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Making Forest Values Work: Enhancing Multi-Dimensional Perspectives towards Sustainable Forest Management

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ABSTRACT

Background and Purpose: Sustainability, sustainable development and sustainable forest management are terms that are commonly, and interchangeably used in the forest industry, however their meaning take on different connotations, relative to varying subject matter. The aim of this paper is to look at these terms in a more comprehensive way, relative to the current ideology of sustainability in forestry.

Materials and Methods: This paper applies a literature review of the concepts of: i) sustainable development; ii) sustainable forest management; and iii) economic and non-economic valuation. The concepts are viewed through a historical dimension of shifting paradigms, originating from production- to service-based forestry. Values are discussed through a review of general value theory and spatial, cultural and temporal differences in valuation. Along the evolution of these concepts, we discuss their applicability as frameworks to develop operational guidelines for forest management, relative to the multi-functionality of forests.

Results and Conclusions: Potential discrepancies between the conceptual origins of sustainable development and sustainable forest management are highlighted, relative to how they have been interpreted and diffused as new perceptions on forest value for the human society. We infer the current paradigm may not reflect the various dimensions adequately as its implementation is likely to be more related to the distribution of power between stakeholders, rather than the value stakeholders' place on the various forest attributes.

Keywords: sustainable forest management, ecosystems multi-dimensionality, value theory, sustainability, forest policy, forest governance

INTRODUCTION

The use of the term sustainability to describe environmental, social or development issues presumes some shared understanding of the significance and application of the term, and what it is referring to. For instance, the term sustainability can be associated with sustained economic development, continued profitability or with the dynamic resilience of a system to reorganise and continue after a shock. Earlier uses of the term can be linked to the concept of 'maximum sustained yield' [1] in the field of natural resource management, a term used in calculating the use of renewable resources like timber or fisheries.

Since the Brundtland Commission[1] first defined sustainable development (SD), the term 'SD' has entered the lexicon of research and in economic, environmental and social policies. SD as defined by the Brundtland Commission in 1987 is "the development that meets the needs of the present without compromising the ability of future generations to meet their own needs" [2]. The ideology of Sustainable Forest Management (SFM) is frequently based on the same principles and is for instance defined in 1993 by the Ministerial Conference for the Protection of Forests in Europe 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" [3].

The activities of the Brundtland Commission contributed to the convening of the 1992 Earth Summit in Rio de Janeiro, Brazil which played a crucial role in promoting the ideology of SFM under the Commission's framework of SD [4]. The United Nations Conference on Environment and Development (UNCED) final report [5] includes a 'Non-Legally Binding Authoritative Statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of All Types of Forests', which infers recommendations to further define forest management principles. Inter alia, it states that forestry issues and opportunities should be examined in a holistic and balanced manner within the overall context of environment and development, taking into consideration the multiple functions and uses of forests, including traditional uses, and the likely economic and social stress when these uses are constrained or restricted, as well as the potential for development that SFM can offer. All types of forests resources and forest lands should be sustainably managed to meet the social, economic, ecological, cultural and spiritual needs of present and future generations. These need to include forest products and services such as wood and non-wood products (as water, food, fodder, medicine, fuel, shelter, employment, recreation, habitats for wildlife, landscape diversity, carbon sinks and reservoirs), and measures should be taken to protect forests against harmful effects of pollution, including air-borne pollution, fires, pests and diseases, in order to maintain their full multiple value [5].

The acknowledgement and recognition of multiple forest services or functions that forests provide, besides timber, is still relatively new. In the 18th Century, high rates of deforestation were occurring in Central Europe due to the overuse of forests for commercial timber production and for extending agricultural land [6]. However, in order to regulate forest utilisation in a way to ensure wood availability for future generations, the German landlord Hans Carlo von Carlowitz formulated the rule to take only as much timber off the woods as would regrow in one generation [7]. Other forest services or functions such as forest regeneration or the provision of clean air have only been relatively recently integrated into the concept of SFM. As such, the way forests are valued by professional forest managers and for society as a whole is continuously evolving, with noticeable national and regional differences. The process of creating a shared understanding or meaning of what makes a forest sustainable is continually developing [8].

DOES SUSTAINABLE FOREST MANAGEMENT DEPEND ON THE VALUES A SOCIETY HOLDS?

In Europe, SFM is defined as a forest management practice that should fulfil the demands of society, both now and in the future [9]. A recognition of changes in the relationship between society and forests has led European ministers to call for a greater dialogue between the forestry sector and society in Europe. This was one of the main themes expressed in the Ministerial Conference for the Protection of Forests in Europe (MCPFE) Resolution L1 'People, Forests and Society', signed in Lisbon in 1998. The relationship between society and forests is well recognized by this MCPFE process and is reflected in the Vienna Declaration signed by European Community in 2003, which states as Resolution V1 'Preserving and Enhancing the Social and Cultural Dimensions of SFM in Europe'. However, in a review of surveys carried out by Rametsteiner against various countries in Europe [9], the results showed that only one quarter of Europeans are satisfied with the status of their forest regarding health and vitality, biological diversity and forest area.

