

DEVELOPMENT OF EFFECTIVE INFORMATION SYSTEMS FOR MONITORING AND CERTIFICATION OF PRODUCTION FOREST CONCESSIONS AND PROGRESS

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ABSTRACT

To improve the assessment of sustainability situation of production forest management a research project has been designed and being implemented jointly by the International Institute for Geo-Information Science and Earth Observation "ITC, TROPENBOS International foundation, and the Indonesian Watershed Management Technology Center, in collaboration with Indonesian Eco-Labeling Institute and the Ministry of Forestry in Indonesia. The project is aiming at "Design and development of an effective monitoring and certification system to support sustainable management of production forest in Indonesia. This article reports on some of the findings of this research program. In this context special attention will be given to the potential role of GIS, Remote Sensing and Decision Science.

INTRODUCTION

Rapid decline of forest cover and forest degradation especially in the tropical rain forest is now acknowledged as a "global problem" with social, economical and environmental implications. To assist in coping with the problem and to promote sustainable forest management, one of the policy instrument which is formulated by the international communities is "Forest Certification" that would allow export of forestry products only from so-called "sustainable managed forests". In this line, the Indonesian Ministry of Forestry has decided to extend the concession rights of only those concessionaries that are practicing Sustainable Forest Management* "mandatory certification". What is Sustainable Forest Management? How can it be achieved and assessed, especially considering the decentralization process that has taken place in Indonesia? What should be the criteria and indicators of achievement? How should they be measured, estimated and generalized; how should they be aggregated to a decision reflecting sustainability? how can it be handled in large areas ranging from a few hundreds to hundred thousands of hectares of forest, many of which not easily accessible.

Currently, many scientists are involved in the development of models, procedures, standards to conceptualise, operationalize and evaluate Sustainable Forestry Management "SFM" at the international, national or forest management unit (FMU) level. As a result, many management models for SFM and guidelines with large sets of sustainability Criteria, Indicators and Verifiers have been developed and recommended. However the developed management models and their related indicator system so

far experiences problem in terms of feasibility, efficiency and effectiveness. This is especially true in Indonesia where new policies for decentralization and partnership with local communities have been adopted. The certification model for the Indonesian production forest had been developed based on a forest management model, which assumes the full authorities for the concessionaire and the central government. Such assumption is not valid and the situation has completely changed. The current criteria and indicators have little connection with the actual forest management practices, and are yet intended to assess the quality of management (LEI, 2000). The current attempts to measure and verify so many criteria, indicators, and verifiers (over 200) require excessively large sets of information from the concessions (Figure 1). Proper acquisition, management and processing of such information are a massive and complex process. In some cases, non-existence, in others non-availability, accessibility and questionable reliability of the data and information, data capture, collection and processing, the time and cost that involved, has made the proper implementation of 'certification' in accordance with these excessive numbers of hierarchically structured indicators ver

* For the license extension purpose, certification process is compulsory/mandatory, while for forest product trading certification is voluntary such as what LEI developed.

