UNITE for the Environment

Day 1:
Cultural practices of conserving water and soil in sustainable agriculture
Day 2
Field trip management

1st Term Teacher Training Manual
P1-P4
2019

CULTURAL PRACTICES IN SUSTAINABLE AGRICULTURE

Cultural practices are traditional agricultural methods used to enhance crop productivity through conserving water and soil to improve crop health/ productivity by reducing weeds, pests and diseases. They are simple and do not require a lot of technical skills or use of chemicals. Examples include bush fallowing, crop rotation, intercropping, contour ploughing, terracing, use of organic manure, etc.

Activity: Whose problem is it and Soil doctors

Part 1

Procedure

Ask participants to think of a problem they face in their daily lives. When posing the following questions, have participants raise their hands to respond.

Does the problem only affect an individual, family, community, nation etc? Will it concern them during the upcoming week, one year, five years, 10 years or 50 years from now?

The activity

Divide participants in groups of 6

Ask participants to brainstorm current 3 main issues/problems facing agriculture and have these listed somewhere.

These may include

- Soil erosion
- Loss of soil fertility
- Climate change/changes in seasons
- Lack of market for produce
- Pests
- Diseases
- Land shortage
- Weeds
- ***Lack of capital/equipment***
- Use of chemicals (herbicides and artificial fertilizers)

As a group, select what you consider as 10 key issues affecting agriculture in communities around Kibale National Park.

Have participants working in groups and allocate each group an issue.

Ask them to discuss the following

- What is the cause of the problem/issue
- Who is affected by the problem (a few individuals, an entire village, district, country or the entire world? Ask them to describe how
- How long has the problem existed?
- Can the problem be resolved? If yes, how can the problem be resolved using sustainable agriculture practices/cultural practices? Cultural methods can include; crop rotation, mulching, growing cover crops, agro forestry, retention ditches etc. The group should describe how this practice addresses the issue ?

Wrap up

1. Ask each group to share what they have discussed.
2. After each presentation, ask all participants if there are any other cultural practices that may have not been tackled and as a group discuss these, and what the issues they help to address

Examples of cultural practices in sustainable agriculture include

Agro-forestry

Agro forestry involves planting trees or shrubs, or keeping those that are already in the farms.

These trees cushion the impact of raindrops on the soil, hence reducing the amount of rain-splash erosion. They shade the soil, reduce the soil temperature and reduce the amount of water that would evaporate into the air. Trees and shrubs also break the wind, reducing the amount of wind erosion.

They also recycle nutrients from deep in the soil; leguminous trees fix nitrogen that benefits food crops and act as habitats for wildlife especially birds. However, not all trees are good for agro forestry but most indigenous trees are. Examples of good agro forestry trees include Calliandra, Sesbania sesban, Maesopsis (Musizi) which can grow well with beans, maize, G.nuts and others. Also coffee can be grown with beans especially if well spaced and for the first seasons before it matures

Photo 1: A man in an agro forestry farm where beans are grown alongside coffee

Cover cropping

This is the growing of crops to cover cultivated ground, reducing erosion by raindrop splash and overland flow. Cover crops protect the soil from excessive heat and creates a good environment for microorganisms. It is sometimes known as live mulching.

The fallen leaves of the cover crop decompose and add organic matter to the soil.

Cover crops are used occasionally to help control weeds and increase nutrients in the soil (by using legumes) or by using plants with long roots to pull nutrients back up to the surface from lower layers of the soil.

Cover crops can also be sown thickly to form living mulch in gardens. They help reduce soil splash and erosion, and keep weeds in check. Examples of cover crops include cow peas, soya beans, velvet bean etc

Photo 2: Clovers grown as cover crops in a maize garden

Timely planting

Timely planting into a well prepared seedbed will help produce a fast growing, uniform crop that will have higher yields and better competition against weeds and pests. The best time to plant depends on locality, variety, weather, water availability, and the best harvest time

Timely planting also ensures that the crop shoots from the ground within one or two weeks after the onset of the rains and protects the ground against raindrop impact. Timely planting can help in disease and pest control, weed control, maximizes rainfall utilization by the crop and the crop matures early when market prices are reasonable.

