The tree, the forest, mathematics and statistics

AGRON 590 MG: Crop-Soil Modeling

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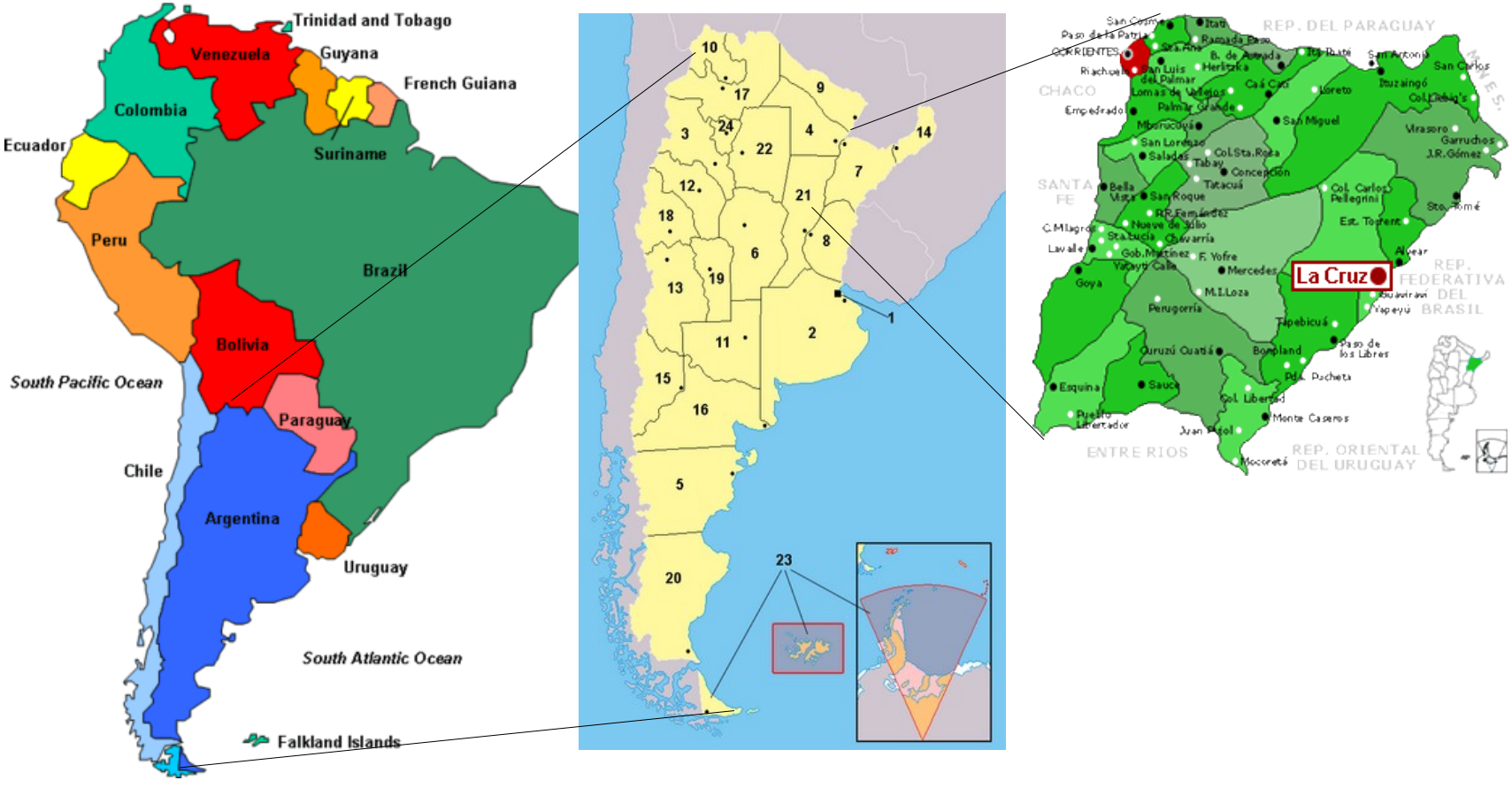
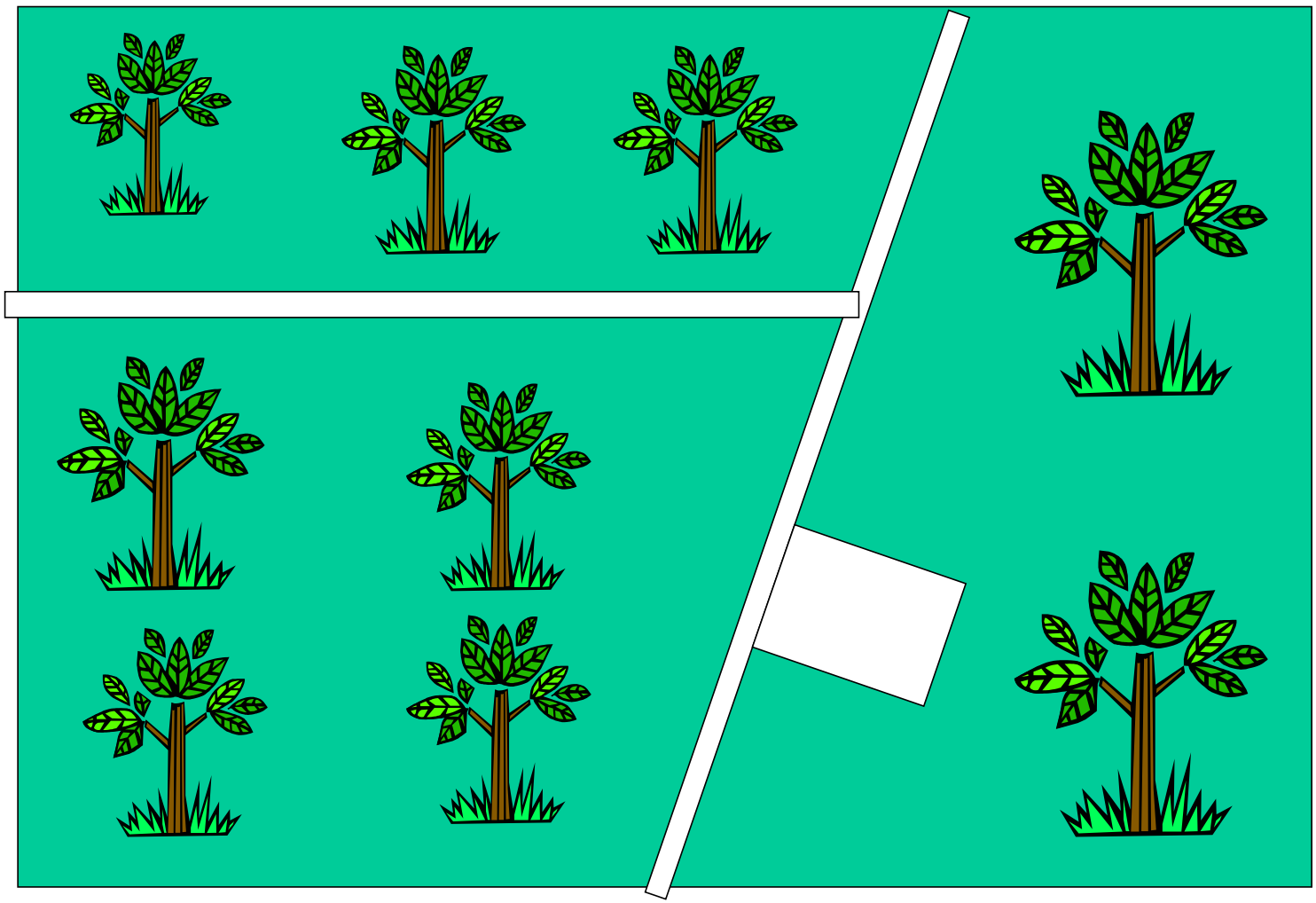
Aug 27, 2010

