

Aktivität 3.9. Das Lebensnetz¹

Cultural Background

Es gibt viele verschiedene Ökosysteme in Deutschland von Tümpeln, über Bäche, Flüsse, bis hin zu Seen und Wäldern. Jedes Ökosystem ist anders beschaffen und es gibt die verschiedensten Faktoren zu berücksichtigen. Leider greift der Mensch zu oft in die verschiedenen Ökosysteme ein, indem er zum Beispiel landwirtschaftliches Düngemittel in die Seen und Flüsse einleitet. So beeinflusst der Mensch Ökosysteme negativ. Dieser negative Einfluss kann das Umkippen von ganzen Ökosystemen zur Folge haben. Eine solche Folge ist nur schwer bis gar nicht rückgängig zu machen. Aus diesem Grund ist es umso wichtiger, dass wir der jungen Generation verdeutlichen, was für eine bedeutende Rolle die verschiedenen Ökosysteme in unserem alltäglichen Leben spielen. Wir müssen verstehen lernen, dass alles miteinander in Verbindung steht. Wird ein Faktor verändert, verursacht dieser *Dominoreaktion*. Vor diesem Hintergrund müssen wir uns der Bedeutung von Umweltschutz bewusst werden.

In Waldsee

In *Waldsee* all participants live surrounded by nature in the Minnesota Northwoods. Different biotopes such as Turtle River Lake and the forest are within a short distance and can be experienced by everyone. Participants in the *Grüne Welle* can venture out and study biotopes up close.

Removable tiles bearing the German names of many plants and animals are set in the floor of the *Waldsee BioHaus* as a constant reminder of the interconnectedness of all things. Villagers work with these tiles to understand the relationships among members of food chain communities.

In the Classroom

Students often learn the names of basic plants and animals in their German classes. This activity goes beyond labeling by offering the possibility of learning the names of a wide variety of plants and animals and to understand interconnections among living creatures and ecosystems.

In this activity, students are assigned an element that is part of the ecosystem. Ecosystems can be a lake, a forest, a pond etc. They collect information on their specific stakeholder with a partner and then with the entire class. The goal is to figure out how stakeholders are connected with each other. A spool of yarn will help to visualize their connectedness.

¹ Adapted from:

https://www.cfa.harvard.edu/smg/Website/UCP/resources/ecosystems/eco_section_1_weboflife.html

Objectives

- **Communication**
 - Students will use German to practice names for plants, animals and other organisms and to describe relationships among these organisms.
- **Culture**
 - Students will learn and reflect on the importance of biotopes and how every stakeholder is connected with another.
- **Connections**
 - Students will understand the dependent relationships that exist among organisms in food chain communities
 - Students will understand the contribution each organism makes to the survival of the whole
 - Students will become more aware of the importance of conserving and protecting ecosystems
 - Students will identify areas in which they can personally help conserve the environment and how they can change their behavior to have a better interaction with nature
- **Communities**
 - Students will have the opportunity to work as a team
 - Students will recognize the importance of individual members of a group

Language Functions in Focus

- Comparing and contrasting
- Describing processes
- Expressing opinions
- Giving reasons and explaining causality
- Introducing oneself
- Suggesting
- Presenting information

Materials

- Paper or note card, pencils, markers, crayons
- A spool of yarn
- A quiet place indoors or outdoors for students to collect information, perform the exercise, and recap and discuss

Preparation

This activity involves partner work as well as class discussions. Do some library and Internet research to gather information on the various living and nonliving stakeholders (animals/plants/ water/sun etc.) that make up a biotope. Familiarize

yourself with several groups of consumer/producer relationships in the natural world and come to class with a list of the groupings and the “who eats whom” hierarchies inherent in each of the groups (see examples of clusters below). Be sure to include plants (producers).

Write the name of each organism on a note card for use later in class. You may want to use printed out images and chalkboard drawings as a help to show how the stakeholders of a biotope are connected with each other.

The preparation leads to an exercise (that involves yarn) where the interconnectedness of all stakeholders becomes apparent.

