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SUSTAINABLE DEVELOPMENT AND SUSTAINABILITY: LANDSCAPE APPROACH AS A PRACTICAL INTERPRETATION OF PRINCIPLES AND IMPLEMENTATION CONCEPTS

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ABSTRACT

The situation for governors and managers of natural resources has increased in complexity. Previously it was enough to sustain the yields of wood, food and energy. Today, maintenance of ecosystem services, conservation of biodiversity, rural development and human wellbeing are new additional objectives. At the same time there are new risks and uncertainties linked to climate change, economic globalisation, energy security and water supply. Consequently, adaptive and holistic research, governance and management are needed. Landscape is a concept and framework that can be used as an approach to enhance implementation of policies about sustainable development as a societal process and sustainability as outcomes on the ground. For our analysis to define the landscape approach we used a hierarchical framework consisting of principles, concepts and initiatives; and included three principles defining SD and sustainability and five international concepts to analyze its implementation for our analysis to define landscape approach. We propose a practical operationalization that consists of five core attributes, (1) a sufficiently large area that matches management requirements and challenges to deliver desired goods, services and values, (2) multi-level and multi-sector stakeholder collaboration that promotes sustainable development as a social process, (3) commitment to and understanding of sustainability as an aim among stakeholders, (4) integrative knowledge production, and (5) sharing of experience, results and information, to develop local or tacit to general or explicit knowledge. Finally, we discuss the need for integrative research to study landscape approach concepts and what local initiatives using different concepts deliver on the ground.

INTRODUCTION

Sustainability and sustainable development (SD) are two major contemporary discourses at global, Pan-European, European Union and national policy levels. During the 1960s and 1970s a global understanding of sustainability challenges developed with the emerging

environmental movement that highlighted several environmental problems (Carson 1962, Palmstierna 1967, Gillberg 1969, 1973, Molina and Rowland 1974). In the 1980s environmental degradation and unsustainable use of natural resources was widely recognized internationally among political leaders. This resulted in new international policies and action plans regarding the sustainable use of forests, water and seas, and the addition of development to the sustainability concept. As a consequence the focus shifted from the state of ecosystems to steering of society (Baker 2006). Thus, sustainability was agreed on as an aim for use of natural capital, and SD as the principle to base further development on (WCED 1987, UN 1992a,b). Still, despite more than 20 years of efforts to implement sustainability and SD policies the human ecological footprint (Wackernagel and Rees 1996) continues to exceed the carrying capacity of our planet, and is increasing (Anon. 2008, Smith 2008, Rockström et al. 2009).

To translate the concepts sustainability and SD into operational practice different guiding principles have been introduced, such as the precautionary principle (Andorno 2004), and the polluter pays principle (Tobey and Smets 1996). In parallel the ecosystem approach was adopted by the signatories of the convention of biological diversity as a suite of principles to be applied for implementation (CBD 2000, FAO 2003). According to FAO (2003) the development of the ecosystem approach was influenced by the systemic approach used by the UNESCO (United Nations Educational, Scientific and Cultural Organization) Man and the Biosphere (MAB) programme, the scientific ecosystem management approach (Gauthier et al. 2009), work done by the World Conservation Union (IUCN), World Wide Fund for nature (WWF) on landscape restoration (Mansourian et al. 2005), and other environmental non-government organisations. Subsequently, different organisations proposed and established concepts for implementation of these principles (for some examples see; Model Forest (IMFN 2008), BR (UNESCO 1996) and EU LEADER (EC 2006)). At the same time national to global policies have been developed based on the same principles and government actors work to implement them. From the point of view of stakeholders in local landscapes as places and spaces this diversity of principles and concepts is sometimes perceived as confusing.

Landscapes are integrated social and ecological systems. Thus, research that carries out independent studies of social and ecological systems does not describe reality well (Folke et al. 2005). To stress this scholars use the term social-ecological system (Berkes and Folke 1998, Berkes et al. 2000, Berkes et al. 2003, Walker et al. 2004), or coupled human and natural systems (CHANS) (Liu et al. 2011). This is consistent with the landscape concept with its biophysical, anthropogenic and perceived dimensions as developed by physical and human geographers (e.g., Sauer 1925, Grodzinski 2005). Further, new research present different dimensions of social-ecological systems as strongly inter-dependent feedback systems and acting as complex adaptive systems (Gunderson and Holling 2002, Waltner-Toews and Kay 2005, Costanza et al. 2001). Thus, both ecological and social system must be included in research and practical work with SD towards sustainability.

However, it is challenging to understand and deal with this complexity for several reasons ranging from different traditions among academic disciplines (Tress et al. 2006, Myrdal 2009), difficulties to fund research that bridges disciplines (Jaeger 2008) and to mutual limited understanding of researchers and practitioners conditions (Wickson et al. 2006). Soft systems methodology has developed as a way to support SD processes toward sustainability in complex social-ecological systems (Checkland 1989, Checkland and Scholes 1990, Checkland and Poulter 2006). Similarly, landscape ecology is an attempt to

support SD and sustainability in landscapes (Liu and Taylor 2002, Wu 2006, Wu and Hobbs 2007, Wiens et al. 2007), while resilience science is an attempt to navigate social-ecological systems, or landscapes towards sustainability (Holling 1973, 2001, Berkes et al. 2000, 2003).

