Silviculture
Guidelines

for Community Forest Management in the Song Da watershed

How to use these guidelines ........................................... 1
Modified coppice-with standards ................................... 4
Single tree selection ................................................. 12
Small group selection .............................................. 12
Glossary .................................................................. 16

first draft, 20.05.2003  Son La
How to use these guidelines

1. Find out from the villagers what their preferred forest product assortment is (What mixture of forest products do they prefer?). Use the forest management goals exercise to do this if possible.
   • Do they prefer to get mostly timber with few poles?
   • Do they prefer to get some timber trees and more medium and small poles?
   • Do they prefer to get fewer timber trees but greater amounts of small and medium poles?
   Remember that the actual quantities of products they can get immediately depends on the condition of the forest at the moment, but in the future, different silvicultural systems will give different mixtures.

2. Use the chart to decide what the forest type is (from the 3 types shown)
   • Is the forest dominated by Schima-Fagaceae and their associated tree species?
   • Is the forest dominated by bamboo?
   • Is the forest of any other type?

3. Work out from the chart what the most suitable silvicultural system is based on Questions 1 and 2

4. Compare the data you have collected from the forest during resource assessment with the “ideal” data shown in the histograms for each silvicultural system. Remember that these histograms show tree numbers per ha, so you will have to convert your own field data by dividing the number of trees in the block by the block area (in hectares)

5. If you find that the number of trees in any size-class from your field data is higher than the “ideal” number shown in the histograms, then there is a possibility to utilise some of the trees in that size class.

6. If you find that the number of trees in any size-class from your field data is less than the “ideal” number shown in the histograms, then there is a problem with that size-class and some improvement or protection activities may be needed and utilisation of that size-class would not be possible.

7. Each size-class in the histogram represents a period of about 5 years growth. This means that all the trees in one size-class will move up to the next bigger size-class after 5 years and are replaced by trees from the size-class below.
8. Depending on whether you can do utilisation or improvement, a number of possible activities are listed (It is assumed that protection activities are already being covered under forest protection regulation). Use this list in your discussions with villagers and based on your observations inside the forest to decide which of these activities to include in the CF management plan.

9. Some examples of how to interpret histograms are shown at the end of this document.

10. The glossary gives a more detailed descriptions of how to carry out the main management activities so that you can discuss these with villagers and if necessary include more details in the CF management plan.
Figure 1 Decision chart for identifying the best silvicultural system

<table>
<thead>
<tr>
<th>What assortment of forest products is preferred by the villagers?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large-sized trees mainly for timber</td>
</tr>
<tr>
<td>Bamboo-dominated or forest with scattered weedy patches</td>
</tr>
<tr>
<td>Medium and smaller sized trees for a mixture of timber, poles and fuelwood</td>
</tr>
<tr>
<td>Schima-Fagaceae dominated forest</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What type of forest is it?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other forest</td>
</tr>
<tr>
<td>Small group selection</td>
</tr>
<tr>
<td>Other forest</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>The best silvicultural option is...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single tree selection</td>
</tr>
<tr>
<td>Small group selection</td>
</tr>
<tr>
<td>Modified coppice with standards</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What mixture of forest products can we expect to get?</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOSTLY TIMBER</td>
</tr>
<tr>
<td>SOME MEDIUM POLES</td>
</tr>
<tr>
<td>SOME TIMBER</td>
</tr>
<tr>
<td>SOME MEDIUM AND SMALL POLES</td>
</tr>
<tr>
<td>LESS TIMBER</td>
</tr>
<tr>
<td>MOSTLY MEDIUM AND SMALL POLES</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select timber-sized trees for utilisation every 5 years</td>
</tr>
<tr>
<td>About 100 timber-trees per ha (10m spacing)</td>
</tr>
<tr>
<td>Smaller trees always identified to replace the trees harvested</td>
</tr>
<tr>
<td>Rotation for timber is about 30 years</td>
</tr>
<tr>
<td>Harvest all sizes of trees in small groups</td>
</tr>
<tr>
<td>Groups are 10 x 10m (0.01 ha) around existing gaps. Select about 10 groups per ha every 5 years</td>
</tr>
<tr>
<td>Improvement operations in groups for ensuring regeneration e.g. cleaning, weeding, bamboo control</td>
</tr>
<tr>
<td>Keep standards for timber at about 50 timber-trees per ha</td>
</tr>
<tr>
<td>3 x 10-year coppice cycles within a 30 year timber rotation</td>
</tr>
<tr>
<td>After 10 years reduce to 200 stems per ha. After 20 years reduce to 50 stems per ha</td>
</tr>
</tbody>
</table>
1. Modified coppice-with standards

