The Murray-Darling Basin is home to about two million people across four states - Queensland, New South Wales, Victoria and South Australia.

The Basin covers more than one million square kilometres, generates more than 40 per cent of the gross value of Australian agricultural production, and includes natural features and places of high environmental and cultural value.

However, the south-eastern Murray-Darling Basin, where most of the water runoff is generated, is in a prolonged drought. Total water inflows into the Murray River in the past 12 years have been about half the long-term average. Research has revealed that water resource development has caused major changes to the water flow regimes. Total flow at the Murray mouth has been reduced by 61 per cent. Research has shown the region’s climate is changing.

In 2004 Australia embarked on an ambitious program of water reforms. Recent steps in the reform include the establishment of the Murray–Darling Basin Authority (MDBA) and the preparation of the Murray-Darling Basin Plan, which will provide a new way for managing water in the Basin by setting environmentally sustainable limits on water extractions.

Impartial, rigorous and peer-reviewed research has a critical role in supporting these water reforms.

Science has provided information on a range of possible future scenarios which decision makers can use to best evaluate the risks associated with water sharing arrangements.

CSIRO works with federal and state governments, industries and communities to help water managers and policy makers make informed decisions to ensure that our valuable water resources are sustainably managed in the future.
River modelling

Water managers use river water modelling software to understand the impacts of alternative water diversions and other water management actions on the reliability of water supplies for all water users.

River modelling uses computer-based programs to track water in the river and helps make inferences on the quantity of the water resources available for river catchments and for the Basin as a whole.

These tools can help all river users, including irrigators, urban water authorities, and environmental water managers. CSIRO’s expertise in developing and linking these models has provided important support for integrated surface water planning across the Basin.

The modelling of river flows and water availability for the development of the MDBA’s Basin Plan has been a collaborative effort of many groups. The modelling capability that underpins the Plan is derived from models and data provided by the Basin States, the MDBA and CSIRO.

CSIRO has linked these models to enable the MDBA to evaluate alternative scenarios in a consistent fashion and has customised them to allow the inclusion of environmental water demands, as specified by the MDBA.

CSIRO is also providing the MDBA with an assessment how ‘fit for purpose’ the models are for setting environmentally sustainable diversion limits.

For more information see Factsheet 2 in this suite.

Environmental information

Studies by CSIRO and other research groups have shown the riverine and floodplain ecology of the Murray-Darling Basin is stressed through lack of water flows.

CSIRO has undertaken environmental research across the Basin for many decades. This has included investigating the functionality of floodplain ecosystems, understanding how ecosystems respond to changing water availability and tools to optimise water management.

The MDBA, using work from CSIRO and others, is identifying key environmental assets and ecosystem functions that must be protected, determining environmental water requirements of these assets and using these to set environmentally sustainable diversion limits.

CSIRO has helped develop the methods for including environmental water demands into river models to allow a better understanding of the impact of these demands on other water users.

For more information see Factsheet 3 in this suite.

Socio-economic analyses

Changes in surface and groundwater use across the Basin are expected to occur following the introduction of the Basin Plan.

The Plan will set sustainable diversion limits for each water resource planning area, which will include consideration of socio-economic impacts. There has been much speculation about these new limits changing the balance between consumptive users and the environment.

To help communities cope with the challenge of reduced future water availability, CSIRO has been undertaking research to support the adaptation of irrigation communities in a water scarce environment.

CSIRO’s multi-disciplinary teams have developed tools and information which can help optimise the social and economic impacts of a changing water regime.

CSIRO is also examining the economic efficiency of current water recovery strategies through economic studies, including comparing alternative incentive policies to acquire water for environmental flows.

For more information see Factsheet 4 in this suite.
Science from CSIRO and others is helping to inform the Murray-Darling Basin Authority’s development of a Basin Plan to provide a new way to manage water resources in the Basin.

**Future climate**

CSIRO’s climate and water scientists are involved in a range of research partnerships investigating the impact of a changing climate on future water resources of in the Murray-Darling Basin.

Research on the characterisation and attribution of climate in south-eastern Australia is leading to improved assessments of future water availability to guide water planning and management.

