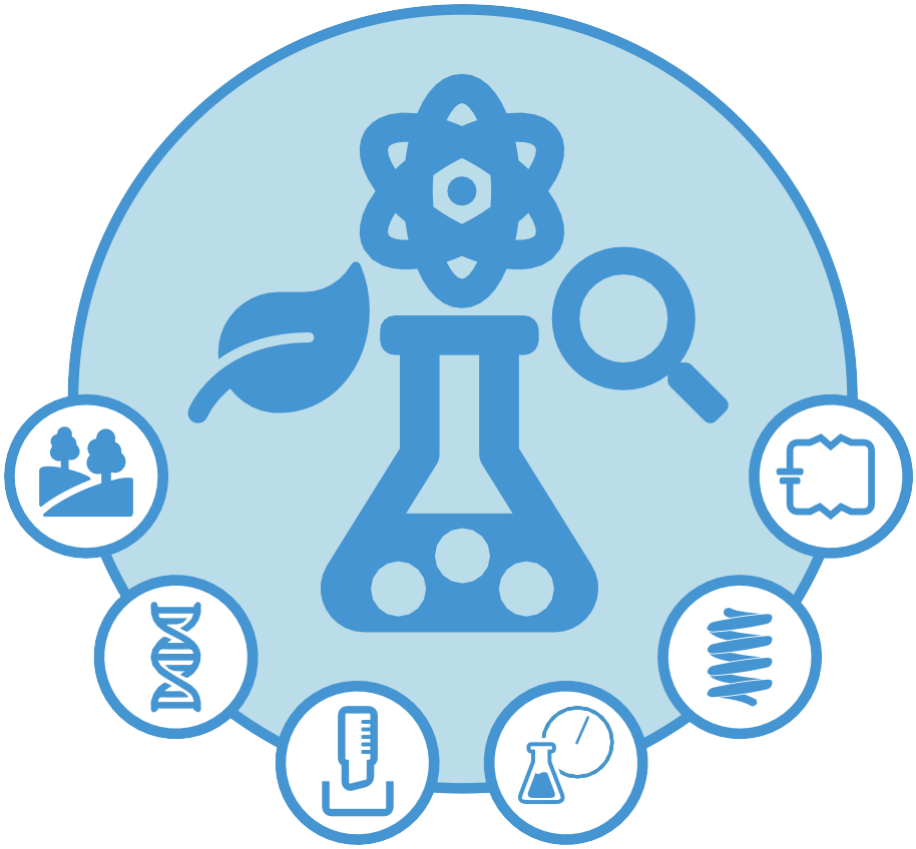
OpenSTEM Africa

VIRTUAL FIELD TRIP



Acknowledgements

Ministry of Education

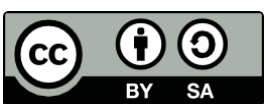
The Ministry of Education, Ghana, for their oversight, support and guidance which has been essential in ensuring that OpenSTEM Africa aligns with and complements other education initiatives and programmes.

CENDLOS, Ghana, for their collaboration and innovation in providing essential avenues for OpenSTEM Africa to reach learners and teachers.

Ghana Education Service, and the expert SHS science teachers, for their expertise in producing materials that are rooted in the Ghanaian school context, accessible and useful to learners and teachers.

For information on OpenSTEM Africa see: www.open.edu/openlearncreate/OpenSTEM_Africa

OPITO for their generous support, which has made OpenSTEM Africa and the development of the Virtual Laboratory and these materials possible.



Contents

Exemplar lessons for the OpenSTEM Africa Virtual Laboratory applications

All the exemplar lessons are examples of lessons which could be used both individually and by whole classes of Senior High School (SHS) students in the elective sciences of Biology, Chemistry and Physics. Each of the lessons is linked specifically to one of the applications in the OpenSTEM Africa Virtual Laboratory. The exemplar lesson is created to give, both to SHS students and to SHS teachers, a clear example of the ways in which the applications can be used in the learning and teaching of practical science. There is a focus throughout the lesson on the student's development of the practical and experimental skills which, along with knowledge and understanding, are integral to the profile of learning, teaching and assessment in SHS sciences.

The 'you' in this lesson is 'you', the Senior High School student. Remember that you can repeat the experiments and activities in this lesson as often as you have time for in class. This freedom to repeat experiments and activities is also important if you are accessing the lesson outside the classroom, for example for homework. Every application in the OpenSTEM Africa Virtual Laboratory contains real data – the experiments are real experiments. This means you might make mistakes the first or second or third time you try an experiment or an activity – and that is exactly what often happens in the real world in the sciences. So, it is helpful for you as a student to share in some of the real-world trial and error of science as you develop your skills as a scientist.

The exemplar lesson also contains a set of teaching notes at the end of this document for 'you' the SHS science teacher, to suggest how you might want to set up this particular lesson with one of your classes. Hopefully it will also generate ideas for other lessons on the same topic, or other lessons which use the same OpenSTEM Africa Virtual Laboratory application.

Virtual Field Trip Exemplar Lesson

Lesson objectives

By the end of the lesson, you will be able to:

- Draw and label a field sketch of an environment
- Make notes about what you observe
- Give examples of organisms in a habitat
- Explain how to sample vegetation using quadrats
- Present biological data in tables and graphs

The following practical and experimental skills will be developed:

- Observation
- Drawing
- Recording
- Classification
- Interpretation
- Data analysis

Background

Fieldwork

Fieldwork can be rewarding and enjoyable. Before starting, it is always useful to plan carefully what you intend to do in the field.

Fieldwork can be divided into three main stages:

- careful observation
- recording what you can see or measure
- analysis and interpretation

When you go on a field trip you observe and record what is going on in the environment. Recording data and observations in an organised way is a key skill. It is better to record more observations than you think you will need, rather than risk recording too few. You can always ignore extra notes when working with your data back in the classroom, but often you cannot go back to make further observations. You should record the location and date of every field observation.

