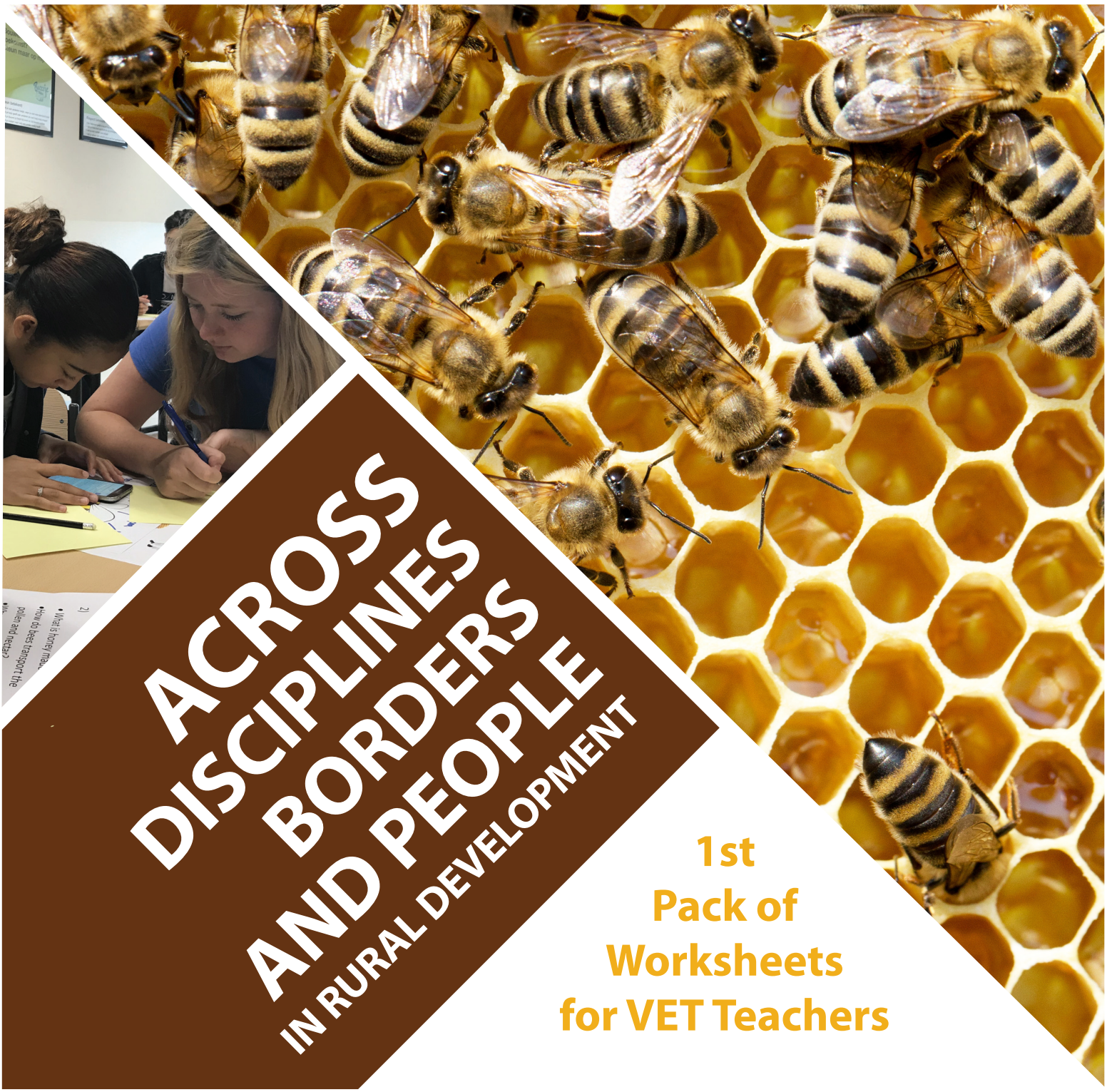
Erasmus+

ACROSS

Cross-cutting Topic I
SUSTAINABLE DEVELOPMENT

Edited by learners of ACROSS summer school in Badenweiler



ACROSS DISCIPLINES BORDERS AND PEOPLE
IN RURAL DEVELOPMENT

1st Pack of Worksheets for VET Teachers

AERES UNIVERSITY OF APPLIED SCIENCES WAGENINGEN

HUMBOLDT-UNIVERSITÄT ZU BERLIN

Czech University of Life Sciences Prague
Institute of Education and Communication

Project Erasmus+ KA2 ACROSS:
Across Disciplines, Borders and People in Rural Development

Cross-cutting Topic I

SUSTAINABLE DEVELOPMENT

Worksheets for VET Teachers

Plant production / Animal husbandry / Environmental sciences / Gardening / Horticulture / Forestry / Food production / Agro-economy / Biology

ENSFEA
Ecole Nationale Supérieure de Formation de l'Enseignement Agricole

SUSTAINABLE DEVELOPMENT – Cross-cutting Topic I

1st Pack of Worksheets for VET Teachers

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INTRODUCTION TO THE WORKSHEETS ON SUSTAINABLE DEVELOPMENT

OLD STYLE TRADITIONS, INDUSTRIALIZED FOOD PRODUCTION OR SUSTAINABLE LAND USE?

This collection of didactical worksheets is one of the results that are achieved in the international Spring School ACROSS, held in April 2019 in Badenweiler, Germany. This international training program provided the unique possibility for students from France, Germany, The Czech Republic, Bulgaria, The Netherlands and Austria to discuss perspectives for agricultural and environmental pedagogy. They have been working on changes in land use, environmental and social challenges and have described perspectives and solutions.

But we do not want to 'keep our experiences and ideas with us': the participants have been working on the development of methods and concepts how to learn and to develop ideas for sustainable agriculture and land use – not just theoretically but also practically.

Education for Sustainable Development (ESD) focuses on the development of knowledge, skills, attitudes and values. That are necessary in creating a sustainable future (UNESCO, 2005). Teachers are being asked to devote attention to sustainable development in general, as well as to specic sustainability - related themes such as climate change, food security and biodiversity.

The European Network of Learning and Teaching in Agriculture and Rural Development (ENTER) launched its Erasmus+ KA2 project ACROSS in 2017. This project aims to support and train pre-service and young in-service vocational teachers facing socially acute challenges in their professional career as well as establishing learning activities to focus on learning for sustainable development.

Jan-Willem Noom
Vice-president of the ENTER Network and member of the ACROSS project team

Worksheet 1 SUSTAINABLE ASPECTS OF FOREST REGENERATION

University College for Agrarian and Environmental Pedagogy Vienna, Austria Specialization: Forestry

There are several projects over the whole world to re-green our planet. To save the Earth from deforestation a lot of trees must be planted. Get some information by watching this movie:

Natural Regeneration under Billion Trees Project:
https://www.youtube.com/watch?v=e7460zQwMuM
For information in more detail have a look on the following site:
https://www.plantabillion.org/

The renewal of a forest is known as regeneration. Forest regeneration is the process by which new tree seedlings become established after forest trees have been harvested or have died from fire, insects, or disease. Regeneration is key to sustainable forestry and can be accomplished through two basic approaches. There are also different possibilities however, these two methods are the most important in regeneration of forests.

1) Natural regeneration
2) Artificial regeneration

1) Natural regeneration
The renewal of a forest crop, by self-sown seed, or by coppice or root-suckers, also the crop so obtained or also it can be defined as reforestation of a stand by natural seeding.
2) Artificial regeneration
It is defined as the renewal of a forest crop by sowing, planting, or other artificial methods. Also the crop so obtained or the renewal of a tree crop by direct seeding, or planting.

Forest regeneration is appropriate wherever biodiversity recovery is one of the main goals of reforestation, such as for wildlife conservation, environmental protection, eco-tourism or to supply a wide variety of forest products to local communities. Forests can be restored in a wide range of circumstances, but degraded sites within protected areas are a high priority, especially where some climax forest remains as a seed source within the landscape. Even in protected areas, there are often large deforested sites: logged over areas or sites formerly cleared for agriculture. If protected areas are to act as Earth's last wildlife refuges, regeneration of such areas will be needed.
Timing is important in the regeneration process. Prompt reforestation can be critical if a landowner's objective is timber production or a forested habitat. Every year that a forest is understocked means a loss in timber growth. Moreover, delaying regeneration can allow brush, grass, or other undesired vegetation to take over a site, making the process of establishing desired trees difficult and expensive. Also, many countries forest-practice laws require reforestation within a few years of a timber harvest.
Determining whether to renew a forest through natural regeneration or tree planting depends in part on the section of the country in which a forest is located. Landowners often prefer to establish new timber stands by promoting natural regeneration rather than by intentionally planting specific trees. Through natural regeneration, existing trees reproduce themselves and develop into a natural community based on the site conditions. Rural property owners can create conditions to promote natural regeneration of desired species. Often, creating such conditions is a more practical option than developing an artificial plantation of hardwoods. Natural regeneration is usually less expensive to initiate, uses trees that are proven to grow in the native soils, and can be established in high densities that produce straight, high-quality stems.

The decision to rely on natural regeneration or plant trees depends on how a forest owner is managing a stand. Most landowners who use the clear-cut silvicultural system follow a harvest with prompt tree

planting. Landowners using the seed-tree silvicultural system also often end up doing some planting, at least on a supplemental basis, particularly when natural regeneration is not as successful as anticipated. By contrast, landowners who use the selection silvicultural system or the shelterwood silvicultural system tend to rely on natural regeneration, though they may undertake some supplemental tree planting, particularly to establish desired species not currently present on the site. Whether a landowner decides to rely on natural regeneration or plant trees, it is important to monitor the results of that decision. If acceptable numbers of new tree seedlings are not established promptly, the switch to planting or the act of planting additional trees becomes progressively more expensive.

Artificial regeneration has both positive and negative impact on the environment and the cultivation of the woods:

ADVANTAGES	**DISADVANTAGES**
quicker results	**soil is disturbed**
full stocking	**expensive method**
no advance growth necessary	**not all age classes are present**
species composition can be regulated	**higher drop out**
better yield is received	**wrong plants (in accordance with the location)**

1. Glossary

	process by which new tree seedlings become established		*renewal of the forest by sowing, planting, …*
	renewal of the forest without human intervention		*due to this fact, forests get more and more*
	areas were more trees were felled than could grow again		*sort of tree promoted by the landowner*
	tree plant just at the beginning of its growing		*written documents ordering for example reforestation*

2. Why is it important to have forests? Discuss in groups of four, the advantages and effects of a wooded surface and take notes of at least six of your important facts.

Picture 1

3. You see advantages and disadvantages of artificial regeneration mentioned above. Please find at least three of them concerning natural regeneration.

ADVANTAGES

DISADVANTAGES

Picture 2

Picture 3

Picture 4

4. Select the forest of your own farm or a wooded area next to your place and write a text about half a page. The text should be added to an introduction sheet of your farm. Describe how forest regeneration is taking place, what different tree species you find (many, less), how the forest is used (wood production, tourism, etc.) and all other information you want to inform us about.

5. In addition think about how you would use this forest if it would be yours. Are there any environmentally friendly activities you could offer? Are there any negative effects? How can you avoid them?

