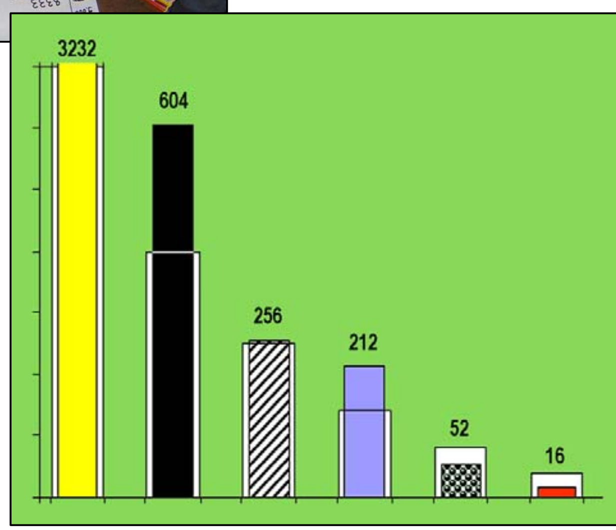
Rural Development Dak Lak - RDDL

Sustainable Forest Model

Concept and Development



Technical Guideline

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Sustainable Forest Model

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1. INTRODUCTION

Timber harvesting is the most important silvicultural measure to be applied in forest management and has to be based on clear and practicable benchmarks which can easily be assessed, monitored and enforced by local forest users and the administration.

Traditionally, stocking tables have been developed as outcome of permanent growth and yield sample plots (PSP) after decades of repeated measurements. However, the use of such stocking tables for harvest planning is restricted to monocultures and few defined mixed forest stands and are of only limited use for the management of mixed uneven-aged natural forests.

Moreover, scientific approaches for yield prediction require decades of research and are likely to produce results which are too difficult to be interpreted by local forest users and local administration alike.

In community forestry, simple but reliable indicators for sustainable utilisation levels are needed which can a) satisfy the varied demand of the local forest user in terms of forest products and at the same time b) ensure sustainability of the forest resource.

In conventional forestry, the volume in m³ of solid timber is used as unit for planning, implementation and controlling. Harvest levels are defined in volume per hectare or as percentage of the total standing volume.

In view of simplicity and practicability of participatory approaches in CFM no volume figures are calculated, instead the number of trees per diameter class is used as only unit for all planning procedures, implementation and controlling.

Stem number per diameter is a very transparent and accountable unit which can be easily measured by local people and field staff and allows a very precise description of planned silvicultural interventions which cannot be achieved by use of general volume figures only.

Harvest amounts are quantified by comparing actual stem numbers as obtained during a forest inventory with stem numbers defined as representing the structure of a well-developed, productive forest under sustainable management, the so-called sustainable forest model (SFM).

A SFM provides an effective monitoring tool within the capacities of both local field staff and local communities which helps to improve transparency, accountability and improving villagers confidence in dealing with government agencies e.g. for timber harvesting application. Without clear benchmarks an approval for harvesting operations will be very difficult to achieve for local communities and will leave them vulnerable for indirect taxes.

2. DESCRIPTION OF SUSTAINABLE FOREST MODEL CONCEPT

Mixed natural forest stands can be best described by the distribution of the stem numbers within defined diameter classes. Many natural forests with a continuous series of age classes and continuous recruitment by natural regeneration illustrate a diameter distribution in which each diameter-class has fewer stems than the adjoining, smaller diameter-class. This can be visualized in form of a falling curve with a negative exponential model.

A higher number in the smaller diameter classes ensures that once a tree has been extracted it can be replaced by many smaller trees to ensure the sustainability of the forest stand.

Diameter distributions differ between various forest kinds with different production potential and consequently specific SFMs for each forest type need to be developed.

Main variables of a stem-number diameter distribution include the number and width of diameter classes and the stem number per diameter class and if defined as representing the structure of a well-developed, productive forest under sustainable management, is called a sustainable forest model (SFM).

