REPORT

ANALYSIS ON ECONOMIC INCENTIVE FRAMEWORK OF SFM AS IMPORTANT OPTION FOR FOREST-BASED CLIMATE CHANGE MITIGATION TO REDUCE EMISSION FROM AND BY TROPICAL FOREST

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Enhancing Forest Carbon Stock to Reduce Emissions from Deforestation and Degradation through Sustainable Forest Management (SFM) Initiatives in Indonesia

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Enhancing Forest Carbon Stock
to Reduce Emission from Deforestation and Degradation
through Sustainable Forest Management (SFM) Initiatives
in Indonesia

Host Government: Indonesia

Executing Agency:
Directorate of Production Forest Use and Business
Directorate-General of Forestry Business Management
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EXECUTIVE SUMMARY

In the international agreement on climate change, sustainable forest management (SFM) is one of the mechanisms within the framework of REDD +. In Indonesia, natural forest management, to produce a timber made since the 70s; the concept of sustainable yield of timber is implemented by the concessionaire companies. Conceptually, yield regulation of timber is expected to achieve sustainability; but in reality the implementation of forest management practices in the field are still facing many obstacles. From 2002 until 2011, certified forests only 32% of the total forest managed area of 22,710,256 ha. There are 140 units that have a certified sustainable forest management, of which 31 units have good performance of SFM category, 35 units have moderate categories, while 74 units of the applicable certification runs out. Area of natural forest management in voluntary certification are 1,102,053 ha, as many as 6 units. On the plantation forest management, mandatory certification have done at 90 units, with an area of 4,914,301 ha, i.e. 49% of the total area. The 19 units from 90 units obtain a certificate that are in good category, and the remaining 71 units of the certificate are not valid. Industrial forest management units that already have voluntary certification cover an area of 2 units of 419,829 ha.

Study "Analysis Framework for Economic Incentives for Sustainable Forest Management as an Important Option in Forest-Based Climate Change Mitigation to Reduce Emissions from and by the Tropical Forest", analyzes the economic incentives for sustainable forest management gained through carbon trading potential of REDD + mechanism. In general, this study will answer two problems: 1) Is there a difference in the reduction of carbon emission, between SFM and Non-SFM units? 2) Is there potential for carbon incentives are different between SFM and Non SFM units?

In the study sample was taken three management units obtaining certification of sustainable forest management (SFM-1, SFM and SFM-2-3). Meanwhile, sample management units that have not obtained certification of sustainable forest management is taken four units (Non SFM-1, Non-2 SFM, SFM-3 Non, Non SFM-4). In this study analysis was performed 1) Sustainability of production and the company's financial health, 2) the ability of carbon emission reduction, 3) Potential supply of natural forest carbon, 4) The benefits of SFM to the private and public sectors and economic incentive framework.

The results of analysis of the sustainability of production using the ratio of production to the AAC criteria and trends, shows the difference between SFM and Non SFM units. SFM unit capable of maintaining the sustainability of production, the rate ratios ranged from 0.45 to 0.65 stable in the long run. In Non-SFM unit has a tendency production decline, in the 90s digit ratio of 0.4-0.85, and in 2011 dropped to 0.1-0.4; this means a decline in standing stock, so the annual production to decline, which gets smaller as compared with the potential of stands at the time initial in forest management . From the ability to obtain profit, SFM unit gains profit and unit non-SFM otherwise tend to get lost. Performance of the company's financial health between units SFM and Non SFM varies, but in general both management units had difficulty on working capital (liquidity problem).

The results of analysis of changes in forest cover, showing the rate of degradation in the working area SFM units lower than the unit of Non-SFM. The rate of degradation in the period 1992-2011 in SFM units was 1.98%, in units of Non SFM was 2.35%, whereas the

2000-2011 periods in units of SFM was 2.44%, in units of Non SFM was 2.61%. The difference in degradation rate between SFM and Non SFM units in the period 1992-2001 is 1.98% and 2.44% for the period 2000-2011. Based on differences in the rate of degradation reduction of carbon units of SFM, in the two periods respectively are 7.93 tCO_2/ha-year and 9.76 tCO_2/ha-year.

The potential supply of carbon SFM unit there are two sources or scenarios. The first scenario is when the present management unit has reached the SFM, or has been a change from Non-SFM to SFM; the second scenario the potential supply of carbon by the SFM and Non SFM units through a special policy that is reduction in the level of timber production. The potential supply of carbon in the first scenario is shown in the analysis of the differences between carbon reduction SFM and Non SFM units above. On the basis of the ability of the reduction of carbon by the SFM, can be estimated potential reduction of carbon emissions SFM Indonesia. The average size of management units for 145,161 ha of SFM, the obtained reduction of carbon emissions on average each management unit 386,129tC /year (1,416,771 tCO_2/year). The number of management units that SFM certification good categories were 31 units covering an area of 4,499,995 ha, bringing the total reduction of emissions by 43.92 $MtCO_2$/year. This estimation only considers emission reductions from reduced degradation rate, not taking into logged-over forest increment, increment of plantation, and reduction of stands damage caused by harvesting. Estimation based on the results of calculation of the reduction of carbon by Rusolono and Tiryana (2011) then the total potential supply of carbon SFM in Indonesia is 556.6 $MtCO_2$/year. In this study, the unit of Non SFM changes to SFM does not have the opportunity cost, because SFM is achieved through improved forest management practices, providing increased efficiency, and increased profit of IDR 1,161 / m^3 amounting to IDR 170,274 /m^3. Conversely, the supply of carbon to the scenario unit Non-SFM and SFM make specific policy through reduced production levels, have opportunity costs. Based on the analysis of revenues and costs of management unit of non-SFM and SFM obtained the average opportunity cost of Non SFM was IDR 708/tCO_2 and SFM unit of IDR 103,910/tCO_2. Based on the opportunity cost of the two groups of forest management unit is constructed of natural forest carbon supply curve. In general SFM unit will produce carbon supply, if the price of carbon is able to close opportunity costs, transaction costs and costs of forest protection. Provided the conditions break event point, if the carbon price of U.S. $ 61.14 / tC (U.S. $ 16.66 / tCO_2). While the Non-SFM unit has a great opportunity to take the carbon supply options through decreased production of timber or a moratorium on logging, because the opportunity cost is very small. If the Non-SFM management units make a moratorium on logging, is expected recovery in the forest for sustainable timber production, and also expected to provide higher profitability in the future, after the contract of carbon trading finished. There are things that need serious attention, the impact of a moratorium on logging to raw materials supply wood processing industry, and regional macroeconomic impact. Regional economic impact is a reduction in workforce, the decline in revenue and continuing impact on other economic sectors, which are backward and forward linkages. Based on economic and social implications are then taken important policy that encourages the achievement of SFM and policies to anticipate its effects. The government can create policies that allow the unit to apply the multiple-use management, which can absorb a larger workforce and increased productivity of various forest products. SFM benefits analyzed using a framework of ecological economic or total economic value. The analysis showed, if the SFM can be achieved then the inevitable losses incurred by private sector and public sector or social cost. This means that if SFM is not achieved then there is a loss in the private sector amounted to IDR 337,000 / ha-year, and the public sector amounted to IDR 299,000 / ha-year, bringing the total IDR 631,000 / ha-year. Until 2011, the unit of management in natural forest management SFM certification as many as 31 units (4,499,995 ha), so that the total benefits of SFM in Indonesia at the present moment of IDR 2.84 trillion / year. Management units that have

not obtained certification of SFM are 74 units (7,467,699 ha). Coupled with the management units that SFM certification category of moderate, assumed not to SFM, then forest area of the Non SFM is 10,775,488 ha (109 units of management). Forest management practices not SFM raises total social cost of IDR 6.80 trillion / year, due to depletion of resources and reduction of ecological functions of forests. This shows the importance of encouraging SFM in Indonesia, so that government revenues and social welfare increase. Therefore, the policy is required to push to achieve SFM, including through economic incentives.

Analytical framework of economic incentives based on: 1) direct incentives based on the potential of carbon emission reduction obtained by SFM with and without opportunity cost, 2) indirect incentives, namely the creation of enabling conditions towards SFM. The incentive is intended to overcome the constraints on aspects of production, conservation, social and institutional. Potential direct incentives for units of SFM from the sale of carbon in REDD + mechanism, if not the government can take the option incentive indirectly, through a policy of regulatory changes that significantly affect: a) Motivating improved management practices, re-investment assets of forests for the production of long-term , b) Reduction of management costs, cut the high cost economy and accelerate the production operations as well as transporting wood to the market, c) Improve the capacity and management system and optimizing the benefits of forest ecosystems through multiple-use management. Incentive instruments in the form of a) the price of carbon for the reduction of carbon emissions in units of SFM, and Non SFM conducting logging moratorium, b) the difference in tariff of non-tax revenues for SFM and non-SFM, c) Resolution forest land disputes through government regulation of adat forests, spatial district and provincial levels, lowering or eliminating reforestation fund and forest resource provision levies in adat forest claim, d) Provision of management rights in the form of multiple-use management to the units of SFM, e) Provision of rights, authority & annual operational oversight by the company itself, f) to the unit SFM there is an affirmation of certainty recognition by stakeholders of the timber, according to legal documents and administrative timber production systems.

Conclusions and recommendations which could be taken from the study are;

1) Sustainable forest management units can reduce carbon emissions from forests, and has the potential to obtain a direct incentive value of carbon (REDD +) while maintaining a level of long-term sustainable production.
2) Sustainable forest management provide benefits to the private and public sector, it's necessary supported by all parties, especially the central government, local government, and the police, so that SFM provides long-term benefits for investors, government and society.
3) Unsustainable forest management which includes the present moment concessions large enough to cause economic loss to the government and society (social cost) is higher than non-tax revenues in the forestry sector.
4) Constraints achieving SFM, there is internal to the unit management and external factors, so that the necessary incentives. Direct economic incentive instruments need to be combined with incentives related to the enabling conditions that can encourage the achievement of SFM.
5) Ministry of Forestry needs to make changes to the rules that give rise to obstacles, or not encourage professionalism on forest management by the management unit, as has been identified in various studies and also reviewed largely on this study. Forest management policies more geared to provide the right and the authority that responsible to the management unit, to develop organizational capacity and management to achieve SFM.

6) Ministry of Forestry to maximize the use of SFM certification as a means of SFM performance evaluation, and provision of incentives or disincentives that need to be given to the SFM and Non-SFM units. To the management unit Non-SFM need concrete steps and a clear timetable for achieving SFM.

7) Ministry of Forestry with SFM management unit needs to perform calculations of carbon (carbon accounting) of each unit in the province level in more detail, as the basis for the supply of carbon to be traded.

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I. INTRODUCTION

1.1. Background

The world concern to climate change and sustainable forest management in development activities has already begun since The Earth Summit was held in Rio de Janeiro, Brazil in June 1992. That conference has created two documents that legally binding, one of them is the Framework Convention of the United Nations (UN) on climate change (The United Nations Framework Convention on Climate Change). The agreement encouraged the other agreements to solve climate change issues. It contained a meaning that Sustainable Forest Management (SFM) is an important mechanism in reducing carbon emissions within the framework of REDD+.

The existing science has long provided a concept of sustainable forest management including yield regulation, multipurpose forest management concept and ecosystem-based forest management concept. The aplication of sustainable forest management in Indonesia's natural forests is emperically limited. It can be seen from the low percentage of forest that has a SFM certification, which is only 32.38% of total production of natural forests that are managed (22,710,256 ha), in other words the natural forest area that has been certified only 7,353,674 ha. Since 2002 until the second quarter of 2011, regarding to business units number, there are already 140 units existed business managements of natural forests which have been mandatory certified. There were 31 management units (4,499,995 ha) have obtained very good/good certification category; 35 management units (3,307,789 ha) have obtained the certification and 74 management units (7,467,699 ha) have expired certification. Besides mandatory certification there are also several companies that conduct voluntary certification, that are 6 units with 1,102,053 ha management area. Meanwhile, from 209 units (total area of 9,963,770 ha) of the business management unit of forest plantations, only 90 forest management units that has been done with the mandatory certification area 4,914,301 ha or 49.32% of the total area, and 19 units (2,499,280 ha) of that 90 units of forest management obtained good categories certificate and the remaining 71 units (2,415,021 ha) certificate is not valid. Only two units of industrial forest management that already have voluntary certification covered 419.829 ha area (DG BUK, 2011).

