The ERA-NET promoting European research on biodiversity

Annex 1

Practical method note 11

Multi-Criteria Decision Analysis

MULTI-CRITERIA DECISION ANALYSIS

WHAT IS MULTI-CRITERIA DECISION ANALYSIS (MCDA)?

MCDA (also called Multi-Criteria Evaluation/Analysis or Multi-Criteria Decision Modelling) is a tool for exploring issues and making decisions that involve multiple dimensions or criteria. It allows economic, social and environmental criteria, including competing priorities, to be systematically evaluated by groups of people. Both quantitative and qualitative data can be incorporated to understand the relative (non-monetary) value placed on different dimensions of decision options (e.g. management options). Broadly, the process involves context or problem definition, representation of evaluation criteria and management options, and evaluation. This method can be used in a participatory way with multiple stakeholders and is a useful way of evaluating decisions where there are competing interests.

HOW TO DO MCDA?

When applied in a participatory way, MCDA typically involves the following stages:

1. **Establish context and identify participants:** This ensures the early identification of key issues; socio-environmental dynamics and identification of stakeholders for involvement in the multi-criteria decision-making process (see Part 3 of this *Handbook*). A combination of interviews, focus groups, workshops and document analysis can indicate perceived differences and views on the issues of interest, and help structure stakeholder involvement.

2. **Define criteria:** Criteria are defined that capture stakeholders' interests via facilitated discussion and literature (e.g. research outputs, policy documentation). Broad criteria, such as environmental, economic, institutional and social variables, can be broken down into more-specific criteria.

3. **Rank or weight criteria:** To reflect differing values and priorities, criteria are ranked to indicate their importance relative to the objective of process – this may be done individually or by agreeing ranks within groups.

4. **Define management options:** Alternative management options are defined (e.g. using literature, policy documents, management plans, and local knowledge). Current management may be compared to potential future scenarios.

5. **Score management options against criteria:** The performance of each management option is scored against each criterion. This may be completed by all stakeholders (individually), a subset of participants or by researchers. This may involve the use of empirical data, expert opinion, scenarios and modelling.

6. **Multi-criteria evaluation:** Normally, algorithms are used to calculate weighted values based on combined scores and ranks that describe the overall preference towards each option. Results can be presented for individuals or aggregated for different groups. Statistical analyses can be applied to test whether differences exist between individuals or groups. The tool may be used more simply by summing the number of votes for each option against all criteria, and then varying these scores by altering the weighting of different criteria arithmetically.

7. **Discuss options based on MCDA results:** MCDA is a decision-support tool so outcomes may be deliberated with participants or amongst decision-makers to assess the degree of consensus, negotiate compromise and manage trade-offs.

BENEFITS AND DRAWBACKS OF MCDA

MCDA can support complex decision-making processes with diverse groups of stakeholders where there are a variety of competing priorities and management options. Both quantitative and qualitative data can be used within an MCDA framework and the method can accommodate uncertainty and knowledge gaps. It is highly suited to the inclusion of local values in decision making, as both criteria and options can be designed or adapted with the input of stakeholders. The method can be used in a transparent step-by-step way with stakeholders to make decisions and there are numerous ways of visually displaying the results of the ranking and evaluation stages so that stakeholders understand how their input influences the results, stimulating further discussion. MCDA methods fit well into broader decision-making processes and the results can be presented in a way that is accessible to policy makers.

