Point Sampling

Point Sampling

- Bitterlich, a scientist, has proved that
  - Counting from a random point
  - Trees whose cross section at breast height exceeds a certain critical angle
  - No. of such Trees X constant factor
  - Unbiased estimate of basal area per Ha

- Trees tallied on the basis of sizes, rather than frequency (b h cross section of tree exceeds a certain critical angle).

- Sampling units are points selected either randomly or systematically.

Point Sampling

- P . P . S . (Probability Proportional to Size) Sampling.
- Angle Count Cruising
- Pointless Cruising
- Variable Plot Cruising
- Poly area/plot Sampling

Contd.

- It does not require direct measurement of either plot areas or tree diameter.
- Sighting angle (Critical angle) fixed by a prism or angle gauge.
- Probability of tallying depends on cross sectional area of the tree, sighting angle used and distance.
- It can be used to compute the basal areas, volumes and number of trees per unit area.

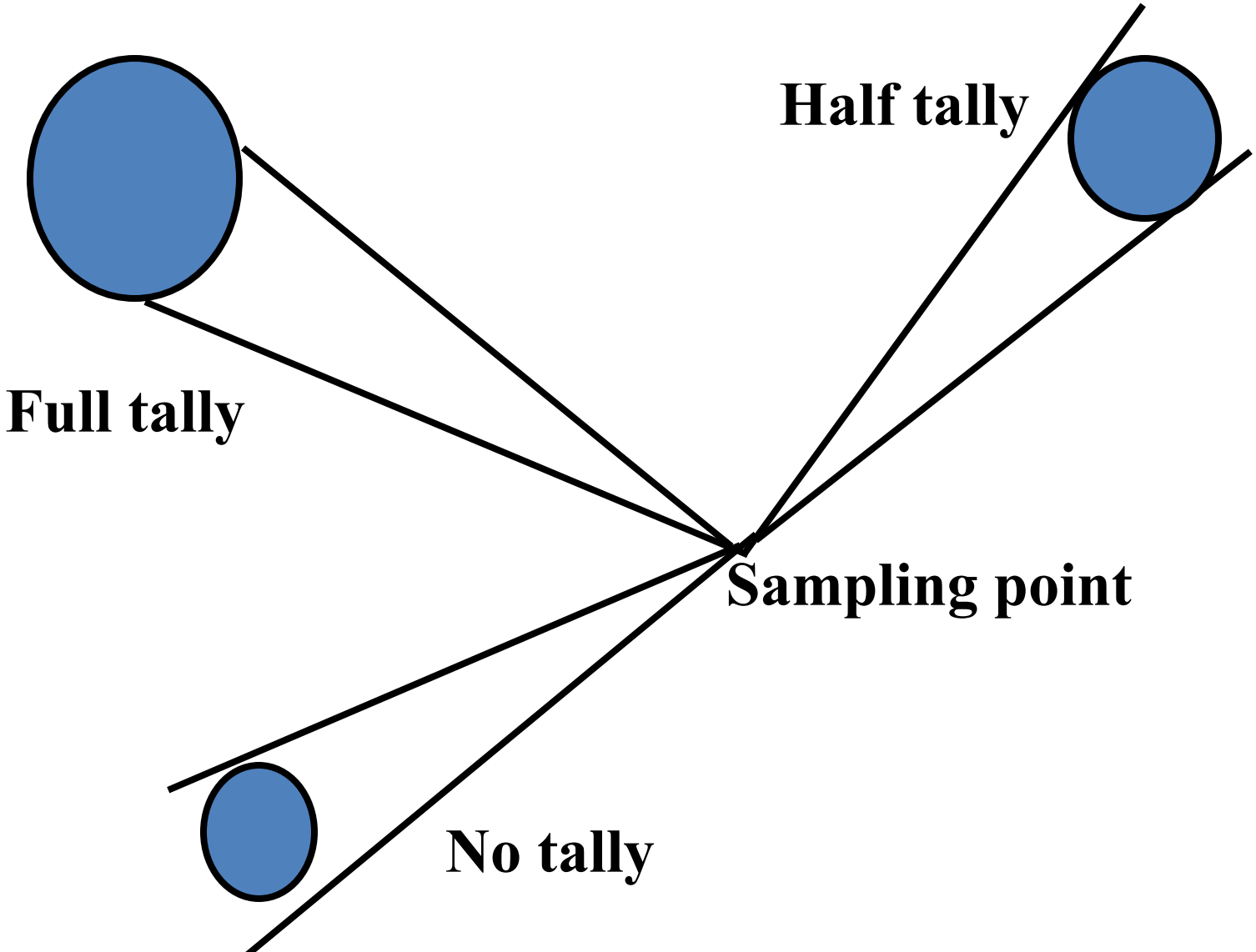
Types of Point Sampling

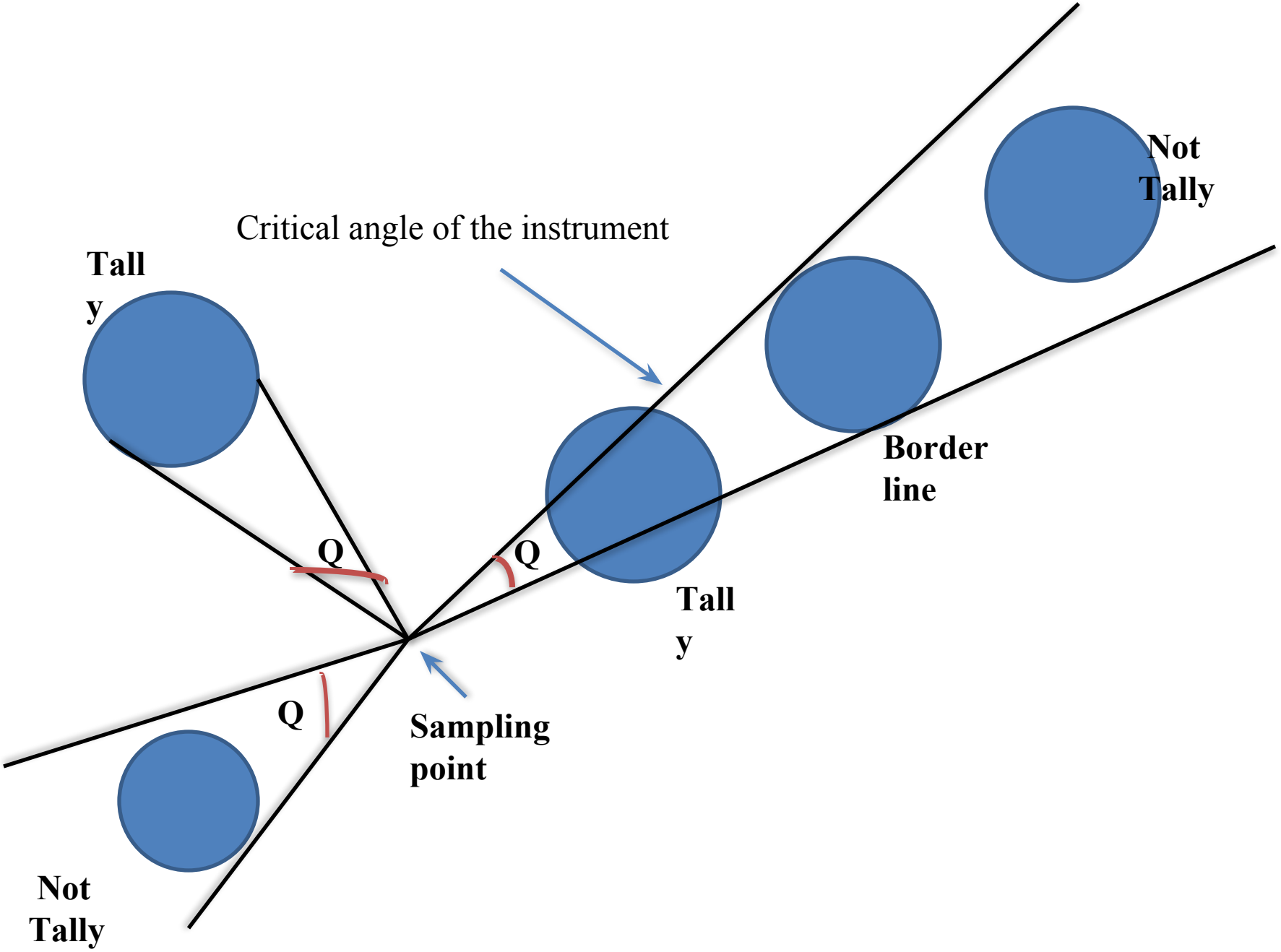
- Horizontal Point Sampling
  - Basal area is estimated
- Vertical Point Sampling
  - Height is estimated

<u>Horizontal Point Sampling</u>

- Sampling points selected either randomly or systematically

SELECTION OF TREES




Critical angle of the instrument
Tall
y
Not
Tally
Border
line
Q
Q
Tall
y
Q
Sampling
point
Not
Tally

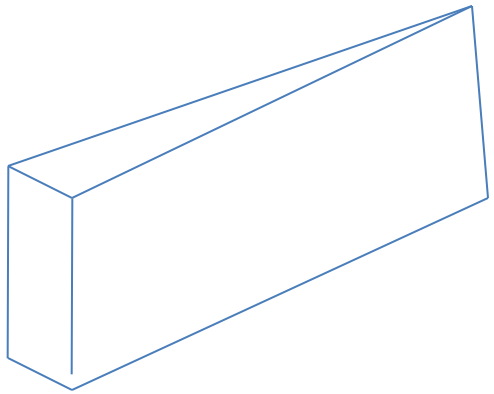
Horizontal Point Sampling

- Trees around the selected point viewed at breast height
- Trees forming an angle bigger than the critical angle are counted
- Tree tally depends on the **size of the tree, the critical angle & their distances from the point of observation**
- Number of trees tallied multiplied by a constant factor (basal area factor) gives the basal area per hectare.