Attempts at fairly and equitably representing forest users' diversified views poses great challenges for forest managers and policy makers alike, because the expectation of the public, and the various uses of forests relative to their needs is changing over time, and differs amongst regions [9]. As part of the theoretical framework of SD, on which SFM is based, environmental policies incorporating SFM take environmental, social, and economic components into consideration in their development. However,

1 - The Commission is formally known as the World Commission on Environment and Development (WCED) of the United Nations. It was formed and led with the aim to highlight the importance of sustainability among the members of UN. Its four year work concluded in defining the term "sustainable development" and publishing its famous report Our Common Future which is also known as the Brundtland Report.

this concept fails to provide a practical framework for interpreting and applying this concept in decision-making and implementation of the concept [10]. For example, the prioritization of forest use and how different groups of society would like to use forest land, depends on the economic, social and environmental awareness and values they hold [11]. For instance, many Europeans tend to oppose forestry measures that disregard nature, except when compensation measures are taking place, e.g. tree felling is only accepted in combination with afforestation [9].

People value forests for a wide range of reasons and receive benefits from them in various ways, both in the form of tangible and intangible benefits, which had not, until recently, been taken into account [12]. 'Sustaining' existing (and future) benefits from the forests is complex as multiple benefits create multiple values, but many of these do not have a market value in economic terms, i.e., the price of biodiversity [13-15]. The transformation of values to concepts is also complicated by differences in spatial, temporal and socio-cultural value perceptions. Valuing forests and their underlying provision of ecosystem service is multi-dimensional as it covers multiple genetic resources, species, different adaptations, habitats and ecosystems [16]. All these dimensions of biodiversity are tightly interconnected, affecting the state, stability, and productivity of the ecosystem as well as ecosystem services [17], thereby making biodiversity not only an ecological, but also a social and economic issue [18]. As Rametsteiner's survey in Germany [9] showed, only a few survey respondents knew the concept of SFM, even though e.g. in Germany the number of people who know the concept increased considerably from 1997 to 2003. Despite that, more than 50% of the Europeans think that the principles of SFM are actually not practiced in Europe [9]. This gap of information should be closed through targeted education programs, and the cause of such a perception should be assessed and dealt with if necessary.

Values and Sustainability

The current conceptualisation of SD can be interpreted as a reflection of multiple values. Value, although a broad term, is considered a part of the underlying conceptualisation, which is fundamental to translating a broad concept like sustainability into long-term, policy objectives [19]. The values that are embodied within the concept (e.g., resource protection) are shifting in their importance in the development of policies some have taken precedence over others which were previously held as more important, which are not always reflected in the behaviours by all actors.

For example, forest management was traditionally based on principles for sustained yields in timber production. As underlined by Spears [20], the shortcomings of this approach included ignorance towards non-wood values and uses. The recognition of other non-timber values, and also, during recent decades, social and ecological values have given rise to broader concepts used in policy-making and research. This concept is, thus, a reflection of the shifting values of a society which, although seeking consensus on subjective values (e.g. income, biodiversity, carbon sequestration), is constantly changing.

In addition, everyday decision-making in forest management is based on long-term objectives (i.e. needs), institutional (i.e. policy goals) and situational aspects (i.e. timber market). Building capacity to achieve these desired needs has a dynamic influence on some of these aspects as capacity can be enhanced, for instance, through the establishment of associations or civil society organizations with various interest groups. Within this line of thinking, several theories (e.g. Logic of Collective Action) have been built which outline the importance of increasing power to pursue common objectives held by the wider group [21]. Since different interest groups, i.e., forest owners, processing industry, energy industry etc. have different values and needs, there is a need for consensus about what will go into policy and how.

For the aim of sustainability to bridge the gap between economic development and socio-environmental interconnectivity [2], a clear understanding of what it actually means has yet to be seen in practice, as the concept itself is broadly used in the political spectrum [18]. As noted by Mansfield [22], much of the discussion over what sustainability is, or is not, takes place in political arenas. How sustainability is used to frame environmental or socio-economic issues and is shaped by political relations and reflects a highly normative stance of deciding what is or is not desirable, meaning what should be sustained.