The SFM approach has to be understood as a static model comparing the currently existing forest status against the model status. No prediction of increment and yield is intended nor required as only the current available surplus is to be harvested in a period of five-years. After a five-year period the new forest status has to be assessed and will be compared against the SFM to derive with new harvest quotas.

However, in case reliable data about growth and yield can be made available the widths of a respective diameter class can be adjusted to present the time for a tree to growth into a next higher diameter class in a period of five years, the so-called time of passage of a tree (Alder and Synnot 1992). In this sense, the model could also be used to explain the growth potential of a forest stand in the coming five or ten years to local forest users.

The SFM is used as a benchmark against which the current forest structure in a respective site is compared during village forest management plan development. Imbalances between the SFM and the current forest status are determining sustainable harvest amounts.

A surplus of trees compared to the SFM in a specific diameter class defines options for harvesting, insufficient stem number defines areas for strict protection.

Any timber extraction is therefore aiming at improving the current forest structure towards the desired SFM structure in an iterative process of repeated thinning cycles. All silvicultural interventions will consequently lead to an improved stand structure after utilization instead of a degradation of forest resources as often seen under large concession management.

SFMs furthermore provide an effective monitoring tool for supportive agencies in form of quantitative off-take levels to be compared against the real implementation.

In the context of community forestry, forest management aims at satisfying the diverse demand of the local forest users for timber throughout all diameter classes, as well as providing a constant flow of forest products. Therefore, conventional forest management systems (e.g. minimum harvestable diameter, long cutting cycles at high single harvest intensity) are in contrast to existing use patterns and needs of forest-depended communities and are therefore not representing socially and economically acceptable solutions.

3. DEVELOPMENT OF SUSTAINABLE FOREST MODELS

SFMs have to be developed separately for the dominant forest types in each ecological region to precisely reflect the specific production potentials.

Required basic data has to be obtained through technical sound forest inventories by measurement of temporary sample plots and through consultation of local forest users regarding their demand for specific forest products.

If available, the measurement of a series of forest succession stages can be conducted to gain a general insight into the forest growth potential of the specific forest, which can be reflected in the diameter class width.

The development of SFMs has to be conducted by qualified technicians from Forestry Research Institutes with sufficient knowledge about the local forest conditions in the specific agro-ecological region.

Sustainable Forest Models require approval by the Department of Agriculture and Rural Development before they can be applied in the context of CF management.

