Handling Complex Environmental Issues – Formal Group Modelling as a Deliberative Platform at the Science-Policy-Democracy Interface

Peter Schlyter[1], Ingrid Stjernquist[1], Harald Sverdrup[1,2]

1. *Environmental and Resource Dynamics Group, Dept. of Physical Geography and Quaternary Geology, Stockholm University, SE-106 91 Stockholm, Sweden*
2. *Applied Systems Analysis Group, Dept. of Chemical Engineering, Lund University, P.O. Box 221, SE-222 21 Lund, Sweden*

ABSTRACT

Against a background that the Swedish Environmental Protection Agency had identified poor progress towards the national environmental objectives for the mountainous areas of central and northern Sweden, we performed group modelling with stakeholders over a one year period. A total of more than 40 different stakeholder interests were invited and close to 40 attended the group modelling sessions. In total four modelling sessions were performed. After an initial and short instruction in systems thinking and the use of Causal Loop Diagrams (CLD) as a common language, group modelling was initiated. From a process point of view we noted that:

A/ While some stakeholders were not communicating (and in some cases barely on speaking terms) with each other before the first modelling session. Modelling provided a platform for dialogue;

B/ As CLD modelling allowed a collective definition of relationships and processes for the modelled area all stakeholders could participate on an equal basis;

C/ Modelling efficiently defused old conflicts as focus was shifted towards processes rather than the goals of any given stake holder;

D/ All participants, and the Swedish EPA, gained a better understanding of the mountains environment (both in a physical and social sense) and identified new relationships and previously unidentified causes for stakeholder conflicts and poor environmental target achievement.

The stakeholders identified factors and processes (social, economic, biophysical and psychological) that affected their life in the mountain area and their relations to the achievement/non-achievement of the national environmental objectives, and their narratives were converted to common system maps as a part of the process. The models were documented and sent to the participants for extended peer review and used in subsequent modelling sessions. The project resulted in:

1/ A joint and in the end uncontested analysis based on CLD-models of the social, economic and environmental dynamics in the Swedish mountains was developed;

2/ A stake-holder based proposal, underpinned by the joint analysis, for a research programme developed during the group modelling sessions;

3/ A publication in the EPA publication series describing the modelling process and its results.

BACKGROUND

There is an increasing interest, both from theoretical and practical perspectives, in more inclusive or deliberative forms of governance. Improved deliberation and new modes of governance holds promise both with regard to wider democratic input in the policy process and to improved substantive efficiency with regard to actual outcomes (cf. Bäckstrand et al 2010, Schlyter & Stjernquist 2010, Schlyter et al. 2009). However, there is, in our opinion, somewhat of a discontinuity between deliberative theory ideals and formal approaches to improve actual deliberative processes and current deliberative practices in truly complex issue/policy settings.

While there is a wealth of writings on deliberative democracy theory (and on green democratization), there are relatively few case studies on formal methods to achieve dialogue about complex, contested and dynamic issues across boundaries between different, often strongly entrenched, interests and stakeholder perspectives. There is clearly a need to test and document operational methods that facilitate broad deliberation on complex, contested and dynamic issues where joint identification of problems, processes and possible solutions are made across stakeholder divides if society is to improve deliberative practice. In our experience group modelling is one such method of great potential but before we present a case study we will briefly comment on some of the difficulties facing deliberative theory from an applied environmental perspective.

PROJECT AIMS

The aims of the project were to:

- map structures and interactions between stakeholders and interest groups in the mountain area
- analyse how processes within the mountain area influences the management the landscape
- analyse how processes within the mountain area influences the ability to reach the Swedish Parliamentary Environmental Objectives
- develop a research programm for the mountain area in support of the envoronmental objectives