Instrument used in Horizontal Point Sampling

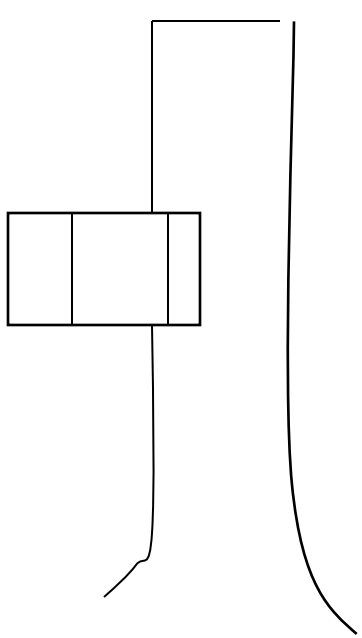
- Wedge Prism
  - Wedge shaped piece of glass
  - Rays of light passing through prism bent depending upon their critical angle
  - while standing , trees are viewed holding the wedge prism in hand
  - Prism to be kept in vertical position
    - Right angle to the line of sight
  - Breast height is then viewed through prism and directly from above it

WEDGE PRISM

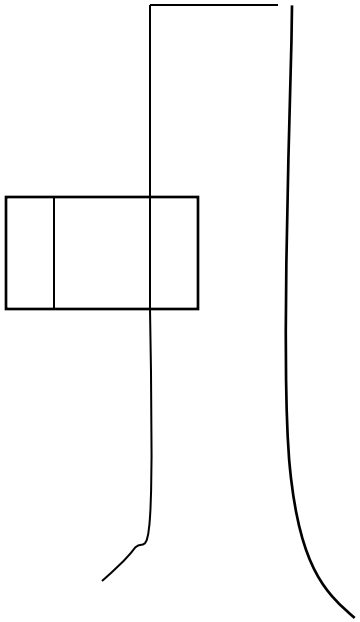


- Prism to be held precisely over the sample point
- full sweep of 360° is taken.
- Distance between the eye and the prism is immaterial

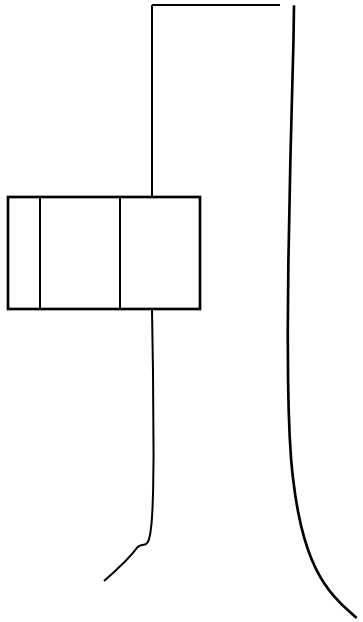
SELECTION OF TREES



In (tally)



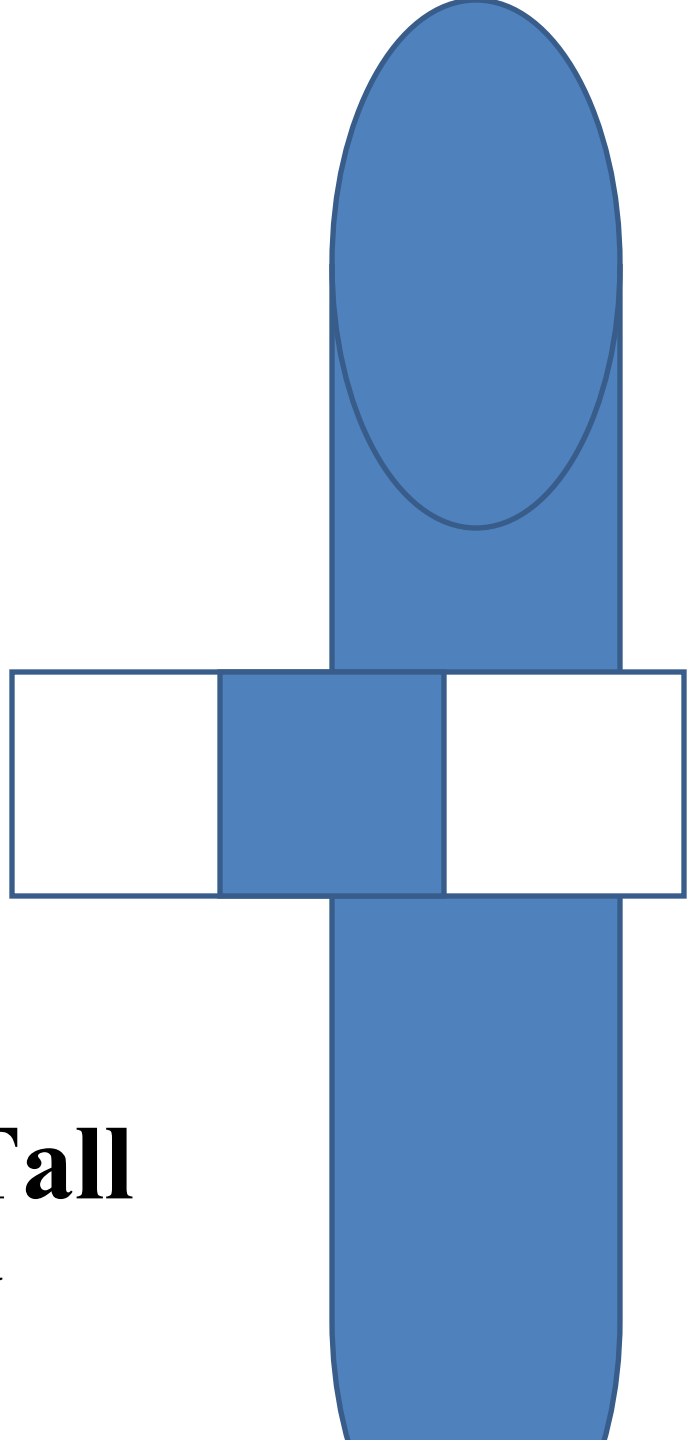
Border line



Out (non-tally)

