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Sustainable Farming Methods

Theme: **Sustainable Food Production**

Total duration: 8 hours

School subjects involved (suggestion): Biology, Geography, Environmental Sciences, English, IT any other science subject
Equipment/materials: none specific, but organization of field trips are necessary
Worksheets: *Annex 1 – Definitions related to agriculture*
Worksheet 1 – Interview sample with farmers

Digital tools: Kahoot/Mentimeter for Orientation phase, MindMup, Mindmeister for visualization of ideas

Brief description

This Learning Unit deals with different farming practices and aims to create a link between sustainability and agriculture. Current agricultural practices are often wasteful and exploitative, however, due to the growing number of human population it is crucial to provide the essential amount of food (both in terms of quality and quantity). Therefore, it is essential for students to understand the importance of agriculture, but also to realize that there are several (very different) farming practices, that can contribute to the long-term sustainability of our planet in a different scale.

Students will be introduced to conventional farming on one hand, as well as alternative farming practices (mainly organic farming and regenerative agriculture). It is advised that students collect hands-on experiences by visiting one or more farms, and being able to realize those practices that contribute to sustainability and soil health. Connection between the quality of food and the farming practices can also be observed and analyzed.

Learning Objectives

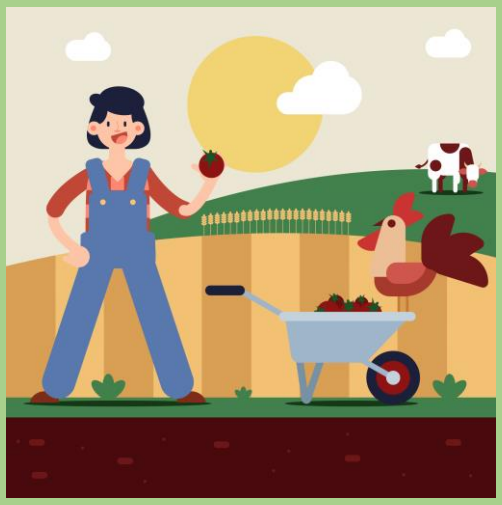
Describe the learning objectives of the Learning Unit, both in terms of knowledge and skills/competences to be acquired by the students.
You can use the following format:

Students will learn about:

- ✓ The differences between conventional farming and alternative farming.
- ✓ Different forms of alternative farming practices (like no-till, cover crops, crop rotation).
- ✓ How farming practices can be linked to sustainability.
- ✓ The importance of soil health in agriculture and growing foods.
- ✓ The difficulties and challenges of sustainable (alternative) farming methods.

Students will be in a position to:

- ✓ Develop their skills in implementing field work.
- ✓ Prepare and perform interviews to farmers.
- ✓ Develop their analytical and teamwork skills.
- ✓ Prepare presentations or videos on a specific topic based on their experiences.
- ✓ Argue in favor (or against) different agricultural methods.



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Steps of the Learning Unit

Orientation

Duration: 30 minutes
School subjects involved (suggestion): English, Science, Biology, any other
Where the activity takes place: In the classroom.
Method (how the students have to work): As a class.
Equipment / materials: Interactive whiteboard, video-presentation, for collecting students' opinions you might use Kahoot or Mentimeter.

Description:
This orientation activity introduces students to agriculture, raising awareness on the importance of the topic. Students should be able to recognize that agriculture on one hand is crucial to feed people on the planet, while on the other hand the current agricultural practices are a major contributor to global greenhouse gas emissions.

Invite students to take part in a class discussion and brainstorming, regarding the following (suggested) topics:

- Where does food come from? Why is agriculture important?
- Are you aware of the effects of agriculture on our planet?
- How would you imagine a farm?
- How would a perfect farm look like? How would a future farm look like?

Showing and then discussing introductory videos on the topic might encourage ideas on the above topics. A sample video can be found on the following link (in English): "Can we create the "perfect" farm?" Students should be able to also recognize and understand the term "agricultural revolution".

