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CSIRO

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Committee Secretary
House of Representatives Standing Committee on Regional Australia
PO Box 6021
Parliament House
Canberra ACT 2600

Dear Ms Leyne

Re: CSIRO's submission to the inquiry into the impact of the Murray Darling Basin Plan in Regional Australia

We thank you for the opportunity to submit comments on the above inquiry. Our response to the Terms of Reference is attached. This written submission is provided in addition to information presented by CSIRO at a private briefing to the Regional Australia Committee on 24 November 2010.

We provide our comments on the basis of CSIRO's recent research in agricultural science, water and the environment of the Murray Darling Basin. We trust that this information will assist the Committee in their deliberations.

Please note that we have lodged a similar submission to the Senate Standing Committee on Rural Affairs and Transport in response to their inquiry into the management of the Murray Darling Basin.

For further enquiries, please contact Sandra Oliver of CSIRO's Ministerial and Parliamentary Liaison Office or my Executive Officer Jenny Baxter in the first instance.

Yours sincerely

Dr Andrew Johnson
CSIRO Group Executive - Environment

CSIRO Submission 10/401

Inquiry into the impact of the Murray-Darling Basin Plan in Regional Australia

House Standing Committee on Regional Australia

December 2010

Enquiries should be addressed to:

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Summary

- CSIRO conducts research in the Murray-Darling Basin to understand the region's ecology and support improved water management for the environment and agriculture.
- CSIRO and other research groups have provided scientific data and modelling tools to the Murray-Darling Basin Authority to enable the development of the Basin Plan by the Authority. How, and if, this information was used by the MDBA was at the discretion of the Authority.
- It is CSIRO's view that:
    - The future management of the Basin requires careful consideration of the complex range of social and economic values associated with water, the environment and agriculture;
    - The full range of social and economic values associated with water are yet to be identified; and
    - Comprehensive assessments of potential reform options are needed to fully identify and understand the likely impacts of different future scenarios for the Basin.
- Here, we discuss ways to consider the complex questions posed by the terms of reference for this Inquiry, particularly regarding opportunities to assess the benefits that the Basin Plan could potentially deliver for Australia.
- We also provide a number of case studies that illustrate how science is playing a role in developing and implementing new technologies to assist the agricultural industry to become more water efficient.

Introduction

The Murray-Darling Basin Authority (MDBA) released the Guide to the Draft Basin Plan on 8 October 2010. A final Plan, due by July 2011, will make recommendations to set limits on the quantities of surface water and groundwater that can be taken from the Basin water resources, and will be used as a basis for Parliamentary decisions to define legally enforceable water limits. The Plan will provide for the integrated and sustainable management of water resources in the Murray-Darling Basin (MDB) and will provide a transformational basis for managing water in the Basin.

CSIRO and other research groups provided underlying research, models and data to enable the development of the Basin Plan. CSIRO undertook work to provide methods, systems and some input data, such as climate scaling factors and groundwater assessments, to the MDBA for the development of sustainable diversion limits (SDLs) for the Plan. How, and if, this information was used by the MDBA was at the discretion of the Authority.

CSIRO has been working in the MDB for over a decade. A major recent research project was the MDB Sustainable Yields Project, which in 2008 provided a rigorous assessment of the potential impacts of development and climate change on surface water and groundwater availability across the Basin. CSIRO's report 'Water Availability in the Murray-Darling Basin' outlines the assessments for 18 regions that comprise the Basin that were undertaken as part of the Sustainable Yields Project. The report is available at http://www.csiro.au/resources/WaterAvailabilityInMurray-DarlingBasinMDBSY.html

Further information on CSIRO's current research in the MDB is available at http://www.csiro.au/science/MDBscience.html

It is CSIRO's view that the future management of the MDB requires careful consideration of the complex range of social and economic values associated with water, the environment and agriculture. Comprehensive assessments of potential reform options are needed to fully identify and understand the likely impacts of different future scenarios for the Basin. We emphasise opportunities to assess the net benefits that the Basin Plan could be expected to deliver for Australia if it is implemented optimally.

Our submission is based on a combination of our past and current research in the MDB as well as our knowledge of scientific literature and other research being conducted in this domain. We address the terms of reference for which CSIRO has relevant research expertise and results to provide input, and in doing so, we suggest ways to consider the complex questions posed by the terms of reference. We have not commented on community views, as sought by the Committee, given CSIRO's role in providing impartial advice rather than advocating for or on behalf of communities or industries.

