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Review

Criteria and indicators for sustainable forest fuel production and harvesting: A review of current standards for sustainable forest management

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ABSTRACT

Forest biomass is increasingly being considered as a source of sustainable energy. It is crucial, however, that this biomass be grown and harvested in a sustainable manner. International processes and certification systems have been developed to ensure sustainable forest management (SFM) in general, but it is important to consider if they adequately address specific impacts of intensified production and harvesting methods related to forest fuels. To explore how existing SFM frameworks address sustainable forest fuel production, criteria and indicators (C&I) from 10 different international processes and organizations and 157 international, national and sub-national forest management certification standards under the Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification (PEFC) were reviewed. International processes include indicators that require identification or reporting of availability, harvested amounts, value, or share in energy consumption of forest fuels. Forest certification standards address several specific woodfuel issues, but not always in a consistent manner. It seems that developed countries more frequently address environmental consequences of harvesting residues or whole trees on soil fertility and biodiversity, while developing countries more frequently address social issues, such as local people's access to firewood and working conditions in charcoal production. Based on findings, options to improve SFM standards for sustainable forest fuel production are discussed. These options include clarification of terminology, systematic inclusion of important management impacts unique to forest fuel production, coordination of efforts with other related governance processes, including tools promoting sustainability at more integrated levels, such as landscape, supply chain and global levels.

1. Introduction

Wood has been used for heating and cooking from time immemorial, and domestic fuelwood is still one of the greatest uses for wood around the world, especially in developing countries [1,2]. The industrial bioenergy sector is also substantial in many countries and it is growing as regional and national government policies increasingly encourage the

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use of domestically available and renewable energy sources that minimize fossil fuel consumption [2,3]. This industrial growth is accompanied by increasing concerns over whether or not environmental and social values are adequately ensured when biomass is grown, harvested, and converted to energy in both developing and developed countries. These concerns have resulted in increasing interest in the development of criteria and indicators (C&I; see Table 1 for a list of abbreviations used in this paper) with which to measure and assess the sustainability of bioenergy production systems, including the sustainable production of bioenergy feedstock [4–10].

A variety of certification schemes currently exist and operate at different points along the bioenergy supply chain

Table 1 – Glossary of abbreviations.

Abbreviation	Full name
International processes and organizations	
ATO	African Timber Organization
CIFOR	Center for International Forestry Research
Dry Zone Africa	The Dry-Zone Africa Process on Criteria and Indicators for Sustainable Forest Management
Dry Zone Asia	Regional Initiative for the Development and Implementation of National Level Criteria and Indicators for the Sustainable Management of Dry Forests in Asia
ITTO	International Tropical Timber Organization
Lepaterique	Lepaterique Process of Central America on Criteria and Indicators for Sustainable Forest Management
MCPFE	Ministerial Conference on the Protection of Forests in Europe
PEOLG	Pan European Operational Level Guidelines
Montreal	The Montreal Process
Near East	The Near East Process
Forest certification systems and standards	
FSC	Forest Stewardship Council
PEFC	Programme for the Endorsement of Forest Certification
AFS	Australian Forestry Standard
ATFS	American Tree Farm System
CerFlor	Certificação Florestal, Sistema Brazileiro de Certificação Florestal
CertForChile	Sistema Chileno de Certificación de Manejo Forestal Sustentable
CSA	Canadian Standards Association
MTCC	Malaysian Timber Certification Council
PAFC	Pan African Forestry Certification System
FCR	Forest certification scheme by the Russian National Council for Forest Certification
SFI	Sustainable Forestry Initiative
UKWAS	UK woodland assurance standard
Selected FSC-accredited certifiers	
IMO	Institut für Marktökologie
SCS	Scientific Certification Systems
SGS	Société Générale de Surveillance
SW	SmartWood
Schemes or standards for sustainable biomass or sustainable bioenergy	
GGL	Green Gold Label by the Control Union, Holland
Laborelec	Laborelec, Belgium
RSB	Roundtable for Sustainable Biofuels
Concepts	
BMP	Best Management Practices
C&I	Criteria and Indicators
FMU	Forest Management Unit
GHG	Greenhouse gases
GMO	Genetically Modified Organism
HCVF	High Conservation Value Forest
NTFP	Non-timber forest products
SFM	Sustainable Forest Management
SLIMF	Small and Low Intensity Managed Forest
WTH	Whole-Tree Harvesting
Other	
ILO	International Labour Organization
TBFRA	Temperate and Boreal Forest Resource Assessment by UNECE/FAO [13]
UBET	Unified Bioenergy Terminology by FAO [12]