



*THE MEANING OF DEADWOOD IN
MAINTAINING BIODIVERSITY*

Introduction

Hi! We are a group of friends from Batory High School in Warsaw, Poland. We are currently in the 1st grade of IB Diploma Programme.

We decided to go for a walk to Mazowiecki Park Krajobrazowy. While we were there, we discussed the issue of deadwood and its implications. After each of us shared the knowledge about the topic, we came to conclusion that there's so much more to appreciate than we thought.





Tymek: Mind you, different species of invertebrates require various kinds of deadwood to flourish. Some of them need coarse woody debris (CWD) which are the trunks of dead trees and the remains of large branches on the ground. Some species live in the decayed parts of live trees e.g. under the bark. The appearance of diverse and endangered saproxylic species of invertebrates is the distinctive feature of primeval forests such as Białowieża Forest. Let's take a closer look at some of the fascinating creepy-crawlies that tunnel through the deadwood.

First of all, *Cucujus cinnaberinus*, a species of a saproxylic beetle. Look at his scarlet elytron! Its oblate shape is an adaptation to the habitat – this 2,5 cm long beetle lives under the bark of old trees such as oaks, poplars and maples. Obviously, it feeds on decomposing wood. However, it doesn't sniff at maggots and larvae of other beetles. In Poland *Cucujus cinnaberinus* is a rare species and its population decreases.





Tymek: Another species of saproxylic beetle is *Buprestis splendens*. It is more picky than his previously mentioned cousin – its appearance is dependent on large conifers and their deadwood. However, *Buprestis splendens* doesn't require coarse woody debris (CWD) in its life cycle. The eggs are laid in the deadwood of crowns. The process of logging of old and weakened trees has a detrimental effect on the population of this beetle and that's why it is critically endangered.

But not only insects thrive in deadwood. It is a habitat of diverse species of millipedes feeding on the decaying organic matter. Look at the...

Zosia: ...yes, but what do we need those invertebrates for? It is obvious that deadwood is their habitat but do they play a greater role in ecosystems?

Tymek: Of course! Millipedes feed on decaying organic matter, so e.g. they play a crucial role in the production of humus. They disintegrate fallen leaves and coarse woody debris...



Zosia: Oh yes, now I understand! They play similar role as fungi...





Zosia: So, milipedes plays central role in the production of humus, just like fungi!

Many types of fungi live in synbiosis with roots of living trees (it can be also named as mycorrhiza); others are simply saprotrophic organisms, which degrade the organic material (mostly wood pulp). That's the way they distribute the nutrients to the plant.

Matylda: Wait, I also know that fungi replace their deficit of nitrogen with symbiosis with microorganisms!

Zosia: Exactly! Now, let's talk about the species of fungi, which colonise the deadwood on different stages of decay. One of the species is the parasitical fungi. They live on trees and and bushes that are still functioning well. For instance, tinder fungus (also known as homes fomentarius), is one of the most popular example of those fungi. They are widely spread in most of forests in Poland.



Matylda: Yes, I have seen them various times while travelling with my parents and siblings!



Zosia: Okay, let's move on. The next group of species of fungi are saprobionts.

Saprobionts such as ascomycota, use very simple organic compounds in still living tissues of the wood. Some of them resolve cellulose and lignin, for example Aphyllophorales (an obsolete order of fungi) .

The last type of fungi we are able to see while discovering the forest is the ones which develop in soil, such as a well-known eyelash cup (*Scutellinia scutellata*). There's so many other interesting organisms

A:Yes, I know, I'm very fond of lichen. There are various types of them, but my personal favourite is *Icmadophila ericetorum*, Lichen plays a very important role since they're bioindicators of how clean from pollution the atmosphere is and the continuity of natural processes.





Matylda: Do you know that every forest ecosystem has its own closed circulation of matter? It is a process of permanent circulation of chemical elements including biogens such as carbon, nitrogen, sulphur, oxygen and phosphorus among live forms and their habitats. These elements, incepted in the form of simple compounds from the soil, are transformed by autotrophic producers into organic compounds and later build into the structure of their own organisms or else used to obtain energy from them. Another levels of consumers use obtained from different organisms compounds for the same aims. Subsequently, the organic matter of necrosing organisms returns to the environment after being degraded by decomposers into dissolving in water mineral

Zosia: So, in order to function properly, the forest ecosystem requires its own circulation of matter, where chemical elements incessantly circulate between live forms and their abiotic



Matylda: Yes, and the circulation of every component in nature is called its biogeochemical cycle. You need to remember that particular elements of the ecosystem (**both abiotic and biotic**) are connected and they compose (the rule of unity of biotope and biocenosis). Matter is called in general the whole known substances. It builds up flora, fauna and the environment. Its amount never decreases or increases. It partakes of persistent circulation. Simple compounds like water, carbon dioxide or mineral salts are absorbed by producers during the process of photosynthesis. From these compounds some proteins, sugars and fats which build plants are generated. When the plant is eaten, the compounds are used by herbivores to build its organism. Some part of the matter is egested for instance in a form of simple inorganic compounds like water and carbon dioxide during a process of breathing. Predators eat herbivores and the matter is found in their body systems. After the death of every organism, its body is eaten up by decomposers, which resolve it into simple compounds. These are later used by the producers and the circulation closes.