Description
This is a typical coppice with standards system where standards are harvested on a 30 (or more) rotation and the coppice on a 10-year cycle. The "modified" refers to the fact that rather than cutting all the coppice, a crop of poles is also grown under the standards. Most of these are cut at 20 years leaving a few as replacements for harvested standards.

Forest type and conditions suitable for this system
- Schima-Fagaceae dominated forest
- Forest dominated by deciduous or semi-deciduous trees
- Good number of growing rootstock (not too old)
  Note: Smaller trees (< 40 cm dbh) usually coppice better than large old trees
- More or less even-aged growing stock (especially in the smaller size-classes)
- This forest type usually contains many species which coppice well
- For good growth of coppice shoots, plenty of light is needed otherwise the shoots growth slowly and are not vigorous. You cannot manage a coppice system under shade.
- Protection of young shoots from grazing and fire is essential

Forest Products
A forest managed with a modified coppice with standards system will give a mixture of forest products. Large quantities of small poles can be produced by utilising 10-year old coppice shoots. Plenty of medium-sized poles will also be produced by thinning 20-year old coppice shoots. Some timber-sized trees will be produced by harvesting the widely-spaced standards.

This is a good system if the village needs a variety of sizes of timber and poles plus some firewood, every year, and if the forest type is suitable.

Method
To begin
- First, select small areas for coppicing. These should be not too small or too large (about 1 ha is best). The total area which can be coppiced each year should be about 1/30th of the block area or in 5 years you can coppice about 1/6th of the block area.
- Carry out the coppicing activity (see glossary). You can cut all the trees in this area, except for leaving widely spaced trees which will later be suitable for timber (standards). The standards should be about 15m apart and their crowns should not be touching.
At 10 years
- There should now be a dense growth of coppice shoots from the cut stumps (stools) beneath the widely spaced standards.
- Thin the coppice regrowth heavily. You only need to leave poles at a spacing of about 7m and can cut everything else back to the stump.
- Also cut about 1/2 of the standards you originally left preferably selecting the largest trees.
- After cutting you should have a forest with widely-spaced standards suitable for future timber with widely spaced poles beneath.

At 20 years
- Coppice the area again. This time, cut all the new coppice regrowth.
- Also cut the remaining standards which you originally left.
- Thin the poles again to leave them at a wide spacing (about 15m apart). These will be your future standards.
- You should now have a forest consisting of widely spaced 20-year old poles plus rootstock below.

At 30 years
- Start to harvest the standards for timber. These should be 30 years old and be good straight trees of timber species. Before selecting any tree for harvesting make sure that you have selected a suitable replacement tree from the younger coppice regrowth.
- Don’t harvest all the standards at once - it is best to select a few each year remembering to identify and protect a replacement for every tree cut.
- Thin the coppice regrowth leaving poles at about 7m spacing.
- The cycle can now begin again from 10 years onwards
### Modified coppice-with-standards

<table>
<thead>
<tr>
<th>Diameter class</th>
<th>Number per ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5 cm White</td>
<td>4,000</td>
</tr>
<tr>
<td>5 - 7.9 cm Yellow</td>
<td>3,200</td>
</tr>
<tr>
<td>8 - 11.9 cm Black</td>
<td>200</td>
</tr>
<tr>
<td>12 - 16.9 cm Stripes</td>
<td>180</td>
</tr>
<tr>
<td>17 - 22.9 cm Blue</td>
<td>50</td>
</tr>
<tr>
<td>23 - 29.9 cm Dots</td>
<td>45</td>
</tr>
<tr>
<td>&gt; 30 cm Red</td>
<td>40</td>
</tr>
</tbody>
</table>
### Utilisation Options