1) The direct and indirect impact of the Proposed Basin Plan on regional communities, including agricultural industries, local business activity and community wellbeing;

The future management of the MDB needs to be guided by a comprehensive assessment of the total net benefits to Australia of proposed reform options. This should be compared to a comprehensive assessment of the expected outcomes of not proceeding with reforms – that is, the “do nothing” scenario.

These assessments could be in economic terms but should consider that some of the benefits from improved environmental condition are unlikely to fully accrue for decades – that is, the issue of inter-generational equity that is paramount in achieving environmental sustainable resource use. These assessments need to recognise that some of the benefits – existence values, biodiversity and cultural values – are challenging to consider in an economic framework but feasible.

The full range of social and economic values associated with water are yet to be identified. While these start with the benefits flowing from agricultural and industrial uses of water, they extend to a wider set of social benefits. Social surveys, using well-tested socio-psychological methods, can elicit information on social values that can help guide policy, reduce zones of conflict and identify how social loss can be mitigated and/or compensated.

Any meaningful assessment has to begin with clear recognition of the costs of not implementing the Plan. This involves assessing the medium and longer-term consequences of no reform, which should consider the issue of changing values through time and the issues associated with choice of discount rate in aggregate cost-benefit analyses. Important outcomes to consider include:

- Environmental outcomes and associated economic costs
    - Costs of water quality degradation;
    - Costs involved with loss of ecosystem goods/services/values such as safe drinking water, tourism and recreational opportunities;
    - Costs associated with restoration/remediation activities like pipelines, treatment plants and alternative water supplies.

- Agricultural outcomes and their dependence on Basin environmental health
  - Can production be sustained or would it fall in some instances due to factors like increasing salinity or less reliable irrigation allocations?
  - What investments would be required to sustain irrigation production?

- Socio-economic impacts for regional communities
  - These will vary in time and space and from sector to sector geographically within the Basin. This complexity needs to be understood to assist policy setting and decision-making.

Other external drivers that determine baseline trends in the “do nothing” scenario include:

- Climate change scenarios;
- Economic trajectory of agricultural and other sectors;
- Social trajectory at local and regional scales (using accepted metrics of social change: employment, income, demography, identity, etc.);
- Continuing regional economy diversification;
- Opportunity cost of no reform at regional and local scales;
- International commodity prices and global food demand;
- National food demand; and
- Australia’s contribution to the global food system.

In considering the impacts on productivity and viability of the Basin it is important to take a whole of system approach. As a starting point, it is important to identify to whom do the benefits of reform accrue, and how do these relate to ‘the national interest’ as required of Basin Plan reforms. Homogenised views of aggregate benefit will not assist policy making and structural adjustment. The full range of values associated with water across society need to be considered to give policy-relevant assessments.

Assessment of the benefits of implementing the alterative scenarios in the proposed Basin Plan could include:

- Social survey to elicit information on social values;
- Determining willingness to pay for environmental quality in the MDB through, for example, Choice Modelling. This could be innovatively extended to ‘willingness to accept compensation’ for loss of environmental benefit using the same methods;

- Valuation of environmental benefits/outcomes;
- Considering how to best structure management of environmental water holdings to realise greatest benefit and how the operation of the environmental water holder impacts other parties.

For specific MDB regional socio-economic consequences it is important to ensure considerations are not just assessing vulnerability, but assessing how successful adjustment can be facilitated, including the consideration of:

- Opportunities to reduce flow-on economic effects, especially to employment, in agricultural services sector and regional economies that are highly dependent on irrigation;
- Opportunities to capitalise on changing demographics in the MDB such as emerging industries, or migration; and
- Empowering local communities, including indigenous communities, through stewardship, skills development, and regional planning support.

2) Options for water-saving measures or water return on a region-by-region basis with consideration given to an analysis of actual usage versus licence entitlement over the preceding fifteen years;

Improving agricultural outcomes in a water constrained context is not a simple assessment of the impacts of reduced water use, but rather how to maximise economic outcomes from reduced water availability, through consideration of:

- Improved water use efficiency of crops, pastures and trees (better varieties, better technologies and better practices at the field scale) expressed in terms of harvested product per megalitres of irrigation used;
- Improved water use efficiency at the farm scale through dynamic changes in the activity mix (crop/pasture choice, water application choices) and strategic changes in the irrigation farm business structure (expressed in dollars per megalitres at the whole farm enterprise scale);
- Opportunities to dynamically link on-farm irrigation strategies with environmental water use strategies and make use of seasonal variability for win-win outcomes;
- Improved delivery efficiency of water through on- and off-farm infrastructure, by considering what investments by government and irrigators make economic sense;
- Opportunities and costs associated with transforming the irrigation sector to a different suite of agricultural activities (including markets, infrastructure) and a different geographic footprint of these activities; and

- Spatial optimisation of land use for environmental, production and carbon sequestration benefits: basin scale and regional scale (expressed in dollar per megalitres or employment per megalitres or some other socio-economic measure at region or basin scale).

