Intro to Point Sampling

FOR 372
March 30, 2023
Elliot Shannon

Point Sampling Basics:

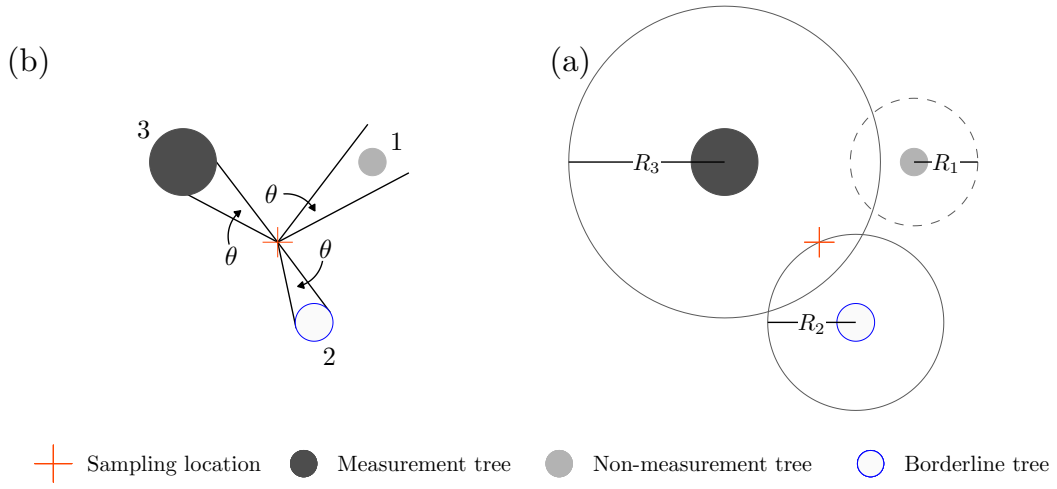
- similar to plot sampling

- a rule for selecting measurement trees around a sampling location

- commonly used in timber cruises due to ease of use (match level of effort with inference)

- unlike plot sampling, there is no physical plot boundary

- instead, each tree has its own inclusion zone based on some measurement (e.g. DBH or height)

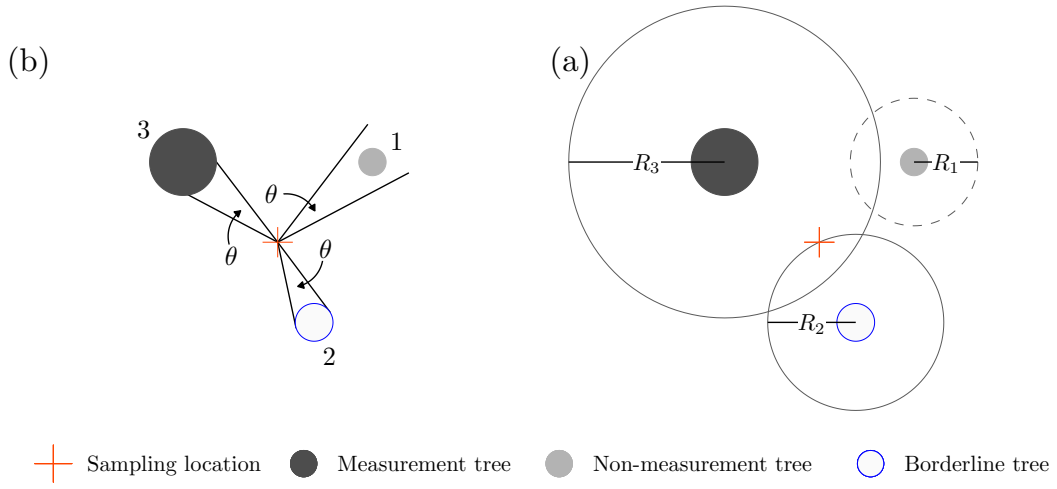


Why we use point sampling:

- we are usually interested in stand value, which is typically concentrated in large trees

