Module 5:
Field Techniques

Forestry Training Institute

Tubmanburg, Liberia

Key Topics

- Basics of Surveys
- Logistics and Data Collection Protocols
- Navigation
- Baseline Studies
- Flora survey protocols
- Invertebrate survey techniques

Basics of surveys

- A survey records the presence or absence of a species or populations at a given site, based on direct or indirect counts, generally expressed as frequencies of observation.
- Surveys may also include the collection of plant and animal material for subsequent analysis.
- Surveys support conservation objectives such as species and landscape management, environmental management and monitoring, and preservation of biodiversity-rich areas.

PRACTICUM: Using a Dichotomous Key to Identify Species

This practicum helps you to learn how life forms are classified and how biological diversity varies at different taxonomic levels.

Basics of surveys

A **biological survey** provides essential information about species' occurrence, distribution, and abundance; it can also be used to evaluate the condition of a site or habitat.

Basics of surveys

Biodiversity surveys help us understand …

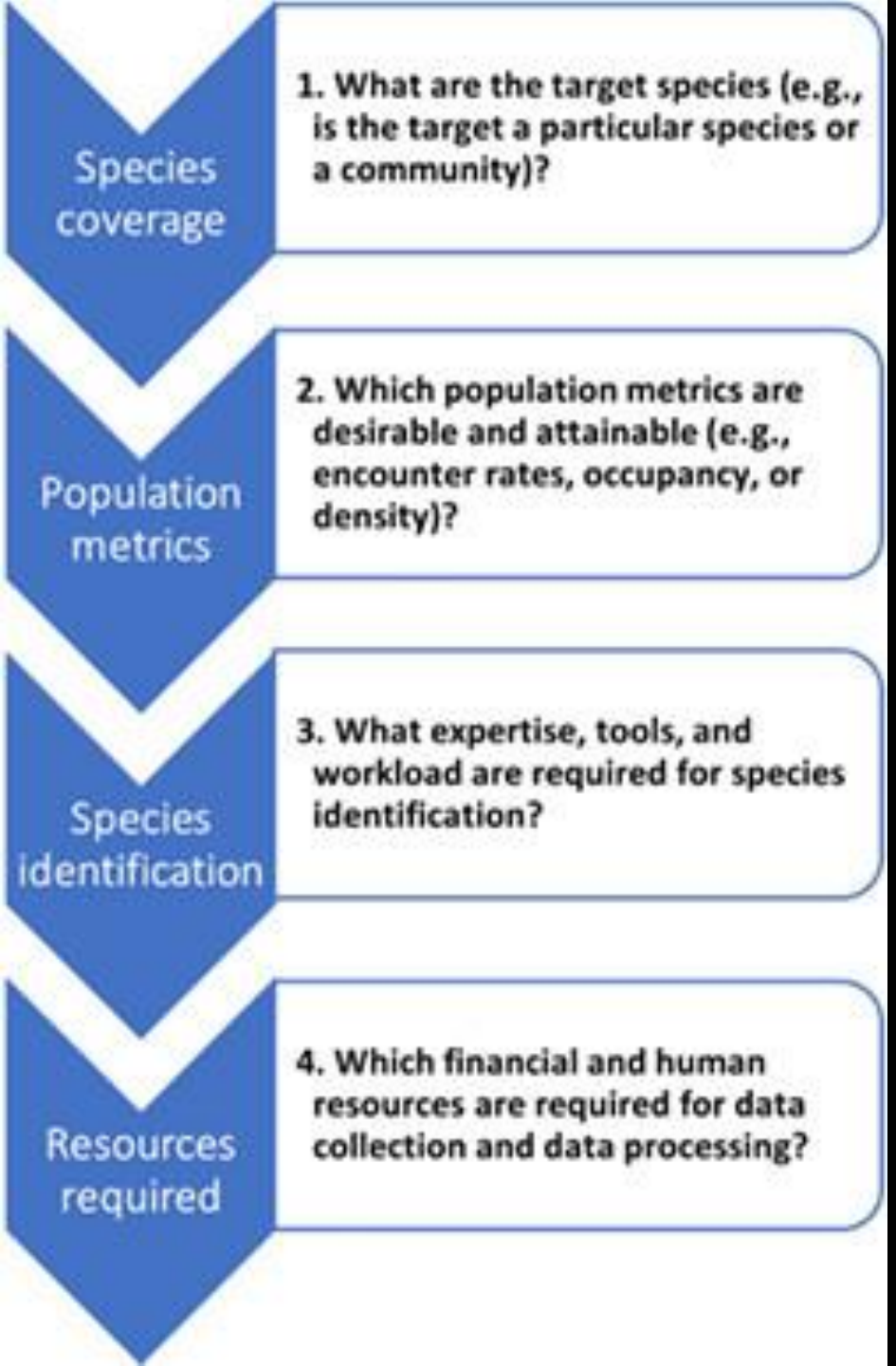
- Local species richness and diversity;
- Patterns in local endemism;
- The location and status of biologically rich areas; and
- Areas that should be prioritized for protection.

Investigating biodiversity in the same location over time serves as the basis for **monitoring programs** that document long-term changes in species composition and distribution, thereby aiding in the development of guidelines for action plans.