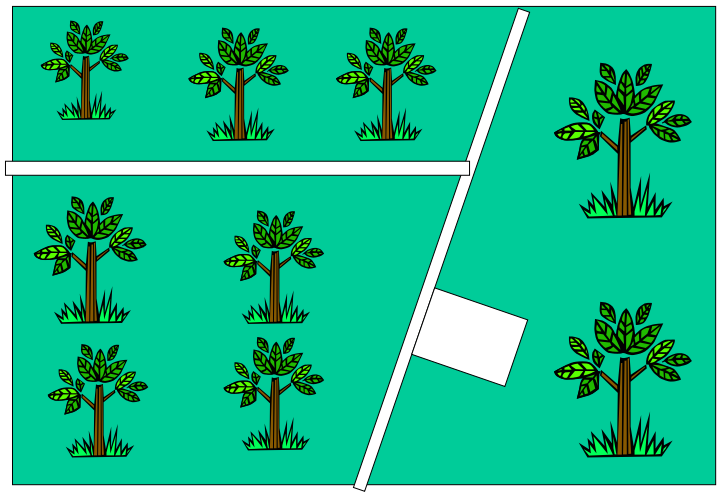
Santa Rosa, Corrientes, Argentina



Eucalyptus Plantation



Task: How much wood is there in the tree plantation?



Task: How much wood is there in the tree plantation?

Doing the math

- $W_v = N \cdot V$
- $V = height \cdot A_{base}$
- $A_{base} = \pi \cdot r^2$
- $d = 2 \cdot r$

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Measurment Device

Caliper

Task: How much wood is there in the tree plantation?