The values related to the concept of SD have been broadened into a new, wider paradigm which seeks to create a response to societal concerns on the processes of current production and consumption versus the future of the planet. On the one hand, there is some consensus around the implementation of the concept while, on the other hand, there is great indecision in the values themselves. A crucial reflection is needed on the representation of needs in the current definition of sustainability, i.e., whose needs are being reflected and how are certain needs are prioritised over others? Secondly, although there is an acknowledgement of different values in society, and in-between different stakeholders, there are no mechanisms to objectively and weigh them to reflect the various views of society. This can contribute to the difficulty in equitable policy development, which inequitably favours particular groups of society. The application of a singular definition of sustainability in policy practice is reflective of the theoretical and ontological assumptions of the actors involved in their development. Hence, it is important to address power relations and their balance in the structure of implicit and explicit values.

Evolution and Change of Values

Social and economic development in recent decades has influenced human values, likely due to the interdependency, changeability and influence of the social experience [23]. Forest values differ on a local scale because physical, geographical, institutional, or historical configurations differ [24]. However, forest policies and the governance of forest use are being increasingly organised at a global level, overlooking an optimisation on the local

scale, which takes into consideration differentiated local contexts [25, 26]. People generally judge forest use in their own country as better than in other countries [9], which might indicate a strong sense of place that, in turn, can be considered a local cultural value provided by the forest. This sense of place has an influence on people's beliefs/values, and what is valued on a local scale, relative to the physical distance between the forest and people.

Taking into account the changes of the social and economic environment throughout human history, should be considered when assessing the drivers or influences over social normative values. Through history, forests have been constantly impacted by anthropogenic changes to the landscape, where past decisions on forest management can influence present management. Up to the beginning of the 20th Century, European forests have been exploited for mining, charcoal production, and shipbuilding. Large areas of forest have been transformed into agricultural land and livestock graze [27].

More recently, European studies indicate an increasing awareness of ecological issues [9]. This includes also a public acceptance towards allowing large predators like wolf and lynx to live in natural habitats [9]. Even though broad empirical studies are mixed, regarding the perception of general public on the SFM options, several regional studies have indicated that people generally prefer mixed stands with native species over monocultures of non-native species [9]. In Scandinavia, for instance, public preferences for forest structures have changed in recent decades and moved towards preferences for more wild structures as people are becoming more conscious of the variety ecosystem services provided by forests besides timber production e.g. an increasing importance for the role of fallen trunks for biodiversity [28]. A study on French forests showed that the main consideration for forest roles is changing over time, with natural habitat and leisure becoming more important, and wood production decreasing in importance [29].

Besides variation of temporal, spatial and socio-economic characteristics, values also vary among the social groups and different cultures. Edwards *et al.* [30] claim that the recreational value of forest stands are perceived differently by different social categories such as age, gender, socio-economic group, level of education and profession. Furthermore, values on nature perception are closely related to cultural identity: Hoyos *et al.* [31] showed that Basque people who have traditionally had a close relation to nature would be willing to pay 28-33 percent more for the protection of a natural area, than other people from Spain. A comparison of surveys from different European countries showed that people from Central Europe have mentioned ecological functions of forests like biodiversity, carbon sink, protection from natural hazards more often as than people in Northern and Western Europe, where more direct economic issues and multiple forest use were more dominant [9]. Another factor influencing people's value of forests and sustainability depends on how, and if, they physically interact with and enter the forest. For instance, data from Austria and Scotland suggests that 98 percent of forest visitors use the forest for walking, dog-walking, cycling and jogging [30].

The SD concept cannot be limited to an exclusive form of implementation. In fact, limiting the concept is a purely quantitative development. For example, restricting the definition of SD towards reducing environmental impacts through technological advancements (i.e., industrial logging under an environmental management system) does not consider the relationship between the exploited environment and local societies and cultures that lost benefits provided by the same local resource (e.g., spiritual, cultural, economic, aesthetic values, etc.) in the absence of the action causing environmental damage. These advances, which are commonly described as SD initiatives, undermine the multidisciplinary aspect of sustainability that needs to be based on qualitative advances of all of its all dimensions [2], not just a reduction of current negative environmental impacts or a slowdown or reversal of current damaging trends.

What is currently occurring in SFM, is the embracing of market-based ideology as environmental policy. The trade-offs generally considered for decision-making frameworks for SFM are impacts on the environment as well as economic factors such as profitability or sustained yields. Relying on market-based instruments such as pollution charges or tradable permits requires the consideration of characteristics of the environmental resource, and the social, political and economic context in which it is being managed. It is difficult to define a universal objective for SFM, as forests, society and values are in constant dynamic flux. This is reflected by the wide range of forest institutions that practice various types of SFM, and in ways that the methods and tools applied in these systems differ significantly, and they have been continuously developing over the time. Questions which undoubtedly relate to SFM should be clarified before using the concept to frame what is currently occurring in our human well-being or natural world. Often the application of environmental, social and economic spheres seems to be overlooked. To know what is meant by the term sustainable or how to apply it to forest management practices is crucial. Defining what makes a forest-based system sustainable, or not, may help in developing new questions or debates which allow recognising the value and normative differences of interactions between humans and the environment [22, 32, 33].

