



PRINCIPLE 4: NATURE RECYCLES EVERYTHING

There is no waste in nature



Erasmus+



AGE RANGE

12–16



DURATION

Preparation:

about 20 min.

Activity:

about 45 min. / 1 lesson

SUMMARY

What can we learn from the way nature recycles? In natural systems like a forest, there is no waste. Everything, when it has come to the end of its life, becomes raw materials for something else. In the activities below students will observe how nature deals with waste.

BIOMIMICRY PRINCIPLES



4 – Nature recycles everything

LEARNING OBJECTIVES

- Students understand the importance of recycling.
- Students understand that 'waste' is valuable raw material in nature.
- Students understand the function of different cycles in nature.

LEARNING OUTCOMES

- Students observe how fallen leaves become soil.
- Students explore what we can compost and what we cannot.
- Students discuss cycles in nature.

BIOLEARN COMPETENCES

- Students are able to abstract principles of sustainability from the way the natural world functions.
- Students are able to assess the consequences of applying biomimicry solutions (values).
- Students are able to work in groups.
- Students are more motivated in learning STEAM and experience that knowledge of STEAM can be widely used.



SUBJECT(S)

- Science – *Biology, Chemistry, Physics*



KEYWORDS

Biomimicry principles;
recycling; waste;
compost; decomposing

SUMMARY OF THE ACTIVITIES

	Activity Name	Short description	Method	Duration	Location
1	Introduction	Presenting the principle 9_principles.ppt	<ul style="list-style-type: none"> Teacher presentation Discussion 	10	Indoor
2	Soil ladder	Investigating the decomposition of leaves	<ul style="list-style-type: none"> Hands-on activity 	25	Outdoor (best in autumn)
3	Compost game (optional extension)	Sorting compostable and non-compostable waste	<ul style="list-style-type: none"> Game 	25	Indoor
4	Review	Discussion after the activity/ies	<ul style="list-style-type: none"> Discussion 	10	Indoor/outdoor

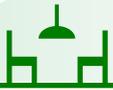
Note: You can choose either Activity 2 or 3, or both if you have time.

BACKGROUND FOR TEACHERS

See at Activity 1: Introduction.

For interconnections see *Nine Principles of Biomimicry* module.

ACTIVITY DETAILS



LOCATION
Indoor

1 | INTRODUCTION

» QUESTION



TOOLS AND MATERIALS

- projector, PC
- [9_principles.ppt](#); 5th slide

Present the slide about Principle 4: [9_principles.ppt](#), slide 5.

There is no 'away' to throw things. Everything produced in nature is biodegradable, there is no waste. There can still be abundance, look at all the blossom on a cherry tree, but that all serves a purpose and will be food and nutrients for others. Once the natural life of a pinecone has come and gone, it breaks down into essential elements that are repurposed into new life.



PREPARATIONS

Arrange classroom for presentation and discussion.

Explanation to [9_principles.ppt](#), 5th slide:

The combination of plants, herbivores, predators and decomposers maintain a cycle of natural materials. In this system plants get their energy from the sun, which then becomes food for other organisms in the food chain. All minerals are recycled and are returned to the soil by decomposers. A dynamic balance is maintained. Humans do things differently; raw materials are mined and manufactured into products for consumption. During and at the end of this process, natural resources are transformed into new materials which do not easily biodegrade. These waste materials create pollution and damage the balance of natural systems.

When we hear of decomposers, mushrooms often come to our mind. However, many more groups of living organisms are involved. For example, large vertebrates such as crows and vultures, insects such as beetles, and many bacteria living in soil are members of this group.

The soil (= storage layer) in a rainforest is thin because the process of digestion and the recycling of mineralized biomass is very fast. Deforestation, therefore, quickly results in the destruction of the soil layer which is difficult to regenerate.



RESOURCES

Benyus, J. M. (2002):
Biomimicry – Innovation inspired by nature. HarperCollins
Publisher, New York, U.S.A.

ACTIVITY DETAILS



LOCATION
Outdoor

2 | SOIL LADDER

» DISCOVER 



TOOLS AND MATERIALS

- small spades for each group
- simple identification key for animals living in soil



PREPARATIONS

Outdoor activity: an area with trees and with decaying leaves.

Nature does not bulk mine the Earth's crust for materials to make things. It uses the materials of dead organisms as the raw material for new life. In this activity students investigate the process of decomposition of vegetation to soil. This activity works well in a woodland where the decomposition of leaves into soil is usually very clear (option a). Alternatively, by digging into soil a soil profile will demonstrate the same results (option b).

Divide the students into groups of 4-5. Ask each group create a 'ladder' on the ground from sticks as below, with each square 40-50 cm wide.



Option a: After marking the squares, follow the instructions below.

1. Leave untouched.
2. Remove whole, not decaying, leaves, needles, sticks, herbaceous plants.
3. See 2 and also remove decaying leaves needles, which can be still identified.
4. See 3 and also remove humus (dark layer with organic materials in it) down to mineral soil level (no organic ingredients).

Option b: Using a small spade, students take samples from each square at different depths as follows:

1. Collect a sample of vegetation from the surface.
2. Take a sample of soil/decaying vegetation from 5 cm depth.
3. Take a sample of soil from 10 cm depth.
4. Take a sample of soil from 15 cm depth.

Ask each group to observe the steps of humus formation. Investigate the animals living in the different levels (it is good if you have a simple identification key) and the different size of soil particles.

Before carrying out the activity, ensure you are in a place where no rare or protected species can be found. After completing the activity, ensure all soil and vegetation is replaced as you found it.

ACTIVITY DETAILS



LOCATION
Indoor

3| COMPOST GAME (OPTIONAL EXTENSION)

» DISCOVER 



TOOLS AND MATERIALS

- Student worksheet: [W3.1](#)
- Teacher's page: [T3.1](#)

Garden composting is common way humans use natural processes to recycle waste. To build your own find instructions here: https://www.youtube.com/watch?v=fW_DVNUt7ms.



PREPARATIONS

- Arrange classroom for group work.
- Cut [W3.1](#) into cards with one set per group.

To compost successfully, we need to select the best ingredients. Provide a set of cards from [W3.1](#) for each group of students. Ask them to decide what can and cannot go into the compost bin. See [T3.1](#) for answers.



LOCATION
Indoor / Outdoor

4| REVIEW

» QUESTION 



PREPARATIONS

- Arrange classroom for a discussion.

After the activity/ies talk with students about the principle:

- This principle is one of the most important things we can learn from nature. In what ways can we mimic nature's example?
- What existing examples are there?
- What other cycles are there in nature?

LITERATURE, ADDITIONAL INFORMATION

https://www.youtube.com/watch?v=fW_DVNUt7ms

T3.1 COMPOST GAME

Solution

WE CAN COMPOST:

Used tissue; potato peel; rotten vegetables and fruits; thin bones, fishbones; cut grass; mouldy bread; wood ash (not too much); fallen leaves; twigs; apple-core; used table napkin

WE SHOULDN'T PUT TO COMPOST:

Plastic bag; used oil; soup leftovers; orange peel; rotten fruits; cigarette stub; meat; weeds; cooked potatoes; coloured magazines

W3.1 – COMPOST GAME

Cards

 Plastic bag	 Used oil	 Used tissue
Potato peel	Soup leftovers	Rotten vegetables and fruits
Orange peel	Thin bones, fishbones	Rotten fruits
Cut grass	Mouldy bread	Wood ash
Fallen leaves	Cigarette stub	Meat
Twigs	Apple-core	Weeds
Cooked potatoes	Used table napkin	Coloured magazines