Inter-cropping

Intercropping is a multiple cropping system, in which two or more crops species planted simultaneously in a field during a growing season

Intercropping can be divided into four types

- Row-intercropping: Growing two or more crops simultaneously where one or more crops are planted in regular rows, and crop or other crops may be grown simultaneously in row or randomly with the first crop.
- Mixed- intercropping: Growing two or more crops simultaneously with no distinct row arrangement. This type of can be suitable for grass-legume intercropping in pastures.
- Strip-intercropping: Growing two or more crops simultaneously in different strips wide enough to permit independent cultivation but narrow enough for the crops to interact.

Photo 3: Strip intercropping of beans with Maize

- Relay- intercropping: Growing two or more crops simultaneously during part of the life cycle of each. A second crop is planted after the first crop has reached its reproductive stage but before it is ready for harvest.
- Intercropping can also include companion planting which is the planting of different crops in proximity

When crops are intercropped, they help each other e.g., fast growing legumes such as beans and cowpeas provide soil cover early in the season before maize or cotton develop a canopy to shield the soil from impact of raindrops. Inter cropping, especially companion planting can help control pests, can foster pollination, provide habitat for beneficial creatures, maximize use of space, and increase crop productivity.
For example, if crops such as beans are intercropped with marigold, the smell of marigolds can help to deter aphids from feeding on neighboring crops such as beans. Marigolds with simple flowers also attract nectar-feeding insects, the larvae of which are predators of aphids. Companion planting can also help distract wildlife for example pepper grown in a garden of beans can deter elephants from coming to the gardens.

Crop rotation

Crop rotation is a practice of growing different crops on the same land in a regular recurring sequence. It is always recommended that the succeeding crop belongs to a different family than the previous one. For example, leafy vegetables can be planted during first cropping season, next fruit vegetables, then root crops, then legumes, then small grains. The planned rotation may vary from two or three years to longer period. Rotation of crops is not only necessary to offer a diverse "diet" to the soil microorganisms, but as they are rooting at different soil depths crops are capable to explore the different soil layers for nutrients. Nutrients that have been leached to deeper layers and that are no longer available for crops can be "recycled" by the crops in rotation. Furthermore, a diversity of crops attracts different types of bacteria and fungi, which in turn, play an important role in the transformation of these substances into plant available nutrients. Crop rotation also hinders the development of weeds, pests and short-persistent soil-borne diseases through their population levels in the soil.
In addition, crop rotation ensures the addition of humus, soil fertility and control of erosion.

Fallowing: This is a practice of leaving land uncultivated for a specific period of time usually over a year. Fallowing allows land to regain its fertility, can help soil erosion, leaching and weed growth. It also helps to control pests and diseases.

Irrigation: Irrigation is the application of controlled amounts of water to plants at needed intervals. Irrigation helps to grow agricultural crops, maintain landscapes, and rejuvenate disturbed soils in dry areas and during periods of less than average rainfall.
With current changes in Climate, irrigation has become necessary because the rains are no longer dependable. Irrigation water improves water conditions in the soil, increases the water content of plant fibers, dissolves nutrients & makes them available to plants. Irrigation affects temperature conditions by regulating the temperature of the surface layer of the soil & the ground layer of the air. One of the ways how irrigation can be promoted is through promoting water harvesting during the rainy seasons such that the collected water can be used during the dry season.

Thinning: This is the removal of weak, dead or excess plants/seedlings, so as to enable the better-established and healthy ones develop properly. Although thinning is primarily aimed at improving the value of the stems, it has other benefits such as risk reduction for insect infestations, disease epidemics, and damage from abiotic agents

Pruning: Pruning is the proper removal of plant parts such as shoots, leaves, roots. Pruning is normally done to correct or maintain tree structure and increase its usefulness. It is done to make the plant more productive and bear quality fruits, increase longevity of the tree, make it into manageable shape and to get maximum returns.
Pruning is sometimes used to control disease outbreak by improving air and light penetration which prevents diseases such as early blight, or by cutting off the affected parts of the plant