The performance of MCDA suffers when there are a high number of management options and criteria involved in the decision-making process; which puts too high burden on the participants to understand all of the options sufficiently well during the ranking and scoring stages. Problems also arise when the decision problem is very complex and there are interactions and feedbacks between the criteria that are difficult to unravel and understand (e.g. trade-offs between ecosystem services). The method has also been criticised where conclusions have been based on the results of a purely quantitative analysis without sufficient consideration of qualitative data, thereby excluding more subjective values that are less easy to define and measure.
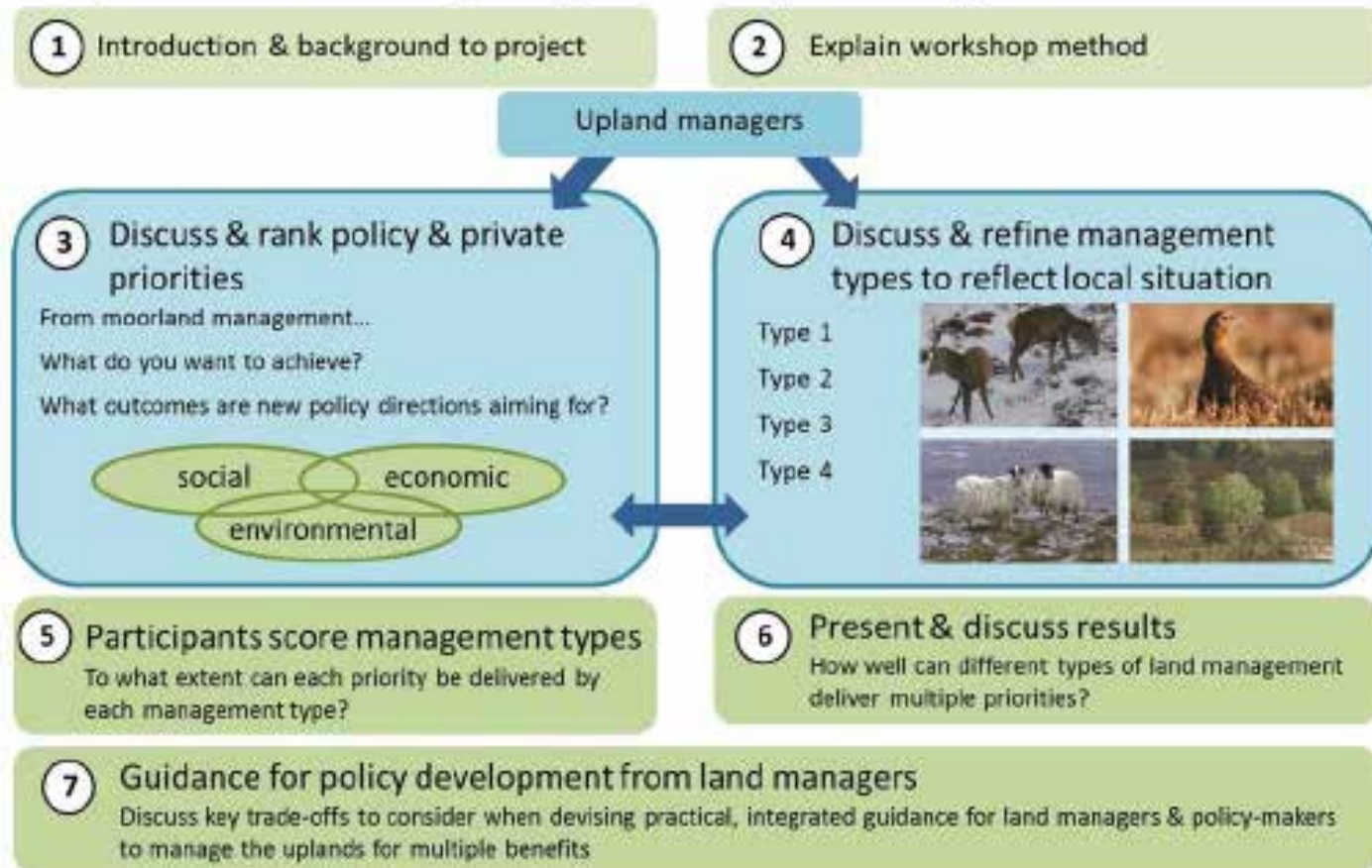
✎ CASE STUDY
EXPERIENCES FROM BIODIVERSITY RESEARCH

The following recommendations were made from the experiences of researchers using MCDA in the HUNT project (see Appendix 1 of the *Handbook* for details of BiodivERsA projects) to investigate the impacts on upland managers from a policy shift towards managing the land for multiple benefits:

✳ For MCDA outcomes to be useful there should be an appetite for change, and for the process to be timely in terms of larger management and policy processes.

✳ Criteria should reflect the views and values of stakeholders as well as drawing on information from research and policy. Each criterion should be clearly defined to avoid ambiguity and it should be recognised that criteria can be either positive (e.g. maximising game numbers for harvest) or negative (e.g. minimising predator numbers). There should be similar numbers of economic, environmental and social criteria to avoid bias towards one dimension.

* Scoring the performance of management options against criteria requires stakeholders to make trade-offs between multiple criteria. It is critical that the questions put to stakeholders to derive these scores are clear and unambiguous in terms of context and scale. Allowing discussion and opportunities to re-score may improve the search for compromise.

* Methods used to derive a final value for each management option should be transparent and there are several ways of doing this, for example aggregating individual responses by stakeholder group or region. No consensus should be inferred without allowing time for further deliberation.

* Visual methods are useful for representing uncertainty and communicating differences of opinion and can form the basis for negotiating compromise and managing trade-offs between biodiversity objectives and other land use priorities.

* A stakeholder who took part in the MCDA process emphasised the importance of keeping the results of such methods in context. Assumptions and judgements about large complex problems should be based on a range of approaches; and not only the results of one method such as MCDA. The issue of managing land for biodiversity and other benefits in the Scottish uplands is highly complex and multi-faceted and it is important that methods such as MCDA are not viewed as the sole solution to a problem.

HUNT Making decisions in the uplands: managing multiple objectives

1. Introduction & background to project
2. Explain workshop method

Upland managers

3. Discuss & rank policy & private priorities
From moorland management...
What do you want to achieve?
What outcomes are new policy directions aiming for?

social economic environmental

4. Discuss & refine management types to reflect local situation
Type 1
Type 2
Type 3
Type 4

5. Participants score management types
To what extent can each priority be delivered by each management type?

6. Present & discuss results
How well can different types of land management deliver multiple priorities?

7. Guidance for policy development from land managers
Discuss key trade-offs to consider when devising practical, integrated guidance for land managers & policy-makers to manage the uplands for multiple benefits

This schematic shows the MCDA process that was used in the HUNT project

SUGGESTED REFERENCES FOR MULTI-CRITERIA DECISION ANALYSIS

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