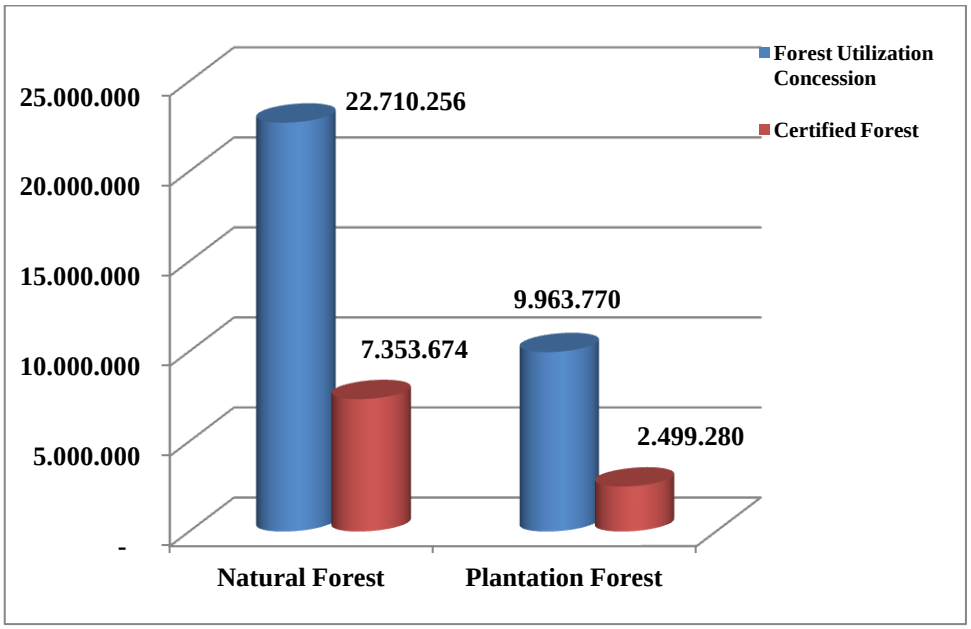


Figure 1. Total area of natural forest and plantation forest managed, and management units that have certified (sumber: Ditjen BUK, 2011)

The problems which make the sustainable forest management do not succeed are: the governance and regulation factor are not able to establish the forest good behavior and the ineffiency of bureaucracy; uncertainty of land (tenure and spatial layout); managing skills are still low, including technical, management and financial aspects; economic motive is existed but without willingness to maintain the availability of a "long term-forest". These cause the low motivation of management units to implement a sustainable forest management system. Besides, there are other several constraints associated with management.

Unsustainable forest management can increase the rate of deforestation and ecosystem degradation. They will cause loosing of products (forests ecological goods and services) which are essentials for the development and prosperity of nowadays and future society.

Regarding to the various factors that have been identified above, there is a big question, "Is there any way to encourage (incentives) the forest management unit which has implemented SFM or to motivate the sustainable forest management?. The study, entitled: "Analysis of Framework for Conducting Economic Incentives for Sustainable Forest Management as an Important Option in Forest-Based Climate Change Mitigation to Reduce Emissions from and by the Tropical Forest", will analyze the economic incentives earned by forest management sustainable through a potential carbon trading scheme on Reducing Emissions from Deforestation and Forest Degradation (REDD +).

1.2. Objectives

ITTO project Enhanching Forest Carbon Stock to Reduce Emissions from Deforestation and Degradation Through Sustainable Forest Management (SFM) Initiatives in Indonesia No. RED-PD 007/09 Rev.2 (F) has the objectives:

a) General objectives: To promote the SFM as important option for forest based climate change mitigation to reduce emission from and by tropical forest.
b) Specific objectives: To develop national strategy in maintaining and increasing forest carbon stock through SFM application.
c) The aim of study and analysis on economic incentive framework of SFM as important option for forest based on climate change mitigation to reduce emission from and by tropical forest (activities 2.2) is availability of the data and information of studies and analysis framework of economic incentives.

1.3. Study Tasks

Study tasks of project ITTO "Enhancing Forest Carbon Stock to Reduce Emissions from Deforestation and Degradation through Sustainable Forest Management (SFM) Initiatives in Indonesia No. RED-PD 007/09 Rev.2 (F), are:

a) Primary and secondary data collection from forest concessionaires sample (certified and non certified)
b) Analysis of economic incentive on practice of sustainable forest management.
c) Conclusion and recommendation economic incentive framework to implement SFM in Indonesia to reduce carbon emission from and by a forest.

II. STUDY FRAMEWORK

2.1. Problems Identification

Generally the problems that need to be solved are:

1) Is there any difference of the carbon reduction between SFM and Non SFM management unit (MU)?
2) Is there potential of carbon incentives are different between management unit SFM and Non SFM?

The details problems are formulated in a few questions. There are some formulations of problems addressed in this study, namely:

1) Is the trend rate of timber production of the sustainable forest management (SFM) relatively more constant than forest management not sustainable (Non SFM), which the production rate tends to decrease?
2) Is the sustainable forest management unit more capable to provide the financial sustainability (profitability and financial health) compared with unsustainable forest management?
3) Is the Sustainable Forest Management (SFM) has higher ability to maintain stocks of stands or carbon (SFM is able to provide carbon emission reductions) compared to forest management is not sustainable (Non SFM)?
4) Will the forests production management provide some benefits to the private and public sector? What kind of incentive that is needed to promote SFM?

2.2. Data Collection

The data collected from the certified and uncertified forest management unit. In this study there are three samples of certified management units of sustainable forest management (SFM-1, SFM-2 and SFM-3) and four example unit (Non SFM-1, Non SFM-2, Non SFM-3, Non SFM-4) of the uncertified ones.

The collected data includes:

1) Land or forest covered data of certified and uncertified management unit. Data of land cover taken from Landsat imagery interpretation results for 10 years.
2) Data of timber production realization of each unit (SFM and Non SFM), the data realization of production or timber production statistics is taken from 10 to 20 years, collected from the Annual Work Plan (RKT), Work Plan Timber Utilization (RKU -PHHK).

3) Data of the company finance of management unit, obtained from financial statements audited by public accountants. These data include the cost of production (production cost), business expenses, sales volume and revenue by type of wood. These data collected for 10 years.

2.3. Data Processing and Analysis

Data processing and analysis are required to answer those questions on the formulation of the problems. Processing and analysis data include:

1) Timber production statistics data of certified management unit, SFM and Non SFM, are analyzed to discover the long-term production trend, by making the ratio between production realization and the long-term annual production quota (annual allowable cutting). The data are analyzed to see trend of this ratio between the SFM and Non SFM sample management unit.
2) The financial data is then used to analyze business profitability and financial health of management unit. Financial data are consolidated by the management units within the group companies, should be separated using financial statement data (costs of each activity and the sale of forest management by forest management units). This is done to obtain the revenue from the sale of timber according to market price, because in group companies usually use transfer price. The company financial health are analyzed using the criteria of liquidity (current ratio), i.e. the ratio between current assets and current liabilities. Analysis of management company health was incorporated in the group, based on the consolidated financial health with the parent company.
3) Each type of land covering size in a few years of Landsat imagery interpretation. The analysis focussed on the trend of each type of land cover changes, particularly related to the degradation of forests into scrubland, grassland and non-forested areas, or a reduction of the work area that occurred in the forest management unit.
4) The land cover change data is used to analyze the rate of degradation. The data rate of forest degradation in SFM and Non SFM units used to estimate carbon stock change of forest stands respectively of Non SFM and SFM management units. The degradation rate of SFM and Non SFM data management unit are used to analyze the differences in forest carbon emissions reductions in the two groups of the unit's management (SFM and Non SFM).
5) The analysis carbon benefits potential of management units SFM are based on the data combination of income (profitability), the level of production (sales volume), and potential of forest carbon stocks. The carbon supply is made to show the relation between the realistic opportunity cost per unit of

management (SFM and Non SFM) and carbon prices to make it financially viable.

6) The analysis of sustainable forest management benefits is based on the differences in the rate of degradation data. The analysis includes the benefits of SFM in preventing some potential loss of stands, reduction of carbon emission, carbon emission reduction value, the value of prevention of loss of timber production profits, the value of state revenue (Non-tax revenues) from the Reforestation Fund and Provision of Forest Resources, and also the prevention of loss of the benefits of Non-timber forest products and hydrological services. The Non-timber forest and hydrological value comes from the results of another study (Bahruni 2008).

7) The analysis of economic incentive instruments were developed from the SFM benefits analysis, the potential supply of carbon, the review of the challenges of achieving SFM, interviews with the management unit respondent, and from another study (Report of the Working Group Team Ministry of Forestry, Analysis and Assessment of Government Policy to Support Management Forest on the ITTO PD 389/05 Rev. (2)), discussions with the management unit, the author's experience during conducting the certification, facilitation for management units to improve management performance to achieve SFM

III. THE RESULT OF DATA COLLECTION

3. 1. The General Description of Management Unit

The sustainable forest management which are the samples in this study consists of three management units, holder of a license for utilization of natural forest timber forest products (IUPHHKHA) i.e. SFM-1, SFM-2 and SFM-3, two units (SFM 2 & 3) located in Kalimantan and one unit (SFM-1) located in Sumatra. Brief profile of three companies as follows:

Table 1. Brief profile of SFM management unit

No	Management Unit	The decree permits the utilization	Area (ha)	AAC (ha/year; m^3/year)
1	SFM-1	Forestry Agreement No. FA/N/039/IV/78 and Ministerial decree of agriculture No. 403/Kpts/UM/6/1979 Extension: Ministerial decree of forestry No. 443/Kpts-II/1998,	90,956	2,000; 85,760
2	SFM-2	Ministerial decree of agriculture: No. 242/Kpts/Um/4/1979 Extension license: Ministerial decree of forestry: No. 15/Kpts-IV/99	184,206	6,650; 470,311
3	SFM-3	Ministerial decree of agriculture: No599/Kpts/UM/II/1978,addendum Ministerial decree of agriculture: No. 666/Kpts/Um/ 10/1979; Ministerial decree of forestry: No. 125/Kpts-IV/ 1986 Extension license: Ministerial decree of forestry: No. 201/Kpts-II/1998	208,300	5,675; 373,000

The table 1 shows that SFM management unit is a management unit that has performed concessions in the long time period, i.e. for twice permit concessions and has large work area.

Those three management unit samples have different types of forests characteristics. The SFM-2 and 3 management units are located in Kalimantan region, generally upland forests- with the dry land form.

The topography of forests in Kalimantan is mostly bumpy, steep and very steep, has a tilt percentage between 8%-40% with an altitude of 400 -1082 meter above sea level (masl). The SFM-1 Unit manejemen in Sumatra region has peat swamp forest type (wetlands) and mangrove forests, flat topography in the lowlands, with an altitude of 2-8 masl.

The climate types in SFM-2 and 3 work area are type A and B according to Schmidt and Fergusson. This area is largely dominated by vegetation of meranti (*Shorea spp*) family *Dipterocarpaceae*, i.e.: white meranti (*Shorea virescens*), red meranti (*Shore leprosula*), yellow meranti (*Shorea platycados*), keruing (*Dipterocarpus sp*), lime (*Dyobalanops sp*), bengkirai (*Shorea laevifolia*), cat's eye (*Hopea sangal*). Beside that there is also protected species from extinction i.e manggris (*Kompassia exelsa*), red meranti (*Shorea beccariana*), tengkawang (*Shorea macrophylla*, *Shorea Seminis*, *Shorea pinanga*, *Shorea stenoptera*). Manggris and tengkawang species have economic value to the communities around the forest. Manggris tree can be used as a nest of honey bees and the tengkawang tree produce fruit tengkawang (tengkawang nut). This area has some species can be harvested with a certain diameter limit restrictions are iron wood (*Eusideroxylon zwageri*), jelutung (*Dyera costulata*) limit diameter of 60 cm up and Kulim (*Scorodocarpus borneensisi*) limit diameter restrictions of 50 cm up. In addition to the tree species, in this area, species of orchids including: *Rhenanthera Matutina*, *Paraphalaenopsis denevel*, *Paraphalaenopsis lacockii*, *Gramatophyyum speciosum* and *Coelogen pandurata* can be found. The diversity of fauna in this region is quite high, especially for mammals and birds. There are several protected species in this area, such as orangutans (*Pongo pygmaeus*), Mueller gibbon (*Hylobates muelleri*), leopard (*Neofelis nebulosa*), bears (*Helarctos malayanus*) and sambar deer (*Cervus unicolor*).

