2004-2005

8 Science

Introduction to MYP Science

Topic 1: Ecology

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IICS Mission Statement

IICS is a non-profit, co-educational, private school established to serve the international community in Turkey, with priority given to the children of expatriates, and with the mission to provide foreign students with:
" A quality educational program in English from Preparatory 1st to 12th grade;
" An individualized program which enables students to develop their full potential;
" An environment of mutual respect and co-operation which fosters respect and sensitivity to the cultural heritage and beliefs of others, recognizing independent and critical thinking as an important preparation for adult life.

It is the school's aim to help develop in students an awareness and an appreciation for history, culture, and people of the host country.

The curriculum is international in nature and is designed to provide students with a sound educational foundation which facilitates their continued education in another international setting or their home country. The School offers a sequential program of studies which, at the secondary level, is designed to prepare students for university entrance.

The Board of Directors acknowledges that the School is a guest institution in the Republic of Turkey and will duly observe the laws of its host country applicable to it. The Board affirms that in its education policies and teaching there will be nothing contrary to the interest of national security, to the activities of the Turkish Nation and to its national values.

Philosophy of the School

We believe...

...in the dignity and worth of all segments of our school community and recognize the importance of our mutual responsibilities not only to each other but also to others in the world community.

...that knowledge is acquired through a constructive process; and therefore, our curriculum should emphasize experiential learning at all levels.

...that all students should have sufficient opportunities for learning and be given due consideration for their individual abilities and backgrounds, within the constraints of the resources of the school.

...that learning is a continuing process; therefore it should foster independent thinking, exploration, and experimentation to help students adapt to an ever-changing environment, and to lead productive lives.

...that education in an international school with a community of diverse cultural and religious backgrounds should provide and promote understanding and appreciation of all creeds and cultures.

...that since English is the primary language of instruction in the school curriculum, the use of English should be especially fostered and emphasized.

...that active parental support is an essential element in the child's educational success.

Sciences

The four year programme for science is designed to build a solid foundation of scientific knowledge and skills. The students will study:
Grade 7 – Integrated Science
Grade 8 – Biology and Physics
Grade 9 – Biology and Chemistry
Grade 10 – Chemistry and Physics

Grade 8 - Biology

Objectives

The study of Biology will enable students to:
• Develop an understanding and knowledge of biological concepts concepts, principles and applications
• Develop an awareness of the historical evolution of biological knowledge
• Develop the skills to carry out scientific investigations
• Recognize the usefulness and the limitations of the scientific approach
• Develop a positive attitude towards conservation of the environment
• Develop curiosity, interest and enjoyment in Biology

Learning about Biology in the MYP is an active process involving hands on and minds on experiences. Students should recognize the international nature of Biology and be able to use the skills they acquire for successful problem solving. There is an emphasis on scientific literacy, which means giving students the knowledge and understanding to make informed decisions about local and global issues.

Course topics
• Cell Processes
• Plant Structures and Photosynthesis
• Ecology and Evolution

Textbook:
Green, Biological Science, Kendall, Hunt. 1992

Assessment
Students will be assessed using the following criteria:

Criterion A One World	Maximum 6
Criterion B Communication	Maximum 6
Criterion C Scientific Knowledge and Concepts	Maximum 6
Criterion D Scientific Enquiry	Maximum 6
Criterion E Processing Data	Maximum 6
Criterion F Performance in Experiments	Maximum 6

Grade 8 - Physics

Objectives

The study of Science will enable students to:
• Develop an understanding and knowledge of physical concepts, principles and applications
• Develop an awareness of the historical evolution of physical knowledge
• Develop the skills to carry out scientific investigations
• Recognize the usefulness and the limitations of the scientific approach
• Develop a positive attitude towards conservation of the environment
• Develop a curiosity and interest in and enjoyment of Physics

Learning about Physics in the MYP is an active process involving hands on and minds on experiences. Students should recognize the international nature of physics and be able to use the skills they acquire for successful problem solving. There is an emphasis on scientific literacy, which means giving students the knowledge and understanding to make informed decisions about local and global issues.

Course topics
• Forces and Motion – a simple study of how and why things move
• Machines and Efficiency – what is a machine, what drives therm, why do we need them
• Energy and Electricity – where does energy come from and how do we use it
• States of Matter – solids liquids and gases; why are they important
• Heat and Kinetic Theory – what is heat and how it relates to temperature
• Light and Sound – the connection is waves, but how are they made and linked

Texts:
Thompson, McLaughlin, Smith, Physical Science, Glencoe. 1995; Hewitt, Conceptual Physics Addison Wesley 1997

Assessment
Students will be assessed using the following criteria:

Criterion A One World	Maximum 6
Criterion B Communication	Maximum 6
Criterion C Scientific Knowledge and Concepts	Maximum 6
Criterion D Scientific Enquiry	Maximum 6
Criterion E Processing Data	Maximum 6
Criterion F Performance in Experiments	Maximum 6

Assessment in Science
Grade 8

Welcome to grade 8 and the second year of the Middle Years Programme (MYP), which continues until grade 10. All of the following general areas (or *criteria*) will be assessed throughout the year:

A. **One World** – *describes the positive and negative ways in which science is used in science around the world, and how it relates to other subjects. Also involves discussing the impact of culture, morals and ethics on science practices around the world.*

B. **Communication** – *describes how scientists exchange ideas by using appropriate vocabulary and language, using graphs, charts, tables and diagrams, reporting, and using IT.*

C. **Scientific Knowledge and Concepts** – *describes the understanding of various laws and theories, and how they've changed. Also includes terminology and manipulating units of measurement.*

D. **Scientific Enquiry** – *describes how to investigate scientific concepts, by for example forming hypotheses, and planning/examining experimental procedures and results.*

E. **Processing Data** – *describes the organization and interpretation of experimental results.*

F. **Performance in Experiments** – *describes the skills involved in doing experiment*s.

The next page gives you the rubrics for each criteria. Note that for any one assessment task, it will probably be impossible to assess all criteria (eg, a written test may only assess number 3 *scientific understanding and concepts* and number 5 *processing data).* Assessment tasks will assess different criteria at different times.

Science Assessment Criteria

(modified for IICS students of grades 7 and 8)

Criterion A: One World (the impact of science in society)

Level	Descriptor
0	No applications of science can be identified in the work and there is no attempt to discuss the impact of science in our world's society.
1	Some application of science is mentioned in the work and an attempt is made to describe the impact of science in our world.
2	Some applications of science are clearly stated and their effects on our world (whether positive or negative) are mentioned.
3	The positive *and* negative effects of science in our world are discussed. There is a clear awareness of different viewpoints (due to e.g. culture, type of society, gender) and these are discussed to a limited extent.
4	As above. However the discussion is more detailed. As well as being aware of different viewpoints, the student shows some understanding of the ethical debate that is connected with some scientific developments.
5	A clear understanding of the contributions and limitations of science across a range of societal issues. A deep insight into cultural background and how it influences the practice of science. A deep understanding of the ethical debate that is often connected with some scientific developments.
6	As above. However the student is also in a position to make reasoned suggestions about how to best integrate science into society.

Criterion B: Communication (of ideas and information)

Level	Descriptor
0	The student does not communicate information or ideas with any clarity.
1	The student is able to use basic scientific vocabulary and can present information in his/her own words in an appropriate form.
2	As above. However, the student communicates some of her/his own ideas and opinions using some scientific knowledge effectively.
3	The student is able to recognise and use a reasonable range of scientific vocabulary and can present some information using appropriate scientific language.
4	As above. However the student can communicate most ideas using scientific language effectively.
5	The student is able to use and interpret a wide range of scientific language and can present detailed and complex information appropriately and accurately.
6	As above. However the student can also communicate even the more difficult and abstract of ideas using scientific language effectively.

Criterion C: Scientific Knowledge & Concepts

Level	Descriptor
0	The student does not demonstrate knowledge of any scientific information.
1	The student is able to recall some basic relevant information.
2	As above, However, the student shows some ability to select information appropriately and express it in his/her own words.
3	The student shows considerable knowledge and understanding of the subject matter, and can apply it to solve 'straightforward' problems.
4	As above. However, some degree of insight into the nature of science is evident.
5	The student shows a high level of knowledge and understanding of the subject matter. The student can apply this knowledge to a range of problem-solving situations. They are able to evaluate new ideas presented to them.
6	As above. However the student is able to produce new ideas and he/she demonstrates a high level of appreciation of the evolving nature of science.

Criterion D: Scientific Enquiry (planning and evaluating an investigation)

Level	Descriptor
0	The plan does not attempt to mention and describe any of the following: a stated problem, a hypothesis, a list of materials, a diagram, a method (procedure), a list of variables
1	There is an undeveloped plan which has: a stated problem, a hypothesis (if relevant), a list of materials, and a method/procedure which makes reference to variables.
2	As above. In addition, the quality of the investigation is discussed. Some mention is made to the successful or unsuccessful parts of the experiment.
3	The student has stated what he/she wants to investigate. If relevant, there is a hypothesis stated along with an attempt to justify it. There is a list of most materials used. There is a method/procedure described which states the kind of measurements to be made. There is a list of variables and these help make the investigation 'fair'. Some mention is made to the successful or unsuccessful parts of the experiment.
4	As above. The student understands the importance of carrying out a set of tests where the variable being investigated is being changed while other variables are being controlled. Some mention is made to the successful or unsuccessful parts of the experiment. The student makes some suggestions to improve the quality of the investigation.
5	As above. However, more scientific details are included both in the hypothesis and the choice of materials. After the experiments, some mention is made to the successful *and* unsuccessful parts of the experiment. The reliability of the results is discussed.
6	As above. However the method includes careful descriptions of how to use the equipment so that the measurements are accurately taken. A thorough evaluation of the work is presented which discusses the results obtained as well as the procedure followed. There is a comprehensive evaluation of the successful and unsuccessful parts of the investigation. Further ideas for investigation are discussed which extend the enquiry.

Criterion E: Data Processing

Level	Descriptor
0	The student has not attempted to analyse the data.
1	The student is able to present data in simple tables and transform data using simple mathematical or diagrammatic (e.g. charts/graphs) methods.
2	As above. However, the student can also draw an obvious conclusion.
3	The student constructs and uses appropriate tables, manipulates data numerically, transforms data into appropriate charts, and detects obvious trends in the data.
4	As above. However, the student examines the data and chart(s) critically to comment on possible patterns. Conclusions are consistent with the evidence. The conclusion attempts to explain patterns in the data using scientific knowledge and understanding.
5	The student is able to present data logically and clearly, carry out relevant calculations, draw appropriate charts, and interpret trends in the data. There is a conclusion which clearly explains the data using relevant scientific knowledge and understanding.
6	As above. However the student can make predictions that are consistent with the data. The conclusion is comprehensively explained using relevant scientific knowledge and understanding.

