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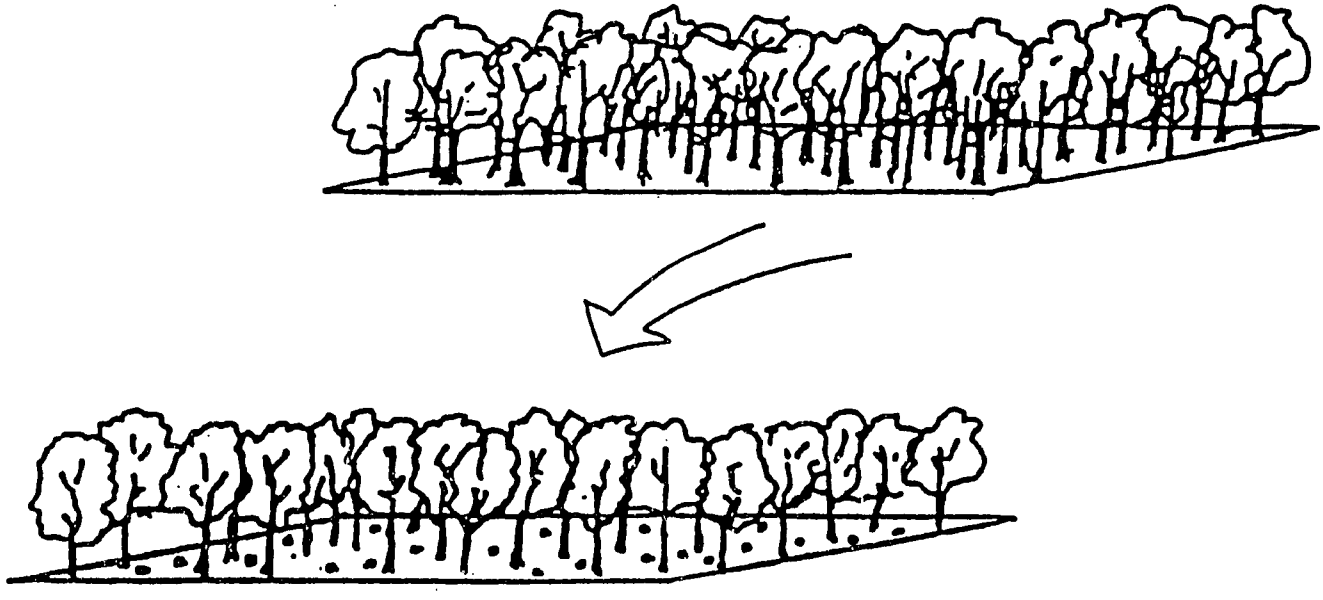
FORESTRY PLANNING & DEVELOPMENT PROJECT
Government of Pakistan–USAID

# THINNING BLOCK PLANTATIONS



**TECHNICAL NOTE**

**FPDP No. 7**

**OCTOBER 1991**

# TECHNICAL NOTE

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# THINNING BLOCK PLANTATIONS

By

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Periodic thinning must be done to encourage the rapid diameter growth of trees in young stands. This is particularly important in farm plantations because fast diameter growth means improved market opportunity in shorter time. Because farmers tend to plant trees too close together, early and frequent thinning may be one of the most important management activities.

## THE BASAL AREA CONCEPT

The biological limits on tree diameter growth can best be expressed in terms of stand density, measured by the amount of space actually occupied by the trees on in a stand.

One convenient way to describe stand density which lends itself to field application is to express it in terms of the square feet of cross sectional area of trees per acre of land. For this purpose, the cross sectional area of each tree is measured in square feet at the DBH (diameter breast high) point, 4-1/2 feet above the ground, and the sum of these areas for all the trees on an acre is expressed as basal area per acre (B.A).

One way to think of stand density is as a tree's limits of tolerance to crowding. Like people, different types of trees have different tolerances. The tolerance for poplar and simal is estimated to be BA=50. For eucalyptus it is BA=100; while shisham, mulberry, and most other broadleaved trees come in the middle at about BA=70. How do we measure this density?

For example, a tree with DBH of 6.8 inches represents 0.25 (1/4) square foot of cross sectional area. If the desired stand density for the species concerned is to have not more than 100 BA then the stand should be thinned if there are more than 400 trees of this size on an acre.

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Properly managed stands have the appearance of openness. To visualize this, imagine that you could move all 400 of the trees in the above acre example, into the center of that one acre. The results would look something like Figure 1.

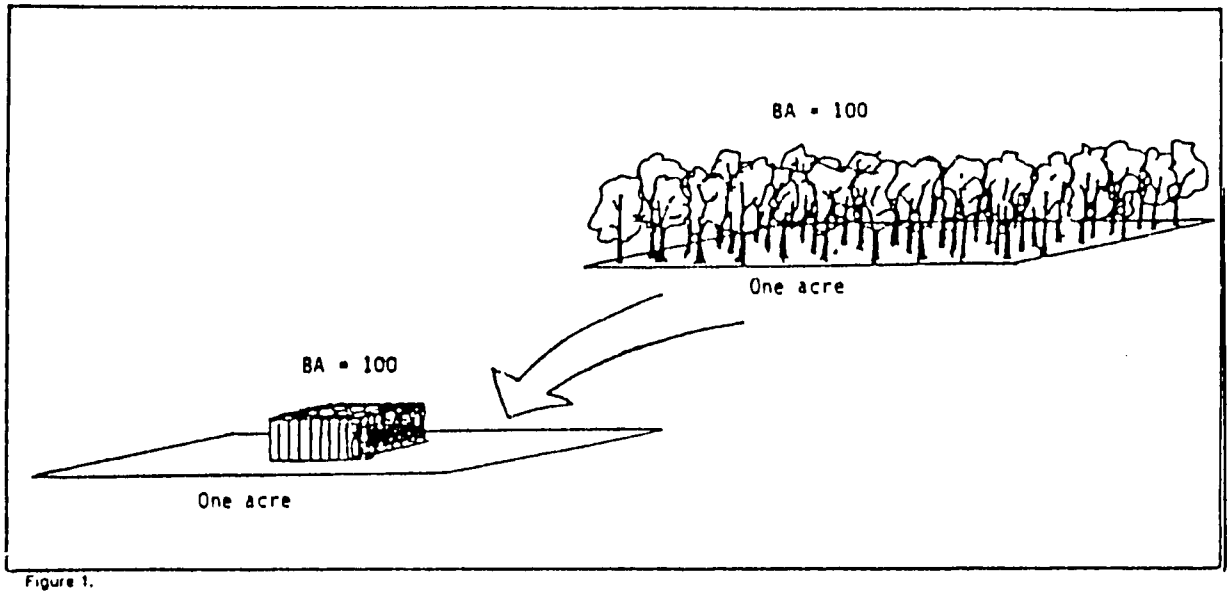



Figure 1.