THE DELIBERATIVE ANALYTIC CHALLENGE

Suggestions that deliberative democracy by default deliver efficient outcomes within the environmental field (Dryzek 2000), or any other field for that matter, have been questioned (e.g Smith 2003, p. 67) and are, in our opinion, unduly optimistic and fail to recognise, among

other things, the difficulties of analysing complex interrelated dynamic issues and the need for a deliberative methods that in a systematic way enables such a collective analysis. Current environmental issues are in general characterised by their complexity and the associated uncertainty (including multiple causes, effects, different time-lags and feed-backs), often involving effects dissociated in space and time from their causes (e.g. in Sweden the over a century accumulated acid rain effects on soils, limnic and terrestrial ecosystems caused by industrial use of fossil fuels far outside the national borders and affected ecosystems) and differential impacts on various stake-holders with, in turn, different perceptions and acceptance of perceived future risks and impacts. If one assumes that deliberative processes will or, less ambitiously, may deliver efficient outcomes one need to consider how the process is tailored to facilitate the joint analysis of complex issues with time-lags, feed-backs and uncertainty. Unfortunately, most theoretical writing is of little help in this respect even though there is much to be said, at a most general level, for a Habermasian assumption that the deliberative process should be characterised by inclusiveness, fairness and an open dialogue. Clearly there is a need for general methods, applicative in deliberative settings, that reduces opportunities for manipulation, discourse control and power play while instead enhancing rational collective analysis and at the same time facilitating mutual recognition of individual as well as joint stakes, problems, interests and actual and potential future conflicts between stake-holders.

SYSTEMS ANALYSIS AND GROUP MODELLING

Environmental issues have, as suggested by Lundgren (19) moved from being "first generation issues" where impacts were more or less local and direct, where causality was relatively obvious and uncontested, conflicts more or less confined both spatially and legally with well defined parties and the effects of potential counter measures were, likewise, reasonably easy to overview and assess with regard to pros, cons and costs. Instead current "second generation" environmental issues are characterised by effects separated in space and time from their causes, which often are highly complex including feed-backs and non-linearity. Causation is more often than not highly contested even among specialists which often results in increasing impacts before actual causes have been identified. Scientific controversy as such facilitates stalling strategies. Thus several factors may combine to allow problems to grow over time and counter action can thus turn out to be both socially and economically costly. One can therefore argue that complexity, including delays and non-linearities, form a significant part of the analytical challenge and that negative environmental

impacts – the environmental problems in everyday parlance – are more of a symptom of a systems problem. Viewed this way, as systems problems, environmental issues are societal issues requiring a systems perspective for their potential solution. This will put some distinct demands on any deliberative process that aims to move beyond a formal democratic procedural criteria of successful deliberation as the process in itself need generally applicable methods to develop a joint systems understanding in order to move forward towards identification of solutions and efficient/acceptable outcomes.

We use the standard methods of systems science and design engineering: Systems analysis to map major causal relationships. The study uses the generic systems dynamics procedure (Vennix et al., 1992, Sterman, 2000, Haraldsson & Sverdrup, 2004), group modelling (Vennix et al., 1992, Maani & Cavana, 2000) and the learning loop (Haraldsson 2005). The method used for constructing the model followed a strict scheme (Haraldsson et al., 2004), as well as deriving links by empirical-, experimental- and Delphi methods (for a review cf. Haraldsson et al., 2005).

Causal loop diagrams (CLD's) are used in the analysis for finding major system connections, important feedbacks and system structures. As the analytic task is about making sense of a complex reality where individual interests/stake-holders often have limited insight outside their immediate experience the analysis needs to be performed as group sessions to allow the development of a joint systems understanding. The CLD's provide a common unambiguous language for describing relationships between components within a system, also for quality control through immediate peer/stake-holder review of the proposed system. The model development process is collaborative and dialectic – characterised by successive cycles of suggestions for important systems relationships, critical assessment and critique within the larger group and subsequent redevelopment and improvement – eventually arriving at a jointly developed, jointly tested and jointly accepted model. It also necessitates careful argumentation and listening to others arguments/counter arguments as what finally goes in into the model is based on a consensual agreement on what is logical or actual causal effects between components. As a language the CLD technique is easily learned and it neither presupposes any advanced mathematical knowledge nor any higher or particular educational background. The notation is after a while easily readable and in our experience stake-holders after a while tend to read diagrams as easily as newspaper text.