Tymek: So, particular steps of the circulation of matter include: mineralization, ammonification, nitrification, circulation of nitrogen and other processes. And this process plays vital role in forest nutrition, especially the poorest soils. Resources of the chemical elements would soon dry up, if it weren't for the permanent circulation in biological circulations occurring mostly thanks to bacteria and fungi for instance decomposers which have the ability to resolve complex carbohydrates like lignin and cellulose (basic lumbers of cell wall in plant cell).

Matylda: The most important biogeochemical circulations include circulations of: carbon, nitrogen, water, oxygen, phosphorus, sulphur. Carbon is accumulated in the forests in different parts of ecosystem in various leaves. Absorption of carbon occurs during photosynthesis. This is a process of nutrients production using carbon dioxide, water and solar power. These nutrients are later used to build plant's body.





Tymek: Simultaneously, with circulation of matter energy flow occurs in the ecosystems. The amount of the matter in the circulation is constant and after various transformations it still remains in the ecosystem. On the other hand the energy must be provided from the outside and gradually it dissolves. Most of that energy comes from the Sun. Plants use power energy and warehouse it in chemical compounds. Major part of that energy is used to build their bodies, produce flowers, fruits and seeds. That's why only some part of the energy reaches consumers of the first level. Herbivores again use major part of received energy contained in food for its life activities (movement, body heating, getting food, breathing, reproduction etc.). Only part of it is warehoused and reaches predators. When a dead matter is eventually resolved by decomposers, the rest of energy contained in the chemical compounds is released. Once the energy is used, it cannot be reused. That's why we say that in nature a circulation of matter and energy flow occur. The most basic source of energy for all the processes of life on Earth. is Sun.

Matylda: So, apart from circulation of matter, very important factor for proper functioning of the forest ecosystem is energy flow, because matter persistently circulates between biotope and biocenosis, on the other hand the energy flows through another steps of trophic chain only in one direction. That's why it constantly needs to be provided. And how you see, the most important source of energy in ecosystems (even in forest ecosystem) in solar energy!





Zosia: But on the other hand, I cannot imagine that deadwood may be beneficial for big animals like vertebrates. They may feed on some species of saproxylic invertebrates but are there any other benefits?



Tymek: There are a lot of instances in which deadwood is beneficial for vertebrates. As you said, we can find many animals that feed on saproxylic invertebrates: from amphibians, reptiles or small, insectivorous mammals such as shrews to birds. But not only does deadwood provide animals with food but it is also their habitat. To exemplify: the trunks of dead trees and the remains of large branches are the habitat of the fire salamander (*Salamandra salamandra*), the common shrew (*Sorex araneus*), the bank vole (*Myodes glareolus*) or the yellow-necked mouse (*Apodemus flavicollis*). Some species of birds require dead trees to live. One example can be the three-toed woodpecker (*Picoides tridactylus*) which is very rare in Poland and not only feeds on the European spruce bark beetle (*Ips typographus*) but it creates its hollows in the spruce trees that are weakened by this insect. But there are also less apparent aspects: have you ever thought that downed trunks are a place where lizards and European pond turtle (*Emys orbicularis*) like to bask?



Matylida: And for instance they may help small animals to cross a stream. But don't you think that not only small animals can reap benefits from the presence of deadwood? Eurasian lynx (*Lynx lynx*), for example. This "tiger of our forests" needs downed trunks to hunt. As lynx hunt from an ambush, the presence of CWD allows the predators to hide from the sight of their prey.

Forest is the sophisticated structure that consists not only of alive trees but also of dead ones and their remains. We must not forget that the deletion of only one element from the whole structure disturbs the subtle balance of the ecosystem. The presence of coarse woody debris plays a crucial role in the proper functioning of matter and energy cycles. What is more, it is essential to the prevalence of various, often endangered organisms. Thanks to their trip, Matylda, Zosia and Tymek will never forget about their conclusions referring to the importance of deadwood.



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Citations

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