:ree stems, without the tops and side branches, don't appear ... represent full use of the land on this acre. The point is, trees need room to grow.

The problem, then, is to realize that our eyes can play tricks on us depending upon how we look at the situation. That's why it is important to know the basic limitations of production and to be able to measure them.

If all trees in a plantation were the same size, our job would be simple. But this almost never happens in fast growing plantations. In young eucalyptus plantations we will most likely find over 1,000 trees per acre ranging from 1 inch to 7 inches in DBH. When the BA is at or near 100, it is a signal that thinning should be considered in the plantation. How do we determine if the BA=100?

## ESTIMATING BASAL AREA (BA)

Precise measurement of BA can be obtained by measuring the DBH of every tree in the stand and summing the following mathematical calculation for each tree:

$(DBH)^2$ X.00545415 = square feet of basal area (for each tree).

When DBH is measured in inches, the constant .00545415 converts the basal area in square inches to basal area per acre in square feet (BA). This is a time consuming computational process not suitable for day to day field use.

A procedure which lends itself to field use is the point sampling method. This procedure allows you to rapidly estimate BA and can be easily shown to a farmer.

The procedure uses a simple angle gauge. A 10-factor gauge is the easiest to use. This gauge can easily be constructed from any commonly available item which is 13/16ths inch wide. One good and available 'tool' is the Pakistan 5 paisa coin. To create a 10 factor angle gauge one holds a 5 paisa coin 25 inches from their eye (Figure 2). Generally, 25 inches is the length of an average man's arm.

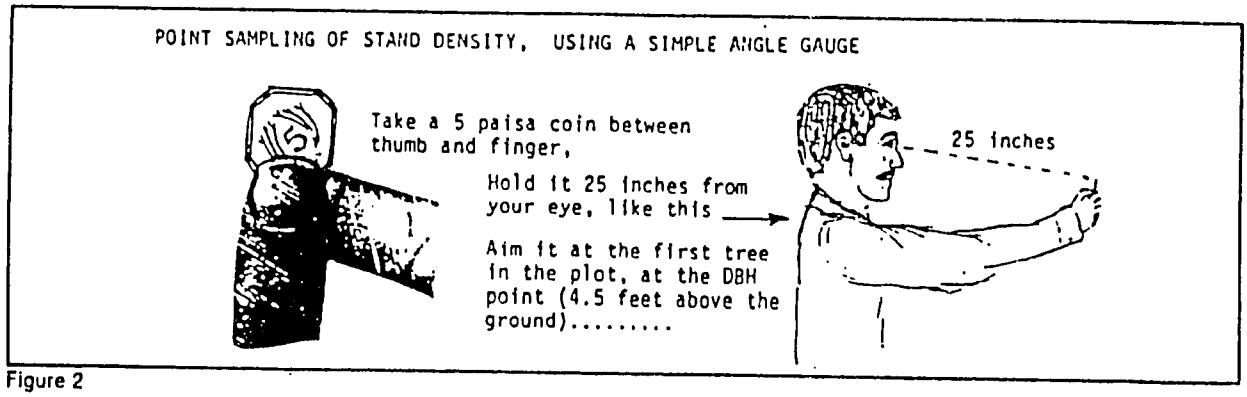


Figure 2

To point sample with an angle-gauge, the individual stands at the center of the 'plot'. One then uses the angle gauge to identify which trees are 'in' the plot (Figure 3). BA for the plot is the number of 'in' trees in a full circle around the plot center, multiplied by the angle-gauge factor.

