# Application of Sustainable Forest Model (SFM) in Community Forest Management (CFM) for stable timber harvesting and usage in natural forests

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## 1. Timber harvesting in natural forests for household consumption and commercial purposes of CFM

Stable timber structure management in natural forests plays an important role in both ecological and economical aspects. Timber trees actually have a decisive role of interaction between ecological elements and basic functions of forests. Therefore, stable timber structure management is a core issue in sustainable forest management. Economically, timbers are valuable for community of both usage and commerce in the past, at present and in the future; therefore, stable timber supply is an indispensable economical element in sustainable forest management. For these reasons, technical solutions are required to meet both ecological and economic aspects in forest management; simultaneously, technical solutions must be simple so that local people can apply in forest resource assessment, making forest management plan and implementation in close collaboration with the local forest services.

Natural forests allocated to communities are usually young, poor and degraded forests, just few medium forests. The Decree No. 40/QD-BNN of MARD dated July 07$^{th}$ 2005 on procedures regulation of timber harvesting and other forest products requires that forests must reach a medium volume with big diameters to be able to be harvested. By applying this Decree, forests currently managed by communities cannot be harvested. This explains the fact that the Decision No. 178/2001/QD-TTg of Government dated November 12$^{th}$ 2001 on benefit sharing and responsibility applied for allocated forests is not valid in reality.

However, local people who rely on forests always have demand for timber; poor and degraded forests are required to be improved so that forests can provide higher timber production volume. An optimal solution to the local people's requirements is to make forest management plans with harvesting activities, based on the application of the Sustainable Forest Model. By doing so, participation will increase which is a pre-condition to gain local people's ownership over forest resources and reduce work load of gvt. forest services.

## 2. Sustainable Forest Model – A tool to determine the stable harvesting amount in natural forests under CFM

Silviculturally, the relation between *the numbers of trees and diameter classes (N/D)* has been examined and studied for different forest types in Vietnam by many national and international forestry experts. Those experts proposed the illustrated mathematic models and elaborated

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"standard and ideal" models for sustainable forest management. This technical approach is a good basis for application in reality, especially in CFM due to its simplicity as "only counting number of trees as diameter classes" and then compare with the sustainable N/D structure of the model to propose silviculture activities, such as thinning, harvesting, forest enrichment and promotion of natural regeneration. More importantly, the model must be designed in a simple and applicable manner to allow villagers to manage their community forest on their own.

*Characteristics of Sustainable Forest Model:*

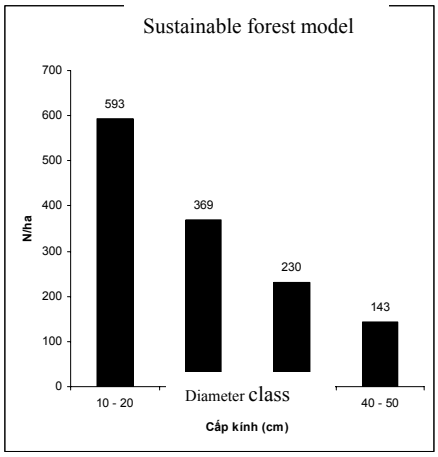


Illustration 1: Form of a sustainable forest model

- Based on the structure N/D (between number of trees and diameter classes) with its negative exponential curve to ensure the sustainable structure of timber trees (illustration 1).
- Appropriate diameter class width that trees in lower diameter classes can move to next upper diameter classes in a 5 year management plan: the increment of timber trees in natural forest usually varies from 3 to 5 cm in a 5 year time period; therefore, the elaboration of sustainable forest model must consider this figure to determine the diameter class width. However, to make the model simpler for easy application by community, diameter classes should be combined to reduce number of diameter classes of the model. Sustainable forest model should only have 3 to 5 diameter classes with the diameter class width of 10 cm.

