

## BIG ANNOUNCEMENT!

If you are interested in obtaining graduate level credit for this course, it is now available!

RS 332 and RS 532!  
Drop one, add the other.

## Graduate level **REQUIRED** reading!

Rick Karban and Mikaela Huntzinger.  
2006.

How to do Ecology:  
A Concise Handbook.  
Princeton University Press, Princeton, NJ.

## Graduate Level Assignment

Design, conduct, analyze, and submit written report on a monitoring project of our choice.

Due last day of class (October 14)

Guidance from Natural Areas  
Program personnel

## Rangeland Measurements & Monitoring

RS332 – 2007

Lectures 2-4:  
**Introduction to Vegetation Sampling**

## Lecture 2

Populations  
Sampling  
Accuracy and Precision  
Types of Error

## Sampling is:

- The process of selecting a part of something with the intent of showing the quality, style, or nature of the whole.
- Providing information about part of a **population** in such a way that **inferences** about the whole population may be made.

Elzinga pg. 61

## We sample because...

- Counting whole population is difficult or impossible
- Sampling can destroy objects of interest
- Sampling can give a more accurate estimate of the population than a complete census
  - Fewer measurements
  - More intense measurements
  - More accurate measurements

## Goals of Sampling

- Make reliable inferences about whole population by making measurements on a limited number of **sample units**.
- Determine an estimate of uncertainty associated with inferences.
- Minimize sample size while optimizing **accuracy** and **precision**.

## What is a population?

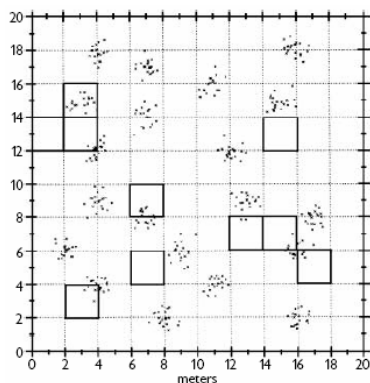
- **Biological population:** an interacting collection of organisms of the same species occupying a defined geographical area.
- **Statistical population:** the set of individual objects (**sample units**) about which you want to make inferences.

## What is a sample?

- A **sample** is a set of **sample units** on which you have made actual measurements/observations.