<table>
<thead>
<tr>
<th>Option</th>
<th>Brief description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvesting trees for timber</td>
<td>• Timber sized trees will be harvestable after 30 years&lt;br&gt;• Always keep about 40-50 trees per ha (15 spacing)&lt;br&gt;• Don’t just harvest the best trees - trees which are damaged or have a poor form should also be removed&lt;br&gt;• Before harvesting any tree always identify and select a replacement tree nearby</td>
</tr>
<tr>
<td>Harvesting medium-sized poles</td>
<td>• These are trees which have reached about 20 years&lt;br&gt;• At 20 years there should be about 130-150 poles available</td>
</tr>
<tr>
<td>Coppicing for small poles and fuelwood</td>
<td>• This includes all the smaller poles produced when 10-year old coppice regrowth is cut. Some will be suitable for fuelwood only</td>
</tr>
</tbody>
</table>

### Improvement Options

<table>
<thead>
<tr>
<th>Option</th>
<th>Brief description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thinning</td>
<td>• At 20 years, the poles are thinned to leave enough trees for 40-50 standards per ha&lt;br&gt;• Remaining trees should be evenly spaced&lt;br&gt;• Remove all crooked and damaged trees as well as any species not suitable for timber (unless there is another specific use for the tree e.g. fruit or medicine)</td>
</tr>
<tr>
<td>Pruning</td>
<td>• Timber trees can be pruned to remove branches and improve future timber quality&lt;br&gt;• This also reduces the canopy and increases the light beneath for coppice regrowth</td>
</tr>
<tr>
<td>Coppicing/singling</td>
<td>• This is the operation where young shoots are cut from stumps to reduce the number per stump</td>
</tr>
<tr>
<td>Cleaning/weeding</td>
<td>• Remove any unwanted shrubs or weeds which may be restricting the growth of coppice shoots</td>
</tr>
</tbody>
</table>
2. Single tree selection

Description
This is a system where trees of all sizes are growing in every area of the forest. Timber is harvested from selected trees which have reached larger size, which are suitable for timber and which are at least 30 years old. Smaller trees are managed to ensure the maximum production of larger timber trees, but not normally for utilisation purposes.

Forest type and conditions suitable for this system
- Forest which is not dominated by Schima-Fagaceae - often this includes more evergreen species (rather than deciduous species)
- Forest dominated by species which do not coppice well and need to regenerate from seed
- Forest which is already very uneven-aged with all size-classes growing together
- Forest on steep slopes
- Forest where there is a danger of weed invasion (or bamboo invasion) if gaps are created

Forest Products
A forest managed with a selection system will give a range of forest products, but the main production will be of timber-sized trees. Some smaller poles will be produced from thinning, but coppice growth will be restricted due to lack of light and there will be fewer small poles and fuelwood.

This is a good system if the main requirement from the villagers is for larger timber-sized trees rather than regular production of large quantities of small poles and fuelwood.

Method
To begin
- Start by looking at the histogram based on sample plots. Are there enough large-sized trees? Are there enough trees in each other size class?
- Identify and mark the timber-sized trees on the ground. Make sure that they are well spaced and will be suitable for future timber production
- Make sure that there are always about 100 timber-sized trees per ha or after harvesting about 100 trees which will be suitable for timber after a further 5 years of growth
- Harvest other trees in any size class which has excess numbers
**Every year**

- Select a block for harvesting. Every year you can select a different block or about 1/5\textsuperscript{th} of the whole village forest area.

- Based on your data analysis, harvest timber-sized trees which are available in the selected area. Numbers depend on the actual stocking in the forest compared against the "ideal" structure in the histogram.