READING

Jongkind, “Rapid survey of the plants of North Lorma, Gola and Grebo National Forests”

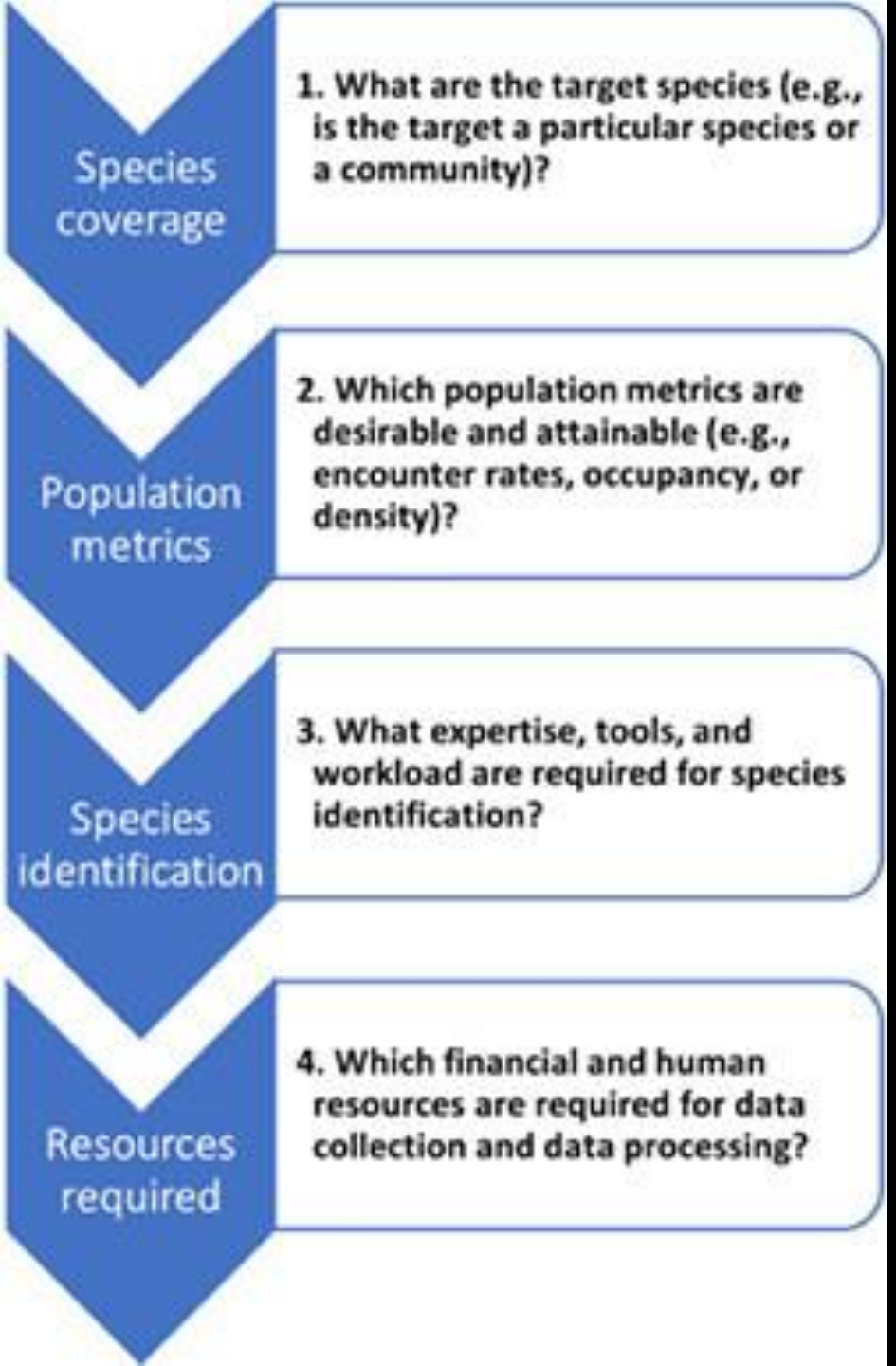
Conservation International, “A Rapid Biological Assessment of North Lorma, Gola and Grebo National Forests, Liberia”



Basics of surveys

Before a survey is conducted, the goals and objectives of the investigation need to be defined…

- What questions or problems does the project address?
- What is expected from the project?
- Who will be involved?



Basics of surveys

- Identify the scope of the investigation. Be clear about what is being sampled and how well that sampling strategy will help you to extrapolate from the data to the real patterns occuring in the surveyed community.
- Determine the best strategies for surveying the target area and the components of the community to be surveyed.

Basics of surveys

In designing biodiversity surveys for management and conservation applications, there are a number of issues that need to be considered, including:

- Spatial scale or sampling unit: e.g., survey area, habitat-based, or comprehensive.
- Sampling strategy: e.g., random (samples taken randomly from the whole community) or systematic (samples taken at regular intervals) sampling.
- Sample size: the desired level of precision for a population estimate depends on the sampling method, the parameter being measured, and its distribution pattern.
- What taxa to survey: e.g., all species or indicator taxa.

Basics of surveys

In designing biodiversity surveys for management and conservation applications, there are a number of issues that need to be considered, including:

- What sites to sample: e.g., selecting areas of significance or a habitat-based sampling approach.
- Best time of year to conduct field work: e.g., single season or any time during the year (depends on factors such as weather, taxa being surveyed, and timing of collaborations among other things).
- Optimal duration of data collection: e.g., single day, several days, monthly, once every year.

Basics of surveys

In designing biodiversity surveys for management and conservation applications, there are a number of issues that need to be considered, including:

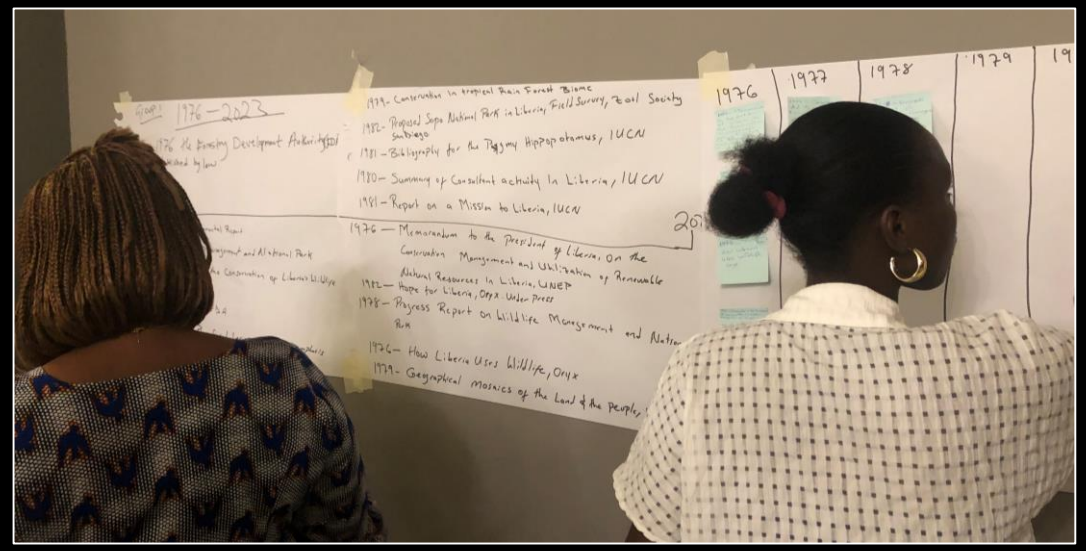
- Types of qualitative and quantitative data required to complete such analyses: e.g., considering this will help determine what type data or specimens to collect.
- Project evaluation: e.g., assessment of expenditures, equipment needs and availability, personnel time, and future expertise required.

Basics of surveys

A baseline study collects and interprets information on the biodiversity values at a site, including current conditions and trends before a project commences. The baseline study plays important roles in supporting the assessment of impacts and risks of a project and designing the long-term biodiversity monitoring program.

Basics of surveys

- Measures of habitat quality typically consider the structure, composition, and ecological function of habitats, and the condition of the habitat at a particular site.
- Measures of habitat condition may also incorporate landscape considerations, e.g., the size of the habitat patch, or degree of habitat fragmentation.
- Approaches may be qualitative, using local input to assign habitat to broad categories of condition (e.g., intact, somewhat degraded, severely degraded), or quantitative, using plots or transects to produce a numeric score of the condition of a habitat.



Basics of surveys

Baseline Surveys

The detectability and abundance of species may vary over time (i.e., daily, seasonal, interannual variation) …

- Variation on longer scales is also possible, e.g., the effects of climatic phenomena such as El Niño events.

It is good practice for baseline surveys to be structured to help measure changes in the baseline study area over time.

Basics of surveys

- **Monitoring**, or surveys conducted periodically over an extended period, allows for comparisons between different seasons or points in time and provides a temporal analysis of biodiversity.
- **Monitoring** is a powerful tool for identifying problems in the early stages, before they become crises. If identified early, problems can be addressed while cost-effective solutions are still available.

Monitoring

Monitoring helps us determine …

- State of the target condition (species, ecosystems, protected areas)
- Degree of success in mitigating threats to the target condition
- Progress of implementing activities

Monitoring

READING:

GoL, “Biomonitoring in the Proposed Grebo-Krahn National Park”

Types of Monitoring

Biological Monitoring:
Focused on the biological state of the target's condition

Types of Monitoring

Threat Monitoring: Focused on assessing whether threats to the target condition have reduced in severity or geographic scope as a result of project activities, e.g., poaching of nesting sea turtles.

Types of Monitoring

Implementation monitoring: focusing on tracking progress toward accomplishing project goals

Planning a Biodiversity Survey

Preliminary Planning

- ☐ Survey design completed
- ☐ Background information and maps
- ☐ Contact with potential collaborators, scientists, field experts, etc.
- ☐ Establish community outreach
- ☐ Site inspection before expedition
- ☐ Funding procured

Logistics

- ☐ Identify survey participants
- ☐ Determine and obtain necessary permits or licenses for research, specimen collection and/or exportation
- ☐ Determine and obtain necessary site access authorizations
- ☐ Calculate lodging, food and other expenses during survey.
- ☐ Negotiate local guides' compensation and other expenses during survey.
- ☐ Identify transportation needs

Planning a Biodiversity Survey

Equipment

- Purchase or borrow necessary field equipment, supplies, and preservation liquids (e.g. ethanol, lysis buffer, formalin).

Post-Survey

- Post-survey retreat to discuss preliminary findings
- Preliminary report (preferably before scientists or participants leave site)
- Ambiguous specimens sent to appropriate expert for identification

Safety and Security

All fieldwork involves taking increased risks concerning safety such as the lack of immediate health support, emergency evacuation problems, potentially dangerous activities such as exposure to insects and other potentially dangerous animals or security issues.

Safety and Security

- Have a first aid-trained individual on the team
- Have communication available to reach a doctor and get emergency evacuations underway. In remote areas consider taking a satellite phone.
- Have an emergency evacuation plan, with contingencies in place.
- Avoid dangerous activities.
- Get support from local authorities or colleagues.

Flora survey protocols

- Botany is the scientific study of plants, and includes studies of their form (anatomy), function (physiology), and diversity (classification) as well as their reproduction, metabolism, diseases, cultural relevance, medicinal uses, and evolution.
- The fundamental tools of flora surveys are dried and preserved plant specimens, which have been collected in the wild, as part of a botanical research expedition.
- Plant material is traditionally collected for fertile plants (with flowers and seeds) that have characters that allow the species to be identified fully. Often repeat visits to the same area, during different flowering seasons, are required.