Qualitative observations are recorded in words, but also as images such as photographs and sketches. You can include subjective terms, such as descriptions of colour and shape; for example, the tree has fan-shaped leaves with spiny edges and hard, yellow fruit. **Quantitative** observations are records of numerical values obtained from measurements or by counting, for example, the silk cotton tree is 50m tall or there are 5 plant species in this 1 m^2 area.

You can develop observational skills through practice – if you get used to noticing different types of plants or animals, you will start to spot patterns in the environment that are not apparent to an untrained eye.

Making a field sketch

Careful field sketches always form a key part of field notes and are important in developing observational skills. Field sketches are *not* perfect drawings; your aim when drawing a field sketch is to highlight the important features. Sketches, unlike photographs, are interpretations, as the act of sketching makes you think about which features to include and which to leave out. You should annotate your field sketch with observations. You can include **biotic** features (such as plants and animals and descriptions of vegetation and habitats), **abiotic** features (such as water and rocks) and features that show human impacts (such as buildings, paths, machinery, agriculture and pollution).

Figure 1 below shows a view from the virtual field trip with an annotated field sketch of the same view.

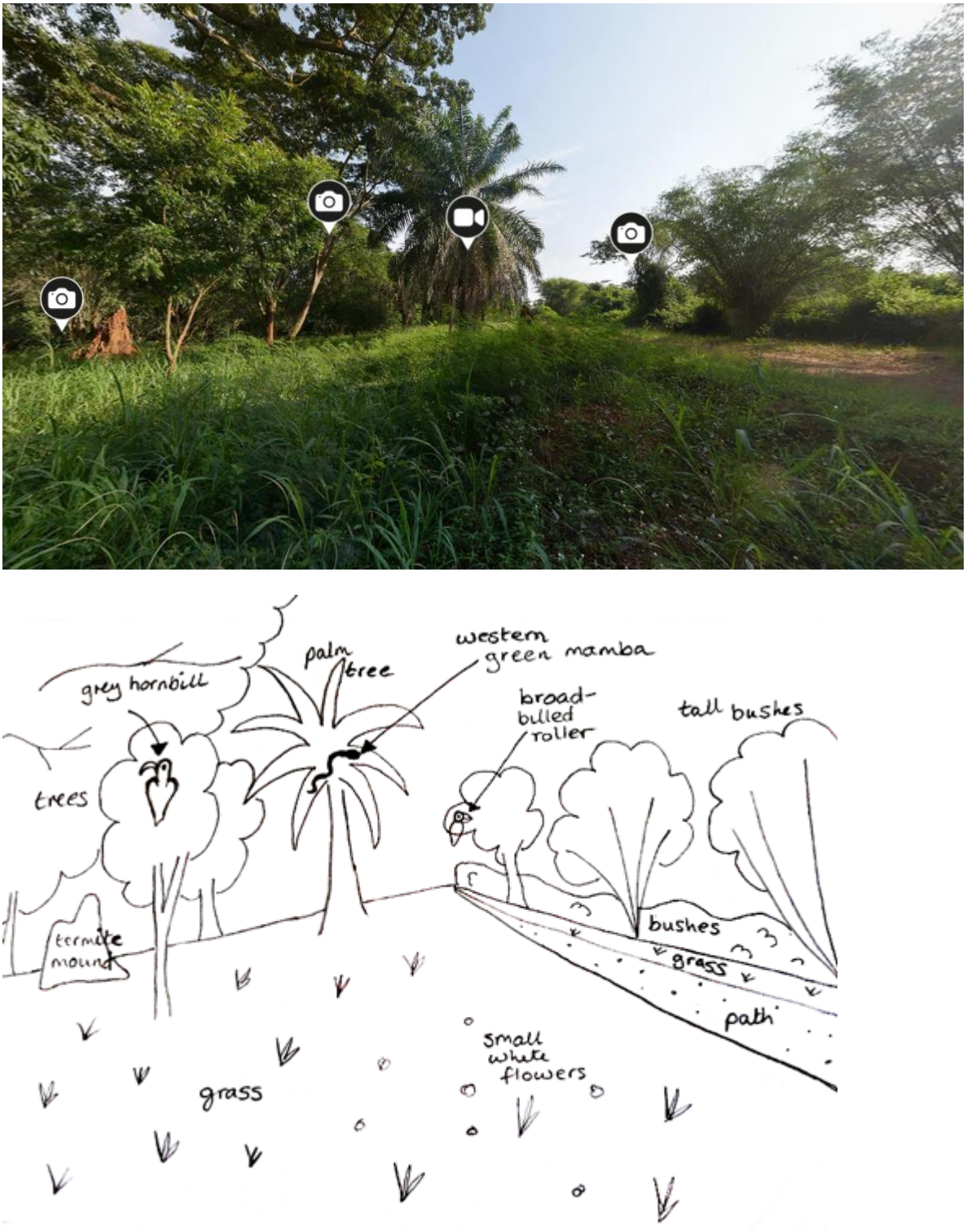


Figure 1. (a) A view of an environment showing different types of vegetation in the Palm tree site panorama in the Legon Botanical Gardens, Ghana. (b) An annotated field sketch of the same view with labels recording relevant information about observations in the environment.

Different organisms live in different places. The term **habitat** means the place where an organism lives. It describes an area in the landscape which supports a particular group of organisms, for example, a grassland habitat is one that is mainly made up of grasses, a woodland habitat is dominated by trees and a lake habitat supports aquatic organisms. These can also be subdivided into more specific habitats, for example, a mangrove forest is dominated by a particular tree species – the mangrove tree.

What are the main points to remember when making a field sketch?
Go to Appendix 3 for the answer.

Hierarchy of living organisms

Individual organisms are named and sorted into a hierarchical system. This is intended to reflect evolutionary relationships, like a huge 'family tree' stretching back millions of years. The hierarchy of categories is shown in Figure 2.

