SELECTING CRITERIA AND ASSESSING OF SUSTAINABLE FOREST MANAGEMENT ON THE CASE OF POLAND

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Abstract:
The paper describes an application of criteria and indicators (C&I) used for forest management unit. First we present the selection of a desirable C&I set in accordance with the ranking method. This method was used in a participatory decision-making environment where a team representing stakeholders connected with forests used their opinion in assessing C&I developed by Center for International Forestry Research. Next, we present forest management unit evaluation in line with said criteria. State Forests in Poland was used for a case-study. Results show that the ranking approach can be used to select sets of C&I for particular forest management unit. Also the results show that State Forests are finding on the road to sustainable management. Using C&I can help in monitoring forest management and fitting next purposes.

Keywords: sustainable development, forest management

1. INTRODUCTION

The term “sustainable development” has emerged in terms of awareness t.at planet's resources are not inexhaustible and that the current development path of human society tends to lead to the ruin of civilizations because it generates negative phenomena, among which social conflict and environmental degradation are the most severe. Given the economic role forests have in different parts of the world, especially the input in the context of exceptional ecological degradation of an increasingly fragile environment, ‘Sustainable Forest Management’ is considered to be one of the main ways of achieving sustainable development of society overall. Sustainable forest management has become the primary goal of forest institutions worldwide. According to the definition it means a set of objectives, activities and outcomes consistent with maintaining or improving the forest’s ecological integrity and contributing to people’s well-being both now and in the future. One of the significant initiatives for achieving sustainable forest management is the development of criteria and indicators. This initiative was originally conceived through the Forest Principles and Chapter 11 of Agenda 21 of the Rio Declaration. Consequently this led to a number of initiatives at the national, regional, international levels. A number of institutions have attempted to develop different sets of criteria: International Timber Trade Organization, Scientific Certification Systems, SGS Forestry. Most of them follow a hierarchical framework organized around three general elements: principles, criteria, indicators. This paper has 2 aims: 1) examine the use of ranking method for evaluating and selecting a set of C&I; 2) asses the sustainability of a forest on the example of particular forest management unit.
The paper is organized as follows: first we consider issues related to assessing sustainable forest management and present the ranking methodology. Next, we present our research results: the selection of a desirable C&I set in accordance with the ranking method and forest management unit evaluation in line with said criteria.

2. CRITERIA AND INDICATORS

C&I are tools which can be used to conceptualise, evaluate and implement sustainable forest management. Sustainability refers to the ability of a human, natural, or mixed system to withstand or adapt to endogenous or exogenous change indefinitely. Sustainability in ecological terms implies that essential life-support systems be maintained over time without degrading their quality. In the case of forest ecosystems maintaining integrity in terms of its structure, function, composition, ecological processes along with environmental service the forest provide, is of particular significance. To be able to apply the concept of sustainable forest management as clearly and as simply as possible it is necessary to describe it in terms of guiding principles, criteria and corresponding indicators (Verma):

1. Principle: A fundamental truth or law as the basis of reasoning or action. Principles in the context of sustainable forest management are seen as providing the primary framework for managing forests in a sustainable fashion.
2. Criteria: A principle or standard that a thing is judged by. A criterion can, therefore, be seen as a ‘second order’ principle, one that adds meaning and operationality to a principle without itself being a direct measure of performance. Criteria are the intermediate points to which the information provided by indicators can be integrated and where an interpretable assessment crystallises.
3. Indicator: An indicator is any variable or component of the forest ecosystem or management system used to infer the status of a particular criterion. Indicators should convey a ‘single meaningful message’.

The currently accepted criteria for forested areas are adequate to a variety of environmentally sustainable goals, such as: maintaining and improving forest resources and their contribution to the global carbon cycle; maintaining health and vitality of forest ecosystems; maintaining and stimulating the production functions of forests (wood and other products); maintenance, protection and improvement of biodiversity of forest ecosystems; maintaining and improving the functions of soil and water protection; maintenance of other social and economic functions of forests (Ichim). These criteria express the same number of requirements to be met simultaneously so as to prove that forest management is sustainable.

Criteria can be identified at various levels: global, regional (ecoregional), national and subnational, or, as in this case, at the forest management unit level. National-level C&I have been developed essentially as reporting and monitoring instruments, not as standards with which to assess sustainability. On the other hand, development of C&I at the forest level has been largely for the

purpose of assessing sustainability. The three main conditions required in selection of the initial sets of C&I are:

- selected sets should represent the global 'state of the art' C&I for the assessment of sustainable forest management at the forest management unit level;
- the most advanced national or regional set of C&I should be included to provide local relevance;
- selected sets should cover ecological, economic and social aspects of sustainability.