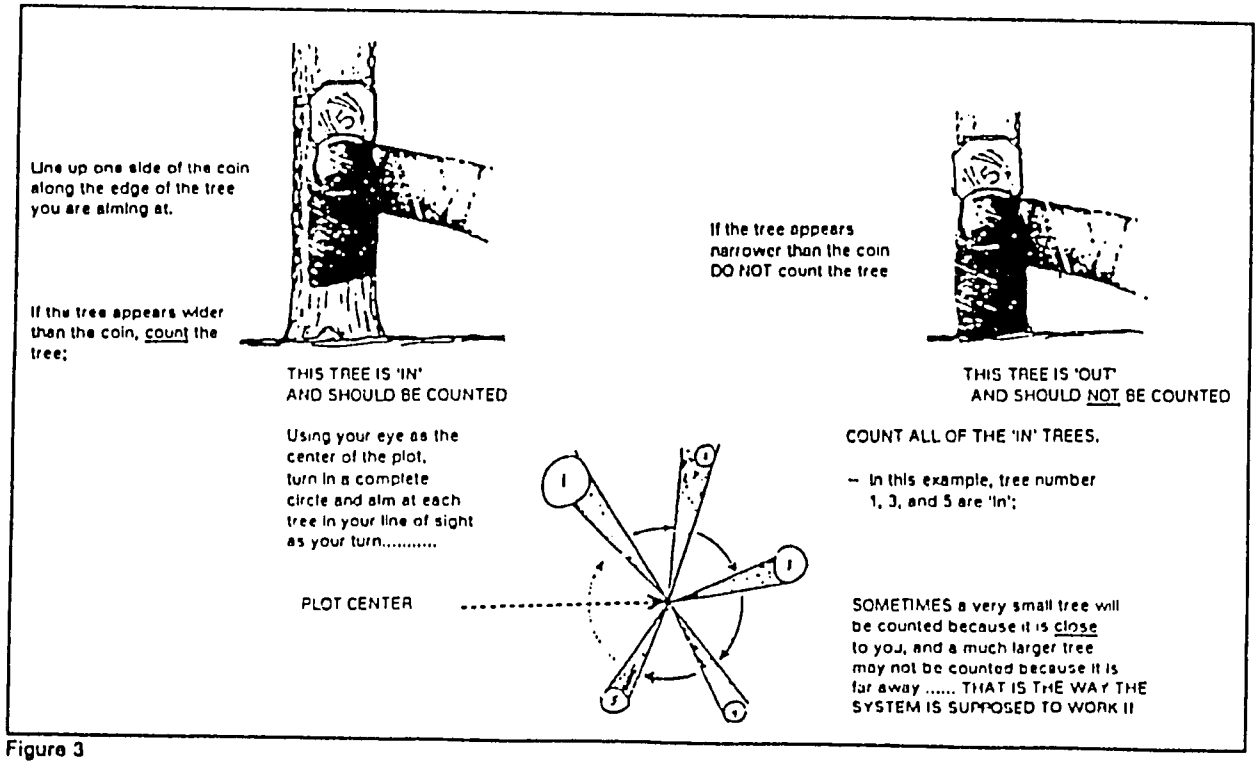


Figure 3

## HOW TO LOCATE SAMPLE POINTS

Step 1

- Walk into the plantation at least 10 steps from one corner and stop;
- Be sure that you are away from the 'edge' of the stand;

Step 2

- Start with the tree closest to you and aim the angle gauge at each tree as you make a complete circle (Figure 3);
- Record the number of 'in' trees on the plot;

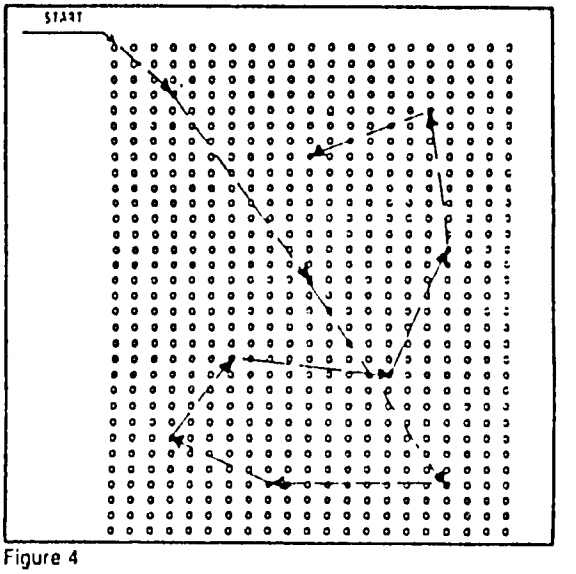


Figure 4

Step 3

- Walk at least 15 steps further into the stand, and repeat Step 2. As shown in Figure 4. Continue this process until you locate 10 sample points throughout the block planting.

The number of 'in' trees counted at each of the 10 points was recorded as follows:

| Point No. | 'In' Trees |
|---|---|
| 1 | 11 |
| 2 | 12 |
| 3 | 10 |
| 4 | 10 |
| 5 | 12 |
| 6 | 11 |
| 7 | 10 |
| 8 | 11 |
| 9 | 12 |
| Total Trees 10 | 11 |
| | =110 |

TO DETERMINE BA/AC FROM THIS SAMPLE

BA = total number of 'in' trees

thus, BA = 110

$$BA = \frac{\text{No. of Trees}}{\text{No. of Plots}} \times \text{ANGLE GAUGE FACTOR}$$

$$BA = \frac{110}{10} \times 10 = 110$$

In this case, when we use 10 plots and a 10 factor angle gauge, the BA is equal to the total number of 'in' trees, or BA = 110.

## DETERMINING IF THE TREES NEEDED TO BE THINNED

Once the basal area per acre and trees per acre are known, thinning guides can be used to determine if trees need to be thinned (if you can convince the farmer that the trees need more space to grow!). Since a tree's tolerance to crowding depends on both species and moisture, separate thinning guides are needed for each of these conditions. Charts 1-5 give thinning guides for different species and moisture conditions.

The thinning guides tell you what percent of the trees must be removed to give the remaining trees adequate room to grow. Room to grow depends on the current number of trees and the current BA of the stand.

## HOW TO USE THE THINNING GUIDES

Let's assume the 10 samples in the previous example were taken in a eucalyptus stand located in a barani area. To determine whether or not the trees need thinning we would use the thinning guide shown in Chart 2. To determine how many trees need to be thinned:

1. Determine the number of trees per acre (TPA). This can be done by:

   a. counting all the trees on one kanal and multiplying that number by 8, or;

   b. counting all of the rows in an acre and multiplying by the average number of trees per row.

   Let's assume that we determined the boundaries of one kanal within the stand. The number of trees in that kanal is 100. Thus, our estimate of TPA is 800.

2. Locate the TPA and BA point on Chart 2. This is done by:

   a. On the vertical axis of Chart 2 locate the TPA value (in this example 800). Draw a horizontal line across Chart 2 at the point TPA = 800.

b. On the horizontal axis of Chart 2 locate the BA value (in this example 110). Draw a vertical line up Chart 2 at the point BA = 110. Mark the point on Chart 2 where the two lines cross (Figure 5).

3. **Determine** the number of trees to be removed. Based on the location of the mark you placed on Chart 2 in step 2.b., read the percent of trees to be removed (in this example 50%).