The release of the Guide to the Proposed Basin Plan by the MDBA, which discusses the possibility of significant reductions in water diversions for irrigation, has placed a focus on the need to identify opportunities to best use limited irrigation water supplies on-farm. However while The Guide acknowledges that such efficiencies might be sought, there is little direction provided to address this issue.

There are numerous potential strategies an individual farmer might consider when determining how best to use a limited supply of irrigation water on-farm. Options such as full- versus partial-irrigation; changes to agronomic practices such as rotations, residue management, crop species and varieties; changes to proportional sharing of water between winter and summer crops; as well as more transformational changes such as investing in new irrigation technology, or disposing of water on the free market and conducting their entire farming operation for the season (or permanently) as a rain-fed enterprise.

All these aspects need to be considered in the context of a warming climate with increasing atmospheric CO_2 concentrations. The comparison between these options is complex, as it depends on a range of biophysical, economic, environmental and social variables, e.g. degree of change in water allocations, farm size, soil types, climate, relative prices (commodity, inputs, and water), and farmer preferences.

3) The role of governments, the agricultural industry and the research sector in developing and delivering infrastructure and technologies aimed at supporting water efficiency within the Murray-Darling Basin.

CSIRO and other research groups have provided research, models and data to support the MDBA's development of a Basin Plan. How, and if, this information was used by the MDBA was at the discretion of the Authority. While research can inform decision making with respect to water efficiency, it is the role of governments to develop regulatory frameworks and some infrastructure, and the role of industry to adapt and respond as appropriate in terms of application of technologies. CSIRO's role in this domain is to provide underpinning research findings, information and scenarios to assist decision makers.

In 2008, CSIRO completed a series of assessments of the current and future water availability in the MDB. These assessments were conducted as part of CSIRO's 'Murray-Darling Basin Sustainable Yields Project', which provided the world's first rigorous assessment of the potential impacts of development and climate change on surface water and groundwater availability across the Basin.

CSIRO is currently conducting research to support a sustainable water future for the MDB across a range of areas to:

- help water managers optimise delivery of environmental water;
- support future management of groundwater in the Basin;
- support the adaptation of irrigation communities to changing water availability;
- investigate the potential impacts of changes in water availability on Indigenous communities of the Basin; and
- better understand the impact of a changing climate on future water resources in the Basin.

CSIRO and other research agencies have a long history of research and development focused on supporting farming practice to improve crop yields in the face of constrained water inputs. Work has focused on both dryland and irrigated farming systems. The application of these systems is becoming increasingly relevant given a much more dynamic water use environment involving a mix of full or partial irrigation and dryland activities. These strategies need to be integrated in space and time to achieve the greatest possible production and profitability from a limited (and increasingly valuable) water resource.

The following case studies illustrate CSIRO's recent work to support water efficiency within the agricultural sector:

New varieties with improved water efficiency:

- CSIRO is working to develop new crop varieties with improved water use efficiency traits in wheat, cotton, and grapes. For instance, two wheat varieties released by CSIRO, Drysdale and Rees, exhibit a trait for enhanced water use efficiency.

Improved water efficiency through improved farming practices:

- CSIRO's farming practices work has supported gains in water use efficiency associated with sowing time, stubble retention and minimum tillage, fertilisation practices, seasonal climate forecasting, crop rotations and farming systems design issues to optimise water use within acceptable risk parameters.
- CSIRO leads a national 'Water Use Efficiency Program' for the grains industry with funding support from the Grains Research and Development Corporation (GRDC). This effort supports partnerships with 17 regional grower groups and

state agencies in all Australian grain growing regions and seeks to raise water use efficiency on Australian grain farms by 10 percent over the next 5 years. More details of this initiative are available at: http://www.csiro.au/science/Water-Use-Efficiency.html and http://www.grdc.com.au/director/events/groundcover?item_id=A3BCD243B56150EEA147870C422298AE&pageNumber=2

Maximising irrigation potential:

- CSIRO has developed a quantitative approach that supports planning to maximise Australia's irrigation potential for a future with less water and to improve local environments. Using spatial analysis, researchers have devised a tool to help planners identify which parts of an irrigation district would provide the best public investment in future irrigation infrastructure and which parts, if retired, would lead to avoidance of high salinity impacts and degradation of ecologically-valuable water courses. A pilot study was conducted in partnership with Goulburn-Murray Water to evaluate opportunities to reconfigure land, water and infrastructure in the Kerang Irrigation district in Victoria. The study identified and estimated costs and benefits of a range of land and water management options under changed water allocation regimes.
- Other CSIRO research has reinforced the importance of considering the whole-farm system and its connection with the broader catchment environment when assessing irrigated agriculture. The sustainability of irrigation systems hinges on the ability to remove salts from the root zone while retaining nutrients and agrochemicals within the root zone, and for the groundwater system to carry excess salt and water away, and the ability of the receiving ecosystems to tolerate the increased solute load. In many cases it is this reality, not the availability of water itself, which sets the limit to irrigation activity.

Water use efficiency in irrigated systems:

- CSIRO's water use efficiency research effort within irrigated systems has focused on cotton and grapes with some recent enhanced activity directed towards irrigated grains and whole of farm design and optimisation.

Cotton:

- Water use efficiency of irrigated cotton has increased substantially in the past two decades and far exceeds the water use efficiency of all other major cotton producing countries. Major drivers include improved yield levels being achieved with CSIRO's new variety program, in some cases doubling water use efficiency from one to two bales of cotton per megalitre. Improved water management is attributed to better soil management and improved irrigation scheduling and on-farm design.

- A major Cotton Catchment Communities Cooperative Research Centre (CRC) project is investigating the impact of different management strategies on the yield and quality of irrigated cotton. This data will be incorporated into existing models, which can then help irrigators and their consultants to make water management decisions that maximise crop profitability where furrow, overhead or drip irrigation systems are used.

Grapes:

- Development of new grape rootstocks and work around partial root-zone drying and deficit irrigation has provided the industry with clear ways of reducing water applications by 30-50 percent. Although this can reduce yield, the quality of grapes (colour, tannins, etc.) is much better and typically receives a higher price point.
- A CSIRO study has collected eight years of irrigation and salt data from 100 grape growers in the Angas Bremer region of South Australia. These growers are among the last irrigators drawing water from the Murray system and hence experience the accumulated impacts of all upstream users. In an attempt to maximise the quality of the wine grapes, they use very small amounts of water, using data on root zone water, root zone salt and changes in groundwater to develop their irrigation schedule.

Cereals:

- Recent work on irrigation options at a whole of farm level in the Riverina region of south-eastern Australia demonstrate the potential to reoptimise broadacre irrigated farming systems based on low security water in the face of reduced irrigation water availability in ways that can maintain or even grow farm profitability.
- A range of whole-farm strategies to using reduced irrigation allocations have been explored together with participating farmers using the APSIM farming systems model. Strategies such as retaining crop residues (previously uncommon in the region) and spreading available water further by partial cereal crop irrigation (rather than full irrigation) allowing planting of more area, has shown significant potential to increase whole-of-farm water use efficiency.
- Two years of experiments at the Yanco Agricultural Institute, NSW, testing delayed permanent water in rice-cropping have indicated potential water use efficiency increases for rice production in the vicinity of 10-15 percent. More detail is available at: http://www.nccarf.edu.au/conference2010/wp-content/uploads/Donald-Gaydon.pdf

Grains in the northern MDB:

- Wheat production in some irrigation districts is limited by a disorder known as 'lodging', where the weight of the developing grain causes the plants to overbalance and fall flat on the ground. In 2008, lodging caused yield losses of up to 3-4 tonnes per hectare on many irrigated farms, and also increased harvesting costs, leading to drastic reductions in water use efficiency (of up to 50 percent). Recent CSIRO research has shown that irrigated growers in the northern region can change their agronomic management to reduce their lodging risk, and improve water use efficiency.

Sorghum in the Darling Downs in Queensland:

- Partial irrigation of stress tolerant crops such as grain sorghum has the potential to improve farm water use efficiency, by applying irrigation water across a larger area to better utilise stored soil water and in-season rainfall. From 2007-2010, irrigation scheduling trials were conducted on the eastern Darling Downs in co-operation with Pacific Seeds to determine the level of partial irrigation application in grain sorghum that gives the highest economic return. The results demonstrated that growing a larger area of pre-watered sorghum combined with a smaller area of dryland sorghum was more profitable (in the long term) than growing a small area of fully irrigated sorghum with a larger area of dryland sorghum.