3. RANKING METHOD

The ranking method belongs to the group of multiple criteria analyses. It involves determining the weight of a particular object within a given set with regard to the adopted preferential aspects. Ranking is a means of ordering objects so that by taking various factors and points of view into account, it becomes possible to conduct comparative and diagnostic analyses (Stabryła). The method is also used in establishing the precedence of e.g. the quality of organisational solutions, the significance (weight) of production and marketing objectives, and the urgency of undertakings. Ranking determines the importance of particular elements within a given set based on the adopted criteria of choice. Preference in terms of particular elements is decided through sequential ranking, with the significance within the adopted set expressed in the form of the ranking number. The ranking number (rank) is an ordinal number corresponding to the given element's level of significance. The relative importance or weight can be calculated based on the ranks assigned to each element.

The method of ranking elements involves the following steps:
1) determination of the scope of ranking,
2) juxtaposition of ranked data,
3) preferential ordering:
– calculating total ranking values,
– calculating mean ranking values,
– determining the ranking position of an element.
In the context of the discussed research, this method involves analysis of each C&I element by assigning a rank depending on its perceived importance. For example criterion *j* with *m* indicators we can describe:
C_j (I_{j1}, I_{j2}, …, I_{jm})
Suppose a participant *k* gave the following ranking to the respective indicators of criterion *j* as follows: $r_{jk1}, r_{jk2}, \ldots, r_{jkm}$. The relative weight for indicator I; ω_{ji} (i=1, 2, …, m) can be calculated as follows:
$\omega_{ji} = \sum r_{ji} / \sum\sum r_{jki}$.

4. METHODOLOGY

We used the set of criteria developed by the Center for International Forestry Research (CIFOR). The assessment team organized for this study consisted of 3 members. The members included: two employees of State Forests and one government employee working with a government's forest research agency. Discussion are as follows: first the facilitator explains the C&I element, the relationships of each of these elements in the hierarchy, the role of ranking technique. Then analysis was done after the general briefing about the study. The weight of particular criteria was evaluated with the use of the ranking method. We adopted a scale of 0-3, where 0 denoted an insignificant criterion and 3 - an important criterion. Criteria ranked as 0 were ignored in subsequent analyses. The selected criteria were then applied to the analysis of State Forests. As the particular team members were familiar with SFs characteristics, the aim of the assessment was to determine the degree to which SFs implement the policy of sustainable development. In the assessment of the level of criterion satisfaction, a positive unipolar scale was used (1-3), where 1 denoted the criterion not being met or being marginally met. Therefore, the employed scale allowed evaluation of the criteria with regard to interpreting the positive feature - progress in terms of sustainable management.

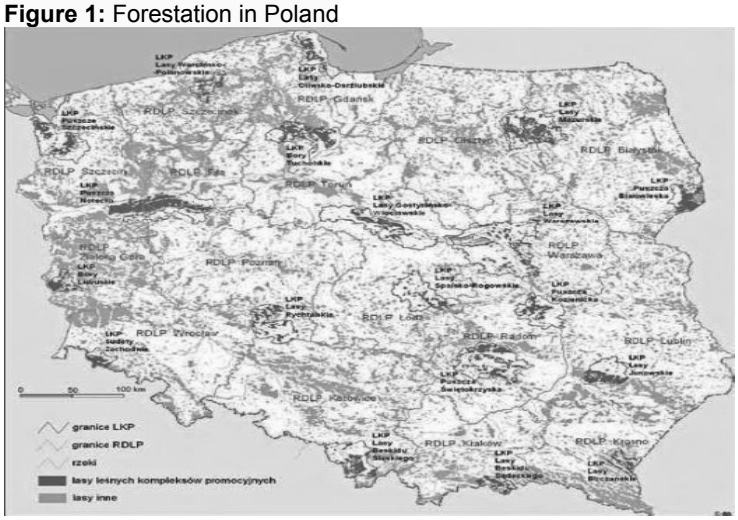
5. STATE FORESTS IN POLAND

Forests once covered almost whole territory of Poland. However the socio-economic developments such as expansion of agriculture and growing demand for timber had changed that. Even at the end of the 18th century forests covered about 40% of the territory within the polish borders at that time, but by 1945 this figure had fallen to just 20%. At present the total area of forest in Poland is 9163 thousand