Criterion F: Performance in Experiments

Level	Descriptor
0	The student has not followed standard laboratory procedures.
1	The student is able to use simple equipment following detailed instructions. He/she can follow a simple procedure safely and make straightforward measurements with some assistance.
2	As above. However, the student can cooperate with other students with some assistance.
3	The student can use most equipment competently and can carry out procedures involving several steps. Observations and measurements are reasonably accurate and consistent.
4	As above. However, the student generally cooperates well with others and follows safety rules.
5	The student works with precision and skill. He/she follows instructions, carry out multi-task procedures, and make adjustments as necessary. Care is taken to collect reliable data.
6	As above. However, the student makes a note of unexpected observations and repeats measurements/observations when necessary. A high level of cooperation is maintained with other students and the student pays attention to safety throughout the work.

Overview of Variables and scientific methods

Variables

Scientists use an experiment to search for ***cause and effect*** relationships in nature. In other words, they design an experiment so that changes to one item *cause* something else to vary in a predictable way. These changing quantities are called ***variables***, and an experiment usually has three kinds: independent, dependent, and controlled.

The ***independent variable*** is the one that is changed by the scientist. In an experiment there is only one independent variable. As the scientist changes the independent variable, he or she *observes* what happens.

The ***dependent variable*** changes in response to the change the scientist makes to the independent variable. The new value of the dependent variable is *caused* by and *depends* on the value of the independent variable. For example, if you open a tap or faucet (the independent variable), the quantity of water flowing (dependent variable) changes in response-the water flow increases. The number of dependent variables in an experiment varies, but there is often more than one.

Experiments also have ***controlled variables*** . Controlled variables are quantities that a scientist wants to remain constant, and he must observe them as carefully as the dependent variables. For example, if we want to measure how much water flow increases when we open a tap, it is important to make sure that the water pressure (the controlled variable) is held constant. That's because both the water pressure and the opening of a tap affect how much water flows. If we change both of them at the same time, we can't be sure how much of the change in water flow is because of the tap opening and how much because of the water pressure. Most experiments have more than one controlled variable. Some people refer to controlled variables as "constant variables."

Some Very Simple Examples of Variables

Question	Independent Variable	Dependent Variables	Controlled Variables	Comments
How much water flows through a faucet?	Water faucet opening (closed, 1/2 open, fully open)	Volume of water flowing measured in liters per minute	Water pressure (how much the water is "pushing")	A better measure of the independent variable would be to find area of the opening in the pipe in square centimeters.
How fast does a candle burn?	Time measured in minutes	Height of candle measured in centimeters	▪ Use same type of candle for every test ▪ Wind--make sure there is none	In this case, time is what causes the dependent variable to change. The scientist simply starts the process, then observes and records data at regular intervals.
Does fertilizer make a plant grow bigger?	Amount of fertilizer measured in grams	▪ Growth of the plant measured by its height ▪ Growth of the plant measured by the number of leaves	▪ Same plants ▪ Same soil ▪ Same size pot ▪ Same amount of water and light ▪ Make measurements of growth at the same time	
Does an electric motor turn faster if you increase the voltage?	Voltage of the electricity supplied to the motor measured in volts	Speed of rotation measured in RPMs	▪ Same motor for every test ▪ Same load on the motor	

1. Ecology

1.1 OK, so what are the important words?

Ecology is the study of the interaction between organisms and their environment. The key word is *interaction.*

A ***population*** is a group of the same species that lives in an area at the same time. For example, all the storks around Büyükçekmece Lake make up a population, as do all the marsh reeds on the lake.

A ***community*** is a group of different species living together in the same environment. Storks, marsh harriers, various species of algae, and marsh reeds are some of the populations that make up the lake community of Büyükçekmece. A community is like an ecosystem except it does not include the abiotic components.

An ***Ecosystem*** is a community of organisms interacting with each other *and* with the physical environment in which they live; ecosystems consist of organisms which depend on each other and with their abiotic environment for survival e.g. a lake, a forest, a grassland, tundra. Abiotic factors include the atmosphere (wind speed direction, temperature, humidity, light intensity, rainfall), water (acidity/basicity, dissolved oxygen, temperature, dissolved nutrients) and soil (water content, acidity/basicity, temperature, nutrients). Biotic factors include the number and variety of producers, consumers, detritivores and decomposers. In summary: *ecosystem = community + abiotic factors*

A ***species*** is a group of organisms with similar characteristics, which can interbreed and produce fertile offspring. For example, Grevy's zebra and Burchell's zebra are two different species because although they can interbreed they cannot produce fertile offspring. Similarly, a donkey and a horse are two different species.

A ***habitat*** is a place or environment in which specified organisms live. For example, a cheetah's habitat is tropical savannah, while a greater flamingo's habitat includes salt lakes and estuaries.

In summary: The community of living organisms that live in a certain together with their non-living (or abiotic) environment is called an ecosystem. Therefore Büyükçekmece Gölü is a freshwater lake ecosystem. Kuçükçekmece Gölü is another freshwater lake system. However, these two freshwater lake ecosystems are not identical and so they will attract slightly different communities.

For example, Büyükçekmece Gölü has more marshland than Kuçükçekmece Gölü, and therefore Büyükçekmece Gölü attracts more marshland species like the “white stork”, “little bittern” and “marsh harrier”.

Within an ecosystem, species live in their ***habitat***. For example, the shy little bitterns’ typical habitat are large, dense reedbeds of marshes. We use habitat to mean the place where a species can be found.

Little bittern

1.2 How do living organisms get food?

A *producer (*or autotroph*)* is a living organism which can produce its own food. Autotrophs include most plants (many of which carry out photosynthesis with the light energy-capturing molecule called chlorophyll) and a few species of bacteria. So plants do not eat food, they make it!

A heterotroph is a living organism which cannot produce its own food and so needs to get food from the outside. Heterotrophs include all animals and fungi and a few species of flowering plants (e.g. venus flycatcher). There are three types of heterotrophs:

- ***Consumers*** which feed on other *living* organisms (e.g. goats, lions, bees).
  - The animals that eat plants are called *primary consumers*.
  - The animals that eat primary consumers are called *secondary consumers*.
  - The animals that eat secondary consumers are called *tertiary consumers*. (Very few animals eat tertiary consumers!!)

- ***Scavengers*** which feed on *dead* organisms by eating it and then digesting it inside their bodies (e.g. earthworms, dung beetles, vultures). Instead of hunting, they eat animals which have recently been killed or have died naturally.

- ***Saprotrophs*** or *decomposers* which feed on *dead* organisms by producing digestive chemicals onto it and then absorbing the products of digestion (e.g. some bacteria and fungi such as bread mold, black mould and field mushrooms).

1.3 What is a food chain?

A food chain shows the transfer of materials (food) and energy from organism to organism (trophic level to trophic level). A food chain is represented by arrows that indicate the direction in which materials and energy are transferred.

In an ecosystem, plants capture the sun's energy and use it to make food. This process of using the sun's energy to convert carbon dioxide and water (with the help of chloroplhyll) into glucose and oxygen is called photosynthesis. Plants then convert glucose into bigger and more complex substances like starch.

Photosynthesis is only the beginning of a chain which links plants to animals. There are many types of animals that will eat the products of the photosynthesis process (e.g starch). Examples are deer eating leaves, rabbits eating carrots, worms eating grass, or ducks eating water plants.
Remember food is made up of many different substances (like glucose, starch, vitamins, proteins, and fats).

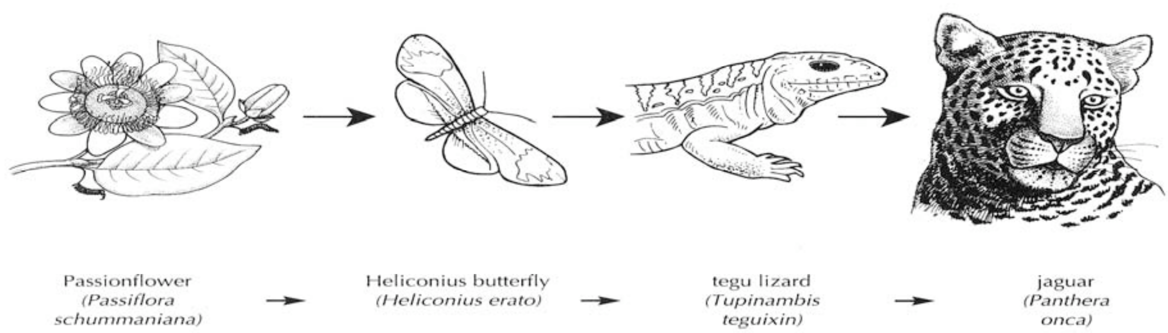
When these animals eat these plants, food substances and energy are transferred from the plants to the animals. These animals are in turn eaten by other animals, again transferring food substances and energy from one animal to another. Examples would be lions eating deer, foxes eating rabbits, or birds eating worms.

This chain of food substances and energy transferring from one species to another can continue several more times, but it eventually ends. It ends with the dead animals that are broken down and used as food or nutrition by bacteria and fungi. As these organisms, referred to as ***decomposers***, feed from the dead animals, they break down the complex food subtances into simple nutrients.

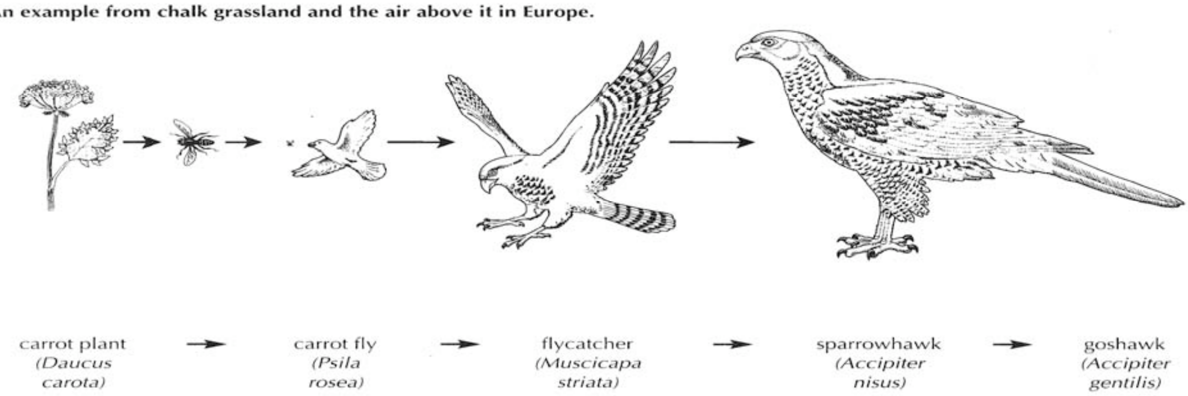
Decomposers play a very important role in this world because they take care of breaking down (cleaning) many dead material. There are more than 100,000 different types of decomposer organisms! These simpler nutrients are returned to the soil and can be used again by the plants. The energy transformation chain starts all over again.

Two examples follow:

An example from rainforest at Iguazu in north-east Argentina.



An example from chalk grassland and the air above it in Europe.

