TABLE OF CONTENTS

Contents

BOTANY (PLANTS AND GRASSES). 2
OBJECTIVES (8.1) 2
The Plant Kingdom in Perspective (8.1.1). 2
The Nature and Classification of Plants (8.1.2). 2
Kingdom Fungi (8.1.3) 3
Kingdom Plantae (8.1.4) 3
The Anatomy of a Tree (Plant Morphology 8.1.5) 5
Tree and Shrub Identification (8.1.6) 9
Common Large Bushes and Trees of the Okavango and Chobe Riverfront Area (8.1.7). 10
GRASSES (8.2) 12
Introduction To Grasses (8.2.1) 12
Anatomy/Morphology of the Grass Plant (8.2.2) 12
Identification of Grasses (8.2.3). 14
Plant Succession (8.2.3). 21

PSG PROGRAMME (NCQF LEVEL 5)

MODULE 8

BOTANY (PLANTS AND GRASSES).

➢ OBJECTIVES (8.1)

- On completion of this module you will:
  - Have a brief understanding of how plants are classified.
  - Have a brief understanding of plant processes.
  - Know the anatomy of a tree.
  - Know how to identify a tree and thus be able to apply this knowledge to identify trees in Southern Africa.
  - Be able to give some interesting facts about trees in terms of general uses, medicinal uses and traditional beliefs associated with specific trees.
  - Know the anatomy of a grass plant.
  - Know how to identify a grass and be able to apply this knowledge to identify grass plants by dividing them into their genus.
  - Be able to explain plant succession.
  - Know the difference between sweet, sour and mixed veld.

➢ The Plant Kingdom in Perspective (8.1.1).

The plant kingdom is one of 5 kingdoms of living organisms in the world. It is useful to take a short overview in order to understand where plants and other plant-like organism fit in.

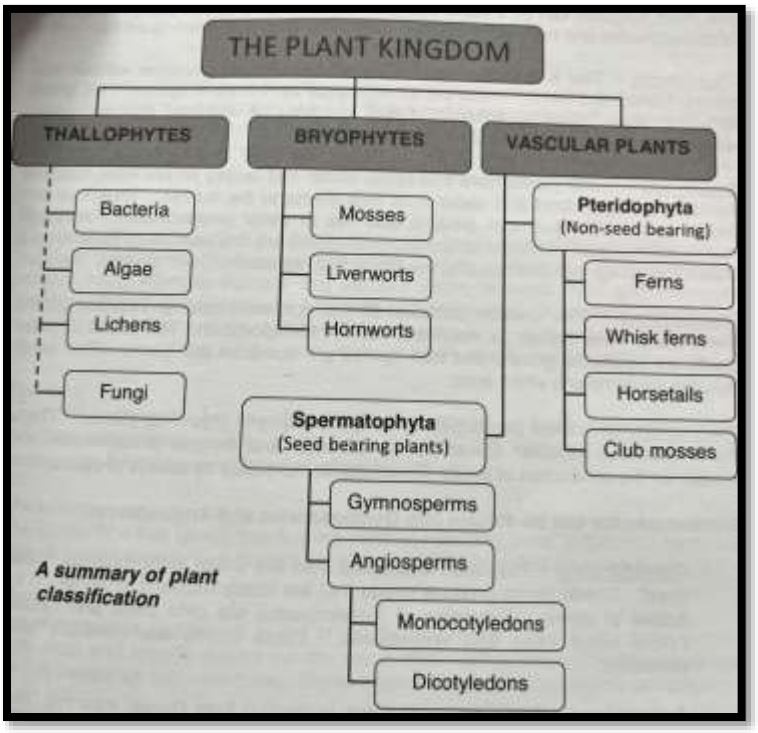
➢ The Nature and Classification of Plants (8.1.2).

- A plant is a chlorophyll containing autotrophic organism that is able to produce its own food from inorganic materials through the process of photosynthesis. There are certain "plants" that are not included within this definition, such as; **fungi** and usually most plants will grow for an indefinite period. These factors clearly distinguish plants from other animals. Plants can be broadly divided into those that possesses stems, leaves and root systems, and those that do not.

NB// Photosynthesis – a process by which plants and other organisms turn carbon dioxide and water into carbohydrates and oxygen using light energy trapped by chlorophyll. **Respiration –** is a metabolic process in cells leading to the production of energy by the breakdown of organic substances (carbohydrates & fats), thus releasing energy to be used by the plant.

- Plant Classification: The plant Kingdom can be divided into:
  - Thallophytes
  - Bryophytes
  - Vascular plants.
  - Even though fungi are not able to photosynthesize they are often placed under the phylum Thallophyta. However just so as to simplify matters of classification we will keep them separate from the plants that can photosynthesize.

The Plant Kingdom (see diagram below).



- Closely resembling plants are fungi, something field guides should be familiar with. They form a separate kingdom called Fungi.

➢ Kingdom Fungi (8.1.3)

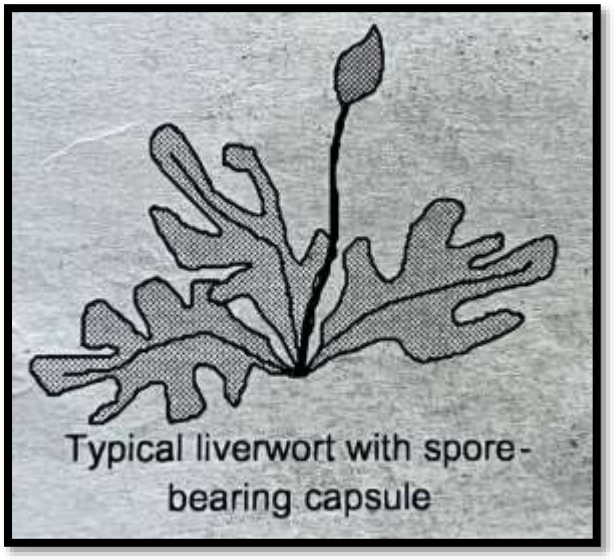
- These plants are unable to photosynthesize (cannot produce their own food). The main body of the fungus is an underground structure (the mycelium) consisting of numerous threads called **hyphae.** Fungi can either be **saprophytes, symbionts, or parasites:**
  a) Saprophytic Fungi – feeds by external digestion (chemical breakdown) of dead organic material thus bringing about decay.
  b) Symbiotic Fungi – this type of fungi form symbiotic relationships with other organisms, for example; breaking down the dead material in termite mounds (termite fungal gardens) or lichens (symbiotic relations between algae and a fungus).
  c) Parasitic Fungi – They absorb food from the living bodies of their hosts, for example, mildew (a thin whitish coating of minute fungal hyphae) growing on plants.

