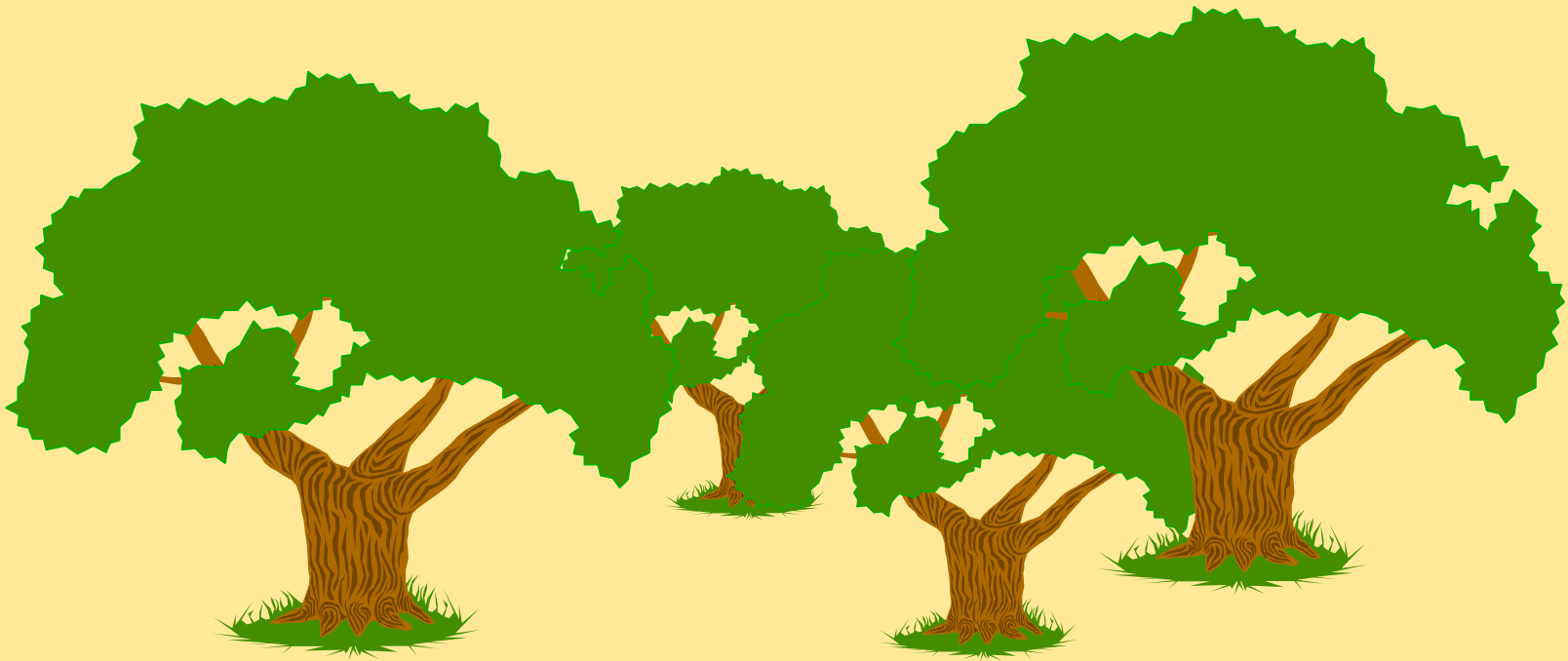


Variables for tree and stand description/characterization

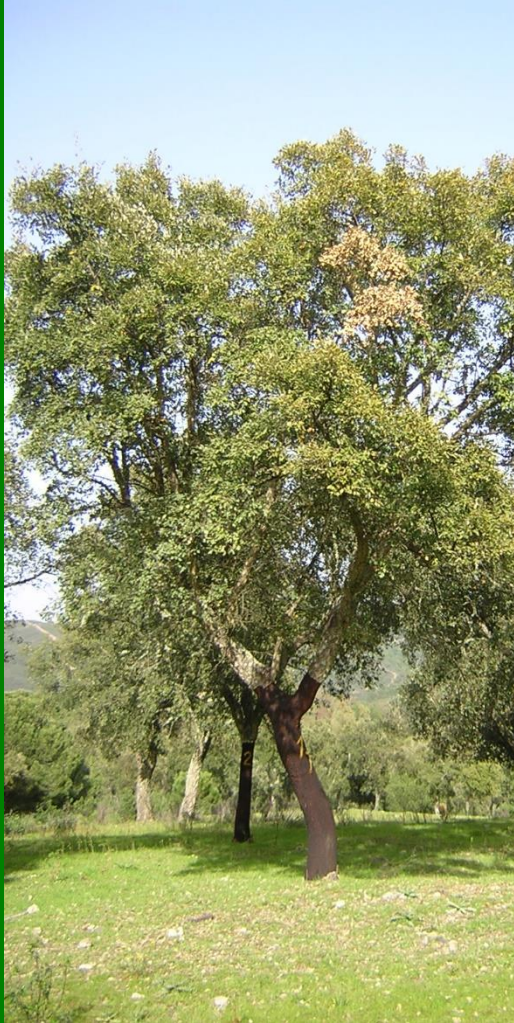
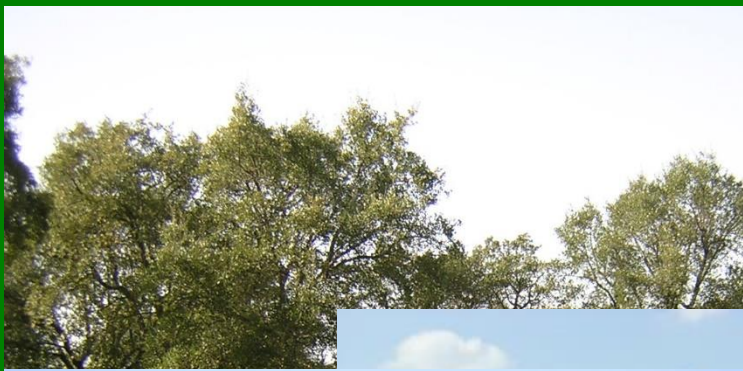


How to describe a stand?

