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Measuring and Monitoring Socio-Cultural Sustainability in the Action of Forest Biodiversity Cooperation Networks

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To safeguard overall sustainability in forest resource management, the ecological, economic, social, and cultural dimensions of sustainability should all be considered. However, the socio-cultural impacts are frequently contemplated only weakly in sustainability assessments. Hitherto, attempts to operationalize socio-cultural impacts arising from economic utilization or conservation of forest resources have been perceived as vague when compared to rigorous ecological and economic indicators. One reason is that socio-cultural impacts of forest management on individuals and communities are many and by nature context- and case-specific: they need local definition, which hampers diffusion of good solutions. This study developed a multi-criteria method for measuring and monitoring socio-cultural impacts of forest resource management; the case of cooperation network projects within Forest Biodiversity Programme for Southern Finland (METSO) provided empirical data. Based on a literature review, a set of 10 criteria and 25 indicators was compiled. Cumulative utility scores, presenting networks' contributions to socio-cultural sustainability, were generated using performance, expert evaluation and weighting data and an additive utility model. The method enables longitudinal monitoring of socio-cultural impacts, which is beneficial because outcomes are different at different time points of projects' life cycles and some appear with a delay. The method can be used in comparing sub-utility distributions i.e. monitoring units' performance profiles, providing valuable information for policy-makers. The multi-criteria approach and the list of socio-cultural criteria are internationally transferable to other countries and contexts such as forest bioenergy, nature tourism, watershed management, that call for analysing socio-cultural impacts of forest resource management activity on private lands.

Keywords additive utility function, community adaptation, criteria and indicators, METSO programme
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1 Introduction

1.1 Defining and Measuring the Socio-Cultural Impacts of Forest Resource Management

The number of approaches and methods for sustainability impact assessment is vast (see e.g. Pope et al. 2004, Ness et al. 2007, Singh et al. 2009). Discussion concerning sustainable development has for the most part involved questions related to ecological and economical sustainability, rather than social or cultural sustainability and impacts of the use of natural resources (Rannikko 1999).

Alongside ecological and economic impacts, production of forest related services (e.g. biodiversity maintenance, carbon assimilation, securing ground water systems) and the use of forests in general has various socio-cultural impacts on local individuals and communities, such as opportunity to participate, sense of self-regulation and distribution of benefits and losses (Leskinen et al. 2008). These impacts should also be carefully evaluated in policy and operational decision-making processes. Sometimes social and cultural impacts are included under the same concept of socio-cultural sustainability (e.g. Stratford and Davison 2002). In this study, social and cultural viewpoints are both recognized, but since they often appear intertwined, the combined concept of socio-cultural sustainability is consistently used.

Social indicators are considered problematic and this is assumable why social matters have been marginalised and relatively weakly researched in forest policy circles (Slee 2007). Meanwhile, the scope of the concept of socio-cultural sustainability is wide and multi-dimensional. Impacts of the utilization of natural resources on socio-cultural sustainability are difficult to measure and tackle in practical decision-making and project management. One of the first suggestions for forest management planning was based on allocating areas for economic, ecological, and socio-cultural (here: recreation etc.) functions in landscape-level planning (Kangas and Store 2002). In comparison to other aspects, the socio-cultural functions or impacts have, however, attracted only minimal research interest in planning and management of forest landscapes.

From social science and folklore viewpoints the interesting aspect is change – not sustainability – in cultural meanings and symbols, and in social structures. Culture can be interpreted as shared meanings in community (Geertz 1973). These shared meanings become visible in traditions and practices, such as recreation or forest work (Ingold 1993). Culturally important phenomena can be experienced both in common and personally (Leskinen et al. 2008). The cultural dimension of sustainability refers to a situation in which individuals and communities face changes that do not violate their values and in which there is sufficient time to get used to changes: legitimate changes which support individual livelihoods in a manner that sustains the individual's capacity to control his or her life (Rannikko 1999).

Before appropriate assessments of overall sustainability can be executed for the given case, a sufficient frame of assessment and knowledge base for each sustainability viewpoint need to be assured. The above aspects justify the separate focus on developing socio-cultural sustainability assessment, but it is important to stress that ultimately single-viewpoint analyses need to be combined in operational monitoring- and impact-analysis activity.

Criteria and indicators (C&I) have become primary vehicles in implementing the principle of sustainable natural resource management (Brand 1997, Mendoza and Prabhu 2003, Reed et al. 2006, Rosenström 2009). In a tropical forestry context in particular, socio-cultural C&I have earlier been defined based on knowledge of stakeholders and experts (Prabhu et. al. 1999, ITTO 2005). Indicators such as heritage values and employment are usually used to monitor socio-cultural sustainability (MCPFE 1993, Mrosek et al. 2006, Parviainen and Västilä 2011). Global and national C&I lists provide a common ground but they are frequently unsuitable for local use (Jackson et al. 2010) – practical use also requires context- and case-specific local indicators utilizing local knowledge (cf. Parkins et al. 2001, Peuhkuri 2002, Hartmuth et al. 2008). Further, sound socio-cultural impact assessment appreciates individuals' place-specific values perceived by multiple senses (Korpela et al. 2008a,b).

Benefits of the C&I approach include transferability and opportunities for numerical analysis.

C&I have been considered useful, in particular for local performance measurement (Brugmann 1997). Quantitative indicators are easier to process and evaluate than qualitative indicators (Lindner et al. 2010). Socio-cultural values may be seen more contentious and less easily measured than ecological values (Slee 2007). Consequently, socio-cultural indicators have often been qualitatively grounded and at least partly descriptive (Briassoulis 2001), thus challenging to compress to a few quantitative indicators.