Doing the math. Some assumptions

- $W_v = N \cdot \overline{V}$
- $N = 1000$
- $\overline{V} = \overline{height} \cdot \overline{A_{base}}$
- $\overline{height} = 10m$
- $\overline{A_{base}} = \pi \cdot \overline{r}^2$
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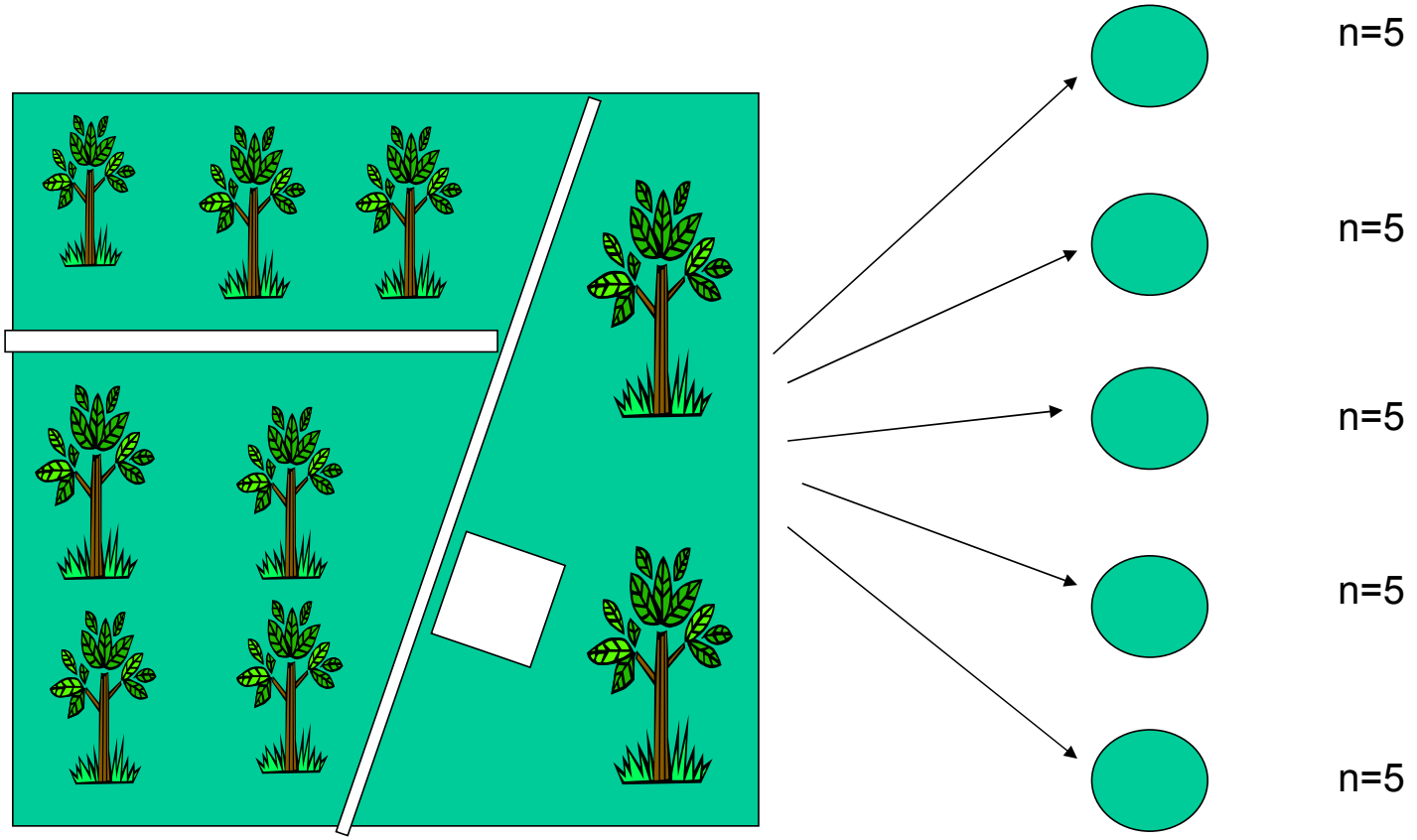
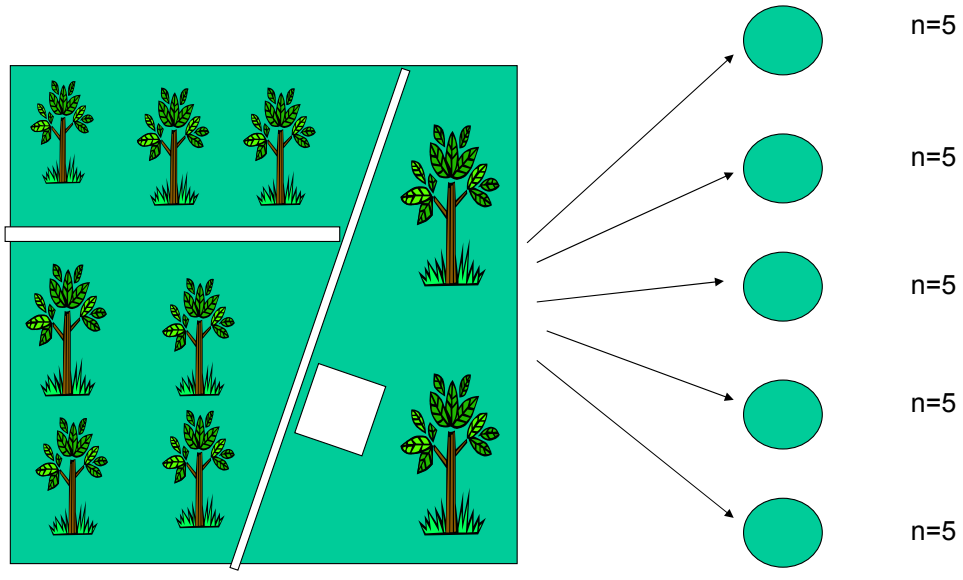
100 samples of size 5 each (or 5 tree diameters per sample)



Task: How much wood is there in the tree plantation?

