Appendix A

MCA Terminology

Analysts or modellers are the people who develop the decision-support model.

Stakeholders are people who will be affected by the outcomes of the decision-making process.

Decision-makers are the people charged with the responsibility of making the management decision. Sometimes the decision-makers will be a subset of the stakeholders. In natural resource management problems, governments are often the decision-maker.

Decision matrix 'scores' how well each management alternative performs with respect to each criterion in discrete MCA.

Management alternatives are possible 'project candidates' from among which the decision-makers can choose. For example, management alternative A could include the harvesting of high quality timber, the purchase of a sawmill and the milling of logs in a sawmill to produce green-off-saw timber, while management alternative B could involve the harvesting of poles, the purchase of a vacuum pressure treatment plant for poles and the treatment of harvested poles in the vacuum pressure facility. In discrete MCA methods there are a finite number of mutually exclusive management alternatives, while in continuous MCA techniques there is an infinite set of management alternatives defined by combinations of various *activities* at various *performance levels* and bounded by *resources*, *constraints* and *goals*.

An *activity* is one of potentially many courses of action that is undertaken as part of a project in a continuous MCA approach to decision-support. Three examples of activities include the harvesting of high quality timber, the purchase of a sawmill and the milling of logs in a sawmill to produce green-off-saw timber.

Resources constrain the decision space in continuous MCA by limiting the *performance level* that can be achieved by a *variable*. Examples of resources may include, capital budget, volume of harvestable timber per hectare and the number of trucks available to haul logs to town.

Variables are objects about which decisions are being made and are closely associated with *activities*. For example, the activity 'harvest timber', might have the variable associated with it, 'number of hectares harvested per annum'. Note that in models incorporating risk or uncertainty, some variables may be independent of the decision-making process. In this case it is common to distinguish between *decision variables* and *independent variables*.

An *objective* is something pursued to its fullest and generally indicates the direction of change desired by the decision makers, e.g. maximise area for wildlife conservation.

An *objective function* is a function of variables that represents mathematically the *objective* or *objectives* that the decision-maker seeks to optimise (maximise or minimise).

Criteria provide the basis for evaluating and comparing potential *management alternatives* in a discrete MCA problem according to a well-defined point of view. Criteria act as surrogate measures of achievement or realisation of the stakeholders' *objectives*. For example, a criterion used to assess the achievement of the objective 'maximise area for wildlife conservation' may be 'forest area logged annually'. More than one criterion may be used to measure the achievement of an objective.

Constraints are formal relationships between *resources* and *activities* that must be satisfied. Constraints restrict the set of *performance levels* that *variables* can assume in continuous MCA approaches.

Goals or soft constraints provide the basis for evaluating and comparing potential management opportunities in many continuous MCA approaches. Goals in continuous MCA have the same function as multiple *objectives* in discrete MCA; however they

enter the decision-support model in a different manner. Goals are special types of constraints that the decision maker ‘hopes’ to achieve, but does not have to achieve. Constraints and goals differ mathematically in MCA by the inclusion of positive and negative *deviation variables* in the latter that allow the under or over achievement of *aspiration levels*. The deviation variables enter the objective function of the problem as the variables that must be optimised. For example, the deviation variable for a goal used to assess the achievement of the objective ‘maximise area for wildlife conservation’ may be ‘underachievement of target wildlife conservation area’.

The *performance level* of a *variable* is the specific value that the variable assumes for a particular *management alternative* in either discrete or continuous MCA. The evaluation of a management alternative against a *criterion* or *aspiration level* is made concrete through measuring or estimating its performance level. This positions the management alternative on a preference scale and facilitates comparison with other management alternatives.

The *aspiration level* represents a target performance level for a *variable* that is desired or acceptable to the decision makers. Aspiration levels are only found in *goals*. When aspiration levels are used, the modeller is implicitly utilising the notion of *satisficing*.

Satisficing is the process of finding a solution to a problem when there is some flexibility allowed (i.e., over or underachievement of *aspiration levels* while imposing a penalty for these deviations) with respect to *goals*.

Priority levels can be used to prioritise the achievement of *criteria* or *goals*. A criterion or goal of priority level one must be achieved as closely as possible before achievement of a criterion or goal of priority level two is attempted, and so on. Priority levels are not weights.

Weights are used to impart the stakeholders’ and decision-makers’ preferences upon *criteria* or *goals* of the same priority level.

A *dominated solution* ‘is one for which there is some other *management alternative* that provides *performance levels* that are just as good, or better, for each and every *objective* [or *goal*]’ (Ignizio and Cavalier 1994, p. 528).

References

Ignizio, J.P. and Cavalier, T.M. (1994), *Linear Programming*, Prentice Hall, Englewood Cliffs, New Jersey.