hectares, which puts forest cover at 29%. This figure ranks Poland in the group of countries with the largest forest area in the region. In the ownership structure of forests in Poland the majority 81% are publicly-owned forests. Forests mainly occur in areas with poorest soils, which is reflected in the structure of forest habitat types. Coniferous forest habitats predominate, accounting for 51% of the total forest area, while broadleaved forest habitats account for 48%. In both groups upland habitats occupy 5% of the forest area and mountain habitats of 8%. Coniferous species dominate in forests, accounting for 69% total area. Pine accounts for 59% of the area of forest in all ownership categories. In the period 1945-2012 the species structure of Poland's forests substantially changed which is evident in the increase share of stands with the prevalence of broadleaved species.

Polish foresters have long stopped viewing forests as a source of raw wood. Today non-productive forest functions are in many cases more important than wood production. The State Forests National Forest Holding is an organization protecting, utilizing, and shaping Poland's forests for over eighty years. It manages publicly owned forests on behalf of the Polish State Treasury.

Figure 1: Forestation in Poland



Source: State of Forests Report, 2009

Prior to Poland's entry into EU the functioning of forest genetic resources was primarily based on directives of the General Director of the State Forests. Currently, the functioning of the forest seed base is in concordance with the EU rules, as well as with the Forest Reproductive Material Act (2001) together with the executive provisions to this act. A key document in terms of forestry development is the "Program of conserving forest genetic resources and breeding of forest trees for years 2011-2035". The strategic purposes of this program are:

- conservation and enrichment of the genetic diversity in the forests,
- breeding of forest trees,
- finding and maintaining at an appropriate quantitative and qualitative level the basic forest material for the needs of reforestation and afforestation.

6. RESULTS

6.1. Stage I

At this stage, the ranking method analysis was applied to determine the weight (significance) of particular criteria and indicators. The team started the C&I analysis at the criteria level. Voting was done individually. Summary of the votes made by each team member is shown in Table 1.

Table 1: Weights of criteria

Criterion	Vote1	Vote 2	Vote 3	Minimum	Maximum	Average	Variance
c.1.1	3	3	3	3	3	3	0
c.1.2	1	3	3	1	3	2,3	0,8
c.1.3	2	2	0	0	2	1,3	0,8
c.1.4	1	2	2	1	2	1,6	0,2
c.1.5	3	3	3	3	3	3	0
c.1.6	1	2	3	1	3	2	0,6
c.2.1	3	3	3	3	3	3	0
c.2.2	2	3	3	2	3	2,6	0,2
c.2.3	2	3	2	2	3	2,3	0,2
c.3.1	2	2	3	2	3	2,3	0,2
c.3.2	1	1	2	1	2	1,3	0,2
c.3.3	2	2	2	2	2	2	0
c.4.1	1	1	3	1	3	1,6	0,8
c.4.2	2	2	2	2	2	2	0
c.5.1	1	1	2	1	2	1,3	0,2
c.5.2	3	2	3	2	3	2,6	0,2
c.5.3	2	1	3	1	2	2	0,6
c.6.1	1	3	3	1	3	2,3	0,8
c.6.2	3	3	3	3	3	3	0
c.6.3	3	3	3	3	3	3	0
c.6.4	3	3	3	3	3	3	0
c.6.5	3	3	3	3	3	3	0
c.6.6	2	2	3	2	3	2,3	0,2

The results show that all criteria are important. No criteria were rated as not important. Criteria 1.1, 1.5,2.1, 6.2-6.5 are rated the highest. It is important to add that all team members were generally consistent, there was low variability among voters. The following observations can be noted:

1. criteria 1.3 (Nonforestry policies do not distort forest management), 3.2 (Nonforestry policies do not distort forest management), 5.1 (There is a recognizable balance between human activities and environmental conditions) can be seen more closely because of low relative weights. Their respective weights are not convergent;
2. criteria 1.1 (There is sustained and adequate funding for the management forest), 1.5 (Legal framework protects forest resources and access), 2.1 (The processes that maintain biodiversity in managed forests are conserved), 6.2-6.5 (Management objectives clearly and precisely described and documented; A comprehensive forest management plan is available) were evaluated as the most significant for sustainable forest management;
3. criteria 1.2 (Precautionary economics policy in place), 1.3 (Nonforestry policies do not distort forest management), 4.1 (Effective mechanisms exist for two-way communication related to forest management among stakeholders), 6.1 (Forest management unit is implemented on the basis of legal title on the land, recognized customary rights, or clear lease agreements) displayed the highest inconsistency (highest variance) in the assessment.