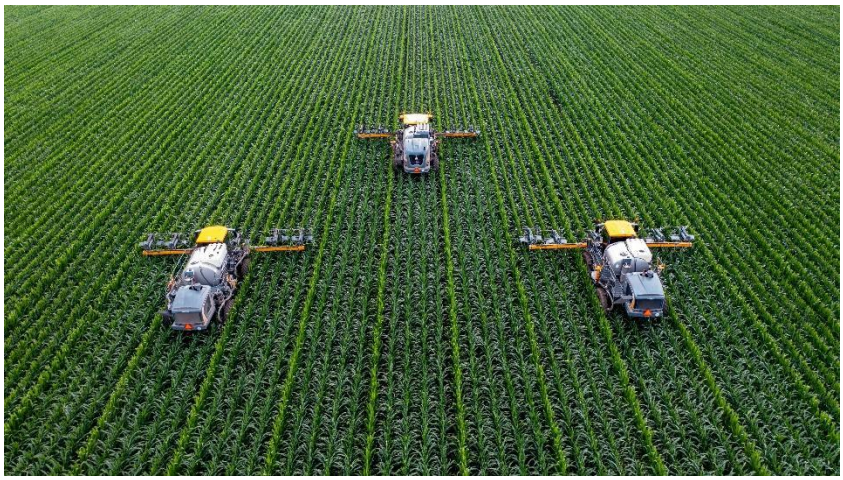
Conceptualisation

Duration: 45 minutes
School subjects involved (suggestion): Biology, Geography, Environmental Sciences, English
Where the activity takes place: In the classroom.
Method (how the students have to work): Students work in groups.
Equipment / materials: Interactive whiteboard, video-presentations in class.

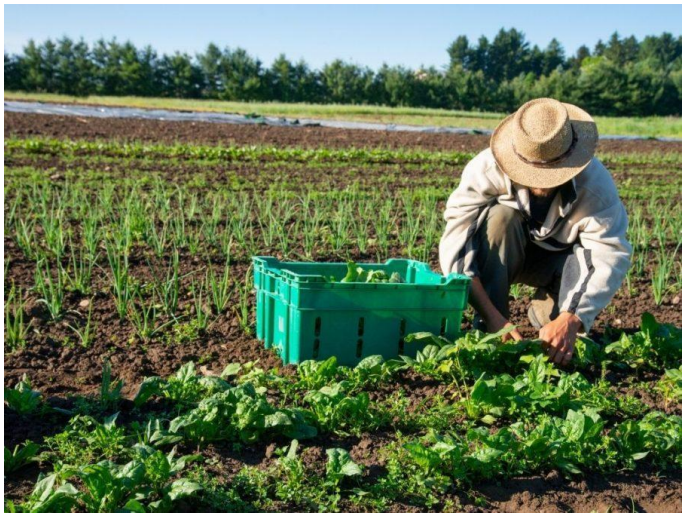
Description:

After being introduced to the importance of agriculture, students should be able to recognize that there are different farming practices. First, introduce 3 main farming methods to students. Make students formulate groups, and then show them 3 photos of the 3 different methods/farms. Ask students to brainstorm about the main differences. Video-presentations on the farming practices can also make the understanding easier.

Conventional/traditional farming:



Organic farming:



Regenerative farming:

The following **sample videos** can be used to make a clear distinction between farming methods:

What is Regenerative Agriculture? Main differences between conventional and regenerative agriculture, as well as examples of regenerative practices.

The importance of Regenerative Agriculture. 5 crucial steps for reaching Regenerative Agriculture, and why is it important for climate matters.

Organic farming. An alternative to conventional farming, with the involvement of more natural ingredients.

REGINA website. A currently running Erasmus+ project, that focuses on Regenerative Agriculture, by creating a learning methodology and a platform. The website will incorporate several case studies on regenerative farming, as well as different educational materials and proposed activities.

The main questions/topics to discuss under this phase:

- Different types of farming methods – introduction on traditional/conventional farming, organic farming and regenerative farming
- What are the main differences of each farming type? How could we describe them?
- Can we assume that there are sustainable farming practices and non-sustainable farming practices? What makes a farm sustainable?

Make sure to prepare students for a series of probably unknown terms. You can give a short explanation to these terms (look at the simple definitions at **Annex 1** attached to this Learning Unit), or alternatively, you can also assign different terms to groups of students to make a short internet-search on the definition, and then ask students to introduce these terms to the whole class:

- biodiversity
- organic matter in soil
- no-till farming
- cover crops
- overgrazing
- agro-forestry
- crop rotation
- monoculture

After being introduced to the different farming practices, group of students should be able to **formulate a hypothesis linked to the differences of farming methods** ("Organic or regenerative agriculture is more sustainable than conventional farming." Or "Organic or regenerative agriculture means less harm to our environment than conventional farming"). However, encourage students to also take into account the negative sides of alternative farming methods, and be also critical (but not cynical). ("Organic or regenerative farming practices would not be able to feed the whole planet." Or "Organic or regenerative agriculture can only be applied in small-scale.")

Alternatively, students may formulate a central question for investigation: "How do different farming methods contribute to sustainability?"