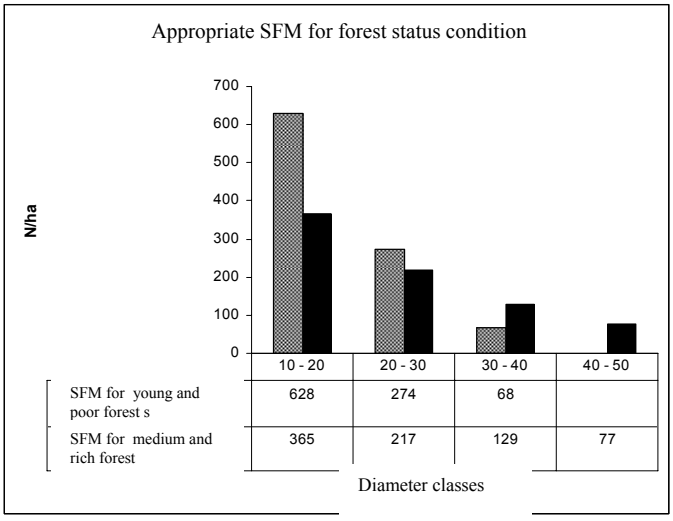


Illustration 2: Appropriate SFM for each forest condition

- Appropriate and stable (but not the ideal or optimal) structure of forest for each ecological condition, each forest type because of the low volume of natural forests after many years of over harvesting. By the use of sustainable forest model, forests are gradually improved with higher production volume to ensure biodiversity, protection functions and simultaneously provide timbers to meet the needs of community. Therefore, SFM is required for each forest condition to manage forest and determine appropriate harvesting amount (illustration 2).
- Serve as the technical reference towards harvesting timber in a sustainable manner in different forest conditions: SFM serves as a tool to regulate current forest conditions and determine the amount of timbers for harvesting. It is not a form of "standard, ideal, model"; however, through improvement and maintenance, forests will gradually reach better conditions. Thinning, pruning and improvement of forests to adjust their structures towards the sustainable one. At the same time timber and fuelwood can be obtained to

meet the needs of community.

If the "standard" model with higher production volume is used, the current forest conditions will not be influenced. Structures of current forest conditions are not suitable to the "standard" model; they need to be adjusted towards one model, called sustainable. Therefore, sustainable forest model is understood as "standard congruent model" to approach the current forest conditions and to serve as the reference to determine the harvesting amount to improve the forest structure (illustration 3). Illustration 4 shows the potential harvesting amount that can be obtained from young and poor forest by application of sustainable forest model. Timber trees in certain diameter classes of current forest blocks that are bigger than these figures in SFM are allowed to be harvested and used in a 5 year time period.

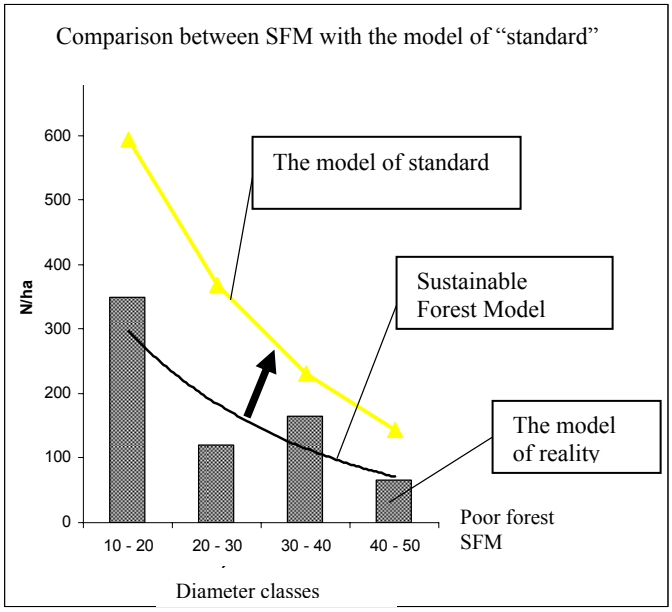



Illustration 3: Comparison between SFM with the model of "standard"

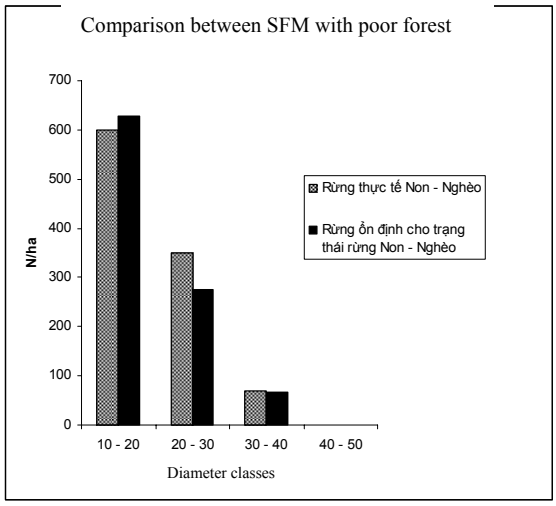
The Sustainable Forest Model is used to decide the numbers of trees to be kept in different diameter classes, so number of trees determined for harvesting will be identified in 5 years. In reality, trees in some diameter classes might be redundant, but other diameter classes may lack trees. Therefore, in principle, the density of trees in forests is maintained by minus and plus among diameter classes.