➢ Kingdom Plantae (8.1.4)

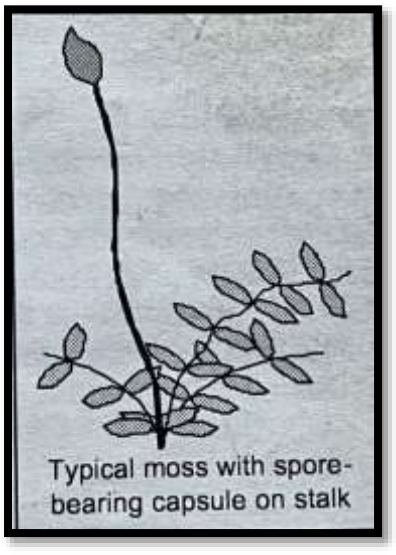
- The main distinguishing characteristics of the plant kingdom are the ability to photosynthesize, and the fact that plant bodies contain true cells. These cell walls containing amongst others cellulose (a product of photosynthesis). The plant kingdom can be divided into four phylum`s all of which except fungi can photosynthesize and have chlorophyll. The four phylum`s are:

1. Thallophytes – this is a division containing all non-animal organisms without true stems, leaves and roots. These plants reproduce by means of spores. This group includes; algae, bacteria & lichens. Fungi can also be included into this group depending on how the classification is broken down.

2. Bryophytes – these plants have true roots, stems and leaves do not have vascular tissue to transport food and water from their stems to the leaves. Thus they are limited in the size they can grow to and live in moist environments. Although reproduction is also by means of spores, their spores are a capsule at the end on a stalk. This group includes Mosses, Liverworts and Hornworts. See diagram below:



3. Pteridophytes - this division contains all the non-seed bearing vascular plants. This plants have tissues for water and nutrient transportation. The stems of these plants are below the ground and their spores are borne on the leaves. This group includes the Ferns and Whisk ferns. See diagram below:



4. Spermatophytes – Most plants belong to spermatophyte (flowering plants), producing true seeds with an outer coating, containing an embryo and food supply. They also have well –differentiated true vascular tissue **(xylem** for water and mineral transportation and **phloem** for the conduction of food). These plants reproduce by means of seeds, and are divided into sub-divisions, namely:

a) Gymnosperms - (naked seeds, not surrounded by an ovary). The name is adopted from the Greek word meaning "naked seed." These plants produce seeds that totally exposed or borne on the scales of cones and they are wind pollinated. Example of gymnosperms are pine trees, Yellowwood and Cedars of South Africa and the Welwitschia of Namibia. The trees within this group are generally softwood trees.

b) Angiosperms – (flowering plants having an ovary which develops into fruit with seed). The word angiosperm is derived from Greek, meaning, "seed enclosed in a vessel or case." Angiosperms or flowering plants produce seeds within a fruit. These plants have an ovary, which once fertilized will develop into a fruit containing a seed. These plants are usually pollinated by means of wind, animals, birds and insects. Angiosperms are further divided into two classes:

   I. Monocotyledons – have one leafed seeds, narrow leaves with parallel veining and no heartwood. Examples are; Palm trees, Grasses Orchids and Lilies.

   II. Dicotyledons – may be herbaceous or woody with heartwood. They have two leafed seed as with net veining in the leaves. They contain a flower with an ovary, which develops into a fruit with seeds.

- Characteristics of Dicotyledonous Plants:

  - The floral parts are arranged in groups of 4 or 5.
  - Net veining in leaves.
  - Woody plants with a central woody column.

- Characteristics of Monocotyledonous Plants:

  - Floral parts arranged in groups of 3.
  - Parallel veins in leaves.
  - A stem containing xylem in scattered bundles surrounded by pith.

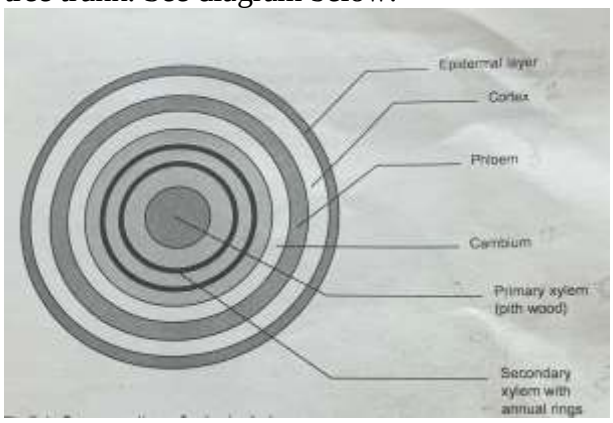
➢ The Anatomy of a Tree (Plant Morphology 8.1.5)

- Plant morphology refers to the physical build of a plant. A typical plant consists of roots, stem, branches, leaves and fruit. Let us investigate these parts:

  - Roots – roots are the basic support for a tree. The roots provide the water and mineral salts that are used in the production of food. At the end of the roots are thousands of root hairs that absorb the water and minerals salts. During the winter months some roots act as storage points for water and nutrients.. Roots may be of different types like, tap roots, fibrous root systems, adventitious roots, prop roots and aerial prop roots. In legume plants root nodules are formed in symbiotic relationship with nitrogen-binding bacteria (**rhizobium),** increasing the fertility of the soil thereby**.** Bacteria enter the root hairs and cause an abnormal growth in the cortex (outer layer of plant tissue). In the cortex they obtain carbohydrates from the plant and at the same time they fix atmospheric nitrogen, which is made available to the plant forming a mutualistic relationship. A portion of the nitrogen diffuses into the soil, thus enriching the soil around the plant.

