

# BIOTA Training Workshop for Para Ecologists in Gobabeb / Namibia

(18 October – 5 November 2004)



## **Training has been conducted by**

Dr. Ute Schmiedel, University of Hamburg

Vilho Snake Mtuleni, BioNasc

Natalie Davidson, DRFN

Veronica Siteketa, DRFN

Prof. emer. Martin Scriba, München

Dr. Cornelia Krug, University of Stellenbosch

Dipl. Geogr. Bettina Koelle, INDIGO

Prof. Manfred Hinz, University of Namibia

Dipl. Biol. Carolin Mayer, University of Hamburg

**Monday, 18th October 2004**

### **Rules in Gobabeb**

- stick to the paths
- use water sparingly
- drink a lot of water
- save energy
- do not touch research set-ups (e.g., spoons in the rivier)
- do not litter (cigarettes etc.)
- separate rubbish

### **Our own house rules**

- be on time (always, for classes and meals)
- both languages to be used (English and Afrikaans)
- Respect one another (cultures, ideas)
- Always feel free to ask questions
- Programme will be flexible
- Neatness
- We should work as a group (team work)

### **Time schedule**

7:15 breakfast

8:00 start

betw. 10 and 10:30 tea / coffee (30 min)

12:30 lunch break

13:00 lunch

14:00 begin afternoon session

15:30 tea / coffee

17:00 feed back session

20:00 supper

### **Draw the area where you are from:**

What is special about it, what do people do there, how does it look like?

### **Introduction interviews**

(the attendants interviewed a partner and introduced him/her to the group)

What is your name?

Where are you from?

How does the landscape, the place look like?

What is special about your place?

How do people use their land?

What did you do until now?

Why do you want to become a para-ecologist?

### **What do I hope to happen?**

- understanding the course and each other
- sharing of experiences
- Do job efficiently after the training
- Interesting course for everyone
- Learn about plant identification and lichens
- Learn field practices
- Respect each other
- Team work, all participate
- Achieve course objectives
- Have fun

### **What do I hope not to happen?**

- lateness
- people do not follow rules
- fighting
- more confused after the course than before
- people not respecting each other
- no communication
- to be uninterested and bored
- be too shy or uncomfortable to ask questions
- badly prepared courses (both sides)
- non-equal participation
- feel left out

**Tuesday, 19<sup>th</sup> October 2004**

### **Why monitoring of biodiversity (brain storming)**

- to learn how land changes from year to year
- to assess and conserve knowledge
- for sustainable management of resource
- to be able to adapt farming methods according to changes
- to be able to make recommendations

### **How to find out what causes differences in the veld: land-use or other factors?**

- look at history of land-use
- long-term ecological records
- start monitoring of present changes
- conduct experiments (different intensities and kinds of land-use)
- analyse soils at both sides of a fence line contrast and see whether or not they are identical but be aware of the fact that soils may also changes in time due to land-use and natural erosion (look at topography)
- look at land-use and see whether it differs at the two sites
- choose and compare neighbouring sites

### **What is BIOTA?**

BIOTA is a long-term monitoring and research project on the impact of different types of land use and climate change on biodiversity. The project is a collaboration

between South African, Namibian and German scientists of different disciplines (e.g., Soil scientists, Botanists, Zoologists, Ethnologists, Economists).

It is carried out in South Africa and Namibia from areas with high winter rainfall (Cape) to areas with high summer rainfall in the Kavango, running also through arid (dry) areas in between (Namaqualand, Namaland).

The yearly (annually) monitoring is conducted on standardised research sites (so called Biodiversity Observatories) which are 1 x 1 km<sup>2</sup> in size and subdivided into a grid of 100 1 ha plots. Typically the Biodiversity Observatories are set up on two sides of a fence line contrast between different land-use types.

### **Biodiversity Observatory**

- What are the sizes of the different plots in m<sup>2</sup>?

10x10 = 100 m<sup>2</sup> (multiply 10x10)

20x50 = 1 000 m<sup>2</sup> (multiply 100 x 100)

100x100 = 10 000 m<sup>2</sup> (multiply 1000 x 1000)

1000 x 1000 (1 km x 1 km) = 1 000 000 m<sup>2</sup>

### **How many hectares fit into one Observatory?**

100 hectares (10 x10 times)

### **How to explain the set-up of a Biota Observatory to another person that does not know anything about BIOTA?**

**Wednesday, 20<sup>th</sup> October 2004**

### **What is biodiversity?**

The living environment (= humans, animals, plants, fungi, bacteria) with its

- .. richness in species
- .. richness in shapes and structures
- .. richness in genes
- .. diversity (richness) in processes and interactions

Diversity is size dependent! The bigger the area, the more species live there

Geo-diversity is the richness of non-living environment (landscape, soils, rock types)

### **What influences biodiversity?**

(result of group work and subsequent clustering of cards)

#### **Man-made influences:**

Overgrazing, deforestation, hunting & poaching, illegal collecting, conservation, environmental unfriendliness, pollution of air and water, sustainable land-use,

#### **Natural conditions**

Structure of landscape, earth crakes, volcanoes, geodiversity

#### **Natural conditions that can be enhanced by humans:**

Soil fertility, ozone hole & UV, fires, soil erosion by wind and water,

## **Climate, Climate change**

rainfall, sunshine

## **What different kinds of land use do exist in Southern Africa?**

Livestock farming: sheep, goats, cattle, donkeys, pigs, chicken, horses, ostriches, game