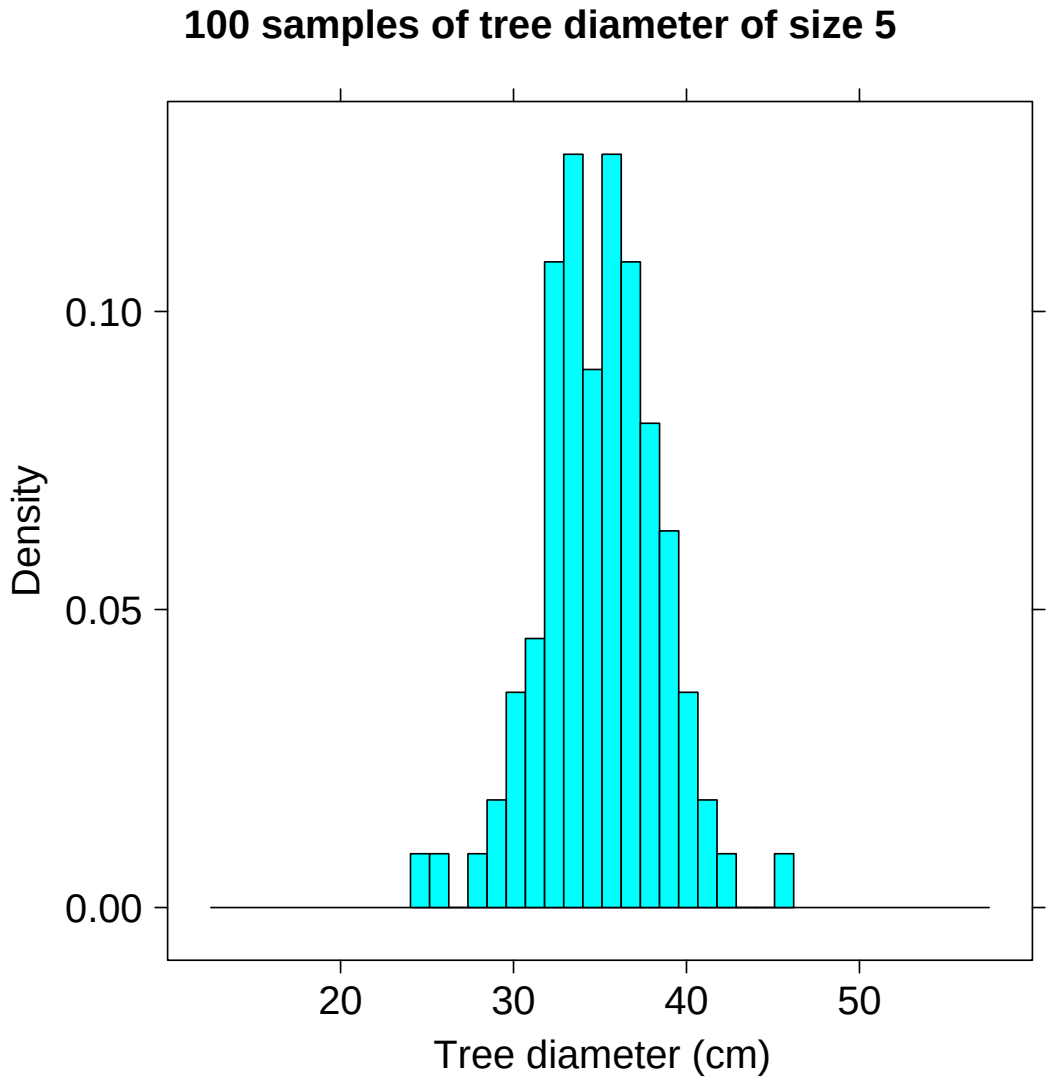
Sampling tree diameters on a computer




```
set.seed(1234)
x <- rnorm(500,35,7)
smpl <- rep(1:100,5)
tr.ag.m <- aggregate(x,
      by=list(smpl),mean)
histogram(x)
```

Task: How much wood is there in the tree plantation?

Using a histogram to see the results



Task: How much wood is there in the tree plantation?

Ready for total wood volume calculations

- Mean diameter of all the samples: $\overline{\overline{d}} = 34.8cm$
- Mean radius: $\overline{r} = \overline{\overline{d}}/2 = 17.4cm$
- Mean base area: $\overline{A_{base}} = \pi \cdot \overline{r}^2 = 951cm^2$
- Total Wood Volume:
  $W_v = N \cdot \overline{height} \cdot \overline{A_{base}} = 1000 \cdot 10m \cdot 0.0951m^2$
- Total Wood Volume: $W_v = 951m^3$