Because the forest management is an economic activity, it is reflecting also the existing economic accepted values. Therefore the paradigm for SFM changed over time, from reflecting the values and assumptions of the neoclassical economic model which allows an unlimited economic growth which was theoretically possible by the substitutability of the resources [34] to a more reserved paradigm (i.e. Bioeconomy concept), aware of the limitations of the ecosystems. Even so, sometimes the limited growth capacity of the economic system as restricted by the biophysical limits of the Earth is often not taken into account [35] leading to challenges for all the stakeholders in order to ensure sustainability [36]. The changing needs and values of the society are more and more refined ranging from forest products to all kind of ecosystems services such as recreation or spiritual ones [37].

Even if past economic policy has made little room for the environment as an economic value [38] the development of transdisciplinary thinking is currently considered to be a must in order to provide the foundation for a sustainable future for the forest economy [38, 39]. Therefore, it seems that in the last decades there was a shift of paradigm concerning sustainability, SD and SFM from a unidimensional value perspective to a multidimensional, integrative value perspective.

This means replacing the unique objective of economic growth (GDP), typical for neoclassical economics, with objectives for human well-being and sustainability, which is typical for ecological economics. The reason for this shift is due to the fact that the both the general public and the policy makers understood that humans without nature cannot exist, while nature can exist without humans. Sustainability itself became one of the most desired social values and it is reflected in all the concepts used by policymakers [40].

Due to this perpetual evolution and change of values the problem of institutional sustainability arises. This institutional sustainability is a value by itself and can be addressed by referring to one of two perspectives on institutions: 1) they are either considered a set of rules, or 2) they are considered a set of roles [41]. Such a change, in the institutional dimension of the SFM, is reflected for instance in the Convention on Biodiversity (CBD) which makes a call to respect, preserve and maintain the knowledge, innovations and practices of indigenous and local communities, promote their wider application with the approval and involvement of communities and encourage equitable sharing of benefits from their use [42].

In order to ensure this sustainability of the perceived forest values, participatory approaches are desired and research is developing measurable indicators for understanding the perceived values and their changes [43].

Participatory Approaches and Power Relations

Traditional forest actors are still more prominent in forest policy than environmental actors [24]. The influence of the local community in forest management is rather low and tools for a better incorporation of societies‘ values into management practices need to be developed. The participation process has to be improved with a greater role for the social sciences [24]. In a review of surveys from different European countries, half of the general public mentioned more positive aspects of forests and the other half more negative aspects; thereby, the positive ones were mainly related to feelings, whereas the negative ones seemed less feeling-dominated but rather cognitively formed opinions [9]. Furthermore, only a few respondents mentioned specific terms related to forest management or the forestry sector itself [9]. This might indicate that local communities are not aware that forest management is actually shaping forests and their character, it seems they do not realize that they have the choice to shape forest management.

An open question is about how the culture-dependent concept of power is actually present in the current definition of sustainability. When talking about politics - defined as ‘the authoritative allocation of values for a society’ [44] - we can assume that certain interest groups, depending on the dominating power regime, will have more power than others in defining sustainability. Finkelstein [45] defines power as the capacity of individual actors to exert their will. Willingness is associated with the well-being of the individual and thus is related to the values s/he has. There are different dimensions of power and [45] outlines four dimensions of power – structural power, ownership power, expert power and prestige power. However, dimensions of power relations differ with geographical context (e.g., local, regional and global relations) and vary between research disciplines [46].

To enhance the participatory process, it is therefore necessary to engage local communities and stakeholder more. Interdisciplinary science can help to shape the participation process through standardised procedures [47].

How to Represent the Multi-Dimensional Concept of Sustainability

The challenge in integrating society‘s values into forest policy could be analysed through a Post Normal Science (PNS) framework. This framework is utilised in complex situations when urgent decision making is needed, but facts are uncertain and values are in dispute [48].

Studying policy impacts as well as evaluating policy programs are crucial to understand and improve local SD [37]. Moving towards SFM, the ecosystem services approach is likely to be a suitable instrument to include non-market services provided by forests in the valuation [49]. Although there has been progress in the development of valuation methods for those ecosystem services there are still big obstacles to incorporate this approach into sustainable policy and practical implementation [50].