**Table sample from reality measurement and comparing with SFM**

| Diameter classes (cm) | N Block | N SFM | Redundant (+) Lack trees (-) | Number of trees for harvesting after balance | Remark |
|---|---|---|---|---|---|
| 10 - 20 | 27,158 | 24,024 | 3,134 | 1,030 | Kept more 2104 trees for diameter 20 – 30 cm lacking trees |
| 20 - 30 | 8,808 | 10,912 | -2,104 | - | |
| 30 - 40 | 4,771 | 4,928 | -157 | - | |
| 40 - 50 | 5,505 | 3,502 | 2,003 | 1,846 | Kept more 157 trees for diameter 30 – 40 cm lacking trees. |
| **Tổng** | **46,242** | **43,366** | **2,876** | **2,876** | |

*(Source: Yong Dong Block, Area = 88ha, Dak Rtih Commune, Dak Rlap District, Dak Nong Province. CFM 5 year plan, ETSP)*

The component of species in forests must also be considered as to which species need to be kept and which species can be harvested to make sure that forest component is stable. Forest improvement, forest inventory or selection and marking of trees for harvesting should be conducted with the participation of local people under the supervision and collaboration of local forest service staff. The discussion with local people to carry out these activities based on the proposed criteria together with local knowledge will ensure the protection of extinct species, species components as state regulations, and those with high economic value to be foreseen in a future harvest.




Illustrate 4: Comparison between poor forest with sustainable forest model

Therefore, a simple silviculture guideline is needed to guide the harvesting practice of timber trees identified by the use of sustainable forest model, including: list of species to be maintained, list of species allowed for harvesting, criteria for selection of trees for harvesting to ensure forest quality, canopy maintenance, protection functions. This all needs a close collaboration between the local forest service and the village people "owning" the community forest resources.

## 3. Methodology for the elaboration of a Sustainable Forest Model

Sustainable forest model needs to be elaborated for each ecological condition, each forest type (evergreen forest, semi-deciduous leaved forest, forest of dipterocarps, timber and bamboo forest...) and forest conditions (young, poor, medium, rich), followed by the main steps illustrated in the illustration 5.

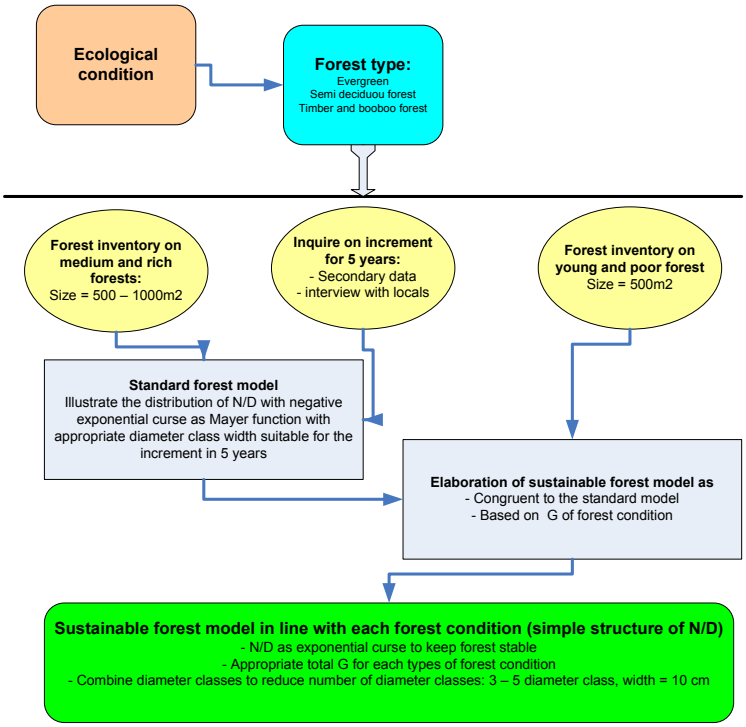



Illustration 5: Steps for elaboration of sustainable forest model

In each ecological condition, to each forest type:

***i) Forest inventory:***

Sample forest inventory is carried out in forest conditions, including:

- Forest inventory conducted in forest conditions (rich, medium). Size of sample plots varies from 500 – 1000m$^2$, about 20 sample plots.
- Forest inventory conducted in different forest conditions: young, poor. Size of sample plots is 500m$^2$, about 5 sample plots for each forest condition

- Inquire of increment in 5 year time: cutting bark method can be used or use secondary data and make interview with local people.