Table 2 presents the results for all indicators. The assessment of particular indicators indicated that:

1. Some indicators (for example means of conflict resolution function without violence, 50% of timber company personnel and forestry officials speak one or more local languages, or 50% local women speak the national language, nutritional status is adequate among local populations) can be consider as a candidate for omission or elimination;
2. There is higher consistency (less variability) in the ranking of the indicators with the highest relative weights. Therefore, consistency decreases for lower rated indicators.

Table 2: Relative importance of indicators

	Importance					Level of satisfaction				
Criterion	Vote 1	Vote 2	Vote 3	Average	Variance	Vote 1	Vote 2	Vote 3	Average	Variance
1.1.1	3	2	3	2,6	0,2	3	3	3	3	0
1.1.2	1	3	3	2,3	0,8	1	2	2	1,6	0,2
1.1.3	2	3	3	2,6	0,2	2	2	3	2,3	0,2

1.1.4	2	3	3	2,6	0,2	2	1	3	2	0,6
1.1.5	3	2	3	2,6	0,2	1	1	2	1,3	0,2
1.1.6	1	1	3	1,6	0,8	1	1	3	1,6	0,8
1.2.1	3	3	3	3	0	1	2	3	2	0,6
1.2.2	2	1	3	2	0,6	3	3	3	3	0
1.3.1	3	2	0	1,6	1,5	2	3	0	1,6	1,5
1.3.2	1	1	0	0,6	0,2	2	2	0	1,3	0,8
1.3.3	1	1	0	0,6	0,2	2	1	0	1	0,6
1.3.4	1	2	0	1	0,6	2	3	0	1,6	1,5
1.3.5	2	1	0	1	0,6	2	2	0	1,3	0,8
1.3.6	1	0	0	0,3	0,2	2	1	0	1	0,6
1.4.1	2	2	2	2	0	2	3	3	2,6	0,2
1.4.2	2	1	1	1,3	0,2	2	2	2	2	0
1.4.3	2	2	3	2,3	0,2	2	1	3	2	0,6
1.4.4	1	2	3	2	0,6	2	2	3	2,3	0,2
1.4.5	1	2	3	2	0,6	1	2	3	2	0,6
1.5.1	3	3	3	3	0	3	3	2	2,6	0,2
1.5.2	1	2	3	2	0,6	3	3	3	3	0
1.5.3	3	3	3	3	0	1	2	2	1,6	0,2
1.5.4	2	3	3	2,6	0,2	2	3	3	2,6	0,2
1.5.5	1	1	3	1,6	0,8	1	2	3	2	0,6
1.5.6	1	2	0	1	0,6	1	1	0	0,6	0,2
1.6.1	1	2	3	2	0,6	2	3	3	2,6	0,2
2.1.1	3	2	3	2,6	0,2	3	3	3	3	0
2.1.2	3	1	3	2,3	0,8	3	3	3	3	0
2.1.3	2	1	2	1,6	0,2	2	1	2	1,6	0,2
2.1.4	2	1	3	2	0,6	2	1	3	2	0,6
2.1.5	2	2	2	2	0	1	1	2	1,3	0,2
2.1.6	3	3	3	3	0	2	1	3	2	0,6
2.1.7	3	3	3	3	0	2	3	3	2,6	0,2
2.1.8	3	3	2	2,6	0,2	3	3	2	2,6	0,2
2.2.1	0	1	3	1,3	1,5	1	1	3	1,6	0,8
2.3.1	2	2	2	2	0	2	1	2	1,6	0,2
2.3.2	1	1	2	1,3	0,2	2	1	3	2	0,6
2.3.3	2	1	2	1,6	0,2	2	1	2	1,6	0,2
2.3.4	3	2	2	2,3	0,2	2	2	2	2	0
3.1.1	3	3	3	3	0	2	3	3	2,6	0,2
3.1.2	3	3	3	3	0	3	3	2	2,6	0,2
3.1.3	1	0	3	1,3	1,5	-	-	2	2	0
3.1.4	3	2	3	2,6	0,2	3	2	2	2,3	0,2
3.1.5	3	2	3	2,6	0,2	3	3	2	2,6	0,2
3.2.1	3	2	2	2,3	0,2	2	1	2	1,6	0,2
3.2.2	3	2	2	2,3	0,2	2	1	1	1,3	0,2
3.2.3	2	1	3	2	0,6	3	3	2	2,6	0,2
3.2.4	2	2	3	2,3	0,2	1	2	2	1,6	0,2
3.2.5	2	1	2	1,6	0,2	2	2	2	2	0
3.2.6	3	3	3	3	0	3	3	2	2,6	0,2
3.3.1	1	3	2	2	0,6	1	2	2	1,6	0,2
3.3.2	0	1	1	0,6	0,2	2	1	1	1,3	0,2
3.3.3	2	1	2	1,6	0,2	3	3	3	3	0
3.3.4	3	3	3	3	0	3	3	2	2,6	0,2
3.3.5	3	2	3	2,6	0,2	1	1	3	1,6	0,8
3.3.6	1	1	3	1,6	0,8	1	1	3	1,6	0,8
4.1.1	1	0	0	0,3	0,2	-	-	-	-	-
4.1.2	1	0	3	1,3	1,5	2	1	1	1,3	0,2
4.1.3	1	1	3	1,6	0,8	1	1	1	1	0