However, it is important to be able to measure a phenomenon if it is to be managed, and to make corrective decisions if the related operations are not producing the desired effects. Qualitative data are frequently considered inaccurate and interpretive, making it difficult to integrate related results to actual decision-making processes. However, with careful consideration, qualitative observations and interpretations may be transformed to an ordinal measurement scale, or even to cardinal scales (interval or ratio scale), which allow aggregative calculations (see Leskinen et al. 2009).

The conclusion from a review of the socio-cultural impact assessment literature (Leskinen et al. 2008) was that socio-cultural impacts need evaluation by some decision-support method, such as a multi-criteria assessment (see Diaz-Balteiro and Romero 2008). Indeed, multi-criteria analysis (MCA) based approaches and methods provide a useful framework to tackle at least some of the above listed problems related to measuring socio-cultural sustainability and the impacts of the management and use of natural resources. They do this by providing a structured way to arrange the various socio-cultural indicators.

MCA methods can be used to aggregate specific indicators and specific units into one measure, and can utilize both quantitative and qualitative data and preferences (e.g. Keeney 1982, Kangas et al. 2008). MCA-based tools have also been used in sustainability assessments in forest management (see e.g. Mendoza and Prabhu 2000). Earlier work in this field has included, for example, ranking, weighting and scoring of sustainability indicators in participatory group decision-making context (e.g. Mendoza and Prabhu 2003, Seidl et al. 2011), determining current forest management sustainability scores according to multiple indicators (e.g. Carabelli et al. 2007) and evaluating alternative sustainable forest management strategies with pairwise comparisons and related analytic hierarchy/network process (AHP/ANP) methodology (e.g. Wolfslehner et al. 2005). Recently, Mustajoki et al. (2011) applied decision analysis interviews and multi-attribute value theory to produce multi-criteria analysis of alternative forest plans in context of sustainability and conflict management. Mendoza and Martins (2006) compiled a comprehensive review of multi-criteria analysis techniques for natural resource management, and Diaz-Balteiro and Romero (2008) evaluated approaches and techniques within the last 30 years for making forestry decisions with multiple criteria.

1.2 The Forest Biodiversity Programme (METSO) and Cooperation Networks

Safeguarding forest biodiversity has become an important topic in global forest policy. Finland has started a particular programme to enhance forest biodiversity. The aim of the Forest Biodiversity Programme (METSO) 2008–2016, is to protect the forest biodiversity in southern Finland and to halt the ongoing decline in forest biodiversity by 2016. While biodiversity conservation is the main target of METSO, social acceptability and social impacts are also considered to be of great importance (e.g. Horne 2006, Horne et al. 2009).

METSO aims to be implemented through ecologically and economically effective means. Such pursuit towards effective forest policy implementation is shared between various countries (see e.g. Götmark et al. 2009, Jacobson et al. 2009, Kemkes et al. 2010, McKinley and Cubbage 2012). The programme is largely based on the voluntary participation of family forest owners, who are given monetary compensation for making permanent or temporary conservation contracts in their forests. The compensation is based on the growing stock in the protected area. The Government believes that the objective can be reached in a socially acceptable manner through voluntary-based instruments instead of traditional top-down protection programmes (Government resolution… 2008).

Cooperation networks represent one institutional policy instrument for achieving the aims

of the METSO programme. In 2010 and 2011 seven cooperation networks were operating, with varying themes and organizational structures, in different parts of southern Finland. These cooperation networks were local or regional institutional projects that were coordinated by regional Forestry Centre units (later referred to as FC), Centres for Economic Development, Transport and the Environment (later referred to as ELYs) and the Finnish Association for Nature Conservation (later referred to as SLL).

The aim of the cooperation networks is to engage forest owners in actively building up biodiversity of connected forests. In addition to promoting biodiversity, cooperation networks ought to maintain forest landscapes, develop recreational activities related to forest biodiversity or promote nature-oriented business opportunities related to forest biodiversity. Networks can also operate in the context of village activities. Thus, cooperation networks are particularly highlighting the socio-cultural aims of the METSO programme (Government resolution… 2008).

1.3 Objectives

The objective of this study was to develop a method for quantifying, evaluating and following up the socio-cultural impacts of developmental forest resource management projects. The method is illustrated through a practical example of the ongoing forest biodiversity cooperation networks of the METSO programme in Finland. The motivation of the quantitative approach is to make the socio-cultural impacts visible, transparent and more concrete. The importance of socio-cultural impact assessment could thereby become stronger in forest-related decision-making and policy evaluation processes worldwide, via better enabling the integration of the socio-cultural aspects into overall sustainability assessments.

The rest of this article is organized as follows. Section 2 describes how the C&I were defined to measure socio-cultural impacts, how the empirical data of the METSO case were acquired, and how the MCA-based approach was utilized in order to quantify the overall socio-cultural impacts of the METSO networks. Section 3 presents the empirical results of the METSO networks, firstly the weights for the criteria and then the total and sub-utilities for the networks' socio-cultural performance. In section 4 we discuss the possibilities and constraints for utilizing the suggested approach in the case at hand and wider in comparable forest resource management activities.

2 Material and Methods

2.1 Criteria and Indicators for Measuring the Socio-Cultural Impacts

The list of socio-cultural C&I for METSO cooperation networks' purposes was compiled with the aid of a literature review (Leskinen et al. 2008) and comments given by the coordinators of the networks. The C&I were organised as a typical decision hierarchy (Fig. 1). The upper level criteria, and thus the indicators, were divided into two categories: individual and community level. The upper level criteria represent different dimensions of socio-cultural sustainability, whereas the indicators measure the performances of networks' actions. The final C&I collection comprised 10 criteria and 25 indicators. Overview of the C&I types and levels is also shown in Table 1.