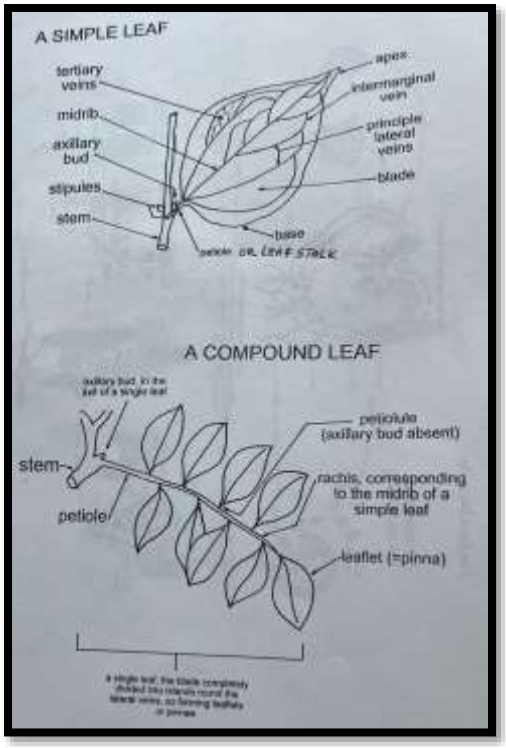
  - The Stem – the stem gives rigidity to the plant, enabling it to erect itself, and orientate itself so that it may assume the most favorable position with regard to resources such as sunlight and aerial gasses. It also gives rise to shoots and branches, which bear the leaves, flowers and fruits. The tissue of the stem provides a conduit (water-conducting channels reaching all parts of the plant).

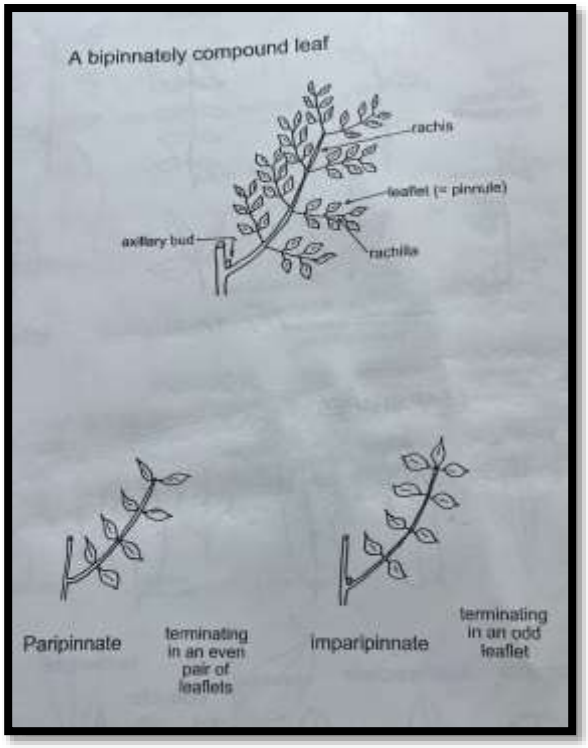
- Common to all plant stems are basic tissue types, vascular tissues (xylem & phloem), which conduct water and nutrients to the cells of the plant (ground tissue), called **pith** at the center of the stem which is surrounded by the vascular tissue and dermal tissue – a protective layer. In angiosperms (flowering plants), the secondary xylem contains the annual phases of secondary growth that produce the rings seen in the cross section of a tree trunk. See diagram below:

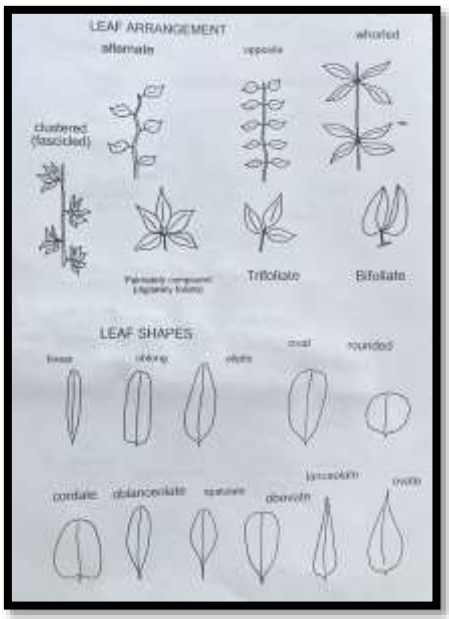


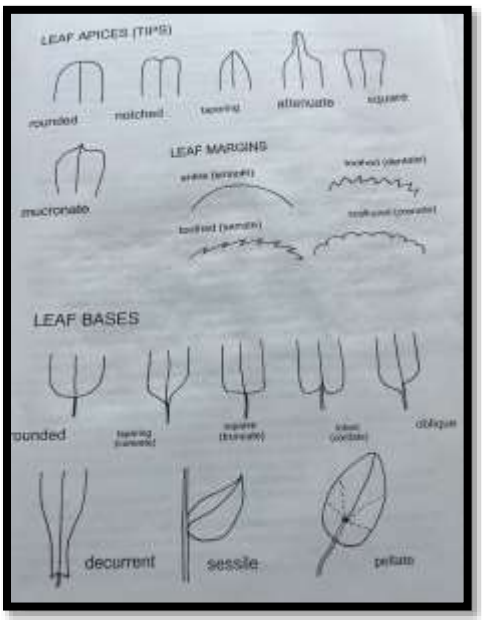
- Xylem – conducts water up the stem, and phloem transports sugars produced by the leaf down the stem. The cambium cells divide actively during the growing season, producing new cells that differentiate into xylem or wood, toward the inner side of the cambium and phloem toward the outer side. As the cambium grows, the diameter of the stem increases and the new phloem presses outward upon the soft tissues of the cortex which become disturbed and eventually die. A second layer of dividing cells, however, is formed in the cortex, producing cork which is the protective tissue that replaces the dead cells of the epidermis. The exterior bark of the trunk therefore consists of dead cells. This explains why termites and fungi often feed off the bark, but not on the rest of the tissue of the stem. The outer bark is not living (dead) and is the protective layer against animals, insects, fire and dehydration. The inner bark contains the cambium layer, which is responsible for the transportation of minerals and water.

