OKOMU NATIONAL PARK BIODIVERSITY

A field survey Manual for Plants, Insects, birds and Mammals

Developed
By
Sustainability and Conservation Education for Rural Area
(SCERA)
For biodiversity Assessments
In
Okomu National Park (ONP)
In partnership with Okomu National park, Funded by Critical Ecosystem Partnership Fund (CEPF)

CRITICAL ECOSYSTEM PARTNERSHIP FUND

SUSTAINABILITY AND CONSERVATION EDUCATION FOR RURAL AREAS
SCERA

OKOMU NATIONAL PARK NIGERIA
Okomu National Park

Foreward

This field survey manual is specifically developed by ***Sustainability and Conservation Education for Rural Area (SCERA) in partnership with Okomu National park (ONP), Funded by Critical Ecosystem Partnership Fund (CEPF)*** for community volunteers and park rangers as a guide to carrying out biodiversity assessments in Okomu National Park**.**

Moreover, the manual specifically covers four taxa: ***Plants, Insects, birds*** *and* ***Mammals***, as part of the project ***"Building Capacity and Sustainable Partnerships for Mainstreaming Biodiversity in Nigeria"*** The manual may be updated regurlarly to include relevant information which might have been missed or any new information.

The manual is organised in five (**5**) chapters. The first chapter (**1**) introduces readers to sampling methods/techniques that could be applied in filed surveys. Chapter two (**2**) covered field survey of plants, chapter three (**3**) covered Insects, chapter four (**4**) covered Birds and chapter five (**5**) covered Mammals.

As much as possible, the contributors have attempted to combine dept and simplicity in the various areas covered, and modern concepts and principles have been applied. For easy understanding, the manual have been witten in simple English.

It is strongly recommended that the manual is used in conjuction with text books and journal articles listed in the bliobiography/further reading section at the end of each chapter. The advantage of this manual includes but not restricted to;

1. Simplicity of the English
2. Conciseness relative to text books
3. Clarity etc.

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Chapter One

1. Sampling methods

1.1 Introduction

In field survey of organisms including plants, insects, birds and mammals in a given habitat, it is rarely possible to survey every part of the habitat (the sampling frame) being studied. This could be due to inaccessibility of part of the study area or the size of the study area in relation to the time available to carry out the survey. This is why only a part/sample (sampling unit) of the habitat is selected for the survey. The result obtained from this sample will then be used to tell the characteristics of the plants, insects, birds and mammals of the whole habitat. To draw valid conclusions from your samples, you have to carefully decide how you will select this sample (portion of the habitat) of the whole forest. Ideally, a sample should be randomly selected and representative (large enough) of the population, in this case the forest/habitat. The process used to select this representative sample unit is called sampling methods while the process of collecting the samples is referred to as sampling.

1.2 Reasons for sampling

The reasons for sampling among others include;

1. Necessity: Sometimes it's simply not possible to study the whole habitat due to its size or inaccessibility.
2. Practicality: It's easier, more efficient, and less time consuming to collect data from a sample.
3. Cost-effectiveness: There are fewer participant, equipment, and researcher costs involved.
4. Manageability: Entering, Storing and running statistical analyses on datasets obtained from a sample of population is easier and reliable.

1.3 Types of sampling methods

There are two broad types of sampling methods;

1. **Probability sampling** involves random selection, allowing you to make strong inferences about the whole group.
2. **Non-probability sampling** involves non-random selection based on convenience or other criteria, allowing you to easily collect data.

1.3.1 Probability sampling methods

Probability sampling implies that every member of the population has a chance of being selected. It is mainly used in quantitative research. If you want to produce results that are representative of the whole population, probability sampling techniques listed below are the most valid choice.

1.3.1.1 Simple random sampling technique

In a simple random sample, every member of the population or parts of the habitat for example has an equal chance of being selected for a survey. To conduct this type of sampling, you can use tools like table of random numbers, coin toasting, dice casting or other techniques that are based entirely on chance.

Example 1

A researcher who is interested in surveying reptiles in Okomu National Park may want to select a simple random sample of 150 grids of the ONP. He will assign numbers to all the grids of ONP say 01, 02, 03 to 200, and generate a random number to select the 100 grids that he will survey.

Note; 150 is a good representative of the park's 200 grids for the researcher to survey reptile and draw conclusion on the reptiles of ONP.

1.3.1.2 Systematic sampling technique

Systematic sampling is similar to simple random sampling, but it is usually slightly easier to conduct. Every member of the population is listed with a number, but instead of randomly generating numbers, individuals are chosen at regular intervals (systematically).

Example 2

From example 1 above, the researcher may number the grids from 1-200 and select every odd grid starting from 1, 3, 5, 7, 9 etc., and end up with 150 grids to carry out the survey.

1.3.1.3. Stratified sampling technique

Stratified sampling involves dividing the population/habitat into subpopulations/sub-habitats that may differ in important ways. It allows you draw more precise conclusions by ensuring that every subgroup is properly represented in the sample. To use this sampling method, you divide the population/habitat into subgroups (called strata) based on the relevant characteristic (e.g. gender, age, colour, topography, size etc.). Based on the overall proportions of the population/habitat, you calculate how many people should be sampled from each subgroup. Then you use random or systematic sampling to select a sample from each subgroup. Therefore, we can have stratified random sampling or systematic random sampling methods.

Example 3	*From example 1 above, the park may have 70 grids occurring on rocks and 130 grids on plain/flat land. The researcher may want to ensure that the sample reflects this topography balance of the park. Hence, the researcher will sort the population (park) into two strata based on topography. Then randomly or systematically sample from each stratum, selecting 50 grids on rocks and 100 grids on flat soil to have a representative sample of 150 grids for the reptile survey.*

1.3.1.4. Cluster sampling technique

Cluster sampling also involves dividing the population into subgroups, but in this case each subgroup has similar characteristics to the whole sample. Instead of sampling individuals from each subgroup, you randomly select entire subgroups.

Example 3	*The parks may have 10 different parts all with roughly the same size and habitat structure/type. The researcher may not have the capacity and ability to travel to every part to survey for reptiles, so he/she may use random sampling to select 5 parts, which is a good representation of the 10 parts to survey reptiles; these are his/her clusters.*

1.3.2 Non-probability sampling methods

In a non-probability sample, individuals are selected based on non-random criteria, and not every individual has a chance of being selected. This type of sample is easier and cheaper to access, but it has a higher risk of sampling bias. That means the inferences you can make about the population are weaker than with probability samples, and your conclusions may be more limited. If you use a non-probability sample, you should still aim to make it as representative of the population as possible.