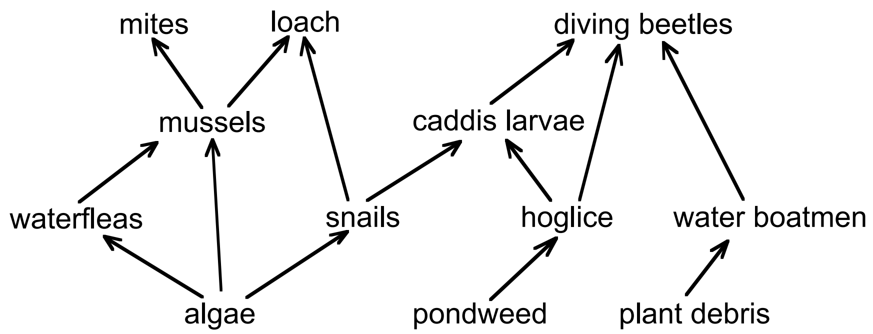


Another example is: algae ---> snails ---> caddis larvae ---> diving beetles

and: algae ---> waterfleas ---> mussels ---> mites

1.4 What is a food web?

Communities consist of many interconnecting food chains, which can be described as a food web. In other words, all the possible feeding relationships that exist in a community make up a food web. For example, look at the two last examples of food chains. Algae are common to both. If we looked at more food chains, we might get the following food web:



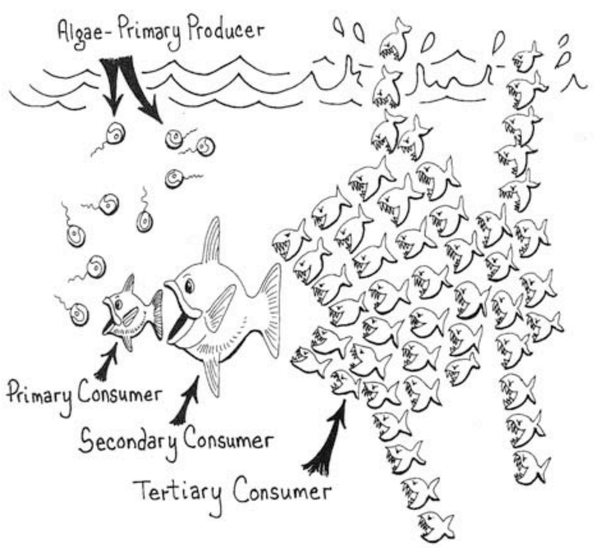
1.5 What are trophic levels?

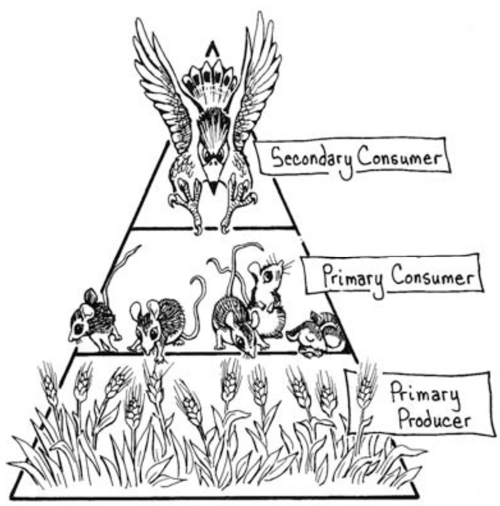
We can think of the links in a food chain in terms of levels, with each level obtaining energy from the one below. The first trophic level consists of the autotrophs or producers (green plants as well as photosynthesising and chemosynthesising bacteria).

All the other trophic levels consist of heterotrophs. The second trophic level consists of *herbivores* (e.g. plant-eaters), and these are often called *primary consumers*. The third trophic level consists of *carnivores* that eat herbivores (secondary consumers). In some communities, there may be levels of carnivores eating carnivores (tertiary or even quaternary consumers).

There may also be omnivores in a food chain or web that eat from more than one trophic level.

What is the food chain in the pyramid below?

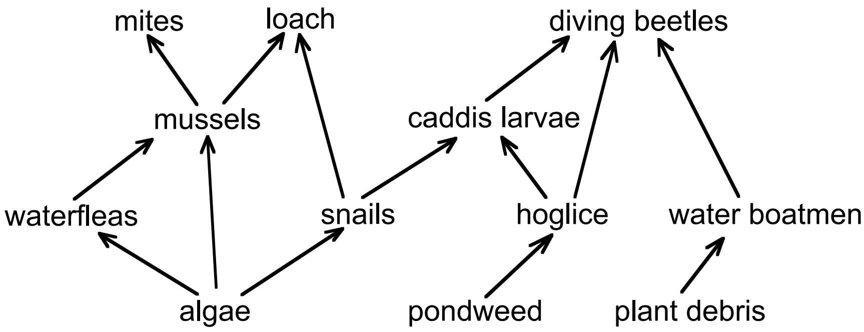




What is the trophic level of organisms in this food chain?

Carrot plant -> carrot fly -> flycaycher -> sparrowhawk -> goshawk

What is the trophic level of organisms in this food web?



1.6 So where does all the energy come from in these food webs?

In an ecosystem, plants capture the sun's energy and use it to produce their own food. This process of using the sun's energy to produce food (in other words, organic compounds) is called photosynthesis.

Photosynthesis is only the beginning of a chain of energy conversions. There are many types of animals that will eat plants. Examples are deer eating shrub leaves, rabbits eating carrots, or worms eating grass. When these animals eat these plants, food energy and organic compounds are transferred from the plants to the animals. These animals are in turn eaten by other animals, again transferring energy and organic compounds from one animal to another. Examples would be lions eating deer, foxes eating rabbits, or birds eating worms.

This chain of energy transferring from one species to another can continue several more times, but it eventually ends. It ends with the dead animals that are broken down and used as food or nutrition by bacteria and fungi. As these organisms, referred to as decomposers, feed from the dead animals, they break down the complex organic compounds into simple nutrients. Decomposers play a very important role in this world because they take care of breaking down (cleaning) many dead materials. There are more than 100,000 different types of decomposer organisms! These simpler nutrients are returned to the soil and can be used again by the plants. The energy transformation chain starts all over again.

1.7 How efficient are energy transformations in food chains?

Ecological efficiency or food chain efficiency is the percentage of usable energy captured at each level of consumption. For example, primary producers (e.g. plants) range in efficiency between 1% and 3% depending on the plant; only 3% of the solar energy absorbed by the plant is actually converted to biomass. A typical primary consumer (herbivore) uses some 10% of the total plant energy (potential) consumed. A secondary consumer's efficiency is also about 10%, meaning that they obtain about 10% of the energy present in the herbivore that it eats. The following describes it well:

"Let's say that I eat a piece of lettuce. If I burned that lettuce, literally burned it with a match, I could get a certain amount of energy out of it. I could consider it a fuel. But if I eat it instead, do I convert all the energy in that lettuce leaf into energy for me? No, first of all, there's a lot of waste. A good bit of that lettuce is a polysaccharide called cellulose, and humans don't have the enzymes to break down cellulose. So most of the leaf goes right through me and is not available for my use. What is usable costs energy to process. So what we finally end up with is maybe 90% of the mass of the leaf lost and

10% retained, either to use for structural purposes or to use for energy.

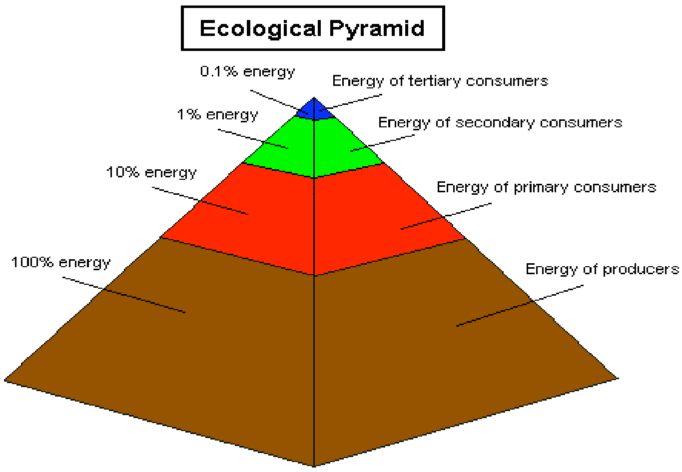
The implication of this is that it takes about 100 [kg] of primary producer mass to support 10 [kg] of primary consumer mass. As you move from primary to secondary consumer, you have similar losses - it takes about 100 [kg] of primary consumer to support 10[kg] of secondary consumer. Put another way, it takes about 1000[kg] of primary producer to support 10 [kg] of secondary consumer."

So energy transformation is not very efficient!

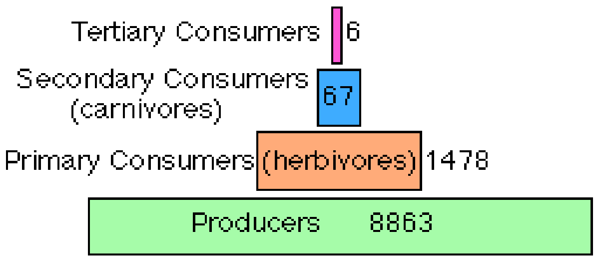
1.8 How can we show energy transformations of a food chain in a diagram?

As a result of energy loss between links, animals at the top of the food chain are relatively rare. An eagle requires a feeding area of hundreds of acres of vegetation to support itself with enough food. When humans eat animals, it requires more plant material to support the human than it would if the human ate the plants directly. Ecological support for vegetarianism!

A pyramid of energy is a diagram representing the energy contents within different trophic levels of a community or food chain. Generally shaped like a pyramid, it is difficult to represent the decomposers.



And we can use numbers to represent the energy present at each trophic level:



Why is it shaped like a pyramid? In other words, why is there little energy available at the top trophic level of the pyramid? The reason has to do with energy loss from one link to the next as described before. Energy is lost because

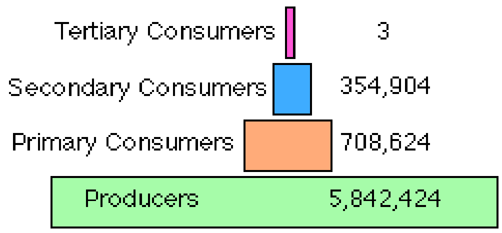
- some energy is bound up in molecules the consumer cannot digest (like cellulose).
- some energy present in food molecules is lost as heat energy (to the atmosphere) during cellular respiration.
- members of higher trophic levels often don't consume every part of an organism

The pyramid of energy also offers an explanation as to why organisms feed on particular organisms and not others. Lions prey on large animals because they can get more energy from a large animal than from a small animal. In fact, lions use up more energy trying to catch a rodent than they would get by eating the rodent! Therefore lions hunt and eat zebras, and a single chase might result in an energy ‘profit’ for the lion.