Landscape is thus a useful concept and framework both for practitioners and researchers. As a consequence landscape approach has been presented as a term and practical application of the ecosystem approach, and other principles (e.g., World Forestry Congress 2009). It is described as a way to address sustainability and SD in a larger area by understanding spaces and places, i.e. landscapes, as integrated social and ecological systems and where successful SD processes toward sustainability require action and interventions in both parts of the system (Borrini-Feyerabend et al. 2004, Dudley et al. 2006, Singer 2007). This requires a holistic and systemic methodology (Wilson and Morren 1990).

The aim of this study is to define landscape approach by analysing a suite of international principles and concepts developed with the aim to implement policies about SD and sustainability on the ground. We first review three principles and five concepts based on analyses of their conceptual frameworks, and use this to define landscape approach for both practical work and research.

METHODOLOGY

The terms sustainability and sustainable development

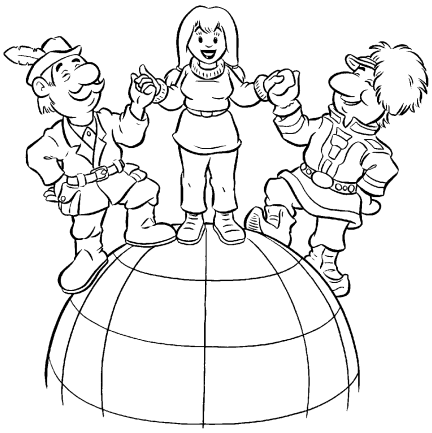
While often used interchangeably in the public debate (e.g., Norton 2005) the meaning of the terms sustainability and SD are not the same (Figure 1). The idea of sustainability has ancient roots in human societies related to the need to define how to use natural resources without depleting them (e.g., Hartig 1804, 1805, Hunter 1996). Today the issue of what is regarded as sustainable is much more complex (Kidd 1992, Lee 1993, Clark 2002). Traditional knowledge and rites in many cultures around the world still reflect and aim at what today is termed ecological integrity, biodiversity conservation or ecological sustainability (Parotta et al. 2006, Ramakrishnan 2001). Ultimately, this is linked to the potential of an exploited ecosystem to subsist over time (Reboratti 1999), and continue to provide goods, services and natural and cultural values for humans.

By contrast, SD is about the societal process of steering toward collective economic, ecological and socio-cultural goals by multiple actors and stakeholders with different power at multiple levels of decision-making (WCED 1987, Baker 2006, Strange and Bayley 2008). This is termed governance, in contrast to government, a term used to refer to the formal institutions of states and their monopoly of power. Governments are today more affected by international agreements and non government actors than ever before, and have thus lost parts of the traditional capacity to govern. Scholars describe this as a shift from government to governance (Pierre 2000, Peters 2000), which requires collaboration among societal sectors at different administrative levels (Ostrom 1990).

The ambition level for sustainability is a social construction, i.e. something that is preferred by the society and can be expressed as socio-cultural norms of behaviour or formal policies (Lee 1993, Clark 2002). Thus, sustainability can be implemented with different levels of ambition. Different ambition levels are described by the concept of weak and strong sustainability (Neumayer 1999). Weak sustainability means that natural

resources are used to fulfil needs and desires as long as future generations have the same opportunities. With this view, nature and species have no intrinsic value, and species need not to be protected if they are not of use to humans. In contrast, strong sustainability means that nature has intrinsic values and one should not strongly modify or change the structure and functioning of ecosystems from their natural state. Regarding ecosystems the ambition levels may include; (1) presence of species, (2) viable populations of species, (3) social and ecological integrity (intact ecological processes and a working social system/society), and (4) resilient social and ecological systems (Angelstam et al. 2004c). This means that the level of sustainability expressed in policy is a negotiated target, which often differs from evidence-based targets (Svancara et al. 2005). When the policy ambition level is agreed on, managers, researchers and other stakeholders may define what policy instruments and tools are needed to reach the policy ambition. It is, however, crucial that those who are involved with the societal steering understand the meaning of norms that policy defines as sustainable, and that information about the status and trends of all sustainability dimensions is transparent, presented in an understandable way and openly available. Lee (1993) used the terms compass and gyroscope to capture the essence of sustainability and SD as a social learning and steering process consisting of adaptive management (the compass) and governance (the gyroscope).

Fig. 1: Sustainability and sustainable development is about people
The society agrees about a policy vision of what is considered as sustainability. Sustainable development is then the societal process towards this vision, i.e. how stakeholders representing different societal sectors and interests collaboratively learn how to steer development in the preferred direction



Analyses

Inspired by the framework of Lammerts van Buren and Blom (1997) to analyse policies and their implementation by using principles, criteria and norms we used a framework consisting of principles, concepts and initiatives. Were concepts are understood as international approaches or tools to address sustainability such as Ramsar Wetland, Biosphere Reserve, World Heritage Site, Model Forest and EU LEADER. Concepts build on different principles such as the Ecosystem Approach, Sustainable Forest Management (SFM) and Agenda 21. When a concept is used and implemented locally we call it an initiative. We used a step-wise approach that included, (1) selection and review of examples

of international principles and concepts aimed to support the SD process towards sustainability (see table 1), (2) analyses of the principles and concepts with the aim to de-construct the landscape approach for operational use, and (3) description of the core attributes of the landscape approach based on the previous three steps.