1.3.2.1 Convenience sampling technique

A convenience sample simply includes the individuals who happen to be most accessible to the researcher. This is an easy and inexpensive way to gather initial data, but there is no way to tell if the sample is representative of the population, so it can't produce generalizable results.

1.3.2.2. Voluntary response sampling

Similar to a convenience sample, a voluntary response sample is mainly based on ease of access. Instead of the researcher choosing participants and directly contacting them, people volunteer themselves (e.g. by responding to a public online survey).

1.3.2.3. Purposive sampling

This type of sampling, also known as judgement sampling, involves the researcher using their expertise to select a sample that is most useful to the purposes of the research. It is often used in qualitative research, where the researcher wants to gain detailed knowledge about a specific phenomenon rather than make statistical inferences, or where the population is very small and specific.

1.4 Conclusion

Different types of sampling methods/techniques are available. Choosing a sampling method will however depends on the nature of habitat to be surveyed and the survey aim. For a survey to be efficient and effective, one will need to carefully select the most appropriate sampling method that is applicable to the survey habitat.

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Chapter Two

2. Plants

2.1 Introduction

Group of many different plants in a given area is referred to as vegetation. Plants/vegetation assessment most often involves surveying plants that cannot move. Since plants usually occur or grow on the soil, rock or any other sediment, they can be found, identified and examined at a convenient or free time. This characteristic makes it much easier to survey plants than it is to survey other living things. For example, the total number of plants in a given area (density), the total number of each different plant (species abundance), the distribution of a species of plant in a given etc. can easily be assessed. A second characteristic of plants, however, causes problems in deciding how best to survey plants. Plant species, and even individuals within a species, in a community can differ greatly in size. For example, a forest may contain Iroko trees that are 30 m tall and canopy cover of about 50%, in contrast to herbs, grasses and Iroko samplings and seedlings in the understorey, which are only a few centimetres in height. Hence, while the standard measure of abundance of animals; which is a count of individuals, can be used for plants, this variety in plant size will mean that counts ignore a large amount of information about the community. For instance, there may be equal numbers of individuals of two species in your study area but the species with a larger average size is likely to be counted more.

Because of these issues, one may be interested in surveying only mature trees, herbaceous plants, shrubs and saplings or even snags in a given forest. Since we cannot survey the whole forest, portions/subareas/sample of the forest are selected using appropriate sampling methods for surveying plants. The process by which we do this is referred to as vegetation sampling/assessment.

2.2 Why sample vegetation?

The reasons for vegetation sampling, among others, includes to;

1. Determine plants community composition in a given area (inventory for conservation purpose).
2. Detect changes in plants is response to environmental change or management action (monitoring for conservation purpose).
3. Determine quality of habitat and resource for utilization for wildlife or other plant species (inventory and monitoring for conservation purpose).

2.3 Vegetation Sampling Metrics

This simply referred to those things we measure during vegetation sampling

This includes;

1. Counts/Enumeration (Abundance); total number of plants or a plant species in a given area.
2. Canopy cover; is a size-based measure of the area covered by the above-ground parts of plants (branches and leaves) of a species when viewed from directly above. Grass cover on the other hand is the measure of the area of ground covered by grasses. There are usually estimated in percentage.
3. Density; the number of plants or individuals of a species of plant per unit area. For plants that don't move, this is a straightforward measure in comparison with that for some animals, which can move in and out of the area during the census period.
4. Frequency; the proportion of area sampled in which a species of plant is present. It is usually used in quadrant.

2.4 Vegetation sampling techniques

There are two broad methods of sampling vegetation after designating the sampling units or area to be sampled using appropriate sampling techniques described in chapter one. These techniques are;

1. Plot/non distance method; this involves the use of quadrant and belt transect with fixed dimension/distance in sampling or surveying vegetation.
2. Plotless/distance method; involves the sampling of vegetation without having a fixed distance within which vegetation will be surveyed.

2.4.1. Plot methods

2.4.1.1 Quadrant

<u>Overview</u>

A quadrant is a frame that is laid down to mark out a specific area of plant community to be sampled. The quadrant method can be used in virtually any vegetation type to quantify the plant community. However, some vegetation types are best sampled using other techniques (e.g., a point-frame for grasslands, or point-quarter method for forests). Quadrants may be square, rectangular or circular and they may be of any appropriate size. Different vegetation types require different quadrant sizes. The sizes most often used are 31.6 x 31.6 cm (0.1 m^2) for Herbaceous plant, 1 x 1 m (1 m^2) for forest floor herb, 3.16 x 3.16 m (10 m^2) for Shrubs and sampling and 10 x 10 m (100 m^2) for forest trees. For large quadrants, over 4 m^2, constructing a large quadrat and moving it will be difficult. An alternative will be to measure out the quadrant using measuring tape. To get a good estimate of species' abundances multiple quadrats should be used in each study area according to your sampling design and various measures (abundance, cover, density, frequency etc.) can be derived from a survey using quadrant method.

Field survey

Materials required

Quadrant of specified shape and size, measuring tape, pencil, field notebook, Global Positioning System Device (GPS), camera and plant field guide e.g., trees, shrubs and lianas of West African dry zones (Arbonnier, 2004).

Protocols

1. Select a sampling unit from the sampling frame in which the survey is to be done using any of the sampling techniques described in chapter one. For example, stratify or divide up the study area in which the plant survey is to be carried out into sub-study areas dependent on topography or other physical features.
2. Mark each of your sampling units with a GPS.
3. Within each sub-study area, randomly place quadrants of appropriate size and shape depending on the plant community of the sub-area. Although a square shape quadrat is often used, keep the shape of the quadrant you are using constant and know its size. Many quadrants should be used in each sub-study area according to your sampling design to get a good estimate of any vegetation metrics you are interested in.
4. The type of sampling carried out in step **1 & 3** above is called stratified random sampling.
5. For large quadrant, use a tape to measure the size of the quadrant and mark the corners of the quadrant with posts or colored ribbon (**see figure 1 below**).
6. Within each quadrat and sub-study area, identify using field guide and count each plant species and record the information in a field note book.

Samples or pictures of unidentifiable plants can be taken for later identification.

