CoastAdapt

Valuation of adaptation options relative to the avoided impacts

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This guide aims to assist the reader step through the process of choosing valuation approaches that are fit for the purpose of the adaptation decision.

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At a glance

Valuation of adaptation options can help to support the adaptation decision-making process. Choosing a fit-for-purpose approach depends on the decision-making context, the level of uncertainty present, availability of resources and skills, timeframes, and community expectations.

This guide discusses the factors that need to be taken into account in selecting a fit for purpose valuation approach, and helps you to choose the best valuation method for the task in hand.

A decision tree is provided that helps you step through a series of questions to define the most appropriate valuation tool or approach for your purpose.

Main text

We provide two 'methods' pieces on the application of valuation methods:

- *Real options for coastal adaptation*
- *Comparing costs and benefits of climate adaptation*

CoastAdapt provides two case studies that describe the application of a third valuation method: Multi-Criteria Analysis. These are:

- *The Sydney Coastal Councils Group experience: prioritising coastal adaptation options at the local level*
- *Kakadu – Vulnerability to climate change impacts*

In addition, the snapshot *AdaptWater: A climate change adaptation tool for the urban water industry* describes an application of cost-benefit analysis.

Introduction

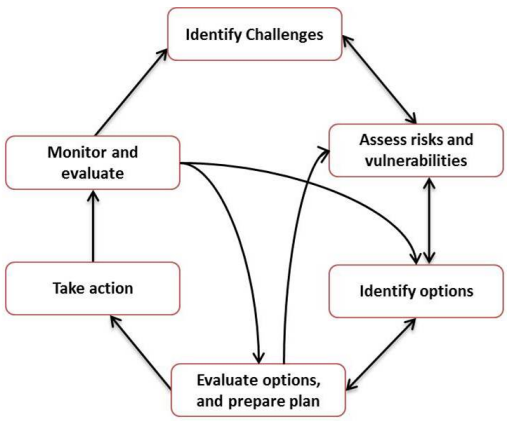
Adaptation decision-making is characterised by uncertainty. This uncertainty challenges many traditional valuation tools, which lack the sophistication to deal with the uneven distribution of costs and benefits over time. This guide aims to assist the reader step through the process of choosing valuation approaches that are fit for the purpose of the adaptation decision.

The tools discussed here are exactly that—tools to support decision-making. No tool is perfect, each has advantages depending on how and to what end it is used. Many of the tools are complementary in nature and can be used sequentially and iteratively as an adaptation pathway (see *Pathways approach*) is developed and refined over time. Some examples are described below to illustrate this.

Adaptation decision-making tends to follow an iterative process that is based on the principles of adaptive management (see Figure 1). This enables decision-makers to take into account the range of uncertainties related to future states (see *Understanding climate scenarios*). The starting point for a valuation study is generally not the same as the starting point for a decision. As Figure 1 illustrates, valuation studies form part of the cycle of decision-making. Choosing a fit-for-purpose valuation method depends heavily on the decision-making context, the level of uncertainty present, and the requirements for stakeholder engagement.

This guidance assumes that the reader has identified that there is a problem of significance that needs to be addressed through adaptation measures. In other words, the identification of challenges (i.e. context setting) and the determination of vulnerabilities (i.e. gathering of information on all risks) will already have been undertaken to some extent before commencing a valuation study. If you are using the C-CADS model (Figure 1), we assume here that you have completed the first step of C-CADS (Figure 1) and made a start on the second step of C-CADS. This guide can be used independently of C-CADS.

Figure 1: CoastAdapt – Coastal Climate Adaptation Decision System. Source: NCCARF.



Commencing a valuation study

When framing and undertaking a valuation exercise, you need to begin with two questions.

1. Do I have all the information I need in the right form and quality to proceed?
2. Can all values be monetised (and should they)?

Do I have the right information to proceed?