Our research is primarily occurring through the South Eastern Australian Climate Initiative (SEACI) in collaboration with the MDBA, federal Department of Climate Change, Bureau of Meteorology and Victorian Department of Sustainability and Environment.

Based on this work, CSIRO has provided the MDBA with advice on defining climate scenarios for use in its modelling to guide the development of the Basin Plan.

*For more information see Factsheet 7 in this suite.*

**Groundwater**

CSIRO is conducting groundwater research and analyses in the Murray-Darling Basin to support the future management of groundwater in the Basin.

To support the Basin Plan, CSIRO and Sinclair Knight Merz (SKM) undertook groundwater assessments covering all of the major aquifers in the Basin. This work drew on data collected by States and involved:

- setting of planning boundaries for groundwater;
- developing a rapid risk assessment method for the whole of the Basin, to evaluate risks such as groundwater salinity, groundwater ecological assets, baseflow impacts, and impacts of groundwater resource itself for a given ‘environmentally-sustainable level of take’;
- numerical modelling for priority groundwater areas to enable refined risk assessment.

*For more information see Factsheet 6 in this suite.*

**Indigenous perspectives**

CSIRO has undertaken a scoping study on the potential impacts of changes in water availability on Indigenous communities of the Basin.

This research provides the MDBA with information to make decisions about water sharing to meet the Plan’s requirement to consider social, cultural, Indigenous and other public benefits.

CSIRO has provided a review and synthesis of the current knowledge of Indigenous cultural, social and economic values of water. This review complements other social and economic contextual reports designed to optimise the outcomes of the Basin Plan.

*For more information see Factsheet 5 in this suite.*
CSIRO: providing the science to underpin future water resource planning across the Murray-Darling Basin

CSIRO has a long history of undertaking important research in the Murray-Darling Basin to gain a greater understanding of the region’s ecology and support improved water management. Ongoing work by CSIRO will continue to provide the science to underpin the implementation of the Basin Plan.

Basin water assessments
In 2008, the CSIRO Murray-Darling Basin Sustainable Yields Project provided the world’s first rigorous assessment of the potential impacts of climate change on surface water and groundwater availability across this major Australian river basin in south-eastern Australia. The $12 million project, led by the Water for a Healthy Country Flagship, involved assessments of water availability in light of changes in climate and development to 2030.

The project involved generating a massive data set to drive a computer-based ‘supermodel’ of the Basin’s water resources, created by linking more than 40 existing and new models of surface and groundwater flows and extractions within the Basin’s individual regions.

This was the first attempt in the Basin to dynamically link groundwater balances with surface water availability, calculating flows through and between the system’s rivers, and groundwater-surface water interactions under current water sharing arrangements, before estimating the water available under each scenario.

This research is providing governments and industry with an unprecedented level of water information to guide future resource planning, management and investment.

Ecological information
In May 2010 CSIRO released research investigating the relationships between watering strategies and the health of the Basin’s plants and fish.

The Ecological Outcomes of Flow Regimes in the Murray-Darling Basin report provides data to help water managers improve and justify delivery of environmental water, including to significant wetlands such as delivery to key sites, including significant wetlands such as the Macquarie Marshes, Gwydir Wetlands and Narran Lakes. It builds on CSIRO’s River Murray Floodplain Inundation Model, a decision support tool for environmental flow management.

Next generation of water management tools
CSIRO researchers are working through the eWater Cooperative Research Centre to produce the next generation of river system modelling tools to better manage Australia’s rivers.

Researchers are developing a new modelling suite that provides a flexible way of modelling the complex water management rules that share water resources between multiple users.

The tool takes account of rules in each river system to track and manage differently-owned parcels of water as they are stored and moved through river systems. It provides a way to track environmental water separately to water used by communities and industries, and allows water managers to explore a range of new river management options.

The $18 million two-year project is supported by the federal government (including the MDBA) and industry partners.

Want to know more?

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CSIRO and the Flagships program
Australia is founding its future on science and innovation. Its national science agency, CSIRO, is a powerhouse of ideas, technologies and skills. CSIRO initiated the National Research Flagships to address Australia’s major research challenges and opportunities. They apply large scale, long term, multidisciplinary science and aim for widespread adoption of solutions.