Cropping: cotton, Lucerne, millies, rice wheat, pumpkin, vegetables, fruits, mahangu, sugar, medical plants

Plantations: Forestry, succulents

Others: water harvesting, fire wood, mining, harvesting constructing material, harvesting food (“veldkos”), alcohol production, medicinal plant harvesting, tourism

## **How does land use influences biodiversity?**

**(Which effects do you know (and why do they happen)?**

### **Trampling:**

Causes wind and water erosion of soils, enhances invasion of plants,

### **Overgrazing (e.g., around water points):**

Causes deforestation, vegetation will disappear, veld will change: poisonous plants and annuals (Namaqua daisies) will come in, increase of opslag, decrease of shrubs, causes erosion, causes bush encroachment, may cause bare patches

(**browsers** feed on shrubs and trees, for example goats, **grazers** feed on grass and herbs for examples sheep)

### **Ploughing:**

Destroys natural vegetation (very slow recovery of natural veld), often only kraalbos and alien plants come back.

### **Collection of firewood**

Destroying also life plants by not only collecting dead wood, loss of soil cover, destroying animals' homes and hides

### **Car tracks:**

Damage plants, remain visible, cause erosion

## **What is the value of biodiversity (why is biodiversity important)?**

- ecotourism
- enjoyment
- for medicinal use
- traditional use of plants (medicine, building, decorating, firewood)
- strengthen veld against hazards
- increases productivity (?)
- cultural use
- important to understand and study it

**Thursday, 21<sup>st</sup> October 2004**

## Lichens

A lichen is a symbiotic (relationship) between fungi and algae. This two different organisms depends on each other for survival. The algae manufacture its own food by photosynthesis, the fungi on the other hand lives off other organisms.

The lichen is different in appearance from its two components. The lichen adapts to environment in which neither the algae nor the fungi could survive on its own. The algae provide sugar and other food stuff to the fungi. The fungi provide a protective covering and moisture to the algae.

There are about 18 000 known species of lichen, each with its own characteristic shape, size and colour.

**Distribution:** Lichens have successfully adapted to almost every habitat on earth.

**Growth:** The growth of lichens is favoured by periods of high humidity, cool temperatures and low light intensities.

### **Ecological Importance**

Lichens are the first colonists of bare habitats and therefore form a ground cover that prevents wind and water erosion.

Good indicators of air pollution (biological indicator).

Good indicator of disturbance (when nature is disturb they are the first to disappear).

Valuable food source for various micro-organisms (insects and animals).

In some area such as Greenland, they are abundant that farmers harvest them as fodder for cattle, replacing grass.

Favourable nesting for birds such as the endemic bird to the west coast of Namibia called the Damara tern.

### **Importance value**

Manufacturing of perfumes

Antibiotics

Colouring agent

**Friday, 22<sup>nd</sup> October 2004**

**What are the functions of the organs of a plant** (roots, stem, leaves, flowers, fruits, seeds)?

#### **Roots:**

- to take up water and nutrients from the soil
- anchoring the plant in the ground
- storage of water, nutrients, starch (reserves)

#### **Stem:**

- to transport of water and nutrients from the roots to the rest of the plant
- to hold plant upright (for light!)
- to give plant the shape
- to climb (climbing plants)
- to store water (stem succulents), nutrient
- to conduct photosynthesis (for some plants with green stems)

- to protect the plant (with some plants the stems form thorns)

### **Leaves:**

- to collect sunlight for photosynthesis (-> sugar, starch)
- protection (some plants have spiny leaves or even the entire leaf can become a thorn)
- storage of water (leaf succulents)
- climbing (some plants use their leaves for climbing, for example some bean or pea plants)

### **Flower:**

Pollination, fertilization (cross breeding with other individuals of the same species)

### **Fruits:**

- to protect the seeds
- to disperse (Afrikaans: versprui) the seeds

### **Seeds:**

- to be dispersed and make the plant grow at a different place as the mother plant did

### **What is a species?**

- plants / animals / fungi / bacteria etc. of one species look similar: with respect to flowers, fruits, leaves, shape of the plant etc.
- there are however, small differences between young and old plants / animals or plants / animals that grow in different habitats (for instance plants growing in the shade and or in the open sunlight)
- individuals that cross-pollinate or mate with each other successfully under natural conditions

Several species that are closely related form one genus (plural = genera)

Many genera that are closely related form one family (for instance the Aster-family = Asteraceae)

### **Why scientific names?**

- Different languages have different names for the same plant or animal species
- People in different areas have different names for the same plant or animal species
- Local names do not give insight whether or not the species are related (for instance Soetdoring, Kameeldoring, Swarthaak are all Acacia species but you can't tell from their Afrikaans name)
- Different species often have the same local name (for instance at least two different plant species are called "knoppie-stinkkruid" in the Namaqualand)

### **Where do the names come from?**

It started off with scientists describing the plants (in latin) for instance ("tree with long, dark green leaves and yellow flowers"). Carl von Linné, a Swedish

biologists, than suggested about 200 year ago to only to use two words to name a plant or animal, one name for the entire genus (see above) and one for the species. For instance: *Acacia erioloba* = Kameeldoring (Acacia is the name for the genus, there are many species in that genus that have this name. *Acacia erioloba* is the name for the species, only the Kameeldoring is named like that)

Scientific names today either

- describe the species, for instance *Osteospermum* = (“bone-seed”) *oppositifolia* (“opposite leaves”)
- or are named after the area they come from (*Acacia karoo*)
- or are named after a person (typically biologists) *Welwitschia amabilis* (named after Mr. Welwitsch)