How to describe a stand?

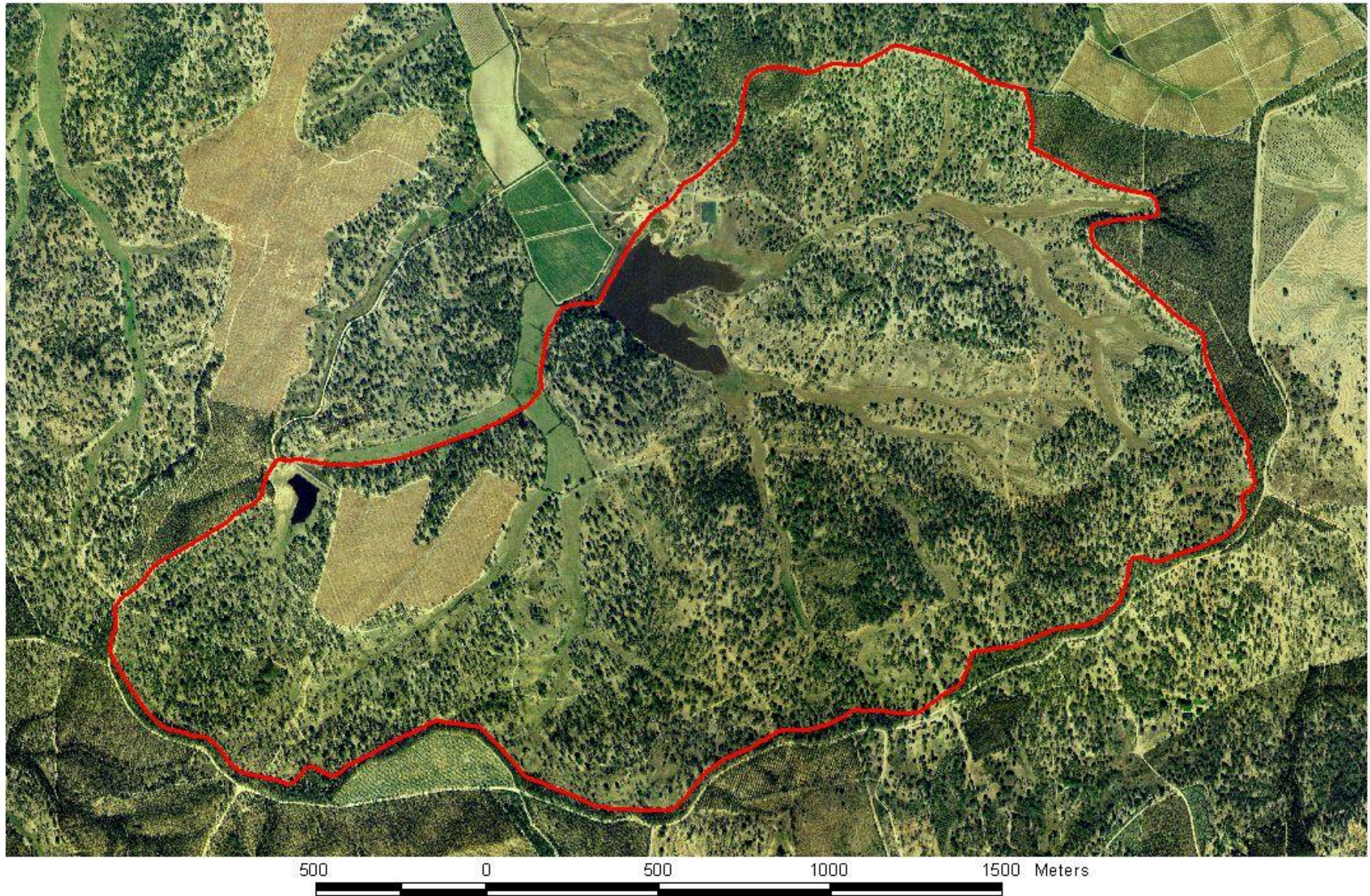
- For management purposes there is the need to describe each stand so that we can decide the silvicultural treatments that must be applied in the planning horizons
- How to do it?
- Let's look at some stands