Table 1: Landscape approach features derived from the 3 principles and 5 concepts analysed in this study.
Observe that Agenda 21 represent both a principle and a concept (Local Agenda 21) and that several of the concepts are based on their own principles (conventions).

		area	collaboration	sustainability	knowledge production	sharing
Principles						
	EcosApp	x	x	x	-	-
	SFM	x	x	x	-	-
	Agenda 21	x	x	x	x	-
Concepts						
	Leader	x	x	x	x	x
	WHS	x	x	x	x	x
	BR	x	x	x	x	x
	MF	x	x	x	x	x
	Ramsar	x	x	x	x	x

REVIEW OF PRINCIPLES AND CONCEPTS

PRINCIPLES

The Ecosystem Approach

The Ecosystem Approach (EA) summarise principles of integrated natural resource management including land, water and living resources. Human needs, conservation, sustainable use, equity, acknowledgement of the multiple functions of ecosystems and their values, and combining this with long term sustainable management are the key features of EA. The EA was endorsed at the fifth Conference of the Parties to the Convention on Biological Diversity in 2003. The EA is captured by 12 principles, the so called Malawi principles (CBD 1998, 2000); (1) The objectives of management of land, water and living resources are a matter of societal choices, (2) Management should be decentralized to the lowest appropriate level, (3) Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems, (4) Recognizing potential gains from management, there is usually a need to understand and manage the ecosystem in an economic context by; a reduction of market driven practises that affect biological diversity negatively, develop incentives that promote conservation and sustainable natural resource management, and internalize costs and benefits in the landscape and ecosystems to a feasible extent, (5) Conservation of ecosystem structure and functioning, in order to maintain ecosystem services, should be a priority target of the ecosystem approach, (6) Ecosystem must be managed within the limits of their functioning, (7) The ecosystem approach should be undertaken at the appropriate spatial and temporal scales, (8) Recognizing the varying temporal scales and lag-effects that characterize ecosystem

processes, objectives for ecosystem management should be set for the long term, (9) Management must recognize that change is inevitable, (10) The ecosystem approach should seek the appropriate balance between, and integration of, conservation and use of biological diversity, (11) The ecosystem approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices, (12) The ecosystem approach should involve all relevant sectors of society and scientific disciplines (FAO 2003, Smith and Maltby 2003, Shepherd 2004, Sayer et al. 2005, Schlaepfer 2005).

Sustainable forest management

SFM refers to the use, management, conservation and SD of all types of forests and other wooded land globally. It means the management of forests in line with SD principles, and accordingly it is defined as having economic, environmental and socio-cultural dimensions. SFM is supported by several different international processes and organizations, taking into account the specific forest conditions in the world (Burton et al. 2003, McDonald and Lane 2004, Rametsteiner and Mayer 2004). In Europe, the SFM process develops through the Ministerial Conference for the Protection of Forests in Europe, which recently changed name to Forest Europe (MCPFE 1993, Forest Europe 2011). At the Pan-European level, SFM is regarded a societal process and an important direction of SD (Angelstam et al. 2004b). It is described as "the stewardship and use of forests and forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil, now and in the future, relevant ecological, economic and social functions, at local, national, and global levels, and that does not cause damage to other ecosystems" (MCPFE 1993, Forest Europe 2011). For tropical forests in developing countries the International Tropical Timber Organization is responsible for development of SFM policies (Siry et al. 2005). The Montreal Process develops SFM principles for temperate and boreal forests of non-European countries (Montréal Process 2009). In addition, collaboration with other international stakeholders contributes to the SFM process (MCPFE 1993, 2006). SFM criteria and indicators are developed by the Ministerial Conference on Protection of Forest in Europe (e.g., MCPFE 1993) and by the Working Group on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests (Montréal Process 2009).

Agenda 21

Agenda 21 originates from the United Nations Conference on Environment and Development (UNCED) in 1992. Since then it has influenced policies and implementation related to SD and sustainability world-wide (UN 2001), and also forms a concept, Local Agenda 21, that has been implemented in thousands of sites globally (UN 1992c, 2002, ICLEI 2002, Barrutia et al. 2007). The Agenda 21 was together with the Rio Declaration on Environment and Development, and the Statement of principles for the Sustainable Management of Forests adopted by 179 governments globally in 1992. It is a comprehensive plan for local, national and global actors to act regarding all human environmental impact (Eckerberg and Forsberg 1998, Evans and Theobald 2003, Evans et al. 2005). The Agenda 21 plan was strongly reaffirmed at the World Summit on Sustainable Development (WSSD) held in Johannesburg 2002. Agenda 21 is an action plan for SD toward the vision of sustainability (Henningsson and Küller 2008). The UN commission on Sustainable development is a high level forum on SD and acts as a preparatory committee for meetings and summits on the implementation of Agenda 21 that is essentially voluntary among member states.

The Agenda 21 plan consists of 4 sections with 40 chapters and 900 pages. The sections are; (1) Social and economic dimensions – poverty issues, how to change consumption patterns, issues related to the population growth and demographics, human health, sustainable settlements and cities, the integration of SD and decision making, (2) Conservation and management of resources for development – protection of the atmosphere and biosphere, deforestation, biodiversity, preservation of sensitive nature types, and pollution control, (3) Strengthening the role of major groups – these groups include children, young people, women, NGOs, local government units, industry, business and workers, (4) Means of implementation – applied research, knowledge production seen as both the development of new knowledge and the production of people with this knowledge, development of international institutions and mechanisms for SD, and supporting financial mechanisms. The implementation of the general principle of Agenda 21 and the concept Local Agenda 21 varies a lot in different countries. Some countries have legislated about its implementation while others are advising local authorities to implement the principle and the concept (Anon. 1993, UN 1992c).