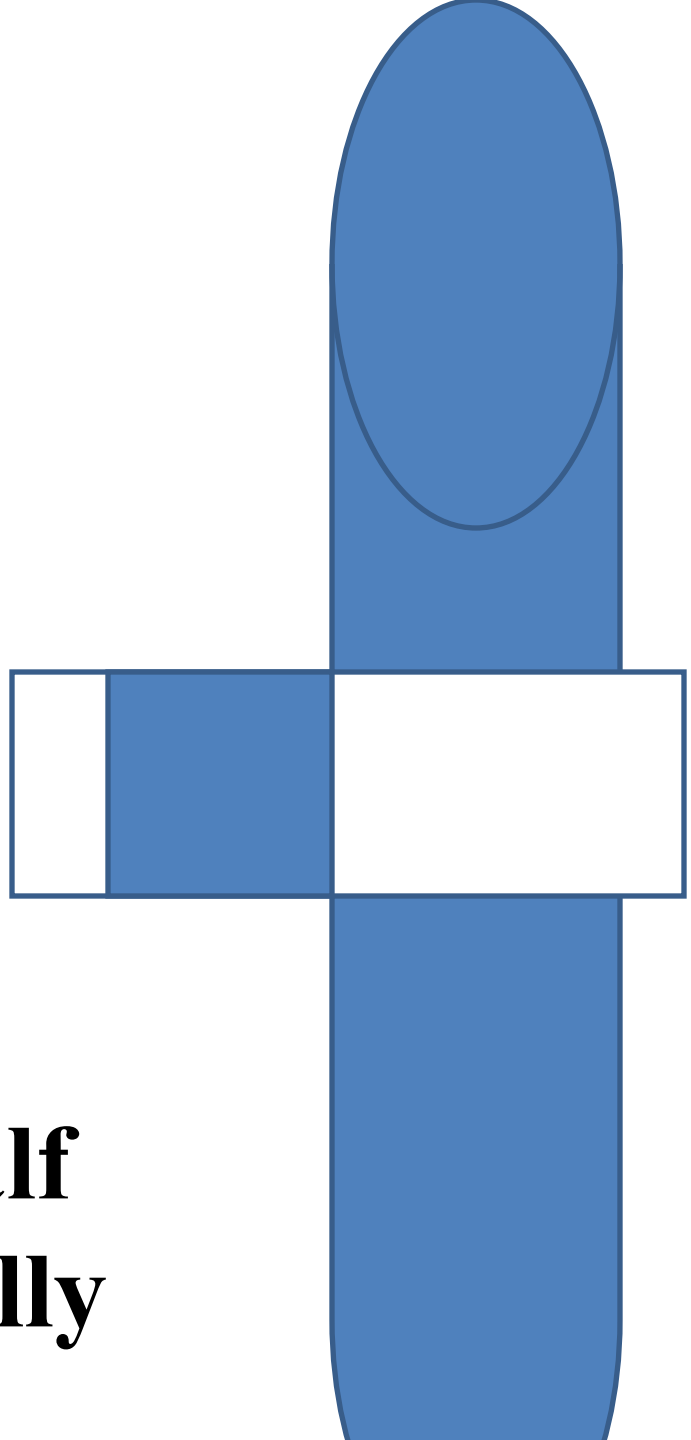
- **Image of trees follow following 3 conditions:**

1. **Overlap - Full Tally**
2. **Just touch - Half Tally**
3. **Separated from tree stem - No Tally**