There were two types of indicators: i) the projects' performance measured numerically (hectares, Euros, number of participants etc.); and ii) expert evaluations (here, the experts were the project coordinators). Expert evaluations were based on subjective assessments and values were collected by using a verbal scale (none-little-some-lot, labelled as 0-1-2-3, respectively), which was then linearly transformed to a numerical zero-one scale (i.e. 0-0.33-0.67-1). The use of these expert evaluations was needed, since it was not possible to identify numerically measurable indicators that would have truly illustrated these aspects of socio-cultural impacts. In this case, we had no other assumption but a linear form of sub-utility functions. Criteria and indicators are described in detail in Tables 2 and 3.

2.2 Obtaining Weights for the Criteria

The project coordinator from each project defined

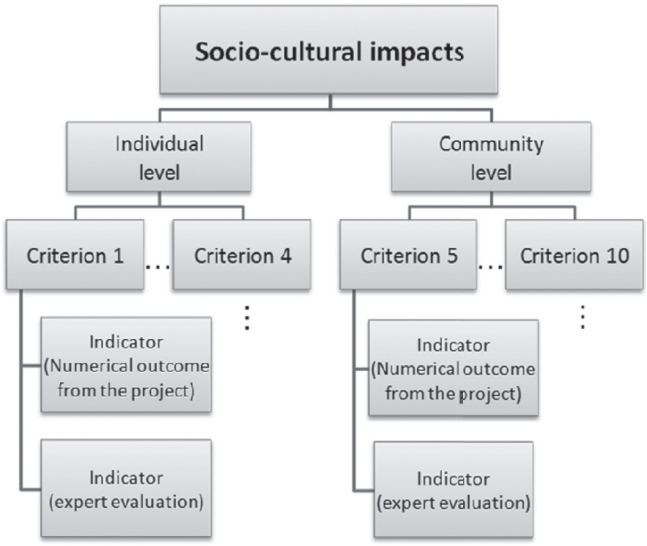

Fig. 1. Illustration of the decision hierarchy for measuring the socio-cultural impacts.

Table 1. Number of criteria and indicators for measuring the socio-cultural impacts under individual and community level categories.

C&I component	Individual level	Community level	Total
Criteria	4	6	10
Indicators (both types together)	11	14	25
Performance-indicators	7	6	13
Expert-evaluation indicators	4	8	12

the importance levels for the criteria for his/her project, which allowed for examinations related to project-specific functions and differences between projects. On the other hand, general weights from the responsible officer of Ministry of Agriculture and Forestry for each criterion were also queried, which allows for (in this case illustrative) policy-motivated performance comparisons between projects. The project coordinators and the officer from the ministry first weighted the ten criteria using the SMART-method (Edwards 1977, von Winterfeldt and Edwards 1986, Kangas et al. 2008), i.e. the respondents were asked to give 100 points (p_j) to the criterion they felt to be the most important and then to allocate points between 0 and 100 to each of the other criteria with respect to the prime criterion. After this, the given points were rescaled to weights (a_j) that sum up to 1 by applying the following formula:

$$a_j = \frac{p_j}{\sum_{i=1}^{m} p_i} \quad (1)$$

For simplicity in this case, equal sub-weights were applied for indicators below each criterion.

2.3 Acquiring Empirical Data from the METSO Networks

Empirical data measuring the performance of the networks for the study were gathered from the coordinators of the cooperation networks in November 2010 and January 2012 using an email questionnaire. All seven ongoing networks replied

Table 2. The individual level criteria (C) and indicators (I).

C1 *Legitimacy from the forest owners' point of view, forest owners' authority and acceptability of operations.* (Forest owners are active actors. They have opportunity to participate and have an influence to final realization of protected areas.)	
I 1.1	How many cases of protected areas final realization has been affected by forest owners' own views?
I 1.2 a)	How many forest owners have taken part in personal consultation?
I 1.2 b)	How many forest owners have taken part in group trainings?
I 1.2 c)	How many forest owners have taken part in trainings? (indoors)
I 1.2 d)	How many forest owners have taken part in trainings? (forest)
I 1.3	Protected areas have been managed flexibly. Alternatives have been offered to forest owners.
I 1.4	Network has successfully provided ecological knowledge to forest owners.
C2 *Legitimacy perceived by other people than forest owners. Opportunity to participate, acceptability of operations.* (Other people than forest owners have had the opportunity to participate. Local groups e.g. bird-watchers, have had an opportunity to participate to the planning of the management of the protected areas.)	
I 2.1	In how many cases of protected areas have other people than forest owners had the opportunity to participate?
I 2.2	Network has successfully encouraged local views.
C3 *Individual level: forest experiences and taking into account local knowledge.* (Forest owners local and tacit knowledge e.g. knowledge of areas earlier land use, have had an influence to final realization on the protected areas.)	
I 3.1	In how many cases of protected areas forest owners local knowledge has been affecting the final solution?
C4 *Forest owners' authority: empowerment and sense of self-regulation.* (Individuals have had an opportunity to influence development. They are involved and development increase individuals control of their lives.)	
I 4.1	Network has successfully activated local people.
C5 *Vitality of the community and empowerment.* (Networks actions support local communities activity e.g. local associations or enterprises start to active).	
I 5.1	How many interest groups have participated in network activities?
I 5.2	Network has created opportunities for new enterprises.
I 5.3	Network has positive effect on other sectors than forest sector.

to the questionnaire. Although ease of data collection was emphasized, the coordinators felt that some values for outcome indicators were too laborious to collect.