Sources

Agriculture Information Bank (2016). Regeneration of Forest. Available on: https://agriinfo.in/regeneration-of-forest-1604/
Schnepf C., Sullivan K. (2014) Forest Renewal. Available on: https://articles.extension.org/pages/71908/forest-renewal:-natural-regeneration-or-tree-planting
Picture natural regeneration: http://www.wald-prinz.de/aufforstung-anpflanzung-mit-douglasien-jungpflanzen/2477
Picture artificial regeneration: http://deutsches-jagd-lexikon.de/index.php?title=Naturverj%C3%BCngung
Picture Hohlspaten: http://www.pflanzverfahren.de/pflanzung/containerpflanzen/hohlspaten-lochpflanzung/
Picture Forest: https://www.worldwildlife.org/habitats/forest-habitat
Picture Forest Walk: https://www.waldwissen.net/wald/erholung/wsl_wert_freizeit/index_DE

Key

1. Glossary

(forest regeneration)	process by which new tree seedlings become established	(artificial regeneration)	renewal of the forest by sowing, planting, etc.
(natural regeneration)	renewal of the forest without human intervention	(timber growth)	due to this fact, forests get more and more
(looged over areas)	areas were more trees were felled than could grow again	(desired species)	sort of tree promoted by the landowner
(seedling)	tree plant just at the beginning of its growing	(forest-practice laws)	written documents ordering for example reforestation

2. Why is it important to have forests?
Forests produce clean water.
Forests are the lungs of the Earth: they absorb and filter toxins from the air.
Forests produce clean oxygen for all life to breathe.
Forests regulate the global climate.
Forests are home for many animals.
Forests are home for the most land-based plants.
Forests are source of income for many people.
People go to the forests for a rest

3. ADVANTAGES: fewer costs by working time, fewer costs by plants, trees are proven to grow in the native soil, conservation of valuable genetic populations, well selection possibilities at tending strategies
DISADVANTAGES: dependence on seed-years, higher efforts on safety precautions (wild animal), unbalanced regeneration/ uneven stocking, no influence on species, slower process

Worksheet 2 THE IMPORTANCE OF ORCHARD MEADOWS

University College for Agrarian and Environmental Pedagogy Vienna, Austria Specialization: Forestry

The cultural landscape that has grown over the centuries has been shaped by litter orchards for generations. These small-scale but all the more valuable habitats need our protection. The variety of different fruit types and the preservation of old and rare varieties make these small-scale, valuable habitats so valuable and provides fresh, healthy food and the basis for many dishes.
Orchard meadows are used at least several times simultaneously. The grasses and herbs are mown for hay production. Beekeepers set up their beehives on these meadows, as the intensively cultivated farmland offers little food and the fruit trees supply the fruit.
Biodiversity - With its variety of different habitats, orchards provide a habitat for a very large number of rare and endangered species and thus a chance to survive. In a typical orchard meadow you will find over 5000 animal and plant species.
Tourism - With the increasing trend "holidays on the farm" also the tourism value of the orchards grows, as it enjoys as a recreation area, with regional culinary specialties, again more appreciation.
Endangerment - Since the middle of the 20th century, the importance of the orchard meadows as feed and caterer is continuously decreasing. Intensive farming makes the comparatively low-yielding crops uninteresting. In addition, reinforced street and residential buildings made of fruit trees often became building land.
Potential - More than 3,000 apple varieties are available in Central Europe, but only around 60 varieties come into the supermarkets, and only two to three in certain individual markets. The remaining 2,940 varieties are still to be found on the orchards and their genetic material is thus preserved and can be used for reproduction.

Cultivation systems

Planting systems - according to plant density and arrangement of planting sites
Crown form - designed crowns, in intensive fruit growing, which are educated by crown design
- natural crowns in the extensive fruit growing, which can develop freely

1. Which of the cultivation systems are basically used in the orchard meadows farming sector?

_____

_____

_____

_____

2. The pupils are divided into small groups. Each group work for a type of fruit (for example "Kanada-Renette", "Kronprinz Rudolf") from a meadow orchard by means of literature and internet research of one crop (apples, pear, ...).

The following characteristics are researched:
origin of the fruit variety
ecological needs
periodically recurring developmental phenomena (phenology) during the year
detailed information on the structure and nature (morphology) of the trees, fruit buds, fruits
internal quality parameters of the fruit (sugar / acidity / nutrient content) and the special processing quality

Documents, literature, computer with internet access and links are provided. The expertise is then recorded on a poster per group and presented to the class.

3. Describe in your own words the diverse tasks that an orchard meadow can fulfill:

_____

_____

_____

_____

Picture 1

Sources

Wurm, Lafer, Kickenweiz, Rühmer, Stinbauer 2010 Erfolgreicher Obstbau, AV Fachverlag
EU Projekt ESTO (European Specialist in Traditional Orchards); Hg Umwelt-Bildungs-Zentrum Steiermark 2015
https://www.arche-noah.at/files/streuobst_definition_oesterreich_arche_noah_und_arge_streuobst_1.pdf
https://www.nabu.de/natur-und-landschaft/landnutzung/streuobst/index.html
Foto: Biosphärenpark Wienerwald / Destillation

Key

2. Sustainable and resource-saving, conservation of biodiversity and varieties in orchards, part of the cultural landscape; must be maintained and managed; Value added from fruit production and various uses of the area under the trees; Source of income; Self-support; Recreation and tourism.

Worksheet 3 ETHICAL MEAT PRODUCTION

University College for Agrarian and Environmental Pedagogy Vienna, Austria Specialization: animal husbandry

For more people it is getting more important where their meat comes from. They often lower their meat consumption and only eats meat when they know where it comes from. To follow this trend the farmers should adapt their production to the consumers' wishes. If they do it, it maybe opens a certain niche for small farmers.

About the video:

Jon Darling of South Carolina's Darling Farm has only been a sheep farmer for four years, but the ethical way he raises lamb is already attracting attention from chefs like Wes Morton of Charleston's The Dewberry Hotel. A former U.S. Army ranger, Darling finds that providing sustenance for his community through farming is an honorable way to continue to serve his country - and perhaps change the way the average American views dinner.

1. Watch the video about ethical meat on the example of lamb production
Watch the video a second time and make some notes about things which are new for you
Here you find the link to the video: https://www.youtube.com/watch?v=O5Y-kEdiSTg

Picture 1

2. Blog entry
A very good friend of you is a very popular blog writer. You as a farmer who produces meat are an expert of ethical meat production. He asks you to write a blog about ethical meet production.
The blog should include:

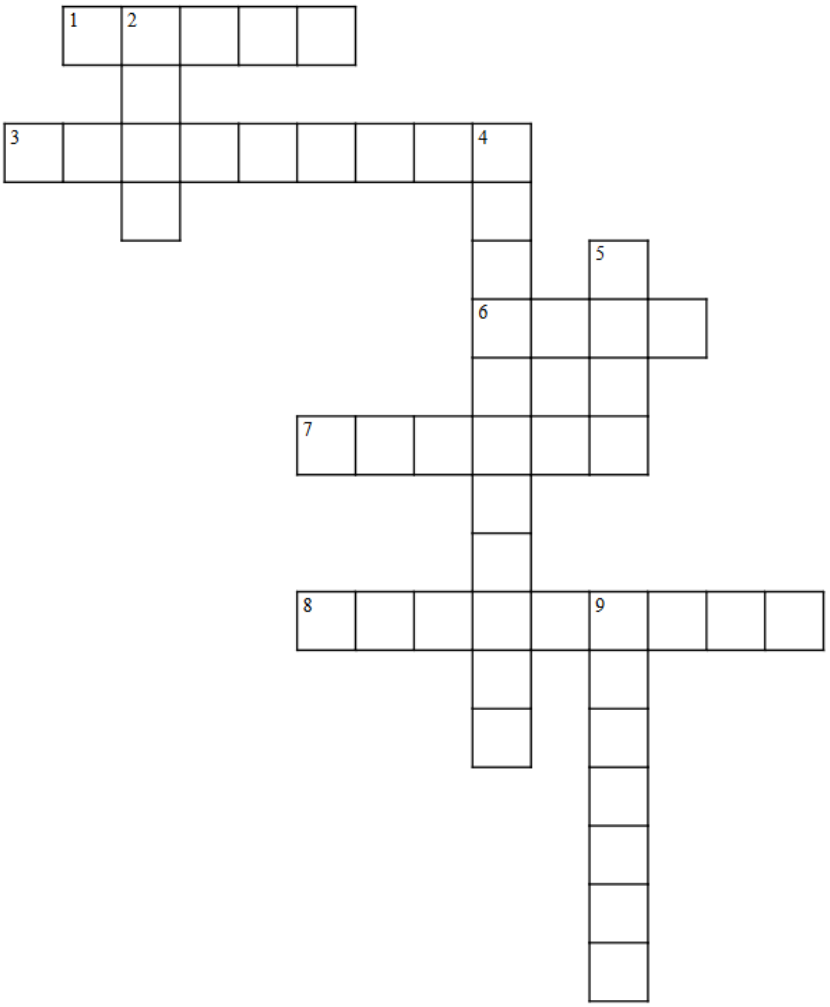
- *good structure of the blog*
- *clear message what ethical meat is for you*
- *should be an advertiser for ethical meat producers*

You can decide on your own if you want to talk about beef, lamp, pork or other animals
The blog should be about 250 words
Before you start to write the blog, you should read number 3 at the worksheet!

3. How to write a good blog
Here are some guidelines to help you write and structure your blog in a way that will make it more accessible and relevant to our readers.
Structuring your blog posting
A well-structured blog posting will catch the readers' attention and make them want to read what you have to say. So, give the blog posting a title that will catch the reader's eye.
This is the first thing they see and will help them decide if it is of interest to them. On Teaching English, you only need to write the title of the blog in the 'Title' field - you do not need to add it in the main 'Body'.

Put the main point in the first paragraph. This is the first thing readers see and it will make them want to read on.
Put the details in the following paragraphs of your posting.
Finally, in the last part of the posting add the background information and your name if you wish to.

4. Crossword puzzle to the video

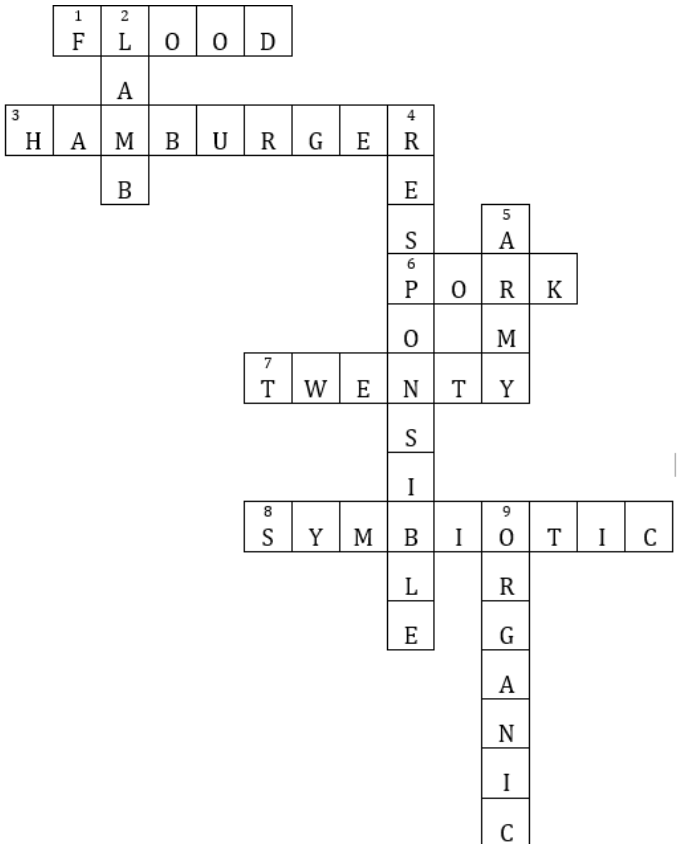


Across
1. They have to feed some lambs with a baby-bottle cause of a... in October.
3. What is a typical food where the animals are disconnected to the meat?
6. Jon Darling produces sheep and...
7. The baby lambs need every ... minutes a baby-bottle in the first days.
8. The relationship between a farmer and a chef should be really…

Down
2. How to you call a young sheep?
4. It is not … if you don't know where your meat comes from.
5. Where worked Jon before he started his farming business?
9. You can produce meat in a conventional way or in an ... way