4.2.1	2	2	3	2,3	0,2	2	2	2	2	0
4.2.2	2	3	3	2,6	0,2	1	2	2	1,6	0,2
4.2.3	2	2	2	2	0	1	1	1	1	0
4.2.4	1	2	3	2	0,6	2	3	2	2,3	0,2
4.2.5	1	2	3	2	0,6	2	2	1	1,6	0,2
4.3.1	3	2	2	2,3	0,2	3	3	1	2,3	0,8
5.1.1	3	3	2	2,6	0,2	2	3	2	2,3	0,2
5.1.2	3	3	2	2,6	0,2	3	3	2	2,6	0,2
5.2.1	1	1	2	1,3	0,2	2	2	1	1,6	0,2
5.2.2	0	1	0	0,3	0,2	-	-	-	-	-
5.2.3	2	1	3	2	0,6	3	3	2	2,6	0,2
5.3.1	1	1	2	1,3	0,2	1	2	3	2	0,6
5.3.2	1	1	3	1,6	0,8	1	2	3	2	0,6
5.3.3	1	1	3	1,6	0,8	3	3	3	3	0
6.1.1	2	3	3	2,6	0,2	3	3	3	3	0
6.1.2	2	3	3	2,6	0,2	2	3	3	2,6	0,2
6.1.3	1	1	2	1,3	0,2	2	3	3	2,6	0,2
6.2.1	3	3	3	3	0	2	3	3	2,6	0,2
6.3.1	3	3	3	3	0	3	3	3	3	0
6.3.2	3	2	3	2,6	0,2	3	3	3	3	0
6.3.3	3	2	3	2,6	0,2	3	2	1	2	0,6
6.3.4	2	2	3	2,3	0,2	2	1	3	2	0,6
6.3.5	1	2	3	2	0,6	1	2	3	2	0,6
6.3.6	2	3	3	2,6	0,2	3	3	3	3	0
6.3.7	3	3	3	3	0	2	3	2	2,3	0,2
6.4.1	3	3	3	3	0	2	2	2	2	0
6.4.2	3	3	3	3	0	1	2	2	1,6	0,2
6.4.3	2	3	3	2,6	0,2	1	1	2	1,3	0,2
6.4.4	3	3	3	3	0	2	3	2	2,3	0,2
6.4.5	3	3	3	3	0	2	2	3	2,3	0,2
6.4.6	2	3	3	2,6	0,2	3	3	2	2,6	0,2
6.4.7	1	3	3	2,3	0,8	3	3	2	2,6	0,2
6.4.8	3	3	2	2,6	0,2	1	2	2	1,6	0,2
6.4.9	2	3	3	2,6	0,2	3	3	2	2,6	0,2
6.5.1	2	2	3	2,3	0,2	1	2	3	2	0,6
6.5.2	2	2	3	2,3	0,2	2	2	3	2,3	0,2
6.5.3	1	1	3	1,6	0,8	2	2	2	2	0
6.5.4	0	1	3	1,3	1,5	1	2	3	2	0,6
6.5.5	3	3	3	3	0	3	2	3	2,6	0,2
6.6.1	3	3	3	3	0	3	2	2	2,3	0,2
6.6.2	2	2	3	2,3	0,2	2	1	3	2	0,6
6.6.3	2	2	3	2,3	0,2	3	3	2	2,6	0,2
6.6.4	2	2	0	1,3	0,8	1	2	-	1,5	0,25

6.2. Stage II

The aim of stage 2 was to determine the level of criterion satisfaction (indicators) by a selected forest management unit. The study did not omit any of the criteria but excluded indicators whose assessment by 2 of the experts was returned as 0: means of conflict resolution function without violence, 50% of timber company personnel and forestry officials speak one or more local languages, or 50% local women speak the national language, nutritional status is adequate among local populations. The obtained results are presented in Table 2.

