

Stakeholder group modelling as a participatory tool to identify and reduce barriers for co-management of multifunctional landscapes

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Background: There is an increasing demand for landscape scale planning at the European and national levels e.g. with regard to green infrastructure and the wider landscape. The European Union promotes a development of a system of green infrastructure and the Swedish Environmental Protection Agency (SEPA) is tasked with developing guidelines for Swedish land, freshwater and sea areas. Green infrastructure is defined by SEPA (2015) as "an ecological network of habitats and structures, nature areas and constructed elements designed, used and managed in such a manner that biodiversity is conserved and societally important ecosystem services are promoted in the whole of the landscape". The development of green infrastructure is supposed to occur through regional action plans and to include land-users and stakeholders (M 2014-1948-MN). However, as Wu et al (2017) notes, in a case study on integrated nature and heritage planning, the ability to plan the landscape holistically is constrained by differences between objectives among involved government agencies and, in practical terms, an exclusion or marginalisation of public influence. Similarly a stakeholder group modelling study on planning for National Environmental Objectives in the Swedish mountains (Sverdrup et al. 2010, Schlyter et al. 2012) illustrated that insufficient or *pro forma* involvement of local actors in the landscape was an important reason for poor environmental outcomes in comparisons with official environmental objectives.

Aim and methods: We aim to test the usefulness of group modelling as an approach for participatory landscape planning, using a real world case, letting stakeholders analyse ways to maintain a long-term sustainable and attractive landscape in an area under an increasing demands for natural resources, ecosystem services, biodiversity protection, infrastructure, housing, recreation and tourism. We used systems dynamics and a group modelling approach (Andersen et al. 2007, Vennix 1996, Sterman 2000, Maani & Cavana 2000, Sverdrup et al 2010, Schlyter et al. 2012, Hovman 2014) with local stakeholders to, in a trans-disciplinary process, develop conceptual models covering the social, economical and ecological aspects of a sustainable landscape planning and green infrastructure management. The modelling involved 20 stakeholder representatives interacting during four workshops spread over a timespan of about a year. Each workshop lasted a full day. The stakeholders represented farmers/forest owners from big estates to small landowners, tourism operators, also recreational users, the local Cultural Heritage Society, other NGOs and municipalities, the County

Administration and the National Park Administration. In the modelling process the stakeholders collectively developed and reviewed their problematizing and understanding of the landscape–land-use system through the joint construction of CLD models.

Results and discussion: The conceptual systems modelling allowed stakeholders to both synthesize and critically assess, their own and others' perspectives, assumptions and biases. Identified key actors, to create a diversified landscape, were the landowners and their long-term motivation to work within the forestry and agricultural sectors. This motivation is affected by the degree of the existence of a continuous collaborative dialogue between stakeholders and authorities. Currently this dialogue affecting the trust in authorities is negatively influenced by – two authority related – reinforcing feedback loops involving aspects of: inflexible standardised rule application, red tape and unclear legal practises; and civil service culture, rule of law in animal husbandry. The stakeholders identified a need for a more a bottom-up approach with an active dialogue between authorities and stakeholders in order to balance a currently existing negatively reinforcing loops affecting the perceived legitimacy of authorities and local critique of objectives for landscape management if one is to achieve a co-managed multifunctional landscape.

A couple of general aspects are noteworthy. First, that that the stakeholders participated without any economical compensation for their time spent during four days modelling sessions and that their interest and willingness to attend was kept-up over a years time. Secondly, through the CLD construction, pre-existing strong conflicts over discourse were transformed into agreement about causes, effects and feedbacks while disagreement over specific objectives and means might still remain. This consensus was reached as participating stakeholders felt that that they got a voice and was listened to as the group got gripped by the task of developing models of joint understanding that passed a collective peer review, i.e. the groups experience of how things worked. This is in line with the experiences of stakeholder based modelling of conflicts around environmental objectives in mountain areas in northern Sweden (Sverdrup et al. 2010, Schlyter et al 2012) but also from our experience of applied stakeholder group modelling of strong conflicts in totally unrelated fields like public procurement. Thirdly the CLD by acting as a common language guaranteed the consistency and continuity of the analysis, i.e. a coherent systems view of the ecological, social and economical components in the model as well as providing an arena for social learning over time (Elbakidze et al 2015). Contrary to other group modelling methods discussed by Reed et al (2009) all the stakeholder perspectives were evaluated on an equivalent basis allowing a joint understanding of the problem even if opinions about the relative strength of different factors in the model may be at hand.

The Swedish landscape is a cultural product and the result of management over centuries. The high biodiversity and green infrastructure values in the future will continue to rely on the active management of landowners and tenants. Better methods for including and systematizing stakeholder input in planning is needed if official rhetoric about participation, holistic planning over sector boundaries and multifunctional landscapes is to be realised, cf. Wu (2017). To effectively, on a landscape scale, plan for a functional green infrastructure including production, conservation and restoration calls for an understanding of the social-ecological system underpinning the landscape. A key to this process is knowledge and learning exchange between authorities and stakeholders, between stakeholders as well as between researchers and all stakeholders (Elbakidze et al 2015). With the on-going and expected impacts of climate change on forestry and agriculture, this process of knowledge exchange is likely to grow in importance over time. As this study suggests, group modelling is a powerful analytic and conflict reducing, transferable and scalable, approach to facilitate participatory landscape planning for multifunctional landscapes.

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