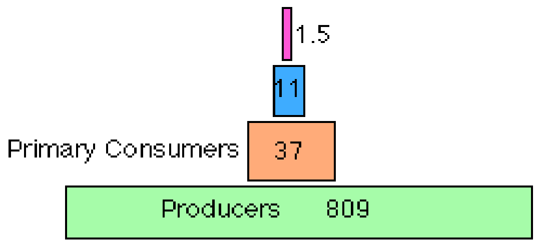
Loss of energy in a food chain explains several ecological principles:

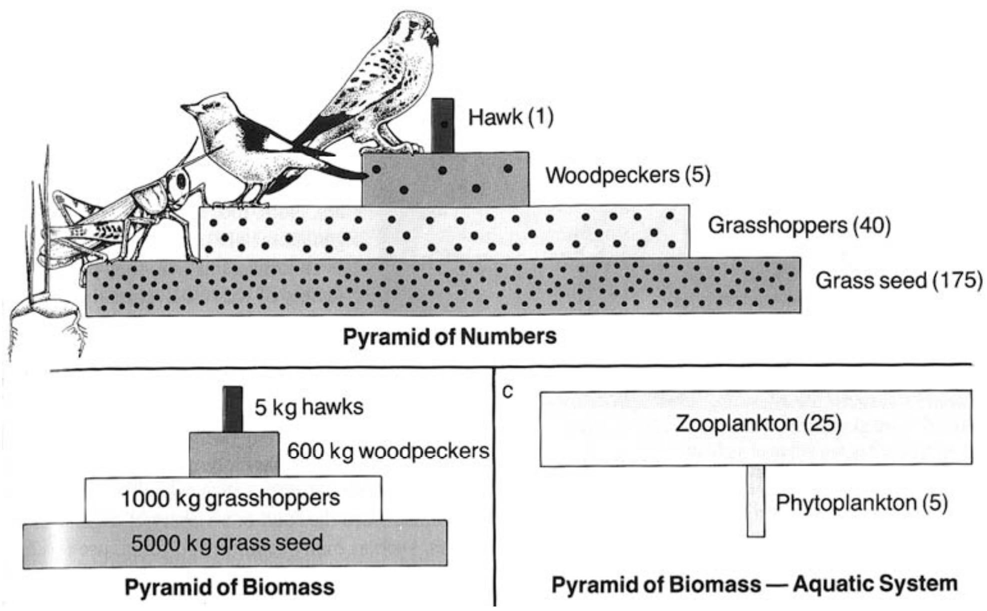
1. *A food chain rarely includes more than 4 links*. So much energy is lost at each trophic level that enough energy seldom remains to support 5th or 6th order consumers.

2. *The loss of energy also explains why there are usually fewer individual organisms in each higher trophic level than in the previous level*. This is known as the *pyramid of numbers*. However the pyramid of number does not apply to all food chains; for example, there will be more caterpillars of some butterfly species than oak trees in a community, and there may be more parasitic worms (e.g. tapeworm) in a lion.



3. *Decrease in energy along food chains suggests that the total organic matter (biomass) present at each trophic level should also decrease because energy is required to build organic matter*. This is true in most food chains and can be represented by a *pyramid of biomass*.



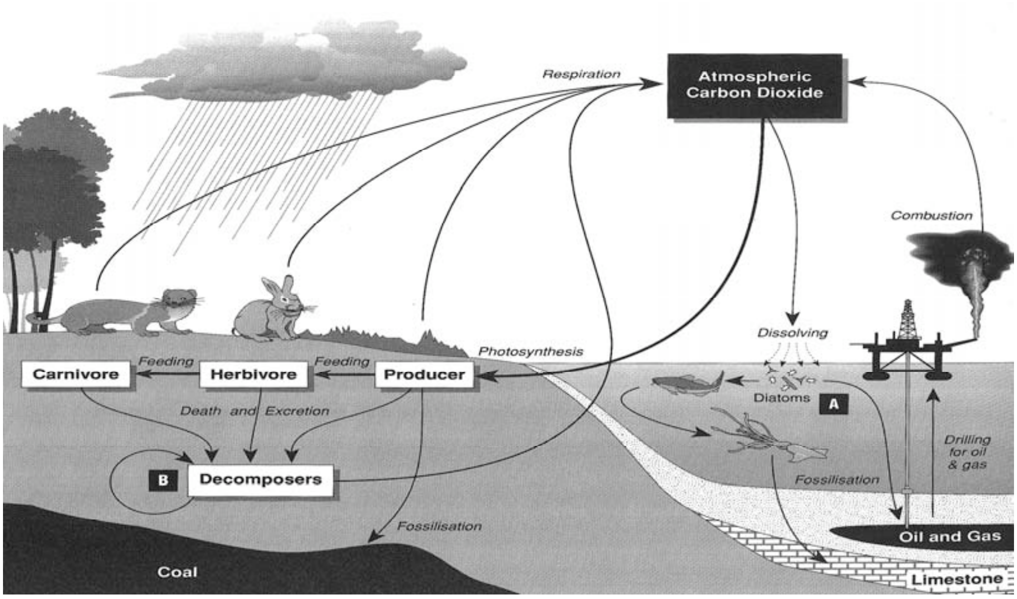


1.9 Are nutrients also lost?

Not really, although some small amounts are! Although energy is not efficiently cycled in an ecosystem, the energy lost is constantly replaced by sunlight energy. This is not the case with nutrients.

If loss of materials occurred, an ecosystem could not survive because soon there would be no matter! So matter, such as carbon, nitrogen, and oxygen are continuously being recycled. In other words, an atom of carbon inside your skin cell may soon find itself in a dust mite's mouth, which might end up inside a cat!

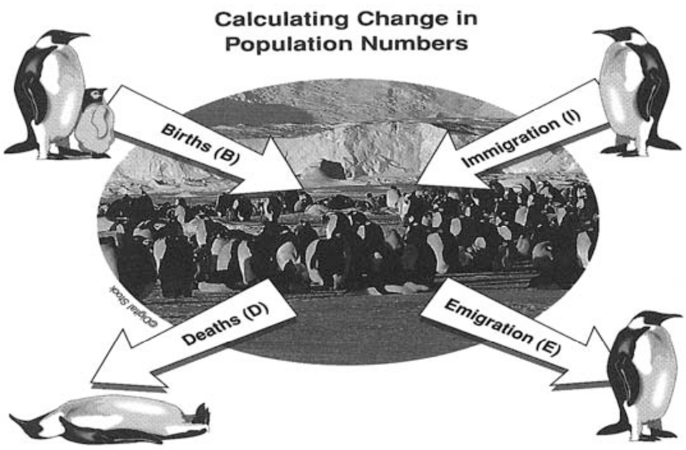
For example, carbon is recycled as shown below:



The concentration of carbon in living matter (18%) is almost 100 times greater than its concentration in the earth (0.19%). So living things extract carbon from their nonliving environment. For life to continue, this carbon must be recycled.

1.10 How is population size affected?

Remember that a population is a group of organisms of the same species living together in one geographical area. This area might be difficult to define as populations may comprise widely dispersed individuals that come together only infrequently (e.g. for mating). The number of individuals comprising a population may also fluctuate considerably over time. These changes make populations dynamic: populations gain individuals through births (natality) and immigration (movements into the population), and lose individuals through deaths (mortality) and emigration (movements out of the population).



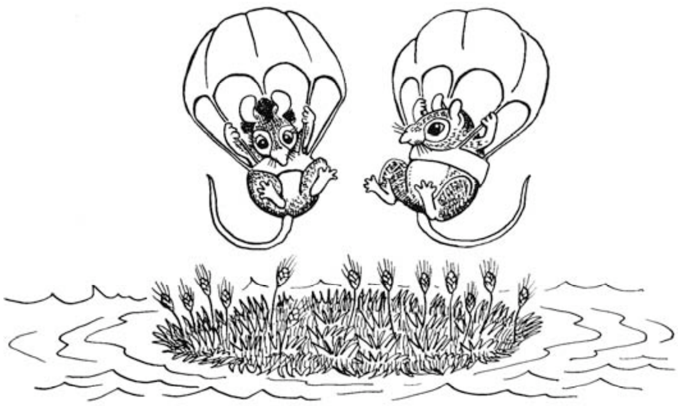
Ecologists usually measure the rate of these four events, for example 542 live births per year or 39 live births per 1000 individuals per year (3.9%). This is expressed as:

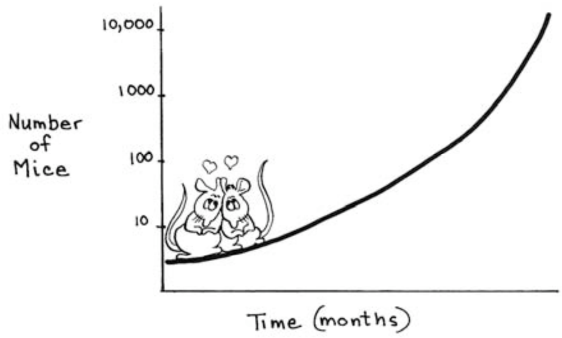
Population growth = Births (B) - Deaths (D) + Immigration (I) - Emigration (E)

The difference between immigration and emigration gives *net migration*.

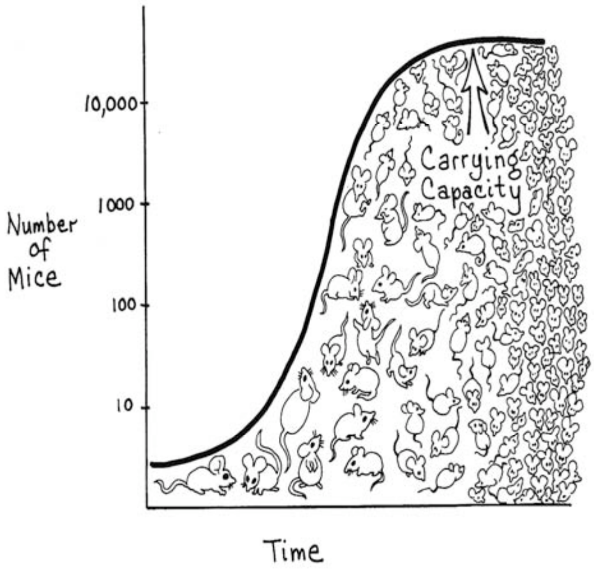
1.11 How do populations grow?