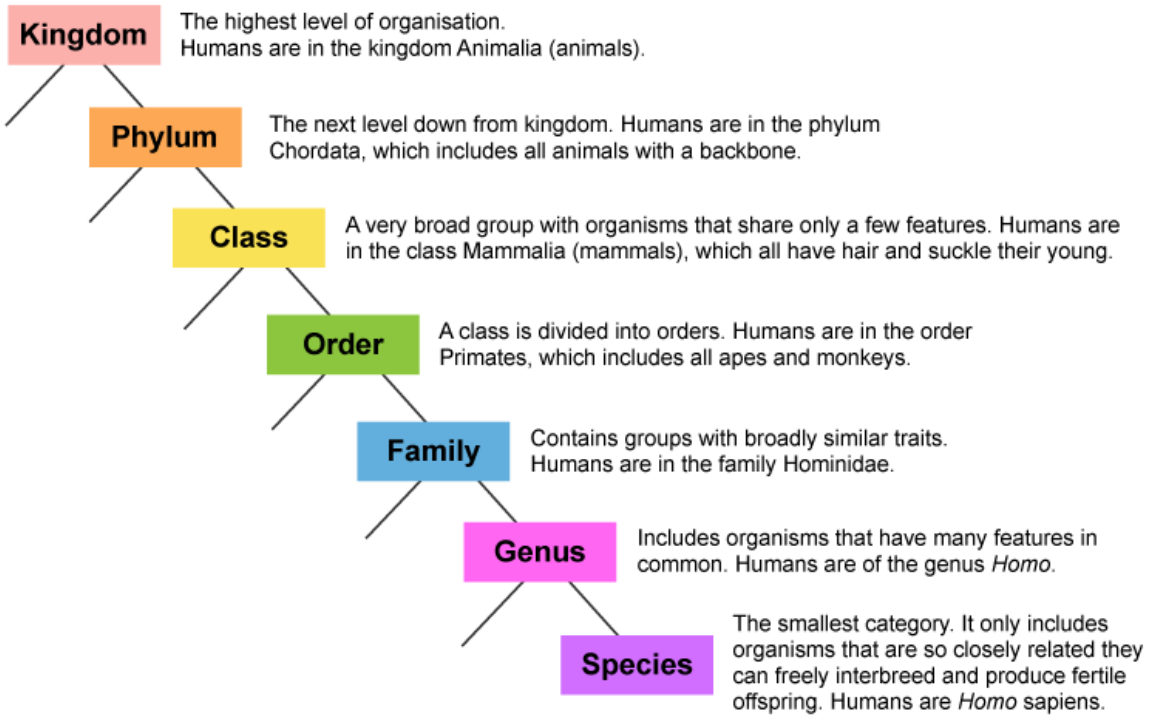


Figure 2. Hierarchy of living organisms

At the lowest level is the species – each species has a scientific binomial name, printed in *italics*. The first part of the name is the genus, which always starts with a capital letter. The second part is the species, which never starts with a capital letter. For example, humans are known scientifically as *Homo sapiens*.

Many, but not all, organisms also have common names. The difficulty is that these common names can vary in different regions or countries. The scientific binomial name is a unique name that is recognised across the world.

The following tables show the taxonomy of two organisms that are not closely related (Table 1) and two that are closely related (Table 2).

Table 1. Taxonomy of two organisms that are not closely related: an animal (kob) and a plant (silk cotton tree)

Taxa	**Organism 1**	**Organism 2**
Kingdom	Animalia	Plantae
Phylum	Chordata	Trachaeophyta
Class	Mammalia	Magnoliopsida
Order	Artiodactyla	Malvales
Family	Bovidae	Malvaceae
Genus	*Kobus*	*Ceiba*
Species	*kob*	*pentandra*
Notes:		
	Kobs are antelopes found in Central, West and East Africa. They have reddish-brown fur with a white eye-ring, inner ear and throat. They are diurnal (active during the day) but inactive during the hotter hours. Males have horns and females do not.	The silk cotton or kapok tree is a tall tree (up to 50m), with buttresses at the roots and large spines sticking out of the trunk. The kapok has woody pods containing a white, fluffy seed covering.

Table 2. Taxonomy of closely related organisms (ring-necked parakeet and African grey parrot)

Taxa	**Organism 1**	**Organism 2**
Kingdom	Animalia	Animalia
Phylum	Chordata	Chordata
Class	Aves	Aves
Order	Psittaciformes	Psittaciformes
Family	Psittacidae	Psittacidae
Genus	*Psittacus*	*Psittacus*
Species	*krameri*	*erithacus*
Notes:	 Ring-necked parakeets (also called rose-ringed parakeets) are medium sized parrots. They are native to Africa and southern Asia.	 African grey parrots have grey body feathers, black bills and red tail feathers. They are native to equatorial Africa and mostly feed on fruit, nuts and seeds with a preference for oil palm fruit.

How can you tell from Table 2 that the two organisms – the ring-necked parakeet and the African grey parrot – are closely related?

Go to Appendix 3 for the answer.

Note: Organisms can also be sorted into different **life-forms** which describes an organism by shape or form that reflect similarities of function rather than genetic relatedness (e.g. tree, climber/creeper, shrub).

Sampling vegetation

It is often impractical to measure all of any population of variables. For example, to count every plant of every species in a grassland would be too time-consuming, so, a **sample** (or subset) is measured. The aim of sampling is to select a sample which is **representative** of the **population**. Samples should be taken either at random or in a manner that allows every member of a population an equal chance of being selected without **bias**.

You can use random sampling with quadrats to investigate plant species within a habitat. A **quadrat** is a frame (usually square) used to outline a sample area for study. You can then identify and count the species present in the quadrat. There are many different sizes and types of quadrat: a suitable quadrat for short grassland vegetation would be 1 m x 1 m.

You can investigate the biodiversity of a habitat or area by looking at **species richness**, which is a measure of the number of different species present in an area. To do this, you could set out quadrats and count the number of species present in each quadrat and then work out an average (mean) species richness for the area.