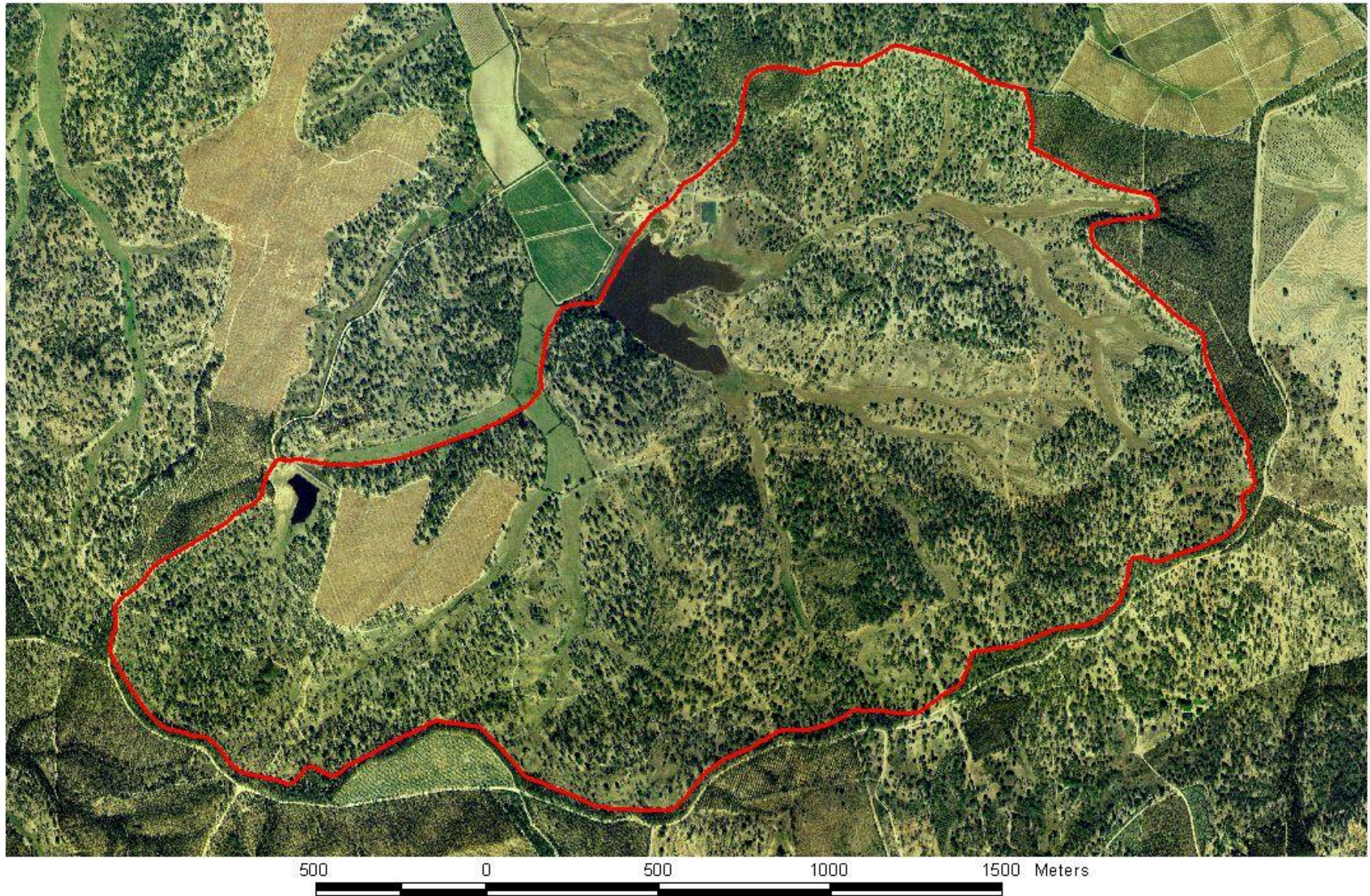


The need to sample

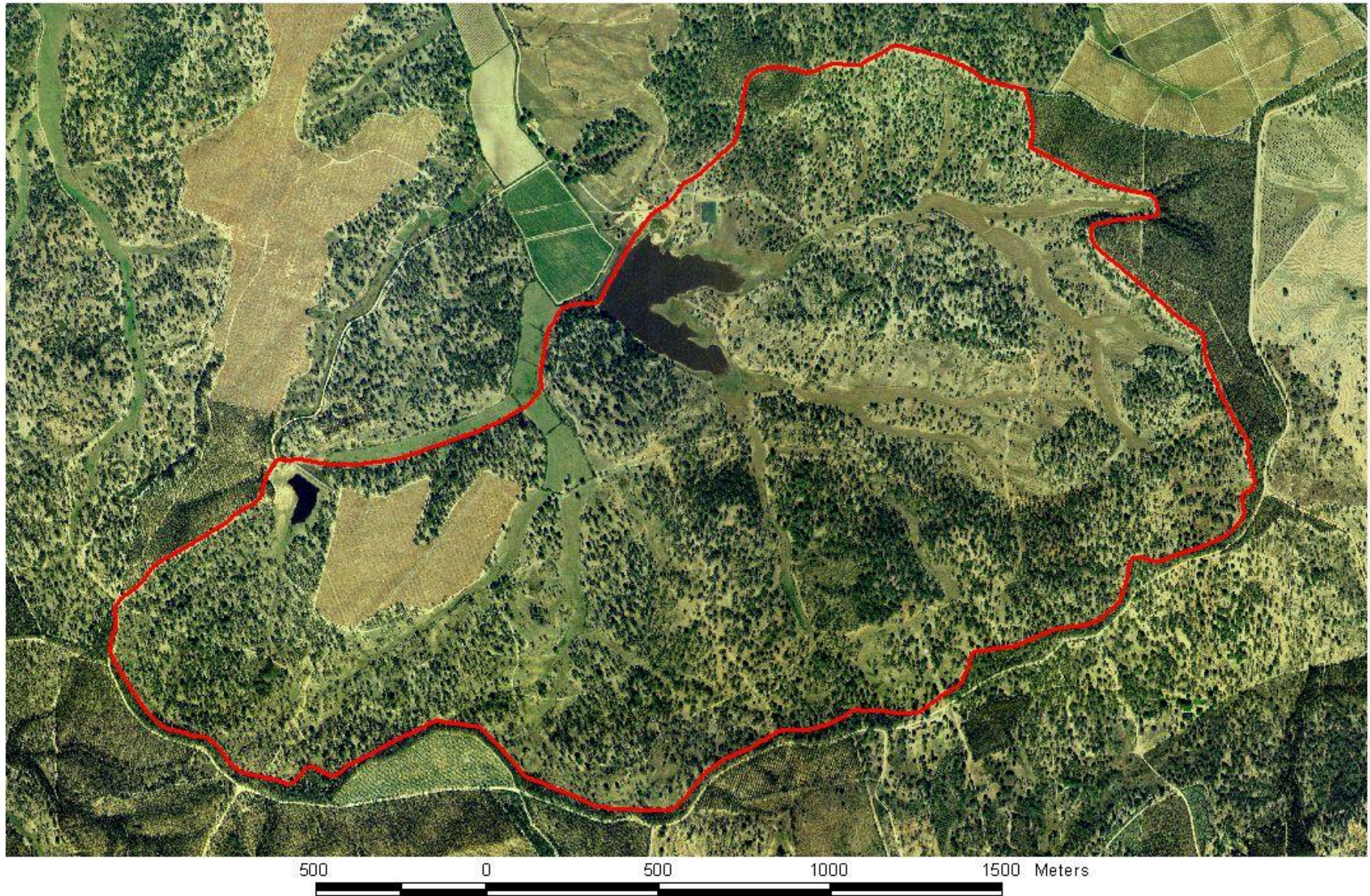