Tables 4 and 5 show the given values for the projects' performance indicators for the years 2010 and 2011, which represent actual values of cooperation networks' action. These follow-up data include various zeros, which probably partly results from difficulties in data collection. In addition, when collecting the 2010 data, the cooperation networks had operated for no longer than one year and the operational activities (which the operational indicators measure) were in their early stages. The performance indicators can be divided into proportional indicators (e.g. in two thirds of cases the forest owner affected the protection details) and absolute indicators that measure the activity level in specific units (hectares, Euros, persons, man-years; e.g. 100 owners participated in group trainings).

Tables 6 and 7 present the given values for the expert-evaluation indicators. The cooperation network coordinators evaluated the statements from the perspective of their own project. In Table 7 indicator (I 7.2) "Network has created conflicts" represents a potential negative impact of networks, while other indicators represent positive impacts of networks' actions. This negative indicator has been transformed in the MCA analyses to positive direction, so that the response "none" is given the highest value (1) and the response "lot" is given the lowest value (0).

2.4 Aggregation of Indicator Values

Multi-attribute utility theory (e.g. von Winterfield

Table 3. The community level criteria (C) and indicators (I).

C6 *Control of transitions.* (Local community has had an opportunity to control communities actions and adapt to changes e.g. create new innovations or new operational models.)
I 6.1 Network has created innovations or new operational models.

C7 *Acceptability: open participation of communities and associations, agreement versus conflict.* (Wide-ranging participation of different interest groups. Conflicts e.g. negative public discussion, indicate problems.)
I 7.1 How many persons have participated in network public events?
I 7.2 Network has created conflicts.
I 7.3 Different interest groups have free entry to network activities.

C8 *Impact on income distribution, polarization of benefits and disadvantages.* (Networks impact to income distribution has been equitable and has brought benefits local community e.g. services are bought from local companies, and network has paid attention to the most vulnerable groups.)
I 8.1 How much nature conservation management (reconstruction) has been made? (Hectares)
I 8.2 How much nature conservation management (reconstruction) has been made? (Man-years)
I 8.3 What is the value of services bought from local companies?
I 8.4 Network has paid attention to the most vulnerable groups.

C9 *Community level: notice of forest experiential and local knowledge.* (Local communities local and tacit knowledge has had an influence to protected areas final realizations. Protected areas include e.g.. locally important recreation areas and landscapes.)
I 9.1 How many cases of protected areas are situated next to well-known recreation areas?
I 9.2 Community has opportunity to effect progress of local recreation areas.

C10 *Social diversity.* (Represents diversity of participants. Different interest groups and organizations have been involved in networks activities.)
I 10.1 Network has reached extensive variety of actors.

and Edwards 1986) can be used in situations, where the utility of actions or choice situation is considered to consist of several attributes. The approach is commonly used to aggregate the benefits from several attributes, which in this study are called criteria. The aggregation function can be additive or multiplicative (e.g. Pukkala 2002). In additive function, the utilities produced are interchangeable, i.e. it is possible to compensate the low performance in some criteria with high performance in other criteria. As this kind of phenomenon was rather evident among the network projects, the overall socio-cultural impacts of the projects were quantified by using a linear additive utility function as follows:

$$U_i = \sum_{j=1}^{m} \frac{a_{ij}}{n_j} u_{jk}\left(c_{ijk}\right) \quad (2)$$

where U_i describes the overall utility or priority of project i and c_{ijk} is the performance of project i with respect to the indicator k below the criterion j, $u_{jk}\,(c_{ijk})$ is the partial utility of the indicator k below the criterion j and a_{ij} is the project specific weight of criterion j. As mentioned, the n indicators below the main criteria were given equal sub-weights so that the weight of the criterion was divided by the number of indicators that were used to define it more accurately.

In order to standardize the values of both the indicators based on project performance and the expert evaluation indicators (in scale 0 … 3; see Section 2.1) to the same scale, the partial utility functions $u_{jk}\,(c_{ijk})$ were used. For each indicator, the maximum value within the seven networks was given a partial utility value of one. The remainder of the alternatives are relative to this, so that the partial utility value zero was given to an indicator value zero. As a result of these operations, the overall performance of each of the projects could be derived on the same scale.

Table 4. Individual level performance indicators and values provided by each project in 2010 and 2011. Two years' data were included for follow-up purposes.* indicates the total number of cases. Empty cells indicate a missing value. Indicators' numbers refer to the above explanation. Note that the number of performance indicators varied between 0 and 5 between criteria.

No	Individual level indicator	Year	South-West Finland ELY	North-Savo Fc	South-East Finland FC	Central Finland FC	SLL	North Karelia ELY	Coast FC
I 1.1	How many cases of protected areas final realization has been affected by forest owners' own views?	2010 2011	0	6/6* 3/9*	1/3* 0	9/9* 1/13*	2 /6* 88/103*	8/9* 20/20*	1/1* 4/4*
I 1.2 a)	How many forest owners have taken part in personal consultation?	2010 2011	30 30	6 21	3 2	0	10 30	0 9	30 30
I 1.2 b)	How many forest owners have taken part in group trainings?	2010 2011	100	0 15	0 0	0 15	15 40	50 0	
I 1.2 c)	How many forest owners have taken part in trainings? (indoors)	2010 2011	100	0	0 0	0	15 20	50 0	1
I 1.2 d)	How many forest owners have taken part in trainings? (forest)	2010 2011	0	0	0 2	65 15	10 15	40 0	10 3
I 3.1	In how many cases of protected areas final realization have forest owners local knowledge been affected?	2010 2011	0	1/6*	3/3* 0	0	3/6*	6/9* 0	0
I 2.1	In how many cases of protected areas have other people than forest owners had the opportunity to participate?	2010 2011	0	0	0 0	0	2/6* 10/103*	2/9* 3/20*	0

Table 5. Community level performance indicators and values provided by each project in 2010 and 2011. * indicates the total number of cases. Empty cells indicate a missing value. Indicators' numbers refer to the above explanation. Note that the number of performance indicators varied between 0 and 3 between criteria.