- Select future timber trees and thin or open these out by harvesting any competing trees e.g. those which are very close, or those where the canopy is touching or overlapping.

- In general, do not cut smaller stems unless there are very dense patches which can be thinned.

- Do not return to the same area for harvesting until another 5 years have passed. In the meantime, harvest any available trees from other blocks.
## Management Options for Single Tree Selection

### Utilisation Options

<table>
<thead>
<tr>
<th>Option</th>
<th>Brief description</th>
</tr>
</thead>
</table>
| Harvesting trees for timber | • Timber sized trees will be harvestable after 30 years  
• Always keep about 100 trees per ha. After a harvest, this number can be reduced, but make sure that there are enough smaller-sized tree which will again be available for timber in 5 years time  
• Timber trees need to be more or less evenly spaced over the whole area.  
• Don’t just harvest the best trees - trees which are damaged or have a poor form should also be removed  
• Before harvesting any tree always identify and select a replacement tree nearby |
| Harvesting medium-sized poles | • There is no specific harvest for trees of this size. Only cut them if they are competing with future timber trees  
• It should be possible to cut some pole-sized trees from the harvesting area every 5 years |
| Harvesting small poles and fuelwood | • In general, don’t harvest such trees. Every time a timber-sized tree is harvested, there needs to be a crop of smaller poles which will grow up and replace it  
• It is especially important not to cut or damage young trees which have regenerated from seed |

### Improvement Options

<table>
<thead>
<tr>
<th>Option</th>
<th>Brief description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thinning</td>
<td>• Only carry out thinning if there are some dense patches of small poles and regeneration</td>
</tr>
</tbody>
</table>
| Pruning            | • Timber trees can be pruned to remove branches and improve future timber quality  
• This also reduces the canopy and increases the light beneath for growth of younger trees |
| Cleaning/weeding   | • Remove any unwanted shrubs or weeds which may be restricting the growth of young trees                                                            |
3. Small group selection

Description
This is a quite similar system to single tree selection. All sizes of trees are growing in every area of the forest, but instead of harvesting single timber-sized trees, small groups of trees are felled. This creates a small open patch in the forest (about 10 x 10m) which is more suitable for regeneration of many species - specially those which require more light e.g. Schima.

Forest type and conditions suitable for this system
- Forests of any type including those dominated by Schima-Fagaceae
- Irregular forest which consists of small patches of different age or size classes.
- Forest which has areas dominated by bamboo and where bamboo may restrict the growth of younger trees and may prevent regeneration
- Forest where there are small weedy patches where weeds need to be eliminated to allow regeneration to take place

Forest Products
As with single tree selection, the main forest product from the small group selection system is timber. However, because small groups are harvested, there will be a greater mixture of forest products of other sizes including small and medium sized poles and fuelwood.

This is a good system if the forest cannot be easily managed under a modified coppice with standards system and if it is in quite irregular or even degraded condition. It will produce a mixture of forest products for villagers' needs.

Method
To begin
- First, identify small areas or "groups" in the forest block. At the start, you can identify about 1/6th of the area as groups.
- The first groups should be places where there are already gaps in the forest e.g. dominated by bamboo or weeds. However, they need not be completely open areas. Groups should be small (about 10 x 10m). This means that in 1 ha there can be up to 16 groups (preferably less to avoid problems later on)
- If bamboo is a useful forest product for villagers, then bamboo clumps can be managed as part of a group (e.g. by harvesting all 3 year old or older culms). If bamboo is not useful as a forest product, then consider cutting as much of the clump as possible to prevent it spreading.
• In selected groups, harvest all trees of all sizes making sure that the area of the group is not exceeded.