CONCEPTS

Ramsar wetland

The concept of Ramsar wetlands builds on the principles of the Ramsar Convention which was signed in 1971 in Ramsar, a city in Iran. This inter-governmental treaty provides a framework for local and national initiatives to conserve and restore important wetlands. It gives the frame for a wise use of wetlands and the resources connected to them. The aim of the convention is to contribute to SD and sustainability by solving issues connected to major wetland areas. International cooperation is emphasized as a key to success. There are more than 150 contracting parties or member countries to the Convention and the almost 1700 initiatives encompassing about 150 million hectares designated as Ramsar wetlands. In the convention a very broad definition of wetlands is used and areas that could be designated includes swamps and marshes, lakes and rivers, wet grasslands, peatlands, oases, estuaries, deltas and tidal flats, near-shore marine areas, mangroves, coral reefs, and human-made sites like fish ponds, rice paddies, reservoirs, and salt pans. All contracting parties should include a minimum of one wetland but are encouraged to include as many as possible that meets the Ramsar convention criteria. The initiatives include both protected areas and areas that are used in a wise and not damaging way. Partners of the convention should promote wise use of all wetland within their territory by taking them into account in their national land-use planning. So far the convention has succeeded in protecting the designated wetlands but has not been as successful with wetlands in general (Farrier and Tucker 2000). All partners should also be committed to applied knowledge production to promote sustainable management and wise use. Consultations with stakeholders and actors are emphasized as an important part when implementing the convention. This is especially true in trans-frontier wetland, large water systems, for species that passes different kinds of borders and large scale development projects in watersheds. The philosophy is to work with natural borders instead of artificial human/made borders (UNESCO 1971, Bowman 1995, Halls 1997, Ramsar convention secretariat 2006).

Biosphere Reserve

A taskforce of the UNESCO MAB Programme launched the Biosphere Reserve (BR) concept in 1974. In 1976 the global network of BRs was started. The idea was to ensure a more systematic conservation on the global level than ever before with designated areas

aiming at complete biogeographical coverage of the world and with a scientific approach. Initially many areas with very unique biodiversity and cultural values were designated as BRs (Batisse 1982, 1986). In the 1990s a discussion started and at the 1995 International Conference on BRs in Seville, Spain, the BRs were given also a new role as learning sites of SD including management of natural resources and to explore ways to meet the basic needs of society towards a more sustainable future. The Seville strategy has since then been a main framework for BRs world-wide. However, the history of the BR concept focusing on conservation only and initially nominating mainly existing protected areas BRs means that there are still issues to be resolved regarding representation of social contexts and ecological habitats for it to contribute fully to the SD process (Dyer and Holland 1991). The BR network seeks to increase international collaboration for successful conservation and the creation of transboundary BRs could be seen as some progress even if there are still many issues related to adaptive management of such areas (Agrawal 2000, Pollock 2009).

BRs have three main functions; (1) to contribute to the conservation of landscapes, ecosystems, species and genetic variation, (2) to foster economic and human development which is socio-culturally and ecologically sustainable, and (3) to provide logistical support for research, monitoring, education and information exchange related to local, national and global issues of conservation and development (UNESCO 1996, Bridgewater 2002). BRs contain three types of management zones; (1) one or more core areas for protection and conservation, (2) a buffer zone that surrounds or adjoins the core areas, and (3) a transition zone that is an area of cooperation where SD is addressed jointly by stakeholders. In BRs a main aim is to develop collaborative learning processes to address complex sustainability issues. Some progress and potential have been reported in this field (Stoll-Kleeman and Welp 2008, Ishwaran et al. 2008). A key challenge is to integrate the BR work in the surrounding society from local to global levels (Francis 2004). BR designation is supported by a national government authority. Typically BRs are organised under national MAB committees and regional networks. The concept of BR site builds on the Seville strategy and the Malawi principles of the ecosystem approach (CBD 1998, 2000).

World heritage site

The World Heritage Site (WHS) concept builds on the principles of the World Heritage Convention. It is a UNESCO designation. This designation is given to special places with natural or man-made structures considered to be of outstanding value to humanity (UNESCO 1972). Outstanding value can be either cultural heritage such as monuments, groups of buildings and sites with historical, aesthetic, archaeological, scientific, ethnological or anthropological value or natural heritage such as outstanding physical, biological and geological formations, habitats of threatened species of animals and plants and areas with scientific, conservation or aesthetic value (UNESCO 2008).

The vision of the World Heritage Convention and the network of World Heritage Sites is to safeguard the protection of natural and cultural heritage by including countries to sign the conventions. More specifically participating countries are asked to nominate national sites of interest and to develop management plans and to monitor the conservation status of the sites. The UNESCO World Heritage Centre can provide technical assistance, training and emergency assistance for sites in immediate danger and support local awareness-building campaigns with the aim to develop sustainable solutions for the sites. Key challenges are to integrate conservation with use and local societal needs at local to global levels (Harrison and Hitchock 2005) and to make the world community accept a shared responsibility for our world heritage (Black 2001, Frey and Pamini 2009).