The Climate in SFM-1 area is type A based on Schmidt and Ferguson, and based on climate, the area is divided into two types of forest ecosystem i.e. peat swamp and mangrove forest. In the peat swamp forest, there are some associations which the named according to the dominant tree species, namely the Association of stretched (*Campnosperma auriculata*) and Pulai (*Alstonia pneumatofora*), Association of Balam (*Palaqium obovatum*) and stone Meranti (*Shorea uliginosa*) and the Association of Ramin (*Gonystylus bancanus*) and Suntai (*Palaquium dasyphillum*). While in the mangrove forest ecosystem composed of *Sonneratia, Rhizophora spp* associations, associations *Xylocarpus-Bruguiera*, associations palm (*Nypa fruticans*), the association *Xylocarpus granatum* and *Bruguiera cylindrical* association. Tree species in the work area is ramin (*Gonystyllus bancanus*), stone meranti (*Shorea uliginosa*), interest meranti (*Shorea teysmanniana*), birds durian (*Durio carinatus*), suntai (*Palaqium obovatum*), bintangur (*Calophyllum soulattri*), geronggang (*Cratoxylon arborescens*), punak (*Tetramerista glabra*), Jangkang (*Xylopia malayana*), bananas (*Mezzetia parviflora*) and chelating (*Eugenia,* sp). The species of fauna that can be easily found are wild boar (*Sus barbatus*), kangkareng (*Antrocoseros malayanus*), long-tailed macaques (*Macaca fascicularis*), agile gibbon (*Hylobates agilis*), the Sumatran tiger (*Panthera tigris sumaterae*), sun bear (*Helarctos malayanus*), eagles crest (*Accipiter trivirgatus*), marsh hawk (*Circus aeroginosus*), magpie leaves (*Cholopsis venusta*) and hornbills (*Buceros rhinoceros*).

The samples of Non SFM that are taken in this study consists of four management units, the holder of a license for utilization of natural forest timber forest products (IUPHHKHA) i.e. Non SFM-1, Non SFM-2, Non SFM-3 and Non SFM-4. From those four management units, three units (Non SFM 1, 2 & 3) are located in Kalimantan and one unit (Non SFM 4) is located in Papua. Brief profile of four companies as follows:

Table 2. Brief profile of Non SFM management unit

No	Management Unit	The decree permits the utilization	Area (ha)	AAC (m^3/year)
1	NON SFM-1	Agreement No. FA/N/014/III/70 HPH decree No. 518/Kpts/Um/II/70 Extension: Ministerial decree of forestry No. 338/Menhut-IV/1993	76,925	50,701
2	NON SFM-2	*Forestry Agreement* No. (FA)/J/080/IX/73 dan HPH decree No. 635/kpts/Um/X/74 Ministerial decree of forestry RI No. 142/Kpts-II/93	294,600	443,900
3	NON SFM-3	Decree of Director General of the Department of Agriculture No. 618/Kpts/UM/10/1978 Extension: Decree of the Minister of Forestry and Plantation No. 853/Kptst-IV/1999	97,500	170,282
4	NON SFM-4	Ministerial decree of forestry No. 1071/Kpts-II/1992 Extension: Ministerial decree of forestry No. 910/kpts-IV/1999	677,310	257,638

The Non SFM-1 area is dominated by Dipterocarpaceae species, such as meranti, bengkirai and resak. In addition, besides those dominant commercial species, this area also has some protected species such as: Acid (*Aromadendron var*.), Campedak, jungle durian (*Durio zibethinus Murr*.), Jelutung (*Dyera lowii Hook. F*), king wood (*Cassia multiyuga Rich*), kedondong forest (*Spondies pinnata Kurz*), kempas (*Koompasia mallacensis*). Other commercial trees that can be found in this area are agathis, angeh (*Shorea sp*), chaos (*Dipterocarpus Mundus*), bengkirai (*Hopea dyeri Heim*), banitan (*Polyaltia lateriflora King*), bintangur (*Callophyllum var 2*), binuang (*Octomeles sumaterana Miq*), bono(*amoora*).

The working area of Non SFM-2 Management Unit topography ranges from 0-8% to 25-40% or flat to steep topography. This area climate type is type A with a Q value of 13%. There is an encounter of two types of vegetation, they are lowland dry forest and swamp forest vegetation. The lowland dry forest vegetation

occupies 80% wide of managed area. Both vegetations feature 140 types of plants such as meranti (*Shorea, spp*), guava wood (*Eugenia spp*), lumbar (*Koompasia excels Taub*), Deraya (*Myristica warb maxima*), banitan (*Shorea faguetiana heirn*), wok (*Eusideroxylon zwageri*), biwan (*Diospyros lollies Bakh*), salempatai (*Alseodahne sp*), float (*Shorea leprosula Miq*), melanin (*Xanthophyllum stipitatum Benn*) and kojeng (*Xylopia, sp*). Among those 44 plant species, 140 of them are protected, devided into 40 species of trees and 4 wild plants. As for the fauna, this area has 39 species of mammals, 10 reptiles genius and 43 species of birds, the fauna include pangolin (*Manis javanica*), kite-kite (*Hylobates mulleri*), snake shoots (*Ahaetulla prasina*), ground frog (*Rana sp*) and birds serindit (*Loriculus pusillus*).

The management unit Non SFM-3 has a topography that is similar to the Non SFM-2, generally consists of dry land with the configuration a bit steep and steep with elevation above sea level is 450-1274 meter above sea level (masl). The forests existence in the work area of this company is the vegetation of tropical lowland rain forests with consisting soil type of red-yellow podzolic and red-yellow podzolic complex latosol and litosol, with geological rock formations and rock quarry bancuh haloq. The climate type area is type A regarding to the clasification of Schmidt by Ferguson with the Q value 14.2%, and the climatic conditions of the area planted dominated by red meranti (*Shorea* sp), white meranti (*Shorea sororea*), bangkirai (*Shorea laevifolia*), keruing (*Dipterocarpus spp*), lime (*Drybalanops oocarpa*) and other types of Non Dipterocarpaceae such as ironwood (*Euxyderoxylon zwageri*), amber mountain / agatis (*Agathis celebica warb*), medang (*Litse spp*), bintangur (*Callophyllum papuanum L*) and nyatoh (*Palaquium lobbianum Burk*). As for the fauna in this area consists of a red feather boar (*Sus cropa*), ferrets (*Macrogalidia sp*), water civet (*Cynogale bennetti*), striped squirrel (*Dactylopsida trivirgata*), a large bat (*Pteropus vampires*), hedgehog (*Prochidna bruijmi*), parrots (*Gacula sp*), blue kingfisher (*Halcyon Sancta*), egrets (*Egreta sp*), forest falcon (Haliastur leucogaster), gray monitor lizard (Veranus nebulosus), a green lizard (*Veranus kordensis*), freshwater crocodiles (*Crocodylus*).

The Non SFM-4 area has a flat to undulating topography (slope range (<8% - 25%) with 100-684 masl altitude. The climate in these areas is based on the category A climate of Schidmt Fergusson with Alluvial, Latosol, Posolik, litosol and Regosol soil type. The types of commercial wood that become the main product SFM 4 are one kind of merbau (*Intsia spp*.). Dipterocarpaceae is often found like Hopea dyeri, Anisopthera Iriana and Vatica rassak. Matoa (*Pometia spp.*) also become the main product from Sapindaceae family. The other types that also dominate are Myrtacea, Myristicaceae and Burseraceae. There are also two types of protected wood: the wooden mace (*Cinnamomum sintoc*) and banyan (*Ficus spp*.). Banyan is considered as the ancestor of the local population so that this species is not allowed to get harvested. Sago is also often found along the river and a source of staple food of the local community.

Some wild animals are often found in the SFM 4 work area, they are wild boar (*Sus barbatus*), estuarine crocodile (*Crocodylus porossus*), the land crocodile (*Crocodylus novaeguineae*), lau lau or kangaroo-ground (*Thylogale bruijnii*). And also various types of birds, such as bird of paradise (*Paradisea minor*), Mambruk (*Goura victoria*), single gelambir cassowaries (*Casuarius unappendiculatus*), cockatoos chef (*Cacatua galerita*) and maleo (*maleo Macrocephalon*).

3. 2. Production and Profitability

The data production realization of SFM and Non SFM is derived from the Annual Work Plan document and the quisioner results. The production data of three management units of SFM and two units of Non-SFM, are shown in Table 3 and a complete data in Annex 1.

Based on this study realization of production grouped into two: small scale production 100.000 m^3/year and more than 100,000 m^3/year. The production realization data will be used in analyzing trends in long-term sustainability, using the ratio of sustainability. The management unit that has a greater realization production of 100 000 m^3/year, has an annual production quota (Annual Allowable Cutting/AAC) approximately 400,000 m^3/year, other management units have the realization production rate of approximately 100,000 m^3/year AAC.

Table 3. The timber production SFM and Non SFM units (m^3)

Year	SFM-1	SFM-2	SFM-3	Non SFM-1	Non SFM-2
1980	na	na	na	89,981	147,172
1985	na	na	136,520	33,358	109,892
1990	39,423	193,730	198,820	49,503	210,794
1995	70,109	263,547	226,276	50,411	150,726
2000	46,961	219,277	260,568	25,236	79,871
2005	65,251	164,828	268,968	20,364	50,063
2010	51,086	273,448	147,740	17,841	92,215
AAC	85,760	470,311	373,000	50,701	443,900

In addition to show the sustainability outcomes of production, we should know the financial performance of SFM and Non SFM management units. We will be able to know it from the profitability that can be achieved. The profit data that is obtained to each unit sourced from a financial statements document. The obtained data are expected in the same year, but the financial report documents can not accessed/ obtained in the same year. Besides the differences in the data, the time period of financial statements are also different. The management units mostly incorporated in the group, so the data in the financial statements is a combined form of forest management companies and wood processing industries (financial

statements). In consolidated financial statements for several year, the management unit SFM and wood processing industries have a negative financial situation (loss), ie the management unit of SFM-2 and 3.

The Information is obtained from the data of financial statements that the SFM management unit earns profit every year, but not with Non SFM, only Non SFM-1 earns profits while the other three units of Non SFM are loss (Table 4). Based on the existed profit data at the particular years, then calculating the average profit per cubic meter, according to prices in 2010, shows that the average profit SFM unit has a higher profitability than Non SFM.

Table 4. Profitability of management units of SFM and Non SFM

Year	Annual Profitabillity (IDR billion)						
	SFM-1	SFM-2	SFM-3	Non SFM-1	Non SFM-2	Non SFM-3	Non SFM-4
2002			12,586	1,268		(12,472)	
2003		39			(57,745)		
2004		30,223	18,868		(22,489)	(8,636)	(41,048)
2005		49,920	40,408	1,480	(9,447)	(4,777)	(30,766)
2006		55,362		863	(67,967)		(67,888)
2007	1,287	75,433			(35,648)		24,074
2008	1,279	90,320	26,535				
2009					(6,364)		
2010					14,183		
	Average of profit (IDR/m^3)						
Average*)	37,587	341,636	131,599	79,282	(84,171)	8,371	na
		170,274			**1,161**		

*Note: *) calculated based on figures 2010 year*

3. 3. Land Cover and Carbon Stock

Land cover data of working area of Non SFM and SFM management unit are derived from interpretation of Landsat imagery maps, from the management unit. The data obtained from the three management units of SFM and two units of Non SFM. Land cover classification is simplified into two type for the analysis of carbon stocks changes i.e forest and non forest.

The working area in each SFM management unit from year 1992-2010 is never changed. It means the land use of SFM management unit is not used apart from forestry activity, which would reduce the work area. The development of forest land cover in the SFM-1 and 2 management unit tends to decline. The forest area of SFM-1 management unit in 2003 and 2009 changes from 98% to 89% and

in SFM-3 management unit in 1993, forest land cover decreased from 100% to 85% in 2010. The development of forest land cover in SFM-2 management unit relatively constant at 86% forest and 14% Non-forest. In 2000, the data interpretation of Landsat imagery in SFM-2 was inconsistent, at first forest land cover was 86%, and two years later it changed to 91%, and in 2005 back to 86% (Table 5).