Consider the forest delimited in red



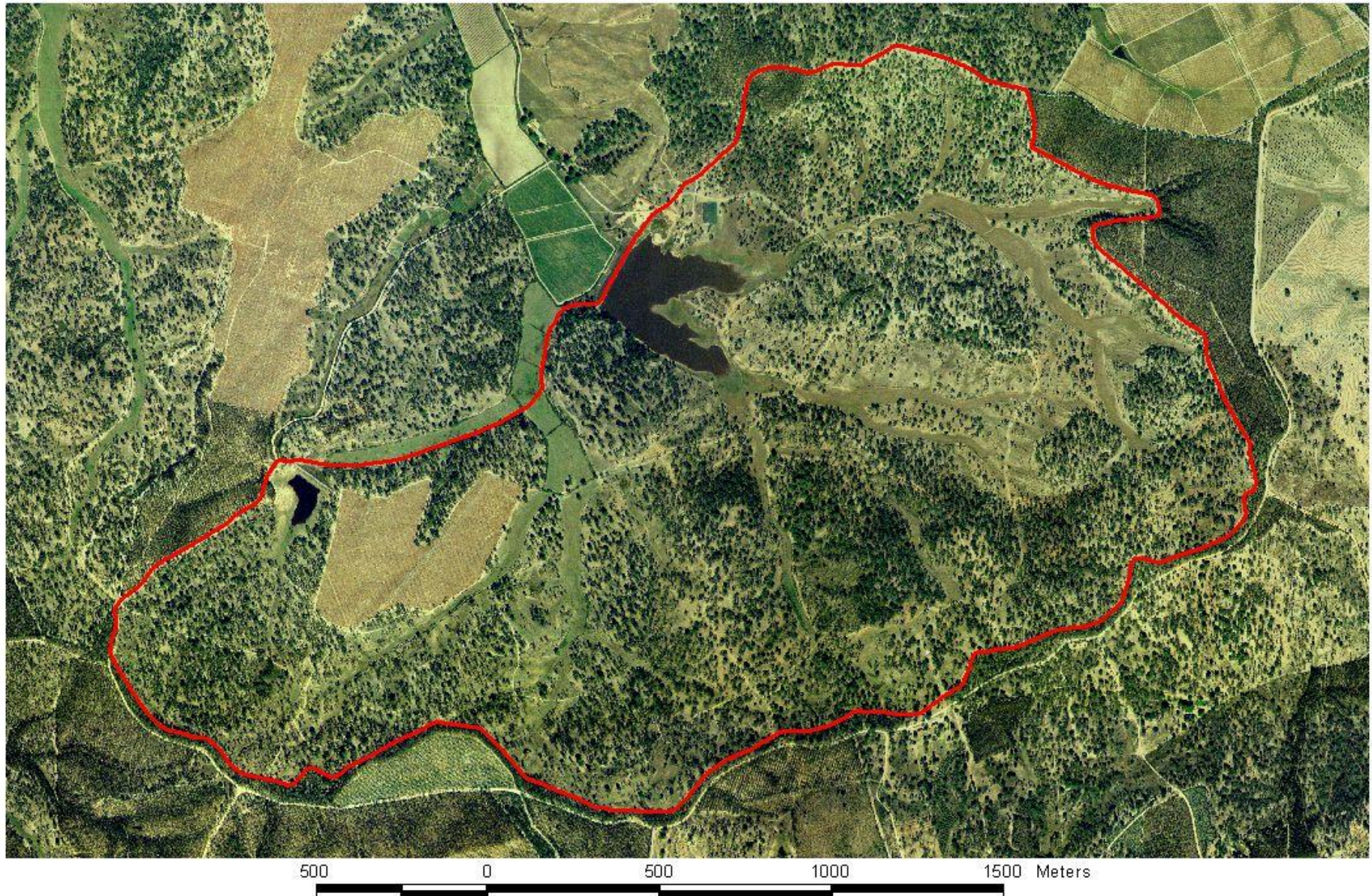
Can we measure every tree?