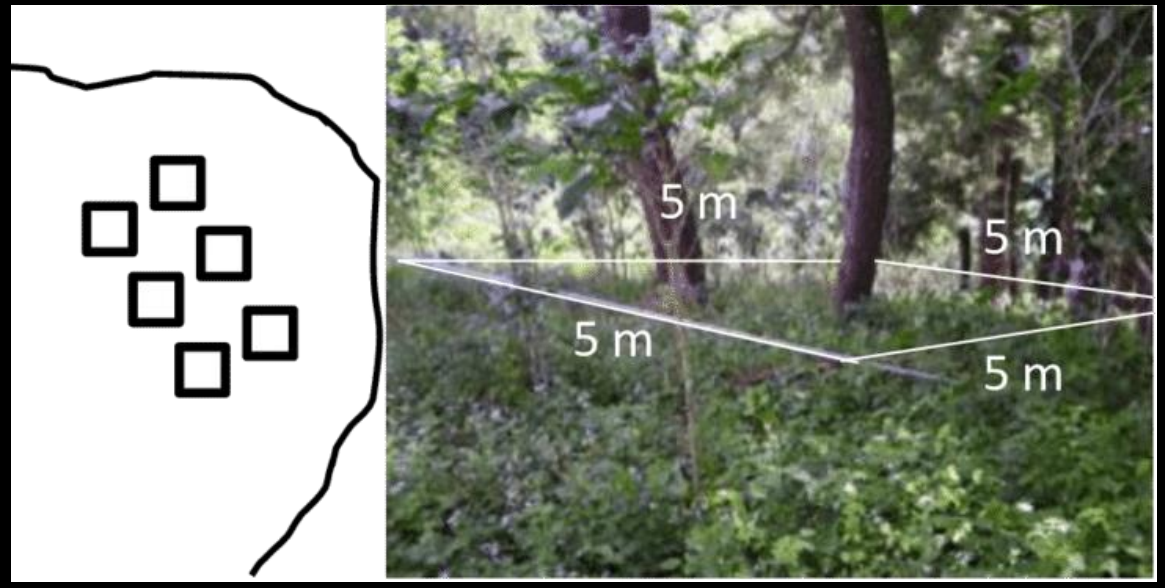
Flora survey protocols

- Vascular plants: the main groups of vascular plants include gymnosperms and flowering plants. Vascular plant surveys are typically conducted when the majority of plants are flowering, easing detection and identification.
- Multiple surveys within a year may be required to capture the plant species in distinct seasons (e.g., wet versus dry seasons).
- If the objective is to provide a quantitative description of the plant communities of the various habitats present within the baseline study area, then plots or transects should be located randomly within habitat types

Flora survey protocols

- There are two major methods of sampling flora: sample units (e.g., plots), or plotless sampling methods (e.g., transects).
- Representative Sampling: All sampling units should be representative of the sampling area or population. The proportion of the different things in the sample, or how they are dispersed should reflect the reality in the wider area. For example, if you only sample close to roads, you miss a lot of individuals.
- Sample units or plots comprise a subset of the total population from which measurements are taken during sampling. Sample units are distinct, non-overlapping entities, such as quadrats or transects, individual plants, branches within a plant, etc.
- A quadrat is a 2-D shape (e.g. square or rectangle, or other shape) used as a sampling unit. The choice of dimensions and shape of the quadrat will affect the precision and accuracy of the parameter estimates subsequently computed. Sometimes a tape is laid on the ground, but more often a frame is used to define the quadrat boundaries.

Flora survey protocols



A transect (a sampling line with fixed length) or plot (a surface area with fixed dimensions) are frequently used for measuring relative abundance of species, and for long-term monitoring of local populations. Both these techniques aim to provide quantitative measures of abundance, and thus allow comparisons between sites or between time intervals.

- Plots - count everything. Used for immovable things (botany).
- Transects - no fixed width: you count what you detect from the center line. Typically used for moving things (animals).

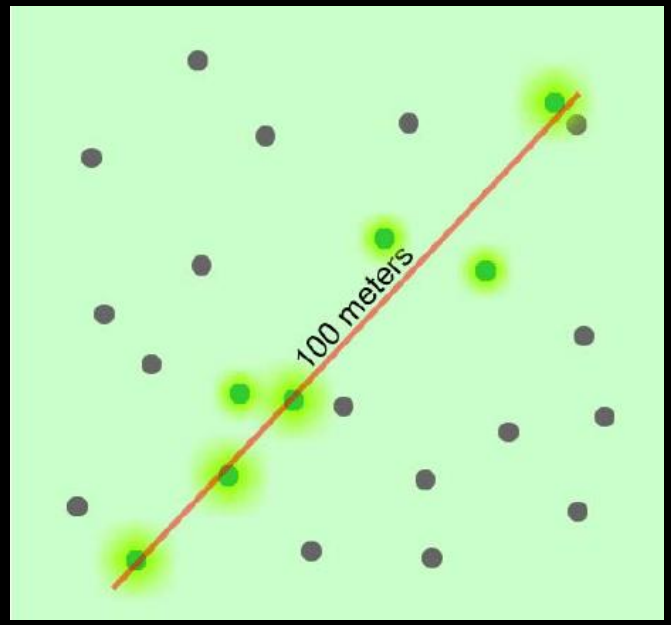
Transects

What is it?	A transect walk is a tool for describing and showing the location and distribution of resources, features, landscape, main land uses along a given transect.
What can it be used for?	• identifying and explaining the cause and effect relationships among topography, soils, natural vegetation, cultivation, and other production activities and human settlement patterns • identifying major problems and possibilities perceived by different groups of local analysts in relation to features or areas along the transect • learning about local technology and practices • contributing as a tool for site selection • triangulating data collected through other tools
What does it tell you?	Natural resources, present land use, vegetation, changes in the physical features and cropping systems, and so on in villages Public resources, land use, social differentiation and mobility in urban communities
Complementary tools	Community resource map, social mapping, time line, seasonal calendar
Key elements	This simple tool is easily adopted and replicated at the community level. It involves outdoor activities, on-field observation, discussions, and diagramming.
Limitations	This tool only takes into account the currently “observable” situation and features, serving as an entry point for more in-depth analysis.