Investigation

Duration: 260 minutes
School subjects involved (suggestion): Biology, Geography, Environmental Sciences (or any other science subject)
Where the activity takes place: Most part of the Investigation phase takes place during a field visit (+ homework)
Method (how the students have to work): Students work in groups.
Equipment / materials: Notes and pens, phones, camera, digital could for storing data (ex. Google Drive), software for presentations

Description:

Based on the Conceptualisation Step, students should now carry out the necessary activities in order to test their hypothesis, or answer the questions. For the proper investigation, ideally, students should prepare for a field visit. Based on the implementation possibilities, teachers might opt for one of the following possibilities:

- Study visit to 2 farms, each dealing with a different farming practice (i.e. 1 conventional and 1 organic/regenerative). In this case, the whole class is visiting the farms.
- Study visit to 1 farm, dealing with an alternative farming practice (i.e. organic or regenerative). In this case, the whole class is visiting the farm.
- If the involvement of farmers is difficult, a solution would be to ask around students, whether they have any relatives (parents, grandparents, friends, etc.) who are growing their food at home. You can also think of small-scale home-gardens. In this case, you will need to find more field-visit options, as not the whole class, only groups will visit the dedicated home-gardens (each group visits one home-garden).

The investigation activities that follow, focus on the main question, of "How can the sustainability of different farming practices be measured?"

1) Planning the activities

Location: In classroom (partly homework)
Time: 20 minutes
Materials: Notes and pens

Description: Students formulate groups, and then plan the field visit(s). For this, the teachers will help with all the organizational matters (see above). You will need to set a date, prepare for the activities carried out during the field visit, and the information you would want to collect. The following questions should be discussed and settled:

- What will be the destination of the field visit(s)? When will the field visit(s) take place? How will the students reach the destination(s)?
- Who will be in contact with the farmer/home-producer?
- What activities will be carried out in the farm/home-garden?
- What data will be collected, what necessary equipment do students need?

Once the above has been discussed, the field visit and data collection can start.

2) Performing

Location: Field visit (outside the classroom), and homework
Time: 180 minutes
Equipment / Materials: phones/camera/video, notes and pens
Digital tools: phones, digital cloud for storing data (ex. Google Drive)

Description:

Activity 1. Field visit on selected farms or home gardens (60 min)

During this activity groups of students will visit the selected farms, and examine the following issues:

- What is the main agricultural product of the farm? What type of plants can you identify there? Is it a monoculture or the farm intends to enhance biodiversity?
- What type of farming practices does the farmer follow?
- Are any of the following methods visible on the farm?
  - planting cover crops
  - crop rotation
  - weeding
  - no-till methods
- What is the overall impression of the farm? Is it well-organized/well-structured? Does the produced food look healthy?

Make sure that students take photographs and take notes to be able to answer the above questions.

Activity 2. Interviewing the farmer or home gardener (45 min)

Above the own examination carried out in Activity 1, students shall also do an interview with the farmer/home-gardener. For the interview, **Worksheet 1** can be used as a sample, but make sure to discuss it with students during the planning phase.

The main aim of the interview is to get a general overview on the motivation behind farming, as well as to see the connection between sustainability and farming practices. The interview should also focus on the obstacles and difficulties that encounter during farming.

Activity 3. Soil sampling (45 min)

One of the main differences between conventional/traditional farming and alternative farming practices (especially regenerative agriculture) can be observed through the condition of the soil. In this activity (still carried out during the field visit), students shall take a sample of the soil and describe it, analyzing it. (A pre-orientation on soil health during Geography/Biology/Environment class would be useful.)

1) Select a location on the farm, where soil can be accessed temporarily. (Always ask for permission.)

2) By using gloves, with hands or by using a shovel, dig up a small area (a small sample of soil) and place it in students' hands.

3) Take a photo of each sample and observe. For observation, make notes/photos, and analyze the followings:

- Was it easy to dig the soil?
- What can you see in the soil? What is the composition of the soil?
- How would you describe the structure and characteristic of the soil? Is the soil compacted?
- How does it feel? Is it dry or wet? Is there a smell? What color is the soil?
- Is there any organic matter? (such as leaves, live plant material, white threads of soil fungus, other organisms) If yes, what do you think of its quantity?
- Are there any animals living in the soil? (such as earthworms) If yes, how many?
- Is there any inorganic matter? (such as stones)
- Do you consider this soil healthy?

4) Once finished with the sampling, make sure to return the soil to the place where it has been removed from.

It is always better to compare different soil samples during the examination. If there are more field visits, this can be done also by comparing the soil of conventional agricultural land and alternative agricultural land. If there is no option for several field visits, different samplings can also be done within the single farm or home-garden, or students can also be asked to find another location (probably around the school) and do the second sampling there (on a non-agricultural land).