CASE STUDY: THE SWEDISH ENVIRONMENTAL OBJECTIVE MAGNIFICENT MOUNTAIN LANDSCAPES

Background

In 1999 the Swedish Parliament unanimously passed fifteen National Environmental Objectives (a sixteenth, biodiversity objective was added 2006) which are supposed to guide not only public policy but also inform activities amongst all sectors, stakeholders and the public at large (Environmental Objectives Portal, 2011). Successful implementation is to a large extent dependent on the aggregated action of a multitude of actors, stake-holders and individual citizens and not only on government policy and action. Progress towards objectives has been varied. Significant critisism has been levelled against the work towards the objectives by the National Audit Office and also by researchers e.g. the balance in resource use between official monitoring and reporting of objective achievement and actual spending on environmental improvement activities, in the way they have been operationalised and in instances of incorrect use in situations affecting individuals seeking planning permissions, permits etc (Emmelin 20XX, Lerman & Emmelin 2004, RIR 2005).

The Swedish Environmental Protection Agency (SEPA) had identified poor progress towards the National Environmental Objective "Magnificent Mountain Landscapes" for the mountainous areas of central and northern Sweden and commissioned an analysis of the environmental objective and its sub-objectives and associated monitoring schemes in order to develop management tool for sustainable development. The remit also included the development of a proposal for a research programme to support future work towards the objective.

Approach and methods

We decided on a systems analysis approach based on group modelling to involve a large number of stake-holders and interests within the mountain areas in the critical appriasal of the Magnificent Mountain Landscapes Objective and the development of a research programme. As such the project can be seen as a rare example of citizen science where the public is not, primarily involved with data collection, but with evaluation of official policy, policy efficiency research agenda formulation (i.e. discourse development).

Ahead of the first group-modelling session we as researchers/stake-holder meeting facilitators read up on the mountain environment covering biophysical, historical, legislative

and governance aspects of relevance to the area based on scientific publications, government, local agency, NGO and other "grey" publications, letters to local newspapers covering debated topics etc. Stake-holders were identified by us and SEPA and invitations to the project were sent out together with questionnaires well ahead of the first scheduled meeting. Questions mainly covered stake-holders awareness of environmental objectives and sub-objectives, their impact on stake-holder activities and vice-versa, stake-holder identified likely future problems/conflicts both with regard to their own activity, other stake-holders activities and the environmental objective.

A total of more than 40 different stakeholder interests were invited and close to 40 attended the group modelling sessions, Table 2. Stake-holders covered actors from the very powerful and capacity strong, e.g. Fastighetsverket (The National Property Board Sweden), Försvarsmakten (Swedish Defence), Jordbruksverket (Swedish Board of Agriculture) via municipalities and NGO's like Naturskyddsföreningen (Swedish Society for the Protection of Nature) and Svenska jägareförbundet (Swedish Hunter's Association) to relatively speaking the more marginalised and capacity weak like the Svenska samernas riksförbund (Swedish Saami Association), Sveriges fäbobrukare (Swedish Hamlet Users Association) and Ekoturismföreningen (The Society for Ecoturism). Personnel from Naturvårdsverkets fjällmiljöenhet (the SEPA Moutain Environment Unit), Östersund) were attending all stake-holder meetings.

Group modelling work-shops with stakeholders was spread over half years period with four large group modelling work-shops and, after request, two smaller meetings with specific stake-holder groups, for a chronology see Table 3. The structure with work-shops spread over months were chosen in order to allow sufficient time for stake-holders to do their homework in terms of critical reflection, peer review and to allow stake-holder modifications to systems maps and the developing report as well as to provide time to enable discussions between stake-holders and with facilitators between work-shops.

As a parallel activity a work-shop with various Swedish researchers doing mountain objective related/relevant work was arranged in connection with the third stake-holder work-shop in order to provide the facilitators and stake-holders with a convenient overview of the "state of the art" in central fields, to inform the researchers about the project and to indicate that a proposal for a future research programme was being developed together with the stake-holders, Figure 1. The researchers were, however, not invited to stake-holder work-shops.