Sources
Video about ethical meat production, available at: https://www.youtube.com/watch?v=O5Y-kEdiSTg
"How to write a good blog", available at: https://www.teachingenglish.org.uk/how-write-a-good-blog,
Picture, available at: https://pixabay.com/de/photos/tier-schafe-schafherde-wiese-3437467/

Key


1 F
2 L O O D
A
3 H A M B U R G E
4 R
B
E
S
5 A
6 P O R K
O
M
7 T W E N T Y
S
I
8 S Y M B I
9 O T I C
L
R
E
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A
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I
C

Worksheet 4 SHEEP FARMING

University College for Agrarian and Environmental Pedagogy Vienna, Austria Specialization: Animal Husbandry

People have raised sheep for milk, meat and wool for thousands of years and for good reasons sheep have some advantages in comparison to other types of livestock:

- **Sheep are relatively small and easy to handle, compared with cows, horses and, pigs and they do not need much space.**
- **Sheep don't need perfect pasture land, they happily eat brush, grasses and weeds that grow in poor soil. Their manure will fertilize the soil and the pastures can be rotated with crop planting. A former sheep pasture is a marvellously fertile spot for growing crops.**
- **Sheep are gentle and docile, although rams can be aggressive at times.**

When selecting the right sheep breed, the first thing to consider is the purpose of the sheep. Are you raising them for meat or for milk? Although sheep don't yield nearly as much milk as cows or goats, some people do enjoy the taste of sheep's milk, it can be used to make delicious cheeses and yogurts. There are hundreds of breeds of sheep but the list of those most commonly raised is fairly small.
The most important breeds of meat sheep in Austria are Merino, Texel, Suffolk and Carinthian spectacle sheep. The breeds of milk sheep in Austria are East Friesian and Lacaune.
Sheep are ruminant animals, which means they eat predominantly plants such fresh grass and hay. They can thrive quite nicely if they are fed nothing but good pasture grasses, salt, vitamins and mineral supplement and fresh water. Pastures for sheep can include a mixture of grasses, brush, and trees. In general, one acre of good quality pasture can support four sheep. Well-managed pastures that are properly grazed have the potential to minimize feed costs and increase profits. Pasture is the most natural diet for sheep and other ruminant animals. Though pasture is not without its own risks, fewer digestive problems are usually encountered among grazing sheep and lambs.
While the pasture grass is growing, sheep can feed themselves without supplements, but in the winter or if there is a drought, you will need to supplement their diet with hay and/or grain. Make sure to use a raised feeder rather than putting the hay on the ground, where it will get wet and dirty. Ewes who are about to lamb or sheep you are raising for market will benefit from supplements of grain. Like other ruminants, sheep need salt to prevent bloating. Salt can be offered in granulated or loose form.

1. Words to remember
There is some vocabulary you should know after reading this text. Try to describe the words below – find synonyms, describe the word or draw a picture. Use a form of translation to remember the word.

- *brush*
- *to fertilize*
- *purpose*
- *to yield*
- *ruminant animals*
- *to thrive*
- *digestive problems*
- *supplements*
- *ewe*
- *ram*

2. Advantages of keeping sheep on pastures
There are mentioned some facts about sheep farming in the text above. Together with a partner, please think about the advantages of keeping sheep on pastures. Try to think about the environmental impact as well – why is it good or bad to keep sheep on pastures outdoors?

_____

_____

_____

_____

3. Match the pictures and names of sheep breeds

Carinthian spectacle sheep ***Merino*** ***Texel*** ***Sufflok*** ***Lacaune*** ***Eastern Friesian***

Breed:

Breed:

Breed:

Breed:

Breed:

Breed:

4. Researching group work
Now divide into 6 groups. Each group can choose one breed from the list above: Merino, Texel, Sufflok, Carinthian spectacle sheep, East Frisian, Lacaune. Do some research about the breed and find out some important facts:
History and development of the breed
Efficiency – milk yield or kilogram of meat
Distribution in Austria – quantity of the sheep
Body condition – pros and cons, characteristics
Environmental impact of the breed – pasture feeding as well?
Create a sheet for your colleagues with a few aspects about your breed, use pictures and try to do it clear structured.
Do a short presentation (5 minutes) about your results in the next lesson.

Sources

Arcuri, L. (2018) Raising Sheep on a Small Farm. Available on: https://www.thespruce.com/how-to-raise-sheep-3016859
Schoenian, S. (2018) Managing pastures for sheep. Available on: http://www.sheep101.info/201/pasturemgt.html
Picture Sufflok sheep: http://www.suffolkzucht.de/herkunft_und_aussehen.htm
Picture Texel sheep: https://www.alpinetgheep.com/texel.html
Picture Lacaune sheep: http://www.naturkost-west.de/index.php/schaeferhof
Picture Eastern Friesian: https://www.bzfe.de/inhalt/milchschafe-3240.html

Picture Merino: https://www.istockphoto.com/at/fotos/merino-schaf?sort=mostpopular&mediatype=photography&phrase=merino%20schaf
Picture Carinthian spectacle sheep: taken by myself in 2017

Key

2. Advantages: most natural way of keeping sheep, modest animal, fertile soil, protecting and gentle way of land use, animal welfare, way to reduce feed costs, extensive pastures can support biodiversity research of the pupils
3. Column 1: Sufflok, Merino, Carinthian spectacle sheep; column 2: Merino, East Friesian, Lacaune

Worksheet 5 SUSTAINABLE ASPECTS OF BREEDING CATTLE

University College for Agrarian and Environmental Pedagogy Vienna, Austria Specialization: Agrarian pedagogy

Read the text about uses and products of cattle, then fill in the gaps in the vocabulary list and answer the questions below!

Cattle are the most important domestic animals. They can change grass, which has little food value for people, into milk, which is rich in food value. They can do this because they have four stomachs to digest the food. Cattle, goats and sheep all digest their food in the same way and are called ruminants.

Some breeds of cattle are kept for their meat, others for their milk. In some countries, cattle are used for ploughing or for pulling carts.

Beef cattle have broad, fleshy hindquarters, a thick neck and short legs. They look almost rectangular in shape. Dairy cattle look bonier than beef cattle. Their udders are bigger and hang lower. They have long legs and slim hindquarters. They look wedge-shaped from the side, because the body tapers towards the head.

Most cattle have coats of thick, short hair. Some which live in cold climates have long hair to keep them warm. The skins of cattle can be made into leather.

Additionally, to those various usages and products of cattle and ruminants in general, they eat grass and therefore cultivate the cultural landscape. This again is important for our environment, because only then CO^2 is stored in the soil and oxygen is produced by photosynthesis. Furthermore, the maintained cultural landscape is important for tourism. In the mountainside, especially cattle as well as other ruminants can move quite good with their cloven hoofs.

	large ruminant animals with horns and cloven hoofs, domesticated for meat or milk,		*a material made from the skin of an animal by tanning or a similar process*
	having a substantial amount of flesh		*animal that chews the feed regurgitated from its rumen*
	the nutritional value of a foodstuff.		*area / region which is dominated by high hills and mountains*

1. How can cattle change grass (which has little food value) into milk? Please write your answer here:

_____

_____

2. What can be done with the skins of cattle? Please write your answer here:

_____

3. What is the difference between beef cattle and dairy cattle? Please write your answer here:

_____

_____

4. Identify the beef cattle and the dairy cattle!

Picture 1: _____ Picture 2: _____

5. Please write down, in which part of the cow´s body the milk is produced: _____

6. Cattle is the most important cultivator of the cultural landscape. What does that mean? What is your opinion about that? Please write your answer here:

_____

_____

6. According to Question 5: Think of the sustainable aspect of breeding cattle and discuss it with your seat neighbour!

Sources

There is no source of the text.
Dairy Cattle: https://de.wikipedia.org/wiki/Basfia_succiniciproducens#/media/File:Cow_female_black_white.jpg
Beef Cattle: https://de.wikipedia.org/wiki/Galloway_(Rind)#/media/File:Belted_Galloway_cow_J1.jpg

Key

(beef cattle)	large ruminant animals with horns and cloven hoofs, domesticated for meat or milk,	(leather)	a material made from the skin of an animal by tanning or a similar process
(fleshy)	having a substantial amount of flesh	(ruminant)	animal that chews the feed regurgitated from its rumen
(food value)	the nutritional value of a foodstuff.	(mountainside)	area / region which is dominated by high hills and mountains

1. They digest the feed in four stomachs (rumen—primary site of microbial fermentation, reticulum, omasum—receives chewed cud, and absorbs volatile fatty acids, abomasum—true stomach.
2. It can be made to leather.
3. Beef cattle have broad, fleshy hindquarters, a thick neck and short legs. They look almost rectangular in shape. Dairy cattle look bonier than beef cattle. Their udders are bigger and hang lower. They have long legs and slim hindquarters. They look wedge-shaped from the side, because the body tapers towards the head.
4. Picture1: dairy cattle, picture 2: beef cattle
5. The milk is produced in the udder.
6. They eat grass and therefore cultivate the cultural landscape. This again is important for our environment, because only then CO^2 is stored in the soil and oxygen is produced by photosynthesis. Furthermore, the maintained cultural landscape is important for tourism.

Worksheet 6 FROM BIOCONTROL AGENT TO INVASIVE SPECIES

Agricultural University Plovdiv, Bulgaria Specialization: Plant production

Invasive alien species are widely recognized as one of the main threats to global biodiversity. Expanding world-wide trade, globalisation of economies and climate change are the main factors, which allow the international movement and establishment of alien species (Roques, 2010).These alien species have already been shown to impose enormous costs on agriculture, forestry as well as to threaten human health and biodiversity (Vilá *et al.*, 2009). In the last 20 years several exotic pests of economic concern like for example: corn rootworm (*Diabrotica virgifera virgifera* LeConte), the chestnut gall maker (*Dryocosmus kuriphilus* Yasumatsu) or the harlequin ladybeetle (*Harmonia axyridis* Pallas) have invaded Europa. The biological control, used as an alternative to pesticides to control pest, is also effective method to manage invasive alien species. Under certain circumstances however, biological control agents can become themselves invasive species, like the case with the harlequin ladybird- an Asian biocontrol agent, which has become successful invader. *Harmonia axyridis* is believed to be an effective colonizer and strong competitor because it has a wide trophic niche, a high level of phenotypic plasticity for several of its life-history traits, is a voracious predator, and has strong dispersal capacities that allow it to undertake long range migrations to over-wintering sites (Adriaens *et al*, 2003).

1. With help of publication, internet etc., try to find answers to the following questions:

Delivering Alien Invasive Species Inventories for Europe

Picture 1

A) Which are the types the biological control?
B) What qualities should the natural enemy possess?
C) What are the stages of the invasion process?
D) What do you know about the DAISIE project?

2. Please connect the words with the appropriate definitions!

Hyperparasite	*Augmentation*	*Parasitoid*
An insect, whose larvae feed and develop within or on the bodies of other arthropods	*Parasite whose host, often an insect, is also a parasite*	*A type of biological control, which involves the supplemental release of natural enemies*

Picture 1 Picture 2

Source: https://www.aboutanimals.com/insect/harlequin-ladybird/

3. Please fill the blanks in the text with the following words:

APHIDS, COLOR, GENERATIONS (2), HIBERNATE, INSECTS, INTRODUCED, PHEROMONES, SOLITARY, TEMPERATURE

Harmonia axyridis, most commonly known as the harlequin, multicolored Asian, or simply Asian ladybeetle, is a large coccinellid beetle. This is one of the most variable species in the world, with an exceptionally wide range of _____ forms. It is native to eastern Asia, but has been artificially introduced to North America and Europe to control _____ and _____. The harlequin ladybeetle can be found on many crop species in agricultural areas where it has been _____. It is often found on deciduous trees, flowering plants, and other plant species found in open areas. In its native range, Harmonia axyridis generally has two _____per year, but in some places five _____ have been observed. Adults tend to live 30 to 90 days, contingent on _____, although some have lived over three years. Harmonia axyridis is a _____ species, although they often congregate over winter to _____Like many insects, the Asian ladybeetle communicates via vision and chemical/sensory signals through the release of various _____.

