



PRINCIPLE 6: NATURE BANKS ON DIVERSITY

Variety is the spice of life



Erasmus+



AGE RANGE

12–16



DURATION

Preparation:
about 20 min.

Activity:
about 45 min. / 1 lesson



SUBJECT(S)

- Science – *Biology*
- Design, Engineering and Technology



KEYWORDS

Biomimicry principles;
diversity; cooperation;
monoculture

SUMMARY

Diversity is very important in nature, it helps create stable ecosystems. In this module students experience what happens when we do not have diversity. We suggest Principle 5 and 6 are delivered in order.

BIOMIMICRY PRINCIPLES



6 – Nature banks on diversity

LEARNING OBJECTIVES

- Students understand the importance of diversity in nature.
- Students understand why diversity is necessary in human societies.
- Students understand that monocultures are not sustainable without human inputs.

LEARNING OUTCOMES

- Students explore how natural habitats are influenced by human activities.
- Students make connections between organisms in a community.
- Students see how vulnerable a monoculture can be.

BIOLEARN COMPETENCES

- Students are able to abstract principles of sustainability from the way the natural world functions.
- Students are able to identify functional design in nature, develop greater awareness and appreciation for design excellence in nature, and appreciate how nature works as a system which is elegant and deeply interconnected.
- Students are able to work in groups.

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	Playing a black locust forest	Students become members of a black locust forest and search for interconnections	<ul style="list-style-type: none"> • Role play 	25	Indoor/ outdoor
3	Review	Discussion after the activity	<ul style="list-style-type: none"> • Discussion 	10	Indoor/ outdoor

BACKGROUND FOR TEACHERS

See at Activity 1: Introduction.

For interconnections see *Nine Principles of Biomimicry* module.

OUTLINE OF THE MODULE



LOCATION
Indoor

1 | INTRODUCTION

» QUESTION



TOOLS AND MATERIALS

- projector, PC
- [9_principles.ppt](#); 7th slide



PREPARATIONS

Arrange classroom for presentation and discussion.



RESOURCES

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

Present the slide about Principle 6: [9_principles.ppt](#), slide 7.

Diversity is one of nature's best insurance policies. When one food source is unavailable, others can be found. Plants use several different strategies to spread seed or defend against predators. We know that species with limited genetic diversity have more difficulty adapting to environmental change, and that ecosystems rich with diversity are more stable.

Explanation to [9_principles.ppt](#), 7th slide:

Biodiversity – the diversity of the plants and animals, which may include the whole of the Earth's wildlife (species, genetic richness, habitat diversity) or the ecosystem of a particular area (e.g. the Carpathian Basin).

A more diverse ecosystem is more resilient and less vulnerable. When the environment changes, individuals who are able to adapt to the changes will survive and multiply. The greater the diversity the greater the opportunity for adaptation. This process is also evident on a larger scale; habitats with high species diversity are more able to adapt to change.

The existence of biodiversity is important for ecosystem services (e.g. pollination, soil fertility, climate control) as our food, clean water and air could not exist without it. Therefore, protecting biodiversity is critical to our future.

Tropical rainforests – terrestrial ecosystems have the largest biodiversity. Two thirds of all the species on Earth are in rainforests. Unfortunately, the area of tropical rainforest is reducing rapidly. Trees are cut down mainly to create space for agricultural production, i.e. monocultures are created on the site of what was once a species rich area.

Coral reef – the largest biodiversity in the marine ecosystem. They are home to 25% of species living in marine habitats. Overfishing and pollution are the biggest threats to the marine ecosystem, and global warming can lead to the destruction of coral reefs. Corals live in symbiosis with single-celled algae which are sensitive to high water temperatures and pollution. Increasing carbon dioxide levels in the air increases the acidity of water, and causes the coral vase to dissolve.

ACTIVITY DETAILS

Monoculture – the less biodiversity in an ecological system the more vulnerable the system is, and the less flexibility it has in response to change. That is, the fewer species the system has (e.g. agricultural monocultures), the more likely it is that a small change will have a big impact (e.g. the appearance of a pest).

Oak forest and robinia forest – the diversity of the oak forest is higher than of a robinia forest. The former is home of more species.

Many people were appalled by the news when in November 2004 a major storm swept the pine forests in the High Tatra. One of the reasons is that since the 19th century spruce was planted (monoculture, which means one species in the same age), which is not a native species in the Tatra. The rapid breeding of death-watch beetle in the collapsed trees made matters worse. It was extended to the still standing trees increasing the rate of destruction.

ACTIVITY DETAILS



LOCATION
Indoor / Outdoor

2| PLAYING A BLACK LOCUST FOREST

» DISCOVER 



TOOLS AND MATERIALS

- ball of string
- student worksheet: [W2.1](#)
- clips (one per student)



PREPARATIONS

This activity can be implemented indoors or out, ensuring there is space for a circle of all students.

Cut [W2.1](#) into cards, with one per student.



RESOURCES

Sweenex, L. B.; Meadows, D., Mehers, G. M. (2011): *The System Thinking Playbook for Climate Change*. Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH, Eschborn, Germany p. 136–142.

This game is very similar to the one in principle 5, but instead uses the elements of a black locust forest.

Use the cards from [W2.1](#) (organisms in a black locust forest) or cards with organisms from any living community in your locality. Note that unlike the oak forest used in principle 5, the black locust forest has less diversity. Students can draw pictures of their organism to become more familiar with them.

Give one card to each student, asking them to clip it onto their clothing. Form students into a circle. They will form the living community of an oak forest and the inorganic surroundings. The first student (the Sun) holds the string and searches for someone who he/she is connected e.g. one of the plants. The student (Sun) keeps the end of the string in one hand and gives the ball to the 'plant'. The next student (plant) does the same: looks for someone with a connection, holds the string and give the ball to the next connection. Continue until everybody holds the string and in connected.

Talk about the role of this web of connections and each element within it. What will happen if we withdraw one or two organisms? Are some elements more important than others? How many elements can be removed without losing the sustainability the forest? There are fewer organisms in a black locust forest, so that if one organism is lost the impact on the system is far greater.

The same result will apply to any ecosystem which has low biodiversity such as a cornfield or apple orchard.

Discuss the differences between activities in principle 5 and 6.



LOCATION
Indoor / Outdoor

3| REVIEW

» DISCOVER 



PREPARATIONS

Arrange classroom for a discussion

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

- Think about the role of diversity in resilience of organisms and ecosystems.
- Where could we easily use this knowledge? (Permaculture could be considered as a good example.)

W2.1 – PLAYING A BLACK LOCUST FOREST

Cards

 Sun	 Water	 Soil	 Air
Black locust	Black locust	Black locust	Black locust
Squirrel	Fox	Wild boar	Roe-deer
Deer	Decaying wood	Great spotted woodpecker	Woodworm
Black elder	Black elder	Black elder	Chervil
Chervil	Chervil	Celandine	Celandine