A student investigating the species richness of a grassland set out 10 quadrats randomly and counted the number of different species in each quadrat.

Quadrat number	1	2	3	4	5	6	7	8	9	10
Number of species present	7	3	8	5	6	4	6	5	10	6

Use this data to calculate the average species richness

Go to Appendix 3 for the answer.

Percentage **frequency** is a measure of abundance, it tells you how often a species occurs in samples. For example, if a species is found in every quadrat sampled, then it has a frequency of 100%. If it is found in 1 out of 10 quadrats, then it would have a percentage frequency of 10%. Percentage frequency therefore tells you how common a species is.

$$\text{Percentage frequency} = \frac{\text{number of quadrats where the species is found}}{\text{total number of quadrats}} \times 100$$

Practical activity

Read the following sections before accessing the application.

In the Virtual field trip, you will be able to explore different habitats, observe some of the plants and animals that are found there and record information about them. There are two activities:

Activity 1: You will explore an environment, make observations of the habitat and some plants and animals, and record information through field sketching, taking notes and using the field guide.

Activity 2: Using quadrats, you will record the plant species present in two locations, calculate the percentage frequency and species richness and construct graphs of the data.

Task 1: Exploring the virtual field trip

You will now explore the virtual field trip to make observations and record information

When you access the Virtual field trip application homepage, first watch the introductory video which explains how to find your way around the virtual field trip, what sorts of things you can observe and how to find different types of information.

Once you have watched the video, make the following notes in your notebook about what you are going to do:

1. Enter the virtual field trip, choose a location to explore and take some drone flights over the area and look at the panoramas.
2. Choose one panorama to study in detail. In your notebook, write notes about the location; for example, name of the location, where it is and the name and location of the panorama, what you observe about the area.
3. Make a field sketch of the panorama you have chosen. Note that each panorama is a 360-degree view of the environment. You should not try to sketch the whole panorama but choose a view that you find interesting and with enough photographs or videos in it so that you can make interesting notes about your observations.
4. Add labels to your field sketch to record the information you have found out, for example, location, habitat type, plant and animal species, evidence of human activity.
5. Find two different organisms in the location you have chosen and collect taxonomic information about them from the field guide. Make notes about each organism; for example, where you observed it, what it looks like, what it eats. Copy the table below into your notebook, making sure you leave a big enough space for making notes. You will use this to record your observations.

Taxa	Organism 1	Organism 2
Kingdom		
Phylum		
Class		
Order		
Family		
Genus		
Species		
Notes:		

You are now ready to attempt Task 1 – exploring the virtual field trip.

Virtual field trip
Go to the OpenSTEM Africa Virtual Laboratory. Click on on the icon to access the Virtual field trip application homepage. Watch the introductory video before entering the experiment.

Task 2: Vegetation sampling

You will now go to the quadrat areas of the virtual field trip to make observations and record information about the plant species present in these areas. There are instructions in the virtual field trip, but here is a list of the steps you are going to take:

1. Enter the virtual field trip, go to the Legon Botanical Gardens and select the Quadrats.
2. Choose Quadrat Area 1 or Quadrat Area 2. In your notebook, write notes about the location.
3. Select the quadrat you are going to study.
4. Record the scientific names of the plant species present in this quadrat. You will be given help to identify the plant species.
5. Move on to the next quadrat that you are going to study and record the plant species present in this quadrat.
6. When you have finished, you can download the whole dataset for Quadrat Areas 1 and 2.
7. Draw a graph of average species richness for Quadrat Areas 1 and 2.

You could copy the tables below into your notebook and use them to record your data. Note that you will need to extend the bottom table to record all the quadrats and species that you observe.

Virtual Field Trip Quadrat Data Collection Form

Date (dd/mm/yy):	
Location:	
Team member names:	
Quadrat size:	
Notes:	

Quadrat number	Scientific name	Common name	Present?	Notes

You are now ready to attempt Activity 2 – Vegetation sampling using the Virtual field trip application.

Once you have completed your investigation, write your answers to the following questions in your notebook.

1. Using the whole dataset, what is the average species richness of Quadrat Area 1 and Quadrat Area 2
2. What is the frequency of *Commelina diffusa* in Quadrat Area 1 and Quadrat Area 2?
3. Which species have the highest frequency in Quadrat Area 1 and Quadrat Area 2?

Summary

You have discovered that on a field trip, you explore an environment and make observations about what you see and can find out about that environment. You now know these observations can be made in words, by taking notes, and in images, by making labelled field sketches. You have discovered habitats with various organisms in them and looked at taxonomic classification. You have found out that plants in a habitat can be surveyed using quadrats to show frequency.

You should now be ready to take the end-of-lesson quiz, which will test what you have learned.

For further explanation of some of the terms used in this lesson, go to the Glossary.

Quiz

Answer the questions, then search for the correct answers in Appendix 4.

Question 1

For each of the statements below select the correct answer from the options given in brackets:

- Silk cotton trees are in the kingdom (Animalia / Plantae)
- Birds are in the kingdom (Animalia / Plantae) and in the class (Aves / Mammalia / Reptilia)
- Monitor lizards are in the phylum (Chordata / Arthropoda) and in the class (Mammalia / Reptilia / Aves)

Question 2

Which of the following statements are true (select all that apply)?

- Field sketches are perfect drawings of the environment
- The aim when drawing a field sketch is to highlight the important features
- You should annotate your field sketch with observations which can include biotic features, abiotic features and features that show human impacts
- A photograph is better than a field sketch for highlighting important features of an environment
- You should only make drawings in a field sketch, not write labels or notes

Question 3

Based on the dataset for Activity 2, which Quadrat Area from Legon Botanical Gardens has the higher average species richness?