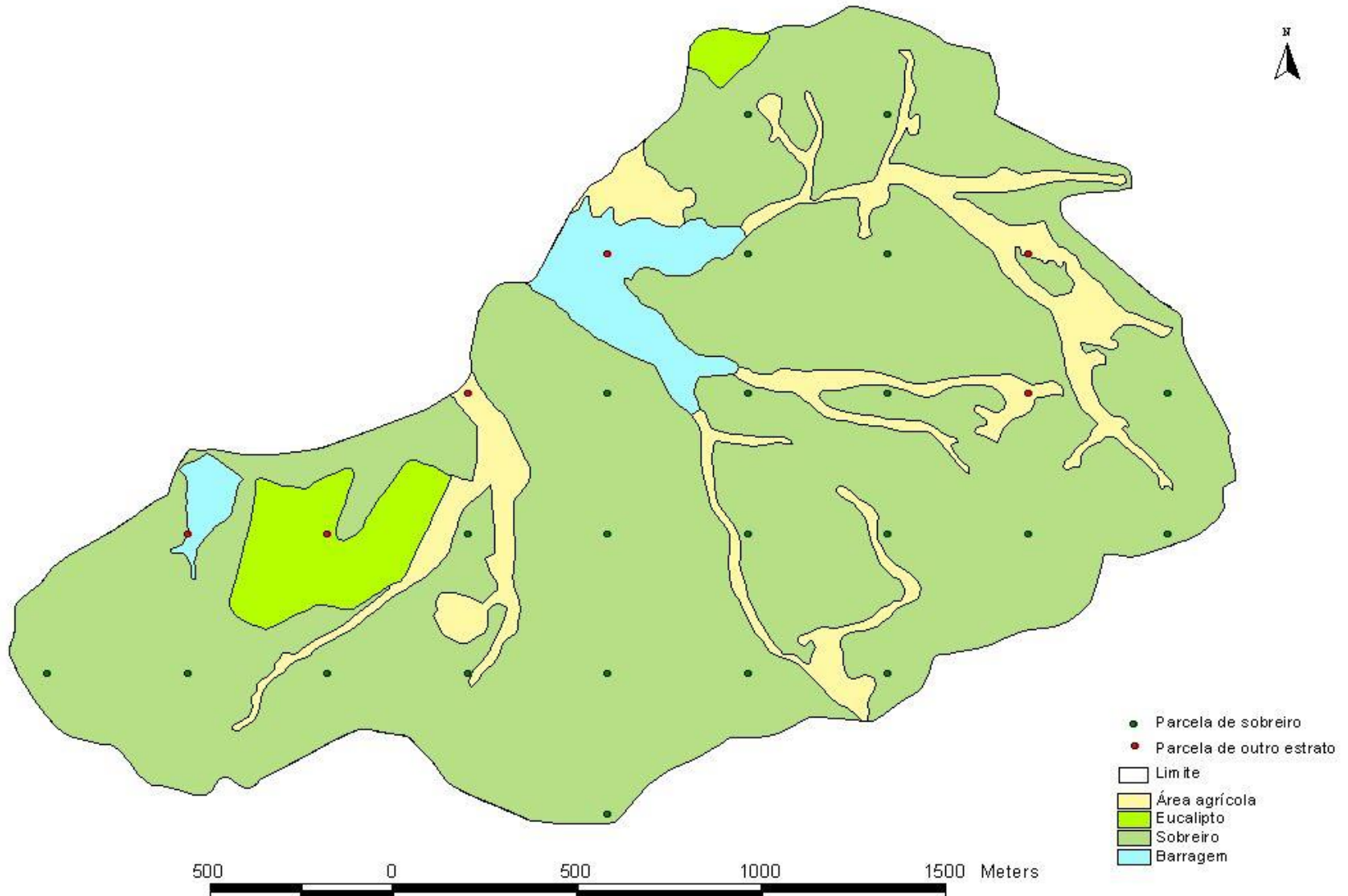
Of course not... there is the need to sample!



Is it easy to sample individual trees? NO!