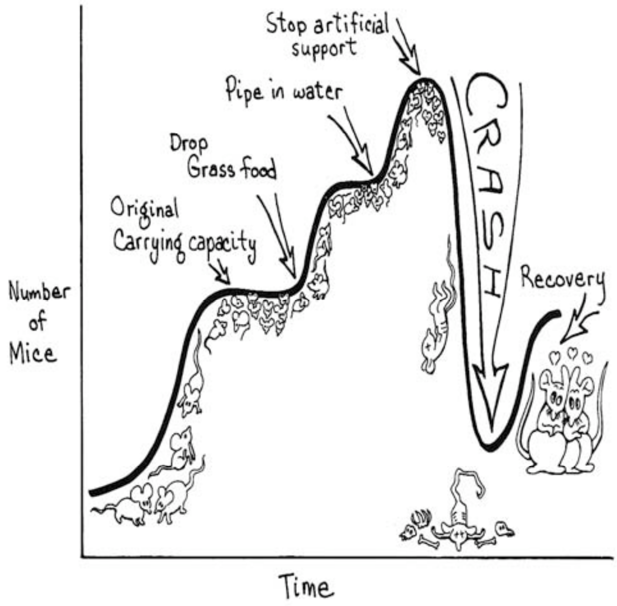
What is it that decides how many individuals of a species you have in a given area? We'll start by considering an island. To simplify things even further, let us assume that we clean it of all life forms (throw a few bombs on it!) and then we plant some green grass. Then we parachute in two mice - one female and one male and they have unlimited grass seeds and water. At first they breed like crazy and soon their children are having children. The rate of population increases dramatically (exponential phase) until there is not enough grass seeds to feed all the mice and so population growth goes to zero (carrying capacity). At first the population size was small, but the growth rate was large. Then as the population size increased, the growth rate went down. Finally the population size stabilized, and the growth rate went to zero, which means that the number of additions (births) in the population equals the number of deaths. This kind of S-shaped curve which describes population size is our jumping off point for considering some things that can affect a population.





The population will 'stabilise' at a point called the *carrying capacity* of that particular habitat. Usually there is some one *limiting resource* that keeps the population from growing bigger. If in our case the limiting factor was grass seeds, then we could add more seeds to the island only to find that the population would increase again until it hit the next limiting factor like water. So we could pipe water in. Eventually we'll reach an ultimate limiting factor which is usually the social stress of overcrowding.





The following all have an effect on the population size:

- Extreme climate such as flood, fire, drought, volcanic eruption, tsunamo and earthquake.
- Biotic factors such as food supply, diseae, parasites, competition with other species or even their own, other predators.

1.12 When we are studying ecology outside, why do we random sample (like with quadrats)?

In most case the populations of each species within a community are too large to be examined directly. Instead of examining every piece of land, soil and water in an ecosystem (impossible!), ecologists only examine a small component. This small component would hopefully give a fairly accurate description of what is in the entire ecosystem.

In other words, ecologists *sample* a small area of a much larger area. This must be done *randomly* so that data is not biased. For example, in studying plants, you could be tempted to only study those areas where there a lot of colourful flowers and ignore areas where there are less attractive plants. A random sample is a small area (or a few individuals if you're studying just one species) which has been selected at random with the aim that it represents the whole ecosystem (or population).

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1.13 Field Studies in Ecology

One way of studying an ecosystem is to go into it! Once in there, we can use different methods to find out what species live there, and which species are the most common. We can also study the soil, climate, air, and light there.

Useful apparatus out "in the field"

Notebook/pencil

Field guide to identify organisms

Hand lens (plant identification):

Tweezers (insects):

Trowel (soil, whole plants):

Pooter (insects):

Specimen tubes
(small, delicate plants) :

Sieve (plants in soil)

Screw-topped jars
(large delicate plants, fungi):

Polythene bags (plants):

Camera
(ecosystem, unusual organisms):

Video movement:
(ecosystem, movement)

Traps

Pitfall-trap: useful for collecting crawling or running insects.

Nets (insects)

Beating Tray (insects in trees and bushes)

Tullgren funnel (insects in soil)

Recording Techniques

Quadrat frames (plants)

Line transects

Tape recorder

Video recorder

MAKING AND USING A POOTER TO SAMPLE SMALL ANIMALS

TOPIC:

Sampling, Identifying, and Counting Small Land Animals

INTRODUCTION:

Cracks and crevices conceal a multitude of tiny creatures. It is fascinating to investigate and identify the animal communities that live in wall crevices, the cracks between paving stones, tree bark on upright and rotting trees, and under stones. Normally it is very difficult to sample such small animals; the pooter overcomes this problem. Simple to construct and safe to use, the pooter can be used to take samples of small animals when and where required; it also contains the small creatures until they can be identified and counted. This project shows how to make the pooter and use it.

TIME NEEDED:

15 minutes to construct the pooter
1 hour to collect and identify animals

MATERIALS:

clear glass jar (*e.g.*, empty jelly or baby food jar) approximately 4 in. high
modeling clay
pencil
2 flexible drinking straws
facial tissue
rubber band
2 clear jars with lids
small paint brush
magnifying glass
animal identification chart (see 9.001)

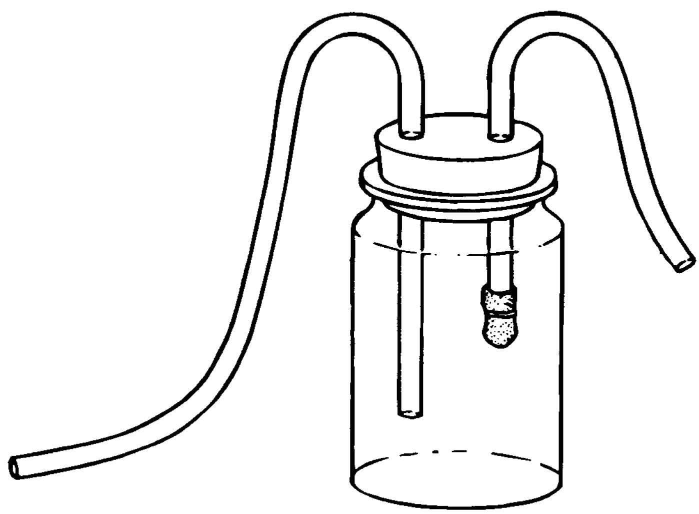
Safety Precautions

Please click on above link to view our safety guidelines.

PROCEDURE:

Making the pooter (use the picture of the assembled pooter in figure 1 as a guide)

figure 1



1. Collect the glass jar, modeling clay, two straws, facial tissue, and rubber band.

2. Mold a piece of modeling clay to fit the neck of the jar; make two holes through it with the pencil, then fit the straws through the holes.

3. Use the rubber band to secure the facial tissue over the end of one of the straws (the end that will be inside the glass jar). The tissue will stop any small animals from going into your mouth.

4. Put the modeling clay into the top of the glass jar. Look at the straws; adjust one straw so that it is almost 2.5 cm above the bottom of the jar. Adjust the other straw so that the tissue-covered end is about 5 cm above the bottom of the jar. The pooter is now ready to use.

Using the pooter

5. Practice indoors first with some small pieces of paper. Point the end of one straw toward the paper. Put the end of the other straw with the tissue over one end in your mouth and suck. The paper will be drawn into and trapped inside the pooter.

6. Go outdoors. Find suitable sites such as crevices in walls, cracks between paving stones, tree bark, leaves, patches of grass, or under stones.

7. Move the end of the straw slowly over the chosen site for 10 seconds, sucking all the time. (See figure 2.) Now take the pooter indoors to examine your sample.

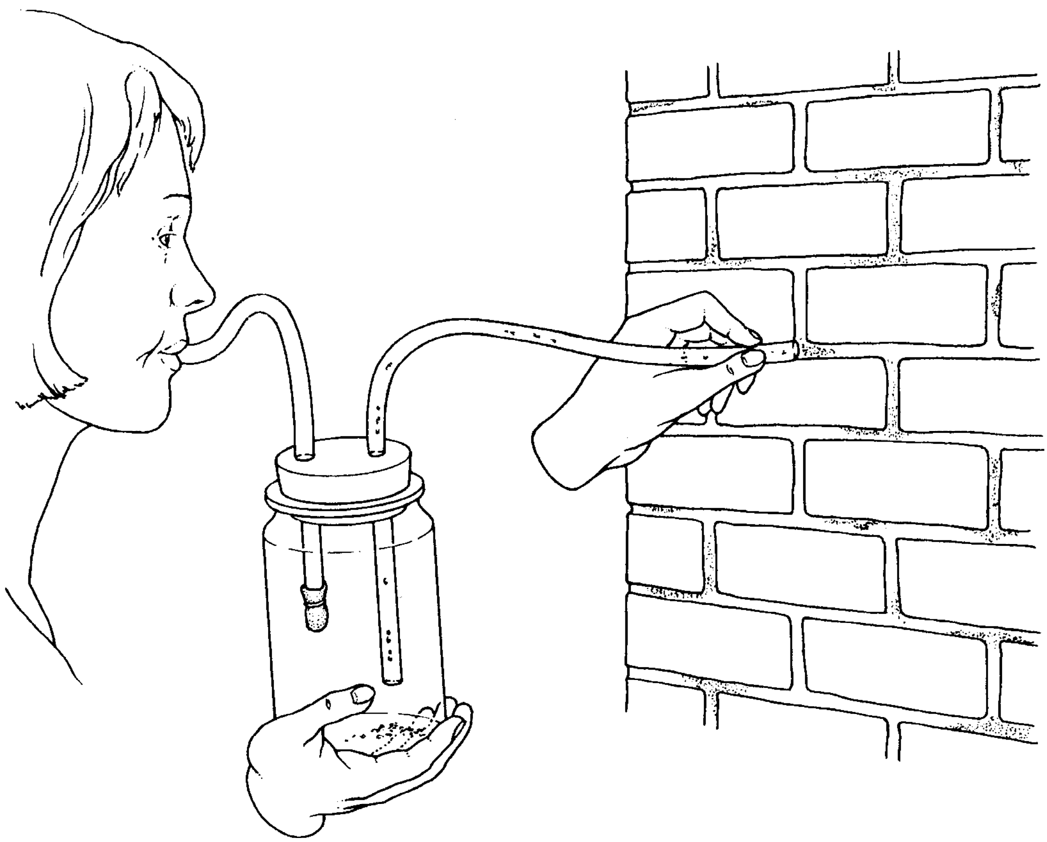


figure 2

8. Carefully remove the modeling clay from the pooter and tip its contents into a glass jar; cover it with a lid. (Any animals remaining in the pooter should be swept into the glass jar using the paint brush.)

9. Use the magnifying glass and animal identification chart to identify and count the captured animals. Record your results in the Data Table.

10. Return the animals to where you found them, or as close as possible to the same place. Repeat steps 7 to 9 at a second site.

How to use the quadrat:

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Method

1. The quadrat is thrown at random.
2. Lower a pin to the ground at each sample number.
3. Record the plant it touches (a "hit").
4. Repeat steps 1,2,3 for different quadrat throws.
5. Calculate the abundance of each plant by dividing the number of hits of each plant by the total number of hits.

You could record your results in the following way:

1st Quadrat:

Sample point	*Plant*	*Sample point*	*Plant*	*Sample point*	*Plant*	*Sample point*	*Plant*
1		*26*		*51*		*76*	
2		*27*		*52*		*77*	
...		...		...		...	
24		*49*		*74*		*99*	
25		*50*		*75*		*100*	

Line Transect

1. Lay out a line of string across an area which cuts across contrasting vegetation (e.g. shade/sun, wet/dry).

2. Tie pieces of string/ribbon at fixed intervals (the intervals will depend on the length of the transect and the type of vegetation.

3. Record the plants which touch the marked off intervals (stations), and also their heights to see if they vary.

Distance from start (m)	Name of plant	Height (cm)
0		
0.5		
1.0		
...		