7. The collected sample data from all quadrats and sub-study area are added together and are considered to constitute an adequate sample of the plant community of the entire study area.

8. Use the data to compute the vegetation metrics (abundance/count of plant species, density, frequency etc.) that you are interested in.

Note;

1. For convenience quadrant size can be varied but be sure to use the same size quadrant throughout a survey.
2. Using too few quadrants will result in an incomplete or inaccurate representation of all the plant species. Using too many will be a waste of time and effort. A species-area curve can be used to determine an adequate number of quadrants to be sampled during a survey by plotting the cumulative number of plant species added with each additional quadrat sampled. Where the curve levels off or flattens, the number of samples is considered adequate.

Figure 1: Quadrant demonstration with volunteers standing at the corners of the square shaped quadrant during community volunteers training on biodiversity assessment in ONP. At the top left corner is a quadrant of smaller size.

2.4.1.2 Transects

<u>Overview</u>

Transects are simply a straight part of any shape upon which an observation is made. Transect can be used for a variety of survey purposes in any vegetation. Transects are commonly used to survey changes in vegetation along an environmental gradient or through differing habitats using belt transects or, for larger sample areas, grad-sects. The length of the transect can be several metres or hundreds of kilometres, depending on the vegetation, size of the area and the aim of the survey.

The Belt transects

Overview

This consist of quadrats of any size laid at intervals along the length of a transect. Cover, density or frequency can be estimated for each quadrat and the variation in the measure along the transect can be determined and correlated with the gradients in environmental factors.

Field survey

Materials required

Quadrant of specified shape and size, measuring tape, pencil, field note book, Global Positioning System Device (GPS), camera and plant field guide.

Protocols

1. Establish transects along the area to be surveyed. Mark each transect with a GPS. The number and length of the transect, and distance between transects will depend on the size of the survey area and survey aim.
2. Along each transect, place a quadrant of appropriate size (measure with a tape) and shape depending on the plant community of the survey area at regular interval /point, say every 20 m.
3. Visit quadrants on each transect to identify plant species using field guide and record observation in a field note book/data sheet.
4. Combine measures from all quadrants to estimate plant species cover, frequency and density from the data.
5. The variation in the measure of each quadrant along the transect can be determined and correlated with the gradients in environmental.

2.4.2. Plotless methods (distance method)

2.4.2.1 Point-centered Quarter Sampling Method (PCQ)

Overview

The point-centered quarter method is one of the most frequently used distance methods employed to sample plant communities particularly forests. After a random point has been located, a pair of perpendicular lines are erected at the random point, forming a cross with four quadrants/quarter (+). The distances to the nearest tree (Diameter at breast height (DBH) ≥ 10 cm) in each quadrant are measured. Each tree within each quadrants/quarter is identified to species, the distance from the point to the tree is recorded, and the DBH is recorded. To gain insight into overstory/understory relations, one can also seek out the nearest sapling (DBH > 2.5 & < 10 cm) in each quarter and record the same information as for trees.

Field survey

Materials required

Quadrat of specified shape and size, measuring tape, pencil, field notebook, Global Positioning System Device (GPS), camera and plant field guide.

Protocols

1. Establish parallel transects spaced at the appropriate distance along the study area.

2. Draw a cross to have four 90° quarters (PCQ sample unit) on the transect line at intervals say 0, 20, 40, 60, 80 m etc., depending on the length of the transect. GPS device should be use to mark the PCQ sample unit for easy location.

3. Identify using field guild the nearest tree and saplings in each quarter starting in a clockwise or anti-clockwise direction.

4. Use a tape to measure the distance & DBH of the nearest tree and saplings you have identified in each quarter (**see figure 2 below**).

5. Record your observation in a field notebook/data sheet in order to compute vegetation metrics (e.g., frequency and density).

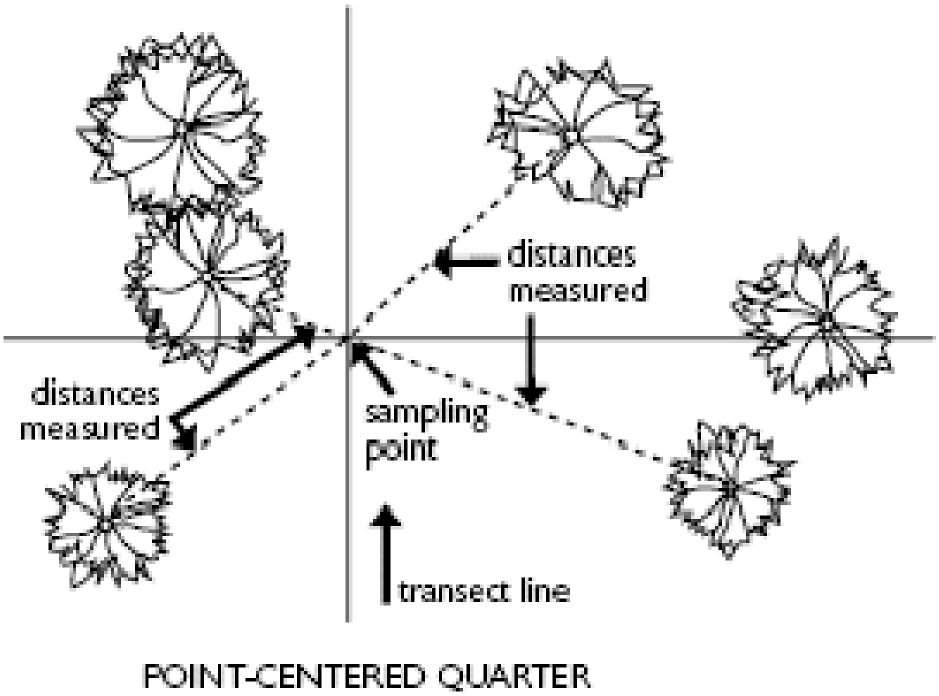

Figure 2: An illustration of the point-centered quarter sampling method.

2.4.2.2 Nearest Individual Sampling Method

Overview

This is another distance method employed to sample plant communities particularly forests. After a random point has been located, distance to the nearest tree (DBH ≥ 10 cm) is measured. Each tree is identified to species, the distance from the point to the tree is recorded, and the DBH is recorded. To gain insight into overstory/understory relations, one can also seek out the nearest sapling (DBH > 2.5 & < 10 cm) at each point and record the same information as for trees.