Flora survey protocols

Distance methods measure the distance from a sampling point (or plant) to the nearest plant or nth nearest plant. The results of such a technique can provide important information about the relationships between plants. Distance methods have several advantages over quadrat-based techniques:

- Usually faster
- Requires less equipment (e.g., meter stick, tape measure)
- Does not require selection or adjustment in quadrat size.



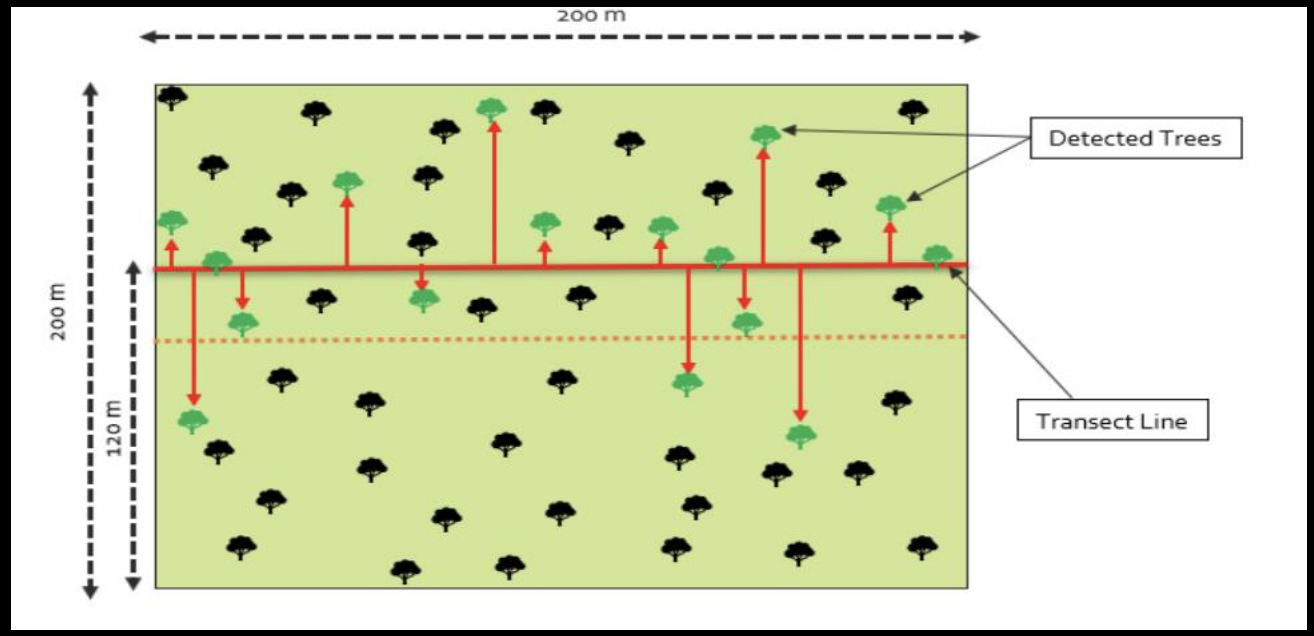
Distance methods can help determine whether plants are growing in patterns or are randomly dispersed. Many plant relationships are difficult to observe without using distance based sampling techniques.

Flora survey protocols

Transect sampling in areas with broad-scale vegetation patterns increases the likelihood of encountering species that occur at a very low density. In difficult terrain, line transects allow estimates without having to locate quadrats. In open terrain, line transects allow sampling over large areas to provide more precise estimates.

Assumptions of transect sampling…

1. Individual vegetation patches are randomly oriented with no preferred orientation of the major axis of the patch.
2. Sample lines are randomly oriented across the study area.



Sampling Techniques

- In most cases, it is impractical or impossible to count all individuals in a population
- Sampling techniques can be used to estimate densities and total population sizes
- Population size can be estimated by either extrapolation from small samples, an index of population size (e.g., number of nests), or the mark-recapture method.

Sampling Techniques

Large mammals

- Mammal inventory methods include walking transects of fixed length to obtain either direct or indirect measures of mammal abundance, conducting aerial surveys, and setting out systematic grids of camera traps over large areas.
- Large mammals may exhibit large-scale seasonal movements, and so it is important that surveys are carried out during the time or times of year when they are most likely to be present.

Sampling Techniques

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Sampling Techniques

Great Ape Surveys

- The conservation of wild great apes requires a detailed understanding of their population size, spatial distribution, and demographic trends.
- The conservation status of most wild ape populations is still poorly known. Great apes occur at low densities throughout their range, and often in remote places with difficult access.
- When these factors are combined with their cryptic nature, the implementation of efficient survey and monitoring programs is notoriously difficult.

Sampling Techniques

Great Ape Surveys

- There are a variety of methods used to survey apes but the most commonly used is nest counts from line transects (a path along which one records and counts occurrences of nests and other signs).
- Recently non-invasive genetic sampling (fe.g., for great apes, fecal samples tend to be the most reliable source of DNA).
- Camera trapping has become an increasingly popular tool to assess species' presence in a given area, monitor population trends, and identify individuals.

Sampling Techniques

<u>Small mammals (rodents, bats, insectivores < 1 kg)</u>

- Bats are usually surveyed using mist nets and harp traps, or with sonograms.
- A variety of capture techniques are used to survey non-flying small mammals, including non-lethal baited box-type traps; snap traps, which kill the animal; and drift fences to direct small mammals to pitfall traps.