To follow-up the activity, ask groups of students to think about the followings as a homework:

- How could farming practices (tilling, removing vegetation from land, cover crops, fertilizers, pesticides) change the soil?
- How could someone improve the soil to be healthy?
- How can we connect the health of the soil to food production and food quality?

Activity 4. Food tasting (30 min)

Different agriculture methods lead to different quality of food (mostly through enhancing or exploiting the healthy soil). One of the best ways to value the farming practices is by tasting the food it produces. During the field visit, ask the farmer/home-gardener to allow students to taste a small sample of the food that was produced on the farm.

During the tasting, make sure students will pay attention to the following examinations:

- What kind of food do you taste? Have you ever tasted this before?
- How does it look like? How does it smell? Does it look healthy?
- When was it harvested?
- What do you think about the taste of the food? Is it better or worse than you expected? Why?

Just like with the soil sampling, it is always better to compare different food samples during the examination. If there are more field visits, this can be easily done by comparing the foods of conventional agricultural land and alternative agricultural land. If there is only one field visit, you can also make a comparison with the same type of food coming from the supermarket.

Sample evaluation tables for food tasting

With more field visits to different farms:

Name of the plant		
	Tasted at the traditional farm	*Tasted at the alternative farm*
Color		
Size		
Harvested at		
Taste		
General impression		

With only one field visit:

Name of the plant		
	Tasted at the farm/home-garden	*Tasted at the supermarket*
Color		
Size		
Harvested at		
Taste		
General impression		

3) Analysis / Findings

Location: Homework
Time: 60 minutes
Equipment / Materials: PC
Digital tools: Software for presentations

Description:

Students (preferably as homework) should conclude on the results of the field visits, and make the necessary conclusions. Students also shall gather their materials collected during the field visits (photos, videos, interviews, soil sampling results, food tasting results, etc.) For this purpose, it is advised for the groups to use a common cloud storage folder.

Students should also make a list of all the farming practices that are considered as sustainable, and also to think about **how sustainability can be integrated into agriculture** (preparing a mind map or a simple visualization tool would be advisory at this stage). Students can use for example MindMup (mindmup.com) or MindMeister (mindmesiter.com) for this purpose.

Conclusion

Duration: 60 minutes
School subjects involved (suggestion): Any
Where the activity takes place: In the classroom (or partly homework)
Method (how the students have to work): Students work in groups.
Equipment / materials: Software for presentations (or video-making)

Description:

Students in their groups will analyze the results and the main findings. This phase will depend on the original hypothesis or questions for investigation, however, students should be able to make a conclusion regarding the following topics, based on the performed activities:

- What are the characteristics of a sustainable farm? What can we consider as a sustainable farming practice? (mainly based on Activity 1 & 2)
- How can we measure the sustainability of a farming practice? What consequences can be drawn from soil health? (mainly based on Activity 3)
- How are farming practices and the taste of the produced food connected with each other? (mainly based on Activity 4)

Students are encouraged to prepare a presentation about their findings, preferably in a form of ppt or video presentation.

Discussion

Duration: 45 minutes
School subjects involved (suggestion): Any.
Where the activity takes place: In the classroom.
Method (how the students have to work): As a class.
Equipment / materials: Software for presentations.

Description:

During the discussion, students shall present their findings to the class, and then brainstorm about the following topics:

- Why is it important to take into account the sustainability aspects in agriculture?
- What could you personally do to encourage sustainable farming practices?
- How do food choices influence different farming practices?

After the students' presentations and the discussion, it is also important to invite students to evaluate the findings as well as their experiences.

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Annex 1 – Short & simple definition on terms related to agriculture