A sustainable society cannot be neatly drawn to fit into geometric forms, such as a triangle or circular diagram, but a new vision is needed in order to show how this system is constantly evolving and making room for different dimensions‘ perceived importance in society [51]. These elements of what make a sustainable society, at any given moment, are never universally agreed upon nor fixed. Ideally, society would be capable of increasing well-being in an equitable and balanced way in terms of resource consumption, neither limiting the economy of material inputs nor the expansion into several dimensions [52, 53, 54]: these may be numerous and differentiated but a complete list of these will never be possible (thus presuming there will always be gaps) and points of overlap are unavoidable. Such a possible conceptual model can be given by a tree-like fractal model (Figure1).

In such a model, each dimension perceived as important by society can be represented as a branch or root. The importance in society of one dimension can increase or decrease, while the dimension itself can appear or disappear, as the society is evolving. This dynamic depends by the pattern of the values accepted by the society at a certain moment in its existence, which can obviously vary in time even for the same society [55].

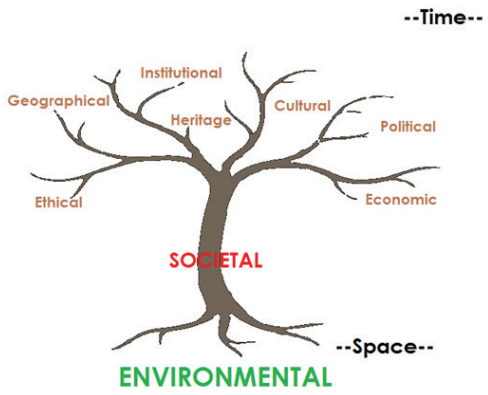

FIGURE 1. "Tree of multidimensional sustainability": conceptual dynamic model of a sustainable society based on cybernetic systems and fractal models.

The environmental space is influencing the society and is reciprocally influenced by the society, like in a cybernetic system. Such a system is characterised by the feedback component which generates changes in the system in order to adapt to the changes of the environment. The short term existence of the society is not determined by the existence of one dimension, but its sustainability is. Considering the development of fractal models [56] such an approach could prove useful in estimating and integrating different dimensions for better and adaptive policies.

DISCUSSION

Despite its overarching influence, science-practice interface should be strengthened [57]. In order to be closer to practice, policy makers, who actually depend on scientific advice, should be able to combine research findings with daily life experiences [24, 57]. However, Janse [58] argues that research studies are often in forms different from what is required by policy- and decision makers. One possible solution may be found in a better cooperation and integration of different kinds of knowledge and values between scientists, policy makers and policy implementation [57 - 59]. Various national and international cooperation projects between scientists and practitioners have been started supported by policy makers (some examples in South Eastern Europe are the following projects: FOPER [60], PRIFORT [21], PROFOR [61]). These projects are often coordinated by leading scientists and also involve young researchers and usually have some impact on policy making or policy implementation.

To truly understand values, it is necessary to develop indicators which are capable of expressing the various values over multiple time periods, for different regions, and among different groups. Although we recognise the difficulty in defining forest values, it is possible to define a time component for them, temporal and spatial limitations should be recognised as influential in the changing values of any society [51]. As each society holds different values which are more influenced by the social, historical cultural and economical factors, rather than environmental changes [51], the changing values of that sustainability system might not be reflecting the environmental considerations adequately.

CONCLUSIONS

Enhancing SD and SFM requires a stronger integration and application of the knowledge gained from scientific study as well as the lessons learned through societal transitions. In order to do so, two major weaknesses of the current concept of sustainability in forest management have been identified:

i) multi-dimensional perspectives of forest management need to be enhanced in order to allow for the use of transdisciplinarity for forest management definition and implementation.
ii) decision making processes need to be enhanced to allow for mechanisms which are more inclusive of multiple perspectives since power relations can affect an effective participation in such processes.

As forest values are personal in nature, it is difficult to create sufficient indicators resulting in subjectivity and partiality. In other words, there is a need of enhancing the multidimensional perspectives towards a more sustainable forest management to encompass multi-dimensional values, as the dynamic fractal model for the society presented in Figure 1. The challenge is not only integrating the different needs into the concept of SD, but also to understand who actually had power to design and to implement the concept. A wholly participative process in decision making, including a wider group of actors and stakeholders, must go beyond traditional public consultations and public-private collaboration in order to realize a shared vision of sustainability and implement a concept which is capable of recognising the inherent power relations embedded within its definition.

