2 Collecting Data

MTH 3240 Environmental Statistics

Spring 2020

Topics

Objectives

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- Recognize bias in non-random sampling schemes.
- Know how the two fundamental random sampling schemes, simple random sampling and systematic sampling, are carried out.

Introduction to Sampling

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- In these cases sampling involves selecting spatial locations or time points at which a variable is measured.

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  A sampling scheme is ***biased*** if it has a systematic tendency to favor certain groups within the population, leading to their ***over-representation*** in the sample.

  It's ***unbiased*** if there's no such tendency.

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    This is called ***judgmental sampling***.

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    This is called ***judgmental sampling***.

    But our judgment can deceive us.

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  1. ***Simple random sampling***
  2. ***Systematic random sampling***

  (These are described in the slides ahead.)

Simple Random Sampling

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  Think of "drawing names from a hat" or "throwing darts at a map."

Example

To estimate the average density of sawgrass plants (plants per 1 m^2) in the Everglades region, we could take a **simple random sample** of locations, and count the number of sawgrass stems in a 1 m^2 *quadrat* at each location.

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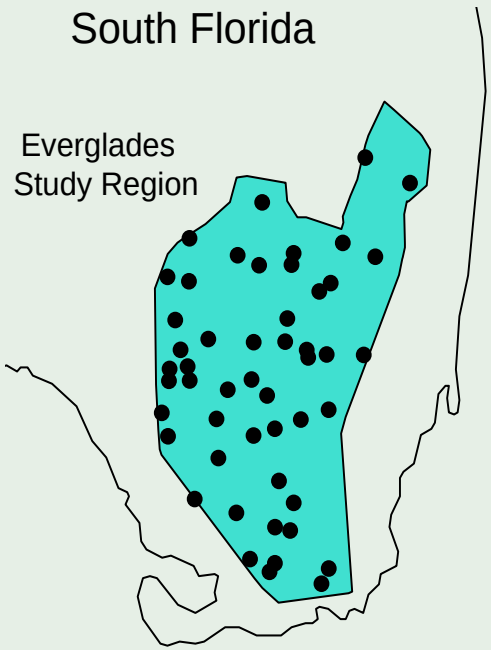
The next slide shows a computer-generated **simple random sample** of $n = 50$ locations in the Everglades.


South Florida
Everglades
Study Region

- An advantage of simple random sampling is that it's always **unbiased**.

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  A disadvantage is that there's no guarantee that the sample of locations will be evenly spread over the study region (especially if n is small).

Systematic Random Sampling

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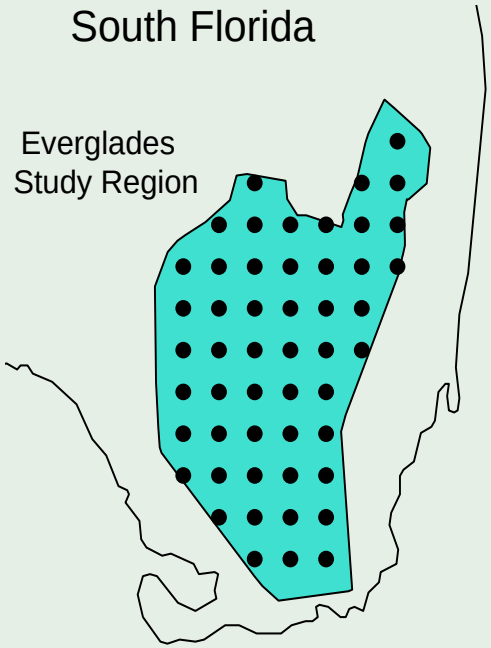
  (When sampling time points, the sample of time points lie at regular intervals).

- To incorporate chance into the sample selection process, the grid is initialized at a single, randomly selected starting location.

Example

The next slide shows a **systematic random sample** of $n = 51$ locations in the Everglades.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  - It's **unbiased**.
  - The sample of locations is guaranteed to be evenly spread over the study region.
- A disadvantage (particularly when sampling **time points**) is that if there's a **cyclical pattern** in the variable being measured, and the interval between sampled time points coincides with the **period** of the **cyclical pattern** (e.g. diurnal, weekly, seasonal etc.), the sample **won't** be representative of the population.

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  ... just that there won't be any *systematic tendency* for it to be unrepresentative.

  In particular, an unbiased sampling scheme using only a small sample size can, just by chance, lead to samples that are uncharacteristic of the population.

Other Sampling Schemes

- Other sampling schemes (used less often) include:
  1. ***Stratified random sampling*** – **Partition** the study region into **sub-regions** defined by a categorical variable (e.g. habitat types), then take a simple random sample from each sub-region.

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  1. ***Stratified random sampling*** – **Partition** the study region into **sub-regions** defined by a categorical variable (e.g. habitat types), then take a simple random sample from each sub-region.
  2. ***Two-stage random sampling*** – Take a simple random sample of **sites**, and then, from each site, take another simple random sample of **specimens** (soil, water, etc.).