### **Different plant types**

Annual plants = (Afrikaans: opslag) only live during the growing / rainy season, they die off when it gets too dry or too cold

Perennial plants: plants that live for several years

Bulb plants = (bolplante) plants that only grow during a certain time of the year (typically during the growing / rainy season) and survive the rest of the year in the bulb (or other underground storage organs) in the soil

Trees, shrubs, some climbers = visible all the year through but might change the colour of the leaves or even drop the leaves during the dry season

### **How does the appearance of a plant vary over the year?**

- Produce new leaves & branches
- Produces flowers and later fruits
- Fruits ripen and they or the seeds get dispersed
- Leaves might become yellow, red or brown
- Leaves might be dropped / shed
- Some plants die off completely (annuals, bulb plants)

### **How to do phenological monitoring?**

(Phenology describes how a plant changes over the year, i.e., growing, flowering, fruiting, shedding leaves etc.)

Generally, the phenological monitoring should be done from above the plant, looking down to the central, upper part of the plant. However, plants of different sizes require slightly different approaches:

#### **Herbs (annual and biennial, geophytes), grasses**

For shoots, leaves, flower, fruits: Count shoots, leaves, flower, fruits from above **for the entire plant**. Measure diameter (broadest width, second diameter and height of plant).

#### **Dwarf shrubs (smaller than 15 cm):**



For shoots, leaves, flower, fruits: Count shoots, leaves, flower, fruits **for an area of 10 x 10 cm** from the top of the plant.

**Dwarf shrubs (15 cm to 1.5 m):**

For shoots, leaves, flower, fruits: Count shoots, leaves, flower, fruits **for an area of 50 x 50 cm** from the top of the plant.

**Small trees and large shrubs (1.50 m to 3 m):**

For flowers and fruits: Count fruits / flowers **for an area of 50 x 50 cm** at the upper crown of the plant.

For shoots and leaves: Count new shoots and leaves of different stages **for an area of 50 x 50 m** at a lower, reachable part of the crown (not shaded by another tree).

**Tall trees (taller than 3 m):**

For flowers and fruits: Count fruits / flowers **for an area of 1 x 1 m or 2 x 2 m** at the upper crown of the plant.

For shoots and leaves: Count new shoots and leaves of different stages **for an area of 50 x 50 m** at a lower, reachable part of the crown (not shaded by another tree).

**Note!!**

- Monitor the same **40-60 plant species** by looking at **10 individuals** every month. Choose mainly plant species that are relevant for grazing / land use (good grazing plants, poisonous plants, plants that typically get less or more under high grazing pressure).
- Do the monitoring always at about **the same time of each month** (that is, during the first week of the month).
- Write always down for **what area size** (for instance 10 x 10 cm, 50 x 50 cm etc.) you did the counting!
- Mark the area where you monitor the respective species with a **GPS and write coordinates down** that you can find the plant again anytime.
- Take an **herbarium sample** of each plant species you monitor (as soon as you have your permit).



**Saturday, 23<sup>rd</sup> of October 2004**

Introduction into the use of computers: How to use Windows Explorer and Microsoft Word.

Visit *Welwitschia mirabilis* population near Gobabeb and the Homebills

Sunday, 24<sup>th</sup> October 2004

Visit Lichenfield at Wlotzkasbaken, Swakopmund, beach, shopping

Monday, 25<sup>th</sup> October 2004

## **Introduction into the practical work. a) Vegetation relevés and to collect plants, b) insect and c) small mammal surveys**

### **a) Botanical practical training:**

#### **How to do vegetation relevés?**

Estimated for each plant per species separately, how much area it covers (as looked from the sky like a bird) from the entire area of the relevé (this is expressed in percent). The single covers of all individuals per species that belong to one size class (i.e., 0.5-1m, 1-2m, 2-5m etc) are added up and noted in the respective column in the data sheet. Also note number of individuals per species per relevé in the column "Abundance".

Percent for the different plot sizes.

Note: Percent is a relative measurement. The bigger the relevé the bigger in square meter (m<sup>2</sup>) is for instance 1 % of the relevé.

**a) for 10 m x 10 m relevé (100 m<sup>2</sup>)**

10 cm x 10 cm	= 0.01 %
10 cm x 1 m	= 0.1 %
50 cm x 50 cm	= 0.25 %
50 cm x 1 m	= 0.5 %
<b>1 m x 1 m</b>	<b>= 1.0 %</b>
1 m x 2 m	= 2.0 %
1 m x 5 m	= 5 %
1 m x 10 m	= 10.0 %
5 m x 5 m	= 25 %
5 m x 10 m	= 50 %
10 m 10 m	= 100 %

**b) for the 20 m x 50 m relevé (1 000 m<sup>2</sup>)**

10 cm x 10 cm	= 0.001 %
10 cm x 1 m	= 0.01 %
50 cm x 50 cm	= 0.025 %
50 cm x 1 m	= 0.05 %
1 m x 1 m	= 0.1 %
1 m x 2 m	= 0.2 %
1 m x 5 m	= 0.5 %
<b>1 m x 10 m</b>	<b>= 1.0 %</b>
5 m x 5 m	= 0.25 %
5 m x 10 m	= 0.5 %
10 m x 10 m	= 10 %
10 m x 20 m	= 20 %
5 m x 50 m	= 25 %
10 m x 25 m	= 25 %
10 m x 50 m	= 50 %
20 m x 25 m	= 50 %
20 m x 50 m	= 100 %

## **How to collect and press plants?**

**NOTE!! Make sure you have a valid permit (not expired) with your name on. Only if you have that you are allowed to collect plants (and animals)!!**

If you **collect plants** for identification and documentation make sure that your sample has all parts of the plant that might be necessary for plant identification, i.e.,

- Flowers and / or fruits (if possible not only fruits from the previous year which might be weathered and might not have seeds)
- Typical and healthy looking leaves
- Nice pieces of branches / twigs

Take enough material for three nice herbarium sheets (they will go to different herbaria and each of them need to be as complete as possible).