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REFERENCES

1. LARKIN PA 1977 An Epitaph for the Concept of Maximum Sustained Yield. *T Am Fish Soc* 106 (1): 1-11. DOI: http://dx.doi.org/10.1577/1548-8659(1977)106<1:AEFTCO>2.0.CO;2
2. WCED 1987 Our Common Future. Oxford University Press, Oxford, England, UK, 400 p
3. MCPFE 1993 Resolution H1: General Guidelines for the Sustainable Management of Forests in Europe. Second Ministerial Conference on the Protection of Forests in Europe, Helsinki, Finland, 16-17 June 1993
4. FERGUSON IS 1996 Sustainable Forest Management. Oxford University Press, Melbourne, Australia, 162 p
5. UNCED 1992 Agenda 21: Programme of Action for Sustainable Development, Rio de Janerio, Brazil, 3-14 June 1992. UN, New York, NY, USA, 351 p.
6. MATHER AS 2001 The transition from deforestation to reforestation in Europe. *In*: Angelson A, Kaimowitz D (*eds*): Agricultural technologies and tropical deforestation. CABI Publishing, Center for International Forestry, Wallingford, UK, pp 35-52. DOI: http://dx.doi.org/10.1079/9780851994512.0000
7. SCHMIDT M 2007 Hannß Carl von Carlowitz und seine "Sylvicultura Oeconomica" (*in German*). Pforzheim University, Pforzheim, Germany. URL: http://umwelt.hs-pforzheim.de/en/other/historical-topics/carlowitz-titel-inhalt/?sword_list%5B0%5D=hann%C3%9F&sword_list%5B1%5D=carl&sword_list%5B2%5D=von&sword_list%5B3%5D=carlowitz (25 November 2011)
8. CLARK WA 2011 Clarifying the spiritual value of forests and their role in sustainable forest management. *Journal for the Study of Religion, Nature and Culture* 5 (1): 18-38. DOI: http://dx.doi.org/10.1558/jsrnc.v5i1.18
9. RAMETSTEINER E, KRAXNER F 2003 Europeans and their forests. What do Europeans think about forests and sustainable forest management? MCPFE, Vienna, Austria, 56 p
10. EDWARDS P, KLEINSCHMIT D 2015 National forest policy between change and resistance. *Scand J For Res* 30 (3): 201-2013. DOI: http://dx.doi.org/10.1080/02827581.2015.1014201
11. ROSENBERG N 1973 Innovative responses to material shortages. *Am Econ Rev* 63 (2): 111-118
12. KENT FK 2012 Integrating property value and local recreation models to value ecosystem services from regional parks. *Landscape Urban Plan* 108 (2-4): 79-90. DOI: http://dx.doi.org/10.1016/j.landurbplan.2012.08.002
13. CHRISTENSEN NL, BARTUSKA AM, BROWN JH, CARPENTER S, D'ANTONIO C, FRANCIS R, FRANKLIN JF, MACMAHON JA, *et al.* 1996 The report of the Ecological Society of America committee on the scientific basis for ecosystem management. *Ecol Appl* 6 (3): 665-691. DOI: http://dx.doi.org/10.2307/2269460
14. RUCKELSHAUS M, KLINGER T, KNOWLTON N, DEMASTER DP 2008 Marine ecosystem-based management in practice: scientific and governance challenges. *BioScience* 58 (1): 53-63. DOI: http://dx.doi.org/10.1641/B580110
15. GREGORY AJ, ATKINS JP, BURDON D, ELLIOTT M 2013 A problem structuring method for ecosystem-based management: The DPSIR modelling process. *Eur J Oper Res* 227 (3): 558-569. DOI: http://dx.doi.org/10.1016/j.ejor.2012.11.020
16. EDENS B, HEIN L 2013 Towards a consistent approach for ecosystem accounting. *Eco Econ* 90: 41-52. DOI: http://dx.doi.org/10.1016/j.ecolecon.2013.03.003
17. SCHNEIDERS A, VAN DAELE T, VAN LANDUYT W, VAN REETH W 2012 Biodiversity and ecosystem services: Complementary approaches for ecosystem management?. *Ecol Indic* 21: 123-133. DOI: http://dx.doi.org/10.1016/j.ecolind.2011.06.021
18. LAURILA-PANT M, LEHIKOINEN A, UUSITALO L, VENESJÄRVI R 2015 How to value biodiversity in environmental management?. *Ecol Indic* 55: 1-11. DOI: http://dx.doi.org/10.1016/j.ecolind.2015.02.034