No	Community level indicator	Year	South-West Finland ELY	North-Savo Fc	South-East Finland FC	Central Finland FC	SLL	North Karelia ELY	Coast FC
I 5.1	How many interest groups have participated in network activities?	2010 2011	21 10	4 5	4 9	9 9	60 55	3 3	5 5
I 7.1	How many persons have participated in network public events?	2010 2011	100 120	0	36 0	85 29	150 300	50 40	0
I 8.1	How much nature conservation management (reconstruction) has been made? (Hectares)	2010 2011	12	0	0.4 3.6	0 18.1	0 2	2.3 4.4	0
I 8.2	How much nature conservation management (reconstruction) has been made? (Man-years)	2010 2011	0	0	0	0	0	0	0
I 8.3	What is the value of services bought from local companies?	2010 2011	1000	0	384 0	0	0	0 2000	0
I 9.1	How many cases of protected areas are situated next to well-known recreation areas?	2010	0	3/6*	1/3*	0	1/6*	1/9*	1/1*

Table 6. Individual level expert evaluation indicators and values (0–3) given by the network coordinators in November 2010 and January 2012. Indicators' numbers refer to the explanation above. Note that the number of expert-evaluation type indicators varied between 0 and 2 between criteria.

No	Indicator	South-West Finland ELY	North-Savo Fc	South-East Finland FC	Central Finland FC	SLL	North Karelia ELY	Coast FC
	Year	2010/2011	2010/2011	2010/2011	2010/2011	2010/2011	2010/2011	2010/2011
I 1.3	Protected areas have been managed flexibly. Forest owner has offered various alternatives.	-/2	3/3	2/1	3/3	3/3	3/3	3/3
I 1.4	Network has successfully provided ecological knowledge to forest owners.	3/3	3/3	2/2	2/2	3/3	3/3	2/2
I 4.1	Network has successfully activated local people.	3/1	0/1	2/2	0/1	3/3	2/2	2/2
I 2.2	Network has successfully encouraged local views.	2/2	2/0	2/2	2/2	2/2	1/2	3/3

Table 7. Community level expert evaluation indicators and values (0–3) given by the network coordinators in November 2010 and January 2012. Indicators' numbers refer to the explanation above. Note that the number of expert-evaluation type indicators varied between 1 and 2 between criteria.

No	Indicator	South-West Finland ELY	North-Savo Fc	South-East Finland FC	Central Finland FC	SLL	North Karelia ELY	Coast FC
	Year	2010/2011	2010/2011	2010/2011	2010/2011	2010/2011	2010/2011	2010/2011
I 5.2	Network has created opportunities for new enterprises.	2/2	0/2	0/0	1/1	1/3	0/0	0/-
I 5.3	Network has positive effect on other sectors than forest sector.	2/1	0/1	1/0	0/1	1/2	1/2	0/2
I 6.1	Network has created innovations or new operational models.	3/3	0/0	2/1	1/1	2/3	2/2	2/2
I 7.2	Network has created conflicts.	0/0	0/1	0/1	0/0	0/0	0/0	1/0
I 7.3	Different interest groups have free entry to network activities.	3/3	1/2	2/2	3/3	3/3	3/3	0/-
I 8.4	Network has paid attention to the most vulnerable groups.	2/0	0/0	0/0	1/0	1/1	3/3	0/-
I 9.2	Community has opportunity to effect progress of local recreation areas.	2/3	1/1	1/1	1/1	2/1	1/0	1/-
I 10.1	Network has reached extensive variety of actors.	2/3	2/1	2/2	1/1	2//2	3/2	2/-

3 Empirical Results of the Socio-cultural Impact Analysis of the METSO Networks

3.1 Weights of the Criteria

The importance weights allocated by project coordinators allows examinations related to project particularities, whereas policy-makers' importance weights reflect general expectations from the networks and they can be used to compare the "performance profiles" of projects with a standard set of weights.

Fig. 2 illustrates the weights of the criteria measuring socio-cultural impacts. In essence, it shows the differences between importance given by cooperation networks to the criteria. Each network has emphasized slightly differently the components of socio-cultural sustainability. Based on the criteria weightings, networks can be divided into two main groups: those which concentrate only on a few components of socio-cultural impact and those which value components more equally. Specialized networks are (labelled here according to the project coordinator) North Karelia ELY, North Savo FC and Coast FC. North Savo FC and North Karelia ELY gave high weights to criteria (C 7) "Acceptability" and (C 1) "Legitimacy from forest owner's point of view", whereas Coast FC gave a high weight to the (C 1) "Legitimacy from forest owner's point of view" but also to (C 3) "Individual level: forest experiences and taking into account local knowledge". On the other hand, North Savo FC and Coast FC gave a very low weight to the criteria (C 6) "Control of transitions" and (C 10) "Social diversity".

Generally, networks gave high weights to criteria for (C 1) "Legitimacy from forest owner's point of view", (C 4) "Forest owner's authority" and (C 7) "Acceptability". The most insignificant criteria were (C 10) "Social diversity" and (C 8) "Impact on income distribution".