Generating Interest

Introduce your students to the concept of *Nahrungsketten* by either supplying them with pictures or images of animals and plants from your local area or by engaging your students in a brainstorming list of local fauna and flora. Divide the students into small groups and ask them to select 3-5 organisms from the list that can be grouped together in a food chain based on the feeding relationships that exist among the organisms. Have each group write their *Nahrungskette* on the board or a large piece of paper and then describe how the animals are connected in a chain based on their feeding relationship.

Introduce the terms: *Produzent, Verbraucher, Pflanzenfresser, Fleischfresser, Fressfeind, Beutetier.*

Ask your students:

- *Gibt es einen Produzenten in eurer Nahrungskette?*
- *Welche Organismen sind keine Produzenten?*
- *Was frisst dieses Tier?*
- *Wer ist sein Fressfeind?*
- *Welcher Organismus befindet sich am Ende deiner Nahrungskette?*
- *Was frisst die Meise?*

Presentation and Practice

Section 1

1. Define an Ecosystem

Ask, “What is an ecosystem?” -*Was ist ein Ökosystem?*- Collect ideas, brainstorm. Arrive at a class definition. It should entail the following aspects:

- An ecosystem can be thought of as a community consisting of different populations of living beings. The term population should refer to all the members of a species that live in a specific location.
- An ecosystem should include the physical environment.
- Organisms fill out the different roles in the system.

-Living beings in the ecosystem depend on other living beings in the ecosystem.

Fragen an die Schüler: Das Ökosystem: Wie sieht ein Ökosystem aus? Was gehört zu einem Ökosystem dazu? Welche Lebewesen gibt es in einem Ökosystem? Was ist die Aufgabe der Lebewesen? Wie ist alles im Ökosystem miteinander verbunden?

2. Consider the Physical Environment

Discuss the necessities of the physical environment for an ecosystem in small groups, then come together and list students' ideas on a chart that could include:

-Sunlight (*Sonnenlicht*)

-Water (*Wasser*)

-Soil (more specifically the nutrients in the soil) (*Erde*)

-Living beings in the ecosystem depend on other living things in the ecosystem. (*Lebewesen*)

Fragen an die Schüler: Warum ist das Umfeld für das Ökosystem wichtig?

3. Consider Roles in the Ecosystem

Explain: Each living thing in an ecosystem can be put into one of three categories: Producers, Consumers and Decomposers.

Ask: "Do you know what to produce means? Do you know what to consume means? What about to decompose?" → Explain the importance of each of those roles in the ecosystem and point out their interdependence.

Es gibt drei verschiedene Kategorien in die Lebewesen eines Ökosystems gehören: Produzenten, Konsumenten, Destruenten.

Fragen an die Schüler: Was bedeutet "produzieren"? Was bedeutet "konsumieren"? Welche wichtige Aufgabe haben die Lebewesen im Ökosystem? Warum ist diese Aufgabe wichtig? Wie stehen diese Lebewesen in Verbindung mit anderen Lebewesen aus derselben und aus anderen Kategorien?

Section 2

Gather your students in a circle. The leader is inside the circle with a ball of yarn. The leader starts by asking the students:

"Wer kann mir eine Pflanze nennen, die in unserer Umgebung (im Wald, auf der Wiese, oder im See) lebt?"

A student answers: *"Löwenzahn!"*

The leader responds: *“Toll! Hier Frau Löwenzahn, halten Sie bitte das Ende des Garns fest.”*

The student holds on to the end of the yarn and the leader unrolls the yarn as he moves away from *Frau Löwenzahn* and asks: *“Gibt es hier ein Tier, das den Löwenzahn gerne frisst?”*

Another student responds, *“Hasen lieben Löwenzahn!”*

Leader: *“Oh, was für ein ausgezeichnetes Abendessen für den Hasen.”* The leader tosses the yarn to the student and says: *“Herr Hase, halten Sie bitte das Garn fest. Durch ihre Abhängigkeit von der Blume und den zarten Blättern des Löwenzahns als Mittagessen sind sie mit dem Löwenzahn verbunden. Werfen Sie mir den Rest des Knäuels zurück. Und wer braucht jetzt den Hasen als Mittagessen?”*

Another student: *“Der Wolf frisst den Hasen zum Mittagessen.”*

Leader: *“Oh lecker, frischer Hasenbraten ist die Lieblings Speise des Wolfes.”* The wolf holds onto the yarn and the network of organisms becomes ever larger.