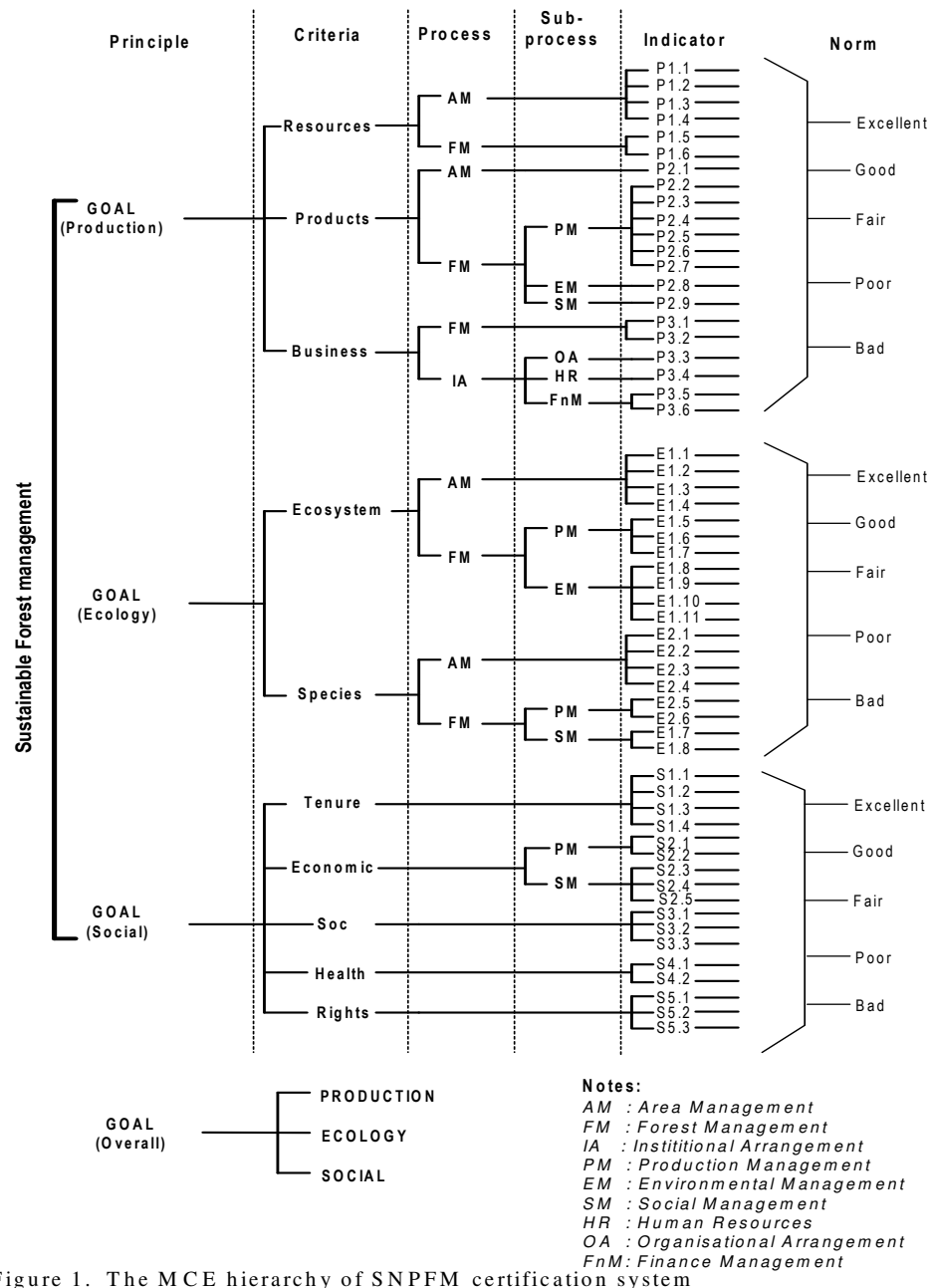


Figure 1. The MCE hierarchy of SNPFM certification system

selecting/adapting a collaborative management model, and its required information systems for monitoring SFM at concession level.. It further supports certification of the concession management. In the latter effort will be made to simplify the current certification process while ensuring its social and political acceptance, and retaining its necessary scientific rigor, and proposes a practical, effective and efficient forest certification and monitoring system. To this end, the research is aimed at the following:

- Bench-marking of the state of the art issues in SFM and certification for production forest at local level, mainly in Indonesia,
- Selection/adaptation of an Integrated model [i.e. including community values / indigenous knowledge] supporting

sustainable forest management at concession level for production forest concessions in Indonesian,

- Improve the existing forest certification model that is suitable for the Indonesian production forest, which is scientifically acceptable by the international communities, and technically and economically feasible to be implement in Indonesia,
- Explore the role of geo-information technology (GIS, Remote Sensing, and Decision Support Systems) in the process of reaching the above disciplinary objectives;
- Institutional and Civil Society strengthening/building through knowledge generation, transfer and application in close collaboration with the local institutions.