Term	*Definition*	*Source*	*For further reading*
Biodiversity	*Biodiversity refers to the variety of living spaces on Earth, including plants, animals, bacteria and fungi. It can be used more specifically to refer to all of the species in one region or ecosystem.*	*National Geographic, Education*	*https://www.amnh.org/research/center-for-biodiversity-conservation/what-is-biodiversity* *https://www.theguardian.com/news/2018/mar/12/what-is-biodiversity-and-why-does-it-matter-to-us* *https://www.britannica.com/science/biodiversity*
Organic matter (in soil)	*Soil organic matter is the portion of soil that is composed of living and dead things in various states of decomposition, such as plant roots and microbes.*	*University of Minnesota, Extension*	*https://www.fao.org/3/a0100e/a0100e04.htm* *https://www.dpi.nsw.gov.au/agriculture/soils/guides/soil-carbon/organic-matter* *https://ec.europa.eu/eip/agriculture/sites/default/files/eip-agri_brochure_soil_organic_matter_matters_2016_en_web.pdf*
No-till farming	*No-till farming methods suggest zero or the least soil disturbance.*	*EOS Data Analytics*	*https://regenerationinternational.org/2018/06/24/no-till-farming/* *https://www.usda.gov/media/blog/2017/11/30/saving-money-time-and-soil-economics-no-till-farming* *https://notillagriculture.com/no-till-farming/what-is-no-till-farming-definition/*
Cover crops	*A cover crop is a plant that is used primarily to slow erosion, improve soil health, enhance water availability, smother weeds, help control pests and diseases, increase biodiversity.*	*Sustainable Agriculture Research and Education*	*https://rodaleinstitute.org/why-organic/organic-farming-practices/cover-crops/* *https://www.usda.gov/peoples-garden/soil-health/cover-crops-crop-rotation* *https://eos.com/blog/cover-crops/*
Overgrazing	*Overgrazing occurs when plants are unprotected to intensive grazing for extended periods of time, or without enough recovery periods. Overgrazing reduces the usefulness, biodiversity and productivity of the land.*	*Earth.com*	*https://www.conserve-energy-future.com/causes-effects-solutions-overgrazing.php* *Desertification Indicator System for Mediterranean Europe* *https://www.envpk.com/overgrazing-causes-effects-and-solutions/*
Agro-forestry	*Agro-forestry is the interaction of agriculture and trees, including the agricultural use of trees (i.e. integrating them into agriculturally-productive landscapes.)*	*World of Agroforestry*	*https://www.fao.org/forestry/agroforestry/80338/en/* *https://www.usda.gov/topics/forestry/agroforestry* *https://www.renature.co/what-is-agroforestry-2/*

Term	Definition	Source	For further reading
Crop rotation	*Crop rotation involves growing various plants in a set order on the same land, contrasting with monocropping or random succession.*	*EOS Data Analytics*	*https://www.rhs.org.uk/vegetables/crop-rotation* *https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Crop_rotation* *https://www.ptagtiv.com/en/blog/crop-rotation/*
Monoculture	*Monoculture farming is a form of agriculture that is based on growing only one type of a crop at one time on a specific field. The concept of monoculture does not only apply to crops, but to farm animals as well.*	*EOS Data Analytics*	*https://www.studysmarter.co.uk/explanations/environmental-science/biological-resources/monoculture/* *https://geopard.tech/blog/monoculture-in-agriculture-advantages-and-disadvantages/* *https://www.conserve-energy-future.com/advantages-disadvantages-examples-monoculture.php*
Regenerative Agriculture	*Regenerative Agriculture describes farming and grazing practices that reverse climate change by rebuilding soil organic matter and restoring degraded soil biodiversity.*	*Regeneration International*	*https://www.nrdc.org/stories/regenerative-agriculture-101#what-is* *https://www.weforum.org/agenda/2022/10/what-is-regenerative-agriculture/* *https://ellenmacarthurfoundation.org/articles/regenerative-agriculture*
Organic farming	*Organic farming is an agricultural method that aims to produce food using natural substances and processes. Organic farming rules encourage a high standard of animal welfare, too.*	*European Commission*	*https://www.soilassociation.org/take-action/organic-living/what-is-organic/* *https://www.iberdrola.com/sustainability/organic-farming* *https://www.fao.org/organicag/oa-faq/oa-faq1/en/*
Conservation Agriculture	*Conservation agriculture is a farming system that promotes maintenance of a permanent soil cover, minimum soil disturbance, and diversification of plant species.*	*Climate ADAPT*	*https://www.fao.org/conservation-agriculture/overview/what-is-conservation-agriculture/en/* *https://ecaf.org/what-is-conservation-agriculture/*

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Worksheet 1 – Interview sample with the farmer/home-gardener

The following interview gives support for interviews carried out during the field visits.

Basic data on the farm/farmer

Location of the farm: _____

Name of the farmer: _____

The main profile in terms of production/cultivation on the farm: _____

Farming practice (i.e. conventional, organic, regenerative, etc.) : _____

Motivation on farming

How long have you been a farmer/home-gardener?

Why did you decide to grow food in the farm/in your home? (Economic benefits, taste of foods/quality of products, environmental aspects, etc.)

Do you like being a farmer/home-gardener?

Farming practices and sustainability

Do you think that sustainability is an important aspect in agriculture?

Do you consider sustainability in your own farming practices?

What do you do in order to enhance sustainability?

Do you think you should pay more attention towards alternative farming practices?

What difficulties and obstacles do you come across in farming? How does it effect the sustainability aspects of the farm/home-garden?

How do you see the future of your farm? What do you want to achieve?