Field survey

Materials required

Quadrat of specified shape and size, measuring tape, pencil, field note book, Global Positioning System Device (GPS), camera and field guide.

Protocols

1. Establish parallel transects spaced at the appropriate distance along the study area.

2. Establish a random point (sampling point) systematically on the transect line at intervals say 0, 20, 40, 60, 80 m etc., depending on the length of the transect. GPS device should be use to mark the sampling point for easy location.

3. Identify using field guild the nearest tree and saplings at each sampling point.

4. Use a tape to measure the distance & DBH of the nearest tree and saplings you have identified at each point (**see figure 3 below**). Identification of the nearest tree/samplings at each point and measurement of distances and DBHs can be done at the same time at each sampling point.

5. Record your observation in a field notebook/data sheet in order to compute vegetation metrics (e.g., frequency and density).

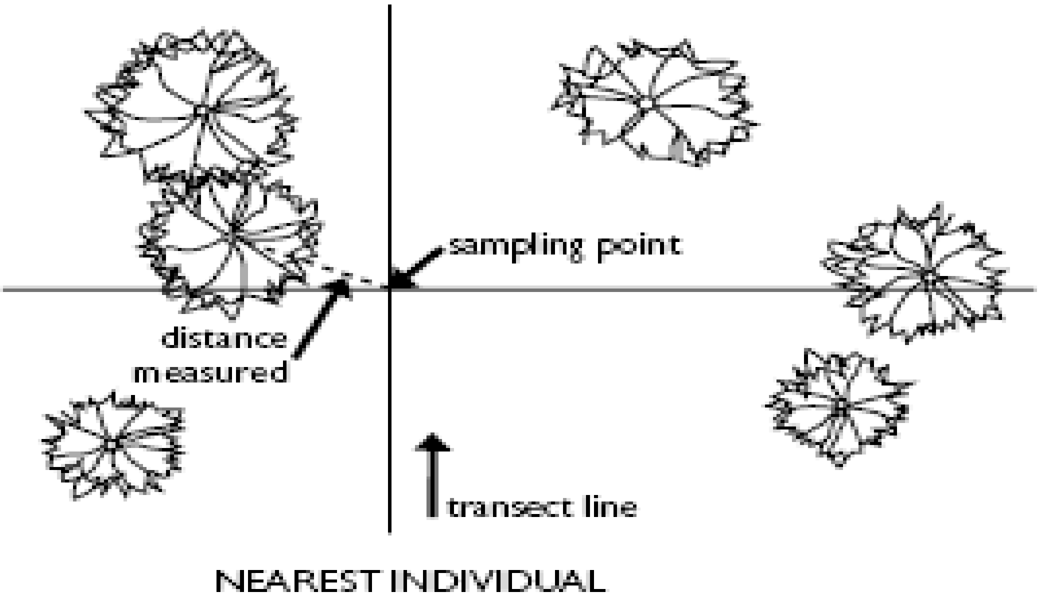

Figure 3: An illustration of the nearest individual sampling method.

2.4.2.2 Nearest Neighbor Sampling Method

Overview

This is another distance method employed to sample plant communities particularly forests. After a random point has been located, the nearest tree (DBH ≥ 10 cm) to the point is selected and the distance between it and its nearest neighbor is measured. Each tree is identified to species, the distance from a tree and its neighbor is recorded, and the DBH is recorded. To gain insight into overstory/understory relations, one can also seek out saplings (DBH > 2.5 & < 10 cm) and record the same information as for trees.

Field survey

Materials required

Quadrat of specified shape and size, measuring tape, pencil, field note book, Global Positioning System Device (GPS), camera and field guide.

Protocols

1. Establish parallel transects spaced at the appropriate distance along the study area
2. Establish a random point (sampling point) on the transect line at intervals, say 0, 20, 40, 60, 80 m etc. depending on the length of the transect. GPS device should be use to mark the sampling point for easy location.
3. Select and identify using field guild the nearest tree (DBH ≥ 10 cm) to the point
4. Identify the nearest tree (nearest neighbor) close to the tree selected in step 3
5. Use a tape to measure the distance between the selected tree and it nearest neighbor at each sampling point

6. Use a tape to measure the DBH of the nearest neighbor tree (DBH ≥ 10 cm) and saplings (DBH > 2.5 & < 10 cm) at each point along the transect (**see figure 4 below**).
7. Record your observation in a field notebook/data sheet in order to compute vegetation metrics (e.g., frequency and density).

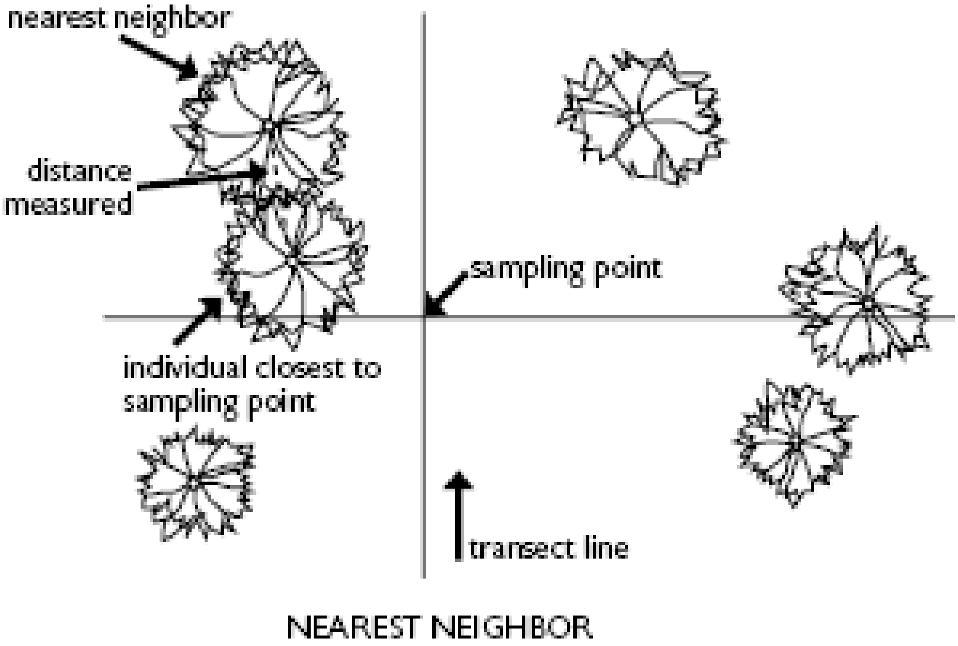

Figure 3: An illustration of the nearest individual sampling method.