19. KARPPINEN H 1998 Values and objectives of non-industrial private forest owners in Finland. *Silva Fenn* 32 (1): 43-59. DOI: http://dx.doi.org/10.14214/sf.699
20. SPEARS J 1999 Sustainable forest management: An evolving goal. Profor, Washington DC, USA, 28 p.
21. GLÜCK P *et al.* 2011 Private forest owners in the Western Balkans – ready for the formation of interest associations. European Forest Institute, Joensuu, Finland, Research Report 25: 227 p URL: http://www.efi.int/files/attachments/publications/efi_rr_25_2011.pdf (11 November 2014)
22. MANSFIELD B 2009 Sustainability. *In*: Castree N, Demeritt D, Liverman D, Rhoads B (*eds*): A Companion to Environmental Geography. Wiley- Blackwell, Chichester, England, UK, pp 37-49. DOI: http://dx.doi.org/10.1002/9781444305722.ch3
23. GRÜBMEYER SF 2007 Quiet Activists - Environmental Values and Value Adjustment in Environmental Policy Advisors. MSc thesis, University of Waikato, Hamilton, New Zealand. 166 p
24. WERLAND S 2009 Global forest governance - Bringing forestry science (back) in. *Forest Policy Econ* 11 (5-6): 446-451. DOI: http://dx.doi.org/10.1016/j.forpol.2008.07.002
25. LEE J, MARTIN A, KRISTJANSON P, WOLLENBERG E 2015 Implications on equity in agricultural carbon market projects: a gendered analysis of access, decision making, and outcomes *Environment and Planning A* 47: 2080–2096. DOI: http://dx.doi.org/10.1177/0308518x15595897
26. KHATUN K, GROSS-CAMP N, CORBERA E, MARTIN A, BALL S, MASSAO G 2015 When Participatory Forest Management makes money: insights from Tanzania on governance, benefit sharing and implications for REDD+ *Environ Plann A* 47: 2097-2112. DOI: http://dx.doi.org/10.1177/0308518x15595899
27. VALBUENA-CARABAÑA M, LÓPEZ DE HEREDIA U, FUENTES-UTRILLA P, GONZÁLEZ-DONCEL I, GIL L 2010 Historical and recent changes in the Spanish forests: A socio-economic process. *Rev Palaeobot Palyno* 162 (3): 492-506. DOI: http://dx.doi.org/10.1016/j.revpalbo.2009.11.003
28. GUNDERSEN VS, FRIVOLD LH 2008 Public preferences for forest structures: a review of quantitative surveys from Finland, Norway and Sweden. *Urban For Urban Gree* 7 (4): 241-258. DOI: http://dx.doi.org/10.1016/j.ufug.2008.05.001
29. OBSERVATOIRE DU DIALOGUE SOCIAL 1998 Image de la forêt et du bois. Niveaux de connaissance et de volonté & idées fausses. Rapport.
30. EDWARDS D, SØNDERGAARD JENSEN F, MARZANO M, MASON B, PIZZIRANI S, SCHELHAAS MJ 2011 A theoretical framework to assess the impacts of forest management on the recreational value of European forests. *Ecol Indic* 11 (1): 81-89. DOI: http://dx.doi.org/10.1016/j.ecolind.2009.06.006
31. HOYOS D, MARIEL P, FERNÁNDEZ-MACHO J 2009 The influence of cultural identity on the WTP to protect natural resources: Some empirical evidence. *Ecol Econ* 68 (8-9): 2372-2381. DOI: http://dx.doi.org/10.1016/j.ecolecon.2009.03.015
32. SNEDDON CS 2000 'Sustainability' in ecological economics, ecology and livelihoods: a review. *Prog Hum Geog* 24 (4): 521-549. DOI: http://dx.doi.org/10.1191/030913200100189076
33. PADOCH C, SEARS RR 2005 Conserving concepts: in praise of sustainability. *Conserv Biol* 19 (1): 39-41. DOI: http://dx.doi.org/10.1111/j.1523-1739.2005.00509.x
34. RESCHER N 1969 Introduction to value theory. Prentice-Hall,Englewood Cliffs. 199 p.
35. DALY HE 2008 A Steady State Economy. Sustainable Development Commission, UK, 10 p. URL: http://www.sd-commission.org.uk/data/files/publications/Herman_Daly_thinkpiece.pdf (30 January 2013)