Every 5 years
• Identify and select new groups, again selecting about 1/6th of the total block area.
• Make sure that new groups are not directly adjacent to older groups (although this will become increasingly difficult)
• Harvest all the trees in each group (larger timber-sized trees plus all other trees)
• Return to the older groups. Carry out any weeding or cleaning in these small areas to make sure that regeneration is not being restricted by weeds or bamboo growth
Small group selection

Number per ha

Diameter class

< 5cm 5 - 7.9 cm 8 - 11.9 cm 12 - 16.9 cm 17 - 22.9 cm 23 - 29.9 cm > 30 cm

White Yellow Black Stripes Blue Dots Red

1.500 600 300 220 150 120 100
## Management Options for Small Group Selection

### Utilisation Options

<table>
<thead>
<tr>
<th>Option</th>
<th>Brief description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvesting groups</td>
<td>• Groups might include timber-sized trees (more than 30 years old) as well as smaller sized material</td>
</tr>
<tr>
<td></td>
<td>• Do not harvest more than 1/6th of the area every 5 years</td>
</tr>
<tr>
<td></td>
<td>• Keep groups more or less evenly spaced over the whole area and not directly adjacent</td>
</tr>
<tr>
<td></td>
<td>• Don’t just select the best areas for group felling. Poorer areas can be chosen mixed with better areas to ensure that forest condition will gradually improve</td>
</tr>
<tr>
<td>Harvesting medium-sized poles and small poles and fuelwood</td>
<td>• There is no specific harvest for trees of these sizes - just cut whatever is available in the identified small groups.</td>
</tr>
<tr>
<td></td>
<td>• It should be possible to cut some pole-sized and smaller trees from the harvesting area every 5 years</td>
</tr>
</tbody>
</table>

### Improvement Options

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Pruning</td>
<td>• Timber trees can be pruned to remove branches and improve future timber quality</td>
</tr>
<tr>
<td></td>
<td>• This also reduces the canopy and increases the light beneath for growth of younger trees</td>
</tr>
<tr>
<td>Cleaning/weeding</td>
<td>• This is an important operation to carry out in previously harvested groups. It may be necessary to do this every year after harvesting the groups - especially if there is a problem with weeds</td>
</tr>
<tr>
<td></td>
<td>• Make sure that all regeneration and coppice growth in the groups can develop and grow without weed competition</td>
</tr>
<tr>
<td>Bamboo management</td>
<td>• Since bamboo will often be dominant in this system, a strategy for managing it needs to be taken</td>
</tr>
<tr>
<td></td>
<td>• This will depend on whether or not there is a demand for bamboo</td>
</tr>
<tr>
<td></td>
<td>• In general, keep larger bamboo species if they are needed by villagers, but cut and prevent smaller bamboo species from spreading</td>
</tr>
<tr>
<td></td>
<td>• See glossary below on bamboo management</td>
</tr>
</tbody>
</table>
## A. Harvesting timber

### What is timber harvesting?
- Timber harvesting means the removal of mature, timber-sized trees by felling.

### Why carry out timber harvesting in village forests?
- To supply timber for villagers’ needs.
- To maintain the forest in a healthy condition.

### Harvesting
- Control the direction trees are felled - up-slope or along the slope is best (not down slope).
- Avoid felling large trees so they fall into pole-stage areas and cause damage to young trees. Fell them into open areas or areas with very young regeneration.
- Cut trees as low on the trunk as possible. Do not leave high stumps.
- Use a good felling technique to avoid splitting or breaking the stem and wasting wood.
- Cut off all branches before removing the logs from the forest.
- Remove harvested trees from the forest as soon as possible.
- Avoid rolling trees or sliding trees down steep slopes. If you have to drag logs, then control them to avoid damage to other trees and to soils.

## B. Pruning

### What is pruning?
- Pruning means the removing branches from established trees.

### Why carry out pruning in village forests?
- To improve the quality of the tree stems for future timber use.
- To produce fuelwood from cut branches.
- To reduce canopy density and shading especially with coppice with standards systems.

### Pruning
- Do not prune branches to more than 50% of the total tree height or do not remove more than half the crown of mature trees otherwise growth will be affected.
- Do not prune young trees (less than 5cm dbh).
- Prune during the winter season to give trees a chance to recover during the growing season.
- Dead branches can be removed at any time.
- Use sharp tools to avoid breaking branches and damaging the tree stems.
C. Coppicing/Singling

What is coppicing/singling?
- Coppicing/singling means removing multiple stems from trees leaving the cut stumps. If a single stem is left this is singling.