The project has started on year 2001 and shall be completed by 2007.

De e op ent of s st in e forest n ge ent ode

Development of Monitoring and Evaluation systems: To support management of the concession as well as acting as a source of information for all the externals, such as the government agencies, Ngo's and mandatory and voluntary certification systems a monitoring and evaluation system will be designed and implemented. In this context, the concepts and methods of Structured System Development Methodology, participatory mapping and data collection, participatory GIS and analysis of remotely sensed data will be applied.

Development of forest certification system Based on the structure and flow of information in accordance with the developed management model and its related monitoring and evaluation system, a Decision Support System for Certification will be developed and evaluated. This system will support Mandatory and Voluntary certification process as required by the Indonesian authorities and the international communities. The system shall allow selection of appropriate set of

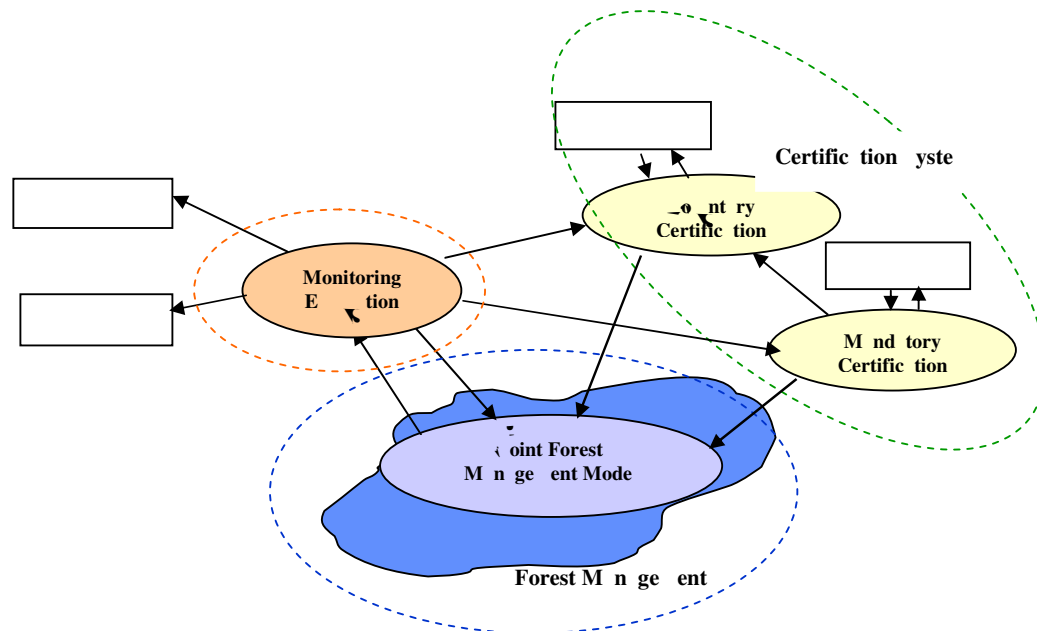


Figure 1. Conceptual presentation of different elements of the research

Applying compensatory model in sustainable forest management evaluation needs careful examination. Allowing complete compensation of bad performance, how bad it is, of certain indicator by the good performance one, may be not true. Certain indicators could be fundamental to achieve the sustainability of forest management such as forest area certainty, biodiversity conservation and assurance of local community and employee's right, while the others are not. Therefore they must be achieved at certain level of performance or threshold and cannot be compensated by any other indicators. However in another part compensation may be acceptable as a fair way in evaluation, it is most unlikely to be good in every aspects of evaluation.