The respondents returned particularly high scores with respect to indicators related to the legal framework protects forest resources (including the security of tenure, existence of nonconfiscatory land-use policy, transparent system of concession allocation), effective control at the local level (rules and norms of resources use are monitored and enforced), existing of comprehensive forest

management plan (management plan looks beyond the second cutting cycle, yield regulation by area and/or volume prescribed).
The State Forests' policy of sustainable development is implemented with consistency and relatively high commitment. The level of satisfaction of the particular criteria differ significantly (table 3). Only five of the indicators: Presence of alternative fuel oils in forest boundary areas, Absence of distorting exchange rate over- or undervaluation, Transparent system of concession allocation, The contribution of all stakeholders are mutually respected and valued at the generally satisfactory level, Baseline studies of local human systems are available and consulted, received low scores. It means that no particular efforts are made in those areas. Activities in terms of legal efforts aimed at preservation of forest resources and processes facilitating biodiversity were said to have a particular impact on the sustainable development of forests.

Table 3: Level of criteria satisfaction by State Forests

Criterium	Description	Note (1-3)
1.1	There is sustained and adequate funding for the management forest	3
1.2	Precautionary economics policy in place	2,3
1.3	Nonforestry policies do not distort forest management	1,3
1.4	The existence of functioning buffer zone	1,6
1.5	Legal framework protects forest resources and access	3
1.6	Demonstrated reinvestment in forest-use options	2
2.1	The processes that maintain biodiversity in managed forests are conserved	3
2.2	Ecosystem function is maintained	2,6
2.3	Conservation of the processes that maintain genetic variation	2,3
3.1	Local management is effective in controlling maintenance of and access to the resources	2,3
3.2	Forest actors have a reasonable share in the economic benefits derived from forest use	1,3
3.3	People link their own and their children's future with management of forest resources	2
4.1	Effective mechanisms exist for two-way communication related to forest management among stakeholders	1,6
4.2	Local stakeholders have detailed, reciprocal knowledge pertaining to forest resources use	2
4.3	Agreement exists on rights and responsibilities of relevant stakeholders	1,3
5.1	There is a recognizable balance between human activities and environmental conditions	2,6
5.2	The relationship between forest management and human health is recognized	2
5.3	The relationship between forest maintenance and human culture is acknowledged as important	2,3
6.1	Forest management unit is implemented on the basis of legal title on the land, recognized	3
6.2	Management objectives clearly and precisely described and documented	3
6.3	A comprehensive forest management plan is available	3
6.4	The implementation of management plan is effective	3
6.5	Effective monitoring and control systems audit management's conformity with planning	2,3
6.6	Equitable distribution and presence of economic rent	3

Taking into consideration both the weight of a criterion and the level of its satisfaction, attention should be drawn to those indicators for which the scores obtained were consistently high in both respects. These include in particular the security of tenure, enrichment planting in based on indigenous locally adapted species, increasing natural population in harmony with maintaining the forest, planning beyond the second cutting cycle, education about natural resource management, diversification of total forest product utilization. They indicate that concerns relating to educating children on issues such as environmental protection, functions of the forest, maintaining sustainable development, and preserving local species are reflected in both strategic planning processes and the implemented programmes. The perceived high significance, however, does not go hand in hand with allocation of suitable funds in institutions responsible for forest management and research, existence of property

rights for exploited non timber forest products, changes in status of decomposition and nutrient cycling, efficiency of systems of production and transformation of forest products. Respondents emphasised the insufficient financing of State Forests and consistently low efficiency of forestry production.

7. CONCLUSIONS

The performed analysis demonstrated the validity of applying the ranking method to selecting the criteria for the assessment of sustainable forest management. One of the advantages of adopting ranking method is its transparent and easiness of using. It offers a convenient environment for a democratic decision process. Also it allows enhancing the participatory approach to decision-making where all stakeholders are involved not only as information providers but as decision-makers. While some criteria were rated lower than others careful analysis should be exercised before making decisions on eliminating a specific criterion.

The results show that the management of State Forests in Poland is conducted in accordance with the policy of sustainable development. None of the criteria reviewed were evaluated as insignificant and the obtained assessments did not vary significantly. Using C&I may aid the process of progress monitoring in terms of implementing sustainable development and facilitate identification of further developmental opportunities.

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