Information is valuable, however, it often comes at a cost and may be limited at the time a decision needs to be made. Careful thought should be given to the costs and benefits of seeking new information (the reader is referred to the *Information Manual 4: Cost and benefit* for a more detailed discussion on this). The type, time and quality of information will underpin the quality of inputs to any valuation exercise. Gorddard et al. (2015) propose an approach to help frame the questions that need to be asked, the Values-Rules-Knowledge framework.

- Values type questions might be:
  - Is there broad consensus on the vision?
  - Is there agreement across stakeholder groups on options?
- Rules type questions might be:
  - Are roles and responsibilities clearly defined?
- Knowledge type questions might centre on:

- Is there certainty of knowledge relating to existing hazards?
- Is there certainty of knowledge relating to future hazards / risks?

At the broadest level, determining where a decision point rests across these three axes (Figure 2) can indicate what level of detail is appropriate for a valuation study, and where to start (see Table 1). For example, if there is significant community conflict over the nature of a proposed solution (e.g. protect or retreat), or if there is a high knowledge deficit (dots 1 and 2 in Figure 2), then more work on knowledge and community values is needed before a valuation study can begin. In fact, the introduction of a Cost-Benefit Analysis (CBA) at such a time may entrench polarised views rather than resolve any differences. However, if there is good knowledge, values are aligned and the regulatory framework is clear, then valuation studies are appropriate and can assist decision-making.

When scaled out to the future, and then brought back to net present values, relatively small changes in assumptions can impact the results of valuation studies. Where lack of knowledge about future states (e.g. future climate, future property prices etc.) is a feature of a valuation study then sensitivity analyses (see *Using climate scenarios*) can help to investigate the consequences of changes and errors in parameter values and assumptions (see *Information Manual 4: Costs and benefits*).

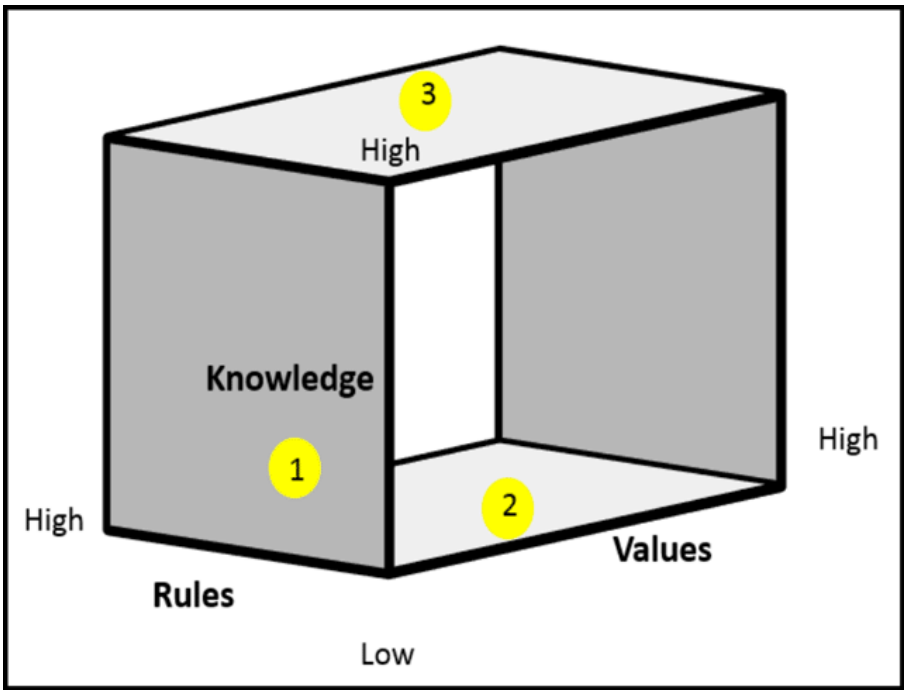


Figure 2: Values Rules Knowledge Framework. Source: Adapted from Gorddard et al. 2015.

Can all values be monetised (and should they)?