We can also examine the non-living components:

Soil Analysis

We can check for

- Humus content
- Water content
- pH (acidity/basicity)
- minerals present

Water Analysis

We can check for

- Humus content
- Water content
- pH (acidity/basicity)

Quadrat readings

Sample point	Plant	Sample point	Plant	Sample point	Plant	Sample point	Plant
1		*26*		*51*		*76*	
2		*27*		*52*		*77*	
3		*28*		*53*		*78*	
4		*29*		*54*		*79*	
5		*30*		*55*		*80*	
6		*31*		*56*		*81*	
7		*32*		*57*		*82*	
8		*33*		*58*		*83*	
9		*34*		*59*		*84*	
10		*35*		*60*		*85*	
11		*36*		*61*		*86*	
12		*37*		*62*		*87*	
13		*38*		*63*		*88*	
14		*39*		*64*		*89*	
15		*40*		*65*		*90*	
16		*41*		*66*		*91*	
17		*42*		*67*		*92*	
18		*43*		*68*		*93*	
19		*44*		*69*		*94*	
20		*45*		*70*		*95*	
21		*46*		*71*		*96*	
22		*47*		*72*		*97*	
23		*48*		*73*		*98*	
24		*49*		*74*		*99*	
25		*50*		*75*		*100*	

Line Transect Readings

Distance from start (m)	Name of plant	Height (cm)

Record of Animals

Date	Type of animal	Size (mm)	Description (e.g. # legs, shape, colour, ...) + diagram	Where did you see it?	What was it doing?	Specific name of animal?

Quick notes on Food chains and Pyramids

Éanna OBoyle

Food chains and energy

Plants are termed **producers** because they can make their own food. All other living organisms are **consumers**. They obtain food from green plants, either directly (primary consumer) or indirectly by feeding on other organisms (secondary or tertiary consumer), dead or alive. The terms herbivore, carnivore and omnivore are used to describe how different consumers feed.

Look at the grassland **food chain** shown.

Primary Producer: Clover
↓
Primary consumer: Snail
↓
Secondary consumer: Thrush
↓
Tertiary consumer: Kestrel

The arrows in the chain indicate the direction of energy flow and feeding. Energy loss is normal throughout a food chain. When the different food chains are connected and put together for an ecosystem, they form a **food web**.

Try these!!

1. Name the term given to plants because they make their own food.
2. Match the two halves of the sentences below. Type the **letter** of the correct ending in the box next to its beginning.

A.	wasted as thermal energy to the surroundings.	a)	Some energy from food is…
B.	a related food-web.	b)	The number of top predators is…
C.	always small compared to producers.	c)	Connected food-chains make…

2. Pyramids of number and biomass

A pyramid of numbers is another way of representing feeding relationships. The grassland food pyramid has a wide base due to a plentiful supply of clover plants in grassland. Study the relative numbers in the pyramid carefully.

Grassland		
Hawk	x	Tertiary consumer
Thrush	xx	Secondary consumer
Snail	xxxxx	Primary consumer
Clover	xxxxxxxxxxxxxxxxxxxxxxxxxxxx	Primary producer

We see from the food pyramid that there are very large numbers of clover plants supporting a snail population in grassland. The snails in turn are eaten by thrushes, who pick them up and in flight drop them on to large stones breaking their protective shells, so allowing them to be eaten. Young thrushes are hunted by hawks. The hawks hover over large fields looking for prey. The number of hawks as top predators is small.

Number pyramids can be inverted when a large plant such as a tree provides the habitat, as a single large tree has many thousands of leaves. These may provide a food source to a large population of insects. However it is only one tree so the pyramid has an unusual base.

Oak Tree

Owl	x	Tertiary consumer
Woodpecker	xx	Secondary consumer
Insects	xxxxxxxxxxxxxxxxxxxxxxxx	Primary consumer
Oak tree	x	Primary producer

If the pyramid was one of biomass, the base would not be inverted as a large tree has a considerable biomass, so it would result in a normal pyramid.

Organisms in a food chain can be weighed and shown as a **pyramid of biomass**. About 90% of food consumed is used up as energy at each feeding level and only 10% becomes part of the consumer organism's biomass. So that:

100kg of clover   10kg of snail   1kg thrush   100g hawk

Grassland

Hawk	x	Tertiary consumer
Thrush	xx	Secondary consumer
Snail	xxx	Primary consumer
Clover	xxxxxxxxxxxxxxxxxxxxxxxxxxx	Primary producer

This helps to explain why the number of top predators is small.

Plants convert about 1% of the sun's energy that falls on their leaves for photosynthesis. Animals that eat plants directly are termed   and so are primary consumers. Animals that eat other animals are called   and are usually secondary or tertiary consumers. When an animal such as a rabbit eats a plant it uses the food to provide energy and raw materials. Some of the plant material is   and   as waste in its droppings. Some energy is lost as   . This means that 100kg of grass may only convert into a biomass of 10kg of rabbit, even though rabbits eat their soft droppings and pass them for a second time through their digestive system to get maximum food benefit.

1.14 Adaptations

Animal Adaptations
An adaptation is something about an animal that makes it possible for it to live in a particular place and in a particular way. It may be a physical adaptation, like the size or shape of the animal's body, or the way in which its body works. Or it may be the way the animal behaves. Each adaptation has been produced by evolution.

As the environment changes, animals that cannot adapt die out, and only the adapted ones survive to produce babies. Because babies are usually more or less like their parents, the whole species soon contains only animals that are adapted to the new environment.

An animal's environment consists of many different things. The climate is important. Whether it is hot, cold, dry, or wet will have an effect on all the creatures that live in a particular place.

Another important part of an animal's environment is what kinds of food plants grow in it. The other animals that live there also have an effect. If there are predators around, the prey animals will have to learn to defend themselves or fun fast to escape.

These adaptations make it possible for a great variety of creatures to live and thrive on earth. animals adapt to the natural world.

Animals in the wild can only live in places they are adapted to. They must have the right kind of habitat where they can find the food and space they need.

More detailed notes:

What Does Adaptation Mean?
The special characteristics that enable plants and animals to be successful in a particular environment are called adaptations. Camouflage, as in a toad's ability to blend in with its surroundings, is a common example of an adaptation.

The bright orange color of a monarch butterfly is an adaptation to warn potential predators that the butterfly is poisonous and prevent it from being eaten. These special features have evolved over long periods of time, through the process of natural selection. Adaptations afford the organism a better chance to survive in its surroundings.

Deserts, where the environment is generally hot and extremely dry, provide many striking examples of how plants and animals are adapted to their surroundings. Plants have many adaptations to cope with the lack of water. Some desert plants, such as the barrel cactus, have expandable stems for storing water. Other plants have adaptations that reduce water loss from their leaves, the part of a plant through which most of the water is lost. Still others have a waxy coating on the leaves, or have small leaves, that reduce the surface area exposed to the drying elements. In many cases, desert plants have no leaves at all. Photosynthesis, which normally occurs in green leaves, is carried out in the stems, which are themselves green with the pigment chlorophyll.

Desert animals also have many adaptations as well to help them survive in the desert climate. Many are nocturnal, meaning active during the cool night rather than the hot daylight hours. The kangaroo rat conserves water by excreting a solid urine rather than liquid.

In sharp contrast, the climate of the tropical rainforest is hot and wet. With over 80 inches of rain per year, as opposed to the desert's 10 inches or less, plants have adaptations that enable them to shed water efficiently. The leaves of many rainforest plants have drip tips for this purpose. Buttress and stilt roots are thought to provide extra support for trees growing in spongy, wet soils.

Tropical rainforest plants also have adaptations to take in what little sunlight is available on the dark forest floor. Large leaves are common; they increase the amount of sunlight a plant can capture. Other plants, like orchids, bromeliads and ferns, grow as epiphytes high up in the canopy where there is more sunlight.

The adaptations discussed above are all adaptations to specific climatic conditions, but organisms have also developed adaptations to other aspects of their environment. Some animals have adapted to eat a certain type of food; others have adapted to avoid being eaten themselves. Most animals have behavioral adaptations which help them attract a mate. In the plant world many flowers have evolved specific structures that help insure pollination by the insects they attract.

Adaptations in the Tundra

Some common adaptations of resident animals in the arctic and alpine tundra:
- short and stocky arms and legs.
- thick, insulating cover of feathers or fur.
- color changing feathers or fur: brown in summer, and white in winter.
- thick fat layer gained quickly during spring in order to have continual energy and warmth during winter months.
- many tundra animals have adapted especially to prevent their bodily fluids from freezing solid.
- resident animals like the ptarmigan and the ground squirrel use solar heating to stay warm and save energy. Both animals stay out in the sun to warm up and during the summer when the weather is warm, seek shade to cool off.

Insects
Not only do animals have to keep warm, but insects needed to develop ways to prevent freezing of their bodily fluids. Like tundra animals, insects also use the sun to keep warm. Insects are also dark in color and hairy for the same reason animals are. Being small also makes it easier for tundra insects to keep warm. However, it also makes them more prone to freezing. This is why insects of the tundra have built up antifreeze agents in their bodies to prevent their cells from freezing. Some

insects even dehydrate so that there will be less body fluid to freeze. Some insects and animals, along with solar heating, use supercooling to prevent fluids from freezing. Supercooling allows the animals or insects body fluids to cool below freezing without becoming solid. Very little of the supercooled animals and insects' bodies freeze anyway, because they clean their bodies of ice producing nuclei.

Diets
Animals and insects are obviously well adapted to the tundra's climate. Their diets must also be adaptable. If their diets were not adaptable, many of the tundra's animals and insects would starve in the winter because of the lack of certain types of food. An example of this type of adaptation is the diet of the brown bear. In the spring, since food is still scarce, bears may dig up roots or even eat seaweed found along water sides. In the summer the brown bear's diet is more complete. They will hunt for salmon and eat berries.

Since the tundra is the youngest biome, some tundra plants, insects, and animals, can also be found in other biomes. For example, brown bears and caribou can also be found in the taiga biome.

Because weather conditions in the arctic and alpine tundra are unpredictable, plants need to adapt to all sorts of weather. Even in a plants growing period, the tundra can experience snow storms and high speed winds. They have adapted in many ways for survival purposes. One of the survival strategies of plants is their cool growing temperature. Tundra plants can grow at temperatures 15ºC to 20ºC (27ºF to 36ºF) which is cooler than any other plant in the world. Small and low growing plants are also a characteristic of tundra plants. This is because of the lack of nutrients found in the soil. Also being close to the dark, warmth, absorbent soil helps to keep plants from freezing.

Plants are also dark and hairy. The darkness of their flesh absorbs solar heat, and the hair helps to trap the heat and keep it close to the surface of the plant. The warmer the plant the faster they grow. Some plants also grow in clumps in order to break harsh winds and protect each other from the cold. These plants also stay warmer because more of the plant is exposed to the sun.

Plants in clumps remain 20 degrees warmer than the surrounding air. Some plants even have dish-like flowers that track the sun. The dish allows more sun to be focused on the center of the flower. The warmth that the plant attracts, allows it to grow quicker and healthier than other plants.