Continue to connect the other students with yarn as they choose to represent other organisms and components of life, and their relationships with the rest of the group emerge. Begin to weave in new elements and other considerations, such as other plants, animals, decomposers, soil, water, sun and so on until the entire circle of students is connected and strung together symbolizing the network and intricate relationships of the *Lebensnetz*.

Now that the complex connections existing among the different members of our ecosystem are easily visible through yarn crisscrossing the circle from member to member, we are ready to demonstrate how important each member of the whole community is to the well-being of the entire system. For that we create a realistic scenario, in which a member of the community is removed and the remaining members of the group then experience the ripple effects such a loss might have on the stability of the ecosystem.

Here is an example for such a scenario: The need for wood as heating fuel, paper products and building materials necessitates the logging of some trees in our ecosystem. As a tree falls, it tugs on the string it holds and everyone who can feel the effects of the tug by the falling tree are in some way impacted by the loss of their community member.

Now, each member of the web of life who felt the tug of the falling tree will now gently tug on the strings they hold upon which all members who can feel this tug say out loud: *“Ich kann es spüren!”* This continues until all members can feel the tug and say: *“Ich kann es auch spüren!”*

Another way to demonstrate the effect disturbance can have on a balanced *Lebensnetz* in which abiotic factors (*Wasser, Erde, Steine, Sonne, Klima*) and biotic

factors (*Pflanzen, Tiere, Mikroorganismen*) function together: just let go of the string as the tree is being cut. This will loosen the structure of the web and gradually weaken its stability. You may choose to remove another member (or several members) of the *Lebensnetz* (perhaps because of a fire that sweeps through the forest) that was already impacted by the death of the tree and now, in its weakened state, is killed by the fire. As the second member lets go of the string, the web further unravels. This can be continued until the *Lebensnetz* falls apart.

Fragen an die Schüler:

“Ist das realistisch?”

“Kann ein ganzes Ökosystem einfach auseinanderfallen?”

4. Introduce the Web of Life Game and Construct the Web

Explain: We are going to play a game that is going to show how each living being in an ecosystem relies on other living beings in order to survive (interdependence). Discover an open area. Assemble the students around that open area.

Wir spielen ein Spiel! Wir wollen zeigen, dass alle Lebewesen in einem Ökosystem von einander abhängig sind. Nur wenn sie einander helfen, können sie überleben. Wir gehen zusammen nach draußen.

Begin with the card with a picture of the sun on it. Hand it to a student and ask: “Which organisms rely directly on the sun for their food?” While students identify organisms (in this case, green plants), hand out the cards with green plants to another student. Instruct the student holding the sun card to hold one end of the yarn and the student holding the green plant card to hold the other end of the yarn.

Afterwards, move on to the green plants and ask: “Which organism relies directly on the green plant for its food?” Hint at the information on each card. Some students might not realize that only plants can make their food directly from the sun. The teacher may need to introduce that fact.

Im Spiel gibt es verschiedene Karten: Sonnen-Karte, Karte mit grünen Pflanzen.

Fragen an die Schüler: Welche Organismen benötigen die Sonne als Nahrungsquelle? Welche Organismen benötigen die grünen Pflanzen als Nahrung?

(Nur Pflanzen brauchen Sonnenlicht als Nahrungsquelle)

As organisms are identified, add them to the food web and continue to add the organisms that depend on them for food. The teacher should go through the cards in the following order: sun, green plants, insects, mice, earthworms, toads, snakes, owls, skunks and fungi. The questioning and constructing needs to be repeated, until all of the connections have been made.

Fragen an die Schüler: Können wir alle Lebewesen identifizieren? Wo stehen die einzelnen Lebewesen in diesem Nahrungsnetz? Wer ist von wem abhängig? Wer ernährt sich von wem?

5. Analyze the Connectedness of the Web

Draw students' attention to the complex web that has been created with the strings. Ask: "What could happen if the owls disappeared?" → Not much would happen. Fungi would have less dead matter.

Fragen an die Schüler: Was passiert, wenn die Eulen verschwinden? Nicht viel würde passieren. Pilze würden weniger abgestorbene Masse.

Ask: "What could happen if the mice disappeared?" Owls, snakes, skunks, earthworms and fungi would be directly affected. Other organisms would also be indirectly affected.