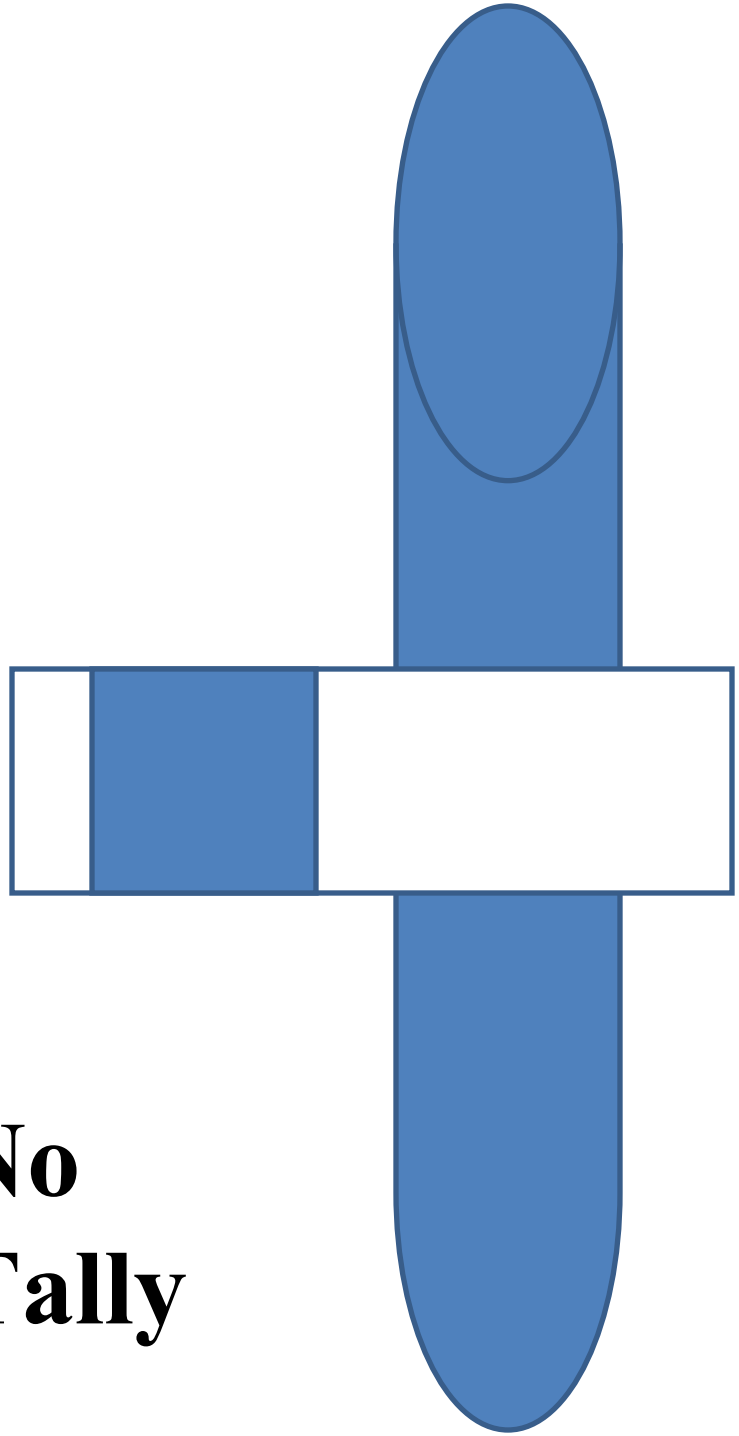


Tall

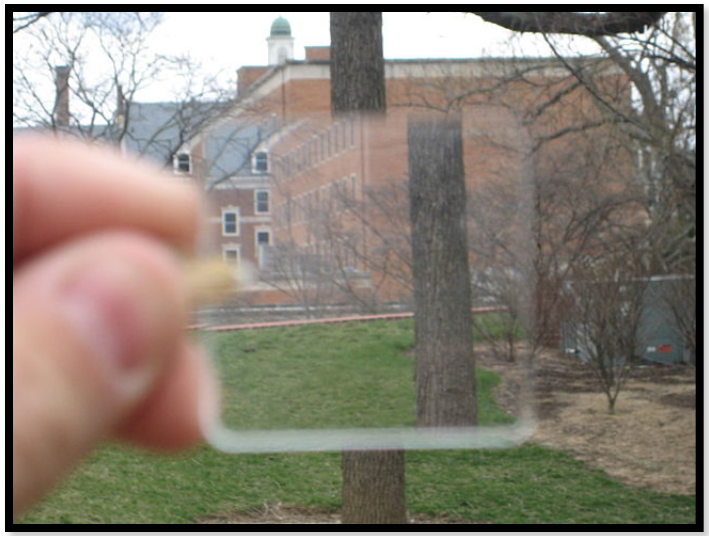
y



Half Tally



No Tally



Contd.

- Tree is viewed simultaneously through the prism and directly from over the prism.
- Trees tallied if the image overlaps the direct view - half tallied if the edges just coincide - ignored if there is a gap.
- The total number of tallies is averaged on the sample points - this multiplied by the basal area factor gives the basal area per ha.

- Full sweep of 360˚is taken
- Note all full and half Tallies
- Take reading at 2 -3 sample points
- Full tallies then counted as - 1
- Half tallies counted as - 0.5
- Total tallies multiplied with BAF to get BA per Ha

CAUTION

- Prism to be held vertically above the sample point.
- Each tree is sighted at the b.h. through the prism.
- Line of sight should be perpendicular to the prism
- The distance between the prism and the eye should be convenient.

- If the prism is not perpendicular to the line of sight it results in fewer tallies.
- If the prism is tilted in the vertical plane - too many tallies

Factors Affecting Accuracy

- Dense stands
  - Difficult sighting - a place higher than the breast height can be sighted - if it tallies then the tree is taken as tallied.
- Slope correction
  - Up to 15% not necessary
- Trees leaning to left or right - The Wedge Prism should be rotated so that the vertical axis of the prism is parallel to the axis of the leaning tree

DOUBTFUL TREES

- Missing (hidden) trees - The cruiser can sway from side to side.

- Double counting trees - Double counting to be avoided.

Computations from point sampling

1. Basal Area per ha / acre

   – No. of full tallying trees = n_1

   – No. of half tallying trees = n_2

   Therefore no. of tallies, $\mathbf{n = n_1 + (n_2/2)}$

   B.A. per ha = (n × B.A.F.)