Adaptations in the Hot Desert

Special Adaptations
•Long eyelashes and ears lined with hair provide protection from blowing sand.
•Nostrils can be closed to keep out blowing sand.
•Snowshoe effect prevents sinking in sand as the body weight rests on sole pads with only the front ends of the hooves touching the ground.
•Thick, calloused “knees” protect the joints when the animal lies down.

•Long legs allow animal to travel great distances easily.
•Thick fur and underwool provide warmth during cold desert nights and some insulation against daytime heat.
•Fat stored in humps helps animal to survive long periods without food; metabolized fat produces water as a by product.

Animals need to be well adapted to the arid climate of the desert. They need to regulate their body temperature all day and all night. Mammals and birds have it the easiest when it comes to body heat regulation. Their body heat remains stable as long as they are not in the heat for prolonged periods of time. In the cold night weather, they remain warm as long as they eat enough food to produce energy. Reptiles and amphibians body temperatures mirror that of the deserts. They have no internal way to regulate their body temperature.

To prevent over heating, both reptiles and animals make burrows to escape the heat. Burrows can remain at a much cooler temperature during the day and a much warmer temperature during the night. Some animals come out of their burrows in the early morning and afternoon, before the heat gets too overwhelming. Other animals only come out during the night, which is one reason why the daytime in the desert can seem so lifeless.

During the hottest, driest times of the year, some animals estivate. Estivation is like hibernation except these animals are not avoiding the cold, but the sweltering heat. By estivating, animals conserve more moisture.

Desert : Plant Adaptations

Plants need to conserve moisture and energy in the dry desert. Many plants slow down growth for half of the year to conserve moisture. Many others also lose their leaves when temperatures become too intense. When the short rain season comes, plants burst into color, sprouting leaves and flowers.

Many large cacti, like the barrel and organ-pipe cacti, store large amounts of water in their thick stems and pulpy interior. Another large cacti that has adapted perfectly to the desert environment is the saguaro cactus. The saguaro grows on the northern and southern slopes of the Sonoran Desert. Here it grows in gravel and rocky soils, usually between he heights of 2,000 and 3,500 feet (610 to 1,068 meters).

The saguaro extracts water from its environment every chance it gets. Its roots are only a few inches (2.5 centimeters) deep in the soil, so it can soak up as much rain and dew before it evaporates. A giant saguaro can soak up to a ton of water during a heavy rain. The saguaro also has a spongy inside layer that helps distribute water in the plant. Its outside skin is pleated, so when more water is absorbed its outside can expend to make room.

Growth is also very slow for the saguaro. It can take thirty years or more before the saguaro can reach a few feet (1.5 meters) high. After eighty years pass, the plant can be 20 feet (6 meters) tall and still not be full-grown. Two centuries may pass before the plant reaches its mature height. By growing slowly, the saguaro expends less energy, food, and water, making it fully adapted to the desert.

Water conservation is very important for all plants in the desert. Many plants achieve this by losing their leaves in one fashion or another. Acacia trees and the ocotillo, a shrub, both shed their leaves during long bouts of dryness. Shedding leaves not only prevents the loss of moisture from evaporation, but also slows the growth of the plant. Slowing growth helps plants use less water, food, and energy during hot seasons.

A large number of desert plants begin as seeds. Seeds can survive without water for indefinite periods of time. Seeds only begin to sprout when the rain washes away anti-sprouting chemicals on their shells. After the rains, the seeds will sprout when the temperatures become more moderate. After these plants sprout they may not live very long, because many desert plants sprout, mature, flower, and then die in a very short period of time.

Other plants don thin, knife-like leaves that prevent water loss by giving the sun a smaller area to evaporate water. Others, like the Joshua tree, have needle-like leaves with a waxy resin that prevents much water from evaporating. Another type of plant, called living stones, exposes only a few of its leaves to the sun. The rest of the plant remains underground, safe from the sun and heat. Other plants remain hydrated with their deep roots. The mesquite tree has roots that can extend 100 feet (30.5 meters) into the ground, tapping water from underground aquifers.

Many plants in the desert are located many feet (meters) away from one another. One reason may be that moisture is limited so plants must space out. Another concept is that some plants are poisonous to others. Roots of the creosote bush have chemicals on them just for the purpose of keeping other plants out of their way.

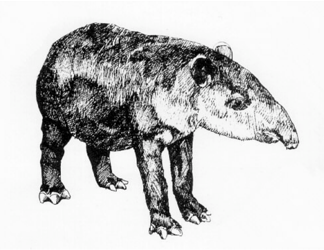
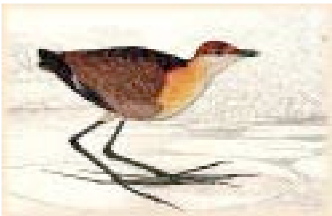
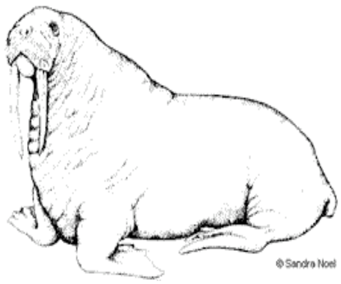
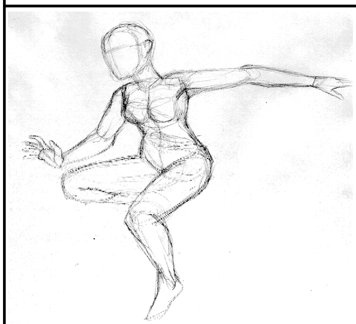
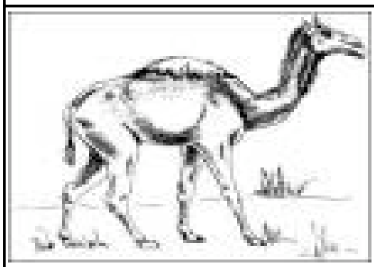
One problem to plants living in or near sand dunes was the constant changing and movement of the dunes. When dunes move, it can uproot plants. Plants needed to adapt to dune areas. So, grasses and shrubs living in dune areas have developed long, tough roots to hold onto sand dunes. After more plants move into the area, they anchor the dune down with their roots and not even wind can move them.

Websites:
http://animaldiversity.ummz.umich.edu/index.html
http://www.life.uiuc.edu/bio100/lectures/s02lects/02s02ecospace.html
http://www.enchantedlearning.com/biomes/
http://www.makalapa.k12.hi.us/Makalapa_Folder/HTML/adapt&survive/adapt&survive.html

Year 8 Adaptations

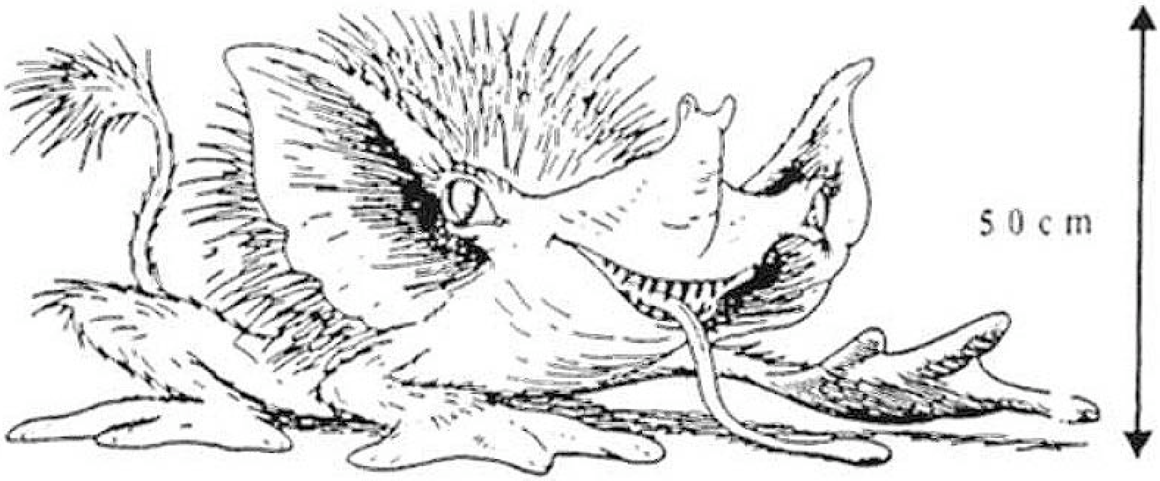
Animal	Habitat	Feature	How is this feature adapted to the animal's habitat?
Camel 			
Egyptian vulture 			
Mole 			

What, do you think, are these animal's habitats? Complete the table!

	Habitat	Feature	How is the feature adapted to habitat?
 Tapir			
 bushbaby			
 jacana			
 Walrus			
 Human			
 Camel			

Creature Feature

Where did this peculiar feature live?



A Simple Dictionary Of Ecology Terms

Autotroph
An organism capable of capturing light and making its own food (photosynthesis).

Carnivore
An organism that feeds on other consumers (meat eaters).

Commensalism
A symbiotic relationship where one species benefits and the other neither benefits or is harmed.

Community
Populations of different organisms that live together.

Consumer
Organisms that cannot make their own food.

Decomposer
An organism that breaks down organic matter in the bodies of other organisms.

Ecology
The study of the relationship between organisms and their environment.

Ecosystem
A major interacting system which involves both organisms and their non-living environment.

Food Chain
A part of a food web which focuses on an individual sequence of who eats whom.

Food Web
A diagram or picture of who eats whom in an ecosystem.

Habitat
The place where an organism lives.

Herbivore
An organism that eats only producers (green plants).

Heterotroph
An organism that depends on autotrophs for its food.

Mutualism
A symbiotic relationship where both species benefit.

Niche
The role of an organism in its environment.

Omnivore
An organism that eats both producers and consumers (green plants and meat).

Organism
A living creature, with one cell or many cells.

Parasitism
A symbiotic relationship where one species benefits and the other is harmed.

Population
Individuals of the same species living together in the same environment.

Predator
An animal that hunts and eats other animals.

Prey
An animal who is hunted and eaten by another animal.

Producer
An organism capable of making its own food (plants, algae, and some bacteria).

Symbiotic Relationship
Two different kinds of organisms living in close contact with each other.