Fragen an die Schüler: Was würde passieren, wenn die Mäuse verschwinden? Eulen, Schlangen, Stinktiere, Regenwürmer und Pilze würden direkt betroffen sein. Andere Lebewesen nur indirekt betroffen sein.

Ask: "What might happen if the green plants disappeared?" Everything other than the sun would be affected.

Fragen an die Schüler: Was würde passieren, wenn alle grünen Pflanzen verschwinden? Alles außer der Sonne wäre betroffen.

Ask the student who has the green plants card to sit down and firmly pull on the strings that he or she is holding except for the one connected to the sun. Anyone who feels a pull, should then also sit down to show they have been affected. Those students should then pull on the strings they hold which should cause the other students who feel the pull to sit down and so on.

Jeder Schüler hält ein eine des Garns in der Hand. Wenn an deinem Stück Jahn gezogen wird, setzt dich hin. Der Schüler mit der grünen Pflanzen-Karte fängt an zu ziehen. Nur das Garn in der Hand des Schülers mit der Sonnen- Karte wird nie gezogen.

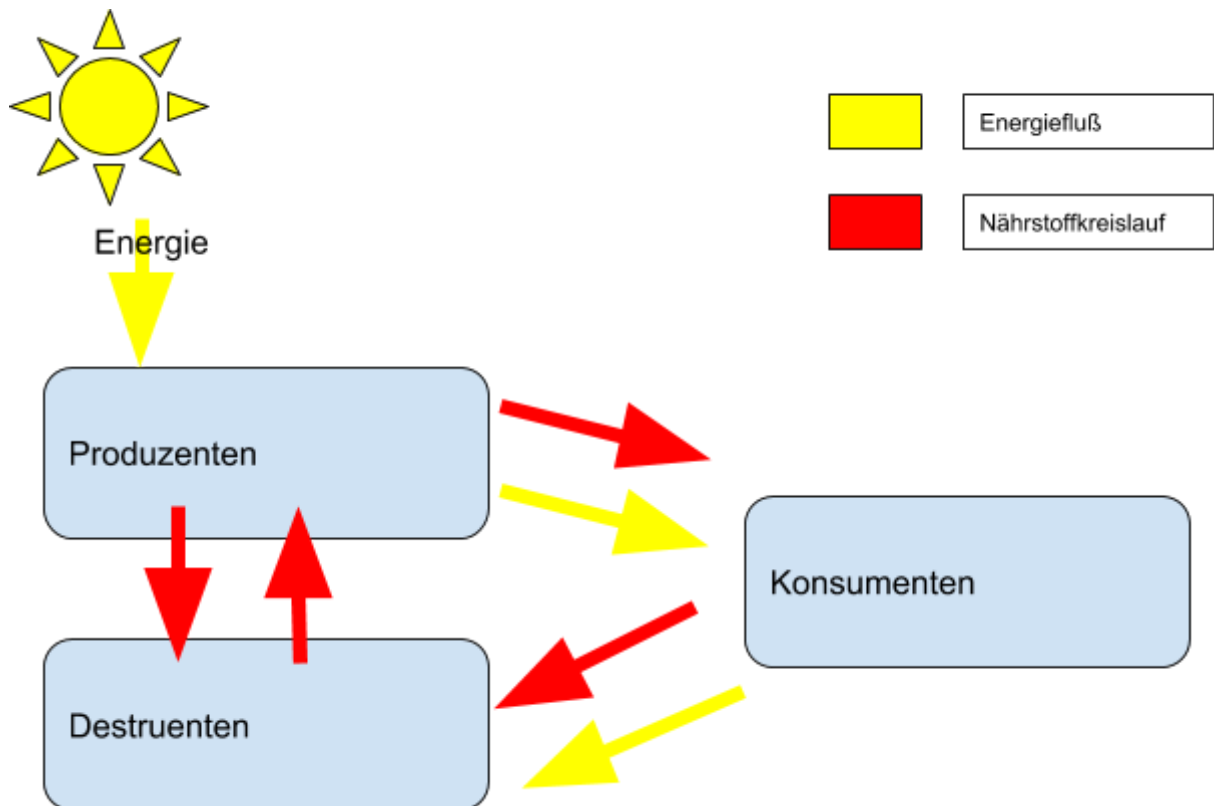
Ask the students: "What does this demonstration show?" If an organism's food source is affected, they will be affected. Sometimes animals might be able to turn to a different food source, but if green plants should disappear, everything would die. They are the link to the sun's energy.