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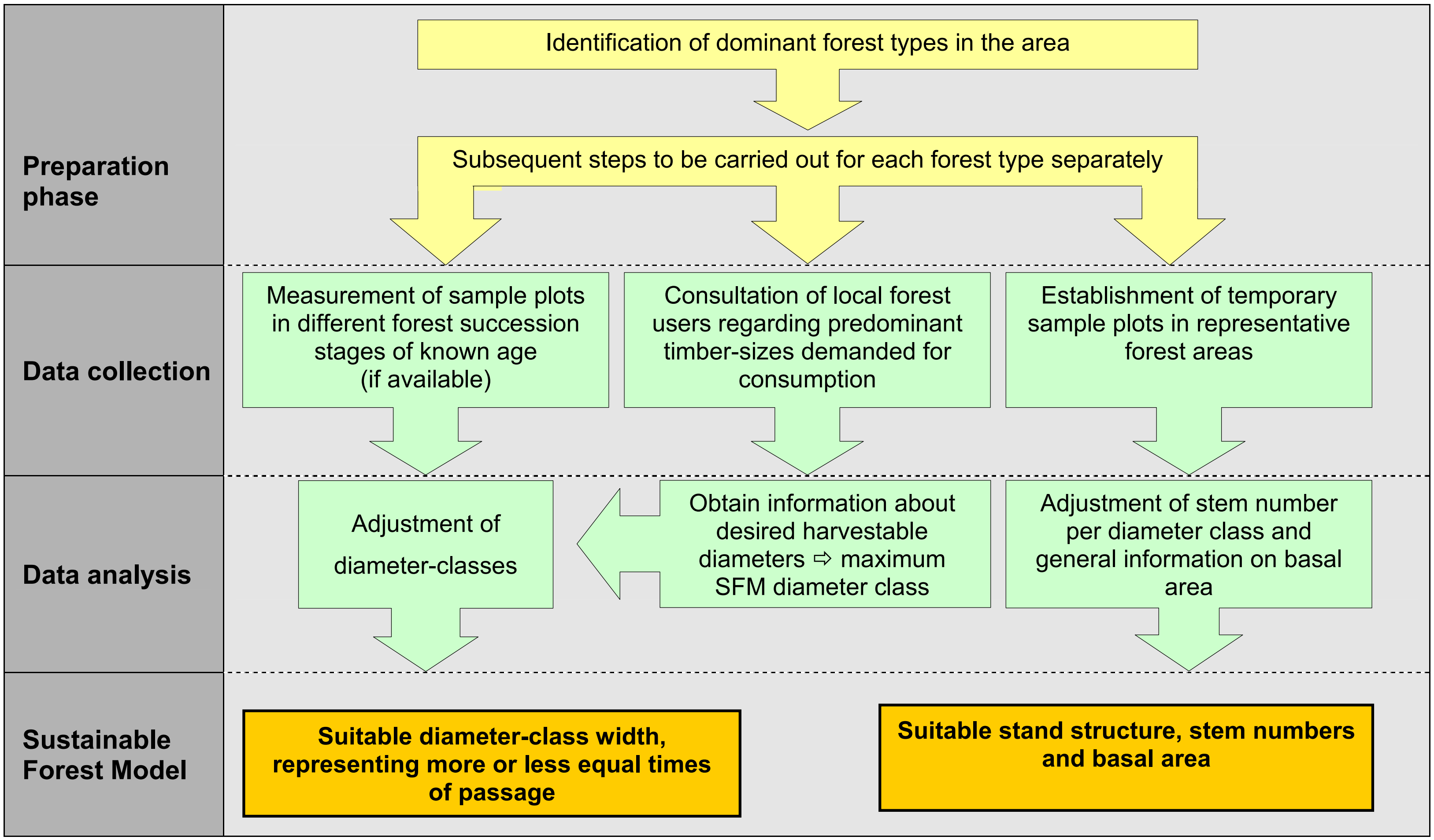
Figure 1: Sequence of tasks required for the elaboration of Sustainable Forest Models (SFMs)



Source: Philipp Roth (2004) amended

4. DESCRIPTION OF TASKS

a) Identification of dominant forest types

Prior to the field implementation a stratification of main dominant forest types regarding different forest growth potential, accompanied forest structure and production potential has to be completed.

The aim is to define forest types which significantly differ in terms of the above mentioned criteria and consequently have to be described in a separate Sustainable Forest Model.

In the context of Dak Lak province two dominant forest types have been identified and separate SFMs developed for i) Dry-Dipterocarp forests and ii) Evergreen forests.

b) Forest Inventory

Data collection is carried out in form of a conventional forest inventory with the establishment of temporary sample plots and measurement of tree species with diameter at breast height. No height measurement is required as no volume figures are to be calculated.

Diameters have to be obtained in full centimeter classes only, measured at the diameter at breast height (dbh).

Temporary sample plots should be established in rectangular form including slope correction measurements in hilly terrain.

The location of the sample plots are selected on purpose (not randomly) following the expertise of the technician in order to present a well-developed forest status of the respective forest type.

In highly heterogeneous natural forests, this often necessitates subjective sampling which also helps to avoid excessive variation of measured plot parameters. In subjective sampling designs the sample locations are chosen deliberately by the designer for their ability to represent the whole without distortion (Philip 1994).