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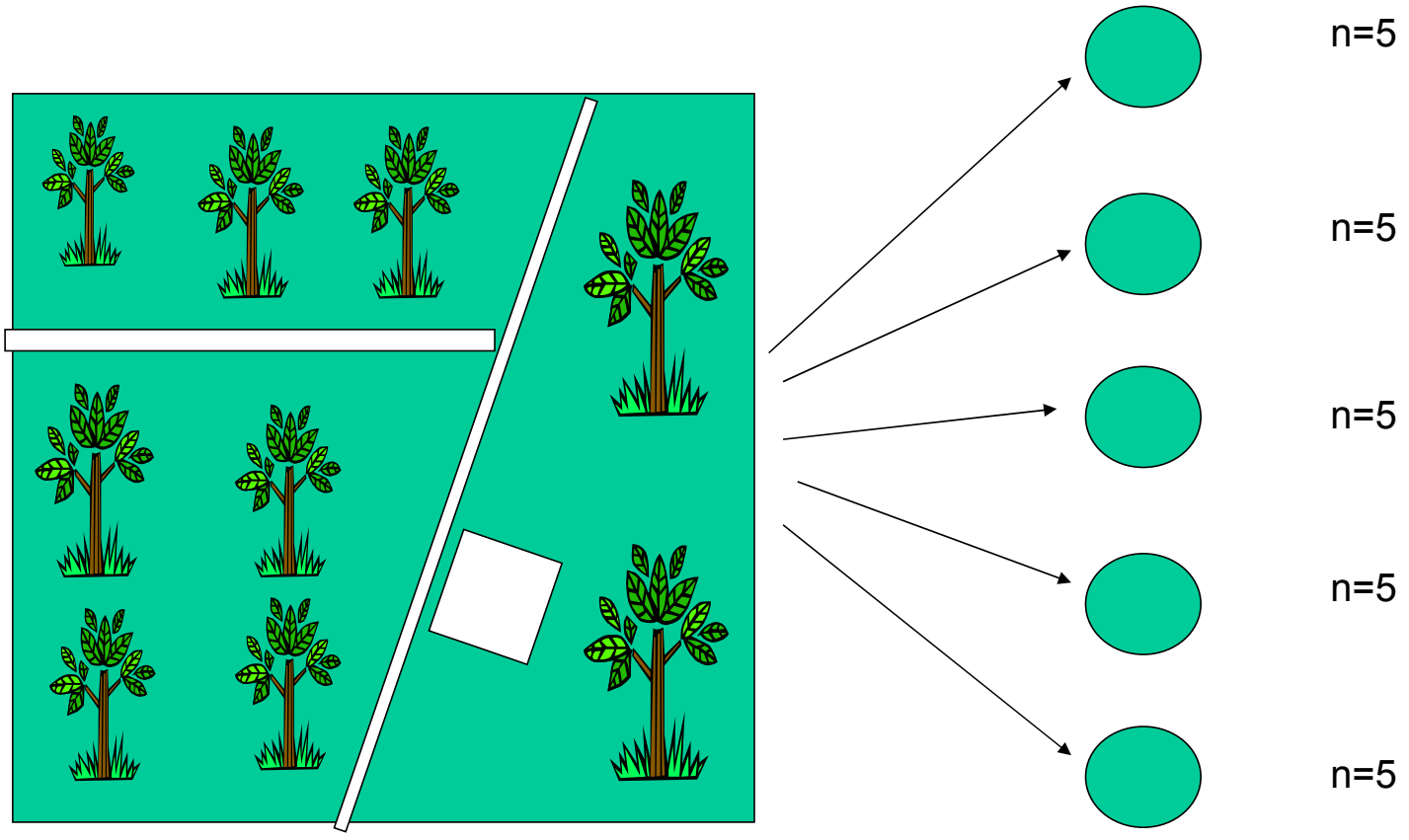
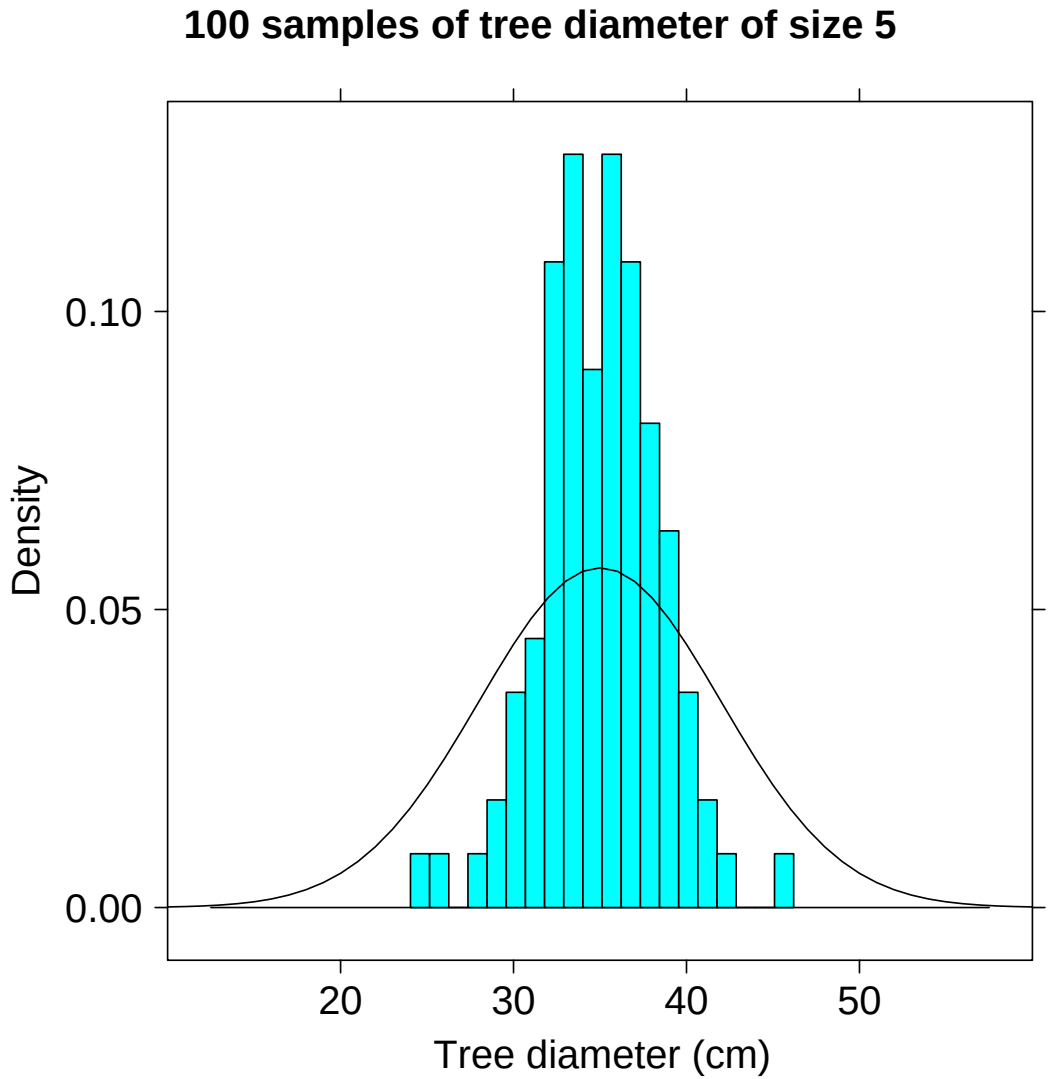
What would happen if we repeat the sampling?



What would happen if we sample all the trees?

Why is the population density more dispersed than the sample?



Some Theory

Population (all trees)

- $\mu = 35$
- $\sigma = 7$

Sampling distribution of means (random sample of trees)

- $\mu_{\overline{d}} = ?$
- $\sigma_{\overline{d}} = ?$

Some Theory

Sampling Distribution of the Mean

Population (all trees)

- $\mu = 35$
- $\sigma = 7$

Sampling distribution of means (random sample of size 5)

- The samples we collected $\overline{\overline{d}} = 34.8cm$
- The samples we collected $s_{\overline{\overline{d}}} = 3.29cm$

Summary

1. Approached a real life problem
2. Set up the problem in mathematical terms
3. We designed a sampling scheme
4. We used computer simulation
5. We solved the task (answered the question)
6. We inquired further into our methods

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Questions?