Sources

Adriaens, Tim; Gomez, Gilles San Martin y; Maes, Dirk, 2008. Invasion history, habitat preferences and phenology of the invasive ladybird Harmonia axyridis in Belgium. BioControl (Dordrecht). 53(1). FEB 2008. 69-88.

Roques A. (2010). Taxonomy, time and geographic patterns. Chapter 2. In Roques A et al. (Eds) Alien terrestrial arthropods of Europe. BioRisk 4 (1): 11-26.

Vilà, M. ,Basnou, C. , Pyšek, P. , Josefsson, M. , Genovesi, P. , Gollasch, S. , Nentwig, W. , Olenin, S. , Roques, A. , Roy, D. , Hulme, P. E. and , (2010), How well do we understand the impacts of alien species on ecosystem services? A pan-European, cross-taxa assessment. Frontiers in Ecology and the Environment, 8: 135-144.

Key

1.

A) There are three broad and somewhat overlapping types of biological control: conservation, classical biological control (introduction of natural enemies to a new locale), and augmentation.

B) A successful natural enemy should have a high reproductive rate, good searching ability, host specificity, be adaptable to different environmental conditions, and be synchronized with its host (pest).

C) The stages of the invasion process are: introduction, establishment, increase in abundance and geographic spread.

D) Delivering Alien Invasive Species in Europe (DAISIE) project funded by the sixth framework programme of the European Commission (Contract Number: SSPI-CT-2003-511202). It provides a 'one-stop-shop' for information on biological invasions in Europe, delivered via an international team of leading experts in the field of biological invasions, latest technological developments in database design and display, and an extensive network of European collaborators and stakeholders.

2.

Hyperparasite - parasite, whose host, often an insect, is also parasite

Augmentation - a type of a biological control, which involves the supplemental release of natural enemies

Parasitoid - an insect, whose larvae feed and develope within or on the bodies of other arthropods

3.

coccinellid; color; Asia, North America; Europe; aphids; scale insects; introduced; generations; generations; temperature; solitary; hibernate; pheromones

Worksheet 7 WHAT IS BIODIVERSITY AND WHAT IS THE IMPORTANCE OF FOOD SECURITY?

Agricultural University Plovdiv, Bulgaria Specialization: Plant production

"Biodiversity" is a word we use to emphasize the richness of nature. It discribes the variety of animals and plants and their habitats and genes. Biological species interact with their environment to create the ecosystems that support the life of living organisms like us. We cannot survive without nature, but too often we take it for granted.

Please watch these videos and answer the following questions.

1. **How is biodiversity distributed globally?**
   https://youtu.be/BTOHSRVqN20

2. **What are hot spots of biodiversity?**
   https://youtu.be/RaQBaVeEbW8

3. **Human activities that threaten biodiversity:**
   https://youtu.be/2RC3Hsk90t8

4. **How does climate change affect biodiversity?**
   https://youtu.be/XFmovUAWQUQ

1. Which human activity would most likely deplete finite resources?
A) Using natural enemies to eliminate pests
B) Developing wildlife sanctuaries
C) Reproducing at an uncontrolled rate
D) Regulating industrial pollution

2. Which of the following statements is an example of introducing a species that threatens biodiversity in a given geographical area?
A) It may not be able to survive in the new environment.
B) It can compete with local species for food and habitat.
C) It can mate with native species, resulting in new genetic combinations.
D) It can serve as a great source of food for native species.

3. Which of the following statements most accurately explains the oxidation phenomenon of the oceans?
A) The sea level will decrease as a result of global warming
B) The pH level in the oceans will decrease as a result of the increase in carbon dioxide in the atmosphere
C) The sea level of the oceans will increase as a result of global warming
D) The emergence of new marine species as a result of the increase of carbon dioxide in the atmosphere

4. Which of the following statements about the disappearance of the species on Earth is true?
A) The recent reduction in the amount of carbon dioxide in the atmosphere has led to the extinction of photosynthetic plant species.
B) The extinction of species is due only to natural cataclysms such as asteroids or volcanic activity.
C) The extinction rate is currently 1,000-10,000 times higher than the natural extinction rate.
D) The biodiversity of the Earth is constant, because the formation and extinction of species always happen at the same speed.

5. Which of the following is mostly responsible for increased carbon dioxide in the atmosphere?
A) Ocean acidification
B) Melting of polar ice caps
C) Burning fossil fuels
D) Increased photosynthetic activity in plants

Sources

https://www.khanacademy.org/partner-content/cas-biodiversity/where-biodiversity-is-found/distribution-patterns/v/distribution-how?modal=1
https://www.khanacademy.org/partner-content/cas-biodiversity/where-biodiversity-is-found/biodiversity-hotspots-cas/v/biodiversity-hotspot?modal=1
https://www.youtube.com/watch?v=2RC3Hsk90t8&feature=youtu.be
https://youtu.be/XFmovUAWQUQ

Key

1. C; 2. B; 3. B; 4. C; 5. C

Worksheet 8 CIRCUS PYGARGUS – FARMERS HELPERS

Agricultural University Plovdiv, Bulgaria Specialization: Plant protection

The *Circus pygargus* is a medium – sized daygrass bird with a body length of 42 – 46 cm, a wingspanof 115-125 cm and a weight of 330-420 g. It is found in Europe (including Bulgaria), Asia and Africa. It inhabits vast open areas. *Circus pygargus* is a migratory bird which feeds on small animals including as mammals, birds, lizards and insects. When birds rest they stay on the ground to be hidden from their enemies hatched. Nest on the ground, among reed, grass or in a bush. It lays 3-5 eggs, dirty white in colour. Incubation eggs is about 30 days, only by the female. The chiks hatch in a chronological order of laying the eggs and leave the nest a her about 35 days (although at the age of two weeks they may escape the nest and hide nearby in dense vegetation).

During the hatching and in the first days after hatching the male brings food to the females and the chiks. The female leaves the nest, meets him, accepts the food, and then returns. If a man or a predator approaches the nest, and starts screaming to warn the female that a danger is coming. Parents feed the juveniles for some time after leaving the nest. They grow one offspring every year. Some people call the *Circus pygargus* as aides for farmer, because they help fight pests by eating mice, lizards and insects.

Picture 1

Picture 2

1. Using Encyclopaedia, Publications, Internet, etc., try to answer the following questions:

A. Is the species endangered?

_____

B. Why do these useful and very beautiful birds disappear?

_____

C. Where in your country are the most habitats of Circus pygargus?

_____

D. When the young hatched and how many eggs are in one clutch?

_____

E. Is there sexual dimorphism in this species?

_____

F. Where does the Circus pygargus winter?

_____

2. Please fill in the empty spaces in the text with the following words:

environmentalists	*mice and mouse - rodents*	*pesticides used in agriculture*
mechanization of the field		*very interesting bird*

The Circus pygargus is a _____ who makes his nests in the tillable fields of wheat and barley. Also called clenched assistants in the field, these birds help fight pests in agriculture. The Circus pygargus feeds on _____ that it finds in the fields. Unfortunately, the bird is danger of extinction in Europe. For a long time, it is not found in the northern part of Bulgaria and has been steadily decreasing, alarming _____. The first reason of the species is disappearing is _____ against rodents, which reach this day-old feathered predator trough the food chain. Their other enemy is _____, especially during the harvest. The first days of harvest usually coincide with the last days before the chicks take off from the nests in the crops. Therefore they are often the victims of combine and other agricultural machinery. The little ones of Circus pygargus are unwelcome victims because people working in the field do not suspect their existence or do not know to find them and save them afterwards.

3. Discuss with your classmates how you could inform farmers about the existence of the species and its' disappearance and give some suggestions:

_____

_____

_____

_____

_____

Sources

https://greenbalkans-wrbc.org/e-ecodb.bas.bg/bspb.org/

Key

1.

A. The European population is less than 65 000 pairs.
B. Because of the mechanization of agriculture and the use of pesticides.
C. In Bulgaria, most birds of this species are in the southeast.
D. Chickens are hatched about 30 days after egg laying and can be 3 - 5.
E. This type has a pronounced sexual dimorphism.
F. *Circus pygargus* winter in Africa.

2. The *Circus pygargus* is a *very interesting bird* who makes his nests in the tillable fields of wheat and barley. Also called clenched assistants in the field, these birds help fight pests in agriculture. The *Circus pygargus* feeds *on mice and mouse - rodents* that it finds in the fields. Unfortunately, the bird is danger of extinction in Europe. For a long time, it is not found in the northern part of Bulgaria and has been steadily decreasing, alarming *environmentalists*. The first reason of the species is disappearing is is *pesticides used in agriculture* against rodents, which reach this day-old feathered predator trough the food chain. Their other enemy is *the mechanization of the field*, especially during the harvest. The first days of harvest usually coincide with the last days before the chicks take off from the nests in the crops. Therefore they are often the victims of combine and other agricultural machinery. The little ones of *Circus pygargus* are unwelcome victims because people working in the field do not suspect their existence or do not know to find them and save them afterwards.

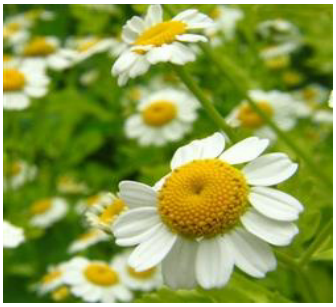
Worksheet 9

FROM BIOCONTROL AGENT TO INVASIVE SPECIES

Agricultural University Plovdiv, Bulgaria | Specialization: Agricultural policy

Why we need to help save the bees? They are vital to the health of agriculture and natural ecosystems. They help keep our planet green! They help fill our farms with crops – and our plates with delicious food! They make life a whole lot sweeter. Bees are also educational. Unfortunately, they are becoming increasingly rare due to a variety of reasons. Loss of habitat may be one. So try creating a bee habitat in your garden or balcony.
BEE the change!

1. These are bees' favourite plants! Match the pictures with their names.

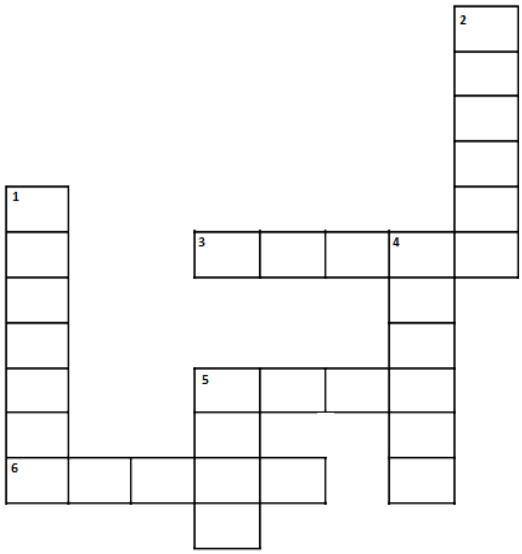


Words: APPLE TREE, PLUM TREE, SUNFLOWER, CHIVES, STRAWBERRY, LAVENDER, ROSEMARY, CHAMOMILE, CLOVER

2. How to save bees? Do you know what kills our little friends? Do not use pesticides (insect-killers) or herbicides (weed-killers) of any kind. The insecticides on your plants will harm and kill the bees that visit them, and herbicides will kill off those flowers that are desirable for bees. So keep them away and stay BIO. There are some other enemies. Guess who are they in a crossword.

DOWN

1. Two words. An insect. These pests eat unoccupied honey bee combs. You can see his flying cousin in your wardrobe.
2. Group of insects with hard front wings.
4. Air-breathing arthropod that has eight legs and chelicerae with fangs able to inject venom.
5. A mammal. Big, fluffy and scary looking. Lives in the forest, but you can see it in the ZOO. Black, brown or white. Loves honey!