Goods and services that are traded in the market can generally be monetised directly or approximate monetary values can be derived through a number of different approaches and low-cost methods such as asset replacement cost and benefit transfer (see Table 2). A number of approaches have also been developed to generate monetary values for non-traded goods and services and for which no proxy value is readily available. Such tools depend on either revealed or stated preferences (also known as contingent valuation) being elicited from a set of users. With revealed preference or indirect valuation methods, the value of a non-traded good or service is determined by the creation of a parallel or surrogate market. Commonly used tools include the Travel Cost Method and Hedonic Pricing. With stated preference or direct valuation methods, a set of people are directly asked about their willingness to pay or willingness to accept a change of some sort. Choice Modeling is a commonly used tool. Refer to Table 2 for further information on each of these valuation approaches.

A more philosophical debate exists around whether the pricing of non-traded goods and services— such as spiritual values or even some ecosystem services such as beautiful views or the bequeathement value of national parks— should ever be monetised. One line of argument is that this diminishes their intrinsic value and makes these Earth system and iconic features subject to a debate about trade-offs. It is also the case that using the 'trump card' argument based on intrinsic values is not a cost free decision, and some judgement is required on the acceptability of this social cost. For example, is it more important to conserve the intrinsically valued asset and give up a development option,

or to protect the intrinsic landscape from sea-level rise? In contested contexts such trade-offs are often inevitable (despite deliberation efforts) especially if one or more interest groups seek to play the 'trump card' tactic.

Sequencing and iteration in decision-making

Depending on the nature of particular decisions, there is likely to be high value in sequencing of tools and even using them iteratively through a decision lifetime as knowledge changes and values evolve. This is well illustrated through the Values-Rules-Knowledge prism (Figure 2) described above. For example, engaging stakeholders in a meaningful way and representing their views and values in the development of future scenarios (see description in Table 3) can help you to consider 'acceptable' adaptation options that would then undergo a more detailed assessment. For example, deliberative tools such as Multi-Criteria Assessment (see Table 3) may be used to establish preferences between options in advance of a more detailed valuation study.

Decision support tools can also be used to establish (environmental, economic or social) thresholds and future trigger points (e.g. loss of a certain percentage of beach and dune, dam water levels) under which future options need to be more fully examined (e.g. narrowing of options, change of course) or implemented (e.g. Haasnoot et al. 2013 who discuss the concept of adaptation pathways in detail; Wise et al. 2014; *Pathways approach*).

Application

Figure 3 and Table 1 below provide an easy to use decision tree that helps you step through a series of questions to define the most appropriate valuation study to support an adaptation assessment, and recommends a particular tool or approach. The tools and approaches are then described in more detail in Table 3. A number of points are worth noting.

- Decision-making for adaptation investment is differentiated from more traditional approaches by the uncertainty attached to future impacts and benefits. This has prompted various principles-based investment frameworks along the lines of 'no regrets', 'low regrets' and 'win-win' to guide investment. In many cases these will lend themselves to an iterative approach whereby some decisions can be made with limited information / low granularity, whereas other decisions are best postponed or made flexible until more information about risks and impacts is available.
- As with more traditional approaches, the use of multiple tools can greatly benefit the decision-making process e.g. to monetise non-market costs and benefits, or to capture and prioritise options. A number of commonly used prioritising / sorting tools are also described in Table 3.

Finally, it must be accepted that different approaches will serve different circumstances and this depends on the context and nature of the problem and possible options, the value of available data, whether timeframes are flexible, appetite for risk, and not least of all, the skill / skills available to the decision-maker.