## What is a sample unit?

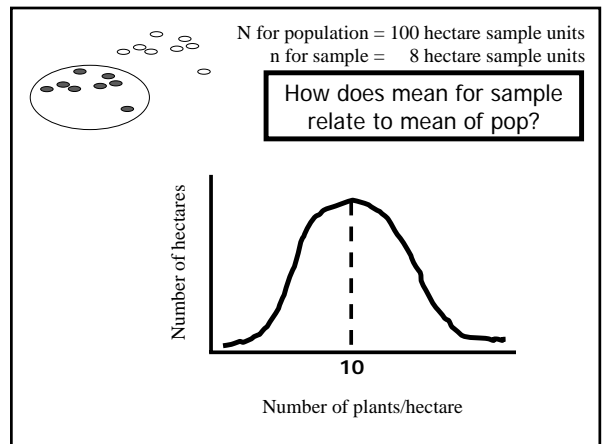
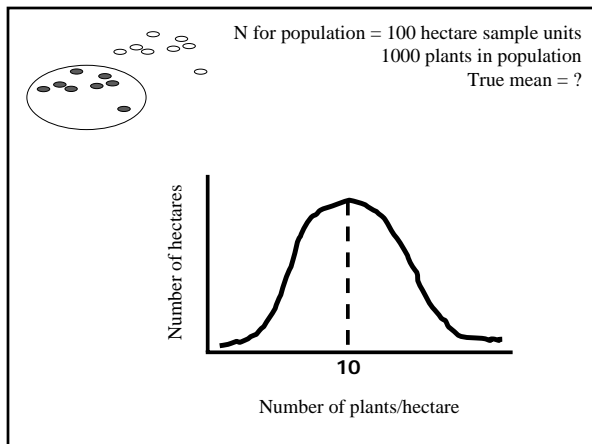
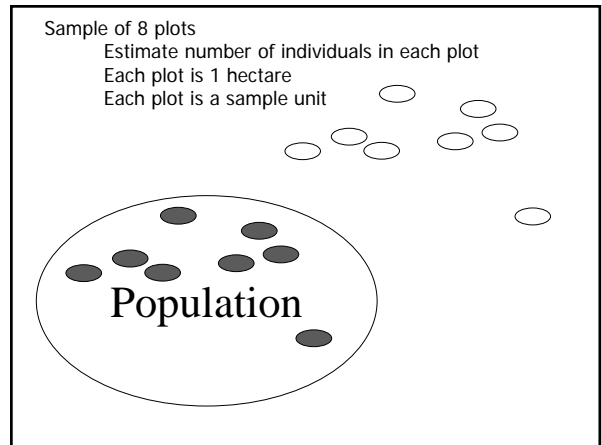
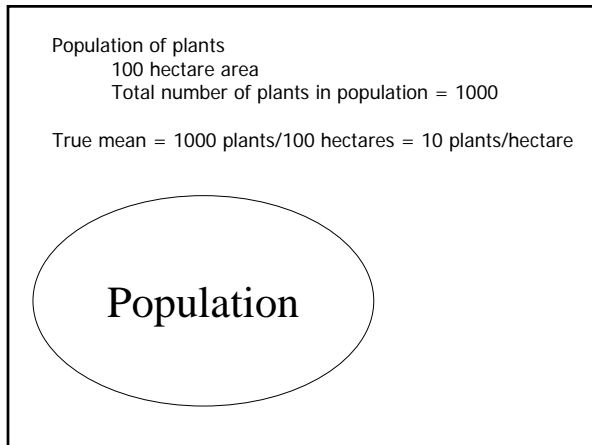
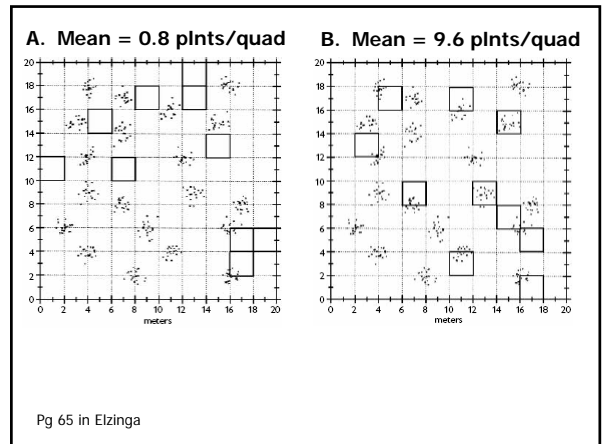
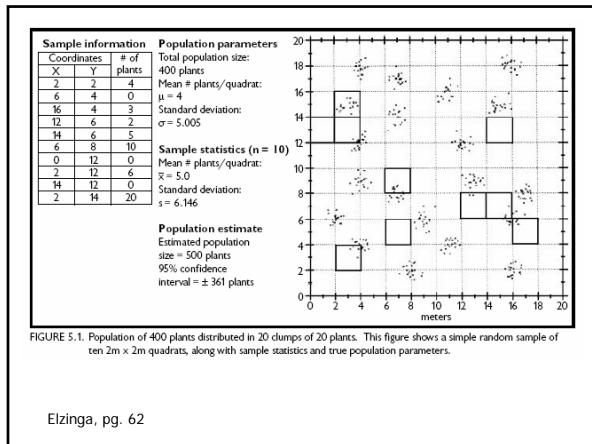
- One plant
- One plot used to estimate cover
- One transect from which you compile frequency data



