

Striking a Balance

SUMMARY INFORMATION

Keywords

Food chain, Food web, waste disposal, ecological balance, rodents

Topics Covered

Biology

Target Grade(s)

6, 7

Estimated Time Required

3 hours

LESSON

Goals and Pre Requisites

Goals

- To derive from students ways to restore ecological balance.

Pre Requisites

Knowledge on the concepts of Food Chain and Food Web.

Instructional Objectives

Students would be able to develop

- An understanding of sustainable ecology
- Analytical thinking
- Reasoning capabilities

Instructional Resources

Problem Statement

We observe a drastic increase in the population of rodents – rats and mice; in areas of domestic living. What are the possible methods to contain the increasing rodent population without disrupting the natural food chain?

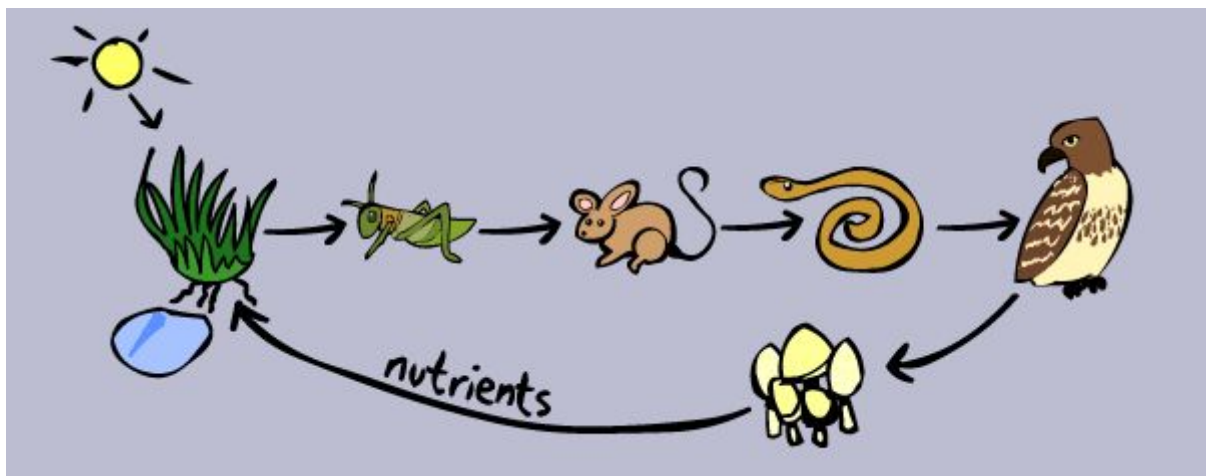
Background

What is Ecological Balance?

Ecological balance is a condition of a dynamic balance within an ecosystem in which the species, genetics and the ecosystem diversity remain in a stable state irrespective of the gradual variations through natural succession. It describes how ecosystems are organised in a state of stability where species coexist with other species and with their environment.

What is a Food Chain and a Food Web?

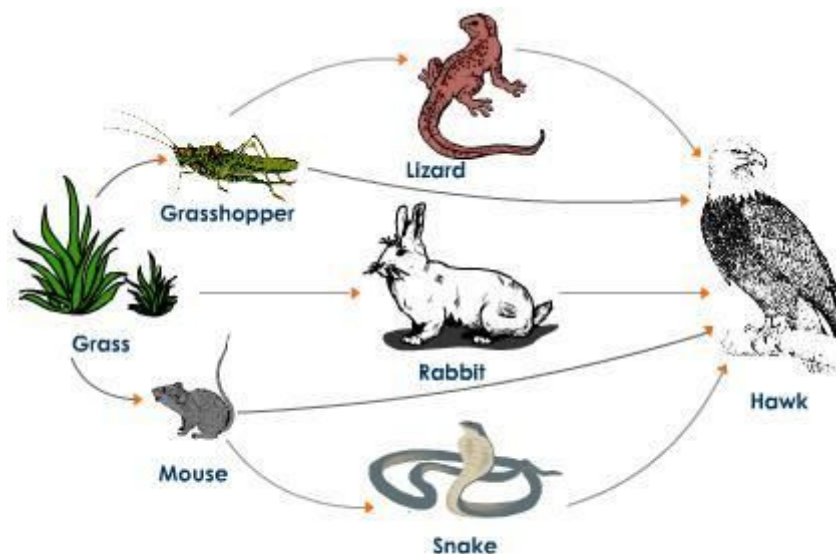
A **food chain** is a linear network of links in a food web starting from producer organisms (such as grass or trees which use radiation from the sun to make their food) and ending at apex predator species (like grizzly bears or killer whales), detritivores (like earthworms or woodlice), or decomposer species (such as fungi or bacteria). A food chain also shows how the organisms are related with each other by the food they eat. Each level of a food chain represents a different trophic level. A food chain differs from a food web, because the complex network of different animals' feeding relations are aggregated and the chain only follows a direct, linear pathway of one animal at a time. A common metric used to quantify food web trophic structure is food chain length.