As far as the SFM is concerned, sample plots have to be located in areas where the present forest condition satisfies the postulation stated above. Thus, rivers, roads, clearings for shifting cultivation or special edaphic forest formations not representative of the forest type should not be located within the sample plots (Gimaretcarpentier et al. 1998).

Selection of different forest areas for sample plot establishment, comprising various degrees of exploitation as well as disparate spatial surrounding environments (for example one forest remnant might be adjacent to old growth forest, while another one might be isolated by agricultural fields) can result in large deviations of recorded parameters among the plots. That is why expert knowledge and profound experience are crucial prerequisites for the elaboration of SFMs through application of temporary plots (Roth 2004)

As the number and layout of the sample plots is not intended as a kind of forest inventory, no statistical parameters such as sampling error or standard deviation for plots are calculated.

Review of existing secondary data from previous inventories can be used to complete the own data collection.

Sample plots can further be established in different succession stages of the same forest type to establish a time line in case the specific age of different succession stages is known by the local population (abandoned shifting cultivation area, last forest fire etc.).

This can yield valuable information on the growth potential of the forest and can be used for an adjustment of the diameter class widths of the model. Pretentious time series can be of special importance where data from long-term observations is not available.

However, as mentioned before growth and yield data are no compulsory input variables for the static SFM model concept.

c) Interviews with local forest users

The SFM is designed to best reflect the demand of the local population in terms of demand for forest products. In terms of timber the most important variable is the desired harvest diameter based on the information of the local forest users.

The demand preferences by local forest users furthermore determine the management goal for the respective stands. If predominantly large sized trees are needed for construction timber, the management goal and therefore the SFM certainly needs to be different from a model representative of a forest where predominantly medium and small sized trees are demanded for a mixture of timber, poles and firewood. Branney and Wode (2003) provide further reference about the silvicultural system and its connection to the SFM.

Consequently, interviews with local forest users are not an option but a necessity regarding the demand-base approach of the entire SFM concept.

A SFM should therefore be calibrated by using the desired harvest diameter as orientation for the maximum diameter class. In case the current forest resources are even providing a sufficient amount of tree above the desired diameter class the SFM diameter classes have to be expanded to properly reflect this.

It is important to realise that despite the fact that the upper diameter-class limit is subject to the demand of the forest user group, villagers are at no point urged to cut trees if reaching the respective minimum harvestable diameter. Instead, freedom over the decision to harvest trees at the desired point in time is maintained, as long as the limits postulated by the SFM are obeyed.

Forest users can furthermore provide valuable information on the history and age of the local forest resources which can be used to derive at estimates for the prediction of the growth and yield potential of a specific forest stand which can be reflected in the width of the diameter classes.

d) Data analysis

Data analysis include the development of stem number diameter distributions derived from the field data and available secondary data. Results are presented in form of histograms per diameter class on a hectare basis.

Calculation of the basal area[1] can be further conducted to get an impression of the density of the forest stand which can be compared with available scientific publications from in- and outside the region.

The diameter distribution is developed for all trees regardless tree species or ecological or economical value.

[1] The cross-sectional area of all trees in a forest unit, usually measured as diameter at breast height (dbh) and expressed in m² per hectare. Commonly used as a measure of tree density in a forest stand.

e) Sustainable Forest Model elaboration

The elaboration of the SFM mainly includes:

- the definition of the highest diameter class,
- the adjustment of the number of diameter classes,
- the diameter class widths and,
- the stem number per diameter class.

As mentioned earlier the highest diameter class should follow the local demand in terms of desired harvest diameter and the maximum available diameters as obtained in the forest surveys.

In general a maximum limit of 40-50 cm is considered sufficient even if solitaire tree individuals might reach by far higher dimensions.

The number of diameter classes needs to be balanced in order to ensure its practicability as a decision-making tool of local forest users (maximum number of diameter classes) and to be precise enough to guide technically sound forest management (minimum number of diameter classes). Following the experiences from various field testing a range of 6 – 7 diameter classes has proven most effective and should be maintained.