The current certification system for assessing sustainability of forest management has problems in input and in processing. In the input part the major problems are that a) the verifiers are of diverse nature and vaguely defined, b) experts assess the verifiers using verbal judgement but these judgements are considered as crisp number so judgement uncertainty is not considered and c) moreover on the ground verifiers are interrelated, but in the current system they are put under different hierarchical levels and hence their ground interaction reality is restricted. In the processing part a) Crisp numbers leads to under estimation or over-estimation, b) these numbers are processed using mathematical aggregation based on AHP (Saaty, 1995) and hence uncontrolled degree of compensation that leads to irrational interactions and information loss and c) interpretation of finally derived crisp number. These problems are systematically researched and analysed in the research to choose a proper approach and necessary procedures, which can lead to decisive assessment of SFM (Purbawiyatna, 2002).

Jeganathan (2003) and Retno (2004) use AHP, Fuzzy-AHP; Fuzzy Reasoning approaches, to explore the alternative method of assessing the sustainability of the forest management. They found that fuzzy reasoning based approaches gives more flexibility, transparency and full control on the processes involved in achieving the rational sustainability assessment. For a complex problem of decision making, such as assessment of the sustainable forest management, the result usually need to be obtained through reasoning by rules. This study has found that

rule base assessment in fuzzy reasoning model allows better linking of the human knowledge with the existing indicators.

Potential role of remote sensing and GIS application

Potential role of application of RS/GIS in certification process were identified as determination of forest management typology, land-cover change determination and analysis of the status of biodiversity (Aguma, 2002; Dahal, 2002; Wardhana, 2002). Fauzi (2001) researched detection of forest structure change using image classification and found remote sensing application practical, since it deal with huge and often inaccessible area.. Cui (2003) and Santosh (2003) found that Landsat-7 ETM+ can play a partial, but also crucial role for supporting forest certification process in Indonesia. They demonstrated that the following six indicators can be positively assessed with reasonable accuracy using remotely sensed data i.e. Landsat ETM+:

- P1.1-"It must be guaranteed that land will remain as a forest area"
- P1.3-"The level of change in land cover due to encroachment and conversion of forest, fire, and other factors"
- P2.5-"Condition of remaining stands"
- P2.7-"Infrastructure of the forest management unit in the harvesting of forest products"
- P2.8-"Implementation of reduced impact logging"
- E1.3-"The intensity of damage in protected areas which includes the danger of forest fires"

Among these 6 indicators, P1.3 and E1.3 can be assessed quantitatively, while others can only be assessed qualitatively. He also showed that object-oriented image analysis, which is implemented by eCognition software, is the suitable image processing method for the information extraction to support forest certification process, although it is not very easy to use. Many functions provided by it are not available yet in other pixel-based techniques, and some of these functions are useful for assessing forest management.

Considering the large amount of indicators and the difficulty of getting relatively cloud free images, Landsat-7 ETM+ data can only partially be used to support certification process in Indonesia. Meanwhile, considering the importance of indicators and regulations that can be assessed, this partial support is also very crucial to the whole certification process. It can help to get pre-

cious and timely information at low cost, and this information are not easy, if not impossible to get by other means.

Virigina (2004) and Anita (2004), explored the role of Landsat-7 ETM+ data in exploring single tree illegal logging. They combined the classification of satellite data with the expert knowledge to successfully locate the newly illegally lodged single tree in the project area. Yohanes (2004), explored the application of remote sensing and GIS to High Conservation Valued Forest with respect to Soil erosion and water conservation.

Concluding Remarks

Monitoring and Certification systems are important instruments to monitor and promote sustainable forest management. However, effective monitoring and credible certification systems require large set of information, which cannot be collected only for monitoring and certification purposes. The quality of the data which is collected for this purpose is acceptable/reliable and their collection make sense if they are systematically collected and used in the process of routine management activities (planning, control and evaluation) of the concession. The foundation of the sustainable management is the concession management model, supported by proper monitoring and certification system. In these processes, the concepts of Adaptive Collaborative Management, which guarantees the right and responsibility of all stakeholders, especially the local communities are an important factor. In these processes, the remote sensing technology, geographic information science, and decision science can play an important supporting role.

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