Sampling Techniques

Amphibians and reptiles

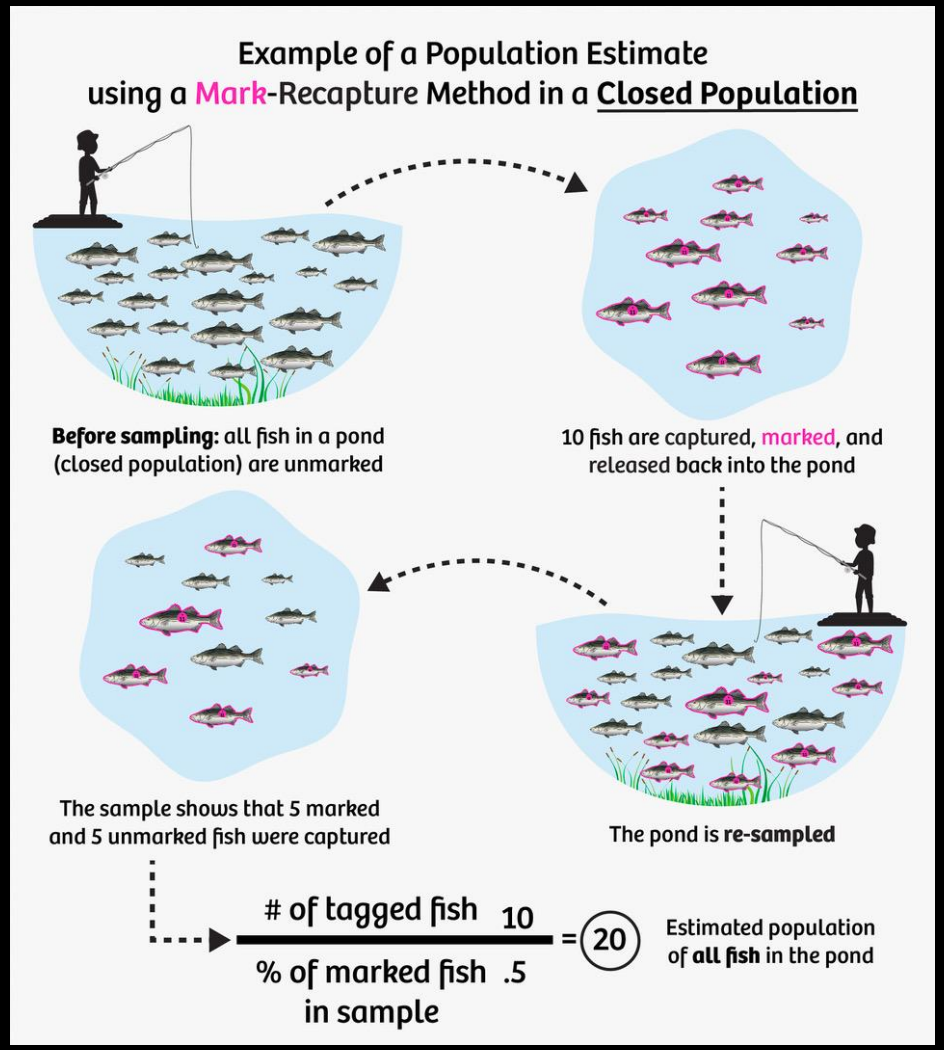
- Amphibians and reptiles are surveyed along transects or within plots of fixed area.
- Survey methods include active searches as well as trapping including the use of drift fences and pitfall traps.
- Diurnal and nocturnal surveys are required to provide a complete picture of the amphibian and reptile communities.
- Most amphibians have an aquatic larval stage and so surveys may look for eggs and larvae in aquatic habitats.
- In tropical systems, surveys are ideally carried out in both the wet and dry seasons.

Sampling Techniques

Fish

- Fish are surveyed at specific sampling locations using a standardized effort of active or passive collecting techniques, including the use of seine nets, dip nets, trap nets, short-set gillnetting, push nets, visual counts (snorkeling) and electrofishing.
- In tropical systems surveys are ideally carried out in both the wet and dry seasons.
- Sampling for fish surveys may often be seasonal, either due to water levels and habitat, or life history, or a combination of both.
- In many parts of the world, important fish specimens can be obtained from local fish markets.

Sampling Techniques



Mark-recapture method

- Scientists capture, tag, and release a random sample of individuals(s) in a population
- Marked individuals are given time to mix back into the population
- Scientists capture a second sample of individuals (*n*), and note how many of them are marked (*x*)
- Population size (*N*) is then estimated by statistical inference.