Crop Spacing: Spacing refers to the planting distance allowable for each crop species between inter-row and intra-row, or just between crops. It varies from one plant species to another. For example for crops like Robusta coffee, the recommended standard spacing is 10 feet between the plants while for Arabica coffee it is eight feet between the plants. Incorrect spacing may lead to over-crowding, resulting in competition for light, water space, soil nutrient, etc this may reduce yields and it may also lower quality of the fruits produced because of competition for light and soil nutrients.
If crops are planted too close to one another, it may be hard for the farmer to carry out farm management practices such as weeding, doing crop inspection. Crop spacing like pruning also allows light and air to circulate amongst crops and these not only helps crops grow well but also minimizes the risk of some bacterial and fungal diseases.

Seed selection: When planting, it is very important to use the right seed because the quality greatly contributes to the health and quality of crops.
It is very important to buy seeds from trusted sources to avoid genetically modified/hybrid seeds or seeds with built in pesticides. Non hybrid seeds are tastier and flavorful, more nutritious, are usually cheaper, can last longer and usually do not ripen all at once (for fruits) and can help you save your own seeds.

Good quality seeds give desired plant population, capacity to withstand the adverse conditions and the seedlings produced will be more vigorous, fast growing and can resist pest and diseases incidence to certain extent.
A good seed should be free from diseases and pests; it should not have any damage or mould.
If you have new seeds, it is important to test the seeding rate, by planting a sample and observing how it germinates.

Applying organic manure

Adding manure to the soil provides the required plant nutrients for vigorous crop growth. This gives quicker cover to the ground and higher yields.
Manure improves soil fertility which in turn results into healthy crops. This helps them to become disease and pest resistant.

Contour farming practices

Contour farming involves ploughing, planting and weeding along the contour that is across the slope rather than up and down.
Contour farming reduces soil erosion by as much as 50% on gentle slopes. Contour ridges can also be used to harvest water.
Trash-lines are constructed by laying plant residues in lines along the contour. Trash-line help in slowing down the runoff and trapping eroded soil.
Grass barrier strips of Napier or other fodder grasses are planted along the contour.

Terraces

Terraces are structures in form of ridges and channels constructed across a slope for the purpose of soil and water conservation. Terraces reduce both the amount and velocity of water moving across the soil surface, which greatly reduces soil erosion. Terraces also increase the infiltration of water and thus conserve moisture. They help to retain nutrients of the land thus boosting soil fertility

Although terraces are normally used on cultivated lands, they can be on grasslands if the land is badly eroded. It is very important to grow some grass or trees on terrace banks; these not only help to hold the soil but can also be used as animal feed.

Water absorption and retention activity

Procedure

1. Create groups of approximately 6 participants and provide each group with the following materials:

- 3 empty plastic containers
- 100 mls of sandy soil
- 100 mls of loam soil
- 100 mls of clay soil
- 300 ml of water (100 mls for each soil type)
- 3 pieces of cloth to line the inside of plastic containers
- 6 water collecting troughs
- Measuring cylinders/cups

2. Cut 3 or 5 equal parts at the bottom of the plastic containers
3. Put a cloth at bottom of each plastic container
4. And pour the three different types of soils in the different containers

5. Have 3 participants pour 100 mls of water in the 3 different types of containers containing different soil types while placing a collecting trough under each container
6. Leave the experiment to run for 15 minutes and ask for predictions (Which soil is going to absorb more water, which soil is going to retain more water)
7. As they wait for the experiment to run mark an area outside using a rope or any other item. This is going to be called a large "pot." Inside the "pot" You put some of the participants to represent a soil type.

   Step 1, start with sand – where you have fewer participants in the pot who arm's length apart. The rest of the participants are water and they try to run through the pot.

   The next round you have loam. You add a few more participants to the pot to create the loam. Now participants stand elbow length (hand on the hips) apart. Again, the remaining participants are water and try to make their way through the pot.

   Finally, you add a few more participants to create clay. They stand shoulder to shoulder. Finally, the remaining participants try to make its way through.