Table 5. Land cover composition and area of SFM management units

Tahun	SFM-1			SFM-2			SFM-3		
	Forest (%)	Non forest (%)	Working area (ha)	forest (%)	Non forest (%)	Working area (ha)	forest (%)	Non forest (%)	Working area (ha)
1992				91	9	184,206			
1993							100	-	208,200
2000				86	14	184,206	90	10	208,200
2002				91	9	184,206			
2003	98	2	90,956						
2005				91	9	184,206	84	16	208,200
2007	94	6	90,956	86	14	184,206			
2009	89	11	90,956						
2010							85	15	208,200
2011				86	14	184,206			

Table 6 shows the data from Landsat imagery interpretation of Non SFM management unit. The development working area of Non SFM unit has been decreased. The decreasing in acreage because natural forests have been degraded and used to be plantation forest, which management is separated from the natural forest management. The development of forest land cover in Non SFM-2 showed a substantial reduction, whereas in Non SFM-1 units are relatively slow declined.

Table 6. Land use compotition and area of Non SFM management units

Year	Non SFM-1			Non SFM-2		
	Forest (%)	Non Forest (%)	Working area (ha)	Forest (%)	Non Forest (%)	Working area (ha)
1991	39	61	76,925			
1994				84	16	294,600
1998	61	39	76,925			
2000				75	25	294,600
2002				73	27	294,600
2003	63	37	66,409			
2005				55	45	294,600
2006				69	31	274,100
2009				63	37	255,530

Based on the development of forest and Non forest land cover in SFM and Non SFM management unit, then the carbon stocks will be calculated. The data on carbon stocks in logged over area on dry land forest is 109 tC/ha (Kusuma, 2007; Junaedi, 2007; Aryono, 2010; Wayana, 2011) and carbon in the peat swamp forest is 65 tC / ha (10cm diameter stand-ups, not including litter, lower plant, seedling and saplings). The conversion to biomass standing volume of 0.95 (IPCC, 2006) and the conversion of biomass into carbon 0.47 (IPCC, 2006), the conversion of carbon to carbon dioxide is 3.67 (Brown 1997).

The development of forest carbon stocks in SFM and Non SFM management unit according to the development of forest cover Landsat imagery interpretation of the results in Table 5 and Table 6 above and in Table 7.

Table 7. Carbon stock of SFM and Non SFM management units (tC)

Year	Carbon Stock of SFM and Non SFM (tC)				
	SFM-1	SFM-2	SFM-3	Non SFM-1	Non SFM-2
1991				3,270,979	
1992		18,226,664			
1993			22,727,112		
1994					27,169,924
1998				5,161,688	
2000		17,280,901	20,505,924		24,209,923
2002					23,447,895
2003	5,808,270			4,599,765	
2005			19,004,579		17,723,218
2006					20,726,646
2007	5,530,200	17,245,097			
2009	5,236,530				17,590,042
2010			19,383,837		
2011		17,389,079			

IV. ANALYSIS RESULT

4.1. Sustainability of Timber Production

The statistics production from forest management unit samples show that the realization of the production do not reach 100% of the production plan (annual production targets) which is allowed. This kind of data show that if forest management unit have produced below the capacity or potential production forests. Based on the data of realization plan, describes as if this management unit production can sustain long term production target, because an over-exploitation does not happen. The image of the production of forest management unit sustainability can not be measured by the criteria of the plan and the realization ratio of annual production. The ratio of the plan and the realization does not reflect the potential for sustainable production based stand, because this ratio only demonstrated the ability of the unit management realize an annual production plan.

To evaluate the long-term production trend, so the ratio between realization of production and annual allowable cutting (AAC) is used. AAC is determined based on the potential of stands, at the beginning of the utilization of timber on the document of long-term planning the utilization, which is based from the survey results of the stand. The production ratio and AAC as a relative measure of long-term production which can be maintained relatively stable or have a tendency towards larger or smaller, based on the tendency of potential of the stand. The results of the analysis are shown in Figure 2.

The analysis of the ratio of annual production and AAC each forest management unit sample, shows the range of utilization levels production potential between 0.3-0.9 production capacity of forests. The ratio of SFM-1 looks slightly decreased but relatively small (not significant). The tendency of the greater number ratio is on SFM-2 and 3 management unit but the ratio is also relatively small. In general, analysis trend of production long-term in the forest management unit can be concluded, SFM shows the level of production relatively stable, ranging between 0.45-0.65 AAC. AAC illustrate potential an annual production in long-term which can be maintained, with the realization of real production does not exceed the actual or potential forest stands.

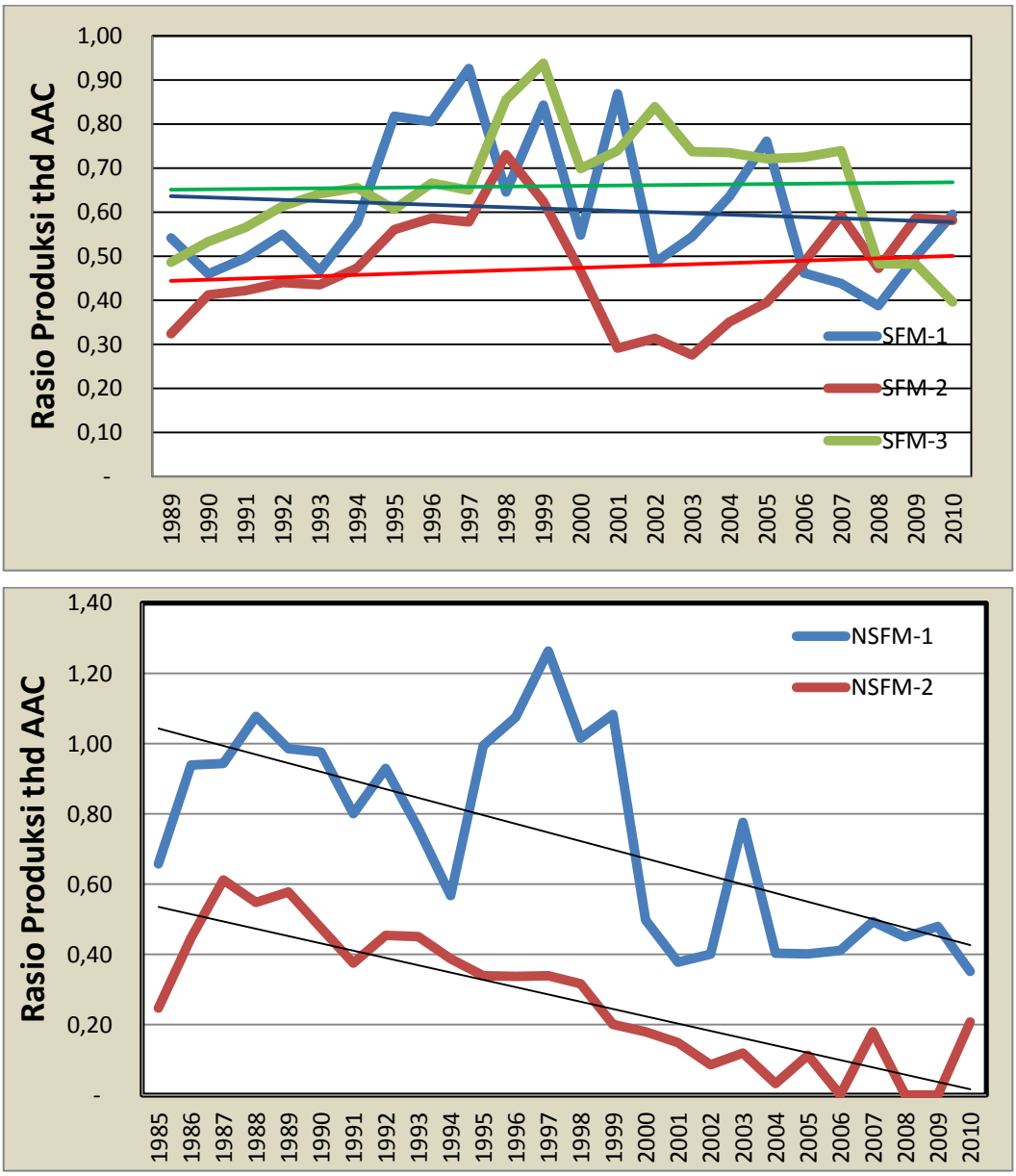


Figure 2. The tendency of realization production in long-term against sustainable production at the management unit of SFM (top) and Non SFM (bottom).

BOX 1:

CRITERIA AND INDICATORS PERFORMANCE OF

PRODUCTION FOREST MANAGEMENT CERTIFICATION

Data recorded on the Ministry of Forestry since 2002 until the second quarter of 2011, states that the management unit that has been done for the mandatory certification IUPHHKHA (natural forest company) is 140 units with an area of 14,275,443 ha and 90 units with an area of 4,914,301 ha for IUPHHK -HT (plantation companies). Of the 140 units of natural forest companies that perform certification predicated management unit 31 is very good and well with an area of 3,449,955 ha, 35 units are predicated management area with 3,307,789 ha and the remaining 74 units with an area of 7,467,699 predicated bad or certification is not valid. As for the plantation of 90 units 19 units which perform the certification area of 2,499,280 ha with both predicated and the remaining 71 units with an area of 2,415,021 ha has been no valid certification. Total forest plantation today is 209 units with a total area of 9,963,770 ha, and is therefore expected that nearly 90% have not made the certification or is the certification process. In addition to the mandatory certified companies there are also several companies that obtain voluntary certification, which is 6 units of natural forest, the total area of 1,102,112 ha and 2 units 420,329 ha of forest plantation area. The success of sustainable forest management was evidenced by a certificate. In the implementation of criteria and indicators are still facing problems, obstacles large enough, there are three functions in the preservation of the production function, ecology and social.

In the production criteria, there are 21 indicators that made the assessment, of the 21 indicators are still below standard, there are several indicators, 25% of firms constrained at P1.1, P1.4, P2.1 P2.7, P2.8, P3. 3 associated with the Area Assurance Management Unit; potential suitability of stands, policies and regulations; organizing region which ensures production activities, application and Reduced-impact logging and monitoring of impacts on soil and water due to forest exploitation, while 50% longer constrained in indicator P1. 2, P1.5, P2.6, P3.1 associated with the commitment of business owners / management; amount and adequacy of professional and technical personnel at all levels; the quantity of timber and forest area harvested for each year for each forest type and the existence, stability, and the condition of protected areas.

Ecological criteria there are 19 indicators, 29% is constrained in the indicator E1.2, E1.4, E1.7, E1.10, E2.4, E2.7, E2.8, namely: Proportion of forest area is protected; conditions diversity of flora and fauna; intensity of the impact of governance on the water; impact the effectiveness of control techniques; condition endangered/endemic/protected; observations of rare plants/endemic and protected and wildlife observation/endemic/rare. 19% of constrained at E1.6, E1.11, E2.1, E2.2 namely: the intensity of the impact of production on land governance; effectiveness of counseling on the importance of maintaining the forest ecosystem; uasan proportion of protected areas in accordance with the consideration of species endemic/endangered/protected; the proportion of area a well-protected areas, specifically intended for kepentingpn survival rate of the species.

Social criteria comprises 17 indicators, of the 17 indicators were 26% compliant, while 42% is constrained in the indicator S1.3, S2.1, S2.4, S4.1, S4.2, S5.1, S5.3, ie aspects of the utilization of results, community economic resources, developing domestic capital, minimizing the impact of management unit, in cooperation with health authorities, an agreement of cooperation and safety. 21% is constrained in S1.1 of the conflict area.

On indicators is an indicator that underlined the alleged relatively more difficult, because a) influenced by external parties and national macro conditions, b) requires the development of information management systems and application technology tepat.Indikator-indicator is below the standard should be increased again by entrepreneurs who filed SFM certification

Performance of forest management is assessed with criteria and indicators are developed by various institutions. In Indonesia, Indonesia Ecolabel Institute has developed SFM certification systems, certification which used in this system, carried out voluntary. Ministry of Forestry also has a mandatory certification system. In 2004 Darusman and bahruni had studied about criteria and standar to SFM (ITTO Project PD 42/00 No. REV.1 (F)), the result is identify criteria and indicators SFM which still not reaching the standard based on voluntary certification (See Box 1).