- large trees are measured more often than small trees

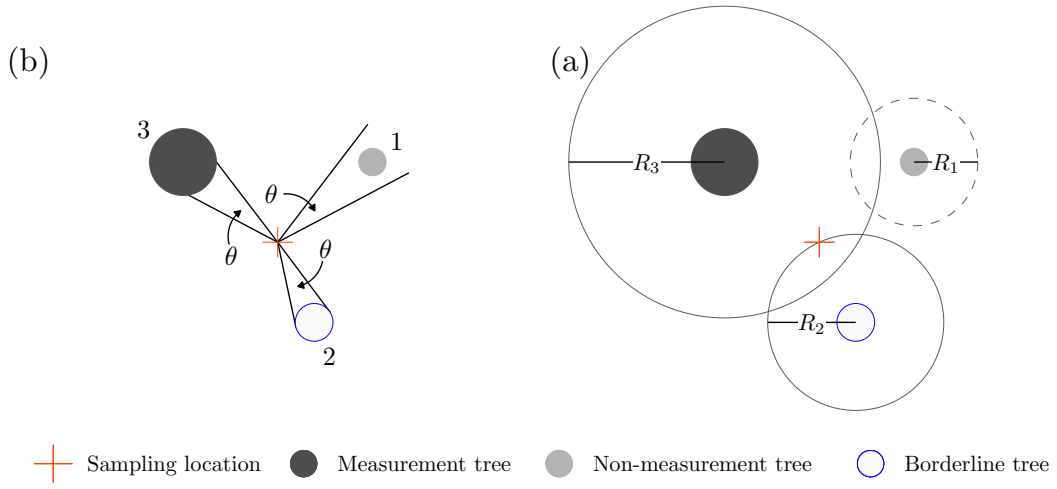
- in horizontal point sampling, selection probability is based on a tree's basal area



How it works:

- forester stands at sampling location and projects a known and fixed angle θ towards each tree's bole at breast height

θ > tree bole	*not* measured
θ = tree bole	borderline tree
θ < tree bole	measured



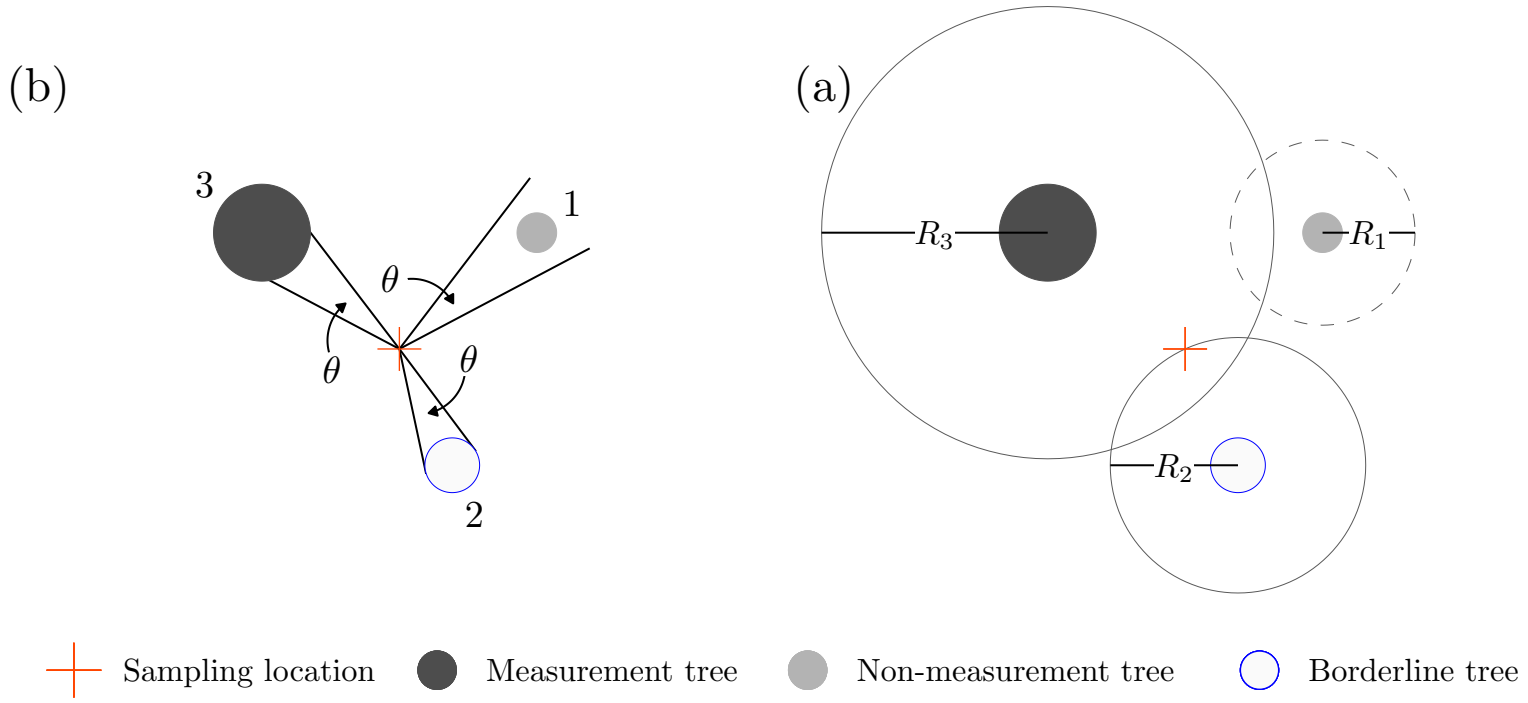
- "measure" can mean tally, take DBH, etc.