   After each round discuss with the group how easy or hard it was for the water to move through the pot

After 15 minutes, return to the experiment and

Ask each group to pour water that was not absorbed in one of the collecting troughs and measure its quantity

Ask each group to measure the quantity of water that collected in the trough under the soil container

Questions for discussion

1. Which soil type absorbed more water?
2. Which soil type retained more water?
3. Which soil type is more suitable for agriculture?
4. Which soil type is least suitable for agriculture?
5. How can water retention of soil be improved?

Water-retaining pits

Water-retaining pits trap runoff and allow it to seep into the soil. A series of pits are dug into the ground where runoff normally occurs. The soil from the pit is used to make banks around the pits. Furrows carry excess water from one pit to the next. The size of the pit depends on the amount of runoff: a typical size is 2m square and 1m deep.

Retention /infiltration/diversion ditches

Retention ditches, also called infiltration ditches, are larger ditches designed to catch and retain all incoming runoff for infiltration into the soil. They increase the supply of water made available to crops planted in and adjacent to the ditch, while also reducing soil erosion. However, they handle much more water. Retention ditches are in essence water harvesting and conservation structures. They are commonly used as an alternative to

diversion ditches (which have an opening at the end), if there is no place to discharge runoff or if there is a need to harvest water for crops such as bananas which need a lot of water. The ditch should have all the impounded water infiltrated within 48 hours to avoid any water logging of the surrounding areas.

Retention ditches are normally constructed with closed ends and wide and deep enough to hold all the runoff expected. Retentions ditches can be useful where soils are permeable, deep and stable. However, retention ditches are not recommended for areas with shallow soil, those prone to landslides or where soil salinity is a possibility.

When used on sloping cropland to stop runoff, the spacing can be based on the usual terrace spacing formula. Retention ditches are also made for harvesting water from roads or tracks and the location of such ditches will be specific to the site. In this situation, the areas of the catchment and the volume of the run off should be estimated.

On soils with lower infiltration rate, or on slopes, the ends can be left open to allow excess water to drain out.

Diversion ditches and retention ditches should be well managed and kept on best working conditions. The agronomic and land husbandry activities on the farm are also necessary to stabilize the embankment with grass and to plant a strip of grass along the upper side of the ditch in order to reduce sedimentation.

Photo 4: Retention ditches in a Banana garden

Practical activity: Making retention/ diversion ditch

Tools

Measuring tape Hoe/Forked hoe Spade

Dimensions

- Ditch maximum length shall be 100 feet,
- Maximum depth shall be 2 feet, and
- Minimum bottom width shall be 1.5 feet

When constructing the ditches, the soil is thrown to the lower side to form an embankment that prevents soil from falling back in. This structure can be stabilized further by planting grass on it.

Mulching

This is the use of dead plant materials such as dry grass, straw, dry leaves, banana leaves, sugar cane trash, and other crop residues to cover soil surface. Mulches are placed around the stem of the plants to control soil erosion and conserve moisture, but can also help reduce weeds, and increase soil fertility when the mulches decay.

Practical activity: Mulching

Things you will need

- Weeding tools
- Spade
- Watering device
- Measuring tape
- Rake

Steps

- Remove all weeds and debris from the area where you want to put down the mulch. If left in place, weeds simply grow through mulch.
- Re-level the soil around your garden so that it's as even as possible, especially close to plant stems or tree trunks. Uneven soil can lead to thin spots of mulch where weeds can regrow and reestablish themselves.
- Start moving your mulch using a wheel barrow into your garden
- Spread mulch over your weed-free soil, using a spade to scoop the mulch into a pile in the middle of the area then raking the mulch outward to create a uniform thickness of at least 3 inches and an even surface. Cover all bare soil, but do not allow the mulch to touch the base of plants. From the plant stem or tree trunk, measure out about 2-3 inches and start the mulch there. As you move away from the plant, the mulch can thicken until it reaches the same thickness of the surrounding garden bed mulch level Mulch touching plants can encourage plants to rot and other plant problems.
- If possible, water your newly mulched area. Irrigation helps the underlying soil and the mulch material to settle.

NB : It is important to maintain the appropriate mulch thickness by checking your mulch every few months and replenishing it as needed. If you allow the mulch to decompose too much, then weeds and other problems may arise. You might have to visit the garden bed every month to check if the mulch has started touching the plant tissues, if so, move it back appropriately.

