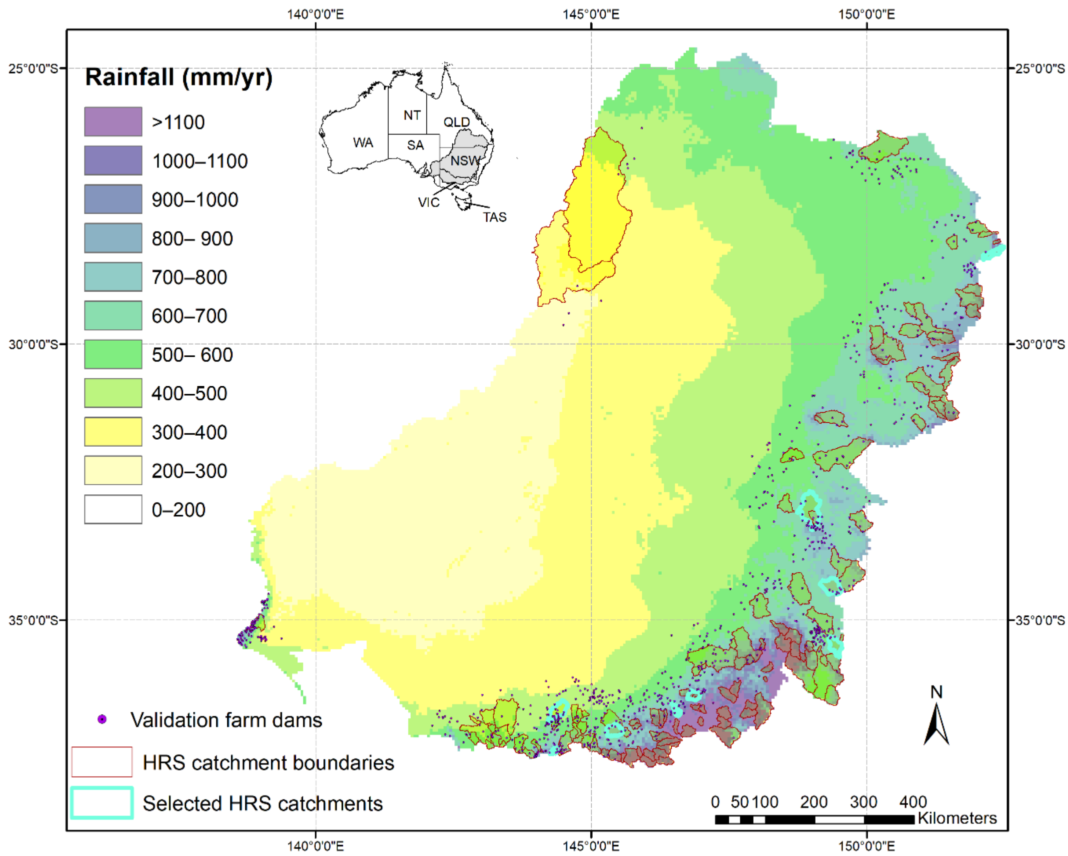

Figure 3 Location of the 133 catchments used to investigate the impacts of landscape farm dams on catchment runoff (shown with red and blue outlines)

Using the new farm data improved the ability of hydrological models to simulate observed streamflow, compared to traditional approaches that do not consider farm dams. Our results show that the impact of farm dams is strongly related to their density in a catchment (Figure 4) and to a lesser extent how much dam water is used each year. Historically, over the 133 catchments in this study this equates to an average reduction of approximately 13%. This increases by 2% for every additional ML/km^2 of farm dam density in the catchment.

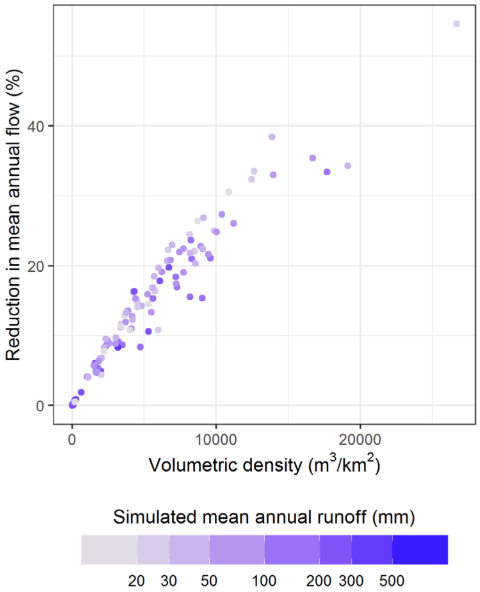

Figure 4 Relationship between landscape farm dam density and associated reduction in the historical mean annual flow for 133 catchments in the Murray-Darling Basin

Climate change is expected to result in higher temperatures and lower rainfall across the Murray–Darling Basin. We modelled the sensitivity of streamflow to rainfall changes for the 133 catchments, finding that the mean annual runoff will reduce by approximately 33% for a 10% reduction in rainfall. Our estimates of impacts of climate change are slightly larger than previous estimates as a result of explicitly modelling the impacts of landscape farm dams. Our analysis indicates that, in a drier future climate, inflows into farm dams will be lower while the use of water from farm dams is likely to be unchanged or increase. This means that, in a drier future climate, farm dams are likely to be empty for longer periods and intercept a greater proportion of catchment runoff.

Implications

Our analysis has compiled a new dataset that shows the volume of landscape farm dams has changed considerably over the last 40 years. When combined with hydrological models that explicitly represent landscape farm dams, this new dataset can improve our ability to simulate observed streamflow and understand the historical impact of farm dams. Explicitly accounting for landscape farm dams in hydrological modelling leads to larger declines in future runoff projections than when more traditional modelling approaches are used. Therefore, representing the effect of landscape farm dams in modelling is critical when assessing future water resource availability in the Murray–Darling Basin.

Each of the Basin states have legislative controls over the construction of new private water storages. These controls mean that new farm dam developments may be required to be licensed as a part of water accounting and allocation frameworks. Therefore, additional water extracted by landscape farm dams may not necessarily lead to an increase in the total volume of water extracted in the Basin, but rather result in a redistribution of location of extractions.

As Australia's national science agency and innovation catalyst, CSIRO is solving the greatest challenges through innovative science and technology

CSIRO. Unlocking a better future for everyone.

Contact us | 1300 363 400 | csiro.au/contact | csiro.au

For more information on the Murray–Darling Water and Environment Research Program (MD-WERP) please visit: Murray–Darling Water and Environment Research Program | Murray–Darling Basin Authority (mdba.gov.au)

A full list of journal articles published through the MD-WERP program, including those referenced in this fact sheet can be found at: Peer-reviewed journal articles | Murray–Darling Basin Authority (mdba.gov.au)