- The Leaves – leaves absorb carbon dioxide and oxygen from the air, which in conjunction with absorbed solar energy, enables the plant to manufacture carbohydrates in the process of photosynthesis. Leaves are the principal food-making organs of a plant; a lateral outgrowth of the stem and branches. Leaves that have undergone modification for specialized purposes normally consists of two main parts – a stalk, called **petiole,** and an expanded, flattened portion, called a **blade.** The green color of the blades of most foliage leaves is due to the presence of chlorophyll.
  - Leaf margins can be entire dentate, scalloped or any of many other variations. Leaves can also be simple, compound, digitately compound, pinnately compound or bi-pinnately compound. The way to distinguish a compound leaf is to look for the **axillary bud** at the base of the leaf. If the axillary bud is absent, you are looking at a leaflet, which forms part of a composite leaf. Leaf arrangements can be opposite, alternate, whorled or clustered. Leaves can be hairy, glossy, rolled under etc. See different types of leaves below:

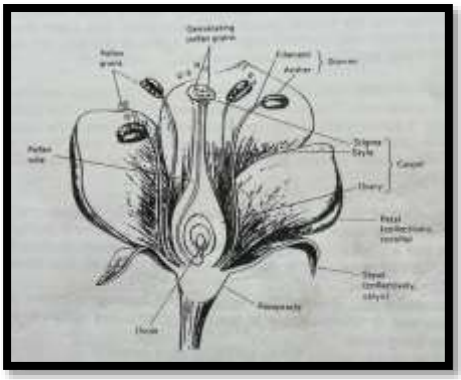


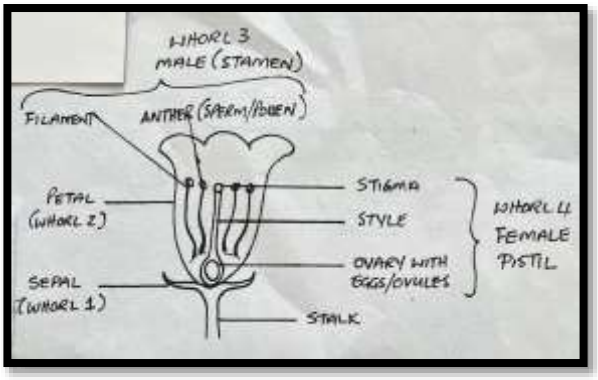






- <u>The Flowers</u> – flowers are specialized reproductive organs which produce seed and fruits. Flowers come in many shapes, size and generally consist of sepals, petals, ovary, style, stigma and anther with a filament. The anthers produce pollen, which is carried by various agents and ends up on the stigma where the process of reproduction starts. See flower diagrams below:





- **The Functions of a Flower are as Follows:**
  - Serves to attract pollinators – usually has brightly colored or conspicuously shaped petals. These pollinators then transfer pollen from the anthers to the stigma. This is called **pollination.**
  - The ovary once pollinated will become the fruit that contains seeds. This is called **ripening.** This fruit is needed for:
    1. Protecting the seeds from desiccation and predation.
    2. Helping to disperse the seeds.
    3. The flesh on the fruit attracts the animals that will disperse the seeds.
  - The seed contain the **embryo** (new plant) and **endosperm** (food for the new plant) in a hard protective shell called the seed coat.
- **Functions of the Plant Parts are as Follows:**
  - Sepal – support the flower
  - Petals- attract pollinators
  - Anther – produces sperm – containing pollen. It is part of the male stamen.
  - Filament – makes the anther easily accessible to pollinators.
  - Stigma – the sticky part of the female pistil that the female pistil that the male pollen adheres to.
  - Style – makes the stigma easily accessible to pollinators.
  - Ovary – contain the ovules (eggs) that will become seeds once pollination has occurred.

- **Types of Flowers are as Follows:**

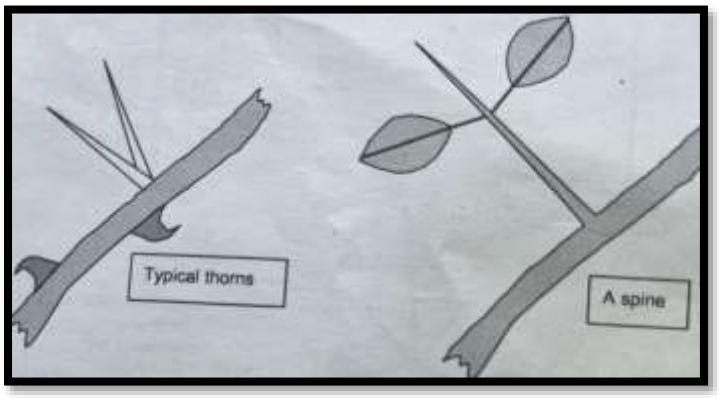
  - **Complete Flower –**contain 4 sets of parts, namely Stamen (male), Pistil (female), Sepals (set) and Petals (set).
  - **Incomplete Flower –** are missing one or more parts. Grasses for instance does not have sepals or petals.
  - **Perfect Flower –** have both stamen (male) and pistil (female) within the same flower.
  - **Imperfect Flower –** have only either stamen or pistil (not both). These male and female flowers could then be on different plants or could be at different places on the same plant.
- **Pollination of Flowers:**
  - Pollinated by animals or birds – have showy flowers.
  - Pollinated by wind – no showy flowers.
  - Pollen sticks to the hairs and feathers of birds, bats, and insects visiting flowers. These could be there for nectar or to look for prey.
  - Many species have specific pollinators – this is good because the plant is assured of a pollinating visitor. A negative is that if the pollinating species is eradicated, the plant will also die out.
- **Fertilization of Flowers:**

- Describe the actual union of the male sperm (pollen) with the female egg (ovule). In angiosperms (plants with an ovary that becomes a fruit), there is a second sperm that combines with a separate cell in the ovary to form the **endosperm**, that will be food for the embryo.