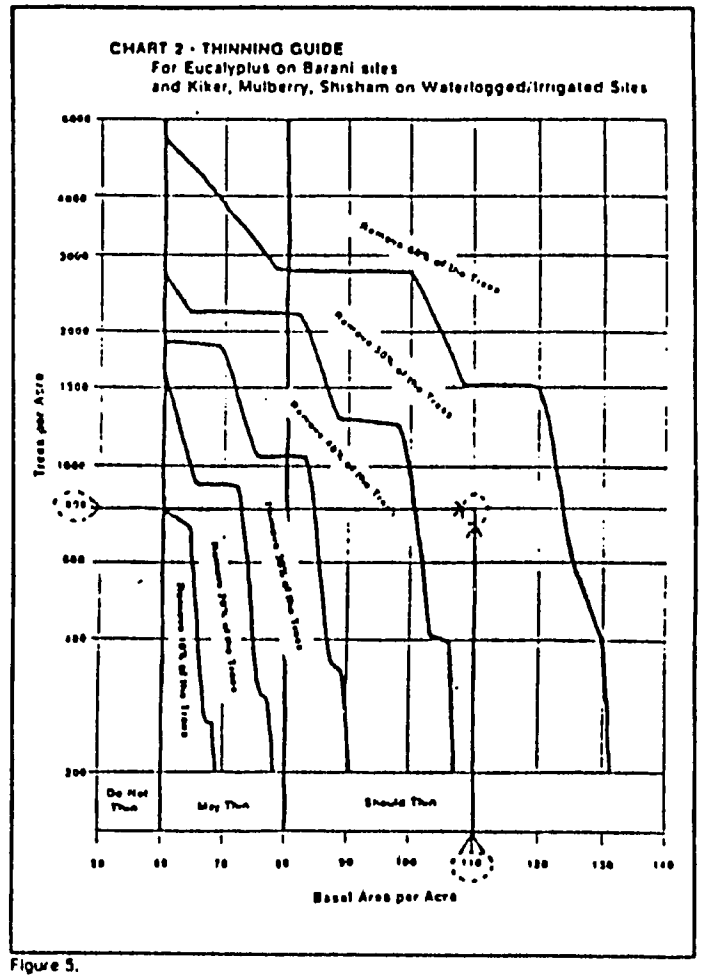


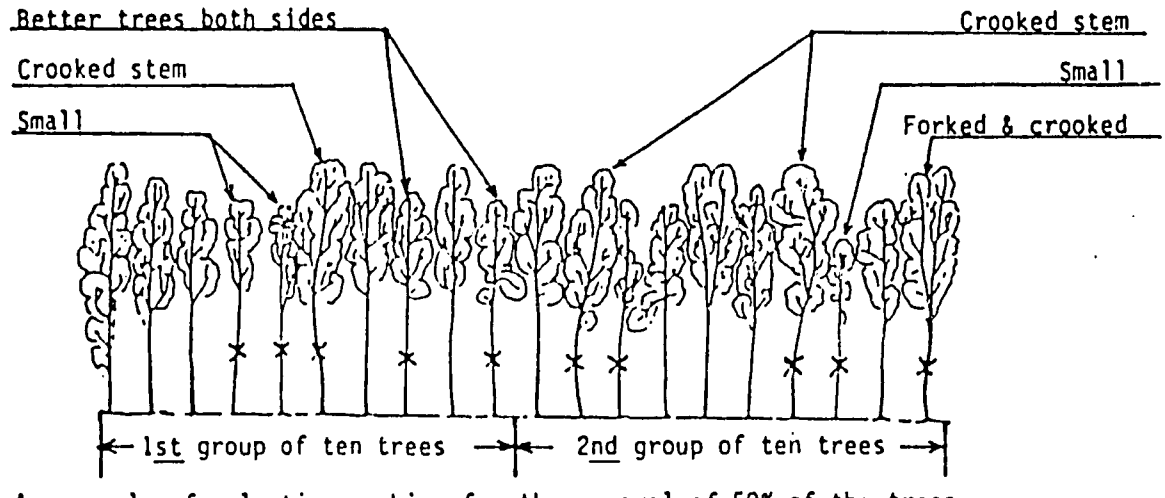

Figure 5.

THINNING THE STAND

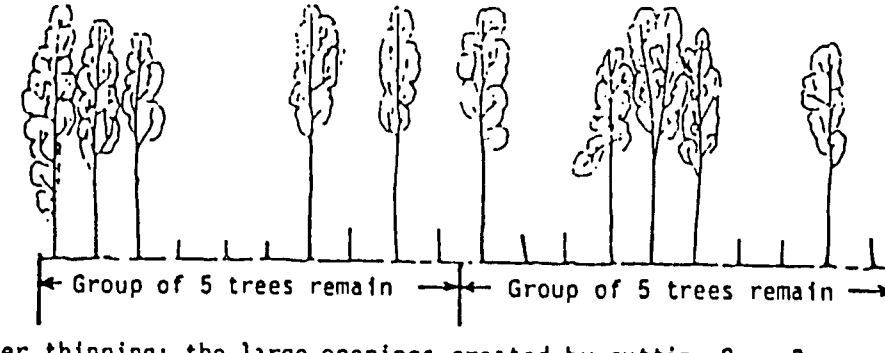
Now that you know how many trees must be removed, it is possible to begin marking the stand for cutting. Two thinning methods are available; a selection method and a mechanical method. The selection method is best suited when you wish to remove the poorest quality trees in the stand or when you wish to remove trees which are needed to meet a specific high quality market requirement. The mechanical method is designed to provide a quick and simple procedure to reduce the total number of trees when there is no 'stem quality' premium in the market. It is especially appropriate for young, high density plantations of eucalyptus and kiker where size and quality of the individual trees are very similar.

## To Implement the Selection Method

To remove trees using the selection method, locate the first tree in one corner of the stand. Count off the first 10 trees in that row. You can use this procedure to either remove the worst trees in the stand to improve its overall quality, or to select desirable trees for a specific market opportunity, or a combination of both. For this example let's assume our objective is to improve the overall quality of the stand. Thus, if you are to remove 50% of the trees, select the worst 5 trees out of the 10-tree group and mark them for cutting (Figure 6) Then go to the next group of 10 trees and repeat the process. Repeat this procedure until you have made a decision on every group of 10 trees in the stand. When you have finished, 50% of the trees will be marked for removal.




An example of selective marking for the removal of 50% of the trees.




After thinning: the large openings created by cutting 2 or 3 consecutive trees in the row are not a problem in block plantings because of trees remaining in the adjacent rows.