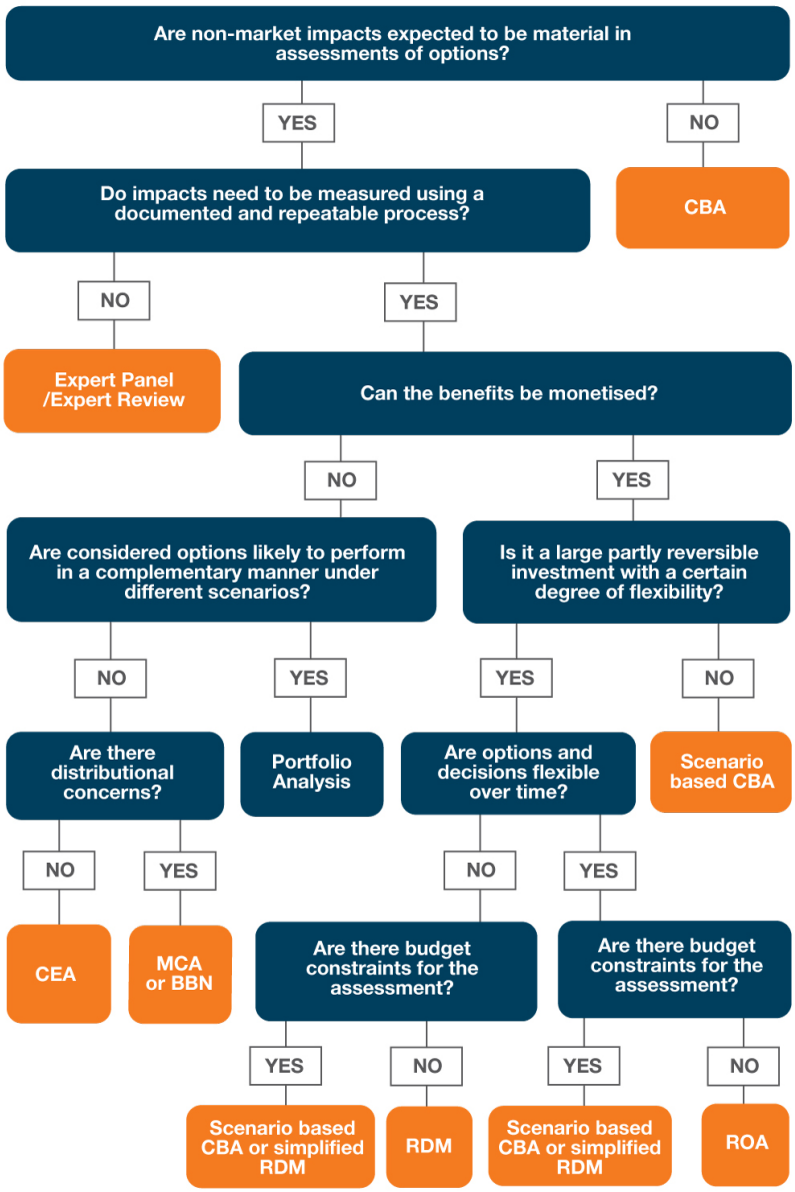
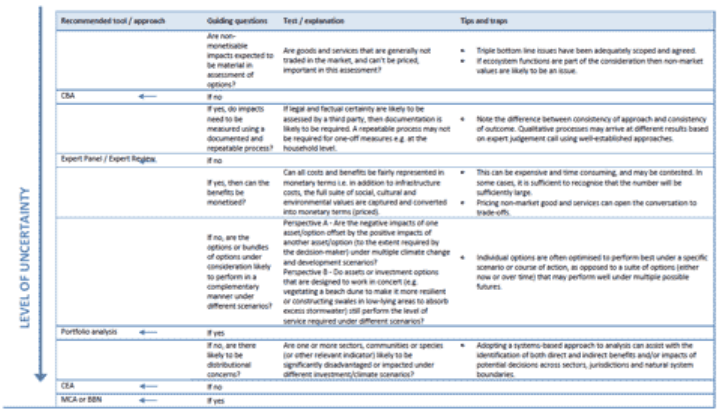