A participatory approach, including local stakeholders is encouraged to strengthen the conservation of cultural and natural heritage sites. In addition networking and cooperation among sites is supported to exchange knowledge and experiences to secure long term successful conservation and funding for this.

Model Forest

The Model Forest (MF) concept originates from Canada where it was developed to support the implementation of SFM and SD in Canada in the late 1980s and early 1990s (Fred Pollett, pers. comm.). There are 6 key principles of a Model Forest (IMFN 2008); (1) Each model forest is a neutral forum that welcomes voluntary participation of representatives of all stakeholder interests and values on the landscape; (2) A large-scale biophysical area representing a broad range of forest values, including social, cultural, economic and environmental concerns; (3) Stakeholders are committed to the conservation and sustainable management of natural resources and the forested landscape; (4) The model forest management process is representative, participative, transparent and accountable, and promotes collaborative work among stakeholders; (5) A program of activities that are reflective of the model forest's vision and stakeholder needs, values and management challenges; (6) A commitment to knowledge sharing, capacity building and networking. During the start-up phase most MFs are coordinated and operated through a facilitating organisation. The facilitator supports the development of a partnership and develops ideas from the partnership into projects and action. Over the years in a successful MF the role of the facilitator might shrink and the partnership, together with other actors and stakeholders should be able to use the MF approach on their own (Axelsson and Angelstam 2006). A main challenge of a MF is to bring stakeholders with different opinions and interests with the aim to develop consensus based solutions that will support the aim of SFM (Brand et al. 1996, Sinclair and Smith 1999, Besseau et al. 2002, Sinclair and Lobe 2005). Today, MFs have been initiated in 24 countries and the international MF Network now consists of almost 60 members. Canada is not the dominant region any more since Latin America has more initiated MFs (www.imfn.net accessed 20110918).

EU Leader

Originally French, LEADER is the EU tool to promote rural development, and funded by EU structural funds. LEADER was introduced in 1991. LEADER can be described as a concept that is used to support a local level SD process aiming at sustainability in European rural areas. The EU member states are very diverse and rural landscapes thus differ much among regions and countries. To use a common tool in all this different contexts is regarded as the preferred way to address rural development instead of having an overall European policy. The concept has 7 key features (Bryden 2006); (1) area based local development strategies, (2) bottom-up elaboration and implementation of strategies, (3) local public-private partnerships: local action groups, (4) facilitating innovation, (5) integrated and multi-sector actions, (6) networking, and (7) cooperation.

Capacity building and innovation in local communities is emphasized as an important part of succeeding with a bottom-up approach within LEADER (Dargan and Shucksmith 2008). Other important aspects are to raise awareness, participation and mobilization of local stakeholders. A participatory approach is considered vital for creating a local development strategy and establishing of clear criteria for the selection of local project and actions to be supported in line with the strategy. Still the creation of new modes of governance often requires facilitation (Böcher 2008). Other scholars describe the work as

the building of social capital in rural areas (Ray 1998, Nardone et al. 2010) and where the LEADER method has had some success (Farrell and Thirion 2005). Continuous evaluation (Svensson et al. 2009) has been shown to be an important part of the learning process, when it is used (High and Nemes 2007).

A LEADER local action group should be formed as a partnership with; (1) professional organizations and unions, representing farmers, non-farming professionals and small scale businesses, (2) local residents and local organizations, (3) Environmental non-government organisations, (4) local institutions and government units, (5) cultural and community service providers, and (6) external networks and research with needed capacity or knowledge (Bryden and Hart 2004, Moseley 2003, EC 2006). Currently there is focus on the new EU member states and acceding countries. Agriculture and other area-demanding industries in rural areas are regarded as very important in rural development (Bryden 2006).

DEFINING LANDSCAPE APPROACH

Geographical area and place

Implementation of a landscape approach requires a defined geographical area with relevant societal actors appropriate to address local to regional sustainability problems. The geographical area is understood as a landscape or socio-ecological system, in which both sub-systems are of equal importance when addressing sustainability issues (Berkes et al. 2003). There are different approaches to define the spatial extent of the landscape's area in which the landscape approach initiative takes place, i.e. administrative borders, a natural border like an ecoregion or a watershed, a landscape with its unique cultural or natural properties, or to just mark a large area on a map. The border of a landscape is often seen as fuzzy by the actors of the initiative. For example, some activities may extend beyond its borders whereas some may not be implemented in the entire area.

For example, the MF and BR concepts use two main approaches to define the area of an initiative. The first is to use an area with a large and diverse set of land owners and land use, and the second is to use a well defined area where the owner or holder of user rights is the main champion of the initiative. For both concepts there are some initiatives with large areas that could be seen as a border on the map that includes the area of project activities. The average size of MF and BR initiatives range from about 850,000 ha, to about 1,100,000 ha (Axelsson 2009). These area extents are well suited for different sustainability issues such as rural development including creation and maintenance of social and cultural capital (e.g. Putnam et al. 1993, Woolcock 1998), or management of for example viable populations of many species (Angelstam et al. 2009) and thus planning for biodiversity conservation (Angelstam et al. 2011).