Sampling Techniques

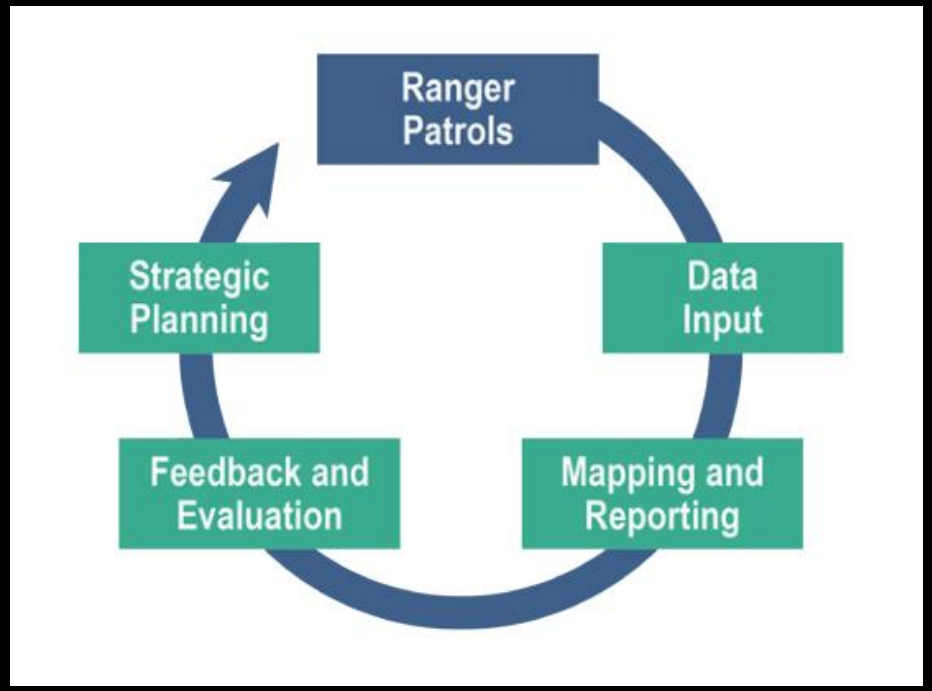
Birds

- A variety of techniques are used to survey **birds**, including **transects**, **point counts**, **mist nets**, and **camera traps** for larger ground-dwelling birds.
- Observations may be visual or made by identifying **vocalizations**. Because birds are small and mobile, in some habitats the ability to reliably detect certain species is a challenge.
- Distinct surveys must be carried out for **diurnal** versus **nocturnal** birds. Surveys are typically carried out during both the breeding and the nonbreeding seasons and usually early in the morning when activity levels and detectability are greatest.

Tools for Conservation

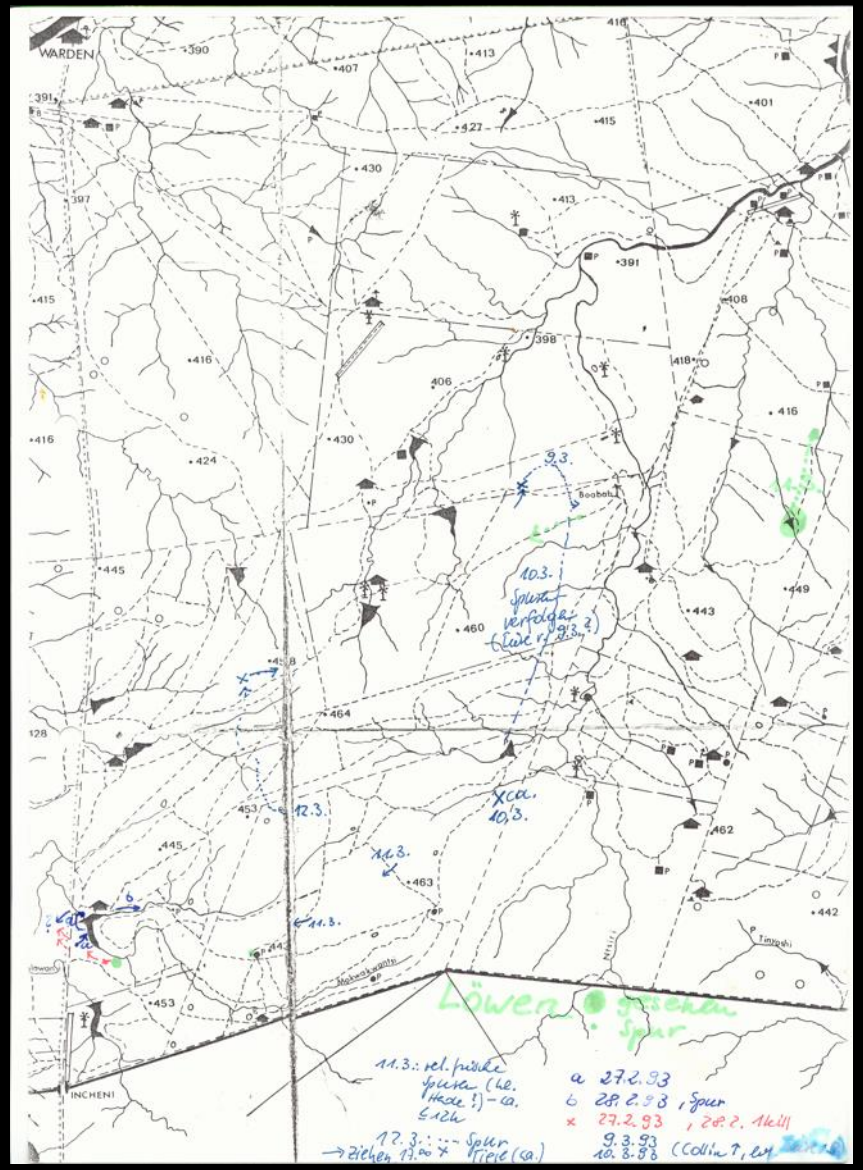
SMART conservation software

SMART (Spatial Monitoring and Reporting Tool) is a data collection method and a suite of best practices aimed at helping protected area and wildlife managers better monitor, evaluate and adaptively manage patrolling activities. SMART improves the ability of protected area agencies and other ranger-based programs to combat poaching and other illegal activities.



How do we collect spatial data about wildlife?

- Radio collars
- Direct observation and paper maps
- Museum records of collection locations



How do we collect spatial data about wildlife?