Note:

1. During vegetation sampling, samples/specimens of plant that could not be identified on the field can be taken for later identification in an institution herbarium. To do this,
2. Fetch part of the plant e.g., small branches and press in a newspaper (put in between pages of newspaper). For bigger trees, pictures can be taken.

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Chapter Three

3. Insects

3.1 Introduction

Insects are invertebrate animals belonging to the class insecta and phylum Arthropoda (which are organisms with jointed appendages/legs. This phylum is the largest in the animal kingdom and contains about 80% of all animals' species. Among the several characteristics of insects are;

1. Possession of wings (some are wingless).
2. Possession of three body parts; head, thorax and abdomen.
3. Head bears a pair of antennae and compound eyes.
4. Have 3 pairs of legs (6 legs) that are jointed.

3.1.1 Classification of insects (groups of insects)

There are different groups of insects based on the presence or absence of wings and/or metamorphosis. Based on these criteria, they are two main groups (subclasses) of insects as follows;

1. Apterygota; primitive wingless insects that do not undergo metamorphosis. Examples of Orders (groups) found under this subclass include; Collembola (springtails) and Thysanura (Bristletails)
2. Pterygota; winged insects with simple metamorphosis. Examples of Orders (groups) found under this subclass include; Lepidoptera (moths and butterflies), Coleoptera (beetle), Odonata (dragonflies), Hymenoptera (ants, bees, wasps etc.), Diptera (houseflies, mosquitoes

etc.), Isoptera (termites), Orthoptera (locusts, grasshopper and crickets) etc.

3.2 Insects survey and reasons for survey

Different aims/groups of insects require different approaches. However, the main requirement is that most or all habitats and micro-habitats that are likely to be important to insect at a study area are sampled. To maximize the range of species/groups of insects recorded, a range of complementary techniques are to be used. Several visits at various times throughout the active periods of the respective groups will usually be needed in order to obtain a reasonable record of the insects in a given study area. It is often most efficient to survey one or a few key groups whose requirements will inform you most about the conservation value of the site for insects and how it should be best managed. Furthermore, methods of preserving sampled insects varies with groups and species of insects. Others require drying while others can be preserved in ethanol.

As with other groups, the most important thing when surveying insect is knowing why you are doing it.

The commonest reasons for surveying insects are to;

3. Determine insect's community composition in a given area (inventory for conservation purpose)
1. Evaluate the importance of a particular area for them and, in doing so, identify how theinsects fauna can be best conserved (inventory for and monitoring for conservation purpose)
2. Monitor changes in the abundance and assemblages of insect's species in response to perceived environmental changes (monitoring for conservation purpose).

3.3 Insects survey methods

They are different methods of surveying insects. Some field methods are effective in surveying some groups of insects than others e.g. night insects, flying insects, crawling insects, soil insects etc. All the methods are classified into two main methods;

1. **Active;** such as sweep netting, sheet/foliage beating, visual survey on transect etc.
2. **Passive;** where traps are set to either attract or intercept insects including pitfall traps, bowl/pan traps, sticky traps, etc.

3.3.1 Active methods

3.3.1.1 Visual survey on line transect

<u>Overview</u>

Visual surveys are commonly used to document the abundance and diversity of insects that can easily be visually identified in the field, often with the aid of close-focus binoculars and nets. These surveys typically involve researchers documenting the presence of a species or counting the total number of individuals of each species observed during a survey on a transect. The most frequently used methods include (1) transects, and (2) point counts. Transect counts use visual identification while searching along predefined routes. Point counts, where an observer stands still and identifies and counts the number of individuals of the target taxa around them during a set period of time, provides an alternative to transects in sites that are difficult to walk in. Distance sampling techniques, where observers note their distance from the observed insect, can be implemented with both transects and point counts to estimate densities. Visual survey can be aided with sweep net for capturing unidentifiable insects.

Field survey

Target group

Visual surveys are only appropriate for large insects that can be easily detected and identified or photographed in the field. Examples include; Butterflies and moths (Lepidoptera) dragonflies and damselflies (Odonata), and large bees (Hymenoptera) such as bumblebees.

Materials required

GPS, field notebook, sweep net, Envelop and 80% ethanol for preserving insects, and insect field guild.

Protocols

1. Randomly lay transects within the area to be surveyed. Ideally, multiple transects should be used in a survey depending on the size of the area. An existing route can be used as the transect line. A GPS device should be use to mark transects.
2. At least three persons should be involved when planning for a visual survey on transect. One person will identify the insects and their numbers, one will record and the third person will sweep net unidentifiable insects (**see figure 1 below**).
3. On each transect, walk steadily and record the number of individuals of each species. The length of the transect, starting time and ending time should be recorded in a field notebook.
4. Sweep net insects that are challenging to identify and transferred into vials and placed in 80% ethanol or envelop depending on the group of insects for later identificationend of the survey period. Pictures of large insects can also be taken for later identification.
5. Combine data from several transects to estimate abundance of insects in the area.

6. For collected insects, filed guide should be used for identification. If possible, the insects should be given to an institution laboratory.

Figure 1: Active visual survey on a line transect (existing route) during the rapid insect assessment of ONP.

3.3.1.2 Foliage tapping (Beating Sheet)

<u>Overview</u>

A beating sheet is a piece of cloth supported by a frame, which is placed below a tree branch or any part of interest. The branches/foliage are then "beat" to remove insects attached to the branches/foliage. Currently, the most common design is two pieces of wood forming an "X," with a piece of white cloth stretched behind. An umbrella can be used as an alternative. Insects can be recorded visually or collected for further identification depending on the survey goals. Preferably, a white sheet is to be used to increase the visibility of insects that will fall unto the sheet.

Field survey

Target group

Beating sheets are appropriate for sampling tree and shrub dwelling insects, such as caterpillars (Lepidoptera), some true bugs (e.g., aphids and scale insects; Hemiptera), some beetles (Coleoptera), and other plant-feeding insects. Is not a good method for sampling flying insects; they will often fly away when the branch is beat.

