Feasibility study of managed aquifer recharge for improved water productivity for Australian cotton production

Introduction

With a reduction in water (due to a changing climate and water reform), irrigated industries in Australia are under pressure to do more with the available water. The cotton industry has already made many adaptations, including increasing water use efficiencies, in order to adapt to the water reduction. However, with an uncertain future climate and the potential for further policy changes to water entitlements, water security has become a key limiting factor in the profitability of the industry.

Managed Aquifer Recharge (MAR) is the purposeful recharge of aquifers using surplus surface water, which can be extracted when required. It has shown great potential to increase water security overseas, for example in increasing options for water supply security in the USA, and interest in MAR is continuing to grow in Australia. MAR systems offer an option to store surplus surface water underground and therefore avoid evaporative losses that can be experienced when storing water above ground. This supplementary water supply can even out the peaks and troughs, leading to greater security and certainty in irrigated cropping. However, MAR systems can be expensive to implement and are also subject to technical and financial uncertainties such as aquifer recharge and recovery rates and costs. Therefore, there is a need for guidance as to when MAR might be a feasible option.

This project will investigate the potential to implement MAR at a regional scale in key irrigated cotton growing regions of Australia. The feasibility of MAR in these areas will be evaluated across all facets (i.e. financial, economic, technical, legislative, social and environmental).

Approach

The feasibility of MAR in each of the case study areas will be evaluated against the 7 criteria below. Methods used to inform the evaluation include literature review, data collation and analysis, model simulation and stakeholder interviews.

1. **Is there demand for more water, or a greater water security?**

It's important to identify stakeholders who would be interested in having more water available, or increasing the reliability of their irrigation water supply.

2. **Is water available to be banked underground?**

This water could include 'excess' surface water such as unused surface water shares, or surface water traded in when trade prices are low.

3. **Is it technically feasible?**

With a long history of groundwater extraction, many important cotton growing areas of Australia now have storage space in their aquifer systems that might be able to store excess surface water in preparation for drier periods. However, it is also important to consider whether the water can be put underground either by gravity or pressurised options, stored for a desired period of time, and then extracted at an acceptable recovery rate.

4. **Is it financially viable and profitable?**

This is influenced by the MAR type (i.e. infiltration methods), source of water - the surface water and groundwater markets, crop prices and yields, infiltration and recovery rates and cost/depth of pumping.

5. **Are there any significant effects on water quality and quantity (either positive or negative) and consequential impacts on the environment?**

Depositing and withdrawing water from the aquifer can impact upon the quality and quantity of the groundwater source and therefore the ecosystems that depend upon them. Redirecting surface water underground may create negative impacts upon existing surface water systems, and may also change the aquifer water quality. However, returning water to spaces in the aquifer may reconnect surface water and groundwater systems that have been disconnected through groundwater extraction, therefore returning some of the natural function to the local waterways. Also, infiltration basins used to recharge the aquifer may provide an ecosystem service otherwise not achieved.

6. **Is it a socially acceptable option to irrigators, stakeholders and the wider community?**

Is the idea of using MAR in their region appealing? This could be influenced by their values, knowledge and beliefs about MAR, and their perceived risks about its implementation in their region.

7. **Are the legislative and policy settings appropriate to support a MAR system, and if not, how would they need to be changed?**

Further clarification is required of any legislative and policy barriers that would need to be addressed for MAR to become a feasible option. This will be investigated for each case study, with insight gained from working MAR systems in the USA.

Outcomes

This study will:

- Inform cotton irrigators and industry advisors whether MAR offers an opportunity to increase water security, sustainability and consequential industry value in the case study areas;
- Provide cotton irrigators and industry advisors insight into any early identified obstacles in the implementation of MAR, specified across all facets (i.e. financial, economic, technical, legislative, social and environmental), that will enable timely, cost-effective choices about investments to be made;
- Collate and integrate existing socio-economic, hydrogeological and governance knowledge, data and information in the case study areas; and
- Develop a framework and methods, from these case studies, that can be applied elsewhere.

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