- Quadrat Area 1
- Quadrat Area 2

Glossary

Abiotic – A non-living part of the environment, e.g. rocks, water, weather

Bias – An inclination or prejudice towards or against a specific finding or outcome, for example, selecting areas that look interesting or easier to count

Biotic – Living organisms

Frequency (of a species) – The proportion of samples in which a given species occurs

Habitat – The place where an organism lives

Life-form – Description of an organism by shape or form that reflects similarities of function rather than genetic relatedness (e.g. tree, climber/creeper)

Population – The total number of things, such as all the trees in a forest

Quadrat – A frame (usually square) used to outline a sample area for study

Qualitative – Non-numerical data or information, for example, colour, shape

Quantitative – Numerical data, any information that can be quantified, counted or measured, and given a numerical value

Representative – How closely the relevant characteristics of the sample match the characteristics of the population

Sample – A limited number of things, such as 50 trees from a forest of trees

Species – The fundamental unit of classification. It describes a group of organisms that are so closely related they can freely interbreed and produce fertile offspring

Species richness – The number of different species present in a particular community or location

Stand – A block of vegetation that is homogenous in its structure and species composition in comparison to surrounding blocks. A stand may vary greatly in size, from a few square metres to many hectares

Taxonomy – The study of the principles and practices of naming and classifying organisms. The hierarchy of classification involves 7 groups: kingdom; phylum; class; order; family; genus; species

Appendix 1: Teacher notes – organisation of the lesson

Combined with using the virtual field trip, this lesson links to the following units in the Teaching Syllabus for Biology:

- SHS 2 Section 1 Diversity of Living Things, Unit 7 Scientific Inquiry Skills
- SHS 2 Section 2 Interactions in Nature, Unit 2 Study of Specific Habitats
- SHS 2 Section 2 Interactions in Nature, Unit 8 Scientific Inquiry Skills

Ideas for organising this exemplar lesson link directly to activities and teaching examples in the OpenSTEM Africa CPD units on *Using ICT to support learning*, and *Approaches to active notetaking*.

A full list of the OpenSTEM Africa CPD units can be found at https://www.open.edu/openlearncreate/CPD_units

Overview

If possible, this lesson should take place in the ICT Lab in your school if this can be arranged through your Head of Science and the Head of ICT. If the lesson takes place in the ICT Lab, it may be possible for each student to work individually at a computer; otherwise divide the class so that students are in small groups at a computer.

If it is not possible to use the ICT Lab for this lesson, then try to set up this lesson in your classroom. You may be lucky enough in your school to have a set of 'empty' tablets or mobile phones which students can use. Or you may be able to bring into the classroom a laptop connected to the internet or to your school intranet – and perhaps connected to a projector to make it possible for the whole class to view at once. If access to ICT is a real challenge in your school but you want your students to view an experiment, you might be able demonstrate it to small groups of your students at a time, using your own mobile phone

Whatever way(s) you set up the class, it would still be helpful to the students to be able to work in pairs or small groups for at least some of the lesson. Do remember as well that students need desk space to be able to write in their notebooks and to draw diagrams.

Steps in organising the lesson

Step 1: (This could be pre-lesson homework). Have students work individually or in pairs to pre-read the Background section of the exemplar lesson. Check understanding by asking them the questions in the Background section.

Step 2: Have each student make notes of the steps they need to do when they enter the OpenSTEM Africa Virtual Field trip. Have each student create a frame for their drawing of the field sketch and create tables in their notebook in preparation for their data collection.

Step 3: Make sure that all have access to/can see the computer screen to begin the practical activity. Ensure that each individual/pair knows how to move around the virtual field trip – or if you are using a laptop/projector, that the class helps to choose where to go on the virtual field trip and that you draw on the expertise of the class as you go through each step of the application, e.g. ask them what the next step is.

Step 4: Have the class follow the instructions for exploring the virtual field trip and gathering the information needed. If students are working in a pair on a PC, for Activity 1 ensure that students agree which locations and panoramas they chose to study and ensure that each student in the pair gets to choose one of the organisms to add to their table.

For Activity 2, make sure that each student in the pair gets to follow all the steps involved for one of the quadrats. Note: the students are required to examine two quadrats in a Quadrat Area. There are 5 quadrats in each Quadrat Area that they could look at. The full dataset consists of data for 10 quadrats in each quadrat area.

Step 5: Allow enough time for everyone in the class to make their own field sketch and collect their own tables of data. Have them check each other's writing and data.

Step 6: Five minutes before the end of the lesson, tell the students to complete the quiz.

Other examples of lessons which could be relevant to the virtual field trip include:

- Biology Section 1 Diversity of Living Things
- Biology Section 2 Interactions in Nature
- Biology Section 3 Humans and Their Environment Unit 5 Scientific Inquiry Skills

Appendix 2: Teacher notes - outputs of the lesson

Syllabus sections addressed by this lesson

Teaching Syllabus for Biology

SHS2 Section 1 Diversity of Living Things Unit 7 Scientific Inquiry Skills

- 1.7.2 classify organisms

SHS 2 Section 2 Interactions in Nature, Unit 2 Study of Specific Habitats

- 2.2.1 outline the general characteristics of aquatic and terrestrial habitats

SHS 2 Section 2 Interactions in Nature Unit 8 Scientific Inquiry Skills

- 2.8.6 interpret biological data
- 2.8.7 present biological data in graphical form

Setting up equipment

To carry out this lesson, students can work on a computer individually or in pairs.

Students need their notebooks, pen, pencil (for drawing) and ruler.

Organising the lesson

The estimated lesson time is 60 minutes for Activity 1, but it could be completed in less time by reducing the amount of writing required in notebooks. It could be split between two shorter lessons by covering the background theory and exploration of the virtual field trip in Lesson 1 and carrying out the field sketching, and making observations and collecting information about species, discussion and conclusions in Lesson 2. Computers would be needed for both lessons.

The estimated lesson time is 60 minutes for Activity 2, but it could be completed in less time by having students complete only 2 of the 5 quadrats or by carrying out a pair-share exercise where pairs or small groups of students look at Quadrat Area 1 and other pairs/ small groups look at Quadrat Area 2. The pairs/ groups would then share and discuss the data for the two areas.