Empirically conclusion can be drawn from the analysis are the practice of sustainable forest management on SFM and Non SFM have different production performance. SFM unit has capable to maintain the sustainability of timber production. It also may indicate that the certification of SFM at the forest management unit in the study is in line with the evidence of production indicator of sustainability.

4.2. Financial Performance

The assumption that used on the analysis is the forest management unit SFM is able to acquire the business sustainability. The business sustainability is measured by business profit and financial health; in particular to depict the availability of working capital for ensures the smooth operation of the company.

Analysis of profit based on data on financial documents between year 2002 and 2008 (not all management units has available data in 2002-2008). The analysis showed that the forest management unit SFM gains profit and vice versa in Non SFM management units tend to experience loss (negative) in a few years, shown in Figure 3.

Financial performance evaluated by liquidity (current asset and liability ratio) of the management unit of SFM and Non SFM showed varying performance. The range of current ratio between 1,5-2 are deemed to have sufficient working capital to ensure the smooth operation of the company. This showed the ability of corporate on financial management in arrange of business financial on timber production from year to year.

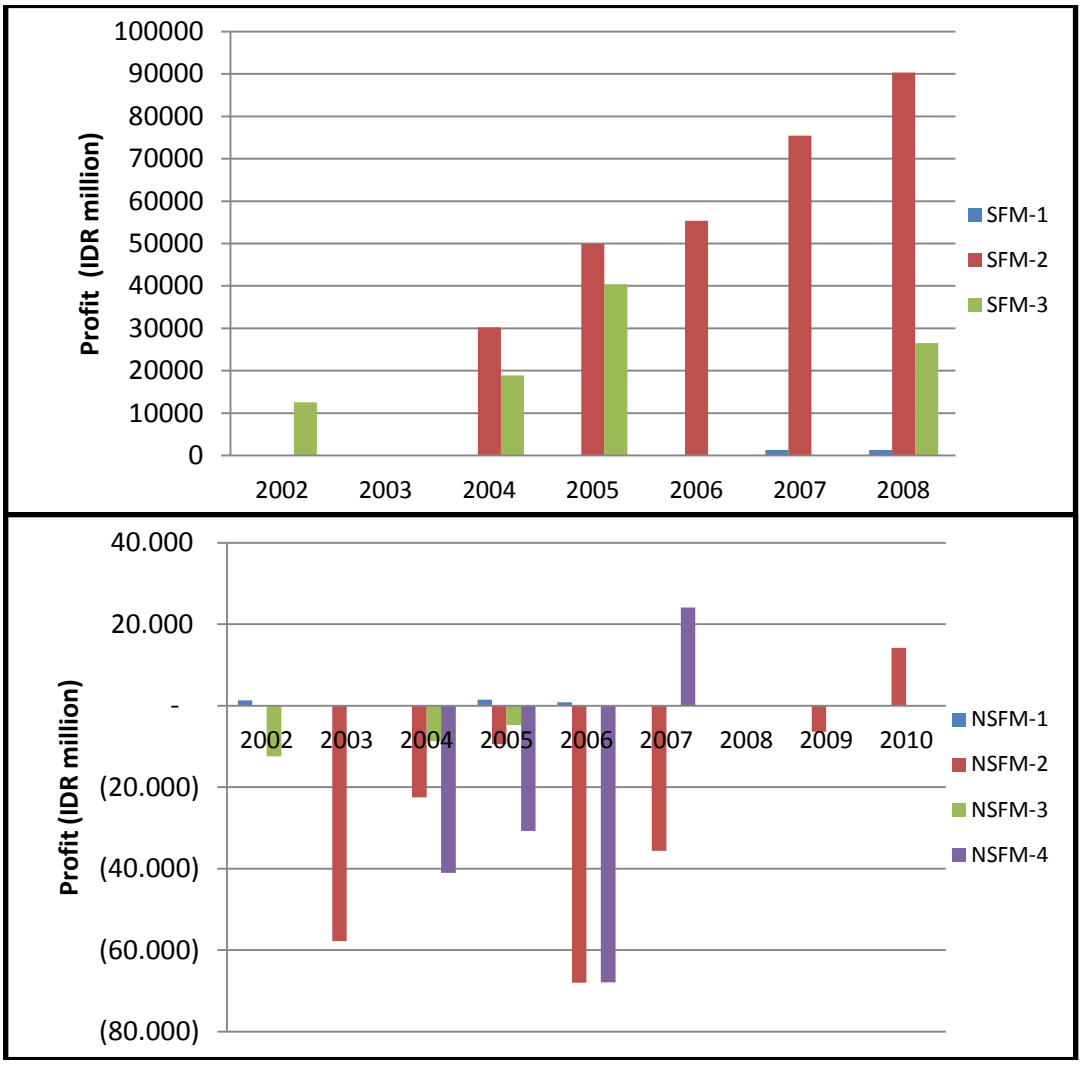


Figure 3. The tendency to obtain profit management unit of SFM (top) and Non-SFM (bottom)

Most of the management units have difficulty of working capital, this occurs at management unit of SFM and Non SFM (Figure 4). Information obtained from the ratio number has indicated that the management unit of SFM which incorporated in the group can be profits but if they consolidated all business units in the business group's the financial condition will becomes unhealthy (The current ratio is low). At group level, It showed a bad management, and can give some affect on the smooth operation of the forest management unit. This situation shows profit in the forest management unit is transferred to the group (especially for the wood processing industry units).

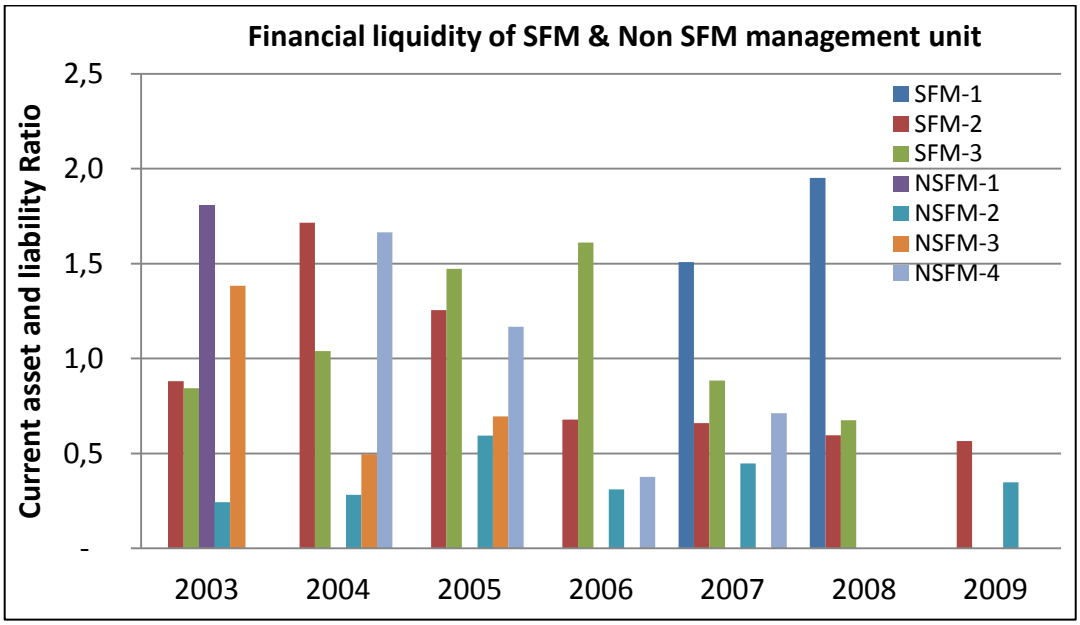


Figure 4. The performance of company's financial of SFM and Non SFM management units

4.3. The Ability of SFM in the Reduction of the Forest Carbon Emissions

Questions to be answered is whether the forest management unit SFM has the ability to maintain carbon stocks of stands forests more than Non SFM. The development indicator of sustainability in production is a forest stock, in addition to production stability indicator. Certified management unit SFM should be able to avoid the decline in forest stock due to other uses, such as clearing for agriculture (mainly shifting cultivation), plantations, settlement and preventing illegal logging. Meanwhile, the management unit Non SFM may occur due to degradation by various utilization, timber harvesting by excessive management unit, or use by others. This condition is evaluated using indicators of land cover changes, in the span of 10-20 years. Analysis of forest cover change is converted to measure changes in forest carbon stocks, shown in Figure 5.

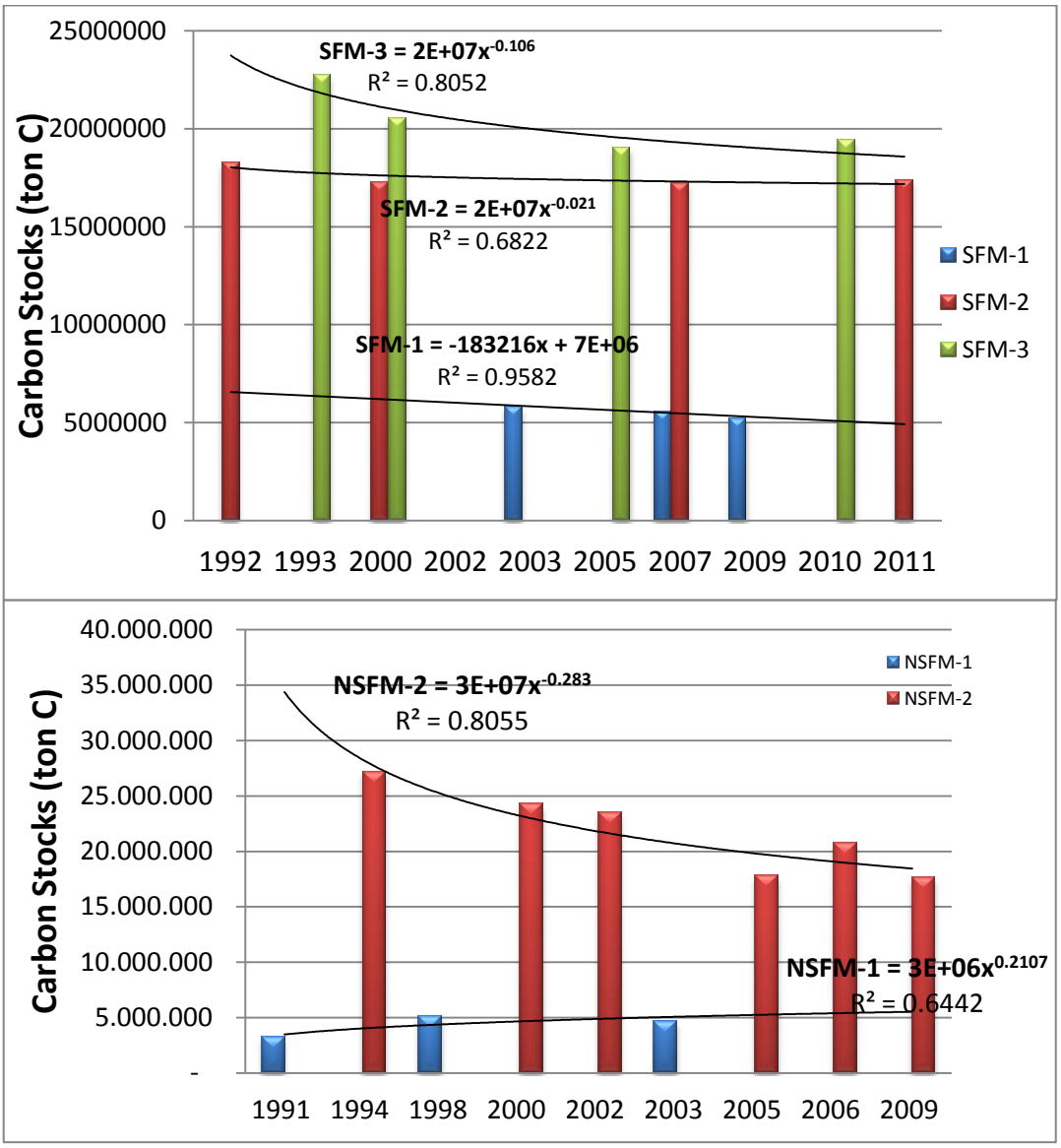


Figure 5 Trend of forest carbon stocks in SFM management unit (top) and Non SFM management unit (bottom)

Data interpretation of Land sat imagery used is the change in forest cover to shrubs, grasses and Non-forested areas. The results of the analysis in SFM-1 management unit, SFM-2 and SFM-3, at different times, showing a trend of change in forest cover is declining at a rate very low. In the combined average of the three management units sample rate of change of forest cover into a bush and non forest lands at 0.37%/yr during the period 1992-2011, and 2000-2011 period amounting to 0.17%/yr. On the forest management unit Non SFM there are only two examples of units that provided data on the results of Land sat imagery interpretation. In the example unit Non SFM-1 land cover data at intervals from 1991 to 2003 (land cover 1991, 1998 and 2003) showed fluctuating size forested area. When used data of 1998 and 2003 there was a trend decline of forested area. In the example

unit Non SFM shows the degradation of forests into scrub and non forest land the rate of degradation 2.35% / yr in the interval 1991-2011, and 2.61% / yr in 2000-2011 (Table 8)

Table 8. The average rate of forest degradation in the management units SFM and Non-SFM

Time period	The rate of degradation (%)		
	SFM	Non SFM	Difference SFM & Non SFM
1992-2011	0.37	2.35	1.98
2000-2011	0.17	2.61	2.44
The Benefit of SFM		1992-2011	2000-2011
The reduction of loss stand (m^3/ha-yr)		1.85	2.28
The reduction of emission forest carbon (tC/ha-yr)		2.16	2.66
The reduction of emission forest carbon (tCO_2/ha-yr)		7.93	9.76

Note: diameter of stand 50cm-up 93.5 m^3/ha; forest carbon from seedling to tree 109.16 tC/ha

The rate of degradation of SFM management units lower than Non-SFM management unit. Differences in rates of degradation at two different time intervals, namely 1992-2001 and 2000-2011 are amounting to 1.98% and 2.44%. Presumably the rate of degradation on Non SFM management unit increased because of the influence factors of decentralization and accessibility of the location Non SFM relatively high. Consequently, the use of forest areas for plantations, mining, encroachment and illegal logging is higher.