DAY 2

FIELD TRIP MANAGEMENT

UNITE offers its upper primary and secondary classes an opportunity to visit four natural areas.

Primary Five students visit the Bigodi Wetland, home to eight species of primates and over 200 bird species. Primary Six students visit the Toro Botanical Gardens in Fort Portal where they learn about native plants including traditional crops. Primary Seven students are taken to Kibale National Park for a nature walk to learn more about the interconnectedness of nature. Secondary Four students visit Queen Elizabeth National Park to understand more about the country's biodiversity and various physical features.

These trips aim at fostering a greater appreciation of nature while students interact with it as well as developing a connection between nature and what is taught in class.

Managing different school/age groups during field trips

Secondary school students

- When working with this group, site guides and teachers must be genuinely interested in them.
- Secondary pupils are confident (on the outside) and often don't feel they need to learn any more. However, get them working on a task together and they are unstoppable!
- They are action oriented and enjoy physical challenges. They want to DO something.
- Site guides and teachers should treat secondary pupils as young adults emphasizing mutual respect and responsibility.
- Secondary pupils prefer being with their peers. They want independence from parents and traditional family groups.

Primary school students

- Site guides and teachers should involve them by asking as many questions as possible. Do not provide them with information directly rather ask them to see how much they know and build on their answers.
- Primary students require flexibility to allow teaching in the "moment". They are liable to be curious about things they see and ask questions. If they do so, answer their question, share the moment and then bring them back to the topic. Don't brush it off or squash the curiosity. If something special happens, another moment (for example a special bird flies over) take the time to appreciate it and talk about it briefly and get back to the topic.
- Encourage them to ask them questions as much as possible. Being free with them creates a good environment for this.
- Do not spend a lot of time indoors with primary school students. Spend maximum 10 minutes indoors unless if the students are still asking questions.
- Involve them in activities and games such as simple logical relationships.
- Appropriate humor works well with this age group. When guiding primary school students, once in a while bring in jokes. They will feel more free and interactive.
- Children at this age can begin to reflect on their own behaviour therefore include positive actions in the experience that these children can take to help wildlife and the environment such as proper waste management, caring and planting for trees, taking information to the parents etc.

Evaluation of field trips

Evaluation is the process of systematically collecting factual information/data to determine if program objectives have been met. Evaluating field trips provides information to ensure that they are having the desired effect and that students are taking your key messages and conservation actions away.

Evaluation identifies what you have accomplished, helps to identify why you were successful or less successful and gives feedback as to how to improve your field trip content and experience.

Evaluation can be through pre and post trip exercises/activities.

Pre-Trip activities

Teachers are encouraged to do a pre trip exercise/ activity before visiting any site. This helps to get students ready, sets a basis for evaluation and helps the teacher prepare well for the trip. Pre trip activity can also help to reduce some degree with novelty effect. This is where a new situation, place, etc. can prevent students learning as much as they normally would because of not being familiar to the environment. Optimal learning seems to occur in settings of moderate novelty, while too little novelty in a learning environment can cause boredom and too much can be distracting or create anxiety. Optimizing novelty has therefore been suggested to be an important factor in improving learning outcomes. Student preparation through pre-trip activities can help achieve this optimal level of novelty. Note that the novelty of a field trip setting is not the same for all participants.

Post trip activities

Post trip activities are very important in evaluating how the field trip went. It tells you if the students understand the purpose of the trip, how much they learned from the trip; after the trip what actions can students take to improve conservation in their communities among others

Role of Teachers, Site guides, Pupils and UNITE staff in a field trip.