2. No. of trees per ha

a) No of trees (stems) per ha

$$N = BAF \times (1/ \Sigma(BA)_i)$$

=(BAF of the prism / Total basal area of tally trees)

b) No. of trees per ha in a particular dia class

$$= \textbf{(no of trees) xBAF} \left[\frac{1}{\textbf{(Basal area of the mid-point of the dia class)}} \right]$$

(actually tallied in that class)

Volume per ha / acre

V = (B.A. per ha / acre) × (Stand Form Height)

General rules for point sampling

- BAF
  - Such that counts should be 10-12
- Natural Timber Stand
  - more than 30 points
- Even aged plantations
  - more than 20 points

No. of sampling points

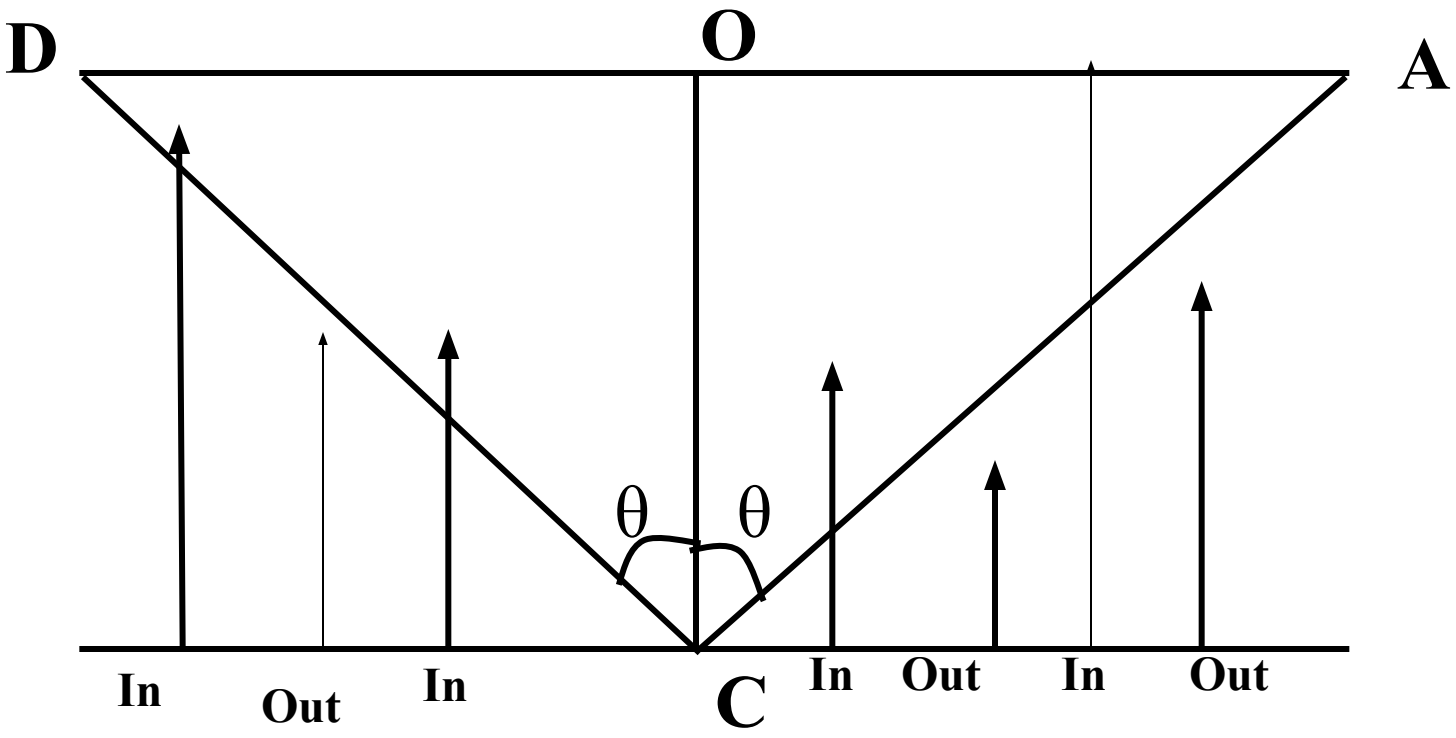
area in acres	No of points
< 10	10
11 - 40	1 per acre
41 - 80	20 + 0.5 (area in acres)
81 - 200	40 + 0.25 (area in acres)

Volume per ha / acre

- V = (B.A. per ha / acre) × (Stand Form Height)
- Basal Area is calculated as dealt earlier
- Stand form height is calculated by a sub sample method.
  - For this, one can use volume tables

Vertical Point Sampling

- Developed by Hirata (Japanese Forester)
- Helps determining the mean stand height



Contd.

- θ : critical angle
- AD :Dia of the area defined by the cone
- OC : limiting ht = h
- OA : limiting distance = OC tan θ
- n : no of trees tallying
- N : no of trees per ha

- The instrument is called as the Conimeter
- Area of base of cone having mean height h is $\pi(OA)^2$ = $\pi(h \tan \theta)^2$ m^2 = $\pi(h^2 \tan^2 \theta)/10000$ ha

Contd.