Materials required

GPS, field notebook, 80% ethanol, forceps, umbrella and tapping stick, and insect field guild

Protocols

1. Randomly lay transects within the area to be surveyed. Ideally, multiple transects should be used in a survey depending on the size of the area. A GPS device should be use to mark transects.
2. On each transect, systematically locate a tree within sections of the transect say 100 m, 200 m etc.,
3. For each tree, select at least three parts to carry out foliage taping/beating
4. Placed the sheet/umbrella under the part of the three selected and tap or beat for a specified number of times e.g., 3 times, 4 times etc., depending on the size of the tree to remove insects (**see figure 2 below**).
5. Identify the insects that have fallen unto the sheet/umbrella and record their numbers using field guide,
6. Using forceps, pick unidentified insects and preserved in 80% ethanol for later identification,

Figure 2: Insect survey using active foliage tapping

3.3.1.3 Sweep netting

<u>Overview</u>

Sweep netting is used to survey insects in low vegetation, particularly flies, bugs, spiders and small beetles. Sweep netting generally involves continuously sweeping vegetation with the net for a specific time period, while walking a measured transect, or covering a specified area. This allows the collector to capture relatively small or inconspicuous insects that may be missed using other methods discussed above.

Field survey

Target group

Sweep netting is used to catch invertebrates in low vegetation, particularly flies, bugs, spiders, butterfly and moths, grasshoppers and small beetles.

Materials required

GPS, field notebook, sweep net, preservatives (80% ethanol and envelope), forceps and field guild.

Protocol

1. Randomly lay transects/quadrants within the area to be surveyed. Ideally, multiple transects should be used in a survey depending on the size of the area. A GPS device should be use to mark transects.
2. On each transect, systematically locate a point at intervals say 100 m, 200 m etc.,
3. At each point, specified an area by randomly placing a quadrant of specified shape and size at the interval points.
4. Sweep through the vegetation using alternate backhand and fore-hand strokes for a specified time say 10 minutes or specified number of sweeps to capture insects.
5. Identify the insects that have been swept using field guide and record their numbers in a field notebook (**see figure 3 below**).
6. Using forceps, pick unidentifiable insects and preserved in 80% ethanol for later identification

Figure 3: Volunteers identifying insects captured by sweep net during biodiversity assessment training demonstration

3.3.2 Passive methods

3.3.2.1 Colored bowls/pan Trapping

Overview

Colored bowls/pan traps are small containers filled with liquid set out to collect insects. Pan traps often rely on colour as an attractant and are effective primarily because insects mistake them for food resources. An insect flies to a bowl/pan, attempts to land, then becomes trapped in the liquid solution—often soapy water. Bowl/pan traps can be made from nearly any object that holds liquid—. Trap size may not affect catch, so small pan traps are desirable to minimize costs; circular pans with a 7 cm diameter are common.

Field survey

Target group

Colored bow/pan trapping is appropriate for surveying flying insects. It is effective at sampling aphids (Hemiptera), thrips (Thysanoptera), bees and parasitic wasps (Hymenoptera), flies (Diptera), some beetles (Coleoptera), and even some grasshoppers (Orthoptera). Trap efficacy for each group varies with bowl/pan colour. Yellow is most commonly used, as yellow traps often collect the largest catches and highest total insect diversity, but other common colours include blue, white, red, and green.

Materials required

GPS, field notebook, 80% ethanol as preservatives, coloured bowls/pan, soap solution, forceps and field guild.

Protocols

1. Bowl/pan traps are typically placed in open areas where they can be seen by target insects.
2. Bowl/pan traps can be placed on the ground (most common), elevated above the ground

3. Hence, for a large study area, place 1 trap per square km or
4. Lay two 70 m perpendicular lines to form an "X" within a randomly selected area of your survey area. Location of traps can be marked with a GPS device.
5. Place one coloured bowl/pan at 5 m intervals on each perpendicular line making a total of 30 traps (i.e. 15 per perpendicular line)
6. Check traps to collect insects after 24 hrs. or more depending on the design of the survey. Forceps should be use in picking insects from the traps.
7. Trapped insects should be preserved in 80% ethanol per trap for identification

Note:

1. The amount of liquid in a trap can affect trap efficacy and should be recorded when setting up and checking traps
2. In dryer areas, the trap solution may evaporate too quickly between visits, so larger pan traps can be used
3. Small amounts of preservative chemicals can be added to prevent fungal growth when the time between visits is necessarily long
4. Other passive survey methods include; sticky trap, light trap etc.

Figure 4: An illustration of the placement of bowl/pan trap on a line transect (qm.qld.gov.au).

3.3.2.2 Pitfall Trapping

Overview

Pitfall traps are open-top containers buried in the ground with the rim/tip at the same level with or slightly below the ground surface to capture ground-dwelling insects. In essence, an insect walks to the trap edge, loses balance, and falls in. The container is then checked, the catch collected or documented, and reset. Pitfall traps are sometimes used dry to collect live insects, but some insects may feed on others so more often the trap is partially filled with a preservative to kill and maintain the trapped insects. A variety of preservatives have been used, including water, ethanol etc. Pitfall traps can be made of glass, plastic, or metal, but disposable plastic cups have become perhaps the most widespread trap container.

Field survey

Target group

Pitfall traps are most appropriate for sampling ground-dwelling insects like beetles (Coleoptera) and ants (Hymenoptera). They may incidentally collect flying insects, especially if the trap is roofless and white or yellow, but are not an effective sampling method for most other groups.

Materials required

GPS, field notebook, 80% ethanol as preservatives, disposable cups as trap, water, forceps and field guild.

Protocols

1. Pitfall traps can be placed nearly anywhere with suitable substrate for digging
2. Randomly lay transects within the area to be surveyed. Ideally, multiple transects should be used in a survey depending on the size of the area. A GPS device should be use to mark transects.
3. Within sections of each transect say 50, 100, 150 etc., randomly place 2-5 pitfall traps with a minimum distance of 1m apart and maximum of 10 m
4. Check traps to collect insects using forceps after 24 hrs. or more depending on the design of the survey
5. Collected insects should be preserved in 80% ethanol per trap for identification

Notes:

1. Traps with baits may attract vertebrates therefore should be avoided.
2. Note the inner color of the trap used because pitfall colour influences the group of insects that will be trapped

3. Double traps (particularly when using disposable cups) should be used to allow fast and easy removal of collected insects by removing the upper cup.

Figure 5: Volunteers setting up pitfall traps during biodiversity assessment training demonstration

3.4 Conclusion

Many of the monitoring methods discussed require collecting insect specimens one way or the other for subsequent identification. After identification, the specimens should be preserved properly depending on the group (for example, butterflies and moths are best preserve in an envelope), and donated to a university and museum insect curators or collection managers whom you might have made an agreement with. Notes including the location of the specimen, date of collection etc., should be attached to specimens.