➢ Tree and Shrub Identification (8.1.6)

Characteristics to look at when Identifying Trees:

1. Tree Size, Form and Foliage Color – note the size and shape of the tree, as well as the color of the crown; and the basic shape of a tree is generally determined. Each species has its specific tree architecture, - shape and color are two most useful features when identifying trees. Look at the shape of the canopy and the different forms that trunks and stems display.
2. The Bark – every species has its own characteristic mature bark pattern. You should examine only mature specimens when attempting to identify trees by their bark characteristics.
3. Branches and Twigs – note the surface texture and color of the branches and twigs; check whether twigs and older branches are rounded, flattened or less square. Take note of any spines or thorns, and note their arrangement. **Spine** – a modified leaf or part of a leaf forming a sharp pointed structure. **Thorn** – a sharply pointed woody structure formed from a modified reduced branch and connected to the vascular system of the plant. See diagram below:



4. Latex – check for the presence of latex (clear, cloudy, milky or colored).
5. Leaves – the leaves absorb carbon dioxide and oxygen from the air, which in conjunction with absorbed solar energy, enables the plant to manufacture carbohydrates (refer to photosynthesis). Leaves are the principal food-making organs of a plant, a lateral outgrowth of the stem and branches. Leaves that have not undergone modification for specialization purposes
   normally consists of two main parts:

- A stalk, called a petiole and an expanded, flattened portion called a blade. The green color of blades of most foliage leaves is due to the presence of chlorophyll.
- Leaf Margins – can be entire dentate, scalloped or any of many other variations. Leaves can also be simple, compound, digitately compound, pinnately or bi-pinnately compound. The way to distinguish a compound leaf is to look for the **axillary bud** at the base of the leaf. If the axillary bud is present, you are looking at a leaf. If the axillary bud is absent, then you are looking at a leaflet, which forms part of a composite leaf. Leaf arrangements can be opposite, alternate, whorled or clustered. Also leaves can have different shapes and the surface can be hairy, glossy or rolled under etc.

- Secretary cavities and odor – crush the leaf and check its smell. Leaves with secretory cavities are usually aromatic, but not all aromatic leaves have secretory cavities. Test for the presence of these cavities in the leaf blade.

6. Flowers – look carefully for flowers which on many trees are small and inconspicuous. Look carefully at flower shapes as this will help with family identification.

➢ Common Large Bushes and Trees of the Okavango and Chobe Riverfront Area (8.1.7).

- Scientific names are very important to know in Botany because of the many thousands of species we have in the region. Many of them have no common names at all and others have more than one common name – used in different areas.
  - Real Fan Palm ---------- Hyphaene petersiana
  - Wild Date Palm ---------- Phoenix reclinata
  - Sycamore Fig ---------- Ficus sycomorus
  - Common wild Fig ---------- Ficus thonningi
  - Jackalberry ---------- Diospyros mespiliformis
  - Silver Cluster-leaf ---------- Terminalia sericea
  - Small Sour Plum ---------- Ximenia Americana
  - Large Fever-berry ---------- Croton megalobotrys
  - Wild Raisin ---------- Grewia flava
  - Buffalo Thorn ---------- Ziziphus mucronata
  - Russet Bushwillow ---------- Combretum hereronse
  - Large-fruited Bushwillow ---------- Combretum zeyheri
  - Leadwood ---------- Combretum imberbe
  - Magic Guari ---------- Euclea divinorum
  - Brown Ivory ---------- Berchemia discolor
  - African Mangosteen ---------- Garcinia livingstonei
  - Savanna Gardenia ---------- Gardenia volkensii
  - Mopane ---------- Colophospermum mopane
  - Kalahari Current ---------- Rhus ternnuinervis
  - Baobab ---------- Adonsonia digitata
  - Sausage Tree ---------- Kigelia Africana
  - Common n Apple-leaf ---------- Lonchocarpus carpasa
  - Wild Teak ---------- Pterocarpus capassa
  - Marula ---------- Sclerocarrrya birrea
  - Camelthorn ---------- Vachellia (Acacia) erioloba
  - Knobthorn ---------- Vachellia (Acacia) nigrescens
  - Umbrella Thorn ---------- Vachellia (Acacia) tortilis
  - Sicklebush ---------- Dichrostachys cinerea
  - Sickle-leaved Albizea ---------- Albezia harveyi
  - Zambezi Teak ---------- Baikiaea plurijuga
  - Natal Mahogany ---------- Trichelia emetic

- **Plants are Important for the Following Reasons:**
  - They release oxygen into the atmosphere for us to breathe (mainly big trees).
  - They supply us with firewood for warmth and cooking.
  - Certain plants fibers are used for materials (bedding and clothing).
  - Wood is used to make tools, implements, furniture and mokoro`s.
  - Materials like wood and grass are used to build shelters.

- Many plants supply us with food.
- Plants stabilize the soil and prevent erosion.
- They are the basis for a healthy ecosystem on which everything depends.
- They are used for medicines.

Common Trees and Related Interesting Information.

- Most of the reasons are self-explanatory but the field of using plants for treating ailments is fascinating and although plants have been used in this way by people from all over the world for thousands of years, only recently has medical science taken the potential of what plants can offer seriously. As a result new research using the latest techniques has identified what chemicals are in plants and also shed some light on which treatments are merely folklore and which actually do work.
- It must always be remembered that there are many dangerously poisonous plants and irresponsible or unknowledgeable use of these plants is not advised. It is interesting to note however that because one part is toxic does not mean that the rest of it is. Depending on what is used, many plants can be both poisonous and medicine. It is also not reliable to watch birds and animals to guess which plants are poisonous; because toxins affect different animals in different ways, depending upon what is being treated. The way they are used also differs; with the most common being:
- **Enamas –** watery or oily solutions that are injected into the rectum.
- **Infusions –** obtained by leaving the drug in cold or boiling water – must be used within 12 hours to stop bacteria growing in it.
- **Liniments –** liquid or semi-liquid preparations for rubbing on externally, usually with pain relieving or stimulating qualities.
- **Ointments –** pasty (semi-solid) mixture of drug with vegetable or animal fat.
- **Snuffs –** finely-powdered, dried medicinal plant for sniffing up the nose.