Figure 6 Selective Thinning Using Groups of 10 Trees

## To Implement the Mechanical Method

To remove trees using the mechanical method, select the first 10 rows of trees in the stand. If 50% of the trees are to be removed, then mark for cutting rows 2, 4, 6, 8 and 10. If 40 % of the trees are to be removed, then mark for cutting rows 2, 4, 6 and 8. If 30% of the trees are to be removed, then mark for cutting rows 3, 6 and 9. The selection method should be used when 20% or less of the trees are to be removed. Once the decision has been made on the first 10 rows, go to the next 10 rows of trees in the stand and repeat the process (Figures 7 and 8). Repeat this procedure until you have made a decision on every set of 10 rows in the stand.

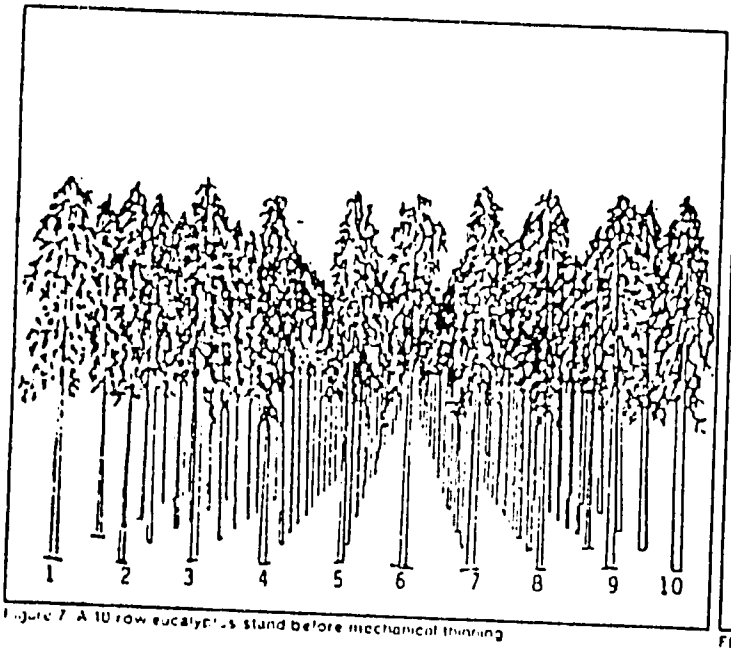


Figure 7. A 10-row eucalyptus stand before mechanical thinning

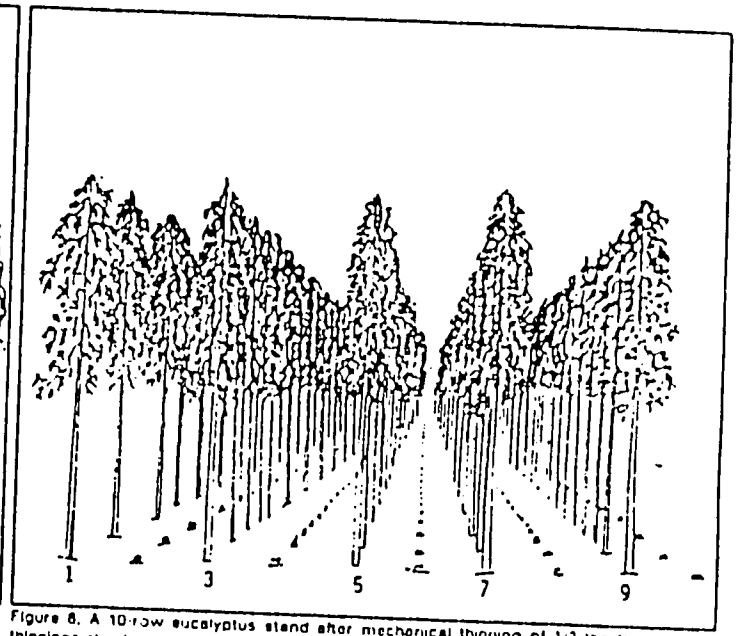


Figure 8. A 10-row eucalyptus stand after mechanical thinning of 1/2 the trees. Later thinnings should be done on the selection system

## SUMMARY:

Thinning tree plantations is an art which must be studied, practiced, and carefully applied. Before thinning a stand you should know the market objectives of the farmer. Thinning should be used to reach those market objectives in the shortest time with the greatest total marketable volume of the appropriate quality standard.

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CHART 1 - THINNING GUIDE
For Eucalyptus on Waterlogged/Irrigated Sites