The project resulted in a joint analysis with CLD-models, for an example see Figure 2, and a stake-holder defined proposal for a future research programme, a report published in the

SEPA report series (Sverdrup et al. 2010) and a public presentation of the results at a seminar at the Swedish Royal Academy of Sciences.

Activities during group modelling sessions

Work-shop 1. The first work-shop's objective was identify important concepts and factors affecting the mountain environment and to analyse a historical background judged to be of importance for the mountain areas long term management with regard to natural resources, social conditions and economic opportunities. During presentations the stake-holders described their role in the mountains, i.e. identified factors and processes (social, economic, biophysical and psychological) that affected their life in the mountain area and their relations to the attainment/non-attainment of the national environmental objectives, as well as their visions for the future. Presentations were followed by short introduction by the facilitators in systems thinking and the use of Causal Loop Diagrams (CLD) as a common language to describe systems.

The rest of the work-shop focused on clarifying the concept Magnificent Mountain Landscapes and on gaining an overview of issues facing the mountain areas as well as defining the system boundaries of the study area (which could not be geographically defined only as, e.g. reindeer herding – critical for maintaining environmental values in the mountain area – is dependent on winter grazing in lowland forests far removed from the mountains in a geographical sense). Stake-holders were divided into two groups for CLD modelling. The first was tasked with developing a general systems map of the major linkages between society, economy and environment in the mountains. The second group with: a/ identifying linkages between tourism, snowmobile use, magnificent nature and reindeer herding, b/ developing a systems map of tourism as an activity and its relations with reindeer herding, mountain farming, infrastructure and "magnificence" and, c/ a systems map of power production, mining, large scale infrastructure and "magnificence". Both group were tasked with identifying stake-holder visions for future regional development, current problems and future challenges. Results were presented by the groups and criticised by all. The facilitators documented the systems map and the discussions, and the "minutes" were later sent to all participants as homework for peer review.

During the review phase the need for more detailed CLD maps of important sub-systems like tourism, snowmobile use, energy production, mining, farming and forestry, saami cultural identity and governance were identified.

Work-shop 2. Work during this meeting followed – after a presentation and tentative consensual agreement on the previous peer review based revisions of CLD's and important concepts – the same format as the previous one with smaller group sessions, presentations, critique and homework. Stake-holders were divided into three groups for group sessions focused on creating CLD maps for important sub-systems. One group worked on forestry and agriculture, governmental and social functions (society, trust, legitimacy and state, regional and local authorities; saami culture and identity). A second group focused on heavy industry, infrastructure (hydro and wind power, power grids, mining, roads). The third group on the role of the state, regional and local government and control, the impact of rules and regulations and governance models. As before, system maps and discussions were documented and sent to the participants for review; so was an early draft version of the project report.

Work-shop 3. This work-shop focused, after the customary review of the results from the previous one, on needs within research and the mountain area management. The stake-holders identified:

1/ future research needs and developed an outline for an integrated research programme more centred on needs for the management of the mountain areas as a social-ecological system than the current programmes,

2/ dysfunctionalities needs for improvement in the current governance strategy for the mountain areas and,

3/ joint visions for the future management and development of the area. As before, system maps and discussion minutes were documented and sent to the participants for review together with the current draft of the project report.

Work-shop 4. This work-shop was devoted to: 1/ reviewing the draft version of the final report in order to arrive at a product that all stake-holders could accept and felt represented the joint analysis and conclusions and, 2/ more in detail define a research programme that would support work towards the environmental objectives and sustainable development in the mountain regions.

Results

The main result of the group modelling was that, even if the official objective may be critisised for being vague, incomplete and difficult to operationalise, the main impediments to realise the objective "Magnificent Mountain Landscapes" are owing to a too narrow focus on

environmental sustainability and to little attention on the social and economic components required for a sustainable development of the mountainous areas. Success in reaching the National Environmental Objectives is to a high degree are dependent on their wide acceptance and a decentralised actions by a multitude of actors, however, local experiences of previous and current administrative practices are not facilitating environmental management, rather they contribute to the difficulties of implementing the environmental politics. Lack of perceived legitimacy of, and trust in, government authorities among local stake-holders, as well as uncertainties related to issues of land ownership and land-use rights are factors that impact negatively on the work to attain environmental objectives.