When examined more closely the rate of degradation in SFM management unit before and after the year 2000, there also showed a trend difference in the rate of degradation. Presumably this has something to do with SFM certification process that started around the 2000s. Management unit after obtaining certification SFM has the rate of degradation relatively lower than that prior to obtaining certification SFM. It also indicates that the SFM management unit repairs in the forest management practices, not only in the harvesting of forest products but also enhance forest protection activities of the various activity disturbances. In addition to forest protection activities, it seems that village development activities in the surrounding forest (social governance activity) also gave positive results. Some of the activities of social governance that is an improvement in the harvesting planning process that take into account the rights of society, improvement of communication and community participation in forest management.

Based on the analysis of land cover changes in the working area of Non SFM and SFM management unit can be concluded that sustainable forest management unit has the potential to reduce forest carbon emissions.

4. 4. Potential of Forest Carbon Supply

Natural forests in carbon supply on REDD+ mechanism regarding the potential reduction of carbon emissions in the forest management unit. Potential supply of natural forest carbon there are two sources, namely:

1) The potential supply of forest management change where "business as usual" is not sustainable (Non SFM) changed into sustainable forest management (SFM).
2) Potential supply by forest management units SFM and Non SFM make a specific policy about production cuts to reduce carbon emissions.

The potential supply of carbon point 1, i.e. changes Non SFM to the SFM, it can be shown by the results of the analysis of carbon emission reduction capabilities above. The rate of degradation in Non SFM unit used as reference levels, and emission reduction level as efforts by the SFM unit at a lower degradation rate than in Non SFM (Table 8). On the basis of the tendency of reduction of carbon from empirical facts, it can be estimated potential reduction of carbon emissions SFM in Indonesia. The number of management units that get good value 31 units and area size certification 4,499,995 ha (BUK, 2011), bringing the total reduction of emissions by 43.92Mt CO_2/year. The average size of SFM management unit for 145,161 ha, obtained by reduction of the average carbon emissions per unit of management 386,129 tC / yr (1,416,771 tCO_2/year).

Rusolono and Tiryana (2011) on the outputs and activities 3 (ITTO RED-PD 007/09 Rev.2(F), make the simulation scenario, the reduction of carbon emissions through SFM (Table 9). In the first scenario that the reference emission level of Non-SFM in deforestation rate 2.2% / yr, than the SFM can be reduced to zero deforestation rate (0%/yr), and production about 200,480 m^3/year is maintained in the long run. Retrieved potential benefit of reducing carbon emissions is 123.69 tCO_2/ha-year, the potential reduction in this scenario is greater than the results of the empirical data analysis. This is because the empirical data SFM and Non-SFM (analysis of land cover) does not take into account the logged natural forest regrowth, forest stand of rehabilitation result and harvesting damage avoided of implementation of reduced impact logging.

Table 9. The results of the simulation scenario, the reduction of carbon emissions through SFM (Rusolono and Tiryana, 2011)

Scenario	Cumulative ($MtCO_2$)	Average ($MtCO_2$/yr)	Average (tCO_2/ha/yr)
S1 (TPTI)	**443.82**	**14.79**	**123.69**
S2 (TPTJ)	300.52	10.02	83.75
S3 (TPTI+TPTJ)	371.33	12.38	103.48
S4 (TPTI+TPTJ+(Reducing AAC)	447.75	14.92	124.78

Note : The working area of management unit 119,607 ha.
Source : Rusolono dan Tiryana, 2011

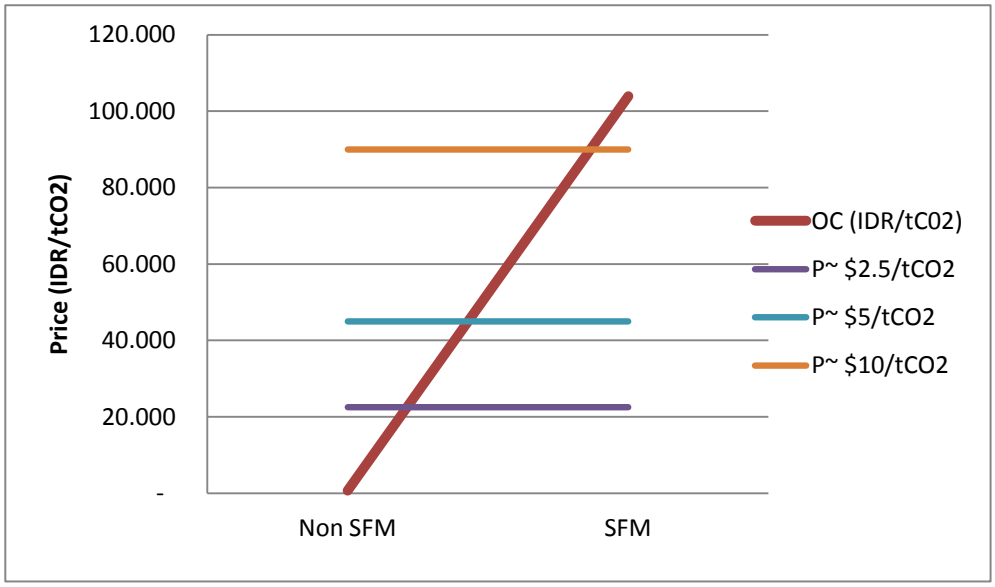
One important points that can be shown here, that the analysis of carbon emission reduction capability of the empirical data of forest cover change, the results are consistent with the scenario of reduction of carbon emissions through SFM by Rusolono and Tiryana in 2011. Based on the results of a calculation by the method of carbon accounting are done Rusolono and Tiryana (2011) the total potential supply of carbon is estimated to 556.6 $MtCO_2$/year SFM Indonesia. When viewed from the cost of production, the study results Darusman and Bahruni (2004) shows the cost of production of Non SFM and SFM management unit did not differ significantly. This means the unit of management to achieve sustainable forest management through improved management and technology does not require substantial additional costs. The study's results showed an increased cost ranging from IDR 26,000 to 44,000/m^3 or increase about 4-6.5% of the cost of production of Non-SFM.

It can be assumed that the degradation in unit Non SFM protection forest activities is ineffective so it results the encroachment, illegal logging, residual stand damage caused by conventional harvesting technique practice (it does not apply reduced impact logging technique), and it is not effective sylvicultural activities (rehabilitation and enrichment of stands). In this study, in general Non-SFM unit has a profit of IDR 1,161/m^3, less than the profit which is owned by a unit of SFM in the amount of IDR 170,274/ m^3. Thus, reduction of carbon emissions by SFM scenarios poses no opportunity costs, because SFM is achieved by improving forest management practices, which provide a higher level of efficiency than the unit Non-SFM. It is the fact SFM is able to control the rate of degradation and loss of potential benefit reductions and carbon standing stock. This means management unit SFM has advantages over Non-sustainable forest management unit of stand loss avoidance (profit) and the potential carbon emission reduction incentives.

In contrast to the potential supply of carbon point 1, point 2 on the potential supply of units of SFM and Non SFM make specific policy reduce emissions, that is the production rate reduction policy. Rusolono and Tiryana (2011) make the simulation scenario 4, that sustainable forest management unit lowers the production rate to 75% of the level of sustainable production in scenario 3 (originally 271,286 to 203,464 m^3/year). Retrieved increase in total reduction of

carbon emissions in scenario 4 than scenario 3, amounting to 21.3 tCO_2/ha-year (Table 9). This additional emission reduction as contribution of timber production decreased of 67,822 m^3/year. Reduction of emissions from declining timber production raises the opportunity cost.

Based on the analysis of revenue and cost per unit of management and Non SFM SFM obtained the average opportunity cost of Non SFM unit of IDR 2,600/tC (IDR 708/tCO_2), and SFM units for IDR 381,352/tC (IDR 103,910/tCO_2). Based on the opportunity cost of the two groups of forest management unit is constructed of natural forest carbon supply curves, shown in Figure 6.



Note : exchange rate US$ 1 = IDR 9,000

Figure 6. Estimates of forest carbon supply curves of SFM and Non SFM unit with altered levels of timber production

In general, potential supply of carbon to the production rate reduction policy scenarios, it is probably done by the management unit Non SFM, because the cost for the supply of carbon by Non SFM is smaller than in SFM management unit. Options that can be done by the management unit Non SFM is a moratorium on harvesting, which means the substitution of timber production by the production of carbon (carbon emission reduction). This can be done by the management unit Non SFM who obtained a very small profit or loss on timber business.

Financial feasibility of the supply of carbon through the policy of a moratorium or a reduction in timber production levels, the carbon price should include the opportunity costs, transaction cost and cost of forest protection. The cost of forest protection should be included because if the moratorium there is

necessary protection activities to ensure permanent protection is no activities that give rise to degradation by other parties such as encroachment or use of land for Non forest and illegal logging.

Evaluate the financial feasibility of SFM management unit for the supply of carbon through the policy of reduction in timber production levels, using the assumption of transaction costs 30% of carbon prices, the cost of protection of 1% opportunity cost. The financial eligibility is fulfilled when at least the condition of break-even point, the carbon price is US $ 61.14/tC (US $ 16.66/tCO_2).

If note deeper or more detailed, there is a diversity of forest conditions and efficiency in each management unit of the SFM and Non SFM. Not all of Non-SFM management unit has a small opportunity cost, fairly wide interval from loss of IDR 188,500 tC until gain a profit IDR 177,500/tC. The opportunity cost on management unit of SFM is not always lower than sustainable forest management units, such as the management unit Non SFM-1 opportunity cost is greater than SFM-1, it can be shown in Table 10. On the basis of variations in opportunity costs, then the chances of each management unit is different to choice of timber production or the production of environmental services "carbon credit".

Table 10. The variation opportunity cost of each management unit

No	Management unit	*Opportunity cost*	
		Rp/tC	Rp/tCO_2
1	Non SFM-2	(188,512)	(51,366)
2	Non SFM-3	18,749	5,109
3	SFM-1	84,181	22,938
4	Non SFM-1	177,564	48,383
5	SFM-3	294,734	80,309
6	SFM-2	765,142	208,485

Considerations in financial management units of Non SFM have opportunity to make reducing or a moratorium on timber production, are quite large. If this option is done, to be expected the management unit can recharge their forests potency for sustainable timber production arrangement (arrangement of timber) in the future. Besides the arrangement also increases the potential for sustainable production of stands are expected to provide higher profitability in the future, after the contract of carbon trading is finished.