In case no reliable data on forest growth and yield could be made available, diameter classes should be equally distributed over the entire range of diameter classes.
Wherever growth data is available diameter classes can be defined as to present an equal time of passage for a five year period for a tree to grow into the next higher diameter class on a statistical average.
A minimum width of diameter classes of 5cm should be ensured throughout all SFMs.

In the next step exponential trendlines are added to the stem number-diameter distributions as obtained from the sample plot data in order to derive at final stem numbers in the various diameter-classes for the SFM.

The basal area of the SFM and the real stem number-diameter distribution should be in the same range to ensure that the SFM will be within the real production potential of the respective forest stand.

5. PROPOSED STANDARDS FOR NATION-WIDE APPLICATION

Proposed standards for the elaboration of a national concept for development of SFMs for seven agro-ecological zones in Vietnam are listed below:

- Development of SFMs for entire Vietnam should be limited to one professional team of silvicultural experts only, to ensure a consistent standard and approach followed.
- SFMs are to be developed separately for each of the seven agro-ecological zones.
- The SFMs are to be developed based on the forest status, a) Rich, b) Medium and c) Poor. The three categories can be further separated into two forest types each (e.g. forests dominated by light-demanding tree species or forests dominated by shade-tolerant tree species) to represent forest types of the region showing very distinct trends of stem number diameter distributions.
- This definition will lead to a maximum of six SFMs per agro-ecological zone.
- The total number of SFMs to be developed for entire Vietnam is defined by 42 SFMs (7 agro-ecological zones * 3 forest status * 2 forest types)

The diameter widths should be standardised to ensure that only one standard diameter tape will be applied in entire Vietnam and is proposed as shown below:

Diameter class [cm]	8-15	15-20	20-25	25-30	30-35	35-45	> 45
Class width [cm]	7	5	5	5	5	10	>
Number of classes	1	2	3	4	5	6	7

The selection of the correct (rich, medium, poor) SFM for data analysis during real implementation can be determined following the procedure as described below:

- Real forest data as obtained during the participatory forest resource assessment is analysed and presented in form of histograms.
- Only the stem numbers of the three highest diameter classes are considered.
- The stem numbers for each of the three diameter classes are then compared against the respective numbers given in the SFMs (Rich, Medium, Poor of the respective region and forest type).
- Total differences for all three diameter classes are recorded for each of the three SFMs.
- The SFM showing the smallest difference to the real forest structure is to be selected for the forest management plan development.

REFERENCES

ALDER, D. AND SYNNOTT, T.J. 1992. Permanent Sample Plot Techniques for Mixed Tropical Forest. Tropical Forestry Papers No. 25. Oxford Forestry Institute, Department of Plant Science, University of Oxford.

BRANNEY, P. AND WODE, B. 2003. Silviculture Guidelines for Community Forest Management in the Song Da Watershed. 1st Draft. Son La, Vietnam. [online] http:// http://www.mekonginfo.org/ partners/SFDP/index.htm

GIMARETCARPENTIER, C.; PELISSIER, R.; PASCAL, J.P. AND HOULLIER, F. 1998: Sampling strategies for the assessment of tree species diversity. Journal of Vegetation Science, 9 (2): pp. 161-172.

PHILIP, M.S. 1994. Measuring Trees and Forests. Second Edition. Wallingford, Oxon, UK: CAB International, 1994. 310 p.