Give each collection a **collection number**, i.e., number them with your initials plus a number. Start with 0001, next collection will get the number 0002 etc.

Complete **herbarium data sheet** for each specimen you collected (if possible directly at the site where you collected it):

Write the collecting no for the plant (incl. your initials) on the data sheet.

- Take a GPS reading of the site where you collected the plant and note it in the data sheet.
- Describe the habitat according the data sheet.
- Describe the plant according to the data sheet (see below for the meaning of the technical words).

### **How to press the plant:**

Write the following information on a double page of old newspaper:

- Collection No (incl. your collection)
- Date of collection
- Locality of collection
- Plant name, if scientific name is not known, write your nick name or the local name.

Put plant into newspaper (A3 size), put two layers of the grey nappies below and two on top. If the plant is very thick, put one layer of hard card board between the plant and the next layer of plants. Put the wooden top on top of the plant press and close the plant press with the two strings as tight as you can.

Change grey nappies about every second day (depending on how much water the plants contain) until they are completely dry. This can take up to 4-6 weeks (for succulents). Dry the wet “nappies” in the sun/wind.

Big fruits (like fruits of *Acacia erioloba* / Kameel doring) will be kept separately in a in a paper bag. Write the same information as you wrote on the newspaper also on the paper bag before you put the fruits in.

### **How to understand the herbarium data sheet:**

Relevé = Plot, survey, plant opname = is the area where you did the vegetation survey. If you collected the plant outside such a relevé leave this field empty.

Altitude = height (in meters) above sea level (sometimes also called elevation). You will get that from your GPS at the same page where you find the latitude and longitude coordinates.

### **Description of plant:**

Annual = Plant only live one year or one growing season and then dies. Next year it will grow out of the seed again.

Biennial = Plant lives for two years only

Perennial = Plant lives for many years (for instance shrubs, trees, but also bulbs)

Ephemeral = plants that only live less than a year but do not occur regularly every year but only at special events

Tree = has one stem which branches at a certain height, typically taller than 1-2 m

Shrub = branches from the ground typically not taller than 2-5 m

Dwarf shrub = (dwerg bos) small shrub, typically only up to 50-1 m tall

Herb = plant without woody stems (for instance annuals, perennials)

Sedges = Afrikaans: sipergras, waterbiesie, matjiesgoed, rietgras. It is a certain type of plant that looks very similar to a grass.

Hydrophyte = Plant that grows in open water (like waterblommetjies)

Climber = plant that climbs in other plants or in fences etc.

Epiphyte = plant that grows on other plants without having a negative effect on it, they don't take anything away from the plant they grow on.

Geophyte = bulb plants, plants with underground organs. They normally only grow during growing season and retreat into their storing organs during the dry season

Succulency = does either leaves or stem store water in a way that you can see it (forming round, thick leaves or thick stems?)

Tussock = (Afrikaans: graspol, graswallejie) plant that forms thick bunches

Fern = Afrikaans: varing. Primitive plant that mainly grows in shady, humid places.

Crown diameter = how broad is the broadest (upper) part of the plant (particularly trees)

### **Occurrence:**

Rare

Occasional = it does occur regularly but not very often

Common = it does occur relatively often

Abundant = it does occur often and in high numbers

Dominant = it dominates the vegetation (it is the most important plant in the area where collected)

Inflorescens = refers to the branch where many flowers are found together. Leaf it out if you are not sure what to write here

Flower colour = Most important for later identification!!! Note the colour(s) of the flower  
Leaves = note shape, colour, whether or not it has hairs, thorns etc.  
Bark = (Afrikaans: bas) the outer layer of the stem of a tree or shrub  
Fruit Do not taste, eat any fruit (or other part of a plant) you which you do not know for sure that it is edible!  
Sap = break a branch and look for sap (milk or other liquid that comes out)

**Habitat:**

Substrate = place where plant grows  
Topography = in what part of the landscape did the plant grow  
Aspect = also called “exposition .“ Only applies if the plant grew on a slope: in which direction did the slope face (look at?). If the plant grew on a flat area you do not have “aspect”.  
Abandoned land = “old lands”, land that has been ploughed and cultivated but is presently not used anymore.  
Planted pasture = land that has been cultivated for livestock feeding (Afrikaans: weiveld)

**Plant distribution:**

Local = only occurs in a small area (for instance: only in the Richtersveld)  
Widespread = plant occurs in a broad area (like from Namibia to the Cape)  
Seasonality = what time of the year does the plant has its leaves?  
Evergreen = all the year through  
Semi-deciduous = the plant sheds parts of its leaves (during the dry season)  
Deciduous = the plant sheds all its leaves (during the dry season)

## **B) How can one distinguish an insect from none insect?**

- The only invertebrates which have wings.
- They have 3 pairs of legs.
- Have pair of antennae.
- The body is divided into three body parts (head, thorax and the abdomen).