Although the financial feasibility of the management unit is met, but there are other things that need serious attention, namely it causes the impact on macroeconomic (regional economic). At present the wood processing industry (sawmill and plywood) has wood raw material shortage. According the Directorate General of Forest Management Development (Bina Usaha Kehutanan), based on data on plan of raw materials fulfillment of primary industry in 2011, by 53 million

cubic meters, whereas timber from natural forests by 5 million cubic meters. If all management unit Non-SFM decide to take a moratorium on harvesting of, means the greater deficit of raw materials. The impact of the reduction (moratorium) of harvesting on the forest management unit it self, the sectors of wood processing industry, the effects are also on outside the forestry sector. Impacts on the management unit are:

a. Local workforce reduction is large enough, given the impact of continued loss of revenue, and will increase the number of poor people in the villages surrounding the forest
b. Possible areas of forest management units will be open access, people who lose their income, will be increasingly dependent on forests or seek alternative sources of income from forest products.

The economic impact on the sectors of wood processing industry is the reduction of labor and reduction of household labor income, which also can increase the number of poor people. Economic impact on the forestry sector,and outside the forestry sector through the mechanism of backward and forward linkages with other sectors. Thus the implications of timber production decrease caused by substitution of carbon credits need to be considered in a comprehensive manner, including economic and social impacts.

Based on economic and social implications of the decision carbon supply by way of reduction of timber production or a moratorium, it is important to take a policy encourage the achievement of SFM, and the anticipated impact of the reduction policy of timber production from natural forests (Non SFM). The government can create policies that allow the management unit to apply the multiple-use management. It is hoped the existing workforce at the management unit can be diverted to the production activities of non-timber forest products, or the development of verity of sylvicultural system. Multi activity of silvicultural system allows for forest development by planting activities with the many options to increase productivity or potential forest. Another important thing is the policies that could encourage efficiency (replacement of timber processing technology and improve management in the industrial sector), as well as increased production outside the forestry sector, to create employment.

4. 5. SFM Benefits and Economic Incentive Framework

SFM has been described above can reduce carbon emissions, and avoid the potential loss of standing timber in the forest, due to excessive timber harvesting activities or by activities other parties that lead to forest degradation.

SFM benefit analysis using by data on carbon stocks in logged-over forest, that is on dry land forest of 109 tC/ha (Kusuma 2007, Junaedi 2007, Aryono 2010, Wayana 2011) and carbon of stands in the peat swamp forest at 65 tC/ha (10cm diameter stand-up). The data potency of natural forest in the dry land forest of sample management unit that is a commercial stand-up 50cm diameter by 93.47 m^3/ha, the conversion factor stands to be logs of 0.56 (multiplication of exploitations factor 0.7 and safety factor 0.8). Conversion standing stock into biomass is 0.95 (IPCC, 2006) and the conversion of biomass into carbon 0.47 (IPCC, 2006), conversion of carbon to carbon dioxide amounting to 3.67 (Brown 1997). Profit of SFM unit on average of IDR 170,274/m^3 and Government Income Outside Taxation or non tax revenue (PNBP), it consist of Reforestation Fund and Forest Resource Provision of IDR 206,339 /m^3.

Based on the results of the analysis of the ability of SFM to reduce carbon emissions in the Table 8 is obtained the benefits of SFM consisting of benefits in private and public sectors. Benefits for the private sector are a) The value of carbon emission reduction potential, b) Prevention of loss of profit long-term timber production, benefits to the public sector consists of a) Prevention of loss of State revenue from dues Reforestation Fund (DR); b) Prevention of loss of Non-timber benefits forest products, c) Prevention of loss of benefits hydrological function, d) Prevention of loss of the benefits of option value and existence value of biodiversity. The benefits of SFM on private sector in the period 2000-2011 amounting to IDR 337,000/ha-yr, the benefits to the public sector during the same period amounting to IDR 299,000/ha-yr; and the total benefits to the two sectors is IDR 631,000/ha-yr (Table 11).

Until 2011, the unit of management in natural forest management SFM certification as many as 31 units (4,499,995 ha), so that the total benefits of SFM in Indonesia at the present moment of IDR 2.84 trillion/yr. Management units that have not obtained certification of SFM by 74 units (7,467,699 ha), and assumed the management units are not SFM. Coupled with the certification of sustainable forest management unit at lower categories are also assumed not to SFM, and then total the Non-SFM forest area is 10,775,488 ha (109 units of forest management). Forest management practices of Non-SFM cause loss the total social benefits (total social cost) is IDR 6.80 trillion / yr, due to unsustainable forest management has made the depletion of resources and reduction of ecological functions of forests.

Table 11. Estimated benefits of SFM for the private and public sectors

Benefit of SFM	1992-2011	2000-2011
The reduction of timber stand loss (m^3/ha-yr)	1.85	2.28
The reduction of emission forest carbon (tC/ha-yr)	2.16	2.66
Value of forest carbon emission reduction (IDR/ha-yr)	97,069	119,800
Prevention of profit loss (IDR/ha-yr)	176,127	217,372
Prevention of non-tax revenue loss (IDR/ha-yr)	213,431	263,413
Prevention of NTFPs loss (IDR/ha-yr) #)	24,031	29,659
Prevention of hydrologi function loss (IDR/ha-yr) #)	515	636
Prevention loss of option value & existence value of biodiversity (IDR/ha-yr) #)	127	157
Total benetif of SFM (IDR/ha-yr)	511,301	631,038

#) source: analyzed from Bahruni, 2008

Loss government revenue of non-tax (DR and PSDH) due to unsustainable forest management (Non-SFM) is accounted for 66% of non-tax government revenue in 2011. In fact, losses Non-SFM as a social cost greater than non-tax government revenues from forestry business (Table 12). This shows the importance of encouraging SFM in Indonesia, so that revenues can be increased and the welfare of society as a whole also increased.

Table 12. Losses on non-taxes of government revenue in forestry sector and social cost of unsustainable forest management

Remark	Government Revenues from Non-Tax, 2011 (IDR)	
	Until half year #)	Estimation in a year
Reforestation fund	1,428,044,092,850	2,856,088,185,700
Forest resource provision	648,945,061,635	**1,297,890,123,270**
Total non-tax revenues	2,076,989,154,485	**4,153,978,308,970**
Estimation loss of Non-SFM		
Loss of non-tax revenues		**2,838,403,621,000**
Total social cost of Non-SFM		**6,799,742,396,544**

#) source: Data release Direktorat Jenderal Bina Usaha Kehutanan Triwulan II Tahun 2011

Sustainable forest management attention is the balance of three aspects of production functions, ecological and social. To achieve sustainability of ecological functions of each unit of management to do the layout, where the areas that have significant value in terms of ecological allocated for conservation. It also needed to

make the identification and management of high conservation value forests (HCVF). One of the important roles of management units SFM is their working area as habitat for wildlife, such as conservation the Sumatran tiger. Providing habitat for Sumatran Tiger is a real need, because the condition of the natural forest is largely degraded. The role of conservation area in area of management unit as outlined in Box 2 Tiger.

Analytical framework of economic incentives based on 1) direct incentives based on the potential benefits of carbon emission reduction obtained when achieving SFM without opportunity costs, as well as the opportunity cost, 2) indirect incentives, that is something that eliminate or minimize the constraints of technical and non technical facing the forest management unit, which is expected to boost efforts towards sustainable forest management. These indirect incentives come through policy by the Ministry of Forestry and other external parties that related to the management unit.

Indirect incentives to be enabling conditions for forest management unit towards SFM, the analysis are done through a review of the factors constraint management unit to reach SFM certification. Review based on information on the outcome document of the Working Group Policy Ministry of Forestry, Document Report of ITTO PD 389/05 Rev. (2), and the results of discussions with the board of directors and managers of the forest management unit. Based on available information, the analysis focused on factors important obstacles facing towards SFM management unit includes:

1) Aspects of production: the certainty of land use, boundary areas, rehabilitation of an open or non-forest areas.
2) Aspects of conservation (ecology): management and monitoring of environmental impacts, HCVF, monitoring and evaluation of impacts on the environment
3) Social aspects: tenure, community dependence on forest resources

BOX 2

SENEPIS AS THE CONSERVATION AREA OF SUMATERAN TIGER (Panthera tigris)
(The Real Evidence of Sustainable Forest Management Based on Conservation in Sumatra)

Forests are megabiodiversity of flora and fauna that has a unique and beauty. Flora and fauna are avaliable in abundant, but there is also an endemic, rare, endangered and extinct. According to the International Union for the Conservation of Nature and Natural Resources (IUCN), currently in Indonesia there are several species of flora and fauna that has categorized as Critically Endangered. That is mean it has critical condition and needed to preserve so as not to become extinct. Those species is the Sumatran tiger (Panthera tigris), the Javan rhino (Rhinoceros sondaicus), kantung Semar (Nepenthe sp), keruing (Dipterocarpus grandiflorus), Tengkawang (Shorea palembanica) etc.

Permit the utilization of forest products in natural forests may disrupt presence of these species. Now a day, forest management is not entirely committed to conservation efforts. The claims of various stakeholders within and outside the country about the importance of preservation of some species, had raised challenges for entrepreneurs, they want to achieve production targets but on the other hand they have to make efforts in conservation.

The Management Unit of Sustainable Forest Management (SFM) can provide benefits for biodiversity conservation, through the allocation of conservation areas and program of HCVF (High Conservation Value Forest).

The real evidence of Sustainable Forest Management based on Conservation Management is the conservation of Sumatran tigers in the Senepis River area in Riau Province, which has located in SFM unit. Senepis determined by the Minister of Forestry as the Sumatran tiger conservation through the Minister of Forestry Decree No.S.05/Menhut-VII/2006 on January 3, 2006. The role of SFM management unit in this case is very important, because according to the reports from PKHS (Sumatran Tiger Conservation Centre), currently estimated to tiger who had inhabited in the forests Senepis is 15-19 individuals. Thus, SFM unit in the region can deliver benefit tiger conservation. SFM has a dual role of running the SFM and conservation. For this function, SFM unit should have the incentives and support from stakeholders.

Certainty of land use is one of the prerequisites for achieving SFM, because forest management has a long-time dimension. Long-term production planning requires certainty of land uses such as forests. Some of the working area of Non-SFM and SFM management units face situation there is a permit the use of land for plantations and mines. But forestry regulation gives legally permission that 10% of working area of management unit can be used for the mining business. In addition, spatial planning at province has not agreed upon by stakeholders, arising as a

result different uses of forest areas. On the one hand, according to the interests of local government perspective and investors outside the forestry sector, expect the forest areas for business development of non-forest such as mining, plantation etc. The other side the Ministry of Forestry and forest management units have invested in that area allocate the area for the forestry business. These conditions become great problems for management unit to achieve sustainable forest management

According forestry agreement between Forestry Ministry and concession holder, management unit has obligation to rehabilitate non-forest areas in his working area. From point of view permit holder this activity is generally not a priority. Because this activity is not clear to the management unit goals, just build a forest, consequently there is no incentive in the context of production goals of growing the forest. It's good if investment interests should be integrated with the interests of ecological restoration in the rehabilitation of non-forest areas.

Another thing that also requires certainty is the right of forest management as a concession by the Ministry of Forestry to the management unit is guaranteed free from claims of customary rights. Conflict tenure and forest use impact low re-investment for increasing the forest asset. These conflicts also disrupt the operation of the company, and raises the cost of conflict resolution is high enough. In the context of resolution of this conflict, recognition of indigenous rights by the management unit which consequently fulfill the demands of compensation for the harvested timber in the area. The Conflicts obviously disrupt the achievement of SFM (the situation described in Box 3). Resume of constraint condition in production aspects and their impact are presented in Table 13.

Table 13. Resume constraint conditions on the production aspects and impacts

Conditions	Impacts
Certainty & area boundaries: Spatial, overlap on utilization permit or conversion of forest, boundaries is only administrative manner, and functions as an affirmation of the right of a weak	• Bureaucracy cost & high cost economic • Concerned with short-term profit, low re-investment in forest resource • The production process is interrupted, and forest degradation
Rehabilitation of open area: Not to be an increase in forest assets for production purposes	• Disincentives to re-investment of forest resources
Certainty of tenure: use conflicts, the demands of fee land and timber forest products	• Disincentives for forest protection • High costs for conflict resolution • High cost (double fee / tax to the reforestation fund, forest resource provision, land and building tax) • Disrupted production process • Potential reduction of stands (forest degradation)
People's dependence on land & forest products: conflict of interest (agricultural, garden, forest products)	

BOX 3.
FOREST AREAS CONFLICT

Conflict of forest area is one of the important things that deserve attention, in the effort to achieve sustainable management. Given the existence of this conflict will affect the planning and implementation of production. Assessment of forest management certification must show the performance management unit that meet appropriate standards of the indicators used in social criteria, ecology and production. In the certification, among others, there are indicators of certain forest areas, the settlement of conflicts over ownership rights claims or land uses by other parties as well as indigenous peoples. In general, the fundamental problems of forest conflicts are caused by differences in forest ownership perspective and overlapping forest utilization.