ROTH, P. 2004. Participatory Forest Resource Assessment in the context of Community Forest Management in Vietnam. Master thesis, Faculty of Forest Science and Forest Ecology Georg-August University of Göttingen

ANNEX 1: SUSTAINABLE FOREST MODEL FOR DRY-DIPTEROCARP FOREST

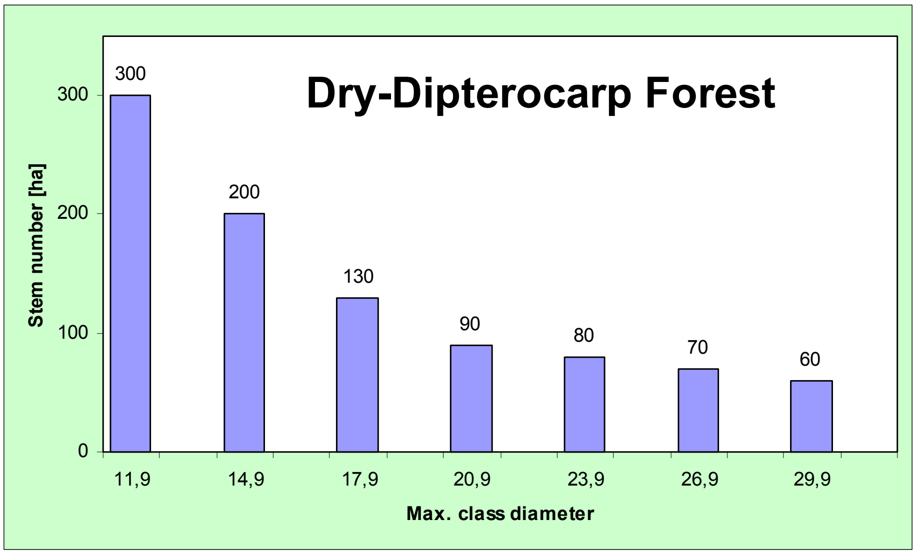


Figure 1: Sustainable Forest Model for Dry-Dipterocarp forest in Dak Lak province

Table 2: Stem numbers and basal areas– dry-dipterocarp forests

D-class	8-11.9	12-14.9	15-17,9	18-20,9	21-23,9	24-26,9	>29,9
N trees / ha	300	200	130	90	80	70	60

ANNEX 2: SUSTAINABLE FOREST MODEL FOR SEMI-DECIDUOUS FOREST

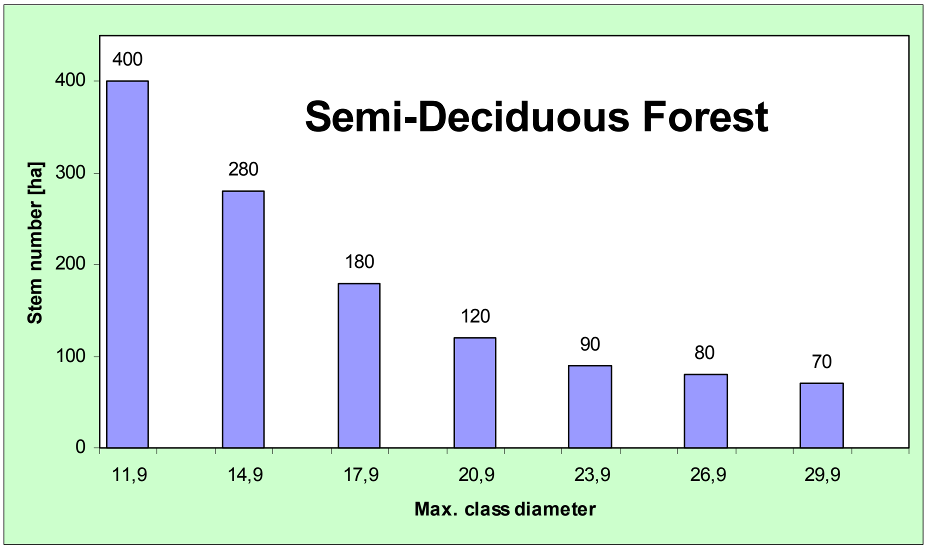


Figure 2: Sustainable Forest Model for Semi-Decidious forest in Dak Lak province

Table 3: Stem numbers and basal areas - evergreen forest stands

D-class	8-11.9	12-14.9	15-17,9	18-20,9	21-23,9	24-26,9	>29,9
N trees / ha	400	280	180	120	90	80	70

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