



Program 5: Integrating Socioeconomics, Policy and Decision Support

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The National Water Initiative aims to optimize economic, social and environmental outcomes through a nationally compatible market, regulatory and planning-based system of surface and groundwater management. There are several requirements to develop practical, long-term strategies that will achieve this goal such as critical integration of a whole-of-water cycle approach with socio-economic issues and engaging with the community in a way that increases the depth of understanding of water issues, builds trust, increases adoption of better practices, clarifies tradeoffs and ensures transparency in decision making. The other four programs will be linked strongly with this program to largely provide the new biophysical science and modelling required to ensure a whole-of-water cycle approach. The decision support, policy and socioeconomic frameworks will include consider ecological determinants and constraints. The framing of any groundwater management problem with experts and interest groups clarifies the knowledge (e.g. flux attributes, boundaries and scales) required as input for integration with the socioeconomic aspects, and vice-versa. Flagship case studies will be used to focus this program's projects and to link with other programs so that the way to provide decision support to a management problem is better understood and delivered. One will be an inland case study of an over-allocated groundwater system with cross-border jurisdictional issues (the Lower South East of South Australia that will address the socioeconomic and environmental issue of sustainable aquifer yield. The various Sub-programs will: identify the appropriate interest groups; frame the issues with them; co-develop a representation of the drivers, interactions and outcomes; and develop integrated models and methods (including the biophysical ones with the other programs) that allow the characterization of quantitative and qualitative tradeoffs. In both cases, the research will be encapsulated in a decision support system (DSS) that will assimilate targeted knowledge from the other biophysical programs. Cutting edge research issues are defined in the Sub-programs below. *Key investigators: CI Jakeman, CI Croke, CI Pannell, CI Curtis, CI Gunningham, CI Gardner, CI McKay, CI Newham and CI Pollino.*

Sub-program 5A: Integrated Assessment Modelling and Decision Support. Constructing and considering the consequences of alternative problems and policy options is fundamental for processes of policy formulation. Formal computer-based decision support tools can provide a means of structuring and exploring problems, and of generating qualitative and quantitative information for analysing and characterising decision options. The aim of this Sub-program is to represent, accrue and share socioeconomic and biophysical knowledge that will elucidate improved outcomes for groundwater and groundwater-connected systems. It will use the 'discipline' of Integrated Assessment (IA) (Giupponi et al., 2006) encompassing: the biophysically-connected system components; the socioeconomic components of policy, other drivers, governance constraints and impacts; and interest groups. It will involve three main modelling approaches to represent the interactions and processes in order to understand, estimate and communicate impacts. These approaches range from those that are more qualitative such as Decision Trees to quantitative approaches such as Bayesian Networks and Coupled Complex Models. Each has strengths and weaknesses for particular uses (Jakeman et al., 2007). The

overall challenge here is to exploit the growing body of experience-based know-how the DSS community is accumulating to inform design and development practices. One of the key elements to this integration is plausible scenario construction (Liu et al., in press) to help assess vulnerability, risk and uncertainty to a range of influences which will form a vital basis for research in this program.

Sub-program 5B: Farmers of the Future: How will they farm groundwater? Agricultural and rural communities are undergoing profound technical, structural and demographic changes. These changes have different implications for specific farm sectors and regions, and individual communities and farm families – with impacts that are variable in nature (creating costs and opportunities) and magnitude. Strategic investment in improved groundwater management requires a strong understanding of the adoptability patterns and socioeconomic implications for rural industries of new technology or management systems. Consideration must be given to the extent to which proposed changes to groundwater management are consistent with the long-term personal and farm business plans of landholders. Methods and databases for socioeconomic profiling of adopters are essential. This Sub-program will build on the current understanding and knowledge base and will integrate it with spatially and temporally referenced hydrologic and agronomic data. In consort with the other Sub-programs, it will develop and evaluate policy instruments that seek to engage landholders and establish long-term commitment to sustainable groundwater-relevant natural resource management (NRM) practices.

Sub-program 5C: Policy, Institutional, Law and Governance issues. The principal instrument proposed by the NWI for communities defining the sustainable use of groundwater is the statutory water plan. Plans are a foundation stone for an efficient water market and the vehicle for settling trade-offs between competing outcomes for water systems, securing ecological and resource security outcomes, addressing over allocation and assigning risks of changes in allocations. This Sub-program will focus on the governance issues relating to the groundwater and surface water planning process and content, including the design of the institutions and the implementation and review of plans. It will explore the design of water plans as a water governance tool and make law reform suggestions. It will address issues including the design of local consultative and managerial committees and irrigation co-ops and the duties of water agencies (i.e. to research environmental and socio-economic issues in preparing and implementing plans and to identify and provide for surface-groundwater interaction and sustainable groundwater extraction, consult in preparing and implementing plans); determine the applicability of the concepts of consumptive pools and share-based access entitlements to groundwater resources; and articulate appropriate management concepts for the injection and storage of water in aquifers.

Sub-program 5D: Vulnerability, Risk, Sensitivity and Uncertainty Issues in Integrated Management of Groundwater. Methods for assessing groundwater vulnerability, risk and uncertainty of predicted outcomes of options for managing groundwater and surface water-groundwater connected systems will be examined in this Sub-program. The crux of model-aided decision-making is to determine whether one alternative is superior to another, by comparison of model outputs for the scenarios being considered. The outputs from integrated models are often highly uncertain, and a key question is how these different types of uncertainties are incorporated in model-aided approaches, with scenario and sensitivity analysis being the two most common (Brouwer and Hofkes, in press). This Sub-program will focus on how to characterise and reduce uncertainty at all stages of groundwater decision-making and how to assess the sensitivity of the outputs of different types of integrated models to variation in the scenarios, inputs, parameters and process descriptions. The main output from this Sub-program will be innovative assessment methods to guide modellers towards the simplest adequate integrated model and to establish how reliably that model can aid groundwater management decisions. Most importantly, it will assess what additional knowledge could inform the management decision options, and by how much and at what cost.