Using technology to boost whole of farm system decision making:

- While rice and cotton have traditionally provided highest returns to irrigation farms, CSIRO research supported by the GRDC is showing significant potential for inclusion of irrigated grains in the farming system in response to years of reduced irrigation water availability. These changes in turn are stimulating new agronomic research to adapt the farming systems to the new constraints and opportunities. The APSIM and APSFarm models developed by CSIRO and partners are proving to be invaluable tools to enable the case study farmers to explore the re-optimisation of their farming system and farm business in the face of changed irrigation water availability. Further details are available at: http://www.grdc.com.au/director/events/groundcover?item_id=A3BB3CD2FE639E8F76F924680EB0E1BE&article_id=C17A49DCB46A02E185953AC72C8738B4
- The IrriSATSMS system developed by CSIRO scientists as part of the Irrigation Futures CRC is an example of technology development that offers improvements in irrigation water use efficiency. IrriSATSMS combines satellite data on crop development with local weather data to provide irrigation farmers with daily crop water requirements that are delivered over farmer’s mobile phones. The system is currently being evaluated in different irrigation regions. This approach has two main aims, firstly to provide growers with an easy to use and understandable daily irrigation water management service and secondly to provide a benchmarking and auditing mechanism to be used by growers and water providers. Further information is available at: http://www.irrigationfutures.org.au/news.asp?catID=8&ID=988

Research gaps and recommendations

As demonstrated by the above case studies, science can support farmers in the MDB to make smarter decisions on-farm through technological advances that integrate biophysical, economic and agronomic information; and through understanding whole farm systems optimisation, enabling greater optimisation of inputs including water.

CSIRO believes significant opportunities still exist to substantially improve yields and financial returns from irrigation water usage in the MDB.

The development of formal water markets and greater market values associated with irrigation water resources are likely to be a continuing stimulus for enhanced irrigation water use efficiency. Subject to budgetary constraints, CSIRO aims to maintain and grow where possible our research effort directed at innovation in on-farm water use efficiency in the MDB. We see this being best achieved through strengthened research and development partnerships with innovative farmers and regional irrigation industries covering issues of technology development/adoption (including plant breeding), irrigated farming systems optimisation and in some cases knowledge-based support for regional specific planning and industry restructuring.

CSIRO is keen to strengthen research and development partnerships and is currently exploring what interest exists in the MDBA and other institutions (such as the rural research and development corporations) for a program of co-investment in knowledge and research services directed towards further improving on-farm water use efficiency while meeting environmental objectives across the Basin.

Specific research needs or opportunities

At the plant / paddock scale

There are ongoing opportunities to develop new varieties (e.g. cotton or grains adapted to the evolving farming systems), new management practices, and/or irrigation technologies, and to support the adoption of such innovations through knowledge sharing and risk management support tools. The rural research and development corporations and the CRC program have a history of supporting such work, albeit within very constrained total funding envelopes.

At the farm scale

There is a need to use allocation forecasts to support decision making. Much of the increased risk incurred by planting larger crop areas under reduced water allocations may potentially be mitigated through the use of effective allocation forecasts. In other words, in years forecast to have higher allocations farmers could take on greater risk in terms of planted crop areas; in poor forecast years, more risk averse. The Bureau of Meteorology have recently released a new stream-flow forecasting product, which demonstrates high forecast skill in critical times of the year for Riverina irrigators. A new project is currently under development between CSIRO, the Queensland Government Department of Employment, Economic Development, and Innovation, and the Bureau of Meteorology to assess the potential value of this new product to irrigation farmers.

At the catchment scale

There is a need for better linking on-farm practice with larger scale responses. This will involve strategies to manage irrigation drainage (surface and deep drainage) and disposal of drainage waters (that may contain high levels of salt, nutrients and/or agrochemicals). In irrigated systems there is a need to set and meet water table targets, in terms of both quantity (water table level) and groundwater quality.

At Industry or Basin scale

There are considerable opportunities to use science based planning and optimisation approaches to minimize negative impacts of water diversion reductions on food production, farm profitability and regional economic outcomes while maximising the environmental benefits that accrue from diversion of water to enhance the ecological function of the MDB system. These optimisation opportunities exist both spatially (within farms, between farms in an irrigation district and between districts or catchments across the Basin) and temporally (through counter cyclical direction of water to the environment and to irrigation farming in ways that enhance the overall benefits that accrue in both domains. Progress in establishing functioning water markets over recent years facilitates enhanced opportunities to optimise water use in both space and time.