36. GLÜCK P, AVDIBEGOVIĆ M, ČABARAVDIĆ A, NONIĆ D, PETROVIĆ N, POSAVEC S, STOJANOVSKA M 2010 The preconditions for the formation of private forest owners' interest associations in Western Balkan Region. *Forest Policy Econ* 12 (4): 250-263. DOI: http://dx.doi.org/10.1016/j.forpol.2010.02.001
37. RAMETSTEINER E, WEISS G 2006 Assessing policies from a systems perspective – experiences with applied innovation systems analysis and implications for policy evaluation. *Forest Policy Econ* 8 (5): 564-576. DOI: http://dx.doi.org/10.1016/j.forpol.2005.07.005
38. ARROW K, BOLIN B, COSTANZA R, DASGUPTA P, FOLKE K, HOLLING CS, JANSSON B, LEVIN S, *et al.* 1995 *Economic* Growth, Carrying Capacity, and the Environment. *Science* 268: 520-521. DOI: http://dx.doi.org/10.1126/science.268.5210.520
39. COSTANZA R 2009 Toward a new sustainable economy. *Real World Economics Review* 49: 20-21. URL: http://www.paecon.net/PAEReview/issue49/Costanza49.pdf (10 December 2014)
40. DALY HE, FARLEY J 2011 Ecological economics: principles and applications. Island press.
41. GOLDSMITH AA 1992 Institutions and Planned Socioeconomic Change: Four Approaches. *Public Admin Rev* 52 (6): 582-587. DOI: http://dx.doi.org/10.2307/977168
42. CBD 2009 Information and Views of the Eighth Meeting of the CBD Working Group on Access and Benefit-sharing, Montreal, 9-15 November 2009. URL: http://www.cbd.int/abs/submissions/abswg-08-iied-en.pdf (30 January 2013)
43. PIUSSI P, FARRELL EP 2000 Interactions between society and forest ecosystems: challenges for the near future. *Forest Ecol Manag* 132 (1): 21-28. DOI: http://dx.doi.org/10.1016/S0378-1127(00)00376-5
44. EASTON D 1979 David Easton - Wikipedia, the free encyclopedia.
45. FINKELSTEIN S 1992 Power in top management teams: Dimensions, measurement, and validation. *The Academy of Management Journal* 35 (3): 505-538. DOI: http://dx.doi.org/10.2307/256485.
46. OGBONNA E, WILKINSON B 1998 Power relations in the UK grocery supply chain: Developments in the 1990s. *Journal of Retailing and Consumer Services* 5 (2): 77-86. DOI: http://dx.doi.org/10.1016/S0969-6989(97)00004-0
47. HERMANS C, ERICKSON J, NOORDEWIER T, SHELDON A, KLINE M 2007 Collaborative environmental planning in river management: An application of multicriteria decision analysis in the White River Watershed in Vermont. *J Environ Manage* 84 (4): 534-546. DOI: http://dx.doi.org/10.1016/j.jenvman.2006.07.013
48. FUNTOWICZ S, RAVETZ J 1993 Science for the post-normal age. *Futures* 25 (7): 739-755. DOI: http://dx.doi.org/10.1016/0016-3287(93)90022-L
49. MEA 2005 Ecosystems and Human Well-being: Synthesis. Island Press, Washington DC, USA
50. SCHILD J, VAN DER PLOEG S, GÓMEZ-BAGGETHUN E, BLIGNAUT J, MURADIAN R, DE GROOT D 2011 Book of Abstracts of the 4th ESP Conference 2011. Wageningen, The Netherlands, 4-7 October 2011. ESP, Wageningen, The Netherlands, 21 p
51. RATNER BD 2004 "Sustainability" as a Dialogue of Values: Challenges to the Sociology of Development. *Socio Inq* 74 (1): 50-69. DOI: http://dx.doi.org/10.1111/j.1475-682X.2004.00079.x
52. MEADOWS DH, MEADOWS DL, RANDERS J 1992 Beyond the limits: global collapse or a sustainable future. Earthscan Publications Ltd.
53. DALY HE 1990 Toward some operational principles of sustainable development. *Ecol Econ* 2 (1): 1-6. DOI: http://dx.doi.org/10.1016/0921-8009(90)90010-R
54. SCHNEIDER F, KALLIS G, MARTINEZ-ALIER J 2010 Crisis or opportunity? Economic degrowth for social equity and ecological sustainability. Introduction to this special issue. *J Clean Prod* 18 (6): 511-518. DOI: http://dx.doi.org/10.1016/j.jclepro.2010.01.014
55. EVELYN J 1964 Silva, Or a Discourse of Forest-Trees and the Propagation of Timber in His Majesty's Dominions. *In*: De La Bédoyère G (*ed*) The Writings of John Evelyn. Boydell Press, Martlesham, England, UK
56. FALCONER K 2003 Fractal Geometry. Mathematical Foundations and Applications. John Wiley & Sons, Chichester, England, UK, 288 p. DOI: http://dx.doi.org/10.1002/0470013850
57. KROTT M 2010 Value and risks of the use of analytical theory in science for forest policy. *Forest Policy Econ* 16: 35-42. DOI: http://dx.doi.org/10.1016/j.forpol.2009.12.004
58. JANSE G 2008 Communication between forest scientists and forest policy-makers in Europe - A survey on both sides of the science/policy interface. *Forest Policy Econ* 10 (3): 183-194. DOI: http://dx.doi.org/10.1016/j.forpol.2007.10.001
59. WILKS-ALLEMAN J, PÜTZ M, HIRSCHI C, FISCHER C 2015 Conflict situations and response strategies in urban forests in Switzerland. *Scand J For Res* 30 (3): 204-216. DOI: http://dx.doi.org/10.1080/02827581.2014.1002217
60. FOPER.ORG 2015 About Us. URL: http://foper.org/about-us/ (10 August 2015)
61. The Program on Forests 2015 Our mission. URL: http://www.profor.info/content/our-mission (10 August 2015)