This virtual field trip application is exploratory – there are lots of options for looking at different habitats and species that you can use with the students as you want. When students are directed to find two different organisms and collect taxonomic and ecological

information, you could organise them to collect similar organisms (e.g. birds) or dissimilar ones, or to work in particular habitats (e.g. aquatic and terrestrial).

Here is a list of the different habitats and indication of some of the features of each panorama.

Legon Botanical Gardens

- **Panorama 5. Dam site:** an open water pond with islands; there are birds, insects and monitor lizards. Abiotic factor: water. Human impacts include the dam which controls the water level in the pond, fences and aerial walkway.
- **Panorama 6. Grass site:** A mosaic of open grassland with scattered trees, birds, kob deer, butterfly and caterpillar.
- **Panorama 7. Palm tree site:** A wooded area with mixed trees, including palm trees with birds, termite mounds, a snake. Human impact: a path through the area.
- **Panorama 8. Farm site:** An area of crops with birds. Human impacts include agriculture, buildings (greenhouses), water supply. Abiotic factor: water.

Sakumo Ramsar site:

- **Panorama 5. Beach coast:** Area of sea, sandy coast and rocky sea defence, with plants, crabs, birds. Abiotic: water, rocks, sand. Human impact: rocky sea defence, sluice connecting the lagoon to the sea, road, cars.
- **Panorama 6. Flood plain near coast:** Flood plain end of the Sakumo Lagoon with aquatic vegetation and lagoon water flowing out towards the sea with grassy vegetation, birds, cattle. Human impacts: sea defence, road, cars, rail line, sluice connecting the lagoon to the sea, agriculture (cattle). Abiotic: water, sand.
- **Panorama 7. Flood plain:** The main flood plain area in the middle section of the Sakumo Lagoon, with aquatic vegetation and mudflat areas that experience variable water levels and are used largely by waterbirds for foraging. Grassy vegetation, aquatic vegetation, sedges and rushes, mangrove tree area, birds, cattle. Abiotic: water, mudflats. Human impacts: agriculture (cattle)
- **Panorama 8. Wooded area:** Agroforested catchment area in the northwestern area of the Sakumo Lagoon with trees planted to serve as a wind break and enhance water retention on the wetland. With trees, birds, dragonfly, aquatic vegetation in the distance.
- **Panorama 9. Mangrove forest:** Mosaic of mangrove and cattail area on the western bank of Sakumo Lagoon near the middle section used for nesting and roosting by birds. With birds, a bird nest with eggs, mangrove trees, rushes, grass. Abiotic: water

The lessons could be extended in the following ways:

- **Activity 1:** Carry out a pair-share exercise where students work in pairs to make observations and record notes about different species or different habitats and then share and compare what they have recorded with another pair of students (e.g. aquatic vs terrestrial habitats: Sakumo – seashore vs mangrove; Legon – dam site vs grass site).
- Produce a one-page summary of the field trip Activity 1 or Activity 2, with examples and illustrations.

- Produce a presentation about the activity for students who have not studied this topic (using presentation software or on paper).
- Direct students to areas where there are environment-human interactions, e.g. agriculture, buildings, and they can think about, discuss and make notes about the interactions (e.g. farming, food, fuel, water, places to live, dangerous lifeforms, transport, pollution, biodiversity loss, environmental protection).

Task 1: Example field notebook record for practical on virtual field trip

Title: Virtual field trip to Legon Botanic Gardens, Ghana

1. Plan of what to do on the virtual field trip
   - Enter the virtual field trip, choose a location to explore, take some drone flights and look at the panoramas
   - Choose one panorama to study and write notes about the location; for example, name of the location, where it is located, the name and location of the panorama
   - Make a field sketch of panorama
   - Add labels to the field sketch to record information, for example, location, habitat type, plant and animal species, evidence of human activity
   - Find two different organisms, collect taxonomic information from the field guide and make notes about the organism; for example, where you observed it, what it looks like, what it eats.