ACROSS

3. A small rodent. An uninvited guest at your house. You can see it on the field or you can get one from the pet shop.
5. A specialised subgroup of theropod dinosaurs. It has feathers and it's toothless. Can fly.
6. A man, woman, or child of the species Homo sapiens, distinguished from other animals by superior mental development, power of articulate speech, and upright stance.

3. ECO-friendly challenge! GIVE UP plastic straws for a week!
The straws we use once end up in the seas and the oceans. Fight the plastic pollution! Challenge your friends, family and yourself.
Why do this…?


Picture 1


Picture 2

When you can reuse it!


Picture 3


Picture 4


Picture 5

Sources

https://www.best-pennywise-tips.com/how-to-attract-bees.html

Key

1. 1) strawberry, 2) chives, 3) rosemary, 4) chamomile, 5) lavender, 6) sunflower, 7) plum tree, 8) apple tree, 9) clover
2. Down: 1) wax moth, 2) beetle, 4) spider, 5) bear
Across: 3) mouse, 5.) bird, 6) human

Worksheet 10 FACTORY FARMING

Institute of Education and Communication, Czech Republic Specialization: Animal husbandry

Do you know what the Meatrix is? It is the generally spread lie about the origin of meat, which we believe in. At least this is what the authors of this witty, animated parody on the popular sci-fi movie Matrix tell us. The mysterious bull Moopheus unveils the truth to Leo, the pig, about his life, when he offers him a pill, which discloses the truth about the real world he lives in. The pleasant family-owned farm, where Leo has been living until now disappears and Leo and Moopheus find themselves in a large-scale industrial hog farm. Leo gradually finds out how people treat farm animals: they keep them in small enclosed spaces with no opportunity to run outside and give them low quality feed. At the same time, large farm are a burden on the environment in the surrounding area. Will Leo want to return to the fantasy land or will he decide to fight for the truth and join Moopheus and his friends.

1. Please watch the video about MEATRIX: https://www.youtube.com/watch?v=DHMOhXjg90g
After watching this video, please answer these questions:

A) What is the film "Meatrix" about? _____

B) Who is the main character? _____

C) Who is Moopheus? _____

2. Please fill answer to the statements with closed answers YES or NO. After that please count with other fellow students ' number of answers YES and NO within your classroom.

STATEMENT	*YOUR ANSWER YES/NO*
I like meat; it is my most favourite meal.	
I eat meat every day.	
I eat meat 3-5 times a week.	
I have thought about where meat (and other animal products) comes from.	
I want to know where meat and other animal products come from.	
I do not eat meat at all.	
I buy meat in a supermarket.	
I buy meat in a local shop.	
I buy meat on a farm.	
I never buy meat.	
Meat is healthy.	
Meat is unhealthy.	

3. Decide if the following statements are TRUE (T) or FALSE (F) in factory farming:

STATEMENT	*TRUE/FALSE*
A) A lot of antibiotics and pesticides are used for fighting with the diseases and bacteria.	
B) Growth hormones are used for stimulating growth of animals.	
C) These farmed animals live their entire lives in small, dark spaces.	
D) These animals are still healthy and so is their meat.	
E) Large farms positively impact the environment around them.	

4. On the next sheet of paper, please draw a picture of typical factory farming (=intensive animal farming).

Key
1. A) about negatives and threats of factory farming, B) pig Leo, C) bull
2. Each answer is correct
3. A) T, B) T, C) T, D) F, E) F

Worksheet 11 CATTLE BREEDING AND ITS CONSEQUENCES ON ENVIRONMENT

Institute of Education and Communication, Czech Republic Specialization: Animal husbandry

The cattle's breeding is the biggest part of the animal production in Europe. That includes dairy and beef industry. Today, the main aim of cattle breeding is the financial profit. The farmer must include many factors into his management, for example nutrition, production, fertility, health of animals, profitability, death ratio, breeding new cows, genotype, the final product realization, environment and stabling. The most used stabling of dairy cows is indoor. The halls are divided into several parts. Beef cattle are more commonly kept on pasture with winter stabling option.

The most discussed ecological topic connected to cattle is methane production. 30 % of methane in the atmosphere is due to ruminant breeding industry (Wallace et al 2015).

With lower digestibility of pasture there is a higher production of methane (Todd et al. 2018).That means, more natural the type of the pasture for a cow is, more methane the cow products. A cow spends 8-9 hours by pasturing and 6-7 hours ruminating per day in natural conditions (Tribe 1955).

Cow is a social animal living in a herd. Every individual is able to recognize and to remember its own social position towards up to 70 other herd members (Fraser & Broom 1997). In commercial dairy farms it can be found up to 500 cows in one herd. Next to it, the cow is often transferred between sectors and groups according needs of a production or a management. This disturbs the social connections between cows.

Intensive farming has brought a negative impact on the environment and the welfare of animals. Hight density of animals brings higher risk of illnesses. Higher need for a treatment leads into an increase of pathogen´s resistance. The amount of manure and its processing also increases the level of methane. Intensive farming negatively influences the biodiversity and nature in close surroundings. Animals are kept in conditions that don't allow to express natural behaviour – from nutrition through reproduction to everyday routine. Today, the official goal of farmers is the financial profit (Stupka 2010).

1. For what have cows been used except of dairy and beef production nowadays or in the past?

_____

_____

2. Connect sectors and types of stabling with categories of cows in the intensive dairy production system.

A. Outdoor individual hut
B. Kindergarten
C. Breeding stall (1 to 2 years old)
D. Dry-standing and lactating sectors

I. Weaned calf on a solid diet
II. Dairy cow
III. New-born calf (0-7 weeks old)
IV. Heifer

3. Identify if the statement is true or false.

Consequences on a future of a cattle industry and a welfare of animals	*True or False*
Restriction of pasture and less movement for animal	
The cow will spend by feeding up to 15 hours per day	
Smaller possibility to express a natural behaviour	
The feeling of satiety	
Greater presence of stereotypical behaviour	

4. Discuss in groups and write down how can this situation influences for example a welfare of individuals, a production and farm employees.

_____

_____

_____

_____

_____

_____

_____

Picture 1

5. Do you agree with these statements? What do you think about animal production status nowadays? What suggestions for its improvement do you have? Would it be good to involve public into this change and how? Prepare your opinions and facts for live discussion.

Picture 2

Picture 3

Sources

Frazer AF & Broom DM. 1997. Farm Animal Behaviour and Welfare. CAB International.

Tribe DE. 1955. The behaviour of grazing animals. In Progress in the Physiology of Farm Animals. Ed. J. Hammond. Vol. II, Pages 285. London: Butterworths.

Todd R, Moffet C, Neel J, Turner K, Steiner J, Cole A. 2018. Improved Practices to Conserve Air Quality, Maintain Animal Productivity, and Enhance Use of Manure and Soil Nutrients of Cattle Production Systems for the Southern Great Plains. American Geophysical Union. #358880

Wallace RJ, Rooke JA, McKain N, Duthie CA, Hyslop JJ, Ross DW, Waterhouse A Watsin M, Roehe R. 2015. The Rumen Microbial Metagenome Associated with High Methane Production in Cattle. MBC Genomics 16:839.

Pictures (chronologically)

Milking - https://www.canr.msu.edu/news/aggressive-dairy-reproductive-management-decisions-are-critical-even-in-tough-economic-times

Dairy farm - https://www.viva.org.uk/promise

Happy cow milk - https://www.stuff.co.nz/business/farming/dairy/99217709/mobile-milking-breaking-the-dairy-model-in-north-canterbury

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Key

1. Grazing of inaccessible areas, leather, transport, help with tillage, entertainment as bull fighting or rodeo, …
2. A-III, B-I, C-IV, D-II
3. True, False, True, False, True
4. Fights in group brings higher amount of stress and risk of injuries, worse mental status of animals has negative effect on production and profit, more work for employees with injured or ill cows, unstable groups of animals make more difficult to create more personal relationship between animal and keeper, unstable groups create worse environment for individual animals who can suffer from lack of sleep and food, in general it lower the level of welfare of animal.

Worksheet 12 GENERATIONS OF BIOFUELS

Institute of Education and Communication, Czech Republic Specialization: Plant production

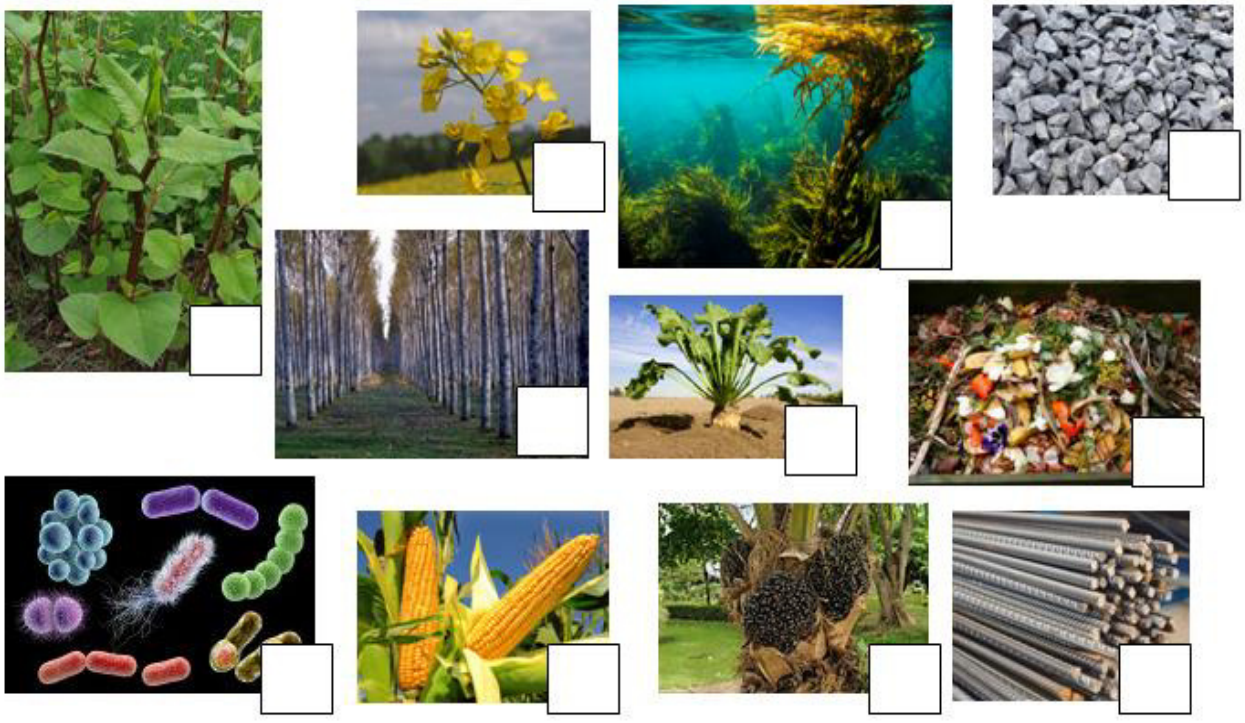
Biofuels are energy sources made from recently grown biomass (plant or animal matter). Biofuels have been around for a long time but petroleum and coal have been used primarily as energy sources due to their high abundance, high energy value and cheap prices. Fossil fuels such as coal and petroleum also come from biomass but the difference is that they took millions of years to produce. Biofuels are making a resurgence due to increasing oil prices, dwindling fossil fuel reserves, the desire to have a renewable, reliable source of energy and as a way to mitigate the effects of climate change.

Biofuels are a renewable resource because they are continually replenished. Fossil fuels on the other hand are not renewable since they require millions of years to form. There are three types of biofuels: 1st, 2nd and 3rd generation biofuels. They are characterized by their sources of biomass, their limitations as a renewable source of energy, and their technological progress.