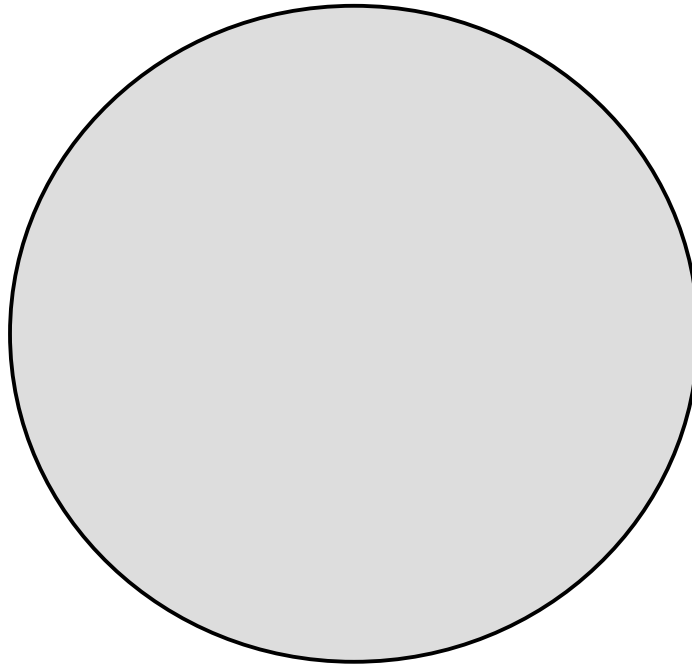


Sampling unit is usually the plot



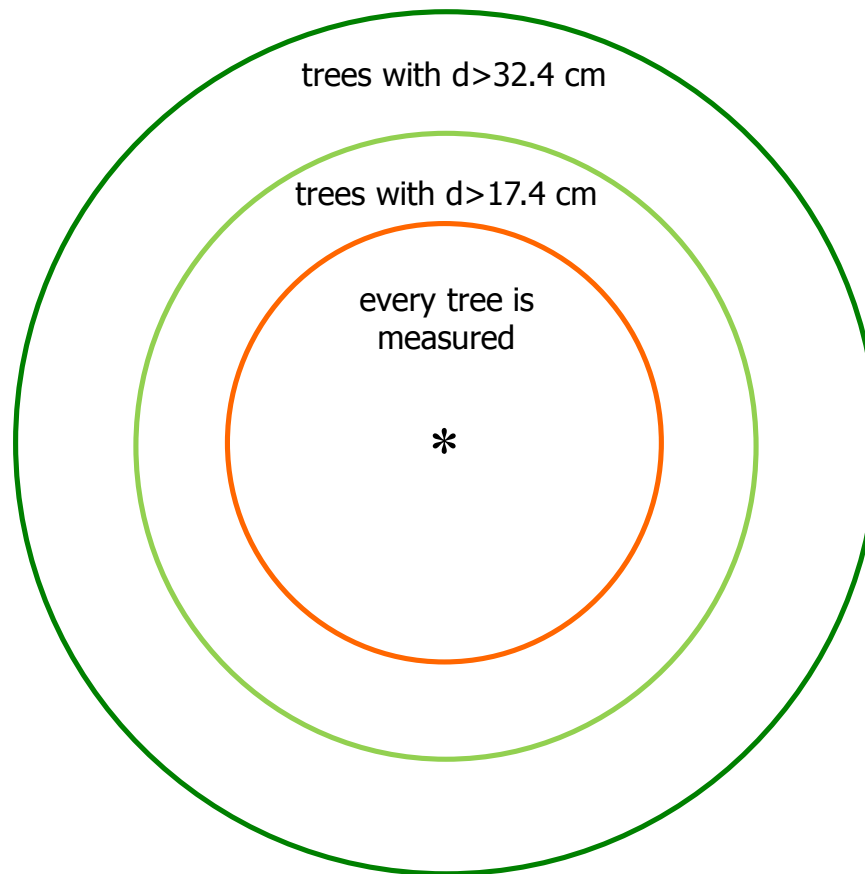
What is a plot?

- It is an area within the stand that is used to measure and evaluate tree and stand variables
- It can be a simple plot usually circular but other shapes are possible



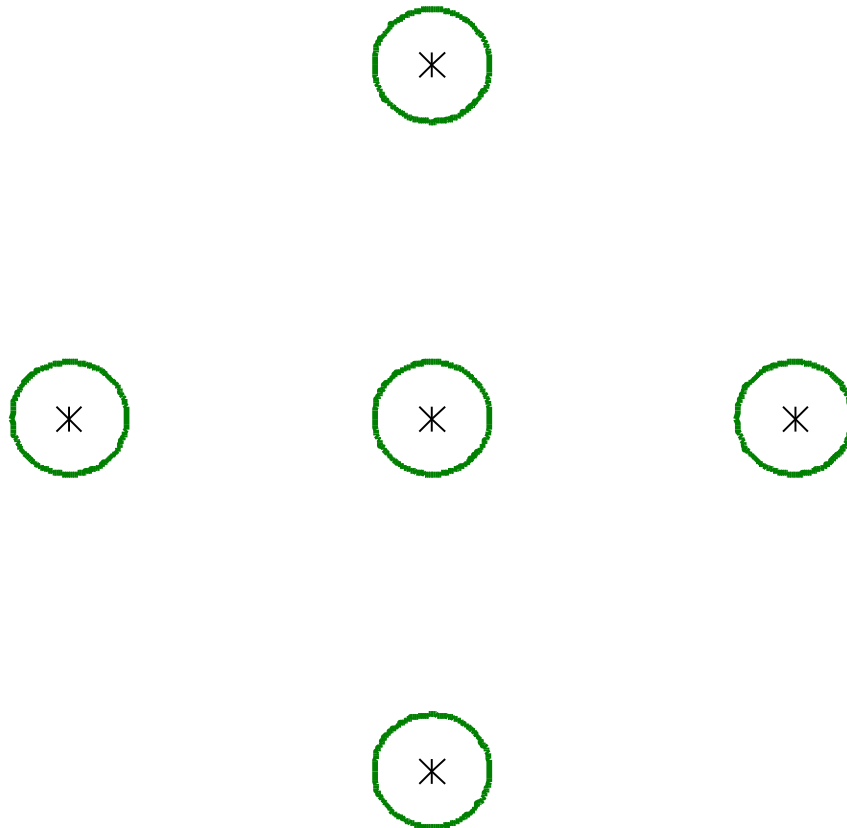
More complex plots

→ Combined or concentric plots



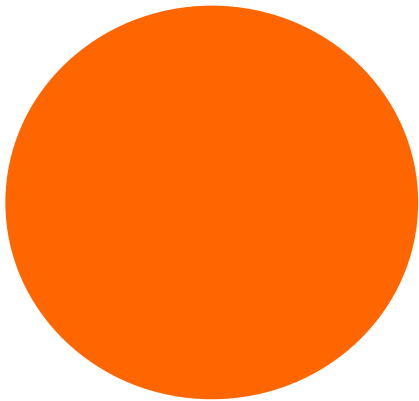
More complex plots

→ **Clustered plots**



Plot shapes

- The best shape is the one that minimizes the ratio border length/area → the circle
- Other shapes are sometimes used: square, rectangle, strips



What do we measure within the plots?