Angle Guage

Relascope

Wedge Prism

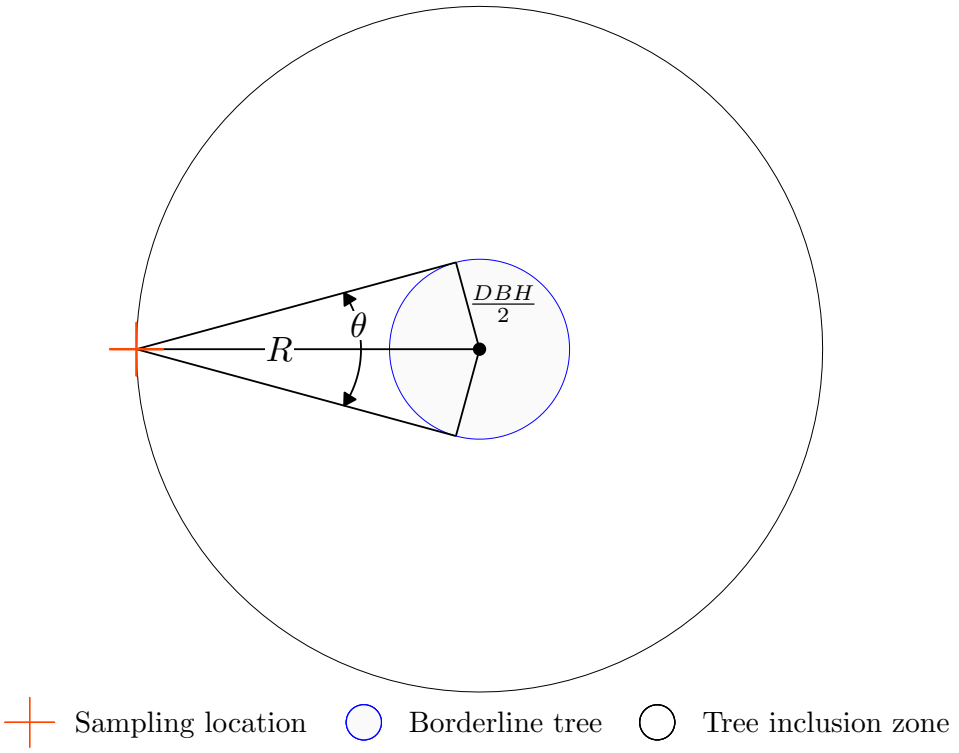
- R_1 R_2 and R_3 are referred to as limiting distances



- Borderline trees have limiting distance equal to the distance to the sampling location

- If we can’t tell if a tree should be measured, we must take additional measurements and calculate limiting distance by hand (otherwise we could introduce bias)

- If borderline tree was smaller or farther away, it would not be measured



- For fixed angle θ, the ratio between a trees DBH and its inclusion zone radius R is:

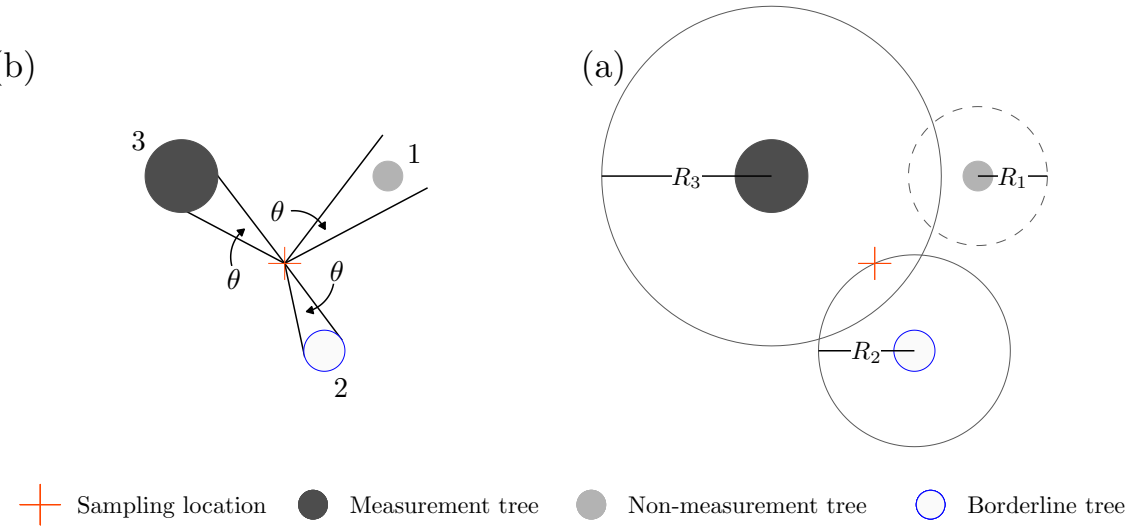
$$\text{constant } k = \frac{DBH\,(\text{in})}{12\,R\,(\text{ft})}$$

$$\text{constant } k = \frac{DBH\,(\text{cm})}{100\,R\,(\text{m})}$$

- regardless of system, $k = 2\sin\left(\frac{\theta}{2}\right)$

So $$\text{limiting distance } R = \frac{DBH\,(\text{in})}{12\,k\,(\text{ft})}$$

$$\text{limiting distance } R = \frac{DBH\,(\text{cm})}{100\,k\,(\text{m})}$$



- Since the inclusion zone for every tree is based on its size (e.g. DBH), each tree has its own expansion factor