3.5 Bibliography/further reading

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Chapter Four

4 Birds

4.1 Introduction

Birds are among the easiest of animals to survey. They are often brightly coloured, highly vocal at certain times of the year and relatively easy to see. They are several reasons for surveying birds in a given habitat or place. This include;

1. To determine the bird fauna composition of an area (Inventory for conservation purpose).
2. Evaluate the population size (i.e. total or absolute numbers) of a species or set of species in a particular area (inventory and monitoring) .
3. To investigate changes in population size via a population index (e.g., relative abundance and diversity) (monitoring for conservation purposes).

Diverse methods exist for field survey of birds. In this chapter, we describe a range of survey methods suitable for various species and conditions.

4.2 Bird field survey methods

Though several methods are listed, there are broadly two types: those for species that are evenly distributed across the landscape; and those for species that are not (i.e. are highly clumped). Listing methods, territory mapping, point counts and transects, for example, are best for species that are evenly distributed (e.g. territorial species), whereas counts of colonies, roosts and flocks are best for species with clumped distributions. The methods can further be categorized into two broad types:

1. **Listing methods**
2. **Distance methods**

4.2.1 Listing methods

Listing methods are applicable to a wide range of species and habitats, but most widely used in tropical habitats. They are suitable for rapid assessments of poorly known areas. They can be used in producing relative abundance index data for population monitoring.

McKinnon's lists

Overview

This is a form of listing that records species on fixed-length lists. This method is simple and can be used by inexperienced observers, in poorly known regions, and in bird-rich habitats. The method provides a simple measure of relative abundance, allowing indices to be compared between species and sites,

Field survey

Materials required

GPS, field notebook, bird field guild and binoculars,

Protocols

1. Walk slowly around the survey area listing the first ***n*** species of birds seen or heard, where ***n*** could be, for example, 10, 15 or 20.

2. List the names of all new bird species encountered and when *n* have been listed, start a new list. For example, when 15 birds have been listed on the list, start a new list.
3. Continue to survey until again, 15 *bird's* species have been encountered.
4. Repeat this process until a reasonable number (more than 15) of lists has been produced.
5. The relative abundance of each species is the proportion of lists on which it was recorded.

<u>Note:</u>

1. A given bird species is not to be repeated on a list, but can be listed on a new list when sighted during the survey.
2. For a survey area with different habitat types, McKinnon lists can be produced for each habitat in order to compare relative abundance index between the habitat's types.

Figure 1: A park ranger recording the birds seen or heard on a McKinnon list during biodiversity assessment training demonstration.

4.2.2 Distance methods

These are methods that involves an estimate of the perpendicular distance from the point when the bird was first detected (heard or seen) by an observer.

4.2.2.1 Transects

There are two types of transect most commonly used in bird survey; line transects and point counts (or point transects). Both are based on recording birds along a predefined route within a predefined survey unit. The aim of transects is to record all birds identified by sight or sound with an estimate of distance when first detected. Distances should be estimated perpendicular to the transect line (rather than the distance from the bird to the observer). Line and point transect are the preferred survey methods in many situations. They are highly adaptable and can be used in terrestrial and marine systems. They can be used to survey individual species, or groups of species. Both can be used to derive relative and absolute measures of bird abundance. Other measures include; diversity and density of birds.

Line transects

Overview

Line transects are used for birds of extensive open habitats, e.g. open savanna habitat. This is a highly adaptable and efficient method. Line transects are undertaken by observers moving along a predetermined fixed route and recording the birds they see or hear on either side of that route. Line transects can be walked or driven on land, sailed at sea, or flown in the air. Because the observer needs to be able to move freely through the land, sea or air, transects are most suitable for large areas of continuous open habitat.

Field survey

Materials required

GPS, pencil, field notebook, bird field guild, laser range, binoculars and telescope.

Protocols

1. Randomly establish transect routes in the area to be surveyed. Where it is difficult to establish routes, an existing route such as roads, paths or field boundaries can be used. A GPS device should be used to mark transect routes in order to aid navigation.
2. The number and total length of transect route will depend on the nature of the survey, the number of birds in the survey and the size of the survey area.
3. To avoid counting the same birds twice, routes need to be at least 150 m apart.
4. Visit each transect at least twice to record birds seen or heard and their number while walking slowly on the transect route.
5. The speed of walking the routes depends on the numbers of birds present, ease of walking through the area and recording birds.
6. A distance band say 20, 30 m etc., away from the transect can be used to estimate distance or a laser range finder can be used to determine the distance of each bird from the transect line.
7. The counts data collected can be used to estimate relative abundance, richness, diversity and density of bird species in the survey area.

Figure 2: Volunteers on existing transect route (road) surveying birds during biodiversity assessment training demonstration.

Point counts or point transects

<u>Over view</u>

These methods are used for highly visible or vocal species, often passerines, in a wide variety of habitats and are particularly suited to dense vegetation. A point count is a count undertaken from a fixed location for a fixed time. Point counts can be used to provide estimates of the relative abundance of each species or, if coupled with distance estimation, can yield absolute densities.

Field survey

Materials required

GPS, pencil, field notebook, bird field guild, laser range, binoculars and telescope.

Protocols

1. Point-count stations (the position from which the count is made) should be laid out within the study plot either in a regular/systematic manner or in a random manner. A GPS device can be used to locate the random point within the survey area.
2. The number of points will depend on the nature of the survey, the richness of the survey area in terms of the number of birds and the size of the area to be surveyed.
3. Points should be at least 150 m apart.
4. To survey birds, visit each point, wait for a set time, say a minute, before beginning to count at each station in order to allow the birds to settle down following your arrival.
5. Identify and count birds seen or heard for a fixed time at each point. Endeavour to count each individual only once at each station. Ideally, this should be either 5 or 10 min, the actual duration depending on habitat and the bird communities present.
6. Note; In areas with a very rich bird fauna or where species are hard to detect or identify, for example, in a tropical rainforest, it may be necessary to count for longer than 10 min.
7. A minimum of two visit to each point is required.
8. A distance band say 30 or 50 m etc., away from each point can be used to estimate distance or a lasser range finder can be used to determine the distance of each bird from the transect line.