Some Of The Most Interesting Plants With Their Proven Uses Are Detailed Below:

- **Baobab** (Adonsonia digitata) citric helps treat diarrhea
- **Milkweed** (Asclepias fruiticosa) extremely poisonous cardiac glycosides, can be fatal with no proven uses as treatment (glycosides are bad).
- **Rooibos Tea** (Aspalathus linearis) – antispasmodic (prevents muscle spasms and cramps). Reduces chances of heart diseases and other aging ailments. Useful in combating skin disease like eczema.
- **Bushman Poison Bulb** (Boophane disticha) extreme toxic alkaloids cause hallucinations, hypertension but in very low volumes have a pain-killing effect (alkaloids are bad, only a small amount could be good).
- **Woolly Caper-bush** (capparis tomentosa) – antispasmodic and anti-inflammatory).
- **Lavender Fever-berry** (Croton gratissimus) saponins (soap), are toxic causing irritation of mouth and nose linings as well as skin.
- **Thornapple** (Datura stramoniam) – highly toxic but in low volumes is effective as sedative (calms down). Affects nerves and is useful for treatment of motion sickness and eye disorder 9it has to be used in small amount .5mg).
- **Devil`s Claw** (Harpagophytum procumbens) – pain-killer (especially for lower-back pain) and effective for arthritis as well as stomach lining problems.
- **Sausage Tree** (Kigelia Africana) – antimicrobial, for cleaning against bacteria (skin related disiases).
- **Wild Daga** (Lleonotis leonurus) – effective for coughs and bronchitis (leaves).
- **Ressurrection Plant** (Myrothammas flabellifolius) – camphor oil is antiseptic and decongestant and pain-reliever.
- **Red Paint Brush** (Scadoxus Puniceus) – extremely toxic, causes convulsions.

- **Marula** (sclerocarrya birrea) – stops diarrhea and clove oil is pain-killer for mouth problems (toothache).
- **Silver cluster-leaf** (Terminalia sericea) – saponins – antimicrobial and anti-inflammatory; high tannin content stops diarrhea.
- **Natal Mahogany** (Trichelia emitica) – antimicrobial and anti-inflammatory.
- **Cape Mistletoe** (Viscum capense) – high tannins stops stops diarrhea; cytotoxins remove skin growths and internal tumours.
- **Ginger** (Zingigber officinale) – anti-ulcer, controls nausea and travel sickness.
- **Buffalo Thorn** (Ziziphus mucronata – strong sedative cals down.

NB// It is interesting to note that normal charcoal has amazing powers of absorption and is very effective in treating cases of ingesting (eating toxins). Simply eat charcoal (or even burn bread) and the poison in the stomach will be attached to the charcoal and will be absorbed into the bloodstream. It will simply be passed out with the faeces which will become black.

➢ GRASSES (8.2)

➢ Introduction To Grasses (8.2.1)

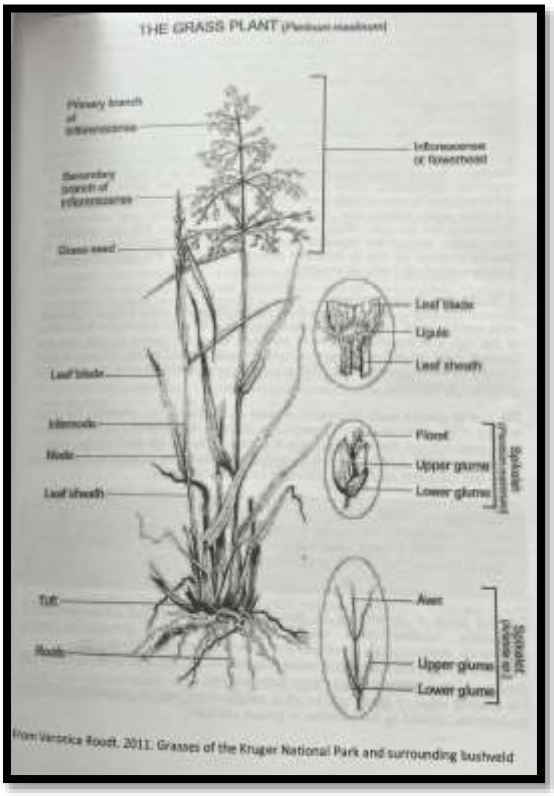
- Grasses are the most important plant family on earth. This importance relates to numbers of individuals, biomass, area covered, diversity of habitats occupied and value to man and animals. Over 30% of the earth`s land area is covered with natural grasslands and savanna areas are dominated by grasses. They occur from the tropics through to the seashores. The most widely distributed flowering plant on earth is a grass – Phragmites australis. The major crops planted by man are all grasses, maize, wheat and rice. Oats barley and millets are also important.
- Civilization can thus be said to have begun with the cultivation of grass species whose seeds had previously been gathered from wild plants. There are 9700 species of grasses worldwide, of which 967 species or approximately 10% occur in Southern Africa.

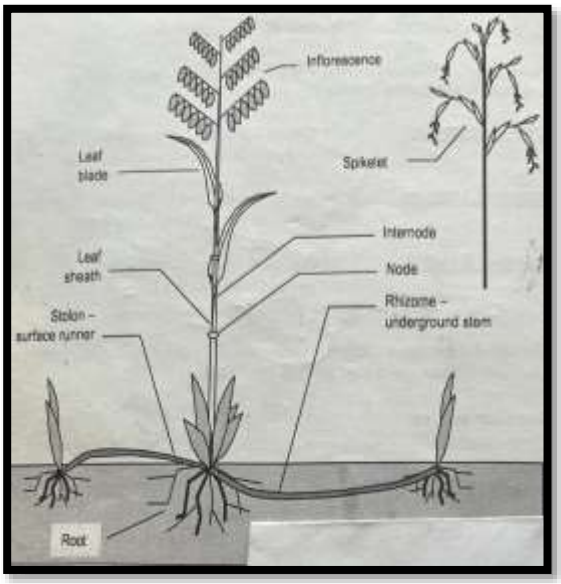
Ecology of Grasses.

- There is little evidence regarding grass evolution to be found in the fossil record, but there is speculation that their rise to dominance is related to the change in the dentation of grazing animals. When grazers adapted to the utilization of grass-like plants, millions of years ago, the evolution of both grasses and grazers followed similar parallel paths. Grasses are able to thrive whilst being heavily utilized; indeed they need to be utilized and if they are not, they become moribund and eventually die. The lack of unpalatable secondary chemical compounds that are common in many other plant families make the grasses even more highly sought after by grazing animals.
- The flower structure of grasses is much reduced due to their wind pollination strategies. Co-evolution with pollinating animals such as bats, bees, wasps etc., has been very important to other plant families where floral parts are dramatically modified to attract pollinators through chemical compounds, shape, color and scent. Due to wind pollination, these adaptive strategies have been largely unnecessary in grasses.
- There has also been a vast increase in the ratio of male flowers to female- fertile flowers amongst the grass species due to the decreased chance of pollen reaching the female flower parts. Linked to this are the highly adapted structures found on grass inflorescences that aid in channeling of air currents ton facilitate the capture of wind borne pollen by the stigmas.