Examples of this are: beetles, ants, termites, crickets etc.

Scorpions and spiders are not classified as insects as they lack the above mentioned characteristics. The most distinct one is that they lack 3 pair of legs.

### **What role do insects play in life?**

#### Ecological importance.

- ❖ They form part of the food chain.
- ❖ They break down dead plant and animal materials into organic matter (decomposers).
- ❖ Well known plant pollinators.
- ❖ Can be used as an indicator.
- ❖ They are used as a biological control agent by farmers.
- ❖ They are responsible for changing landscapes.
- ❖ They transmit diseases (e.g. mosquitoes transmit Malaria).

#### Economic importance

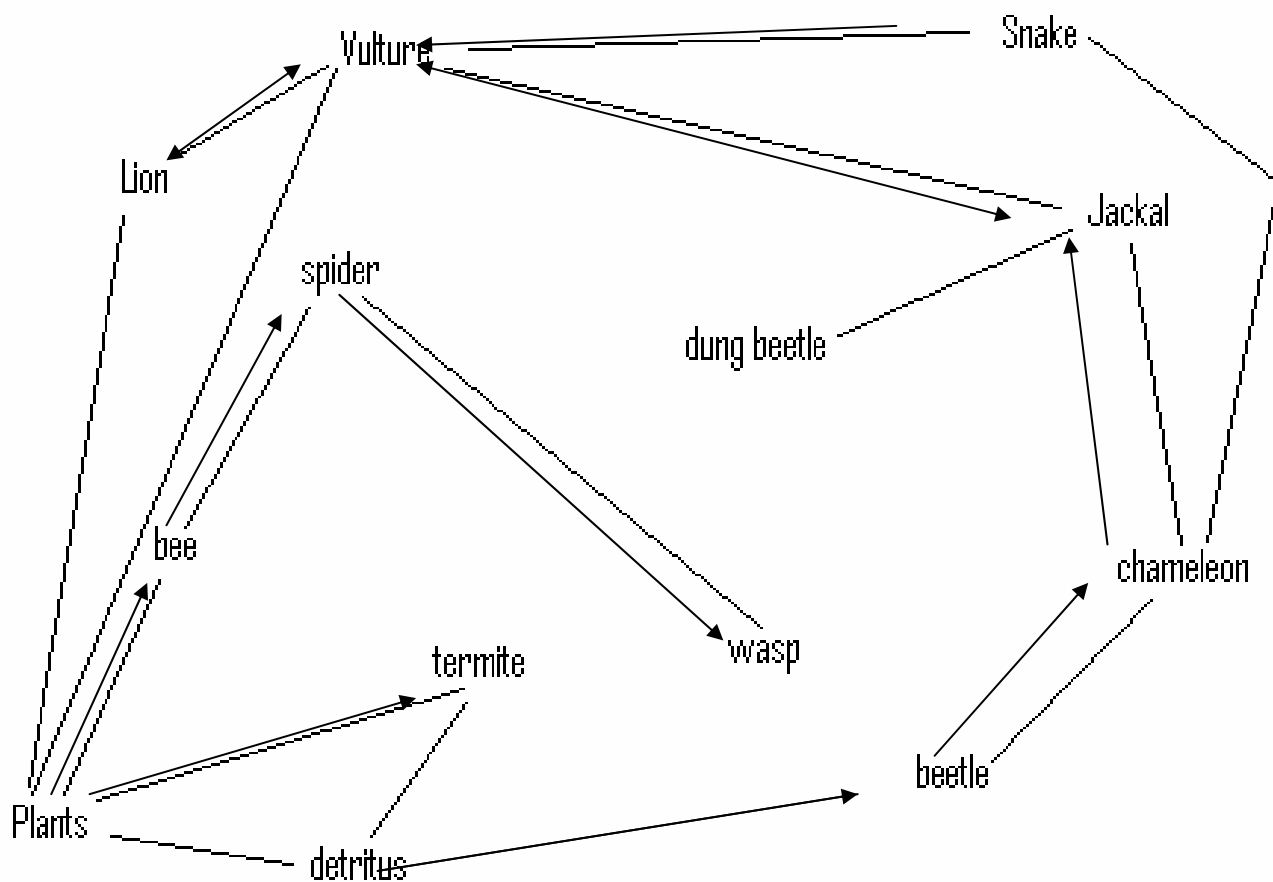
- ❖ Food for human (e.g. honey).
- ❖ Used by Bushmen as a poison for their arrows.

### **How do people in your community control pest?**

- ❖ They use chemicals.

NB. > Most chemicals are not species selective, in other words they do not only kill the target insects, but also the none targeted once. In a long run this will have environmental problems.

## How organisms depend on one another for survival (food web)



The soil acts as a store for all the nutrients that living organisms requires. Plants are the primary producers. Energy flow from one animal to another by eating each other.

What happens is when one of the above animals is removed it create a problem to the whole ecosystem leading to the ecosystem collapsing.