Poor coordination between state agencies and often conflicting advise or decisions further reduce local society trust and legitimacy. Some agencies had a better record than others, in particular the Forestry Board with local branch offices, whereas others historically have been involved in abuse of power and even legal irregularities. In short, the majority of the stake-holders felt that "the state" in many cases had poor local knowledge, often acted arbitrary and showed little interest in local lively-hoods and that consequently the perceived legitimacy of its policies were low. While SEPA's reputation, as a state agency, is not too bad it focuses according to the stake-holder analysis too narrowly on the environmental aspects while failing to acknowledge that in order to achieve the environmental objectives is have to take not only environmental aspects into account but social and economic ones as well – environmental sustainability is only one component in the sustainable development triad.

Based on the group modelling participants concluded that there was a need to:

1/ In general, develop a new, more participatory, governance/management strategy for the mountain areas with a broader focus including social, economic and environmental aspects.
2/ Develop indicators to monitor the efficiency and quality of the governance/management of the state agencies in the region.
3/ Let a unified sustainability perspective inform planning and management in the mountain region.
4/ Develop new appropriate, relevant and operationally useful environmental objectives that also are monitorable as the current monitored parameters are partly arbitrary, of poor relevance and hardly covered the whole field of components that aggregated constitute magnificent mountain landscapes.
5/ Develop integrated prognostication and scenario models that may make use of available official statistics and the monitoring results (cf. 4 above) so as to proactively assess environmental impacts of changes in resource exploitation, technology and e.g. climate change.

6/ Develop grass-root contacts and coordination between local interests and stake-holders to balance the state influence and achieve co-management of the mountain environment.

With regard to the proposed research programme the stake-holdersgroup modelling participants concluded that:

1/ They all agree on the need for a new integrated transdisciplinary research programme. The stake-holders argue that it is crucial for its success that the research is multidisciplinary and that it include stake-holders and land-users in the programme. The research should, with environmental objectives in focus, encompass the full triad of sustainable development aspects. The social dimension was particularly emphasised.

2/ The stake-holders believes that the SEPA and other major authorities need to actively participate in the research programme.

3/ The research ought to be supported by "field tests", i.e. the results need to be tested against real world conditions. The stake-holders need to be assured that field validations have been made.

4/ Stake-holders wants results presented in a for them understandable and useful form and not only through scientific publications.

5/ The research needs to get sufficient resources to solve the tasks at hand and the researches to show local stake-holders respect.

CONCLUSIONS

Several observations are of interest:

1/ While some stakeholders were not communicating (and in some cases barely on speaking terms) with each other before the first modelling session. Modelling provided a platform for dialogue;

2/ As CLD modelling allowed a collective definition of relationships and processes for the modelled area all stakeholders could participate on an equal basis;

3/ Modelling efficiently defused old conflicts as focus was shifted towards processes rather than the goals of any given stake holder;

4/ All participants, and the Swedish EPA, gained a better understanding of the mountains environment (both in a physical and social sense) and identified new relationships and previously unidentified causes for stakeholder conflicts and poor environmental target achievement.

5/ A joint and in the end non-contested CLD-model over the social, economic and environmental dynamics in the Swedish mountains was developed.

6/ The joint analysis underpinned a stake-holder based proposal for a research programme developed during the group modelling sessions.

Several participants expressed that the group modelling sessions provided the first instance for decades when they felt that they got a chance to express their concerns and felt

listened to, and that CLD's as system maps combined with group modelling sessions provided a uniquely functional platform for dialog and process understanding while still allowing for different objectives and values. Through CLD's stake-holders clollectively develop a better understanding of the overall system and its behaviour as well as a better understanding and respect for other stake-holder perspectives and problems. Through the modelling process the stake-holders jointly developed an assessment not only of current but of future issues issues potentially impacting on their livelyhoods and the mountain environment.