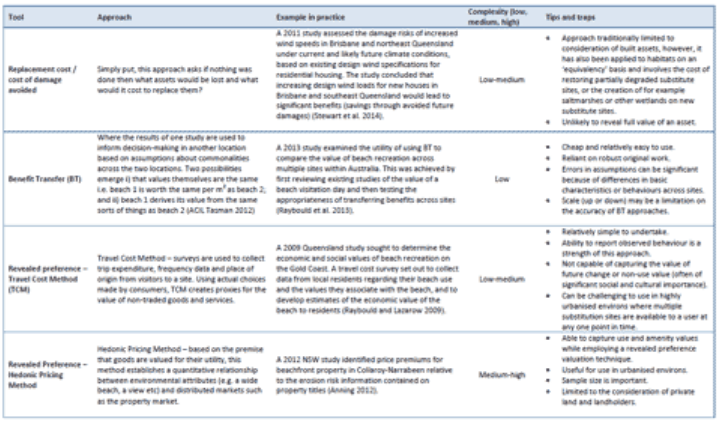
Figure 3: Matching the valuation approach to the decision context. Source: Adapted from DEFRA 2013; Dittrich et al. 2016; Hatfield-Dodds 2005.

Table 1: Identifying the best adaptation assessment method (refer to Table 3 for a description of the tools and approaches). Source: Adapted from: DEFRA 2013; Dittrich et al. 2016.



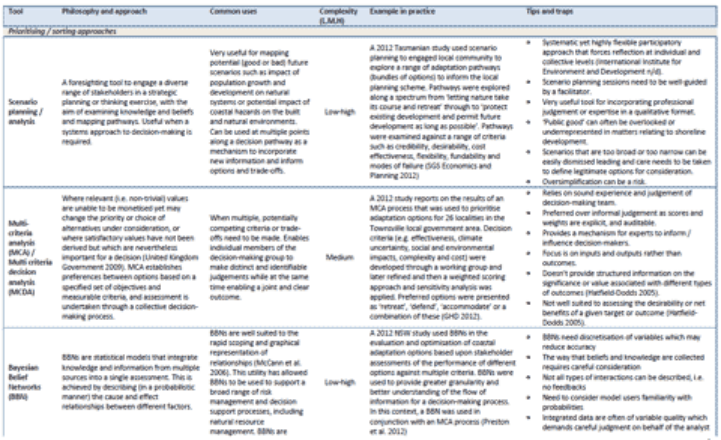
Recommended tool / approach	Guiding questions	Test / explanation	Tips and traps
	Are non-monetisable impacts expected to be material in assessment of options?	Are goods and services that are generally not traded in the market, and can't be priced, important in this assessment?	• Triple bottom line issues have been adequately scoped and agreed. • If ecosystem functions are part of the consideration then non-market values are likely to be an issue.
CBA ←	If no		
	If yes, do impacts need to be measured using a documented and repeatable process?	If legal and factual certainty are likely to be assessed by a third party, then documentation is likely to be required. A repeatable process may not be required for one-off measures e.g. at the household level.	• Note the difference between consistency of approach and consistency of outcome. Qualitative processes may arrive at different results based on expert judgement call using well-established approaches.
Expert Panel / Expert Review ←	If no		
	If yes, then can the benefits be monetised?	Can all costs and benefits be fairly represented in monetary terms i.e. in addition to infrastructure costs, the full suite of social, cultural and environmental values are captured and converted into monetary terms (priced).	• This can be expensive and time consuming, and may be contested. In some cases, it is sufficient to recognise that the number will be sufficiently large. • Pricing non-market good and services can open the conversation to trade-offs.
	If no, are the options or bundles of options under consideration likely to perform in a complementary manner under different scenarios?	Perspective A - Are the negative impacts of one asset/option offset by the positive impacts of another asset/option (to the extent required by the decision-maker) under multiple climate change and development scenarios? Perspective B - Do assets or investment options that are designed to work in concert (e.g. vegetating a beach dune to make it more resilient or constructing swales in low-lying areas to absorb excess stormwater) still perform the level of service required under different scenarios?	• Individual options are often optimised to perform best under a specific scenario or course of action, as opposed to a suite of options (either now or over time) that may perform well under multiple possible futures.
Portfolio analysis ←	If yes		
	If no, are there likely to be distributional concerns?	Are one or more sectors, communities or species (or other relevant indicator) likely to be significantly disadvantaged or impacted under different investment/climate scenarios?	• Adopting a systems-based approach to analysis can assist with the identification of both direct and indirect benefits and/or impacts of potential decisions across sectors, jurisdictions and natural system boundaries.
CBA ←	If no		
MCA or BBN ←	If yes		