The Ministry of Agriculture and Forestry defined the criteria importance scoring from the perspective of the project funder. They also allocated rather equal weighting, instead of focusing on a small number of criteria. This weight definition is in accordance with their instructions to networks. The Ministry weights are divided very equally, except for two criteria: (C 6) "Control of transitions" and (C 8) "Impacts on income distribution". Overall, these two criteria received a very low importance from all respondents.

3.2 Networks' Aggregated Performances

Fig. 3 shows the aggregated socio-cultural impacts of each cooperation network at the end of the years 2010 and 2011. The colours of Fig. 3

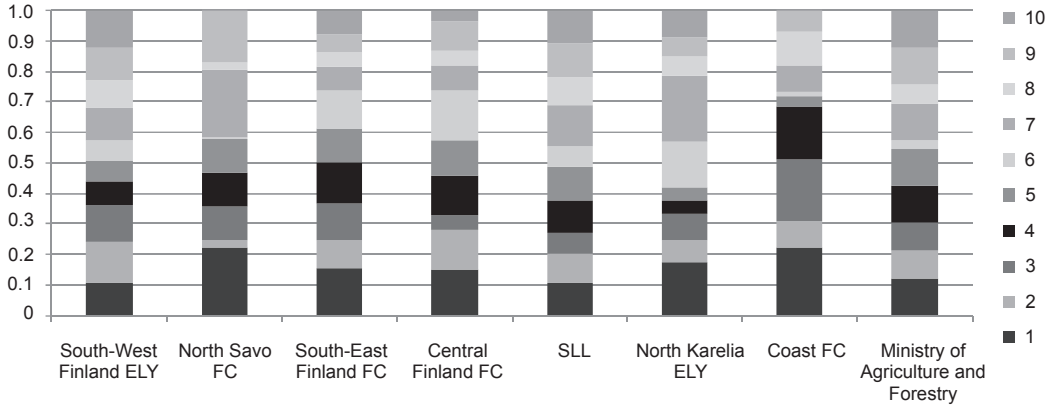

Fig. 2. Importance of criteria from each cooperation network (labelled according to the coordinating organization) and the Ministry of Agriculture and Forestry. The sum of criteria weights is one. The criteria 1–10 are explained in Tables 2 and 3.

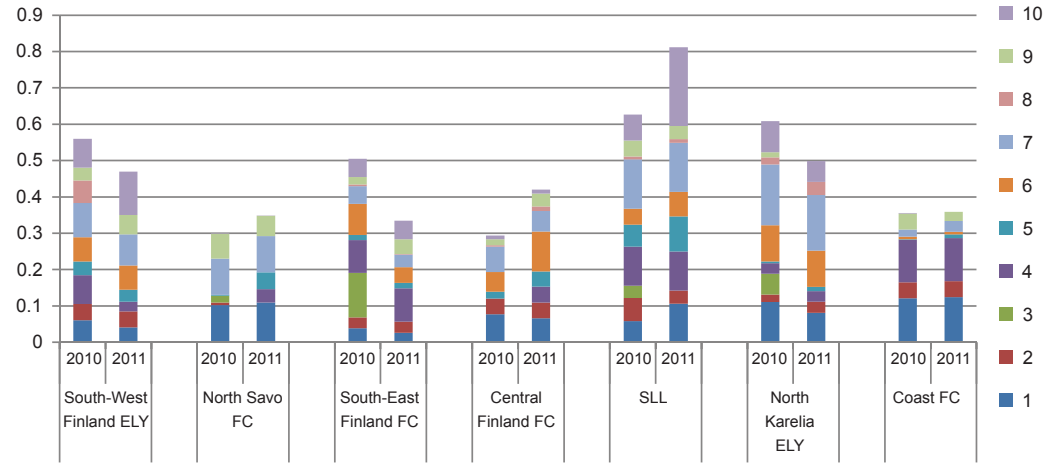

Fig. 3. Weighted indicator values and their sums from each network in 2010 and 2011. The bar heights signify the amount of positive socio-cultural impacts (and/or absence of negative impacts) of each cooperation network. Colours represent the contribution of each of the ten criteria to the positive socio-cultural impacts (partial utility). The criteria 1–10 are explained in Tables 2 and 3.

represent the structures of these impacts through partial utilities from 10 criteria which have a varying number of indicators. The bar with an equal share of colours describes a situation where impacts result fairly equally from the 10 criteria. North Savo FC's bars contain only a few colours whereas SLL and North Karelia ELY 2010 bars include all ten possible colours.

Individual profiles are consequences of both the values of indicators and their distribution as well as the weights of the criteria. For instance, Coast FC's project weighted criterion (C 3) "Individual level: forest experiences and taking into account local knowledge" highly. However, indicator values under the criterion were zeros, and as a result the criterion also received the value zero. At the same time, North Karelia ELY and SLL received high values of indicators under those criteria they had weighted as high. These networks thus logically concentrated (and/or were successful and effective) on aspects that they felt important. In 2011, criterion (C 3) "Individual level: forest experiences and taking into account local knowledge" received only zero values from all networks. Owing to this criteria having only one indicator, it is very sensitive to missing values.

The high estimated total utility from socio-cultural impact assessment can be achieved either via equal weights and diverse performance or via concentrated weights and corresponding performance. For example, South-West Finland ELY weighted all ten criteria equally; on the other hand, North-Karelia ELY concentrated its focus and operations mainly on three criteria. These two networks both succeeded in creating high utility scores with aggregated socio-cultural impacts. This means that the criteria they identified to be the most important and their actual operations are in agreement with their objectives. In addition, SLL received high values for performance indicators under criterion (C 7) "Acceptability" and (C 10) "Social diversity", which they valued as important. The low total utility of Central Finland FC network in 2010 can be explained by several zeros in the project's performance indicators. In 2011 they reported more indicator values and the result is better.