### Beetles 1

- 3 pairs of legs
- 2 pairs of wings
- 380.000 species in the world
- chitin and calcium
- jaws for biting and chewing
- antennas for feeling and tasting
- compound eyes
- thorax – muscles
- abdomen – gut, respiratory system (tracheas), sex organs



## Beetles 2

- 45 families
- hardened body: chitin and calcium
- hardened forewing = elytra
- elytra often permanently fused, forming an air chamber
- hindwings are membranous, can be folded under elytra, or are reduced; flightless
- jaws for biting or chewing
- family : **darkling beetles**
  - Gobabeb: 82 species
  - Namib: 320 species
  - = 80 % are endemic
- often with long legs (running)
- widespread in arid and desert areas (Namib)

## Features of the Namib Desert

- Air temperature in shadow is up to 45 degrees Celsius
- Surface temperature of in plant-free areas is up to 70 degrees Celsius
- Relative daily humidity between 0,0-2,5 %

## Problems of desert animals

1. To hold body temperature constant = thermo regulation
2. To avoid loss of water from the body = moisture regulation

## Adaptation of darkling beetles

### 1. Thermoregulation

- Living nocturnal
- During daytime living under stones, in holes, between roots, dug into the sand of dunes
- Developing a whitish waxy bloom above their surface
- Long slender legs, fast running

### 2. Moisture regulation

- Waxy blooms
- Small pores in chitin
- Air chamber below elytra for water storage
- Closing of spiraculums
- Feed on water-rich food

Fog harvesting beetles , weight increases about 12-30 %

## C) Para-Ecologist Training: Small Mammals

*Cornelia B. Krug, Conservation Ecology Department, University of Stellenbosch*

### 1. What is a mammal (soogdier)?

A mammal is an animal belonging to the vertebrates (animals with an inner skeleton). Mammals give birth to live young that grow in the womb (uterus) and feed their

young with breast milk. Mammals take care of their young – at least until they are weaned.

Mammals do have 4 legs (2 front legs and 2 hind legs), and their body is covered with hair. In some species, the legs are reduced, and the body is hair less.

## **2. *What is a small mammal?***

A small mammal is a terrestrial mammal, belonging to the order Rodentia (Knagdiere) and Insectivora (Insektevreter). Their body weight is usually less than 1kg.

The following animals are regarded as small mammals:

Insectivora:

Shrews (skeerbeke):

Elephant shrews (klaasneuse):

Golden moles (goue molle):

Rodentia:

Gerbils (nagmuise):

Mice and rats (muise 'n rote):

## **3. *The role of small mammals in the food chain***

Small mammals are in the middle of the food chain. They eat plants and plant parts, like leaves, seeds, fruit and flowers, but also dry material (detritus). They also eat insects (like beetle larvae, ants and termites). In turn, they are eaten by a number of small to medium-size predators, like owls, raptors, mongooses, cats, jackals, foxes.... Many of these species depend on small mammals as their main food source. As small mammals eat flowers, they also act as pollinators. Some of them hoard (or cache) seeds in their burrows, and so help with the dispersal and germination of plant species.

Some of the rodents can also become pest species – they will eat grains and other crops, and also inhabit human dwellings where they can get into the food stores.

## **4. *Where do small mammals live?***

Most commonly, small mammals live in underground burrows (gerbils, striped mice), which they dig themselves. Some species use abandoned burrows of other species (e.g. shrews). Other small mammals build nests out of grass (vlei rat, climbing mouse, striped mouse) or sticks (bush karoo rat), and some build their nests in trees (tree rat). Some species (pigmy mouse) simply live under logs or branches on the ground, while others (rock mouse, pigmy rock mouse, dassie rat) live in rock crevices.

## **5. *How do small mammals adapt to arid conditions?***

Small mammals can adapt to arid conditions in a number of ways. Overheating and moisture loss can be avoided by being active at night, and spending the day in cool underground burrow. To get water, they can also eat food that has a high water content, like succulent plants or insect larvae. Gerbils do have special adaptations to the arid environment – they can metabolise water from dry food (i.e. they can make water when they digest their food), and they are also able to concentrate their urine.

To avoid overheating during the day, small mammals usually restrict their activity to the morning and afternoon hours, and stay in the shade of bushes.

## **6. *Why study small mammals?***

To know where they live (which habitats they occupy) and what they eat

To find out what eats them

To find out about their daily activities  
To investigate which small mammals live in an area (biodiversity monitoring)  
To study changes in small mammal populations over time  
To study how they adapt to their environment  
To find out about their social behaviour and how they interact  
To determine their reproductive biology (how many young they have, and when they have them)

### **7. *How to study small mammals***

Live-trapping is usually used to determine which small mammal species occur in an area or habitat.

To capture small mammals, traps are required. There are a number of different traps, the most commonly used are foldable or non-foldable box traps made out of aluminium or stainless steel sheets. Traps made out of PVC pipes are also available. Traps are usually either set out in a line, or in a grid. Traps can also be placed next to burrow entrances and runways to increase trapping success.

To attract the small mammals, bait (food) is placed in the traps. Normally, a mix of peanut butter and oats are used. However, other food items (marmite, bacon, insect larvae) can be used to attract insectivorous species.

Depending on the species studied, traps are either checked in the morning and evening, or at regular intervals during a 24h period.

Checking traps and collecting data:

When a small mammal has been found in the trap, the following data are recorded (see also attached datasheet):

- Site where traps are laid out
- Date and time of trap check
- Trap number or placement
- Species
- Sex: – male or female
- Ageclass: adult, subadult, juvenile
- Body measurements: weight, body length, tail length, hindfoot length, ear size
- Breeding condition: males: scrotal or abdominal testes, female: perforate (open) or imperforate (closed) vagina, pregnancy, lactation
- Anything that is special / noteworthy is recorded

### **Practical Work: Trapping small mammals in Nara hummocks**

Monday:

Bait was prepared. Peanut butter and oats were mixed to form a very stiff dough.