9. The counts data collected can be used to estimate relative abundance, richness, diversity and density of birds' species in the survey area.

Figure 3: Volunteers viewing birds at a point station during biodiversity assessment training demonstration.

4.3 Bibliography/further reading

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Chapter Five

5. Mammals

5.1 Introduction

Survey methods for mammals depend largely on the size of the species and its natural life characteristics. Reasons for surveying mammals could either be for an inventory or monitoring purposes as outlined in previous chapters. On one hand, diurnal, common and highly visible mammal species can easily be surveyed. While on the other hand, nocturnal, rare mammal species that are difficult to detect, will be difficult to survey. Field survey methods also with groups of mammals. Mammals are broadly classified into three;

1. **Small mammals**; Small mammals are divided into small terrestrial and volant mammals (bats). Usually smaller than the largest rodents (capybara, nutria, grasscutter) or lagomorphs (hares, rabbits). Examples include; moles, shrews, rats etc.
2. **Medium sized mammals**; They are small carnivores, small primates, large rodents, hyraxes, pangolins etc.
3. **Large mammals**; Most ungulates, diurnal primates, most carnivores larger than a fox or house cat. Examples include elephant, lion, leopard, buffalo, monkeys, baboons etc.

5.2 Mammals field survey methods

5.2.1 Active survey on line transect

Line transects are best used for visible mammals (relatively large and conspicuous) in open habitats. As discussed in the previous chapter. The protocols are basically the same with that discussed in previous chapters for line transect.

5.2.2 Counting calls

<u>Overview</u>

This method is used to survey both diurnal and nocturnal vocal mammals. For example, lions roar, and seals and sea lions can be heard roaring even in dense fog. The idea is to count calls or bursts of calls for a standard unit of time, and to use these counts as an index of population size.

<u>Field survey</u>

<u>Materials required</u>

GPS, field note book/data sheet, and mammal's field guide.

<u>Protocols</u>

1. Randomly generates point for the study area with appropriate minimum distance between points.
2. At each point, counts the number of times a species of mammal calls is heard. While it is difficult to recognize individuals of a species from their calls, species can be distinguished.
3. Dungs, burrows, runways, footprints, and feeding signs especially for herbivorous mammals may also be counted.
4. Collected data can be used to estimate population size or abundance.

5.2.3 Trapping

Small mammals are readily live-trapped in box traps, which is the most common method for assessing the abundances of many mammal species. Many trap designs are available for surveying mammals depending on the aim of the survey.

<u>Snap traps</u>

<u>Overview</u>

Snap traps are used in inventories of small mammals when the objective is to restrain the animals to obtain voucher specimens or specimens for collections. A snap trap usually consists of a trigger pan, supplied with bait and mounted on a flat piece of wood to which a spring-loaded metal bale is attached. When a tiny bit of pressure is applied to the trigger pan, the spring is released and the bale snaps down on the animal. The bale kills the animal, usually by cervical dislocation.

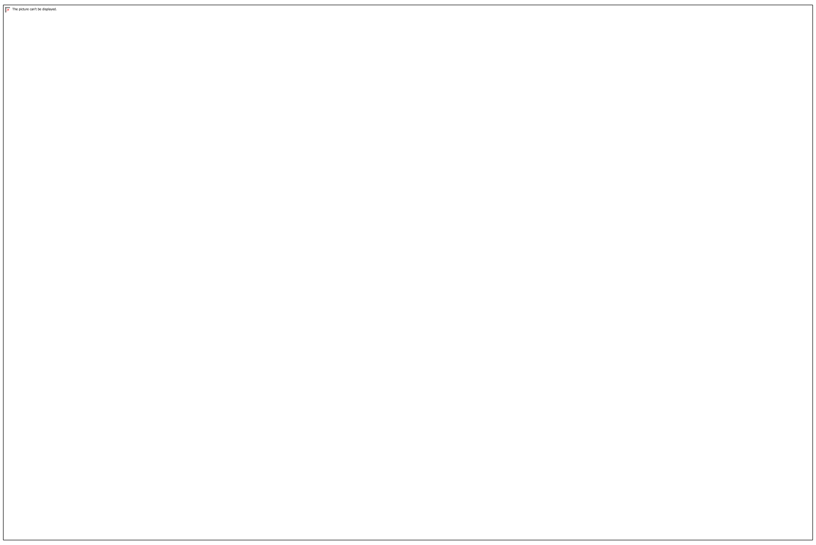

Figure 1: A sample of a Snap trap

<u>Box trap (life trap)</u>

<u>Overview</u>

Box traps are the most effective way to capture small terrestrial mammals without harming them. Box traps have a trip pan that causes spring-loaded doors at one or both ends of the trap to close when an animal touches it. For optimal results, baits should be placed on the trip pan. Most small mammals can spend several hours in a box. Box traps come in a variety of styles and sizes. The type of trap used should be appropriate for the species that are expected to be captured. Box/Life traps available for surveying small mammals include; Longworth Trap, Sherman trap, Ugglan trap, Havahart Trap, Trip Trap, Wellfield trap and Pitfall Trap.

General field survey for traps

Material required

GPS, field note book/data sheet, traps, bait, personal protective wears such as gloves, and mammal's field guide.

General protocols

1. Place trap at appropriate area used by mammals, e.g., around burrows, runways/tracks, around bushes, streams, ponds etc.
2. A minimum of 100 traps placed at least 100 m apart is required for an efficient inventory survey.
3. To protect small mammals from cold and rain, boards are often used to cover live traps.
4. Food is usually provided to lure animals into the traps, but also to sustain them once they have been caught. Different food items should be provided when targeting different species.
5. Traps should be visited twice a day; early morning and evening, or four times a day to reduce the stress of capture.
6. For night trapping, night checks should be carried out if possible, or traps should be set as late as possible and checked as early as possible in the morning.
7. Pitfall traps and other multi-catch traps should be visited as often as possible, since trapped animals can injure one another by fighting.

Note;

1. Most animals trapped in traps will be alive, and a decision has to be made if a particular animal is to be released or kept as a voucher specimen.
2. There could be risks of disease transmission from wildlife species- depending on handling.
3. As a general precaution, investigators should wear personal protective equipment (PPE) for handling live or death animals.
4. In regions with specific risks (*e.g.* hantavirus, Lassa fever, rabies etc.) a mask or full protective gear is recommended.
5. Small mammals especially rodents are handled by holding the skin at the back of the necks gently but firm.

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