2. Field notes

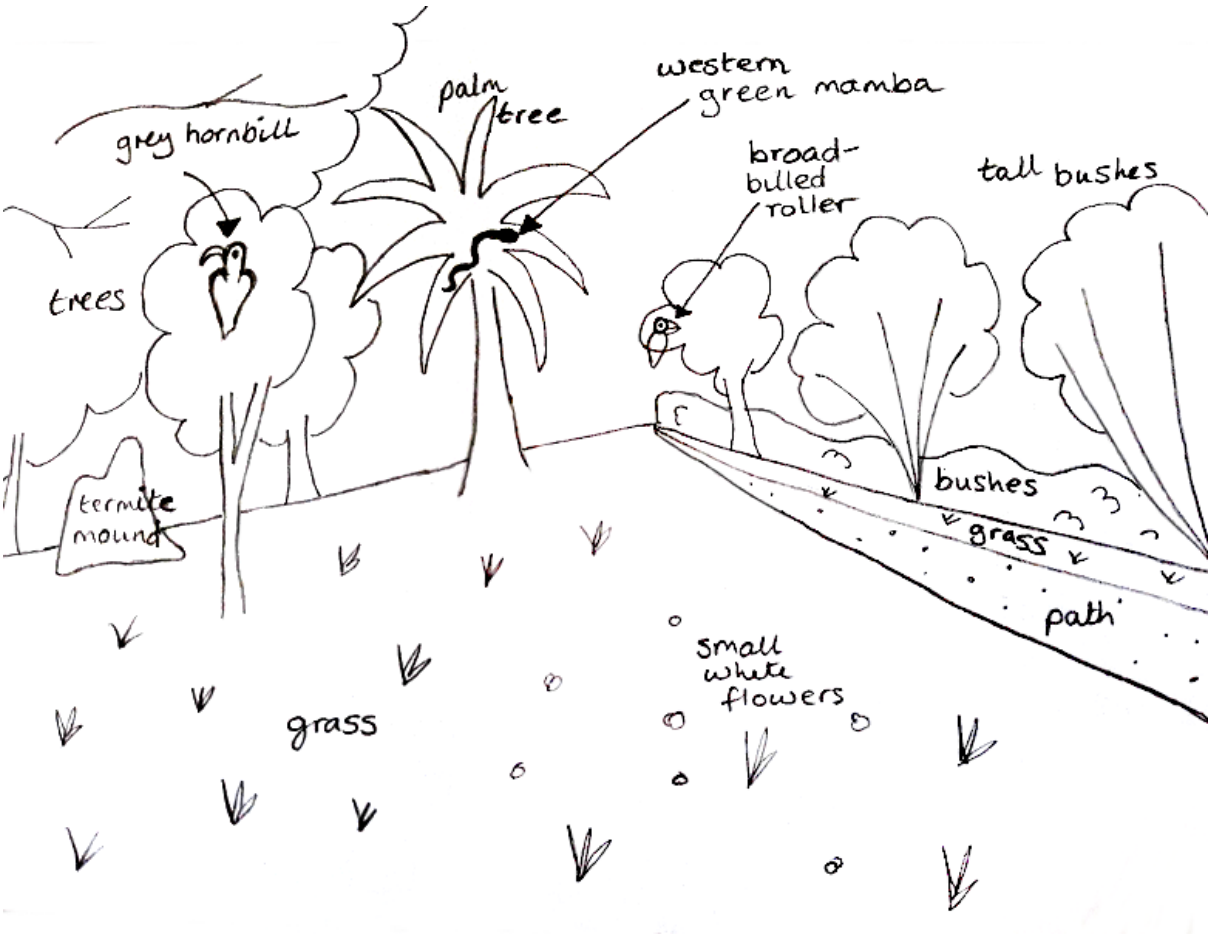
Location: Legon Botanic Gardens, Ghana

This is a is a tropical botanical garden located in Accra, the capital city of Ghana. The botanic garden has a dam with a pond, a farm and woodland and grassland areas.

Panorama: Palm tree site.

This is a woodland habitat, with mixed trees including palm trees, silk-cotton trees, bushes and grasses. There is a human made path running through the site. There are several bird species – green turaco, grey hornbill, broad-billed roller and a yellow-billed kite. There is a slender-tailed squirrel (mammal). There is a western green mamba (a snake) in one of the palm trees. There are several termite mounds in the area.

3. Labelled field sketch of one view from the Palm tree site panorama



4. Table of two organisms from the Palm tree site panorama

Taxa	Organism 1	Organism 2
Kingdom	Animalia	Animalia
Phylum	Chordata	Arthropoda
Class	Reptilia	Insecta
Order	Squamata	Blattodea
Family	Elapidae	Termitidae
Genus	*Dendroaspis*	*Macrotermes*
Species	*viridis*	
Notes:	The Western green mamba is a bright green snake that was seen in a palm tree. It is highly venomous and eats prey such as rodents.	Termites are insects that live in large termite mounds which they build from soil. They eat a fungus that they grow in a fungus garden inside the mound. They feed plant material to the fungus.

Task 2: Example Field Notebook for Vegetation sampling exercise

Virtual Field Trip Quadrat Data Collection Form

Date (dd/mm/yy):	23/09/21
Location:	**Quadrat Area 1,** Legon Botanical Gardens, Accra
Team member names:	….
Quadrat size:	1 m x 1 m
Notes:	Shady woodland site with short ground vegetation. Ground cover is thin, lots of soil showing

Note: these do not need to be in alphabetical order, this is so it is easy for you to check

Quadrat number	**Scientific name**	**Common name**	**Present?**	**Notes**
Q1	*Asystasia buettneri*		x	
	Cyperus		x	
	Elytraria marginata		x	
Q2	*Asystasia buettneri*		x	
	Commelina diffusa	Climbing dayflower	x	
	Cyperus		x	
	Elytraria marginata		x	
Q3	*Asystasia buettneri*		x	
	Desmodium triflorum	Creeping tick trefoil/ three-flower beggarweed	x	
	Elytraria marginata		x	
Q4	*Asystasia buettneri*		x	
	Commelina diffusa	Climbing dayflower	x	
	Cyperus		x	
	Elytraria marginata		x	
Q5	*Asystasia buettneri*		x	
	Commelina diffusa	Climbing dayflower	x	
	Cyperus		x	
	Elytraria marginata		x	

Virtual Field Trip Quadrat Data Collection Form

Date (dd/mm/yy):	23/09/21
Location:	**Quadrat Area 2**, Legon Botanical Gardens, Accra
Team member names:	….
Quadrat size:	1 m x 1 m
Notes:	Open sunny woodland site with ground vegetation. A mix of sun and shade, long grassy vegetation. A few patches of bare soil.

Quadrat number	Scientific name	Common name	Present? (x)	Notes
Q1	*Evolvulus alsinoides*	Dwarf-morning-glory	x	
	Sporobolus pyramidalis	Giant rat's tail grass	x	
Q2	*Chamaecrista rotundifolia*	Round-leaf cassia	x	
	Panicum maximum	Guinea grass	x	
	Sporobolus pyramidalis	Giant rat's tail grass	x	
Q3	*Chamaecrista rotundifolia*	Round-leaf cassia	x	
	Cyanthillium cinereum	*Little ironweed*	x	
	Desmodium triflorum	Creeping tick trefoil/ three-flower beggarweed	x	
	Evolvulus alsinoides	Dwarf-morning-glory	x	
	Gomphrena serrata		x	