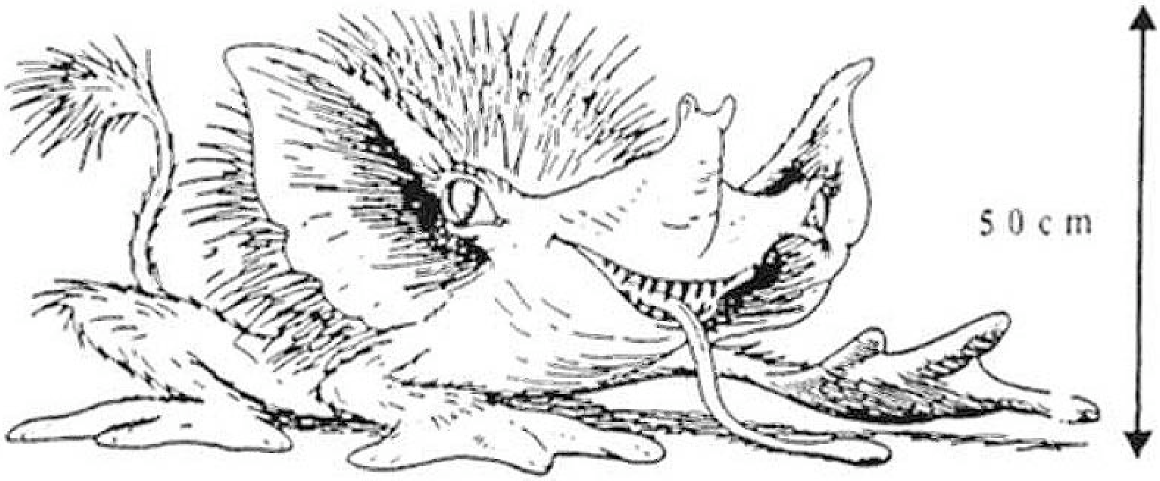
Slide Presentation

Write your replies in your science notebook, not on this sheet!

1. What parts of the world did I visit on these slides?
2. What type of ecosystem is represented by the Okovango Delta? How did this delta contrast with the surrounding areas? What kind of animals would be attracted to this ecosystem?
3. Describe how one living organism is adapted to live in the Okovango Delta.
4. Describe three other ecosystems that I visited. Of all the places visited, which one appealed to you most.
5. Why do you think it is rare to find a dark giraffe like the one in the slide?
6. Why do you think zebra and wildebeest always hang out together?
7. Can you suggest a food chain based on some living organisms that you saw? Now construct a food web using the food chain that you have just drawn!
8. The Masai people live inside many of the national parks in southern Kenya and northern Tanzania. Why is this and how do you think it is possible for them to live there without decreasing the diversity of life in the parks?
9. What is biodiversity? What role if any has the camera in promoting biodiversity?
10. What part of the world would you like to travel to in search of wildlife (not wild life!)?

Creature Feature

Where did this peculiar feature live?



8 Science

Creature Feature Task

Criteria	Elements	Points possible	Earned Assessment Self	Earned Assessment Teacher
C Knowledge and Concepts	A clear opinion has been stated as to the natural habitat of the creature.	5		
	At least 5 pieces of evidence are stated to substantiate the opinion.	15		
	The relevance and importance of each piece of evidence is explained	20		
	An explanation is made as to how all the pieces of evidence "add up" to supporting the identification of the probable natural "home" of the creature.	10		
	Relevant personal experiences and previous learning is brought in to provide support.	10		
	Total for criterion E	***60***		
B Communication	Clear, large, and labeled drawings are used to help present the evidence.	10		
	Use of a range of scientific words, which are explained.	15		
	Accurate and appropriate presentation of a wide range of detailed and complex information.	15		
	The work is organized and clear.	10		
	There is a reference section included, which is complete and accurately written.	10		
	Total for criterion B	***60***		

The grade for each assessment criteria, according to the general science criteria, ranges from 0 to 6. These will be found by dividing the total by 10 and then removing the decimal values. For example a total of 34 out of 60 = 34/10 = 3.4 = a grade 3. However for marks of 55 and over a grade 6 will be rewarded.

	6☐	5☐	4-3☐	2-1☐	0☐
Purpose of study	Basic and more complex aims clearly stated. Importance and explanation of random sampling in producing data is fully explained.	Basic and some complex aims clearly stated. Importance and explanation of random sampling in producing data is explained to a large extent.	Basic and at least one complex aim stated, though rather unclearly. The importance of random sampling in producing data is explained to some extent.	Basic aims stated vaguely and unclearly. There is little or no evidence of the importance of random sampling in producing data.	Basic aims not stated, and no understanding demonstrated of what is meant by random sampling.
Description of ecosystem	Features and characteristics of ecosystem explained and discussed in accurate detail. Includes mention of soil, flora, fauna, climate, degree of wilderness, time of year. Also compared to similar ecosystems.	Features and characteristics of ecosystem explained and discussed in considerate detail. Includes mention of most of the following: soil, flora, fauna, climate, degree of wilderness, time of year.	Features and characteristics of ecosystem explained in basic details, although may lack mention of soil, flora, fauna, climate, degree of wilderness, time of year.	Some basic features and characteristics of ecosystem explained.	Little or no knowledge demonstrated of ecosystem.
Map of habitat	Very clear and fully labeled. Includes dimensions, outstanding features (e.g. hills, trees, water, paths, rocks, etc).	Clear and fully labeled with dimensions and most of the outstanding features (e.g. hills, trees, water, paths, rocks, etc).	Reasonably clear and labeled with dimensions and some of the outstanding features (e.g. hills, trees, water, paths, rocks, etc).	Unclear and not labeled, or only a few features labeled.	No map, or so unclear that it does not provide any information relevant to its features.
Descriptions and aims of methods used	Full and detailed description of plant and animal sampling techniques. The advantages of each are described, as well as an analysis of how they complement each other.	Full and detailed description of plant and animal sampling techniques. The advantages of each are described to some extent, as well as how they might complement each other.	Basic, and at times detailed, description of plant and animal sampling techniques. The advantages of each are described but incorrectly or in a misleading way. Some attempt at how they complement each other.	Very basis or misleading description of plant and animal sampling techniques. The advantages of each are not described accurately, and neither is there an attempt to describe how they complement each other.	Incorrect or no description of plant and animal sampling techniques. The advantages of each are not described, nor how they complement each other.
Description of plants	Names (where possible), detailed descriptions and accurately labeled drawings of all plants shown.	Names (where possible), some basic descriptions and drawings of all plants shown.	Names (where possible), some very basic descriptions and quite clear drawings of all plants shown.	Names (where possible), few descriptions and unclear drawings of some or all plants shown.	No names, nor basic descriptions/drawings of any plants shown.
Description and behaviour of animals	Names (where possible), some basic descriptions and drawings of all animals shown. Behaviour of animals discussed.	Names (where possible), some basic descriptions and drawings of animals shown. Behaviour of animals discussed in basic detail.	Names (where possible), some very basic descriptions and quite clear drawings of all animals shown. Some mention of behaviour.	Names (where possible), few descriptions and unclear drawings of some or all animals shown	No names, nor basic descriptions/drawings of any animals shown
Relationship of organisms in ecosystem.	Fully and accurately discussed.	Discussed in some detail and on the whole is accurate.	Some detail and some cases of correct information.	Lack of detail and frequent misleading information given.	No details or information presented.

8 Science Ecology	**Extra guidelines to the Ecology report (criterion C)**	**Éanna OBoyle**

These comments and questions aim to clarify the rubric. Not all the questions have to be answered – you might have others!

Purpose of study: Why did we go outside to study ecology instead of learning from a book? Why did we not just go outside and simply look around to see what was in our habitat? What was the reason for using different techniques of collecting data? Why didn't we use just one method of collecting data and information? How useful is the data discovered for other people or for the school? What did you learn from it? Did it help you understand science better? In what way was the study scientific? Was making the pooter, line transect, and other materials of use? Why or why not? What is meant by random sampling in trying to describe the whole ecosystem? Why did we not get data or sample from all parts of the ecosystem?
Description of ecosystem: What is the biome in this part of the world? What type of ecosystem did we study in this biome…. forest, desert, grassland, seashore, marshland, freshwater, …? Was it a typical forest, desert, grassland, seashore,… ecosystem? How was it special? What do you know about the soil, flora, fauna, climate, degree of wilderness, time of year, …. of our ecosystem? How might the ecosystem change throughout the year?
Map of habitat: You need to include a map of the area studied by the class. Don't include where you collected quadrat readings. However you could include where you used your line transect or where you put the pitfall trap. You need to draw a clearly drawn diagram (hand drawn or by computer). You need to fully label the diagram by including all important features and characteristics (e.g dimensions, hills, trees, water, paths, rocks, etc).
Descriptions and aims of methods used: Here you need to describe each technique or method that you used (e.g. the quadrat, the line transect, the pooter, the pitfall trap, the sheet, the net if you used one, etc. Draw diagrams for each method. What was the reason for using each method and what type of information was found from each method (don't include the result here…that comes later!)? What were the advantages and disadvantages of each method? It is very important here to discuss how all the different methods help to give a full description of the ecosystem!
Description of plants: Give drawings or photographs of each plant discovered (you can use my camera!). I now have a guidebook to the plants.
Description and behaviour of animals: Animals should be described as arthropods (e.g insects or beetles or flies or wasps or butterfly, etc), amphibians (e.g. frog), birds (e.g. seagull), etc… Again give drawings or pictures of animals discovered. Describe where the animals were discovered and what they were doing when you discovered them. How are the animals discovered using the pitfall trap different to those found using the sheet or net or other methods of collecting animals?
Relationship of organisms within ecosystem: Can you suggest a food chain? Or a food web? Or a pyramid of numbers? Can you explain what food chains, food webs, or a pyramid of numbers mean? What were the producers? The consumers? Can you identify any primary or secondary consumers in the ecosystem studied? Are there decomposers or scavengers in the ecosystem? How are all the living organisms connected to produce an ecosystem that exists because of the interdependence of animals and plants and the non-living components?

8 Science Ecology

Criterion E: Processing Data

Éanna OBoyle

	6	5	4-3	2-1	0
Presentation of group data	Full data presented with appropriate tables & charts. Tables and charts correctly labeled and clear. There is wide variation in the presentation of data and the charts provide extra insight.	Full data presented, with tables and appropriate charts. Tables and charts correctly labeled and clear. There is variation in the presentation of data.	Full data presented, with tables and charts. However table or chart presentation may be inappropriate or (e.g. line graph instead of pie-chart).	Some data presented. Tables presented but charts inappropriate or incorrect. Presentation incomplete (for example, axes of charts not labeled or without units). Unclearly presented.	Irrelevant, incorrect, or no data presented, and no analysis.
Analysis of class data	Full data presented, and critically analyzed using relevant scientific knowledge and understanding.	Full data presented and analyzed using, on the whole, relevant scientific knowledge and understanding.	Full data presented and analyzed to a small extent using some relevant scientific knowledge and understanding.	Some data presented and analyzed using, on the whole, irrelevant scientific knowledge and lack of understanding.	Little or no data presented, and no analysis.
Summary of findings	Trends detected and deeply discussed. Connections are made between different types of data.	Most or all trends and findings noted and described in detail.	Most trends and findings discussed and analysed to some extent	Some trends and findings mentioned and discussed to a minor extent.	No trends or findings discussed of scientific interest.
Suggestions for sensible improvements.	Detailed and relevant suggestions. They are pracrical and realistic.	Detailed and in general relevant suggestions.	Quite detailed and in some cases relevant suggestions.	Vague or unclear suggestions. Obvious suggestions made.	No suggestions or none of scientific interest.
Reliability of results	Discussed critically and in depth.	For the most part, discussed in detail and in depth.	Discussed to some extent but lacking in detail.	Unclear or limited discussion	Very unclear or no discussion.