Decision support systems in practice– some observations

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Introduction

Observations on the application of a range of learning and decision support tools mainly dealing with soil and water conservation, water quality and climate risk management in Queensland's semi-arid tropics grain producing areas are presented. These observations, while clearly subjective, are offered to support discussion toward development of better risk assessment and decision support tools for farmers.

Our experience comes from being part of teams measuring hydrology and water quality, and developing models and decision support tools such as: PERFECT (Littleboy et al. 1992; APSIM (McCown et al. 1996); Howwet? (Freebairn et al. 1994); Howoften? (Glanville et al. 1997); Howleaky? (McClymont et al. 2011) and "action learning tools" such as a rainfall simulator to demonstrate effects of soil cover on runoff and erosion (Cawley et al. 1992). Some personal observations on how a range of decision support systems have been used follows.

Simplicity and transparency

1. The simplest things generally work best, and the simpler the better. This requires that the essence of an issue needs to be distilled. A good example is the French and Shultz water use efficiency (WUE) model. It was reported as been relevant to southern Australia. However it relevant wherever water is a major limiting factor in most seasons. The concept is useful for estimating crop expectations and as a review or benchmark tool. WUE has been readily accepted and used by farmers across a wide range of geographies yet some scientists regard it as being too simplistic. Another example is the application of a simple rainfall lookup program, Howoften?, which requires the user to formulate their issue as a simple probability question - what is the chance of x rain falling in y days between two dates?. The program simply makes the exploration of rainfall records efficient. I a short interactive session, many "what if" questions can be asked. The program does not aim to give a definitive answer, but rather provides a means for efficient exploration of historic rainfall data.
2. The easier a model or decision support tool is to use, the more chance it has of being used. It does not take much complexity to put people off! Our simplest tools are the most used and with minimal on going support.
3. The more comprehensive a DSS aims to be, the more complex and less transparent it will be, and the greater the support it requires.
4. Active demonstrations and physical models are generally more effective than computer based models. As a collector of hydrology and erosion data for 20 years, it is hard to admit that an active simulated rainfall demonstration over a morning can have as much impact on farmers as the results from 10 years of field research.
5. A rapid cycle of question and answer, allowing for iterative convergence on an insight into a systems variability and responsiveness seems to be a common denominator for an effective learning approach. Computer based tools allow for many "what ifs" to be explored without any risks being taken.
6. Employ Ockham's Razor ruthlessly – the simplest explanation is generally the best. The Pareto principle is Ockham's best friend; look for the 20% effort that gets 80% of the gain. Also see Ward's (2006) "simplicity cycle". This is particularly important in developing new tools where

time and resources are limiting.

Who says the world has to be complex?

7. Increased complexity seems to be a common pathway for scientists. A common criticism from within scientific ranks is that an approach is too simplistic. This should be taken as a compliment as it indicates you are on the right track. It is a natural tendency for scientists to go for the more refined approach. This sounds reasonable as we attempt to push the barriers of ignorance back, but in the end, the addition of complexity (or parameters) does not necessarily result in an improvement in prediction or explanation. This comment is about over-parameterising models. Why use a 10-parameter model when 2 parameters will do nearly as good a job? This is not to say there is not a role for detailed models –there clearly is, but model complexity needs to match the question being answered. For example, you cannot expect a simple WUE model to have any useful opinion on row spacing or crop nutrition.
8. Uncertainty and complexity. It's common to hear scientists say that farming is a very complex business. Our experience suggests that farmers don't find farming complex as they are well skilled in putting information into context for their particular circumstances. What does challenge farm decision making though is uncertainty: in weather; markets; and outcomes of agronomic practices.
9. Pragmatic water balance can provide a lot of information on the gross elements of an agricultural system. Basically, water balance models are integrators of weather, plant and management interactions.
10. There is a view that many models should be termed "instructive" rather than objective or mechanistic. There use should be restricted to exploring systems, with less literal or absolute interpretation given to their output. This is a hard pill to swallow for modellers but it may be the true home for most models.
11. If a model is used and the user does not have a feel for what the answer should look like, beware! That means; don't use a model unless you have a knowledgeable person to support you or you are aware of the inner workings of the model. This is one of the golden rules for using models.
12. Regardless of model complexity, there is always plenty of scope for misuse. Maybe the developers are not modest enough when indicating limitations?

Acknowledge stakeholders as experts

13. In farming systems, the farmer is clearly the best expert, and expert farmers generally use a range of other experts to support them. It is worth remembering who has the greatest vested interest in problem solving and acknowledge their expertise.
14. Being useful to decision makers requires getting into their shoes. For any decision support tool to be useful it needs to provide information that is relevant to at least one decision –this means we need to be explicit about which decision, when this decision needs to be made, and presented in a form that is accessible when the decision point arrives. How many decision points are there in agriculture? We suspect not that many. For example, in the northern grain belt, there are three key periods; winter crop, early summer and late summer crops planting periods. While each season is different, after a few years, the number of new situations or key questions arising decreases. The main issues will have been dealt with at least once, with seasonal adjustments needed each year.
15. When planning a decision support activity, ask the user what they want, and cross-examine until you get what is needed. We are often too quick to pick up on the popular, and easily tractable, rather than put ourselves into a challenging position. For example, what are the chances of a group of scientists "consulting" with farmers likely to find that the farmers needs coincide with their own special discipline? How do we really take ourselves away from our comfort zone? – We don't have an answer to this question!
16. There is no replacement for the expert. If it's a systems issue, this means several experts and

possibly a synthesiser are needed. Without any formal models or decision support tools, experts can always give a well-informed opinion. This opinion is generally based on many experiences, which capture far more elements of an issue than is possible through a formal or coded system. Without the expert, models can be dangerous or at best misleading.

17. Local ownership –things developed close to home are generally the most focused and used. We have observed that when a group does not develop something, they will not use it. This was the case for some of the very effective nutrition "wheel calculators" and is even more the case for computer based tools.
18. Scientists are generally slow adopters of new technology that has not been developed by them! The same is also true of extension specialists and consultants.

Modesty and limitations

19. Risk awareness" has a role where auditable systems are not appropriate or palatable. Simple paper based risk awareness tools can be used as a framework for engaging farmers in a non threatening manner that encourages learning rather than regulation. A one page check list can be as useful as a 50 page Best Management Practice manual or simulation model
20. Gaming is a very powerful approach to learning. Models have a role to play here, but are not often used, and when used, they are sometimes used with too much emphasis on the model being correct, rather than instructive. A gaming approach becomes powerful when it creates an environment of risk taking, without serious consequence, but with strong feedback and interaction between players.
21. The enhanced availability of near real-time weather data for many locations opens up the possibility for using a range of analysis tools to explore probabilities. If we believe that the best source of probabilities for future events lies in past records, then things have never been easier.
22. A decline in interest in a DSS tool may be a sign of success rather than failure, indicating that available lessons have been learnt.

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