The main drawback of the first generation biofuels is that they come from biomass that is also a food source. This presents a problem when there is not enough food to feed everyone. The second generation biofuels come from non-food biomass, but still compete with food production for land use. Finally, the third generation biofuels present the best possibility for alternative fuel because they don't compete with food. However, there are still some challenges in making them economically feasible (Bowyer et al. 2018).

Watch also this video, it can help you to understand this topic:
https://www.youtube.com/watch?v=ZGmwtDffc74

1. Mark in following picture, which one of presented sources can be used like raw material for producing biofuels. Mark also for which generation of biofuels it can be used.
Please, use this symbols: 1. (for 1st generation); 2. (etc.), 3. (etc.); X (if you think that it cannot be used like raw material for biofuel)



2. Try to shortly characterize each generation of biofuels. You can use useful information from the introduction text or video.

1st generation *2nd generation* *3rd generation*



3. Following to the introduction text, try to think about problems or positives of using or producing biofuels for environment. Write three main advantages and three disadvantages

+ _____

+ _____

+ _____

- _____

- _____

- _____

4. Think about biofuels. Which generation of them is the most perspective source of energy for future and which one of them is the most eco-friendly? What would have to happen for replace fossil fuels with biofuels? Discuss in a pairs...

Picture 1

Picture 2

Picture 3

Sources

Bowyer, J., Howe, J., Levins, R. A., Groot,
H., Fernholz, K., Pepke, E., & Henderson, C. (2018). Third generation biofuels implications for wood-derived fuels.

Key

1. Japanese knotweed (2), oil seed rape (1),algae (3), gravel (X), black poplar forest (2), beet (1), bio-waste (2), microbes (3), maize (1), palm oil tree (1), iron (X)

2.

1st generation: Biofuels come from biomass that is also a food source.
2nd generation: Biofuels come from non-food biomass.
3rd generation: Biofuels come from algae.

3.

Advantages: For example: Renewable, employment in local farms, eco-friendly.
Disadvantages: For example: Burning food (1st generation), exhaust the soil (2nd generation), We don’t have rentable technology for producing it jet (3rd generation).

Worksheet 13 THE OPTIONS OF REGULATIONS OF BROAD-LEAVED "RUMEX SP."

Institute of Education and Communication, Czech Republic Specialization: Plant protection

Permanent grasslands are natural or artificial permanent cultures of forage species, as grass, legumes and other monocotyledonous and dicotyledonous species. For farming are the most important meadows and pastures. As in other crops also in permanent grasslands grow some weeds. It is harder to determine what is weed in permanent grassland, than in arable land. Some species are good parts, but at higher presence are considered as a weed. Some species are considered as absolute weed, which means that they cause damage in any presence. Two of these weeds are *Rumex crispus* and *Rumex obtusifolius*.

Rumex species love intensively fertilised grasslands, especially meadows, where are able to create a lot of seeds and quickly multiple. They do not occur in pastures at frequent grazing, because they are not able to multiple themselves. Their disadvantage is in rapid creation of low-quality biomass, the shadowing of other plants and the creation of tens of thousands of seeds that are able to survive in the soil for ten years.

Organic regulation of Rumex species lies in next principles:

1. Biological regulation of plants

There is tested the option of the use of natural enemy Green dock beetle (*Gastrophysa viridula*) and Rust (*Uromyces rumicis*). In practical use it is problematic.

2. Mechanical regulation of plants

Because the elimination of overground biomass of *Rumex* species is little effective, it is necessary to eliminate the underground biomass. We can engrave roots with a simple tool, which is adapted for the depth of 15 – 20 cm. The efficiency of this method is 20 – 80 plant per hour, depending to workers skill. In Austria, they developed machine with rotor, which crush the plants into depth of 15 cm. The efficiency of this method is 400 – 600 plants per hour.

3. Thermal regulation of plants

There are used two methods: a) regulation with steam under the big pressure (efficiency is about 80%), b) regulation with microwave radiation (efficiency is 80 – 99 %) The main problem of this method is energetic consumption.

DICTIONARY:

Legumes- group of plants that belongs to family *Fabaceae*, which are fixing nitrogen from the air
Meadows- mowed grasslands
Pastures- grazed grasslands, where cattle live all or only in part of season
Crops- the plants, from which we have some benefits
Weeds- the plants, which cause damage in crops
Arable land- territory where are growing temporary species (always one year)
To fertilise- add some nutrients, which are necessary to grow a crop (mostly N, P, K, Ca…)
Rust- group of sponge from department *Basidiomycota*, which have typical rusty colour
Steam- water in gas state.

1. Write down what would be reasons why we grow permanent grassland:

_____

_____

Picture 1: Green dock beetle

Picture 2: Rust (Uromyces rumicis)

Picture 3: Rumex crispus

2. Connect by lines the following characteristics with the ecosystems, they are typical for (organic and conventional)

organic farming ☐

conventional farming ☐

A. sustainability
B. pesticides
C. organic fertilisers
D. mineral fertilisers
E. hand work
F. profit
G. responsibility
H. local-farming
I. large companies
J. new technologies
K. precise farming

3. In a short discussion in groups decide for some type of regulation or their combination, and then give a short presentation to the class about next possible advantages. Think about next few questions s and decide for the method
A) What method is probably the less time-consuming?
B) For what method you will probably use sprayer?
C) What method is the most and the less expensive in your opinion?
D) What method is the most eco-friendly?

For each method try to write down as much possible eco-hazard as you can imagine.
A) Biological regulation

_____

B) Mechanical regulation

_____

C) Thermal regulation

_____

Key
2. Organic farming: A, C, D, E, F, G, I, H, J, K; conventional farming: B, C, D, E, F, I, J, K

Worksheet 14 PLANT LIFE CYCLE (LEGUMES EXAMPLE AND ASSOCIATED ECO-FRIENDLY ADVANTAGES)

ENSFEA Toulouse, France Specialization: Plant science

Every living thing goes through changes. Living things grow through different stages. Then they reach the end of their life cycles and die. There are many kinds of plants. Each kind has its own life cycle. Many plants start their life cycles as a seed. The seed needs certain things, or it will not grow into plant. Sometimes seeds wait in the ground until they can get the things they need. They wait for warmth from the sun. They wait for water. When they have what they need, they start to grow. A tiny little sprout will push out of each seed. The sprouts stretch up until they poke through the dirt and into the air. The plants continue to grow when they get sunshine and water. The stems grow taller and leaves unfold. More leaves and stems grow on the main stems. The adult plants grow flowers. The flowers of many plants make fruit. The fruit has seeds inside it so more new plants can grow. When a seed begins to grow, it is the beginning of another plant life cycle ("Plant Life Cycles | 2nd Grade Reading Comprehension Worksheets," n. d.). There are four stages in the life of a bean plant: 1). The seed is the capsule in which the new plant is housed. 2- Germination is the process in which the baby plant emerges from the seed hull. 3- Leaf growth begins when the seedling grows its true sets of adult leaves (as opposed to the immature initial leaf structures). 4- Flowering stages reveal that the plant has fully matured and is ready to begin reproducing (Andy Martin Gardening Instructor, n. d.). For instance, the figure1 shows the life cycle of a bean plant which is a legume. Legumes still rank among the most important of all staple food crops, especially the pulses (edible seeds), such as peas and beans, chickpeas, and lentils. Legumes are also important as cover plants to hold and stabilize soils, as nutrient-rich feed for livestock, and as green fertilizer) ("Plant Life," n. d.). legumes contribute to reduce the emission of greenhouse gases, as they release 5–7 times less GHG per unit area compared with other crops (Stagnari, Maggio, Galieni, & Pisante, 2017). Bean is an eco-friendly plant that during its growth with the help of Rhizobium bacteria in the root nodes fixes Nitrogen needed for the Plant growth and then contribute to soil Nitrogen. It is used in crop rotation with for instance wheat to contribute to soil richness in terms of soil macronutrient (Nitrogen).

Answer the following questions based on the reading passage. Don't forget to go back to the passage whenever necessary to find or confirm your answers.

1. What is the process of living, growing, changing, and dying called?

_____

2. How do many plants begin?

_____

3. Where can you usually find seeds in an adult plant?

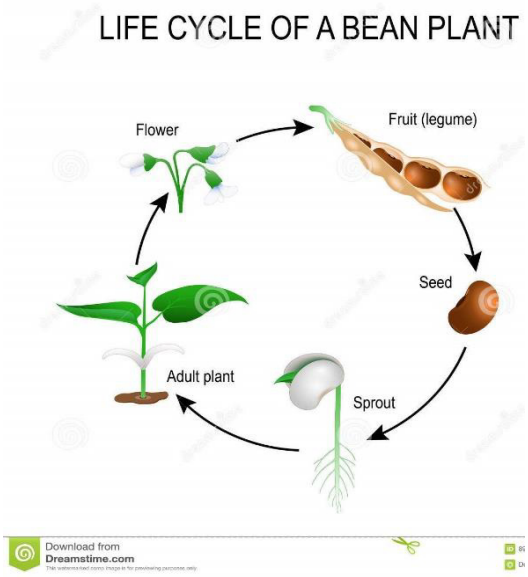
_____

4. How does the crop rotation using legume benefit the soil?

_____

5. How can legumes prevent soil erosion?

_____



Picture 1: Life cycle of a bean plant

6. Compare of GHG produced by legumes and other crops. Which one is more eco-friendly?

_____

_____

Sources

https://www.dreamstime.com/stock-illustration-life-cycle-bean-plant-stages-growing-seed-most-common-example-seed-to-adult-image89668879
Andy Martin Gardening Instructor. (n.d.). Life Cycle Bean Plant. Retrieved April 4, 2019, from Love To Know website: https://garden.lovetoknow.com/garden-basics/life-cycle-bean-plant
Plant Life Cycles | 2nd Grade Reading Comprehension Worksheets. (n.d.). Retrieved April 4, 2019, from https://www.k12reader.com/worksheet/plant-life-cycles/
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Stagnari, F., Maggio, A., Galieni, A., & Pisante, M. (2017). Multiple benefits of legumes for agriculture sustainability: an overview. Chemical and Biological Technologies in Agriculture, 4(1), 2. https://doi.org/10.1186/s40538-016-0085-1

Key

1. Life cycle
2. As seeds
3. In the fruit
4. At the end of growth period, when the biomass of this legume plant is added and ploughed in the soil, it enhances the nitrogen level of the soil.
5. Cover crops helps stabilizing the soil and avoids soil erosion.
6. The GHG produced by legumes is 5-7 times less then by other crops. So, legumes are more eco-friendly.

Worksheet 15

HOW "FOOD MILES" IMPACT OUR ENVIRONMENT?

ENSFEA Toulouse, France — Specialization: Agro-economy

Global trade has resulted in more and more products travelling ever-increasing distances from production to final consumption and disposal, which lead to the concept of "food miles", a phrase coined by Tim Lang, renowned professor of food policy at London's City University, known for his ground breaking work in many areas of food, health, and environmental impact. The term implies the complex impacts underlying the food system, such as energy use and contribution to climate change, dependence on fossil fuels, traffic congestion as well as social and economic impacts on rural communities and developing countries.

Here is a cool fact: Food miles of a food is the highest if it is transported by road. Road transport produces 60% of the world's food transport carbon emissions.

Eating local means fewer food miles, which equals fewer emissions from transport vehicles, including airplanes, ships, and trucks. A comparison between locally grown and conventionally grown produce found that local-grown produce travels about 50 miles to reach the consumer's table half a day from harvest, while conventionally grown produce travels 1,500 miles and reaches the table 13 days past harvest. Conventional food distribution uses 4-17 times more fuel and emits 5-17 times more CO_2 than local and regional systems, according to an Iowa study. Local food systems rely upon a network of small, family farms, which are usually sustainably run, meaning they minimize pesticide use, practice no-till agriculture and composting, minimize transport to consumers, and use very little or no packaging.