At 18:00, 20 traps were set. 10 in the nara hummocks, 10 in the open. A teaspoonful of bait was put in each trap.

Tuesday - Thursday:

Traps were checked at 8:30, 9:30 and 10:30. At 10:30, the traps were closed. At 16:00, the traps were opened and then checked again at 18:00.

Between 8:30 and 9:30, we took a walk. We looked for tracks, other places where small mammals can live (e.g. rocks and rocky outcrops) and looked at the three ecosystems of Gobabeb – the riverbed, the gravel plains and the dunes. In the

afternoon, we looked at different books to learn more about mammals (and other animals) occurring at our observatories.

On Thursday evening at 18:45, the traps were brought back in.

20 traps were open over 3 nights. In these 60 trap nights (20 traps x 3 nights), we caught two species: *Gerbillurus paeba* (hairy-footed gerbil / haarpoot nagmuis) and *Rhabdomys pumilio* (striped mouse / streepmuis). In total, we caught 2 *Gerbillurus* females, three *Rhabdomys* males and one *Rhabdomys* female.

*Gerbillurus paeba* (hairy-footed gerbil / haarpoot nagmuis):

Distribution: They occur throughout Namibia, and in the Northern and Western Cape of South Africa.

Habitat: They live in the western arid zone of Southern Africa. They prefer sandy soils with a grass, shrub or light woodland cover. They occur in areas with rainfall ranging between 100 – 600 mm per year.

Habits: They are active in the night, and are usually active on the ground. They live in burrows which are built at the base of tussock grasses or shrubs.

Food: They eat grass seeds and seeds of bushes, but also gnaw the seedpods of Acacia species.

Reproduction: Young are born at any time throughout the year. Usually, there are 2 – 5 babies per litter. They are born after 26 days, and are weaned after 19 days.

*Rhabdomys pumilio* (striped mouse / streepmuis):

Distribution: They occur throughout South Africa and Namibia, excluding the north east of both countries.

Habitat: They occur in a wide variety of habitats, but need to have cover available. They occur in areas with rainfall ranging from less than 100mm to 1 200mm.

Habits: The species is mostly active during the day, with activity peaks in the morning and afternoon. They live in burrows, with the burrow entrance hidden between vegetation. They also build grass nests. They also make tracks (runways) which they use regularly.

Food: They eat seeds, green plant material and insects, depending on what is available to them.

Reproduction: Young are usually born during the summer months, or when food is plentiful. They have 2 – 9 babies per litter. They are born after 25 days, and are weaned after 20 days. The females are able to conceive again as soon as a litter is born.

Additional Reading:

Chris and Tilde Stuart: Fieldguide to the Mammals of Southern Africa

John Skinner and Reay Smithers: The Mammals of the Southern African Subregion

G. De Graaff: The Rodents of South Africa

Table 1: Potential occurrence of four small mammal species at the observatories.

Species	<i>Gerbillurus paeba</i> hairy-footed gerbil haarpootnagmuis	<i>Desmodillus auricularis</i> short-tailed gerbil  kortsternagmuis	<i>Rhabdomys pumilio</i> striped mouse  streepmuis.	<i>Macroscelides proboscideus</i> Round-eared elephant shrew Ronde-oor klaasneus
Distribution	Arid west of Southern Africa	Arid west of Southern Africa	Throughout Southern Africa	Southwestern parts of Southern Africa
Habitat	Sandy soils with sparse grass or bush	Hard soils with sparse grass or karroid bush	Any soil with grass, bushes, shrubs	Any type of soil with bush and grass cover
Food	Seeds	Seeds	seeds, green plants, insects	Insects, mainly ants and termites
Mutompo <i>Robert</i>	<b>Yes</b>			<b>Yes</b>
Namaland <i>Jerome</i>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	
Gobabeb <i>Justine</i>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	
Keetmanshoop <i>Richard</i>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	
Richtersveld <i>Theodor</i>	<b>Yes</b>		<b>Yes</b>	
Paulshoek <i>Mariana</i>			<b>Yes</b>	<b>Yes</b>
Soebatsfontein <i>Reginald</i>		<b>Yes</b>	<b>Yes</b>	<b>Yes</b>
Knersvlakte <i>Gerda</i>				

Table 2: Small Mammals captured at Visnara, Gobabeb

Date	Time	Trap No	Species	Mark	Age Class	Sex	Mass (g)	HF (mm)	Ear (mm)	Tail (mm)	BL (mm)	M
26/10/2004	08:30	6	<i>Gerbillurus paeba</i>	new	adult	female	36	26	15	100	70	
27/10/2004	08:40	3	<i>Gerbillurus paeba</i>	new	adult	female	27	28	10	100	78	
27/10/2004	18:10	8	<i>Rhabdomys pumilio</i>	new	adult	male	55	26	12	110	100	s
28/10/2004	08:40	1	<i>Rhabdomys pumilio</i>	new	adult	male	54	24	12	111	94	abc
28/10/2004	19:00	9	<i>Rhabdomys pumilio</i>	new	adult	female	59	24	12	100	99	
28/10/2004	19:15	20	<i>Rhabdomys pumilio</i>	new	adult	male	66	23	10	82	91	s

## How to use the form for the livestock census?

Complete form together with each farmer / herder who farms on and around the BIOTA Observatory at the end of every month for his/ her specific herd.

What do the different terms in the form mean?