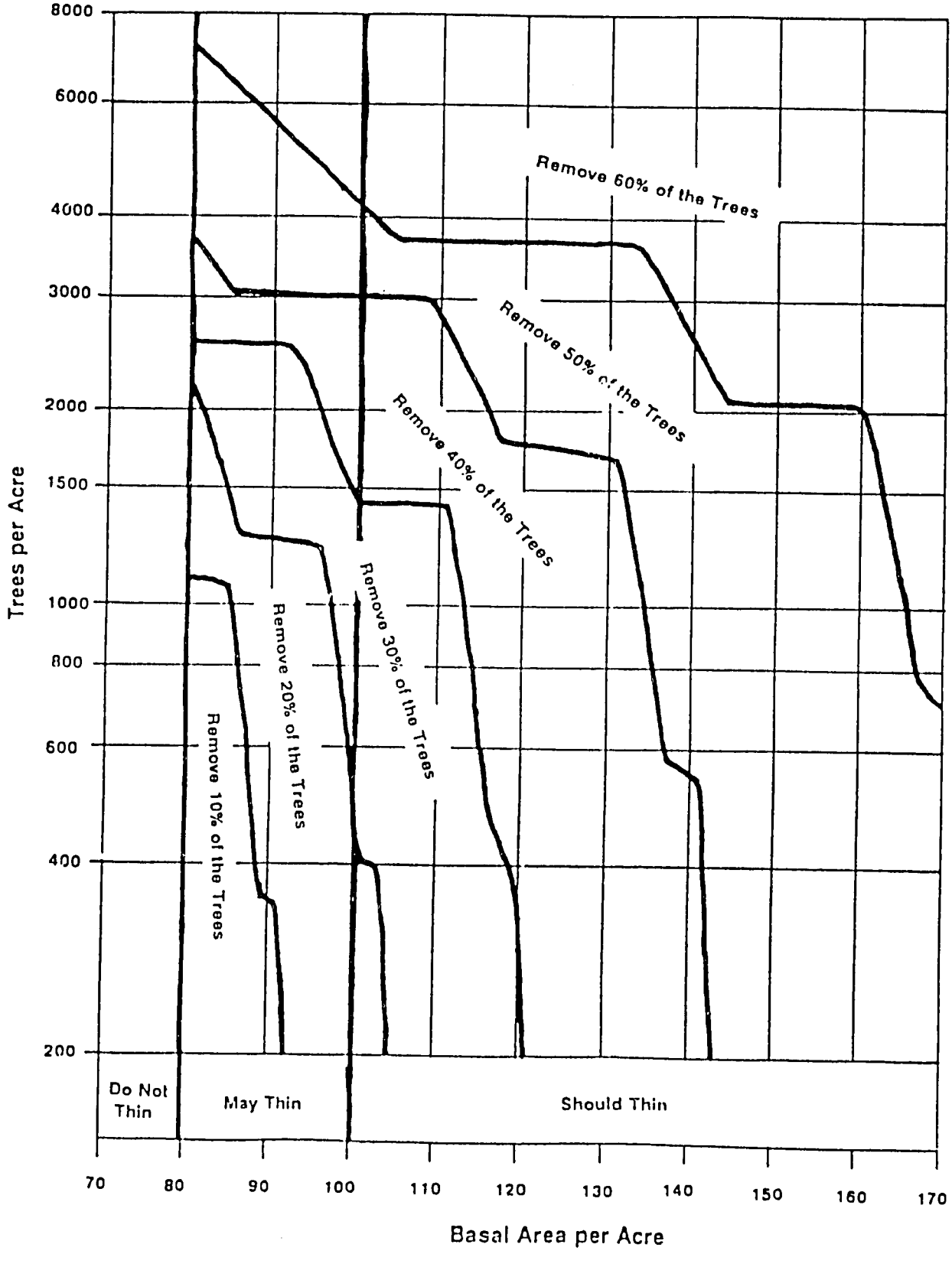


CHART 2 - THINNING GUIDE
For Eucalyptus on Barani sites
and Kiker, Mulberry, Shisham on Waterlogged/Irrigated Sites