A **food web** (or **food cycle**) is the natural interconnection of food chains and generally a graphical representation of what-eats-what in an ecological community. Another name for **food web** is a consumer-resource system. Ecologists can broadly lump all life forms into one of two categories called trophic levels: 1) the autotrophs, and 2) the heterotrophs. To maintain their bodies, grow, develop, and to reproduce, autotrophs produce organic matter from inorganic substances, including both minerals and gases such as carbon dioxide. These chemical reactions require energy, which mainly comes from the sun and largely by photosynthesis, although a very small amount comes from hydrothermal

vents and hot springs. A gradient exists between trophic levels running from complete autotrophs that obtain their sole source of carbon from the atmosphere, to mixotrophs (such as carnivorous plants) that are autotrophic organisms that partially obtain organic matter from sources other than the atmosphere, and complete heterotrophs that must feed to obtain organic matter.

The food web is a simplified illustration of the various methods of feeding that links an ecosystem into a unified system of exchange. There are different kinds of feeding relations that can be roughly divided into herbivory, carnivory, scavenging and parasitism. Some of the organic matter eaten by heterotrophs, such as sugars, provides energy. Autotrophs and heterotrophs come in all sizes, from microscopic to many tonnes - from cyanobacteria to giant redwoods, and from viruses and bdellovibrio to blue whales.



Procedure

1. Introduce the **Problem Statement** to students.
2. Form students into groups of four.
3. Allow them to brainstorm with their groups, on the given **Problem Statement**.
4. Each group must come up with their unique solution(s) to the given problem.
5. Each group can compare their solutions with fellow groups and with their teacher to check on the feasibility of their solution.
 - In order to check on feasibility, instruct students to discuss with their team mates and have a rough sketch of their plan before

constructing it. Students must be able to provide justification for their choice of materials.

6. Ask students to build a timeline (within the estimated amount of time provided under summary information) and ensure that all members of each group are involved in planning the project in terms of availability and cost of materials (if any).
7. Student groups are required to substantiate their solutions through analysis, case studies, research and statistics.
8. Students must make sure that the design incorporated in their process would address the existing problem.
9. Each group can present their solution and evaluate feasibility with peer groups and the teacher.

Sample Methodology

Note: The following is an example of how the given **Problem Statement** might be addressed. **For Teacher Reference only.**

Materials Required

Food waste, Plastic waste, wood and paper waste.

Procedure

1. Students may segregate waste under the categories of Food, plastic, Wood and paper.
2. They may now develop methods to recycle each of these categories of waste e.g. using food waste as a form of organic manure, recycling plastic waste to develop artificial jewellery and recycling of paper waste to develop papers for diaries, pocket journals etc.
3. They should justify on how their means of recycling a particular type of waste would contain the increasing rodent population.

Extension

- Use the same concept to species belonging to higher order food webs.
- Case study on Waste Disposal Schemes in foreign countries. Observe points of similarities that may be used in our country.

<https://sweden.se/nature/the-swedish-recycling-revolution/>

<http://www.howtogermany.com/pages/recycling.html>

- Composting as a means of recycling waste food materials -

Step 1: Choose a spot with soil that has good ventilation. Dig a 3ft x 3ft (1ft= 12 inches) deep pit that can be filled with your pile, for composting.

Step 2: Your pile would require 2 mandates: **Green Materials** (food scraps, Vegetable scraps, Egg shells, Coffee grounds, Grass and Plant clippings) and **Brown Materials** (Dry leaves, finely chopped wood and bark chips, shredded newspaper, straw, sawdust from untreated wood). Alternate your pit with 4-8 inch deep layers of green and brown materials. Green materials are Nitrogen rich whereas Brown materials are Carbon rich.

Step 3: Sprinkle water over the pile regularly so that it has consistency of a damp sponge. Do not add too much water otherwise the microorganisms in your pit will become waterlogged and drown. If this happens, your pile will rot instead of compost.

Step 4: Check to see if your pile is decomposing by monitoring temperature. Check the temperature of the pile with a thermometer or by simply placing your hand in the middle of the pile. The ideal temperature must be 55-65 degree Celsius.

Step 5: During the growing season, you should provide the pile with oxygen by turning it once a week with a garden fork. The best time to turn the compost is when the centre of the pile feels warm. Stirring helps the pile cook faster and prevents material from becoming matted down and developing a bad odour.

Step 6: When the compost no longer gives off heat and becomes dry, brown and crumbly, it's fully cooked and ready to feed to the garden!

Assessment and Rubric

Define the need or problem – Did students identify the need to resolve this problem? Were they able to relate the problem to their own environment?

Come up with ideas - Did students weigh various possibilities before arriving at a solution? Did each group collaborate effectively to (1) work within the time given (2) give equal opportunity for participation (3) consolidate relevant information (4) provide rationale for their decisions and choices.

Select the most promising idea or design - Were students able to evaluate the feasibility of their solution to the given problem statement? On what basis was the feasibility of the solution determined?

Communicate and plan the project – Were groups able to provide justification for their choice of materials? Were students able to see completion of the activity within the estimated time?

Create/Build and test a design –Were all members of the team participative during the course of the activity?

Evaluate and revise the design – Were student groups able to present their solutions in a clear and distinct manner with other groups? Were they keen on improving their model further?

Credits

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