Naam = Name of the farmer

Maand = month & year for which the questionnaire (form) has been completed

Kamp or veepos ligging = Place where the stock post / herd was at that month

### **Bokke = goats**

Lammers (tot 4 maande oud) = Lambs up to 4 months old

Speenlammers (4 maande en ouer) = Lambs 4 months and older

Kapater = castrated goat

Ooi (2-tand en ouer) = female goat (about 1 year and older)

Ram = not castrated goat (about 1 year and older)

Skape = Sheep

Hamel = castrated sheep

Getal = total numbers

Aantal verkoop = Numbers of sold sheep or goats

Plaaslik = sold directly on the farm to neighbours, labourers etc.

Bemark = sold at the market or to trader

Aantal geslag = Number of slaughtered sheep or goats

Aantal vrektes = Number of mortalities

Droogte = drought

Roofdiere = predators (e.g., jackals, leopards, baboon etc.)

Siektes = diseases

Ander = others (for instance theft)

Notas = notes

Totaal = Total number

Melk = Milk

Gemiddle hoeveelheid / dag = average amount per day

Kraalmis = dung, kraal-manure

Hoeveelheid en rede vir gebruik = amount and purpose of use

Wol en velle = Wool and skins

Hoeveelheid en aantal wat verkoop is = Total amount and amount that has been sold

Voedsel = Fodder

Verskaf hoeveelheid b.v. bale of emmers = give amount, e.g., bulks or buckets

Lusern = Lucerne

Graan = grains (koring = wheat, millies =maize etc.)

Pitvoer = grain-food, ready-mix

Ander b.v. blare of peuale = Others, for example leaves of thorn trees

Hoeveelheid dae wat water bronne gebruik is = How many days have water resources been used?

Genoeg = sufficient

Nie genoeg = not sufficient

Weiding en veld kondisie = grazing and condition of the veld (vegetation)

Dae = days

Goed, gemid, sleg = good, medium, bad

Vee kondisie = livestock condition

Aarbeid = labour

Ure / dag = hours per day (in average)

Gebeurtenisse = Events (Give numbers of goats / sheep per event, i.e., how many sheep has been castrated? How many are pregnant?)

Gedek = pregnant

Weer gedek = pregnant again (second time / year)

Geboortes = birth / delivery

Gespeen = separated from the mother

Kapater = castrated

Gedip = dipped (as a treatment against ticks etc.)

Inspuit = Injection

Doseer = dose (give type of treatment and dose)

Anders = others

## How to do a tree census on the Observatory (and surrounding)?

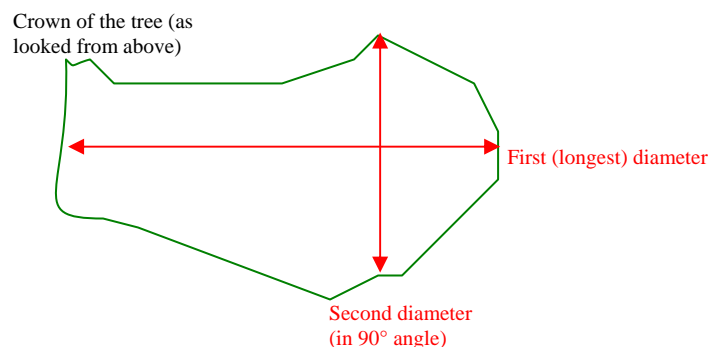
Write scientific name, local name or your field name (if you do not know any of the two others) into cell of the first column.

Measure every three on the Observatory (and surrounding if trees are rare in your area):

Take GPS reading of the coordinates with your GPS

Measure height of the tree by using a measuring stick or any other stick which you know exactly how long it is (measure it!). Please stick next to the tree and have a look at the stick and tree from a certain distance in order to estimate the total height of the tree compared to the stick. Write height into the respective cell of your form.

Measure first the **longest extension (broadest diameter)** of the crown by using a measuring tape. Start measuring on the ground exactly below the furthest tip of one side of the branch (look up) and pull it straight to the opposite site of the crown. After you measured the longest extension of the crown, put the tape out in a 90° angle to the first one and measure the broadest extension of the crown you can find in that direction.





## **Plant-animal interactions**

Plants can not move – animals come to plants for food

Main interactions:

- Herbivory
- Pollination
- Seed dispersal

### **Herbivory**

Plant tries to protect or hide by:

- Having thorns (Kameeldoring)
- Being poisonous or unpalatable (Kraalbos)
- Grow big (trees -> animals can not reach the leaves)
- Stay small and hide under other plants
- Camouflage (living stones; look like the stones surrounding)

### **Pollination**

Plants need to reproduce, sexual organ of a plant is the flower with anthers (male organ with pollen) and stigma (female organ with ovary). Petals (crown leaves) serve for the attraction of animals to transport pollen from one plant to the other.

Attraction of animals by:

- Colour
- Smell

### **Food offered from the plant to animals (like a reward):**

- Nectar
- Pollen
- Starch bodies or fleshy petals

### **Possible pollinators:**

- Insects (bees, butterflies, moths, flies, beetles, pollen wasps)
- Mammals (bats, mice, monkeys)
- Reptiles (lizards)
- Abiotic: wind and water

### **Seed dispersal**

- Fruits get eaten, seeds (inside fruits) will be carried in the animal's stomach
- Seeds get eaten, but not all of them (they might be 'stored' by a mouse in a hole and forgotten)
- Burrs that stick to the fur of animals