Fragen an die Schüler: Was zeigt uns dies? Wenn die Nahrungsquelle eines Lebewesens betroffen ist, ist dieses Lebewesen auch betroffen. Manchmal können Tiere auf eine andere Nahrungsquelle ausweichen, aber wenn die Pflanzen sterben, alle würden sterben, weil sie mit der Sonnenenergie in Verbindung stehen.

Students should now be instructed to return to their seats.

6. Introduce the Forest Food Web Diagram

Hand out a Forest Food Web sheet and explain to the students, that it shows the relationships in an ecosystem, such as those illustrated in the game. Point out, that the arrows on the food web show how energy is being directed to something else. They do not just go from eater to eaten. Say, “You can remember the right direction of the arrow by having it go from an organism to the mouth of the being that eats it.”



Section 3

7. Contrast Simple Linear and Domino Causality

Say, “Usually, when we describe how things happen, we use linear or direct cause and effect. We can say that one thing directly causes another thing to happen. For example, green plants cause the energy to be there for the mice.”

Fragen an die Schüler: Wie geschehen Dinge? Was ist die Ursache? Was folgt auf eine Ursache? Was ist die Wirkung?

The teacher should now introduce the concept of domino causality. Then he or she needs to explain that domino causality means effects causing new effects, the same way dominoes fall over. Set up some dominoes and show how if one falls down, it causes the next one to fall down, which causes another one to fall over and so on.

Fragen an die Schüler: Wisst ihr, was ein Dominoeffekt ist? Was sind Dominosteine? Was passiert wenn man Dominosteine in einer Reihe aufstellt und man einen Stein anstößt?

Causes create effects which then become causes themselves. This shows the importance of understanding that within an ecosystem, events can have both direct and indirect effects.

Auf Ursachen folgen Wirkungen. Diese Wirkungen werden dann zu einer neuen Ursache. In einem Ökosystem können Ereignisse direkte und indirekte Wirkungen haben.

Have students write down what domino causality is and make sure all students understand that concept.

8. Show how Domino Causality explains Food Chain and Food Web Relationships

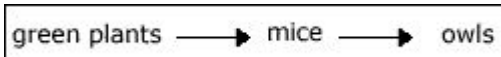
Explain that relationships in a food web are just like dominoes. One thing causes another thing, which then also causes another thing. For example, the green plants cause energy to be available for mice and the mice cause energy for owls and so on.

Fragen an die Schüler: Wie stehen Mäuse, Eulen und grüne Pflanzen in Verbindung? Ist Energie hier eine wichtige Komponente?

If something were to happen to the green plants, there would be no energy for the mice which would mean that there is no energy for the owls.

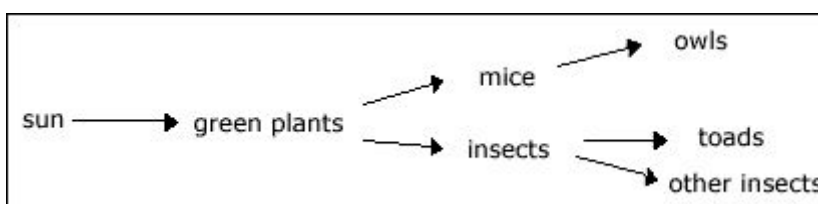
Fragen an die Schüler: Was ändert sich, wenn etwas mit den grünen Pflanzen geschieht? Gibt es dann noch Energie für Mäuse und Eulen?

Food Chain (*Nahrungskette*) is a term often used when talking about a row of dominoes set up in a straight line to describe a linear set of connections, like this:



Note to Teacher: You can create a set of dominoes using the pictures included in the game (green plants, owls etc.).

The teacher can also set up dominoes that branch out in different ways to illustrate the following:



This is the difference between a food chain and a food web. In the food web, the dominoes branch out to show that there can be many effects of one cause when

certain dominoes fall. The web describes what happens in an ecosystem more accurately than a food chain does.