- Recall that $TF = \dfrac{\text{target unit area}}{\text{inclusion zone area}}$

- For horizontal point sampling

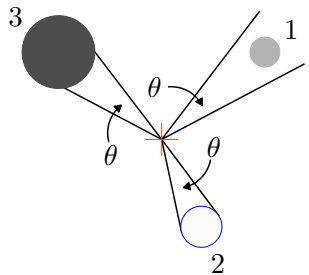
$$\text{inclusion zone area} = \pi R^2$$

$$\text{limiting distance } R = \frac{DBH\,(\text{in})}{12\,k\,(\text{ft})} = \frac{DBH\,(\text{cm})}{100\,k\,(\text{m})}$$

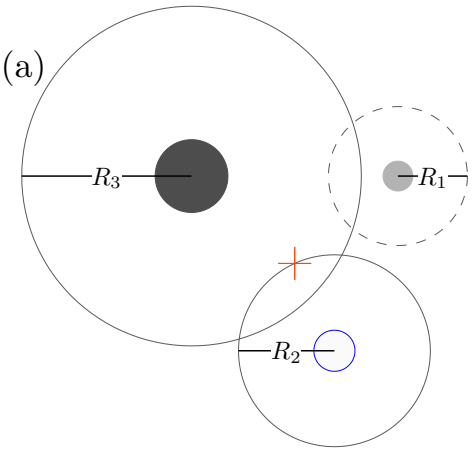
- So for a target unit area of 1 acre, we have $k = 2\sin\left(\frac{\theta}{2}\right)$

$$TF = \frac{\text{target unit area}}{\text{inclusion zone area}} = \frac{43560\ \text{sq. ft}}{\pi\left(DBH \big/ (12\,k)\right)^2} = \ldots = \frac{10890\,k^2}{BA}$$

(b)



(a)



Sampling location Measurement tree Non-measurement tree Borderline tree

$$TF = \frac{\text{target unit area}}{\text{inclusion zone area}} = \frac{43560 \text{ sq. ft}}{\pi \left(DBH / (12k) \right)^2} = \ldots = \frac{10890 k^2}{BA}$$

- And in metric, we have:

$$TF = \frac{\text{target unit area}}{\text{inclusion zone area}} = \frac{10000 \text{ sq. m}}{\pi \left(DBH / (100k) \right)^2} = \ldots = \frac{2500 k^2}{BA}$$

- And as before, we can use this expansion factor for a single tree to give us an expanded measurement, where

expanded measurement = individual measurement × *TF*

Now you try, *we are interested in measurements per acre*, and we are using an angle guage with θ = 0.35 radians (20°):

What is the TF for a tree with a 10 inch DBH
a 40 inch DBH
a 95 inch DBH

$$TF = \frac{\text{target unit area}}{\text{inclusion zone area}} = \frac{43560 \text{ sq. ft}}{\pi \left(DBH / (12k) \right)^2} = \ldots = \frac{10890 k^2}{BA}$$

$$k = 2 \sin\left(\frac{\theta}{2}\right)$$

$$BA = 0.005454 \times DBH^2$$

$$TF = \frac{\text{target unit area}}{\text{inclusion zone area}} = \frac{10000 \text{ sq. m}}{\pi \left(DBH / (100k) \right)^2} = \ldots = \frac{2500 k^2}{BA}$$

Now you try, *we are interested in measurements per acre*, and we are using an angle guage with θ = 0.35 radians (20°):

What is the TF for a tree with a 10 inch DBH — 605.27
a 40 inch DBH — 37.83
a 95 inch DBH — 6.71

$$TF = \frac{\text{target unit area}}{\text{inclusion zone area}} = \frac{43560 \text{ sq. ft}}{\pi \left(DBH / (12k) \right)^2} = \ldots = \frac{10890 k^2}{BA}$$

$$k = 2 \sin\left(\frac{\theta}{2}\right)$$

$$BA = 0.005454 \times DBH^2$$

$$TF = \frac{\text{target unit area}}{\text{inclusion zone area}} = \frac{10000 \text{ sq. m}}{\pi \left(DBH / (100k) \right)^2} = \ldots = \frac{2500 k^2}{BA}$$