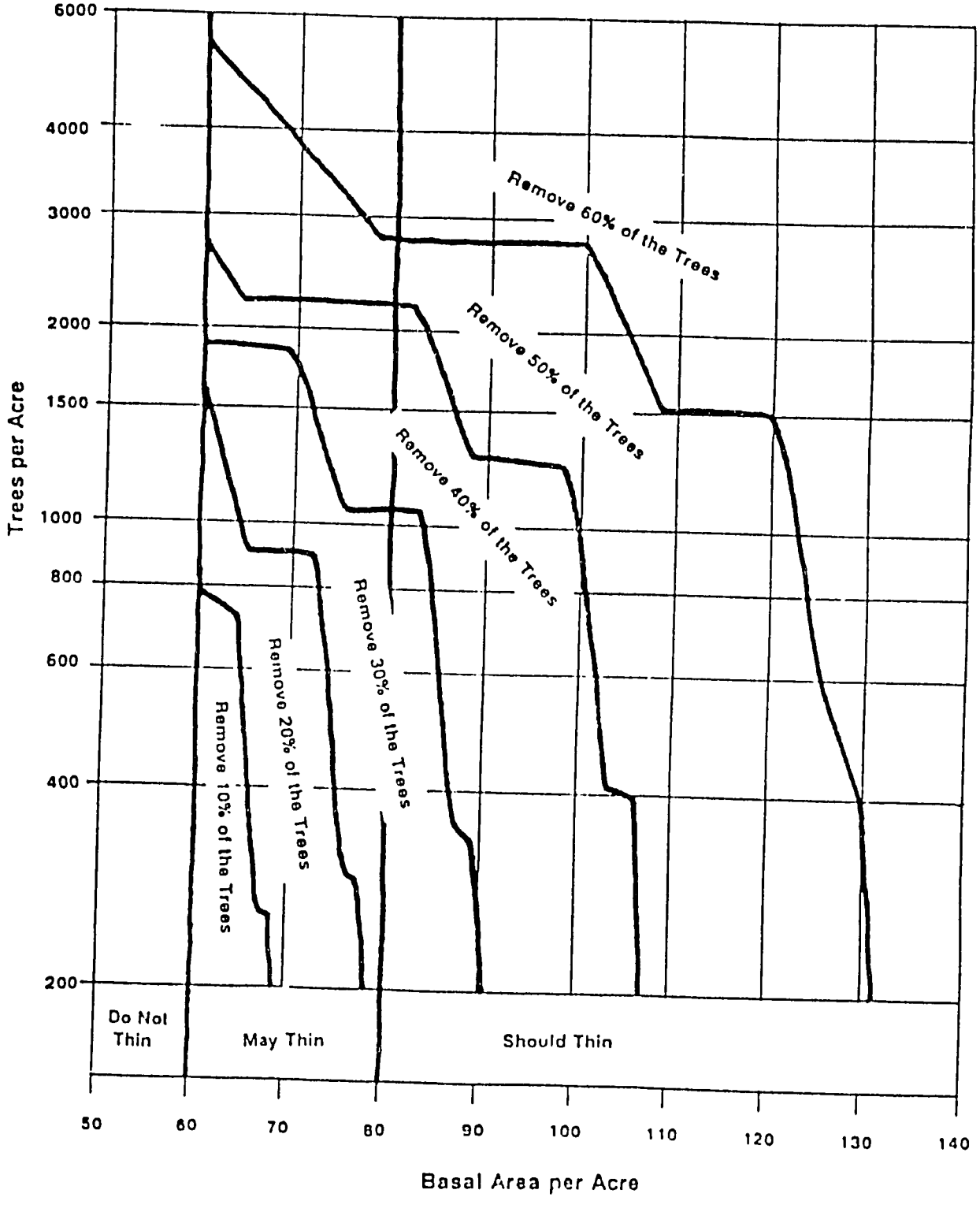
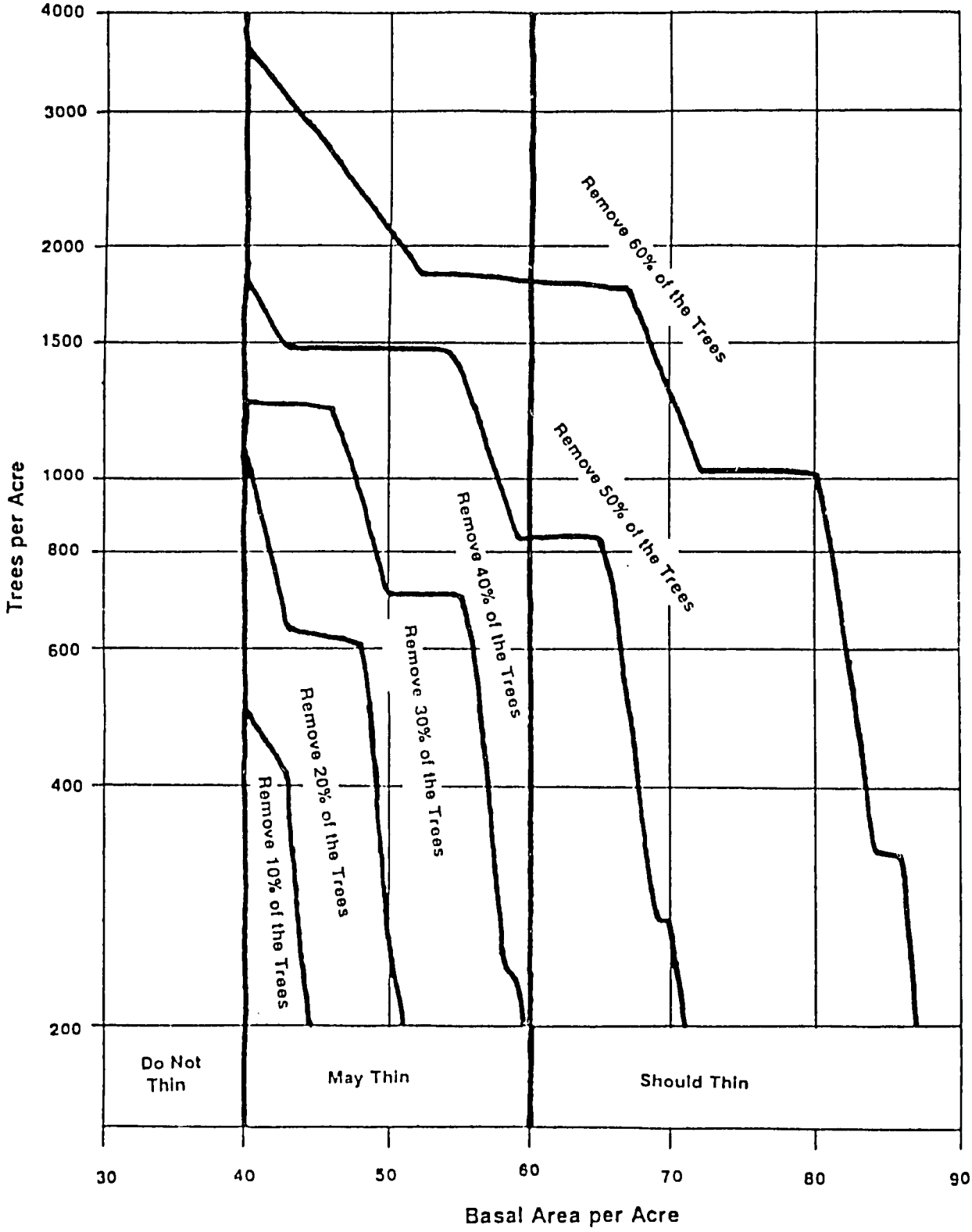


CHART 3 - THINNING GUIDE.
For Poplar, Semal, Willow on Waterlogged/Irrigated Sites