The Swedish EPA is currently considering planning to fund a larger integrated transdisciplinar project in part based on the recommendations from the study as well as extending the group modelling approach to other policy areas.

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Table 1. List of participating stake-holders

Ajtte, Svenskt fjäll- och samemuseum , Kjell-Åke Aronsson
Bergsstaten, Jan-Olof Hedström
Destination Funäsdalen, Hans-Ola Törnberg
Dorotea kommun, Nicke Grahn
Ekoturismföreningen, Maria Kjellström
Energimyndigheten, Fredrik Dahlström
Fastighetsverket, Sven Hagström
Föreningen Sveriges Fäbodbrukare, Kristian Olofsson, Pauline Palmkrantz
Försvarsmakten, Lars Moe, Mikael Köhler
Jordbruksverket , Svante Nilsson
Länsstyrelsen i Norrbotten Kultur/Miljö Gunilla Edbom
Länsstyrelsen Jämtland Naturvård, Ruben Johansson
Länsstyrelsen Jämtland Ren/Markförvaltning, Jens Andersson
Länsstyrelsen Norrbotten Ren/Markförvaltning, Erik Gustavsson, Gunilla Manbré
Länsstyrelsen Västerbotten, Kultur/Miljö Jeanette Joelsson
Länsstyrelsen Västerbotten, Markförvaltning Torleif Eriksson
Länsstyrelsen Västerbotten, Miljöskydd Peter Vennman
LRF (Lantbrukarnas riksförbund), Eilert Apelqvist
Malung-Sälens kommun, Ingemar Kyhlberg
Naturskyddsföreningen, Bengt-Göran Carlsson
Naturvårdsverket, Per-Olov Wikberg, Lena Sundin Rådström, Hördur Haraldsson, Bo Nilsson, Anna Von Sydow, Kristian Skånberg, Nils Hallberg
Nätverket Norden, Östen Stenlund
Norra Dalarnas Turistråd, Joacim Johansson
Polarforskningssekretariatet, Olle Melander
Riksantikvarieämbetet. Rikard Sohlenius
Rikspolisen/Fjällräddning, Bengt-Göran Wiik
Rovdjursföreningen, Krister Persson
Sametinget, Ingrid Rehnfeldt
SKISTAR , Anders Aspholm
SLAO samt Svensk Turism, Hans Gerremo
SNOFED/Snöskoter, Elisabet Jonsson, Pär Persson
SSCO/Snöskoter, Jan Sund
SSR (Svenska samers riksförbund) Jörgen Jonsson, Helen Larsson
Svenska Jägareförbundet, Hans Geibrink
Svenska Kraftnät, Katrin Seuss
Svenska Turistföreningen, Pelle Andersson
Sveriges Geologiska Undersökning (SGU) Christina Lundmark
Tillväxtverket, Kerstin Lindblad
Vägverket, GunnBritt Mariedahl

Table 2. Chronology of activities.

Date	Location and activity *
June 15, 2009,	Östersund. Work-shop with stake-holders
August 19, 2009,	Östersund. Work-shop with stake-holders
September 2,	Östersund. Meeting with “Mountain Researchers” presentations by researchers from FjällMistra, Large Predator Research and land-use research. The facilitators and most stake-holders present.
September 3 2009,	Östersund. Work-shop with stake-holders
November 10, 2009,	Umeå. Informal meeting with Svenska samernas riksförbund and Sametinget. Revised CLDs and texts
November 11, 2009.	Umeå. Workshop with stake-holders
November 19, 2009.	Informal meeting with the Swedish Tourist Association (STF), Svenska Liftägare (SLAO) and ski-resort representatives in Stockholm. Revised CLDs and texts
February 16, 2010.	Stochkolm. Final work-shop at the Royal Academy of Sciences where the final report is presented. SEPA, stake-holders, authorities, researchers and and media present

* During the whole process: e-mail dialogue with Nätverk Norden, Svenska Fäbodföreningen, Naturskyddsföreningen and various other stake-holders.

FIGURES

Figure 1.