The area of a BR should be divided into zones with different management aims according to its statuary framework. With the development of the BR concept to become more balanced in regards to SD and since the reality in a landscape often does not fit with this required zonation (UNESCO 1996, 2010) some designated BRs have started to use an integrated approach with a mixture of areas representing the different zones. Some have developed this further towards an ecologically functional landscape approach (Magnusson et al. 2004, UNESCO 2008). A similar approach to the BR zonation and the BR network is the spheres of influence concept developed in the Eastern Ontario MF (EOMF 2007). It includes a (1) sphere of concentration that is the core area delineated by the MF border where processes, products and tools are developed and tested, (2) sphere of adoption and

extension, where results and experiences from the sphere of concentration will be adopted by MF partners and others in relation to local needs, (3) sphere of adaptation, where results from the MF can be adapted for use or where one can learn from them, (4) sphere of collaboration, with a focus on the Canadian Model Forest Network and the Forest Communities program, and (5) sphere of exchange, focused on exchange with international MFs to enhance and develop their activities.

Thus, a general understanding of the geographical area is as a multi-level construction with (1) an area for implementation, adaptation, testing and evaluation, (2) an area to influence, i.e. where the result from the implementation area can be dissemination and scaled up, (3) a larger area for sharing and networking. These three dimensions of the area do overlap and are thus not strictly delimited.

Collaboration

SD is a collaborative learning process (i.e. social learning, Keen et al. 2005) in the local to global community (Daniels and Walker 2001, Pretty 2003, Wals 2009) with the aim to build social capital and capacity to address sustainability issues (Woolcock 1998). Several national to international policies demand participatory approaches (for example UN 1992b, European Commission 2000, Moseley 2003, Bryden and Hart 2004, Anon. 2008) to address sustainability issues. Words like partnership, participation, and bottom-up approach have increased in usage in natural resource management contexts indicating the growing importance of collaboration. The aim is to develop collaboration among stakeholders to a higher level (cf. Arnstein 1969), i.e. a partnership, which makes participation meaningful to all involved partners and is a core part of the SD process (Svensson and Nilsson 2008). A landscape approach initiative uses the assessments (ecological, economic and social) of the sustainability status of the area as a starting point for collaboration (Veltheim and Pajari 2005). This will result in a partnership with stakeholders and actors from different sectors that represent the landscape. The representation of partners depends, however, on the issue or activity at hand.

Partnership building requires a trust and understanding among partners and the development of collaborative learning processes. Initially, the aim is often to learn about each other and to build respect for each other's perspectives and interests. To do this there is a need to work with and handle inequalities in power and capacity, i.e. to build equity through empowerment and acceptance (Lickers and Story 1997, Holmes et al. 2002, Pollock 2004). The process to develop a true partnership requires patience and often takes several years (Borrini-Feyerabend et al. 2004). One approach is to start with small steps, first with a task that is easy to solve, and then as confidence grows step by step address more difficult issues. Collaboration requires open-minded partners. The collaborative process benefits if a neutral facilitator assist in the process development, identifies the collaborative potential and gaps, assists with communication and develops a plan for the procedure (Daniels and Walker 2001, Gray 2008, Axelsson 2009).

An important part of partnership building is empowerment, the often long process of building capacity among local stakeholders to enable them to participate as equal partners in the initiative (Borrini-Feyerabend 2004, Barbour et al. 2004, Elbakidze et al. 2007, 2010, Axelsson 2009). It might also be a long process for more powerful actors to change from a traditional kind of management to a more participatory approach and to see and understand the advantages with this change in perspective (Daniels and Walker 1996, 2001, Hemmati 2002). To conclude, the aim is to create a new common space for

collaborative learning among actors and stakeholders that usually do not meet and collaborate. When the context, participants and facilitation of this space connects this could be a space where ideas emerge and production of new knowledge production occur (Lattanzi 1998, Nowotny 1999, Nowotny et al. 2001).

Commitment to and understanding of sustainability

This feature of landscape approach is about sustainability as the major aim and about a comprehensive and collaborative approach to understand and address sustainability. To address sustainability issues in a landscape there is a need to learn about the status and trends of ecological, economic and socio-cultural dimensions of sustainability (Bell and Morse 2003, Angelstam et al. 2007, Axelsson et al. 2008), to map the coupled human and ecological system in the geographical area (Angelstam et al. 2004a, Elbakidze et al. 2010, Liu et al. 2011). In addition, there is a need to understand the social landscape, i.e. social structure, with its actors and stakeholders representing local to national and international levels from different societal sectors, i.e. the public, civil and business sectors (Elbakidze et al. 2010).

There is also a need for a continuously ongoing dialogue about the societal ambition level regarding sustainability, or feedback to policy makers. This requires assessment of landscape's different sustainability dimensions by comparing indicators with norms (Andersson 2011). As an example, the application of the SFM concept often includes breaking down sustainability objectives into criteria (values, goals) and indicators (quantitative measurable and qualitative variables), that tells forest and natural resource managers, policy-makers, media, authorities exercising governance, students and the general public how different SFM dimensions develop (Rametsteiner and Simula 2003). In an assessment, monitoring data need to be compared with a norm. Policies may define norms or performance targets that need to be satisfied for a particular indicator variable to be characterized as sustainable (Lammert van Buren and Blom 1997). However, defining norms is often not only difficult but also controversial (Vucetich and Nelson 2010).