1. Differences of Land Ownership Viewpoint

The existence of different interpretations of the concept of land ownership is held by indigenous peoples and the government. The de jure on the natural resources contained in the Earth Indonesia (including forest) controlled by the state (Article 33 of the Constitution 45), but de facto it is not recognized by society, because people use the customary legal basis in forest ownership. In fact, the allocation of forest areas for concessions, the government low pay attention the existence of indigenous peoples, so that the concessions rights have no guarantee of the forest is free from claims of indigenous peoples. Granting concessions like this obviously leaves a heavy burden for the company. Because, people assume that the land belongs to those who have been determined by the norm and customary rights. People always demand what become their entitled, among other in the form of rent, and fees of harvested trees, timber fee payments to indigenous communities ranged between IDR 50,000-150,000/m3.

2. Overlapping Forest Utilization

In a forest area very often happened overlap the utilization of natural resources for various purposes such as agriculture, forestry, mining, settlement or transmigration and so on. This resulted in the loss of forest area managed by the forest company. The implications of this condition will interfere with the setting of sustainable production. Main problems of overlapping forest use is not yet agreed upon and ratified spatial province or district, of differences in the interests of communities and local governments on the one hand by the central government (ministries of forestry) on the other hand, the weak coordination of licensing the use of forest areas. Multi-stakeholder participation in forest management is less than the maximum, related to understanding the diversity of functions of forests are very minimum and they tend to have a rigidity of interpretation of interests. It is also indicated by the interests of local governments tend to support the utilization of forest areas for other purposes. Economic interests outside the forestry sector received support from various parties, the forest became marginalized.

Ecological aspects of the condition are often considered only as a complement, rather than something that is important (as opposed to the principles of SFM which requires the preservation of ecological functions). This is because there is no clear relationship between the environmental impact analysis and real timber production activities in the field. Management units implement only meets administrative purposes, without the clarity of the implementation of activities in the field, and consequences to low environment impact of logging activities.

Monitoring and evaluation of environmental impacts is often not worked by management unit, and also received less attention by the supervisor of government (local and central government). Supervision is more dominant on the activities of timber production, beginning from logging planning through to the logs transported to the industry. Supervision or guidance by central and local forestry agencies are not coordinated and supervision patterns do not encourage SFM. Oversight activities do not solve real problems in the field faced by the management unit for the operation of good forest management practices.

The issues of economic cost are still high enough to dominate the forest management activities in the field. Technical and administrative rules which obliged, but obeyed by the management unit, becomes the object of supervision and open space a high economic cost. Through the disobedience of an obligation by this management unit, there are opportunities negotiation between them to get forgiveness and payments.

These costs are often associated with the approval the production planning, monitoring mechanisms on the activities of production and and logs delivery to industries site. Supervision on ecological and social aspects received less attention, almost no feedback of surveillance results to solve management problems in field, including no steps forward to resolve land conflicts with the community. Forest management system that puts the entire management unit, as the operator of technical guidance and rules set by the government does not make an impact management unit to develop organizational capacity and system management. At present, company's financial health is quite low, due to shortage of working capital, so the activities related to ecological and social aspects are often not become a priority, then SFM is inhibited. Resume of ecological aspects, institutional and management is presented in Table 14.

Table 14. Resume of ecological conditions, institutional, management and its impacts

Conditions	Impacts
EIA (Environmental Impact Assessment), HCVF: Implementation in field is weak, also ineffective monitoring and evaluation (because it's the object of supervision not considered important)	• The loss of biodiversity value, negative environmental impacts • Supervision does not encourage sustainable forest management (weak commitment, low capacity human resource, administrative compliance only)
licensing: Permits for utilization (base map of working area, approval of long term management plan and annual management plan, heavy equipment procurement plan, logpond and corridors construction, etc.	• Bureaucracy inefficiency/ time consuming • High cost economy
Supervision / Coaching: High frequency, not integrated, judging pattern, great team, lack of competency of human resources, costs charged to UM	• High-cost economy • Supervision patterns do not encourage SFM
Logs delivery : Too many stakeholder who check the transportation document, differences in perceptions about the legality of logs	• Transportation of logs and industrial raw materials are hampered • High-cost economy
Commitment owners & management to SFM is weak: Competence and career development of human resource (HR) less developed, Accuracy of data & information low to support SFM	• Management system is not developed • Productivity is less • Motive on the production in short-run to get maximum profit • Re-investment low on forest resources
Taxes & fees: Heavy taxes, dues DR in dollars, levies, levies unofficial	• High-cost economy • Influenced by the global economy (exchange rate)
Financial health: Financial loss, low liquidity	• Disrupted operations • Priorities on timber production while other aspects of SFM neglected

Direct incentives for sustainable forest management unit sales of carbon in REDD + mechanism. Government to facilitate the transaction with the buyer, and each management unit perform calculations of carbon emission reductions that exist in each working area. Revenue from the sale of carbon largely distributed to the unit management, to strengthening the practice of SFM. If the potential revenue from the reduction of carbon emissions could not be realized, the government can take an indirect incentive options. This is done through incentives policy about regulatory changes that significantly affect on: a) Motivates an improved forest management practices, re-investment in forest assets for long-term production, b) Reduction of management costs, cut the high economic costs, and expedite or streamline production operations as well as transporting timber to the market (industry), c) Improve the capacity and management systems, and optimizing the benefits of forest ecosystems with multiple-use management. Several kinds of

incentives that identified necessary for sustainable forest management are presented in Table 15.

Non-SFM management unit subject to non-tax rates of the Reforestation Fund and Forest Resource Provision higher than SFM management unit. Non-tax rate for SFM unit is in accordance with the economic rent of stands, so that the benefits of SFM on timber production from economic view of point are not reduced. The imposition of higher tariffs on non-sustainable forest management units need to be phased strategy, because the management unit experiencing financial difficulties can have the opposite effect on or business is shut down that provide the continuing impact on macro level. Provision of 2-5 years of preparation time given to the Non-SFM, and imposed a higher tariff, until the sustainable forest management achieved by the unit.

Non-SFM management unit can decide to elect substitution of timber production with carbon credit by a moratorium on timber harvesting. But not all unit of Non-SFM take this option, only the Non-SFM is experiencing financial difficulties are severe enough, such as liquidity is very less and lasts long enough, so the stunted forest management operations. The new management unit obtain utilization of timber concessions, shall be accompanied by the commitment of investors and management, to practice sustainable forest management within the certain time table. Gradual licensing policy to be considered, with the consideration that for a long enough period of time, e.g. 5-8 years, as the economic life of most of the infrastructure investment in forest management, is a measure of time to achieve SFM.

Table 15. Resume incentive type and its impact to SFM

Incentives	Impacts
Carbon benefits of direct incentives and operating profit of timber attached to the achievement of SFM	• Strengthening the performance of SFM
Incentive there is no levy on carbon value as government revenues outside taxation (PNPB) as compensation on environmental value by the SFM unit	• Strengthening the public benefits of SFM (IDR 631,000 / ha-yr)
Carbon price incentive to compensate the opportunity cost due to reduced logging or logging moratorium, for non-sustainable forest management unit that losses in timber production	• Encourage recovery of stands, as a basis towards SFM
Incentive differences in non tax rates (reforestation fund and forest resource provision) between SFM and Non-SFM	• Push to improve the performance of Non SFM to SFM
Certainty of spatial district and provincial	• Support to company operation • The cost savings • Eliminate double levies or re-distribution benefit between the government and indigenous or local peoples
Resolve overlapping claims land rights or forest areas between states and indigenous peoples among other by completion government regulation on community forest,decline or eliminate forestry levies on claims of traditional forest	

Granting of forest management rights to SFM unit that includes a variety of forest products (goods & environment services) in an integrated manner, without due process permits and business license fees vary according to the commodity replaced by multiple-use management	• Optimizing the benefits & efficiency of forest ecosystem management
To the SFM unit is granted the rights authority & control annual operating by his self (from the planning until monitoring & evaluation, administration and reporting, including the infrastructure required)	• Support to company operation • The cost savings • Encourage professionalism of forest management
For SFM management unit there confirmation the recognition from the forestry office on logs has a legal document according to production system and logs administration to be communicated and recognized by other stakeholders (including the police)	• Smooth the process of selling or procurement of raw materials • Trimming the high economic costs (cost savings)

Achievement of sustainable forest management is influenced by various factors, both internal and external factors at management unit (MU). Economic incentives are just one factor to encourage the establishment of sustainable forest management. Need attention that economic incentives can not work alone as a single factor for realizing timber production sustainable. Therefore, in addition to the economic incentive instruments need a comprehensive integrated approach, particularly the incentives associated with the enabling condition to influence the decisions of management units and the parties concerned to achieve the SFM.

V. CONCLUSION AND RECOMMENDATION

5. 1. Conclusion

1) Sustainable forest management units can reduce carbon emissions from forests, and has the potential to obtain a direct incentive value of carbon (REDD +) while maintaining a level of long-term sustainable production.
2) Sustainable forest management provide benefits to the private and public sector, it's necessary supported by all parties, especially the central government, local government, and the police, so that SFM provides long-term benefits for investors, government and society.
3) Unsustainable forest management which includes the present moment concessions large enough to cause economic loss to the government and society (social cost) is higher than non-tax revenues in the forestry sector.
4) Constraints achieving SFM, there is internal to the unit management and external factors, so that the necessary incentives. Direct economic incentive instruments need to be combined with incentives related to the enabling conditions that can encourage the achievement of SFM.

5. 2. Recommendation

1) Ministry of Forestry needs to make changes to the rules that give rise to obstacles, or not encourage professionalism on forest management by the management unit, as has been identified in various studies and also reviewed largely on this study. Forest management policies more geared to provide the right and the authority that responsible to the management unit, to develop organizational capacity and management to achieve SFM.
2) Ministry of Forestry to maximize the use of SFM certification as a means of SFM performance evaluation, and provision of incentives or disincentives that need to be given to the SFM and Non-SFM units. To the management unit Non-SFM need concrete steps and a clear timetable for achieving SFM.
3) Ministry of Forestry with SFM management unit needs to perform calculations of carbon (carbon accounting) of each unit in the province level in more detail, as the basis for the supply of carbon to be traded.

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APPENDIX

Annex 1. Data on realization of production management units SFM and Non SFM

Tahun	SFM-1	SFM-2	SFM-3	Non SFM-1	Non SFM-2
1985	Na	Na	136,520	33,358	109,892
1986	2,673	Na	109,361	47,593	198,546
1987	19,525	Na	118,864	47,830	271,559
1988	38,495	56,682	136,874	54,631	243,151
1989	46,416	152,569	181,356	49,983	256,709
1990	39,423	193,730	198,820	49,503	210,794
1991	42,555	198,548	210,823	40,601	166,534
1992	47,155	207,008	228,897	47,111	201,799
1993	40,037	204,637	239,400	38,457	200,103
1994	49,335	222,436	244,414	28,770	172,116
1995	70,109	263,547	226,276	50,411	150,726
1996	69,043	275,819	248,358	54,505	149,823
1997	79,388	271,913	242,454	64,073	150,586
1998	55,353	343,600	319,148	51,502	140,423
1999	72,274	293,585	349,812	54,927	89,159
2000	46,961	219,277	260,568	25,236	79,871
2001	74,478	137,007	275,884	19,168	66,127
2002	41,635	147,544	313,132	20,305	38,332
2003	46,664	129,836	275,073	39,361	52,861
2004	54,474	164,828	274,198	20,463	14,544
2005	65,251	185,572	268,968	20,364	50,063
2006	39,614	228,268	270,369	20,867	na
2007	37,562	278,852	275,649	25,016	79,997
2008	33,247	222,264	180,218	22,791	na
2009	42,741	275,630	179,796	24,310	na
2010	51,086	273,448	147,740	17,841	92,215

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Bahruni

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