GPS

- Collars/patches that upload
- Field indicators
  - scat, tracks

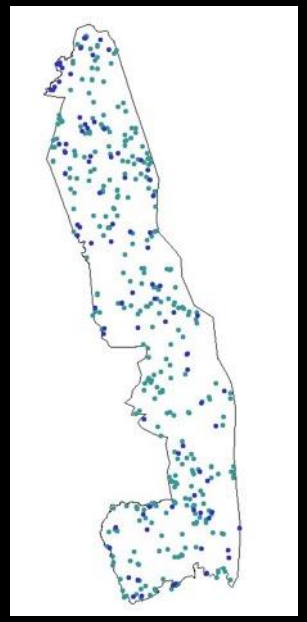
Remotely sensed data

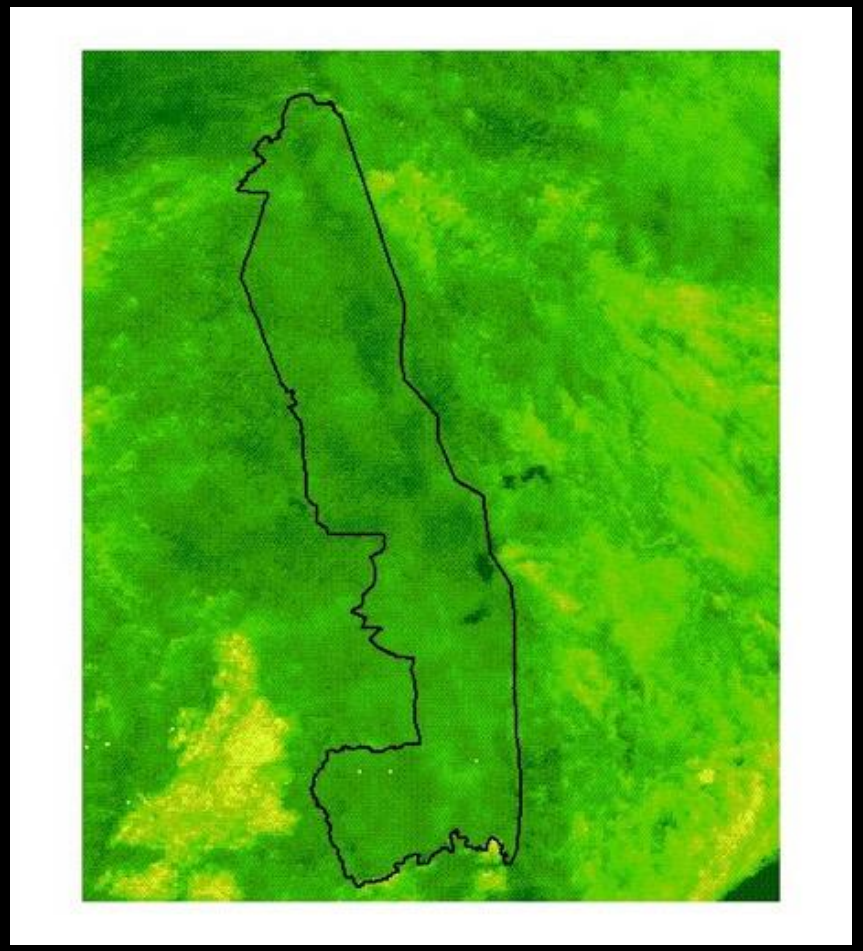
- Satellite imagery
  - Vegetation, landcover, climate
- Aerial photography
- Radar etc.

How do we use spatial data about wildlife?

Spatial data helps scientists and conservation managers learn about…

- Home ranges
- Habitat selection
- Biogeography questions

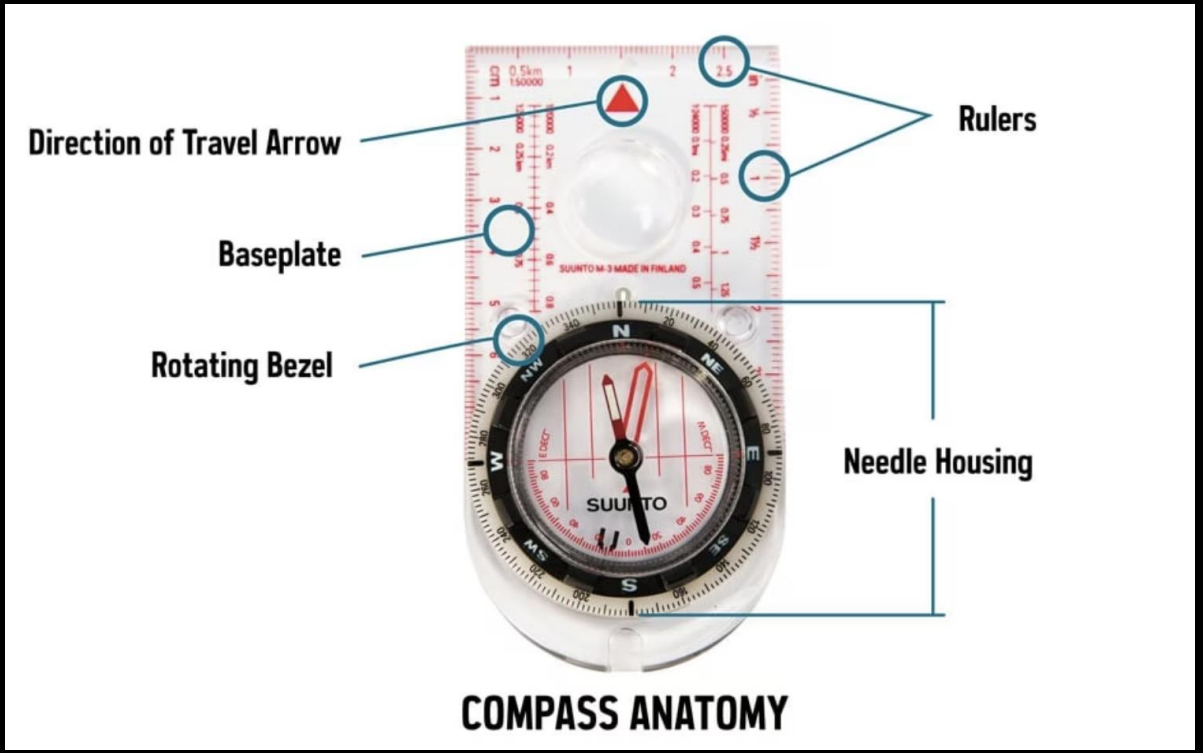




Navigation with a Compass

Why use “old technology”? In most cases, a GPS (Global Positioning System) unit can be used for navigation. However, there are a couple of downsides that can give a map and compass an advantage.

1. Maps and compasses don’t have batteries that die
2. Maps and compasses are a LOT cheaper than a GPS unit.
3. Compasses can be used under dense forest canopies that will block satellite acquisition from most GPS units.



Navigation with a Compass

PRACTICUM

“Navigating with a Compass”