Knowledge production

Knowledge about the state and trends of different parts of the landscape seen as an integrated social and ecological system in relation to norms is vital to be able to identify and address sustainability issues at hand (e.g. Lee 1993, Bell and Morse 2003, Angelstam et al. 2004a, Rockström et al. 2009, Josefsson 2009). Transdisciplinary knowledge production through collaboration is an important way to identify and learn about SD issues, issues and factors that influence sustainability and the development process based on needs and interests of stakeholders representing different societal sectors at different levels (Tress et al. 2006, Axelsson 2010). This means that everyone will bring in their expertise and through a collaborative learning process (Daniels and Walker 2001, Cheng and Fiero 2005) will define a framework for the knowledge production process. Some partners in the process will contribute with their disciplinary expertise. Others will need to take inter- or transdisciplinary perspectives to be able to facilitate the production of socially robust knowledge. Socially robust knowledge means knowledge that would contribute to improvements and technical solutions related to sustainability and SD, and where these are socially acceptable (Nowotny 1999). The concept of knowledge production thus includes both the production of new knowledge and local capacity building. Knowledge production is tightly connected to the process of learning about the area of an initiative and the needs

and interests of different stakeholders but also to understand the areas interconnectedness with the regional, national and international levels (Carlsson 2008).

The importance of social learning is clear from the conceptual frameworks of the studied concepts (Axelsson and Angelstam 2006, Axelsson 2009). A key priority was to build capacity among stakeholders to strengthen stakeholder involvement at the local level, by empowering them to have a say in management and strategic decisions locally and to make their voice heard on the national level. The level of ambition might, however, differ among concepts. The ultimate aim of the social learning process is that the community will learn how to manage their own sustainability (Leeuwis and Pyburn 2002, Keen et al. 2005, Wals 2009). This requires an approach were local or tacit knowledge from initiatives is developed into explicit knowledge (Nonaka and Konno 1998), by the use of comparative studies of local initiatives, collaborative reflections and critical learning at the local initiative, concept network levels and as joint learning processes with other concepts and stakeholders.

Sharing

Sharing is about two things, (1) to share experiences and new knowledge with others to enhance the knowledge production process. This can be done by treating the local initiative, the concept network level and collaboration with other networks as learning organisations (Senge 2006), and (2) to disseminate and communicate the new knowledge and experiences, which results from a landscape approach initiative, its concept network and other networks or stakeholders (Morris et al. 1987, Cheng et al. 2008, Cox 2009, Pollock 2009). Both tasks requires an understanding of the multi-level governance (Bache and Flinders 2004) of landscape approach initiatives, the local level (local partners and other stakeholders), the concept network (official network of the concept), other networks (the networks of other landscape approach concepts and other stakeholders)(IMFN 2008, 2009, UNESCO 2002, Svensson et al. 2001). The building of trust and credibility are important parts of the sharing process (Peters et al. 1997).

To share experiences and new knowledge with others to enhance the knowledge production process refers to the previous section on *knowledge production* but with an emphasis on the multi-level properties of the landscape approach initiative. This means that the local initiative could be a part in collaborative learning and knowledge production processes at the local level, network level and with other networks (Dyer and Holland 1991, Axelsson et al in review). In a local initiative the knowledge production process results in local or tacit knowledge. To make this knowledge more general, quality assured and explicit (Nonaka and Konno 1998) there is a need to critically assess, reflect locally, within the concept network and with other networks (Terry et al. 2006, Brulin and Svensson 2011). This process to make the knowledge socially robust and commonly available can be seen as an integration of practical and experiential knowledge with theoretic and scientific knowledge and political ethical knowledge as expressed in policy documents at different levels from local to global (Gustavsson 2000).

Dissemination of the new knowledge and experiences is about communication, education and an increase of public awareness (Hesselink et al. 2004) with the aim to scale up the changed and more sustainable behaviours from the landscape approach initiative (Binswanger and Aiyer 2003, Mansuri and Rao 2004, Grin et al. 2010). Finally, we like to emphasize that sharing include both new technical knowledge and knowledge about new ways to address sustainability, for example as reflective practitioners (Clark 2002, Schön

2009), as collaborative learning processes (Daniels and Walker 2001) and as learning through ongoing evaluations (Svensson et al. 2009).

DISCUSSION

Landscape approach – a synthesis

Since the appearance of the SD discourse in the late 1980s there has been a proliferation of principles and concepts aiming at practical application initiatives on the ground within a wide range of natural resource sectors such as forestry, agriculture, fisheries and rural development. The policy level principles analysed in this study had similar aims (e.g., FAO 2003, Axelsson et al. 2008, Angelstam et al. 2004b, Sayer and McGinnis 2005). For example, the ecosystem approach stresses the need to consider both ecological and social systems, i.e. being consistent with the idea of landscape (COST/ESF 2010) and the term integrated landscape approach (World Forestry Congress 2009). Subsequently, more or less sector-specific, but yet very similar, concepts for implementation of SD toward sustainability on the ground have emerged.

As the proliferation of principles and concepts is confusing not only to researchers, but also to governors and managers, our analyses of general principles (Agenda 21, the ecosystem approach and SFM) and sector-specific operational concepts (Ramsar Wetland, Biosphere Reserve, World Heritage Site, Model Forest, EU LEADER and Agenda 21) indicate that they share a number of common attributes linked to the term landscape.