In 2010, the best performances were found under the indicators (I 1.3) "Protected areas have been managed flexibly" and (I 4.1) "Network has successfully activated local people". Only minor positive impacts were identified from the indicators (I 5.2) "Network has created opportunities for new enterprises" and (I 5.3) "Network has positive effect on other sectors than the forest sector". In 2010, negative impacts, i.e. conflicts, were recognized only in one cooperation network,

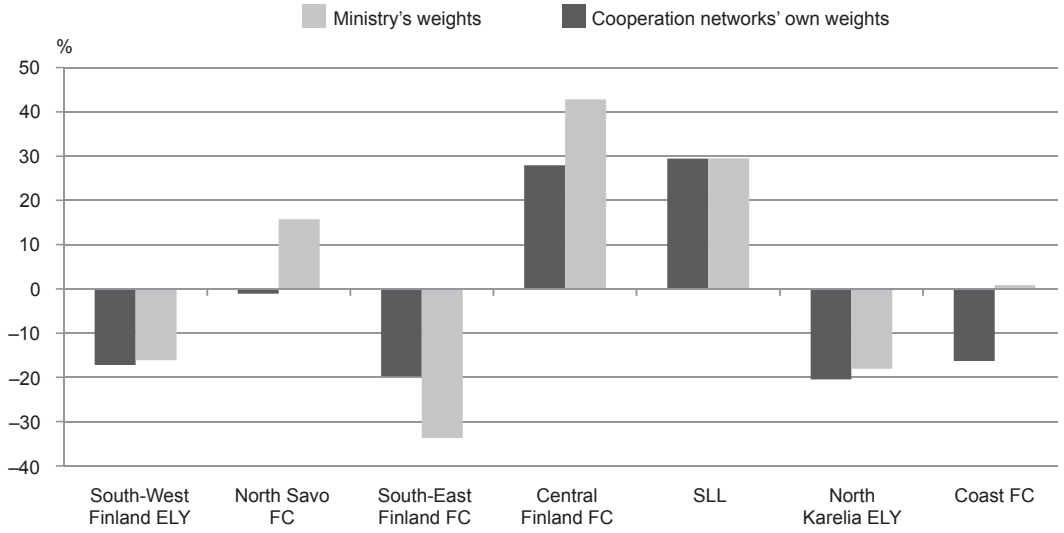

Fig. 4. Relative changes in networks' performances from 2010 to 2011 with importances allocated to criteria by the Ministry of Agriculture and Forestry and the networks themselves.

but they were recognized by two networks in 2011. The best performances in 2011 were found in indicators (I 1.2 a-d) "How many forest owners have taken part in trainings?", (I 10.1) "Network has reached extensive variety of actors" and (I 6.1) "Network has created innovations or new operational models".

When considering the differences between the 2010 and 2011 results, Fig. 3 shows that the greatest absolute changes are in the bars of SLL (rise of 0.18 utility units) and South-East Finland FC (decline of 0.17 utility units). The result shows that generally networks have the greatest positive socio-cultural impacts in criterion (C 7) "Acceptability: open participation of communities and associations, agreement versus conflict" and criterion (C 1) "Legitimacy from forest owners' point of view, forest owners' authority and acceptability of operations." On the contrary, only a few positive socio-cultural impacts have been recognized under criteria (C 8) "Impact on income distribution, polarization of benefits and disadvantages".

Fig. 4 represents the proportional (relative) changes in networks' performances between the years 2010 and 2011, measured by using cooperation networks' own weights and the weights given by the Ministry of Agriculture and Forestry. The figure indicates that the performance measure, derived with the method at hand, has changed by up to some 40 percent from 2010 to 2011. Two cooperation networks, coordinated by SLL and Central Finland FC, improved their performances from 2010 according to both weightings. On the other hand, three networks reduced their performance during the second year according to both weightings. The highest change difference between the ministry's and a network's own weightings was found in the case of Coast FC (17%-units) and the lowest in the case of SLL (0.05%-units).

4 Discussion

4.1 Analysis of the Presented Method

The use of the above described method enables for assessing socio-cultural impacts and monitoring the change of those impacts over time. As the operations of the networks develop over their project life cycles, the nature of their impacts may also change. Overall, it is typical that a number of socio-cultural impacts appear only after several years. Showing this development via the use of the presented method may be beneficial for: i) the funders of the projects, who look after effective-

ness; ii) the project personnel, who are responsible for annual reporting and operational planning; and iii) stakeholders and general public, who are generally interested in the impacts and legitimacy of using public money. In addition, a similar method could be used to make funding decisions, for example, and thus a project's expected impacts would be input to the MCA calculations and the aggregated socio-cultural utility outputs could then be used to rank the projects together with other expected impacts.

Even though the METSO projects' "performance profiles" showed differences between the networks, and the method enabled comparison between projects, the primary use of C&I is the follow-up of the networks; for this reason assessing impacts requires follow-up data from several years, as only this makes comparison between years possible. The present follow-up data from the years 2010 and 2011 illustrates some changes in project performances: generally, the criterion (C 5) "Vitality of the community and empowerment" had slightly risen in the second year. At the same time (C 1) "Forest experiences and taking into account local knowledge" received no values at all 2011. In both years, the best performances were found under the criterion (C 7) "Acceptability", one that networks also valued highly in the weighting procedure. At the end of 2010, the cooperation networks had only just begun their work. Owing to this timing, informing and training indicators were awarded the highest values. One year later, the highest values were found in indicators concerning innovation and the variety of actors. This indicates that the monitoring tool does seem to function logically, which makes its usability in years to come promising.