## CHART 4 - THINNING GUIDE
For Kiker, Mulberry, Shisham on Barani Sites

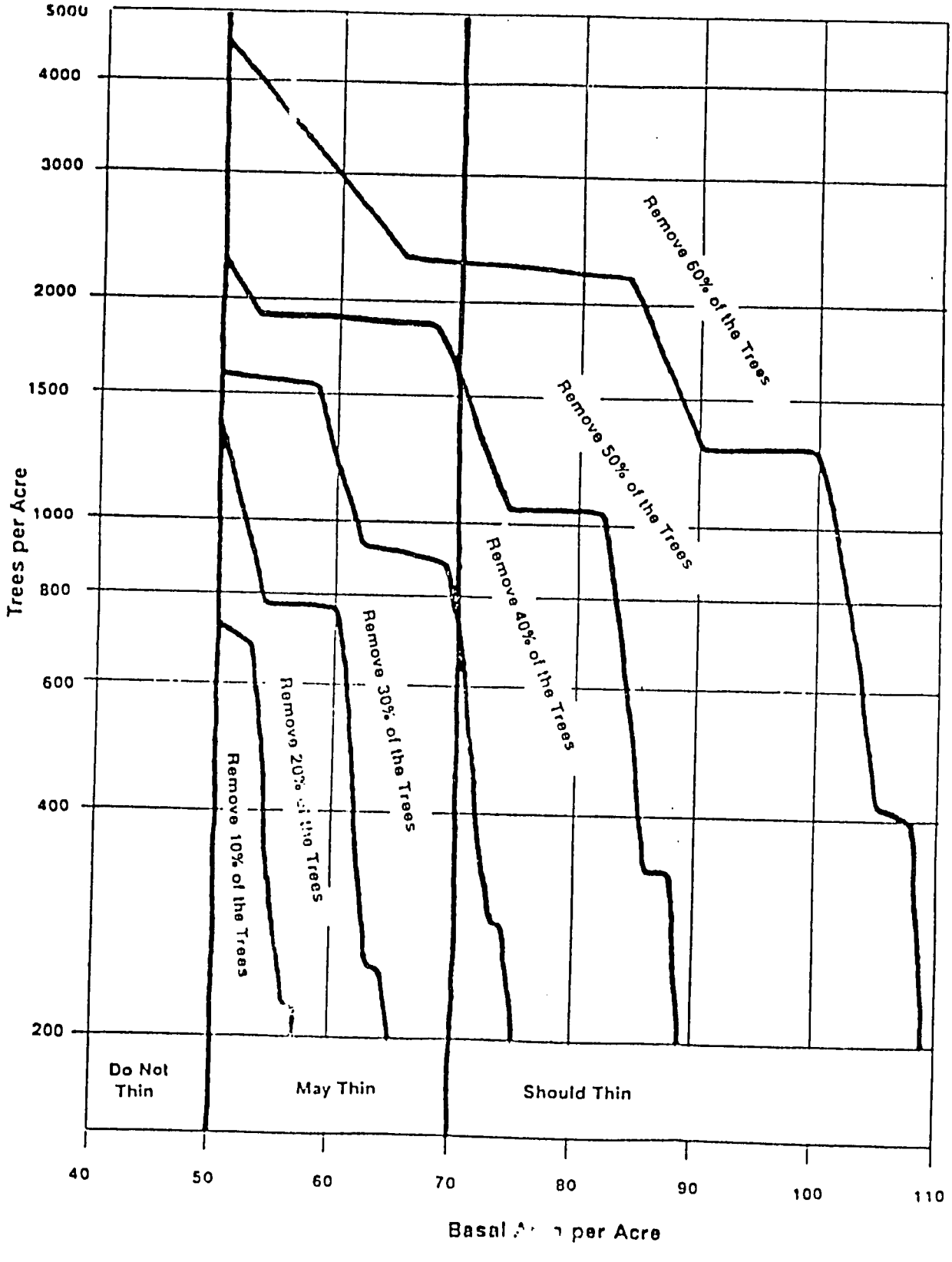
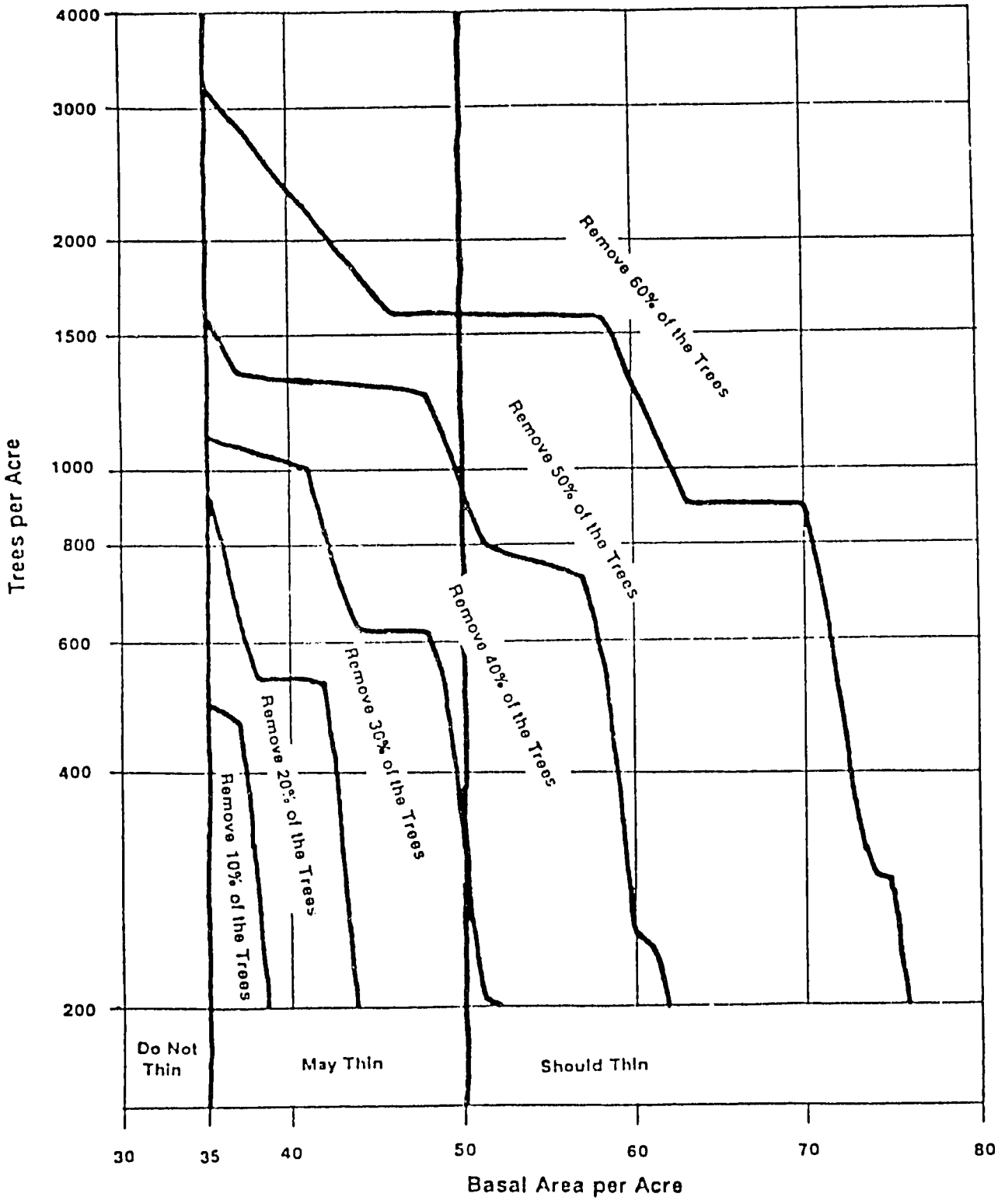



CHART 5 - THINNING GUIDE
For Poplar, Semal, Willow on Barani Sites