Thus, to consider a large geographical area when addressing sustainability, and to include both social and ecological systems and their interactions through a steering and societal decision-making processes (Baker 2006), has been termed landscape approach (Dudley et al. 2006, Singer 2007, Borrini-Feyerabend et al. 2004). The term landscape approach to support SD as a societal process and sustainability on the ground originates from conservation. It developed as an understanding that sustainable solutions to conservation often required the involvement of people living in the area. This could be described as a social learning process where stakeholders develop and implement management solutions. This understanding has grown to a paradigm shift in conservation (Singer 2007) and landscape approaches are thus today widely accepted and used to address mainly environmental and ecological sustainability issues. Presently the landscape approach has influenced many national and international policies about sustainability and SD (European Commission 1979, 1992, 2000, European Landscape Convention 2000). Singer (2007) describes it as an approach that "enables stakeholders to come together in order to better understand and preserve their environment". Similarly, the World Forestry Congress concluded that and "integrated landscape approach" is needed to implement SFM policy (World Forestry Congress 2009). In this study we show that all the studied principles and concepts share properties that match the term landscape approach, even if they may emphasise different sustainability dimensions.

Do landscape approach initiatives contribute to SD and sustainability? – toward a research agenda

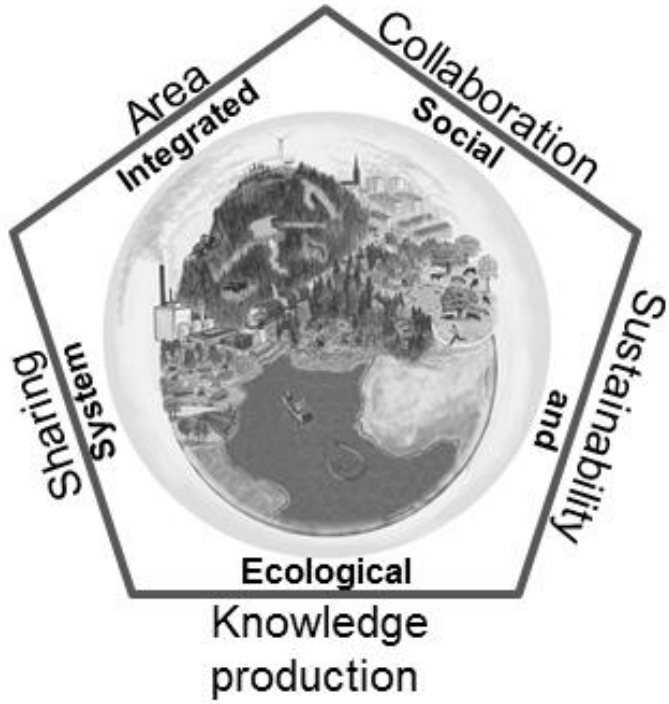
Many on-the-ground initiatives that represent the principles and concepts that were reviewed in this study are being initiated and implemented on the ground. Only in Europe there are more than 2 000 Leader, more than 250 BRs (the EuroMAB area includes North America and countries East of the European continent), about 140 WHS and about 450

Ramsar Wetlands (Western Europe)(webpages of the different concepts accessed on September 23, 2011). It is thus timely to assess by comparative studies (e.g., Axelsson 2009, Elbakidze et al. 2010, O´Neil 2004) what these principles, concepts and initiatives have accomplished at different levels of governance in terms of SD processes, and increased sustainability on the ground. A main challenge is to learn from these on-the-ground experiences and the local or tacit knowledge that the initiatives have resulted in. To go from tacit knowledge to generally available and quality assured or explicit knowledge that could be useful to all people trying to address sustainability issues globally (Nonaka and Konno 1998). The analysed principles and concepts resulted in five general attributes; an area, collaboration, commitment to and understanding of sustainability, knowledge production and sharing (Table 1, Figure 2) that can be summarised by one term, "landscape approach" that can be used as a framework for systematic analyses of implementation initiatives of different concepts that aim at supporting the implementation of contemporary policies about forests, water and rural development as well as participation and collaboration. In addition we hope that our definition of the landscape approach will be useful to practitioners' comprehension and use of different concepts. Based on the experience of this pilot study we see the need to;

1. Make a comprehensive survey of the *principles* for SD in the context of natural resource management.
2. Make a survey of international, regional, national and local/traditional ***concepts*** aiming to implement principles such as the ecosystem approach and SFM.
3. Compare selected ***concepts*** (such as Ramsar Wetlands, BR, MF, World Heritage and EU LEADER) with each other, using the landscape approach framework.
4. Compare ***implementation initiatives*** representing different concepts using the the core attributes of landscape approach (Figure 2).
5. Apply a multiple case study approach of "mature" ***implementation initiatives*** to assess stakeholders' view regarding if particular initiative satisfies the attributeslandscape approach.
6. Apply a biographic approach to study landscape approach ***initiatives*** with different age to assess the time it takes to develop social learning process in different biophysical, economic development phases, and governance contexts.
7. Assess the prerequisites for multi-level social learning, deconstructed as the development of collaboration, integrative place-based knowledge production and sharing of knowledge and experiences locally and among implementation initiatives

To conclude, the term landscape provides a bridge to communicate biophysical, anthropogenic and perceived dimensions of place and space, and as such enhance collaboration among stakeholders. Hence, he term landscape approach captures the essence of a wide range of principles and concepts aiming to support the implementation of policies about sustainability and sustainable development by transdisciplinary knowledge production in landscapes.

Fig. 2: Illustration of the landscape approach and its five core attributes



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