➢ Anatomy/Morphology of the Grass Plant (8.2.2).

- This is the typical build of the grass plant. The entire grass plant consisting of roots, stem, and leaves is also referred to as the **tiller**. Closer inspection of the inflorescence will reveal separate units containing the individual florets and seeds called **spikelets.** Grasses may be tufted, erect, creeping, floating or even climbing. All these forms are however constructed in a modular fashion from repeating units. Each of these modular units (or phytomers) consists of an internode, with associated node, leaf, bud and adventitious root. See diagrams below:





- The morphology of grass plants can be divided into two parts, namely the **vegetative** and **reproductive** parts:
  - The vegetative parts:
    - Roots – Grasses have an adventitious root system formed by a number of roots developing directly from the culm bases (the aerial above ground). Depending on the effective depth of the soil, the root system can develop to 2 meters deep, but very seldom penetrate more than 1 meter below the surface. The functions of the roots are to anchor the plant, absorb moisture and nutrients, and the storage of reserve nutrients. Many species develop **rhizosheaths** (coating of soil particles that cling to plant roots) that are protective coverings that contain nitrogen fixing bacteria.
    - Stems – fall into three categories, aerial culms, underground rhizomes and stolon that lie at the soil surface.
      a) Aerial Culms – the aerial stem or culm of a grass is characterized by internodes interrupted by thickened nodes. The culm has the important function of bearing the leaves and inflorescences. The branching pattern and posture of the stem gives its characteristic appearance. The position of the leaves with regards to the nodes affects the effectiveness of photosynthesis. The stem is also responsible for the transport of water and nutrients to and from the different parts of the grass plant.
      b) Stolons – stolons are modified stems growing horizontally below the surface of the soil. These reproductive structures are important because roots, stems or

inflorescences arise from their nodes and stolons are also important identification pointers of grass species).

c) Rhizomes – are modified stems growing horizontally below the surface of the soil. Rhizomes, like stolons develop roots, culms, leaves or inflorescence at the nodes, thereby giving rise to new independent plant. They also enable the plant to survive harsh winters and drought due to the underground structures.

- Leaves – grass leaves consist of three parts, the leaf sheath that covers the culm, the blade that extends from the sheath, and the collar, and ligule that extends from the sheath and blade. The most important function of the leaves is to produce organic compounds through the process of photosynthesis, with the aid of chlorophyll and sunlight energy. In very dry conditions, many grass species are able to curl their leaves into a tight roll in in order to conserve water by minimalizing transpiration from the stomach on the upper surface of the leaf.

♦ The Reproductive Parts:

- Inflorescences – the inflorescence of a grass plant is a flower-bearing structure arising out of the stem (culm). After the inflorescence has fruited, no further vegetative growth can take place. The inflorescence grasses is used more commonly than any other part of the grass in the identification of the species.
- Inflorescences can be divided into three groups:
  a) Spikes – are unbranched inflorescences with sessile spikelets on the central axis.
  b) Racemes – are unbranched inflorescences with pedicellate or penduculate (a flower having a stalk) spikelets on the central axis.
  c) Panicles – are branched inflorescences with a main axis giving rise to secondary axes which bear the spikelets.
- Spikelets – a spikelet is the flower-bearing unit of an inflorescence, with the main function of protection and seed dispersal. They are also responsible for the effective seed germination.

➢ Identification of Grasses (8.2.3).

When trying to identify a grass species, the following characteristics are useful:

I. The inflorescence of a grass is the major identification feature – see the Solitary, Digitate and Paniculate inflorescence.

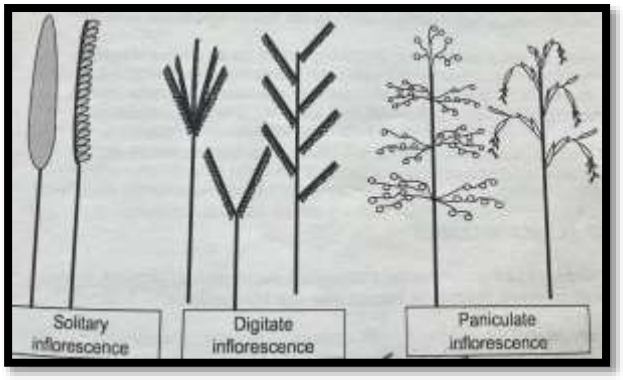
II. The identification of the grass can further be aided by looking at the following:

a. The Leaf – pay special attention on hairs on the leaf and the structure at the base of the leaf.

b. The height of the plant or tiller – remembering that this may differ from region to region.

c. Any aromatic qualities will become apparent if the grass is crushed, and can be quite distinctive.

d. Distribution maps in your guide book are always a good guideline as is habitat preference. See different inflorescences below:



- **Further Grass Divisions into their Genus (Surname Equivalent).**

  - Eragrostis (genus) – the seed overlap to form spikes (love-grass; compacted seeds) see diagram below: Eragrostis superb – (Heart-seed love grass).



- Aristida (genus) – always 3 awns (sticky grass).
  See below: Aristida meriodinalis – (Coppery three-awn grass).



- Stipagrostis (genus) – 3 awns but one or two are fathered (bushman grass). See below: Stipagrostis uniplumis – (Silky Bushman grass).



- Panicum (genus) – big oval seeds with yellow & purple flowers.
  See below: Panicum maximum – (Buffalo grass).



- Sporobolus (genus) – single small seeds (dropseed).
  See below: Sporobolus fimbriatus – (Bushveld dropseed).



- Pollination of Grasses:

  - All grasses in Southern Africa are wind pollinated, the pollen retaining its viability only over short distances. The daily flowering and pollination appears to be fixed within narrow time limits for each species, this presumably increasing the chances of successful pollination. Closely related species maybe reproductively isolated by flowering at different times of the day.