Watch the video https://www.youtube.com/watch?v=_t0orGGOfAA about a journey of shrimps and answer the following questions.

A) What are "food miles"?

B) What impact do they have on our environment?

C) What can we do to reduce the food miles and its impacts?

Picture 1

Source : https://www.dailymail.co.uk/femail/food/article-5417253/How-McDonalds-UK-Big-Mac-travels-8-000-MILES.html

Sources

Cerasela Stancu and Ann Smith, Food Miles – the international debate and implications for New Zealand exporters, Business & Sustainability Series Briefing Paper 1.

2. L. SIRIEIX, G. GROLLEAU, B. SCHAER, Consumers and Food miles, presented to the AIEA2 and SOBER International 3. Conference, Londrina Parana, Brazil, 22th – 27th July 2007

http://cercenvis.nic.in/PDF/foodandenv.pdf

http://www.pollutionissues.co.uk/food-miles-environmental-impact-food.html

https://sharonpalmer.com/2016-08-30-the-impact-of-food-miles/

Key

A) Food miles are the distance a certain food travels from its point of origin to its point of destination to consume. It is one of the factors used to assess the carbon footprint and environmental impact of food.

B) The longer the distance, the higher the level of food-processing required – implying that long-distance transport of food is responsible for additional emissions due to increased food-processing and packaging.

C) Shop locally and use public transportation system to the farm directly. Buy fresh seasonal produce grown locally. Buy food with as little packaging as possible. Buy organic produce, etc.

Worksheet 16 FARMING IN AN ECO-FRIENDLY WAY

ENSFEA Toulouse, France Specialization: Food production

The increase in world population has led to the increased demand of food. However the available arable land keeps decreasing as a result of urbanization. As a result farmers started to look for options to increase production per hectare without increasing the land cultivated. This is the reason for increased adoption of Conventional farming. Farmers use a lot of synthetic inputs to increase their output. However, high-external input, resource-intensive agricultural systems have caused massive deforestation, water scarcities, biodiversity loss, soil depletion and high levels of greenhouse gas emissions("Designing agro-ecological transitions; A review |SpringerLink," n.d.).
Agro-ecology is a key part of the global response to the impact of conventional farming, offering a unique approach to meeting significant increases in our food needs of the future while ensuring the conservation of natural resources. Agro-ecology is an integrated approach that simultaneously applies ecological and social concepts and principles to the design and management of food and agricultural systems. It seeks to optimize the interactions between plants, animals, humans and the environment while taking into consideration the social aspects that need to be addressed for a sustainable and fair food system(Falco & Perrings, 2003).
An Agro-ecological practice is characterized by the diversity of crops, minimal/no use of synthetic inputs, synergies; efficiency; resilience; recycling; co-creation and sharing of knowledge, Human and social values; culture and food traditions.
Agro-ecology is important because it goes beyond short-term goals and improves the long-term health and sustainability of agricultural systems. An important feature of Agro-ecology is its lack of dependency on petrochemicals and oil in the cultivation of plants. Agro-ecology also promotes more efficient and less depleting uses of water and land than industrial agriculture. Soil ecosystems are better preserved. The principles of Agro-ecology also add to the aesthetics and health of human environments("(9) EE 101: 'Sustainable Farming through Agro-ecology' by Stephen Gliessman with Mark Bittman - YouTube," n. d.). The methods of Agro-ecology invite participation by non-professionals as well as professionals in ideas and activities that are cognitively and emotionally rewarding to human beings (Gliessman, 2018).

1. Read the text above and write the differences between conventional farming and Agro-ecological farming

CONVENTIONAL FARMING	*AGROECOLOGICAL FARMING*

Picture 1 and 2: Examples of conventional farm planting only one crop, one variety ,heavy soil preparation, and a high use if chemicals

2. What could be the possible solutions for the problems below in Agro-ecological farming where the use of chemicals is prohibited?

PROBLEMS	***POSSIBLE SOLUTIONS***
A) Existence of pest in the farm	
B) Soil degradation	
C) Pollution by nitrate	
D) Loss of biodiversity	
E) Water scarcity	

Picture 3 and 4: Example of Agro-ecological farm with diversity of crops and varieties, no use of chemicals and light machinery on soil preparation

Sources

EE 101: "Sustainable Farming through Agroecology" by Stephen Gliessman with Mark Bittman - YouTube. (n.d.). Retrieved March 30, 2019, from https://www.youtube.com/watch?v=ObffHbRuJgc.
Designing agroecological transitions; A review | SpringerLink. (n.d.). Retrieved March 30, 2019, from https://link.springer.com/article/10.1007/s13593-015-0318-x.
Falco, S. D., & Perrings, C. (2003). Crop Genetic Diversity, Productivity and Stability of Agroecosystems. A Theoretical and Empirical Investigation. Scottish Journal of Political Economy, 50(2), 207–216. https://doi.org/10.1111/1467-9485.5002006.
Gliessman, S. (2018). Defining Agroecology. Agroecology and Sustainable Food Systems, 42(6), 599–600. https://doi.org/10.1080/21683565.2018.1432329.

Key

1.

CONVENTIONAL FARMING	AGROECOLOGICAL FARMING
Based on economical orientation	Based on ecological orientation
Use monoculture crops	Diversity of crops and varieties
Use synthetic fertilizers	Use compost and organic matter
Air and water pollution is common	No problem of pollution
Soil fertility is maintained for a short term	Soil fertility maintained on a long term basis
Intensive irrigation required	Minimal irrigation requirements

2.

A) Biological control-biological control of pests means no pesticides are applied, this means that people and the environment are protected from the effect of pesticides.
B) Cover crops-cover crops will protect the topsoil from events such as leaching of nutrients.
C) Legumes-mixing legumes and other crops will help minimize the use of nitrogen fertilizers because legumes can utilize the nitrogen in the atmosphere, thus no nitrogen fertilizer needed to be applied.
D) Local and mixed breeds-farming with local and mixed breed is a way of conserving the biodiversity and not only one breed is allowed to grow.
E) Minimum irrigation- The reduced use of water on crop is an efficient way to save water.

Worksheet 17 INFRASTRUCTURE OF AGRO-ECOLOGY

ENSFEA Toulouse, France Specialisation: Horticulture

Today the IAE are an important part of the biodiversity and are a subject to know, the IAE are the future of agriculture and French horticulture. It is useful to all human beings living on this planet to know the IAE and there are different types of IAE, they can be used in several ways. An IAE is an Agro Ecological Infrastructure for example the establishment of a hedge on the edges of the cornfields the hedge is an agroecological infrastructure. It allows the reproduction of auxiliary and also of windbreaker and storm IAE has several functions:
- An economic function, farmers in France using PSI have seen a considerable reduction in their use of plant protection products. Biodiversity enables soil restructuring and crop auxiliary reproduction.
- A socio-economic function Farmers using AEIs have seen their health improve because they no longer use phytosanitary products. Today we know that phytosanitary products are the causes of many cancers (skin cancers in particular)
- An environmental function, the IAE allow cultivation aids (ladybug, hover fly, bee) to create their nests in crops and thus to pollinate them later or to destroy the harmful potential present on crops.

1. What does IAE mean? Please write down your answer

_____

2. Name at least 3 types of IAE existing in France:

_____

_____

_____

3. In the form of a table describe the advantages / disadvantages of an IAE.

ADVANTAGES	*DISADVANTAGES*

4. How are PSIs useful for sustainable development?

_____

_____

_____

_____

_____

_____

_____

Sources *Picture 1*

https://fr.wikipedia.org/wiki/Infrastructure_agro%C3%A9cologique
https://hal.archives-ouvertes.fr/hal-01461090/
https://www.herbea.org/fr/glossaire/Infrastructure+agro%C3%A9cologique
http://www.ecophytopic.fr/tr/ecophytopic-et-ses-actus/les-synth%C3%A8ses-decophytopic/les-infrastructures-agro-%C3%A9cologiques

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Key

1. Agro-Ecological Infrastructure
2.

Hurdles in the curbs in the fields
Sowing flowers in the fields to bait crop auxiliaries
Set up different crops on the same production field (Corn / climbing beans)

3.

Allows breeding of crop auxiliaries	Efficiency of the IAE
Allows to have a diversity of cultures on the same field	Root competition with main production
Allows a better quality of pollination thus a better yield	Size of the IAE: An IAE must have a sufficient size in the field to have a correct efficiency

4.

They are useful for sustainable development because:
Improve pollination
Enable biodiversity of a field
Do not use pesticides or reduce the use of phytosanitary products

Worksheet 18 IS PLASTIC FANTASTIC?

Humboldt University Berlin, Germany Specialization: Ecology

The world population is living, working, vacationing, increasingly conglomerating along the coasts, and standing on the front row of the greatest, most unprecedented, plastic waste tide ever faced. Plastic is versatile, lightweight, flexible, moisture resistant, strong, and relatively inexpensive. Those are the attractive qualities that lead us, around the world, to such a voracious appetite and over-consumption of plastic goods.

But on the other hand, the removable plastic product are not friendly to the environment. It is impossible to destroy them or many people do not collect plastic in order to recycle them.

On our planet, there are thousands square miles polluted by plastic waste. If people do not change their habits, the Earth will be not a planned for living of human being.

Shocking report reveals that 95% of plastic polluting the world's oceans comes from just TEN rivers including the Ganges and Niger. About five trillion pounds is floating in the sea, and targeting the major sources - such as the Yangtze and the Ganges - could almost halve it, scientists claim. The team calculated halving plastic pollution in these waterways could potentially reduce the total contribution by all rivers by 45 per cent.

The 10 most polluting rivers are: Yangtze in East China Sea Asia, Indus in Arabian Sea Asia, Yellow River and Hai He in Yellow Sea Asia, Nile in Mediterranean Africa, Ganges Bay of Bengal Asia, Pearl River and Mekong in South China, Amur Sea of Okhotsk Asia, Niger Gulf of Guinea Africa. South China Sea Asia.

Picture 1: Plastics today - key challenges

1. Please write AT LEAST THREE advantages and disadvantages about plastics in the following empty lines.

ADVANTAGES:

A. _____

B. _____

C. _____

D. _____

E. _____

DISADVANTAGES:

A. _____

B. _____

C. _____

D. _____

E. _____

2. What plastic products would you have problem to live without? Please write down at least three products:

A. _____

B. _____

C. _____

D. _____

E. _____

Picture 2

3. Please watch video about plastic waste and answer questions: https://www.youtube.com/watch?v=UynITtG7HLE

From which five countries comes the biggest plastic waste in the world?

COUNTRY 1: _____

COUNTRY 2: _____

COUNTRY 3: _____

COUNTRY 4: _____

COUNTRY 5: _____

4. What can happen if government banns the plastic materials? Please describe what we can get or loose.

_____

_____

_____

5. Please watch 2 minutes long video. How do you feel after watching?
https://www.dailymail.co.uk/sciencetech/article-4970214/95-plastic-oceans-comes-just-TEN-rivers.html

Sources

https://eur-lex.europa.eu/legal-content/EN/TXT/DOC/?uri=CELEX:52018DC0028&from=EN
https://www.euractiv.com/section/circular-economy/opinion/plastics-strategy-eu-must-heed-example-of-best-practices/
http://www.dailymail.co.uk/sciencetech/article-4970214/95-plastic-oceans-comes-just-TEN-rivers.html

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Key

1. Advantages: cheap to produce, use in electrical installations, unbreakable, odourless, light to carry
Disadvantages: low heat resistant, poor ductility, soft, can causes CANCER, some are impossible to recycle – it causes large waste, some less developed countries do not know how the handle waste policy
2. For example packing material, building material, construction, electronics items…
3. China, Indonesia, Philippines, Thailand and Vietnam

Worksheet 19 IMPACT OF HORSE KEEPING ON THE ENVIRONMENT

Humboldt University Berlin, Germany Specialization: Animal husbandry

We are all familiar with the benefits we derive from horses' ownership, including a large contribution of these gentle giants to our physical and mental wellbeing, yet benefits accrue to the community as well from having horses in the neighbourhood, ranging from socioeconomic to environmental. As horses' ownership increases throughout the developed world, these benefits need to be better recognized and incorporated into land-use planning efforts. For example, horses are an ecological means of transport, as well of logging in, natural reservation´s forest; grazing of horses brings balance into less easy accessible loans and finally, spending time with horses is an ecological alternative of free time activity.