→ We can measure:

- ✓ Trees
- ✓ Shrubs
- ✓ Soil variables
- ✓ Wildlife
- ✓ ...

And how do we characterize the stand?

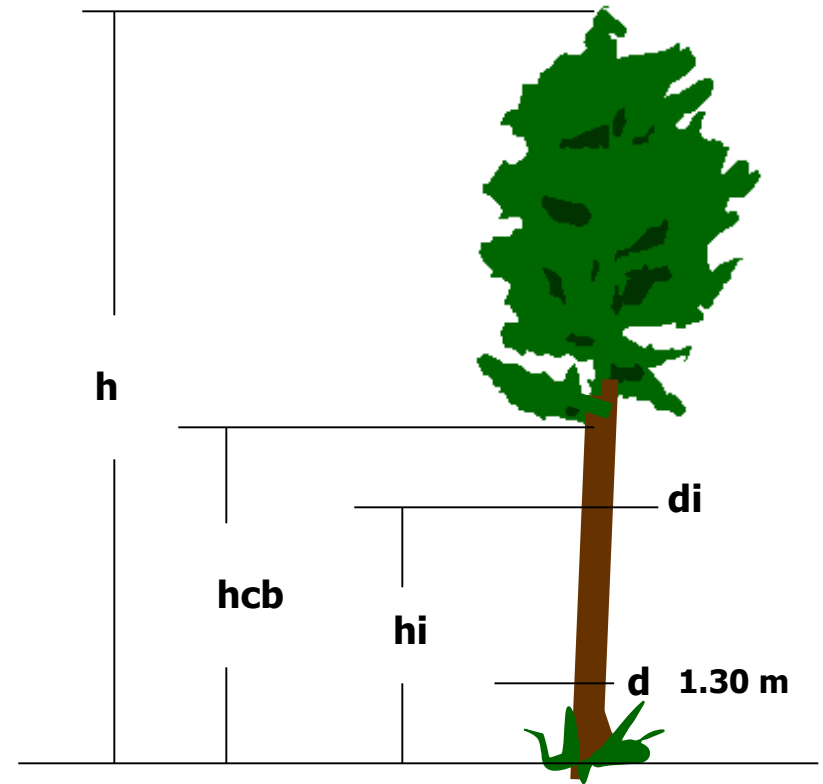
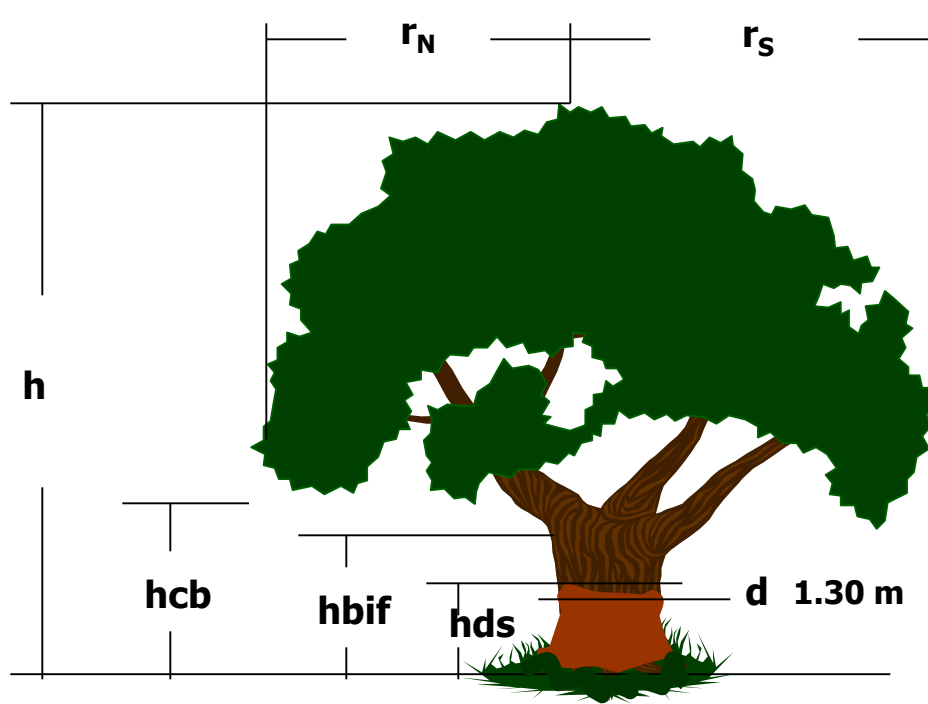
→ **By the tree variables themselves but mainly by summarizing them into stand variables:**

- ✓ Total biomass and biomass per tree component (leaves, branches, stems, roots)
- ✓ Standing volume
- ✓ Several indicators of sustainable forest management
- ✓ ...