Fragen an die Schüler: Kennt ihr den Unterschied zwischen einer Nahrungskette und einem Nahrungsnetz?

Bei einem Nahrungsnetz zeigen uns die Dominosteine, dass eine Ursache mehrere Wirkungen haben kann.

Discuss with students the importance of the link to the sun. The energy from the sun is converted into food energy by green plants. The sun energy is converted into food energy by the green plants. As it is passed along the food web, energy is lost. When things decay, the remaining energy becomes heat energy that is dissipated into the environment (The processes of life, such as growing or eating always require energy, resulting in heat as a by-product.).

Fragen an die Schüler: Wie stehen die Lebewesen in Verbindung zur Sonne? Was passiert mit der Energie der Sonne? Was machen Pflanzen mit der Sonnenenergie? Wird Energie im Nahrungsnetz weitergegeben? Was geschieht mit der Energie, wenn sie weitergegeben wird? Was geschieht mit der Energie, wenn Organismen verwesen? Ist Hitze ein Nebenprodukt, wenn Organismen wachsen und essen?

Differentiate between Matter and Energy. Explain that they are not the same thing.

Fragen an die Schüler: Was ist Energie? Was ist Masse? Wie unterschieden sich beide voneinander?

Matter refers to what things are made of, particles called atoms. Matter is recycled during decay.

Alle Dinge sind aus Masse gemacht. Sie bestehen aus Partikeln und Atomen. Die Masse wird bei dem Verwesungsprozess recycelt.

You cannot see energy. It cannot be recycled. Instead, when it is used, a lot of it gets transformed into heat energy. At some point, so much energy that is available is transformed into heat, that there is no more left to be used by living beings.

Energie ist unsichtbar und kann nicht recycelt werden. Wenn man Energie benutzt, wird ein Teil der Energie in Hitze umgewandelt. Am Ende ist fast alle Energie in Hitze umgewandelt und kann nicht mehr von Lebewesen genutzt werden.

Hence, our link to the sun is crucial because it is the very first domino in the set and represents a virtually unlimited energy source.

Fragen an die Schüler: Warum ist also die Verbindung zur Sonne so wichtig?

Die Sonne dient als unerschöpfliche Energiequelle?

Whenever we talk about energy, we explain the Domino Causality. However, whenever we talk about matter, we should explain the patterns with cyclic causality (section 2).

Although, energy and matter are different things, once they enter the living world and become “food”, in a sense, they “travel” alongside each other. The Nutrient Cycles Game in Section 2 should help make students aware of that.

10. Extend the Concepts of other Ecosystems Discussions

Summarize ideas from the lesson revisiting the Learning targets. Ask students how domino causality might be involved in other food web activities.

Fragen an die Schüler zur Rekapitulation: Was war der Dominoeffekt? Wie kann man mit Hilfe des Dominoeffekts ein Ökosystem erklären? Was ist Energie? Warum ist Energie wichtig? Von wo kommt Energie und wofür wird sie benutzt?

Below you will find important words for this unit:

Wortschatz

Auf deutsch	Auf englisch
Das Ökosystem	ecosystem
Der Fluss	river
Der See	lake
Der Wald	forrest
Das Sonnenlicht	sunlight
Die Sonne	sun
Das Wasser	water
Die Erde	soil
Die Natur	nature
Das Biotop	biotope
Die Pflanze	plant
Die Organismen (Pl.)	organism

Die Lebewesen (Pl.)	living beings
Die Masse	matter
Die Energie	energy
Die Energiequelle	energy source
Die Hitze	heat
Der Energiefluss	energy source
Der Produzent	producer
Der Konsument	consumer
Der Destruent	decomposer
Das Nahrungsnetz	food web
Die Nahrungskette	food chain
Das Garn	yarn
Die Ursache	cause
Die Wirkung	effect
Der Faktor	factor
Der Einfluss	impact
Das Umfeld	physical environment
beeinflussen	influence
produzieren	produce
konsumieren	consume
verwesen	decay
in Verbindung stehen	be connected/linked to
Die Kategorie	category
Die Mikroorganismen (Pl.)	microorganisms
passieren	happens
ernähren	nouris so.
direkt	direct

indirekt	indirect
betroffen sein	be affected by
sich unterscheiden	differ
Der Dominoeffekt	domino causality