Teachers

- Prepare students before the trip; this can be through giving them some information about the site to visit, conducting pre trip activities and contacting UNITE staff in case of any inquiries.
- Share with the guides where the students' interests lie and what the students need to know.
- Brief the site guide on the background of the students to help the guides plan on better ways of managing them. For example, do the students understand English or vernacular has to be used if they are to understand certain concepts. However, with P5, P6 and P7 English should be encouraged and may be the teacher can interpret to make students understand more, Latin and scientific names should be minimized
- Discuss with the guide the time schedule and program though flexibility is highly encouraged. The guide should be encouraged to spend less time indoors doing the briefing session unless otherwise. The indoor briefing session should maximum be 10 minutes
- Work hand in hand with the guide to have student's use multiple senses such as touch, smell, hear, taste and see. Discuss with the guide to understand what is possible and what is not possible

- Help students make connections to their homes/environs and curriculum while building on the guide's information.
- Build on the guide's information to ask students as many questions as you can, this makes the tour more interactive and not just a long boring walk/lecture
- Encourage the guide to ask questions as well instead of just lecturing to the students.
- Supporting the guide to ensure that there is order during the experience. This can be through helping in grouping of students, emphasizing trip rules.
- Ensure student safety of students
- Conducting a post field trip exercise

Students

Observe site regulations such as noise, safety and litter policy, time management among others

- Ask as many questions as possible to the site guides, teachers and UNITE staff and also answer and participate when the guide and teachers ask you questions.
- Actively participate and be observant during field trip activities
- Actively participate in the pre and post field trip activities
- Ensure personal safety
- Make connections with what they experience during the field trip with what they learn in class.
- Relate what they experience during the field trip with what happens in their communities while identifying conservation actions they can take up in their respective communities.

Site guides

- Briefing students about the site, its rules and regulations. This ideally should not take more than 10 minutes unless if pupils have questions.
- Ensuring safety of the students and teachers by giving precautions and emergency protocols
- Guiding students through showing them the right trails while providing them with information as much as possible. Note: He/she should rather ask questions and support students if they fail with the support of the teachers than giving all the information
- Supporting teachers in conducting the field trip in a way that is student centered.

UNITE staff

- Ensuring that logistically the field trips are supported through arranging transport and meals for teachers and students
- Booking with UWA or other sites ahead of time
- Supporting teachers and site guides during field trip guiding and interpretation sessions through connecting the information to conservation and the curriculum while focusing on student centered methods.
- Supplement on the information provided by the guide and teachers during the field trip

FIELD TRIP ACTIVITIES

Activity 1: Primary Seven - Forest web (Kibale National Park)

Objective: To develop an understanding of biodiversity and complex connections in the forest.

Pre trip activity

Web of Life (adapted from Project Learning Tree's Activity 45)
Students will simulate a food web of an African savanna and discover ways that plants and animals are connected to each other.

Background Information

An ecosystem is a complex living system. The African savanna ecosystem, a tropical grassland, is one such example. Savannas are characterized by grasses and small dispersed trees. The trees are spread out so that they do not form a canopy, allowing plenty of sunlight to reach the ground for the grasses. The ecosystem appears to be dominated by grasses, but a healthy savanna is composed of many different plants and animals that interact with and depend on one another.

One way that plants and animals are connected is through the energy from food. A primary function of any ecosystem is to produce and distribute energy. All life depends on photosynthesis, the ability of green plants to use sunlight to synthesize simple sugars from carbon dioxide and water. Plants take energy from sunlight and make it available to animals. Herbivores (plant eaters) eat the plants and then carnivores (flesh eaters) eat the herbivores or other carnivores. This creates a food chain.

A food chain is a simplified way to show energy relationships between plant and animals in an ecosystem. For example, sun – plant seed – mouse – owl. This shows that a seed is eaten by a mouse, which is then eaten by an owl. In reality, though most animals eat more than one type of food. A food web describes the interconnection of the food chains in an ecosystem and gives a picture of how plants and animals in the ecosystem relate to each other.

There are other ways plants and animals are connected besides just food. For example, some plants rely on animals to pollinate their flowers, disperse seeds, or keep insect populations in check. Animals may depend on plants for shelter or to help regulate the amount of moisture and sunlight in their environment.

No matter how unrelated organisms may seem in an ecosystem they are in fact connected.