Tree variables

Tree variables

Direct measurement

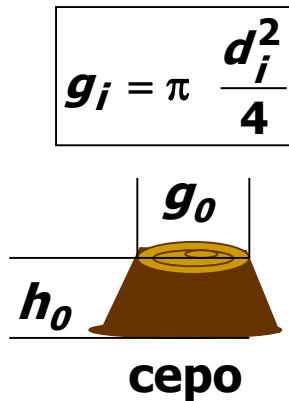


Tree variables

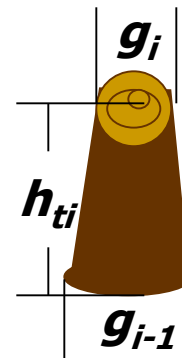
Indirect measurement

Volume da árvore

$$V = V_0 + \sum_{i=1}^n V_i + V_b$$

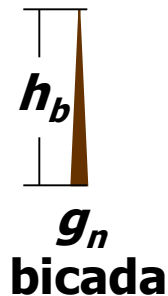


$$V_0 = g_0 h_0$$

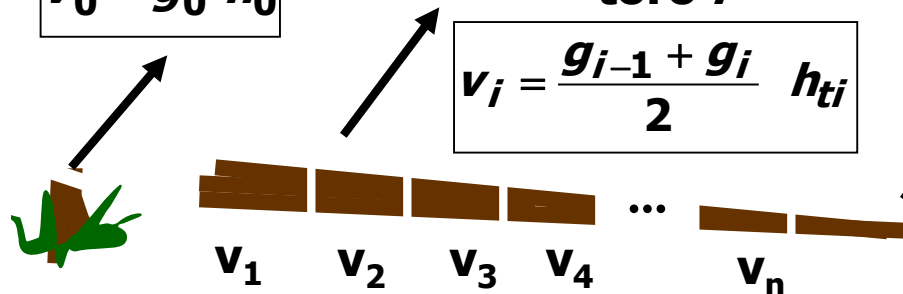


toro i

$$V_i = \frac{g_{i-1} + g_i}{2} h_{ti}$$



$$V_b = \frac{1}{3} g_n h_b$$



Tree variables

Estimation (prediction) with equations

The variables that are difficult (or time consuming) to measure are very often estimated with regression equations

For instance:

Tree height:

$$h = h_{dom} e^{\left(\frac{1}{d} - \frac{1}{d_{dom}} \right) \left(-2.713 - 0.207 h_{dom} + 0.0557 \frac{N}{1000} \right)}$$

Tree volume:

$$v = 3.739 \frac{d^{1.815}}{100000} h^{1.145}$$



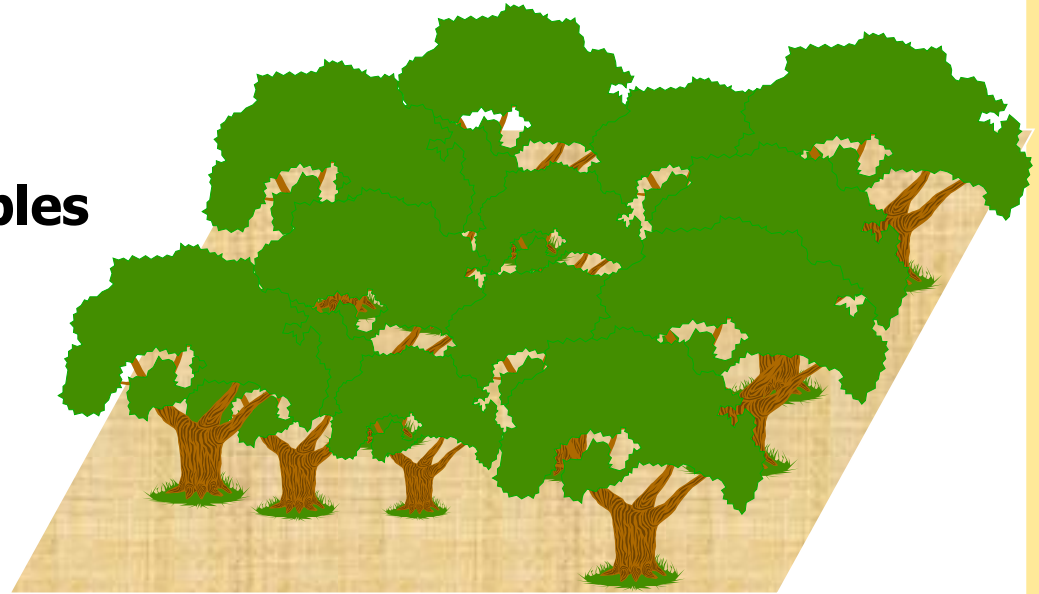
Stand variables

Stand variables

Stand variables are evaluated in plots with a fixed area

They can be:

- **area related**
(usually reported to the ha)
- **averages**
- **distributions of tree variables**



Stand variables- examples

→ Dominant height (h_{dom})

- ✓ Average of the trees with a larger dbh (100 ha^{-1})

→ Stand density ($N - \text{ha}^{-1}$)

- ✓ Number of trees alive per ha

→ Basal area ($G - \text{m}^2 \text{ ha}^{-1}$)

- ✓ Sum of the basal area (g) of all the trees within the plot

→ Total volume ($V - \text{m}^3 \text{ ha}^{-1}$)

- ✓ Sum of the volume (v) of all the trees within the plot

→ Total biomass ($W - \text{Mg ha}^{-1}$)

- ✓ Sum of the biomass (w) of all the trees within the plot

Stand variables

how to obtain them?

→ Measurement (direct or indirect)

- ✓ Of all the trees within the plot (d , sometimes h)
- ✓ Of sample trees (h)

→ Estimation (prediction) with regression equations developed at tree level

- ✓ For the non-sample trees

→ Estimation (prediction) with regression equations developed at stand level

Terminology for tree and stand variables

2nd version

[illegible]