Table 2: Commonly used approaches to generate monetary values for non-traded goods and services. Additional sources: Anning 2012; Lazarow et al. 2013.



Tool	Approach	Example in practice	Complexity (low, medium, high)	Tips and traps
Replacement cost / cost of damage avoided	Simply put, this approach asks if nothing was done then what assets would be lost and what would it cost to replace them?	A 2011 study assessed the damage risks of increased wind speeds in Brisbane and northeast Queensland under current and likely future climate conditions, based on existing design wind specifications for residential housing. The study concluded that increasing design wind loads for new houses in Brisbane and southeast Queensland would lead to significant benefits (savings through avoided future damages) (Stewart et al. 2014).	Low-medium	• Approach traditionally limited to consideration of built assets, however, it has also been applied to habitats on an 'equivalency' basis and involves the cost of restoring partially degraded substitute sites, or the creation of for example saltmarshes or other wetlands on new substitute sites. • Unlikely to reveal full value of an asset.
Benefit Transfer (BT)	Where the results of one study are used to inform decision-making in another location based on assumptions about commonalities across the two locations. Two possibilities emerge i) that values themselves are the same i.e. beach 2 is worth the same per m^2 as beach 2; and ii) beach 1 derives its value from the same sorts of things as beach 2 (ACIL Tasman 2012)	A 2013 study examined the utility of using BT to compare the value of beach recreation across multiple sites within Australia. This was achieved by first reviewing existing studies of the value of a beach visitation day and then testing the appropriateness of transferring benefits across sites (Raybould et al. 2013).	Low	• Cheap and relatively easy to use. • Reliant on robust original work. • Errors in assumptions can be significant because of differences in basic characteristics or behaviours across sites. • Scale (up or down) may be a limitation on the accuracy of BT approaches.
Revealed preference – Travel Cost Method (TCM)	Travel Cost Method – surveys are used to collect trip expenditure, frequency data and place of origin from visitors to a site. Using actual choices made by consumers, TCM creates proxies for the value of non-traded goods and services.	A 2009 Queensland study sought to determine the economic and social values of beach recreation on the Gold Coast. A travel cost survey set out to collect data from local residents regarding their beach use and the values they associate with the beach, and to develop estimates of the economic value of the beach to residents (Raybould and Lazarow 2009).	Low-medium	• Relatively simple to undertake. • Ability to report observed behaviour is a strength of this approach. • Not capable of capturing the value of future change or non-use value (often of significant social and cultural importance). • Can be challenging to use in highly urbanised environs where multiple substitution sites are available to a user at any one point in time.
Revealed Preference – Hedonic Pricing Method	Hedonic Pricing Method – based on the premise that goods are valued for their utility, this method establishes a quantitative relationship between environmental attributes (e.g. a wide beach, a view etc) and distributed markets such as the property market.	A 2012 NSW study identified price premiums for beachfront property in Collaroy-Narrabeen relative to the erosion risk information contained on property titles (Anning 2012).	Medium-high	• Able to capture use and amenity values while employing a revealed preference valuation technique. • Useful for use in urbanised environs. • Sample size is important. • Limited to the consideration of private land and landholders.

Table 3: Summary of commonly used prioritising / sorting and valuation approaches.