***ii) Elaboration of sustainable forest model in accordance with forest condition:***

- Establish the "standard" model: based on the data (number of trees and diameter classes - N/D) from sample plots on rich forests with diameter class width appropriately to the increment of forest in 5 years, illustrate the standard structure by the Mayer function.
- Establish the sustainable forest model in accordance with forest condition: based on the total basal area (G) of forest condition, elaborate the congruent standard model of N/D. This is actually a sustainable forest model for each forest condition. However, there might be so many diameter classes due to the small diameter class width (3 – 5 cm). This will create complexity and cost lot of time for both forest inventory and data analysis.
- Establish sustainable forest model in accordance with forest condition with fewer diameter classes as making it simpler: Similarly to the steps of elaboration of sustainable forest model addressed previously, then combine diameter classes to make diameter class width wider (10 cm), with a fewer diameter classes, about 3 to 5 classes; at the same time basal area (G) of forest conditions needs to be adjusted. This is the sustainable forest model to be used in CFM.

***iii) Country wide application, rough cost calculation***

Two options for the elaboration of sustainable forest models proposed, as follow: i) nationally manage to elaborate different sustainable forest models for different ecological conditions and forest types and then put those models in the CFM guideline for the usage of the whole country ii) compile the guideline of how to establish SFM and then provide it to provinces that their forestry offices will build models by themselves for their own locality in close collaboration with provincial FIPI or other research/university institutions. An interesting side effect of this task is the following: The task setting is in line with the Support Programme 5 of the National Forest Strategy to improve the linkages between Research-Education-Training-Extension (RETE).

If elaboration of sustainable forest models shall become valid for the whole country, the tentative number of models will be:

- Number of sample plots to be conducted of inventory: 7 ecological regions x 2 main forest types x 3 forest status conditions x 10 sample plots = 420 sample plots
- Number of sustainable forest models: 7 ecological regions x 2 main forest types x 3 forest status conditions = 42 models
- Some specific forest models, such as mixed wood – bamboo, bamboo forests, etc.., makes a total of **appr. 50 SFM models to be elaborated nation wide.**

This workload can be done by a working group of 8 members in 3 to 4 months. Present experience by ETSP come up to appr. 1000 USD per SFM. If done in more numbers, the costs can be reduced considerably. So for a total of 50 models costs of USD 40'000.- would occur. A detailed project proposal and cost calculation could be established to help MARD/FD to apply for financial support through TFF.

## 4. Application of sustainable forest models to make harvesting plan in CFM

### *i) Periodically conduct participatory forest inventory (every 5 year time) – Estimate number of trees in accordance with diameter classes of each forest block:*

In every 5 year time, conduct participatory forest inventory; the forest inventory method must be simple, low expense oriented one and especially villagers can apply. The sample inventory method with small size of sample plot (10x30m) is used; the proportion of sample plots is about 1% of total area of forest block. Only species and diameter classes are identified by color tapes. Locals then can estimate number of trees in accordance with diameter classes.

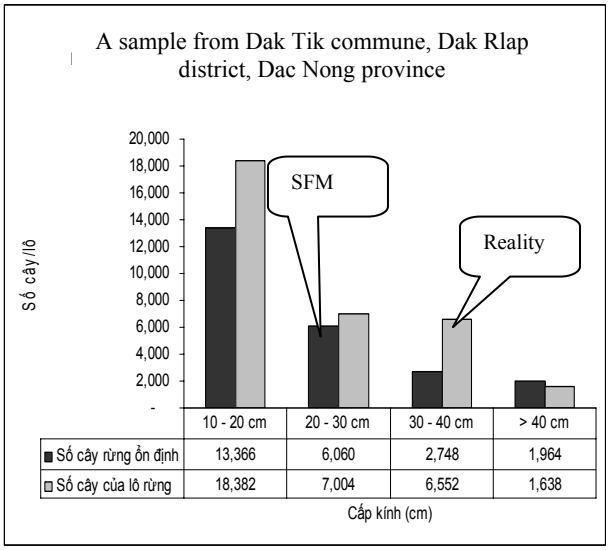



Illustration 6: compare number of trees of forest block with those of SFM to determine the stable harvesting amount

### *ii) Estimate the timber supply by forest blocks:*

Compare the structure of N/D with this figure of sustainable forest model to estimate the timber and fuelwood supply in 5 years. Based on this comparison, community will discuss silviculture techniques that should be applied for the forest block. Trees in diameter classes that are redundant compared with the requirement by sustainable forest model can be harvested for domestic consumption or for sale; forest blocks that lack trees in diameter classes should be improved by silviculture techniques such as maintenance, protection and additional planting by forest enrichment.