- Seed Dispersal:

- Most plants only relocate twice in their life-cycle, once at pollination and again at seed dispersal. Seeds may be wind borne on long hairs that act as parachutes (Phragmites). Others are blown around in the form of tumbleweed (Trichneura). Aquatic species literally float their seeds away on corky inflorescences. Animal dispersed species often have sticky seeds that adhere to animals and are thus dispersed (Aristida). Other species have hooks, barbs etc., That cling to fur and are thus moved to new habitats (Hetropogen). The seed of some species are self-propelled, their twisted tails reacting to changing humidity and corkscrewing themselves into the soil. Many seeds have tough covering that are indigestible, thus passing through the digestive tracts of animals and being dispersed. Other species produce oil that is attractive to ants that collect the seed and carry it underground where it may germinate.

- Grazing Value of Grazers:

  - Grass plants have growing points at the tip of the shoot and at the base of each inter-node and each leaf, thus with the growing zone situated at or even below the surface of the soil; it is therefore fairly well protected from both heavy grazing and fire. Grasses have an optimal grazing adaptation and there is a fine balance in their utilization with the greatest threat being a disturbance in this balance through overgrazing or under-grazing.
  - The lack of grazing leads to organic material accumulation that smothers the grass leading to its nutrients used for plant re-growth and this weakens the root systems leading to the death of the grass. A clear correlation exists between the amount of adaptation to grazing; the grazing value and the plants reaction or its ecological status.
  - Grazing value is determined by many factors such as, leaf production ability, palatability, nutritive value, growth vigor, digestibility, perenniality, habitat preference, environmental conditions and genetic variations within species. For the purpose here, the grazing value may be classed into the following categories – very low/low/average and high/very high/varying.
  - The grazing value of grass species of a specific area may be subject to short term fluctuations caused by the variation in annual rainfall.

- NB// **Ananul Plant** – a plant that completes its life cycle in one year. **Perennial**

- **Plant –** a plant with a life cycle longer than two years.

➢ Plant Succession (8.2.3).

- What is Plant Succession?

  - It is the progressive development of vegetation within an area through a series of different plant communities, starting with a **pioneer** community and finally terminating in a **climax** community. Each successive stage is establishing for a longer period of time as the soil conditions improve and a state of equilibrium is approached.
  - Plant succession takes place when new plant communities being established. The easiest way to view this, is to think about an area that has been stripped of all vegetation, like a disused land that used to be ploughed. The first plants to establish themselves are called the **pioneers.** They are usually weeds, and the reason why they are first to establish themselves, is because they have the ability to survive in very adverse conditions. Such conditions in this denuded areas are very difficult; the soil is impoverished with little or no nutrients, no compost and no roots to bind the soil; with extreme fluctuations in soil temperature because of lack of shading. Pioneers are

capable of surviving under such conditions and their very presence improves conditions; they contribute humus to the soil, their roots start binding the soil and they have some shading effect.

- These improvements enable other plants to now also start moving in, these are called **sub-climax plants,** and several stages of sub-climax plants may now establish themselves in turn. Ironically, the better a plant does its job of inhabiting the area and improving by its presence, the sooner it has to make way for the new generation, which will replace it. In this way the plant community will continually develop towards what is known as the **climax community,** in other words the best that nature can produce under those circumstances, i.e., **Pioneer - Sub-climax – Climax!!!**
- The development of a climax community will be dictated by environmental factors. Potentially, any community could develop until it becomes a tropical rain forest, but it makes sense that factors like climate, soil and topography will limit the development. The climax plant-community of any area is therefore the result of environmental factors of that area, and represents the highest level of productivity under those circumstances. It is important to note that succession is a lengthy process, and can take up to hundreds of years, depending on the specific environment.
- Plant Succession can be classified in various ways:
  a. **Progressive Succession –** when the successive plant communities lead to an improvement in the habitat.
  b. **Retrogressive Succession –** when the successive plant communities lead to a deterioration of habitat.
  c. **Primary Succession –** occurs where no vegetation has ever grown before, in an area where the soil has recently weathered and been prepared for growth.
  d. **Secondary Succession –** occurs in areas where climax community was previously established but for whatever reasons returned to a pioneer state. The cycle therefore has to begin again for the second time.

- Increaser and Decreaser Species:

  - Grasses differ not only in the role that that play, but also in forage value and fuel value. In general a grass with lots of stems and little leaf material will be low in forage value and fuel value; while a grass with high leaf content and low stem content will be high in fodder value and fuel value. **Panicum maximum** has a forage value of 10 with fuel value of 6, while **Eragrostis regidior** has a forage and fuel value of 0 and 2 respectively. Some grasses with aromatic oils have low forage value, but high fuel value due to a large but unpalatable leaf component.
  - The following conditions can exist, and are indicated by an abundance or absence of certain grass species:
    a. **Decreaser Species –** grass species that tend to decrease when the veld is under or over-utilized (often climax grasses).
    b. **Increaser 1 Species –** grass species which that tend to increase when the veld is under-utilized (often climax grasses).
    c. **Increaser 2 Species –** grass species which tend to increase when the veld is over-utilized (mostly sub-climax & pioneer grasses).

- The following species are typical of large parts of Southern Africa landscape. Obviously different species will occur in some localities:

  - Decreaser Species Example:

    - Blue Buffalo grass ------ Cenchrus ciliaris.

- Finger grass ------- Digitaria eriantha.
- Buffalo grass -------- Panicum maximum.
- Common Signal grass ----- Urochloa mosambicensis.

- Increaser 1 Species Examples:

  - Fine Thatch grass ---------- Hyperhenia fillipendula.
  - Turpentine grass ---------- Cymbopogon excavates.

- Inccreaser 2 Species Examples:

  - Curly-leaved Love grass ----- Eragrostis rigidior.
  - Sand Quick grass ---------- Schimidtia pappophoroides.
  - Carrot Seed grass ---------- Tragus berteronianus.

- Sour Veld, Sweet Veld & Mixed Veld:

  - Sweet or sour veld is not determined by the grass species, but rather by conditions such as soil nutrients, rainfall and temperature. Soil nutrients are primarily determined by Mother Material and rainfall.
  - Sweet Veld – low rainfall, 250 – 500mm/annum and Sour Veld – high rainfall, 625mm/annum and higher.
  - Generally sweet veld is rich in protein because of the abundance of nutrients (nitrogen) in the soil, while sour veld is rich in carbohydrates, but low in proteins. This makes the grass in sour veld much less palatable; less protein which is the nice digestible stuff, and more cellulose (plant cell walls) which is the hard unpalatable stuff.