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Socioecological landscape planning approach and multicriteria acceptability analysis in multiple-purpose forest management

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Abstract

In the socioecological landscape planning of natural resource management, sociocultural and ecological decision criteria are integrated with 'traditional' economic considerations in an analytic and systemic way. As the main phases, the approach involves (1) pinpointing the sites of foremost importance from the viewpoint of ecological and sociocultural management objectives; (2) elaborating different so-called ecological and sociocultural networks, the combinations of which determine alternative socioecological networks; (3) producing alternative timber production programmes for areas not included in different socioecological networks (resulting in different alternative management plans for the whole area under planning); (4) evaluating the relative worth of alternative plans with respect to each relevant objective; and, finally, (5) the holistic comparison of alternative management plans by applying multiple criteria decision aid methods. This article first discusses the principles and rationale of the approach. Then an illustrative application of the new planning approach is presented. In the application, recreational and ecological objectives were integrated into forest management planning of a landscape owned by the State. The criteria were measured on ordinal scale, and they were ranked according to their mutual importance. Stochastic multicriteria acceptability analysis with ordinal criteria (SMAA-O) was used in the holistic comparison of alternative landscape-level plans. The socioecological landscape planning approach was found practicable. The Finnish Forest and Park Service, governing the vast majority of State-owned lands in Finland, has already made the decision to apply the approach in strategic natural resource management.

Keywords: Forest planning; GIS; Landscape planning; Multicriteria analysis; Multi-functional forestry; Natural resource management; SMAA methods

1. Introduction

The multi-objective approach can be considered to be a starting point for almost all planning involving the natural resources. In many planning situations, the number of objectives is greater the greater the number of people and interest groups affected by the planning and the more there are final decision-makers. The spectrum of objectives in forest planning and the demands set on planning are generally at their widest in forests owned by public bodies, for example, by the state. There the plans typically apply to large areas,

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and the number of people keen to participate in decision-making related to the management of the common resource is great. In practice, there have been attempts to face up to the challenge of multi-objectivity by means such as participatory and ecosystem management planning.

The ecological aim in ecosystem management planning is to apply broad-in-scope ecological review to find the means of securing the biodiversity of the landscape (Grumbine, 1994; Lackey, 1998; Leitao and Ahern, 2002). Landscape ecological assessments are implemented to determine the ecological potential of the planning area, to produce alternative ecological solutions and to assess the worth of alternative solutions in relation to the preservation of the viability of organisms. In practice, ecosystem management and landscape ecological planning often also include considerations related to objectives other than those of just ecology, such as objectives related to wood production, forest recreation and nature tourism (e.g. Karvonen, 2000; Pirot et al., 2000).

Then the central task of planning at the landscape level becomes that of reconciling the various objectives, forms of use, and multi-functionality of the area under consideration. To take an example from practical forestry; sites of great ecological or scenic value are often taken into account by leaving some forest stands or other sub-areas outside forest treatment aimed at wood production. From the viewpoint of wood production, this creates set-aside areas of different kinds in the forests. Planning is at its most efficient if the choice of these sites is considered simultaneously in regard to all the relevant planning-case-wise objectives (Store and Kangas, 2001). However, a problem of central importance has been how to efficiently integrate sociocultural objectives into multi-functional planning.

The socioecological landscape planning approach provides one solution for alleviating this integration problem. The approach was recently introduced by Kangas and Store (2002). The socioecological planning represents a typical task for the management of multiple-purpose forestry to find a balance between timber production, recreation and nature conservation, and to identify areas of conflict. In the socio-ecological planning, as presented in this paper, the process of multi-functional planning is approached in an analytical, systematic and systemic way so that all the phases of the process together form an integrated whole.

2. General outiline for the socioecological forest planning approach

In the socioecological planning process, a host of different alternative ecological networks consisting of ecologically valuable patches and connections between them are produced. For areas belonging to these ecological networks, only ecologically acceptable treatment options, if any, are allowed. Correspondingly, alternative sociocultural networks are elaborated with various amounts of land area reserved for recreational and other sociocultural purposes. Combinations of these two kinds of networks form the socioecological networks. If there are l ecological networks and n sociocultural networks, the number of alternative socioecological networks is $l \times n$.

In the next phase, when applied in forestry context, each socioecological network is provided with m alternative wood-production programmes involving different treatments for forest stands not set aside from wood production due to their ecological or sociocultural values. Thus, we finally have $l \times n \times m$ alternative management plans each with different ecological, sociocultural, and economic consequences.

These entire landscape level forest plans are then finalised for the evaluation step. For example, additional analyses useful in the evaluation can be produced, such as wildlife habitat assessments utilising spatial models within GIS. The priorities of alternative plans are assessed with respect to their ecological, sociocultural and economic objectives, and finally holistically with respect to all objectives. In the holistic evaluation, Multiple Criteria Decision Aid (MCDA) methods are applied (for a review of MCDA methods, see, e.g. Bouyssou et al., 2000; Belton and Stewart, 2001; Kangas and Kangas, 2002 for their forestry applications). Elaborating sociocultural and ecological networks as well as using MCDA methods in the evaluation of alternative plans can also serve as channels and platforms for public participation.