Directions:

1. Have students form a circle (sitting or standing) in the school compound.
2. Give each student an ecosystem card and tell them to read about their organism. This can either be a plant or an animal that lives in Savanna

3. Briefly go around the circle and have the students say what their organism is and give an overview. Ask each student to identify their organism as a producer, consumer, or decomposer.
4. Introduce students to the web of life concept (see background).
5. Starting with a student with a plant card ask them to hold the end of the ball of string and then gently pass/toss the rest of the ball to another student who has a card with an organism that would interact with theirs. The second student should hold on to part of the string and pass the rest to another student with an organism that would interact with theirs. This will continue until all students, "organisms", are linked in the ecosystem and the ball is returned to the first student.
6. Have students step back until the string is taunt. Ask the students to keep very, very still. If they feel a tug on the string then they should tug in response. When they are all still tell the original student (the first plant) to gently begin tugging. Remind everyone if they feel a tug then they should tug in response. Through this the vibration will spread through the food web until everyone is tugging and whole web is shaking.
7. Ask students how the tugging demonstrates what might happen when one of the links in an ecosystem is damaged through natural or human-made stress.
8. Ask the students to pick one organism that seems less important than the others. Have that person drop out of the web. Ask if any other organisms should drop out because they depended on that organism. Have them drop out. You can continue to build from there – asking either students who depend on those organisms to drop out or start with a "new" less important organism and go from there.
9. Discuss with the students:
    a. What happens when we remove a link in the ecosystem?
    b. Were the changes more dramatic when the system was composed of many parts or when it had fewer parts? (fewer)
    c. What can be said about the relationship between how many parts the system has and how stable it is? In general, complexity should make it more stable.
    d. What happens when humans are introduced into the web?

During the trip

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Procedure

- Ask participants to take a walk on the trails and ask them to identify a group secretary to write down anything they see or hear during the walk. They should write **words** (not sentences) of things they will see or hear during the walk. (These words will later be used as web words)

- When they return from the walk, give them at least 20 minutes to create a web using the words they wrote.

- Show the ball of string and explain that the string will let us see the connections between

- Encourage them to describe connections they are creating. Examples include verbs and phrases such as **affects, include, causes, can lead to, contains, supports, increases, reduces,** etc while using evidence from the walk where possible.
- Ask the group, if there are other connections that might have not been described

Post trip discussion

- Have the students discuss similarities and differences between the African savannas to the forest ecosystem.

Activity 2: Primary Six - Transpiration experiment (Tooro Botanical Gardens)

Pre-field trip exercise

Ask the pupils the following questions:

- What are plants?
- What makes plants important?
- What makes plants different from each other? How do plant leaves differ (The teacher can present broad and narrow, simple and compound leaves to learners and ask learners to observe them and describe the differences)
- How do plants help formation of rainfall?

(Allow the pupils to discuss amongst themselves and note down their responses

During the trip

Procedure

Divide participants into two groups. Ask one group to select a plant with broad leaves and the other group to select a plant with narrow/slender leaves. All these plants should be within 10 meters from the start point and should have leaves that can be reached easily. Each group is then named after the plant they choose.

Give each group two transparent plastic bags and masking tape

Ask each group to place one polythene bag over a leaf in the open and another under the shade (for both narrow and broad leaf) **they should not break the leaves off the plants**

They should then secure the bag on the stem with the tape to ensure that the leaf is fully covered

Ask the participants their predictions on what they will find in the transparent plastic bags. Will the bags be similar or different, if there will be differences, what will cause the differences.

Leave the experiment to run until the groups return from the walk.

When you return from the walk, ask students to go to each of the bags to make observations and record these.

Ask them to explain what is happening and why before discussing it as a group.

Then discuss as a group the following questions:

- *Is there a difference between the plastic bags placed on broad leaves and those placed on narrow leaves?*
- *If yes, what is the difference?*
- *What might be the causes of the differences?*
- *Is there a difference between plastic bags that were in the open space and those under shade?*

- *If yes, what is the difference?*
- *What might be the causes of the difference?*
- *How do the findings relate to the predictions?*
- *What conclusions can they make from their observations?*
- *And how does this relate to rainfall formation?*

Post field trip exercise

At the end of the walk, the guide gathers the students together to share their favorite memories of their botanical garden adventure and ask these questions as a final review:

- *Did the learners find/see what they had expected?*
- *What key things did they learn during the field trip?*
- *What things did they appreciate about TBG*
- *What role would the learners play in protecting vegetation in their communities?*

Activity 3: Primary Five- Who lives here (Bigodi Wetland Sanctuary)

Background:

Different ecosystems support different life forms. Wetland ecosystems are rich complex ecosystems, and because of this they support a diversity of plants and animals. These plants and animals in a way support each other to survive in the complex ecosystem but do not all live in the same environment or habitat. Different environments in a wetland have different species, for example you will not find the same species in a water logged papyrus part of the wetland as those in a forested part of the wetland. In addition some environments more species than others

Pre field trip activity for teachers to be done at school

- Start by asking pupils do some areas habited by more people than others? Do they think it is the same with wild animals?
- Divide the class into two groups and allocate them the groups an equal area; one in the school play ground and the other group in the nearby school vegetation.
- In 20 minutes, ask each group to observe the different species of insects (not number of insects) of insects they observed. They can write the local names or even draw or describe features for those species that they may not ably identify
- Have the groups back in class and ask each group to share the number of species observed. Which group saw more species than the other and what could be the reasons for this?

At the site

Materials: Notebooks and pens and monitoring sheets

Procedure:

1. Before you take students on a walk ask them the different habitats that can be found in a wetland and its environs. Answers may include open vegetation/grassland, thick vegetation/forest and open water (ponds and rivers)
2. Ask students which habitat/environment they think has more birds, mammals and butterflies?
3. Divide the group into three main groups and identify three different habitats of: thick vegetation/forest, grassland/open vegetation and swamp vegetation.
4. Allocate 1 group to mammals, the other to birds and the last one to butterflies.
5. On every determined stop over i.e. grassland/open vegetation, open water and thick/forest vegetation, ask students to record the different number of individual

animals counted as per the groups i.e. Group 1 to focus on birds, Group 2 on mammals and Group 3 butterflies. Spend at least 15 minutes at each stop over.

Grassland/open vegetation
Group 1: Number of butterflies----------
Group 2: Number of mammals----------
Group 3: Number of birds----------
Thick vegetation
Group 1: Number of butterflies----------
Group 2: Number of mammals----------
Group 3: Number of birds----------
Swamp vegetation
Group 1: Number of butterflies----------
Group 2: Number of mammals----------
Group 3: Number of birds----------

After the walk, allow groups to share their observations in a group and have the observations listed on a chart where all students can see and read.

Afterwards, lead them into a discussion based on the following questions

1. Overall which habitat has?
   i. More birds----------
   ii. More mammals----------
   iii. More Butterflies----------
2. How does this relate to the prediction made before the start of the trip?

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3. What might be the reasons for the distribution in (1) above?

_____

_____

3. Identify any animals that live in two or more different habitats?

_____

_____

4. Why are these animals able to live in different environments?

_____

_____

Post trip activity

- Divide the class into groups of up to 8
- Draw the table shown below on the blackboard to help pupils think about things and places that they know and are familiar with. Ask one member to copy the table in the group's notebook.

Wetlands are similar to:	**Explanation of similarities**
Community	
School	
Filter	
Food	
Home	
Nursery	

Recreation park	

Are there any challenges facing wetlands and the wildlife that lives there? If yes what are the challenges? _____
How can these challenges be addressed? _____
_____

Activity 4: Senior Four – Group work (Queen Elizabeth National Park)
Background
Biodiversity distribution is influenced by a number of factors

Pre –field trip discussion
What is Biodiversity?
Ask students to move out and based on what they observe, mention the examples of biodiversity around Bigodi SS?
Discuss what factors have influenced the distribution of biodiversity around the school? (Certain factors can lead to increase in biodiversity in some areas while others may lead reduction of biodiversity)

Field trip discussion
Discuss the factors that have influenced distribution of biodiversity in Queen Elizabeth National Park?
Post trip activity
Divide the class in 4 different groups

- Water bodies
- Vegetation
- Topography
- Human activities

Based on observations and examples from QE, ask each group to analyze how their factor has influenced distribution of wildlife in QE