- If no of trees per ha are N then the no. of trees in this cone area = $N \times \pi(h^2 \tan^2 \theta) / 10000$
- If the no. of trees counted as n then

$$n = N \times \pi(h^2 \tan^2 \theta) / 10000$$

$$h = \sqrt{10000n/(\pi N \tan^2 \theta)}$$

$$h = (100/\tan \theta)\sqrt{n/\pi N}$$

If conimeter is so chosen that $\tan \theta = 1$

$$h = 56.4\sqrt{n/N}$$

– Eye level height is added to the h to get mean stand height

Advantages of Point Sampling

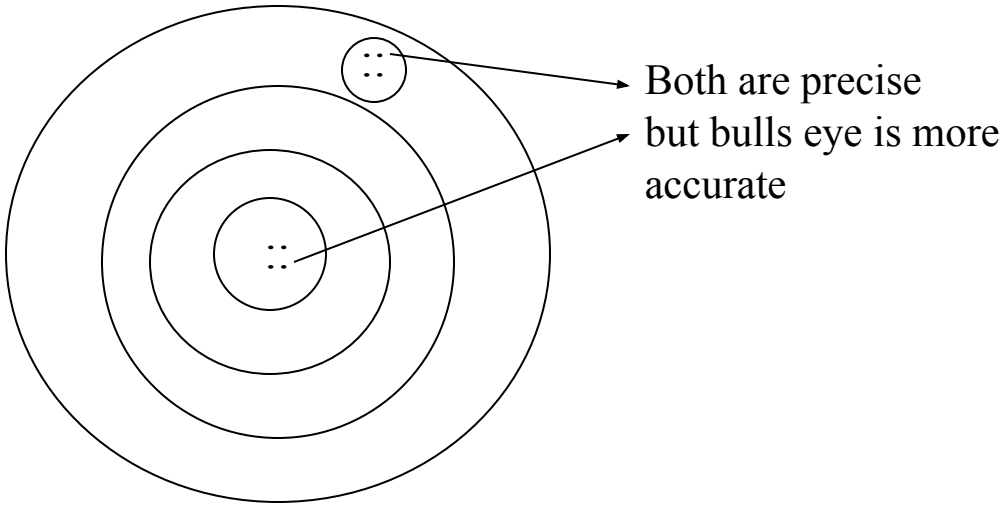
- No need to lay fixed area plots. Hence time saved.
- High value trees sampled in greater proportions.
- Basal area and volume per unit area derived without direct measurement of dia.
- Volume determination made in quick time - ideal for reconnaissance survey.

Limitations of Point Sampling

- Difficult to compute sampling intensity
- Heavy undergrowth reduces visibility -unsuitable for dense tropical rain forests.
- Skilled crew is required.
- Small error in tallying gets magnified.
- Slope compensation, edge effect, hidden trees, boundary over lap etc. have to be taken care of.

THANKS

■ Precision and Accuracy:



■ Statistically:

Accuracy- success of estimating the true value of a quantity

Precision- clustering of sample value about their own average

Bias Accuracy and Precision

- **Bias:** Bias is a systematic distortion.

  It may be due to

  - flaw in measurement
  - faulty method of selecting sample
  - faulty method of analysis.

- **How to check:** constantly monitoring instruments and techniques

(recheck)

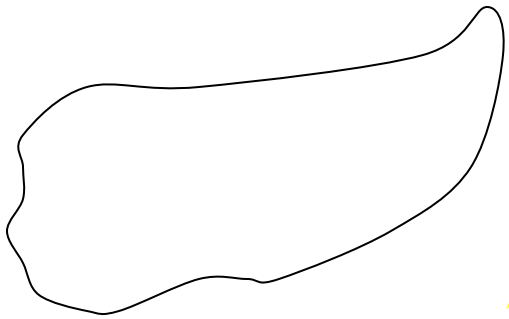
(training of staff)

Sampling Method for Continuous Variable

- Simple Random Sampling:

- Every possible combination of n units should have an equal chance of being selected.
- Selection of one units does not effect selection of another unit.
- How to do ?:
- Assign every unit a unique #
- Draw lots or generate random #
- Two cases possible
    - Sample without replacement
    - Sample with replacement.

- **Practical example:**



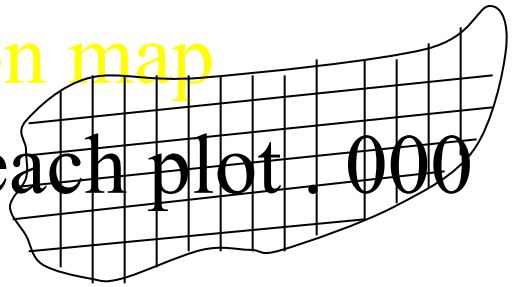
250 acre forest

- Object: get volume/ acre of trees in dia more than 5” dbh outside bark

- Sample size = 0.25 acre

a) Make 1000 equal div. on map

b) Assign no. 1 to 999 to each plot . 000 corresponds to 1000



c) Draw lot, or generate random no. measure the selected plot for required value (sample without replacement)

d) Now it becomes a population with no. of units in population = N = 1000

e) If 25 quarter acre plots are taken for sampling at random

- Each value of one plot is one unit,
- After selecting these 25 units; the sample size is now n = 25. We can get the standard error for simple random sampling

