# Thinking about a
# decision
# support system?

**NATIONAL CENTRE FOR GROUNDWATER RESEARCH AND TRAINING**

This resource introduces decision support systems (DSS), which are computer-based tools designed to support decision making and planning processes. Many decision support systems have been developed to aid with decisions about complex environmental management issues, including groundwater issues.
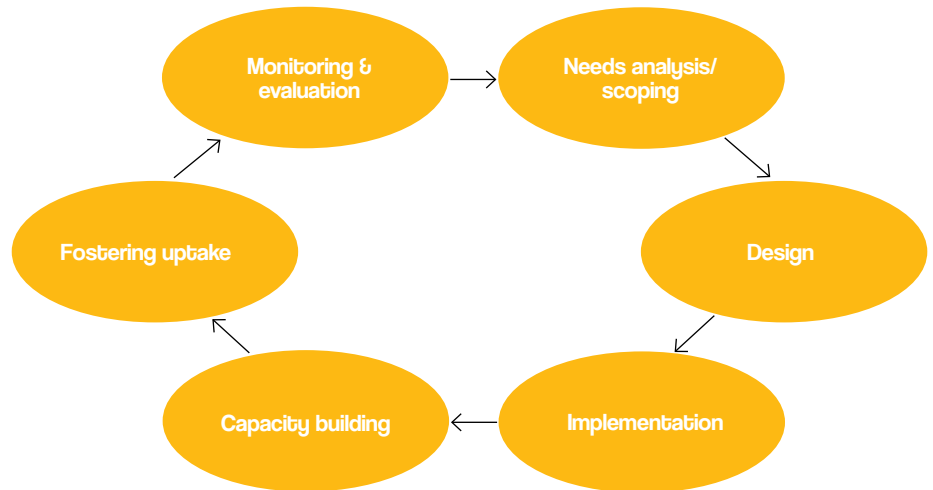
## WHAT ARE DSS?

The role of natural resource managers is to make decisions about how land and water resources are used now and into the future. The management of natural resources for human and environmental outcomes is often highly complex and contested, in part due to incomplete or poor knowledge about the natural and social systems. Decision support systems (DSS) are computer-based tools designed to support decision making and planning processes. They offer a way of capturing and testing assumptions about complex system behaviour and/or examining alternative solutions to the way we manage resources, including groundwater. Numerous environmental DSS (eDSS) have been developed for application to complex environmental and natural resource management (NRM) issues. These are also known as environmental decision information support tools (eDISTs).

## HOW CAN DSS BE USED?

DSS can help structure and explore complex environmental problems as well as provide information for analysing and assessing decision options. They have been developed and used by research and other organisations for a range of purposes including predictive modelling, optimisation modelling, exploratory or scenario modelling and, increasingly, participatory modelling and facilitation (see table overleaf).

## DO YOU NEED ONE?

You and your colleagues are in the best position to know whether or not your organisation needs a DSS. Think about how a DSS could support your current decision making processes. For example:

- Would a tool that allows you to organise and analyse existing spatial and temporal data improve your organisation's knowledge about the system and its capacity to make improved, or more efficient, decisions?
- Do you need to explore alternative options for the use or management of land or water resources, under either current or future conditions (e.g. climate, demographic)?
- Is your organisation required to evaluate and report on the outcomes of your decision-making processes?
- Is there a requirement for your organisation to engage the community or other stakeholders in the decision-making process?

If you answered yes to any of these questions then a DSS may help your decision making.

## DEVELOPMENT PROCESS

Six phases are recommended in the development of any DSS (as shown in the diagram above). All phases will likely require considerable collaboration between the DSS developer and the intended user(s).

To be effective and useful to a specific end-user, a DSS needs to improve the efficiency of decisions currently made by that organisation, or support existing or new actions through provision of new information. This requires the end-user organisation and DSS developer to work closely to define the purpose of a DSS, including who will use it and how they will use it (needs analysis or scoping).



Monitoring & evaluation → Needs analysis/scoping → Design → Implementation → Capacity building → Fostering uptake →

Adapted from Walker 2002.

Tightly defining the purpose of the DSS will inform the design of the DSS through the identification of:

- appropriate models or analysis tools to incorporate in the DSS
- the necessary level of complexity including variables and processes and the spatial and temporal scale of the DSS
- domain experts and the level of stakeholder involvement.

The design and implementation phase of the development of a DSS will often be an iterative process whereby prototypes are developed by the DSS developer and tested collaboratively with the DSS users. Capacity building is a critical phase if the DSS is to be adopted and used by organisations to improve their decision making activities. The crucial nature of the capacity building and facilitation role is not always recognised and resourced by either DSS developers or funders. Monitoring and evaluation of the performance of the DSS and its use will identify areas of future improvement and development.

## USES OF DECISION SUPPORT SYSTEMS

| Type of modelling | Description | Use | Users |
|---|---|---|---|
| Predictive modelling | DSS used for predictive modelling are often used to develop mechanistic understanding of biophysical processes in environmental systems and their human and non-human drivers. | Scientific research | University and other research organisations |
| Optimisation modelling | Optimisation models are used to identify the optimal allocation of resources that meets one or more specified objective given specified constraints. | Organisational decision making; scientific research | University and other research organisations |
| Scenario modelling | Many DSS allow the modelling of scenarios to explore the likely consequences of given combination(s) of resource-use and management practices. | Organisational decision making; scientific research | Governments, private enterprise & NGOs, university and other research organisations |
| Participatory modelling and facilitation | Research and other organisations are increasingly using participatory modelling approaches to promote and inform dialogue, debate and deliberation between stakeholders as a means of influencing behaviour, building system understanding (social learning), or making decisions about the use and management of natural resources. | Organisational decision making; scientific research | Governments, private enterprise & NGOs, university and other research organisations |

## Want to know more?

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