### *iii) Making 5 year forest management plan and annual plan, including:*

*A*ssessment of timber demand of community in 5 year time, balance this demand with the timber supply from forest blocks, propose silviculture activities such as thinning, harvesting, forest enrichment, promotion of natural regeneration, integration of NTFP, fire prevention, forest protection.. The 5 year forest management plan is made for each forest block, including: silviculture activities, quantity, place, time, responsibilities. Based on the 5 year forest management plan, annual plan is made.

### *iv) Implementation of CFM plan, monitoring and evaluation:*

Implementation of CFM plan and monitoring need to be guided by a simple silviculture guideline. It is necessary to aware that there is much difference between conventional silviculture techniques and those applied in CFM. Silviculture techniques applied in CFM are favorable for small harvesting amount with frequent harvests to meet the demand for domestic consumption (partly for sale). Therefore, harvesting in CFM can be called as “harvesting with low impact”.

***v)*** Steps i) to iv) require ToT capacity inputs in every province under the leadership of Forest Sub-departments and Extension Centers. Local forest staff needs to be trained in this easy-to-apply method to be able to advise and monitor future village owned community forests. For that provincial forest service needs to take ToT leadership. Experience made by ETSP and RDDL show ways how to set up these training cells. With this, the provincial and

district forest services have the capacity to train, advise and monitor/control the village owned community forests, being in line with the government's rules and regulations.

## 5. Conclusion

The use of sustainable forest model to determine stable timber harvesting amount in CFM is suitable to the capacity of local people and other concerned stakeholders:

***i. To community and locals (especially ethnic minority groups):***

- This approach helps villagers in making forest management plan, in implementation of the plans actively; and particularly villagers can receive benefits and simultaneously maintain forest sustainably. If the current harvesting procedures must be followed, remote communities cannot harvest any timber and fuelwood because of a long harvesting cycle, high harvesting investments, being beyond the capacity of a village community. Consequently, timber demand and short term incomes of villagers will probably not be met.
- The comparison between N/D structures of current forest blocks and those figures of SFM in 5 year time actually simplify the assessment of forest growth in order to define the benefit sharing mechanism. Villagers only need to measure and count number of trees by using color tapes; and number of diameter classes can be from 3 to 5 only. These requirements are actually very easy for villager to carry out. Every 5 year, conduct forest inventory and then compare the figures with those of the sustainable forest model. Number of trees in different diameter classes that is bigger than in SFM is actually the growth of forest, villagers can harvest and benefit of those trees.

***ii. To state forest agencies***

This approach creates a favorable condition for forestry staff to monitor changes of forest resources after allocation to community together with villagers; use the sustainable forest model with 3 to 5 diameter classes to monitor. A good forest block means its trees in different diameter classes are not lower than those in SFM; to young, poor or degraded forests, the sustainable forest model will help in proposing silviculture techniques to improve the forests toward the sustainable forest structure. In addition, the State can archive the forest protection purposes for a better environment and society. To do so, forest staff at lower levels (commune) needs to be trained intensively and supervised by district/provincial forest authorities. Thus CFM with SFM as core element will create new job opportunities for forest personnel (shift from police function only to advisory service providers with monitoring/controlling functions).

## 6. Recommendations

In order to implement the stable timber harvesting and create an appropriate benefit sharing mechanism in CFM, the following is to be recommended to MARD/FD:

- Apply SFM in the 40 commune CFM pilot.
- Approve the use of sustainable forest model as a simple technical solution in CFM. SFM must be elaborated by professional forestry agencies such as: universities, institutes and be approved by designated authority for wide application.
- Issue the benefit sharing policy for CFM based on the increase of number of trees in diameter classes as comparing with those figures of sustainable forest model.
- Compile simple silviculture guidelines and provide trainings to communities, so villagers can conduct the annual forest management plans under the supervision of local forest authorities.

- Train forestry staff, extensionists on techniques, method and participatory approach in making CFM plans and support for implementation.

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