Cont…

$$S_{\bar{y}} = \sqrt{\frac{s_y^2}{n}\left(1 - \frac{n}{N}\right)}$$

Here $\left(1 - \frac{n}{N}\right)$ is also called as finite population correction (fpc) factor

n= # of units in sample

N= # of units in entire population

If sampling is done with replacement

Treated as infinite population and fpc taken as 1.

then

$$S_{\bar{y}} = \sqrt{\frac{s_y^2}{n}}$$

- **Note: For large Sample:**

  Confidence Interval for 95% prob. is –

  Estimate ±2 (Standard error of estimate)

here large sample

n>30

- **For Small Sample:** * Generally it is true that most of forest parameter follow normal distribution.

  * For such distributions students t can be calculated for C.I.

- In order to estimate ‘t’ two parameter are needed

  - degrees of freedom.

  - degree of certainty (probability level).

Cont….

Then C.I. = estimate ± t (S.E.)

C.I. = $x \pm t\, s_x$

Eg.

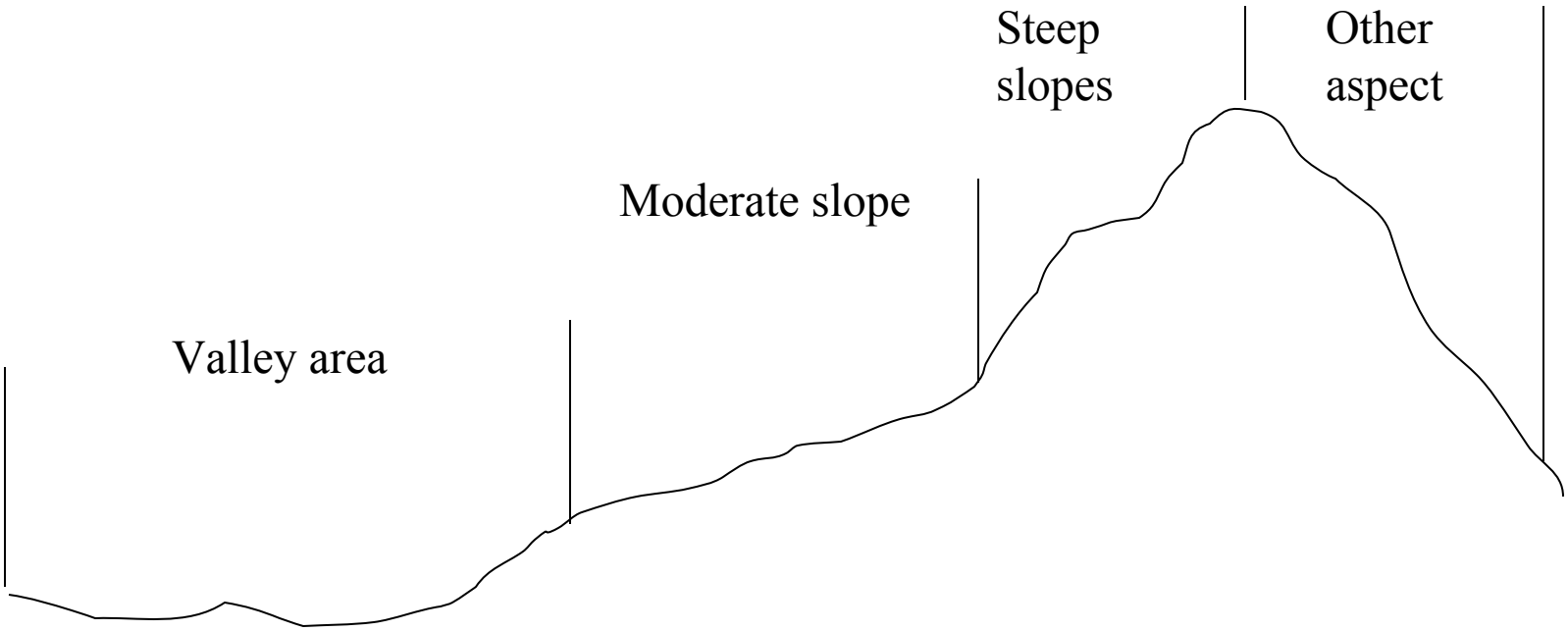
If volume measured in 25 plots of the previous example, we can get

1. Standard error of mean volume
2. Read ‘t’ against 24 df and 95 %
3. Then confidence interval per acre area basis can be calculated
4. C.I. = v + t (Standard error of mean volume)

- **Stratified Random Sampling:**

  - In this groups are made based on similarity of characteristics of units.

  - Variability within group should be less than the variability through out the population.



- **Points to be noted for S.R. Sampling**

1. Each unit in the pop. can be assigned to only one strata.
2. Lack of knowledge of size of each strata is a barrier.

- **Sample Allocation in S.R.S.:**
  - Proportional allocation
    - Units allocated in proportion to area of the stratas
  - Optimum allocation
    - Units allocated in such a way as to minimise standard error
  - Optimum Allocation with Varying Sampling Cost
    - Units allocated in such a way to minimise standard error and taking in to account the different costs of sampling in each strata.

Thank you