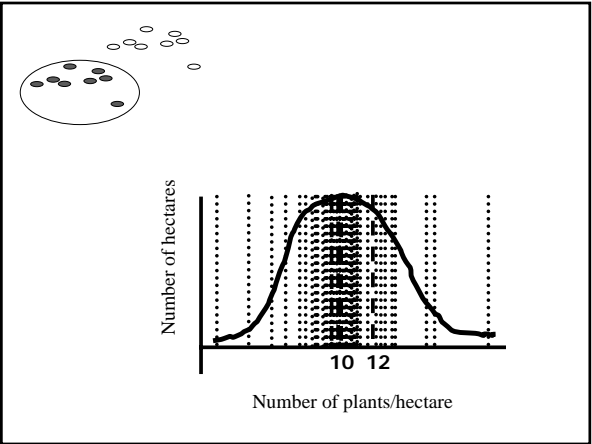
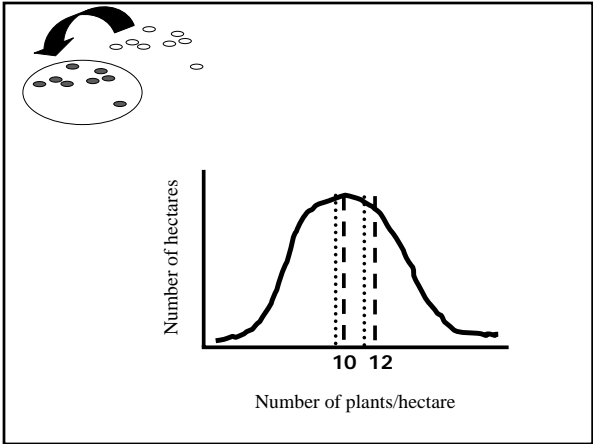
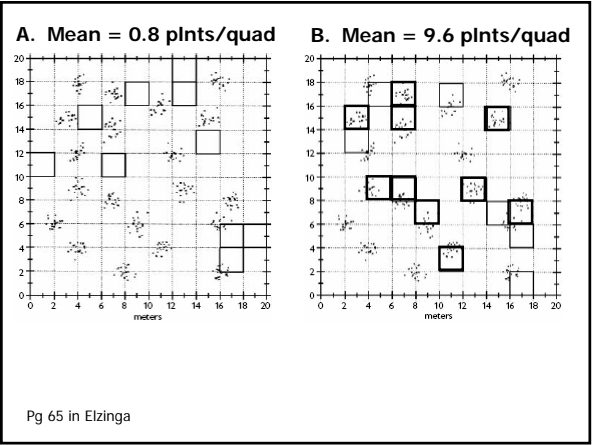
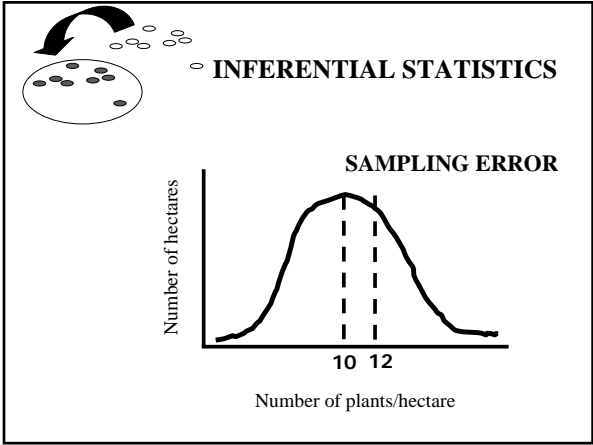
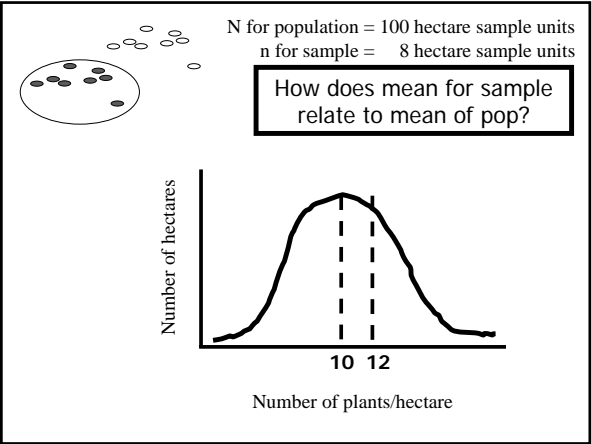
Elzinga, pg. 62

## More about populations...

- **Population parameters** are the true descriptive characteristics of a population.
  - Assumed to be fixed, but unknown quantities
  - Change only when the population changes
- **Sample statistics** are descriptive measures from a sample that are used to estimate population parameters
  - Vary from sample to sample
  - Change when population changes



Say we know the number of plants in those eight plots.....



## Accuracy, Precision, & Bias

### Accuracy is

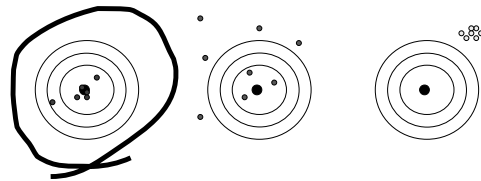
the closeness of a measured or computed value to its true value.

### Precision is

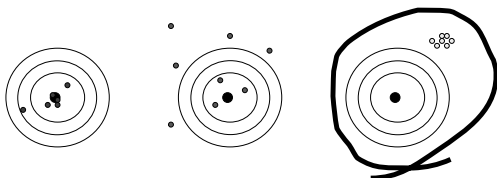
the closeness of repeated measures to the same quantity.

Not the TRUE quantity,  
just the SAME quantity you measured before.

### Which is most accurate?



### Which is most precise?



### Precision

The sample **standard deviation** ( $s$ ) gives a measure of precision, or repeatability, of our sample, but does not assess its accuracy.

Example: Which estimate is more precise?

7 plants/m<sup>2</sup>,  $s = 1.8$

7 plants/m<sup>2</sup>,  $s = 5.0$

## Bias is

systematic distortion arising from a flaw in measurement or inappropriate method of sampling.

Which is (are) most precise?

Most accurate?

Most biased?