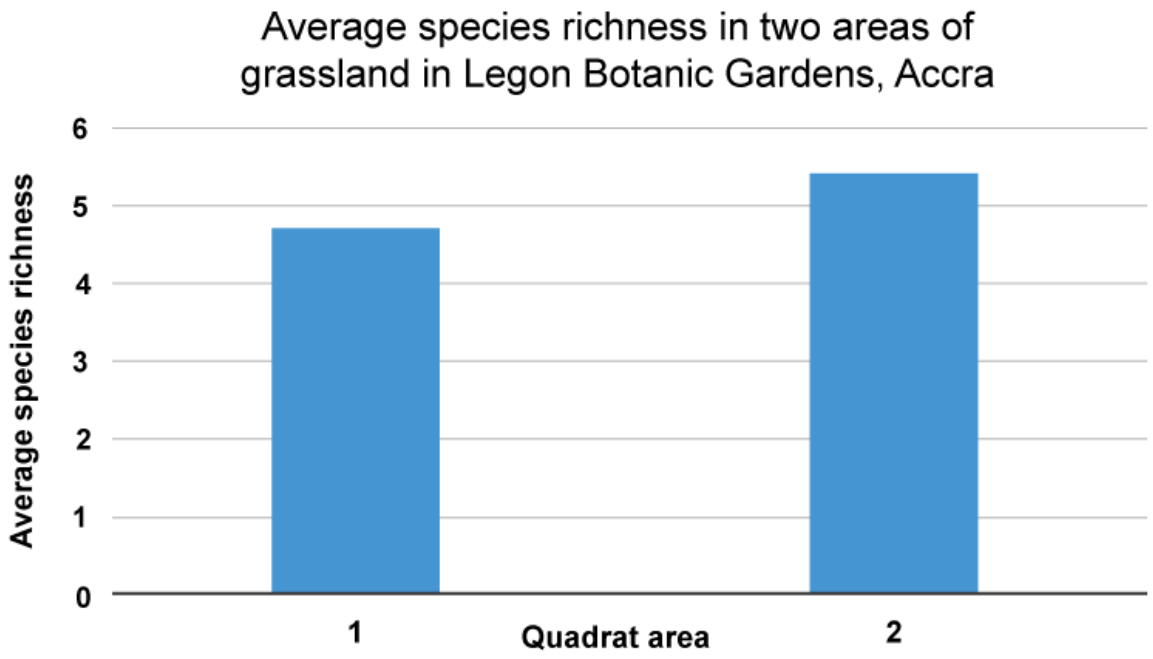
Quadrat number	Scientific name	Common name	Present? (x)	Notes
	Heteropogon contortus	*Black speargrass*	x	
	Portulaca	Purslane	x	
	Setaria helvola	Yellow foxtail/ yellow bristle grass	x	
Q4	*Commelina diffusa*	Climbing dayflower	x	
	Sporobolus pyramidalis	Giant rat's tail grass	x	
Q5	*Cyanthillium cinereum*	*Little ironweed*	x	
	Heteropogon contortus	*Black speargrass*	x	
	Sporobolus pyramidalis	Giant rat's tail grass	x	
	Tridax procumbens	Coatbuttons / tridax daisy	x	

Calculations and Graphs

Question 1: Using the whole dataset, draw a graph of the average species richness of Quadrat Area 1 and Quadrat Area 2

Average species richness of Quadrat Area 1 = 4.7

Average species richness of Quadrat Area 2 = 5.4



Question 2. What is the frequency of *Commelina diffusa* in Quadrat Area 1 and Quadrat Area 2?

Frequency of *Commelina diffusa* in Quadrat Area 1 = 7/10 x 100 = 70%

Frequency of *Commelina diffusa* in Quadrat Area 2 = 3/10 x 100 = 30%

Question 3. Which species has the highest frequency in Quadrat Area 1 and Quadrat Area 2?

Quadrat Area 1: *Elytraria marginata* (100%)

Quadrat Area 2: *Sporobolus pyramidalis* (90%)

Appendix 3: In-text question answers

What are the main points to remember when making a field sketch?

Answer:

To highlight the important features and to annotate your drawing with observations.

How can you tell from Table 2 that the two organisms – the ring-necked parakeet and the African grey parrot – are closely related?

Answer:

They are in the same kingdom, phylum, class, order, family and genus. They are both in the genus *Psittacus* but are different species: *Psittacus krameri* and *Psittacus erithacus.*

A student investigating the species richness of a grassland set out 10 quadrats randomly and counted the number of different species in each quadrat.

Quadrat number	1	2	3	4	5	6	7	8	9	10
Number of species present	7	3	8	5	6	4	6	5	10	6

Use this data to calculate the average species richness

Answer:

Average species richness = $\frac{7+3+8+5+6+4+6+5+10+6}{10}$ = 6

Appendix 4: Quiz answers

Correct answers are **highlighted in green**.

Question 1

For each of the statements below select the correct answer from the options given in brackets:

- Silk cotton trees are in the kingdom (Animalia / **Plantae**)
- Birds are in the kingdom (**Animalia** / Plantae) and in the class (**Aves** / Mammalia / Reptilia)
- Monitor lizards are in the phylum (**Chordata** / Arthropoda) and in the class (Mammalia / **Reptilia** / Aves)

Question 2

Which of the following statements are true (select all that apply)?

- Field sketches are perfect drawings of the environment
- **The aim when drawing a field sketch is to highlight the important features.**
- **You should annotate your field sketch with observations which can include biotic features, abiotic features and features that show human impacts.**
- A photograph is better than a field sketch for highlighting important features of an environment.
- You should only make drawings in a field sketch, not write labels or notes

Question 3

Based on the dataset for Activity 2, which Quadrat Area from Legon Botanical Gardens has the higher average species richness?

- Quadrat Area 1
- **Quadrat Area 2**

Feedback

Quadrat Area 2 has the higher average species richness. The average species richness of Quadrat Area 1 = 4.7 and the average species richness of Quadrat Area 2 = 5.4

ACKNOWLEDGEMENTS

Grateful acknowledgement is made to the following sources:

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- Figure 1a: Screenshot from Virtual field trip panorama / William Gblerkpor
- Figure 1b: Sarah Davies
- Figure 2. Sarah Davies
- Table 1: Kob and Silk cotton tree: William Gblerkpor
- Table 2: African Grey Parrot and Ring-necked parakeet: William Gblerkpor

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