The presented method can easily be made applicable in a variety of other biodiversity maintenance projects that function on private land by simply tailoring the indicators for the case at hand. The possibilities for using a similar approach in other types of projects than biodiversity-related ones are also evident but a bit more challenging due to requirements for greater changes in the indicators. However, the criteria list is rather general and can be more easily transformed to assessments of other topics. For example, the method could be adjusted to the cases of assessing the socio-cultural impacts of nature-based business or recreation projects. The MCA-features (acquiring the weights and indicator values, transforming data and applying the linear additive utility model) remain similar when transferring the method to other kinds of socio-cultural impact assessments. It has to be noted, though, that it may be hard to distinguish the actual socio-cultural impacts of a particular project from those socio-cultural impacts of the local forestry practice in general.

A particular benefit of using the presented method is that it makes the socio-cultural approach visible and more practical and possibly also strengthens its position when the different effects of the activity at hand are considered. Measuring and monitoring the socio-cultural impacts allows for paying attention to action that results in higher positive and lower negative socio-cultural impacts. It thus creates added value for the four-pillar sustainability concept. In other words, the approach may assist decision makers, policy evaluators and forestry and environmental practitioners when they plan and perform programmes or projects and evaluate overall sustainability impacts. In turn, this can make the socio-cultural impacts a more important part of the decision making process when integrated with the parallel ecological and economic impact assessments.

In the present METSO case, the criteria weightings were collected by using a rather simple MCA-based method, aimed at ease of data collection from project coordinators. The use of this method was based on practical preconditions, which did not enable e.g. the use of pairwise comparisons that have been applied in methods such as the Analytic Hierarchy Process (AHP) and its regression-based modifications (Saaty 1980, Kangas et al. 2008). This disabled, for example, uncertainty analyses that would have otherwise shown the level of uncertainty behind the weights given to criteria (e.g. Leskinen et al. 2008).

In addition, some of the indicator values, namely the expert evaluations, were collected by using a verbal scale (none-little-some-lot). Although given by 'experts' of the topic, many of these assessments are highly subjective. This is critical when considering the objectivity of the method's outputs. But due to the qualitative nature of socio-cultural impacts, carefully selected expert evalu-

ation indicators are probably the best practical way to contemplate these impacts. Further, with a limited knowledge base only linear sub-utility functions could be applied. When refining the knowledge base, for example by adding expert knowledge on the link between evaluation points or performance levels and respective marginal sub-utilities with respect to socio-cultural sustainability in the case of the criterion at hand, the same method can be used, providing better inner validity. Moreover, the impact assessment would be more reliable than in our exemplary case if more actors and community members than just the coordinator gave their weights for the criteria and if more expert evaluations were given to the verbal scale assessment tasks.

Some indicators have weak or only indirect link to socio-cultural sustainability. This is due to the fact that no better indicators were identified. However, it is assumed that the use of individual and community level criteria, multiple indicators and two types of indicators enabled catching the essence of the latent or hardly measurable socio-cultural impacts. Better inner validity of both performance and expert evaluation indicators could perhaps be reached via an in-depth workshop with practical actors and experts of the topic. Due practical reasons, this kind of workshop could not be arranged for the case of this study.

It was recognized that the present form of the calculation procedure is rather sensitive to missing values in the performance indicators. When enhancing and applying the method in future, this sensitivity of the measurement tool needs to be reduced e.g. by adding new easily measurable indicators or replacing some poor indicators with better ones.

It seems that assessing socio-cultural impacts of biodiversity maintenance or other forest resource management activities requires qualitative interpretation regardless of the relevance of qualitatively grounded indicators or the available quantitative indicators. Therefore in future, the reported method could be utilised more thoroughly in the framework of participatory integrated assessment (Salter et al. 2010), i.e. by organizing meetings in which the initially measured socio-cultural sustainability impacts are discussed along with other impacts of the activity.

4.2 Conclusions

The study at hand illustrates that the conceptually demanding socio-cultural impacts of forest resource management can be measured and monitored in practice with a relatively simple multi-criteria analysis method. The presented method combines qualitative and quantitative information and enables the quantification of qualitatively grounded evaluations of socio-cultural impacts, thus enabling their use in various overall sustainability assessments. Essentially, the method allows for taking into account the diversity of socio-cultural sustainability viewpoints. It makes use of both operational statistics and expert evaluations.

The presented method can be modified and applied in several types of forestry-related impact assessments that thus far have missed a proper socio-cultural component. Especially the multi-criteria approach, i.e. producing additive utility scores based on performance and expert-evaluation indicators and criteria weights is transferable. Although the presented case-specific indicators are not applicable as such in other cases, the compiled list of socio-cultural criteria is rather general and thus internationally transferable to other contexts that call for analysing socio-cultural impacts of forest resource management activity on private land (e.g. forest bioenergy, nature tourism, watershed management). For public land activities, the criteria list needs to be revised.

Based on the feedback from the METSO case respondents, it will be critical in forthcoming socio-cultural impact assessments to make sure that the actors accept and understand the main principles of the method (Gasparatos 2010). In addition, it is important that the respondents understand the reasons for yearly collection of the monitoring material i.e. the value of the socio-cultural impact assessment for the quality of their work and for the sustainability of local communities is demonstrated. This would require offering the actors an opportunity to further simplify the indicators, automatic calculation procedures and a tailored workbook or an easy-to-use web-based tool including output templates and opportunity for sensitivity analyses.

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