Why carry out singling in village forests?
- To produce small poles and fuelwood
- To improve the quality and growth of the remaining uncut stem (if singling)
- To reduce stocking density
- To regenerate the forest through coppice regrowth

Coppicing/singling
- Singling is a simple operation, but it must be carefully carried out to avoid damage. Use of suitable cutting tools is important.
- Not all species will coppice. The best coppicers are often deciduous or semi-deciduous species like Schima wallichii or Fagaceae
- Cut the shoots about 15cm above the ground trying not to damage the stump
- Young coppice growth requires plenty of light - this is why it is best in a coppice-with-standards system or small group selection

D. Thinning

What is thinning?
- Thinning means removing some of the trees (usually pole sized trees) in densely stocked forest or patches of forest

Why is thinning carried out in village forests?
- To improve the growth rate and diameter of the remaining trees in the forest (by reducing competition)
- To improve the final timber crop by removing deformed tree stems which will not be needed for timber
- To open the canopy to allow more light to penetrate to the understorey e.g. for coppice growth
- To produce poles and fuelwood to meet the needs of villagers

Thinning
- Carry out thinning regularly and often. If thinning pole-sized trees carry out a thinning every 5 years.
- During a single thinning you can remove up to 25% of the trees (or growing stock) depending on the actual stocking
- The best spacing for thinning depends on the age (or size of the trees). For medium-sized poles in a modified coppice with standards system, the spacing can be about 7m between trees.
- Mark trees before starting thinning. Trees should be marked on the basis of their form (straightness and branchiness) as well as the crop density.
- All poor quality trees should be removed during thinning before they reach timber size.
E. Weeding/cleaning

What is weeding/cleaning?
- Weeding and cleaning are important improvement operations in village forests
- Weeding and cleaning means the removal of any vegetation which is competing with the growth of the trees. This can include grasses, shrubs, lianas, small bamboos etc.

Why is thinning carried out in village forests?
- To encourage better growth of the trees and other products which villagers really need from their forest
- To reduce risk of fire damage

Weeding and Cleaning
- Carry out weeding and cleaning regularly in all managed village forests
- These operations are especially important in degraded and open forest areas and in areas where there is already a weed problem
- The aim of weeding and cleaning is to remove all competing vegetation to allow the trees to grow up and eventually to suppress weed growth by their shade effect.
- Weeding and cleaning are particularly important in modified coppice with standards systems and group selection systems where open gaps are created in the forest. Weeds need to be controlled in these areas.

F. Bamboo management

What is bamboo management?
- Bamboo management includes both the utilisation of bamboo to meet villagers’ needs and control of bamboo when it becomes a problem for forest growth and regeneration.

Why manage bamboo in village forests?
- To supply bamboo poles for villagers’ use
- To maintain bamboo clumps in a healthy and productive condition
- To remove or control bamboo where it is competing with tree growth and regeneration

Bamboo management
- First, decide whether villagers need bamboo from their forest or not. This will determine how it is managed.
- If bamboo is required, then clumps can be maintained in a healthy and productive condition by regular harvesting of culms. This means removal or all 3-year old culms and of any malformed culms.
- When harvesting culms, cut as low as possible, and try to open out the centre of the clump (remove congestion). This will give better growth of new culms from rhizomes and will stimulate rhizome production.
- Piling up soil around a clump (mounding) will also help to stimulate rhizome development and production of new culms.
F. Bamboo management contd.

Bamboo management

• If bamboo is not needed, and if it is becoming a problem for regeneration and growth of trees, then it needs to be controlled
• Regular cutting back of all culms (including young culms) will reduce growth.
• Complete harvesting of all culms on a regular basis (especially with small invasive bamboo species) will eventually weaken the growth of clumps.
• Raking and controlled burning of leaf litter will help to create improved conditions for tree regeneration