Tool	Philosophy and approach	Common uses	Complexity (L,M,H)	Example in practice	Tips and traps
Prioritising / sorting approaches					
Scenario planning / analysis	A foresighting tool to engage a diverse range of stakeholders in a strategic planning or thinking exercise, with the aim of examining knowledge and beliefs and mapping pathways. Useful when a systems approach to decision-making is required.	Very useful for mapping potential (good or bad) future scenarios such as impact of population growth and development on natural systems or potential impact of coastal hazards on the built and natural environments. Can be used at multiple points along a decision pathway as a mechanism to incorporate new information and inform options and trade-offs.	Low-high	A 2012 Tasmanian study used scenario planning to engaged local community to explore a range of adaptation pathways (bundles of options) to inform the local planning scheme. Pathways were explored along a spectrum from 'letting nature take its course and retreat' through to 'protect existing development and permit future development as long as possible'. Pathways were examined against a range of criteria such as credibility, desirability, cost effectiveness, flexibility, fundability and modes of failure (SGS Economics and Planning 2012)	• Systematic yet highly flexible participatory approach that forces reflection at individual and collective levels (International Institute for Environment and Development n/d). • Scenario planning sessions need to be well-guided by a facilitator. • Very useful tool for incorporating professional judgement or expertise in a qualitative format. • 'Public good' can often be overlooked or underrepresented in matters relating to shoreline development. • Scenarios that are too broad or too narrow can be easily dismissed leading and care needs to be taken to define legitimate options for consideration. • Oversimplification can be a risk.
Multi-criteria analysis (MCA) / Multi-criteria decision analysis (MCDA)	Where relevant (i.e. non-trivial) values are unable to be monetised yet may change the priority or choice of alternatives under consideration, or where satisfactory values have not been derived but which are nevertheless important for a decision (United Kingdom Government 2009). MCA establishes preferences between options based on a specified set of objectives and measurable criteria, and assessment is undertaken through a collective decision-making process.	When multiple, potentially competing criteria or trade-offs need to be made. Enables individual members of the decision-making group to make distinct and identifiable judgements while at the same time enabling a joint and clear outcome.	Medium	A 2012 study reports on the results of an MCA process that was used to prioritise adaptation options for 26 localities in the Townsville local government area. Decision criteria (e.g. effectiveness, climate uncertainty, social and environmental impacts, complexity and cost) were developed through a working group and later refined and then a weighted scoring approach and sensitivity analysis was applied. Preferred options were presented as 'retreat', 'defend', 'accommodate' or a combination of these (GHD 2012).	• Relies on sound experience and judgement of decision-making team. • Preferred over informal judgement as scores and weights are explicit, and auditable. • Provides a mechanism for experts to inform / influence decision-makers. • Focus is on inputs and outputs rather than outcomes. • Doesn't provide structured information on the significance or value associated with different types of outcomes (Hatfield-Dodds 2005). • Not well suited to assessing the desirability or net benefits of a given target or outcome (Hatfield-Dodds 2005).
Bayesian Belief Networks (BBNs)	BBNs are statistical models that integrate knowledge and information from multiple sources into a single assessment. This is achieved by describing (in a probabilistic manner) the cause and effect relationships between different factors.	BBNs are well suited to the rapid scoping and graphical representation of relationships (McCann et al. 2006). This utility has allowed BBNs to be used to support a broad range of risk management and decision support processes, including natural resource management. BBNs are	Low-high	A 2012 NSW study used BBNs in the evaluation and optimisation of coastal adaptation options based upon stakeholder assessments of the performance of different options against multiple criteria. BBNs were used to provide greater granularity and better understanding of the flow of information for a decision-making process. In this context, a BBN was used in conjunction with an MCA process (Preston et al. 2012)	• BBNs need discretisation of variables which may reduce accuracy • The way that beliefs and knowledge are collected requires careful consideration • Not all types of interactions can be described, i.e. no feedbacks • Need to consider model users familiarity with probabilities • Integrated data are often of variable quality which demands careful judgment on behalf of the analyst

Source material

hide

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Further reading

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