Good grazing management is an important means of preserving animal health, grazing and sustainable farming. It is important to control grazing in terms of species composition due to possible dangerous plant species and proper nutritional value. The number of animals should correspond with the pastureland size so that the animals do not destroy the plants by excessive grazing or, on the contrary, they are able to graze on the grass at the time when the plants are the most digestible for the animals.

On the other hand, bad grazing management can cause destroying the pastureland by stinging, scraping or insufficient grazing or by the use of pesticides and chemical fertilizers. Poor handling of grazing can cause contamination of rivers or other water sources by horse excrements or it can lead to the formation of a mud, and thus the soil becomes unproductive due to the inability to process water and nutrients. The use of water cans with insufficient measures against health hazards (insect larvae, algae, manure) is also a very wrong decision.

In practice, we distinguish three basic types of horses stabling:

1. Internal: – binding, box, loose with deep bedding
– with or without paddock
2. External: grazing (pasture)
3. Seasonally combined

Internal stabling of horses has both positive and negative impact on the environment:

ADVANTAGES	DISADVANTAGES
- easier, accurate cleaning	- larger muck production
- higher hygienic standard	- air pollutants
- lower space requirements	- larger water consumption (cleaning…)
	- industrial processing of feed - hay, granules
	- industrial processing of straw or other bedding

1. Similarly, to the above explained impact of the internal stabling of horses on the environment, list at least three advantages and three disadvantages of the external stabling of horses.

ADVANTAGES *DISADVANTAGES*

_____ _____

_____ _____

_____ _____

2. Discuss in pairs, how the horses on pasture will affect:

A) meadow _____ *C) insect* _____

B) wild animals, birds _____ *D) possible fire* _____

3. Select a concrete farm in your region and create a short PPT presentation on the impact of its activities on the environment. Briefly describe the farm (number of livestock, type of production, etc.) and point out how it affects the environment. In case of negative effects, suggest how to avoid them and offer more environmentally friendly activities.

Picture 1

Sources

Bolte, D. (2014). Ecological Benefits of Horses. ELCR. Available on: https://elcr.org/ecological-benefits-of-horses/
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Harveston, K. (2017). 3 Ways Horses Make Our Earth a Better Place. Greentumble. Available on: https://greentumble.com/3-ways-horses-make-our-earth-a-better-place/

Picture 2

Key

1. ADVANTAGES: natural conditions; smaller production of muck; grazing as a feed and a bedding; sustainability of the land architecture; support for a local biodiversity; less water consumption…
DISADVANTAGES: higher incidence of parasites; possible contamination of natural water resources; greater territorial requirements; less horse control (greater risk of injury or their escape); preventing wildlife migration due to fencing...
2.
A) No overgrown grass, space for floral development and growth, greater biodiversity for both flora and fauna
B) The possibility of feeding wild animals on the suitable length of grass, the possibility of hiding of animals, etc.
C) Nutrition for insects in excrements of horses
D) Due to the grazing of the meadow, there is no drying of the grass and shrubs, which are natural fuel for the fire

Worksheet 20 ENDANGERMENT OF HONEYBEES THROUGH VARROA MITE

Humboldt University Berlin, Germany Specialization: Animal husbandry

When talking about apiculture, the varroa mite (*Varroa destructor*) is one of the main factors for bee colonies not surviving the winter. With a number of other pathogens, they lead to the death of entire colonies, but this has not always been the case. Namely due to an experiment, which went wrong in the 1970s, varroa destructor was introduced from Asia to Europe. If this hadn't happened, there would still be wild bee colonies in Europe, independent of beekeepers and their treatments. When people realised the dangers for the honey bee (Apis Mellifera), it was already too late to stop the mite from spreading.

To give the bees a better chance to survive cold winters, beekeepers treat them with formic acid to reduce the number of mites in the colony. The degree of infestation is crucial for the bees because in winter time the size of their cluster is the basis of them surviving. To get a better picture of the results of the treatment, it is recommended to do a varroa diagnose. This is done by installing a board underneath the beehive and counting the weekly number of fallen mites. Another method to get rid of the unwanted guests is to introduce male varroa sexual pheromones into the beehive, finding the right dosage and time has proven to be rather difficult though. Often forgotten, since being very rare in Europe, the book scorpion forms a symbiotic relationship with the bees. After living in harmony for thousands of years the scorpion was nearly wiped out after plastic beehives were introduced. The bees give the book scorpions a warm place to prosper. They do this because they know that the scorpions' diet is based mainly around mites, such as the varroa mite.

Although there are already a number of ways to combat the infestation, chemical groups are constantly searching for solutions and better ways to solve the varroa problematic, while at the same time they are producing a lot of chemicals such as such as neonicotinoides to improve plant production. Bees a very sensitive to these strong chemicals, and even if they don't usually lead to immediate death, they hinder them in their doing and thereby harm and weaken the colony.

1. What can be done against varroa to give bee colonies a better chance of surviving cold winters? To your mind, which method is the most sustainable?

_____

_____

_____

2. What other causes can you think of for the decrease in the numbers of bee colonies and insects in general? Name six.

_____

_____

_____

3. What do you think about the chemical industry producing chemicals to prevent the varroa mite from and do you think it is rational to find a all time solution taking into consideration, that organisms tend to develop resistances. Also, is the chemical industry a neutral player in the discussion?

_____

_____

_____

4. Try to apply the Darwin's law ,,survival of the fittest" to the Varroa Problematic and the chemicals being used.

_____

_____

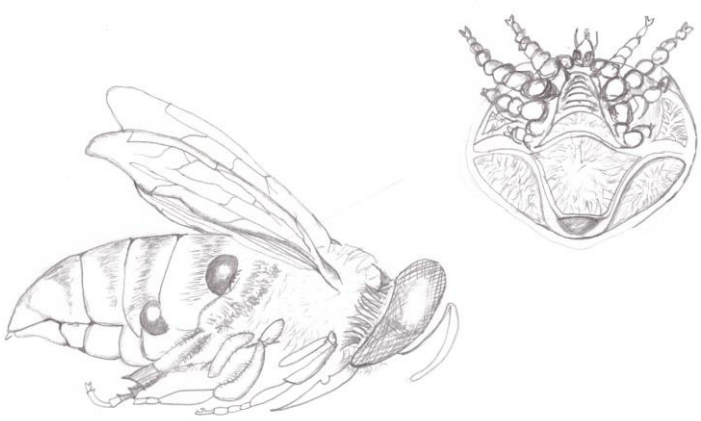
_____

5. To finish, think about what you can personally do to improve the bee health.

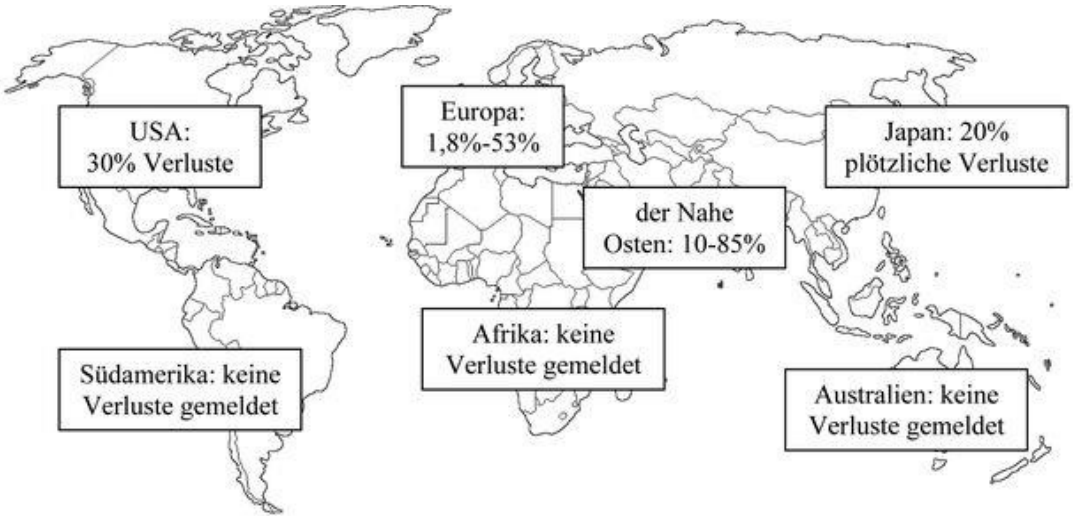
_____

_____

_____



Picture 1: left: Honeybee (Apis Mellifera) with mites. Right: Fully grown Varro mite (Varroa Destructor) from bottom



Picture 2: Global percentage of bee colony losses though varroa infestation

Key

1. You can use chemical protection e. g. formid acid, Varidol 125 etc. But using biological and natural method such as small scorpions is better solution.
2. Brainless using chemical sprays, light pollution, loosing natural environment places, dry, decreasing number of roads with water pools, appearance of *nosema apis*…
3. Nowadays, there are chemical sprays necessary but for our future is better biological way of protecting.
4. There is a possibility for bee to develop something like resistance againts varroa beetle. It is really nature way but its production is really dangerous.
5. Plant more bee friendly plants, care for the countryside, support living in villages, care for water sources around you…

Worksheet 21

AGROFORESTRY: ADVANTAGES AND DISADVANTAGES OF CULTIVATION

Humboldt University Berlin, Germany | Specialization: Forestry

Agroforestry is an agricultural production system, which combine elements of agriculture and forestry. Trees or shrubs are grown around or among corps and pastureland. If then animals (chicken, pics, cattle, etc.) are hold on the same surface, it's called agrosilvipastoral system.
It has varied benefits, including increased biodiversity, reduced erosion and improved water balance. However, because of their diversity and rather low yields, the marketing of the products is often difficult, which affects the economics of such systems.
The opposite is a study that has proved that agroforestry has considerable additional income of up to 30%. This way less surface is necessary then in a normal agricultural or forestry system. In some case, the trees are planted in rows (with three to ten meters distance); in those interstices crops are cultivated in such Alley cropping.
Agroforestry practices have been successful in sub-Saharan Africa, in parts of the United States, in Spain and in Germany. Here it finds application for example in cattle breeding and apple production. Been theoretical based of ecology, via agroecology, it is one of the three principal agricultural land-use sciences.

Picture 1

Picture 2

1. Which are the benefits for the yield and those for the chicken? Please write your answer here:

_____

_____

_____

2. What are the benefits for the crops in the second picture? Please write your answer here:

_____

_____

_____

3. On the following two pictures you'll see an agroforestry yield and a conventional yield. Please call two advantages and two disadvantages that both have in a mind-map.

ADVANTAGES

DISADVANTAGES

Sources

Text: https://de.wikipedia.org/wiki/Agroforstwirtschaft
https://en.wikipedia.org/wiki/Agroforestry
1. Chicken: http://www.agforward.eu/files/agforward/images/Farmer%20Networks/poultrysystemNL.jpg
2. Alley Cropping: http://4.bp.blogspot.com/-4ga1YUY12JU/UtT7Qm2RlFI/AAAAAAAAFSg/Nt6Yrkz0XTU/s1600/ALLEY-CROPPING-DEFINITION.jpg
3. http://blog.worldagroforestry.org/wp-content/uploads/2015/09/alleycropping-in-france.jpg
4. http://footage.framepool.com/shotimg/qf/959987970-weizenernte-maehdrescher-weizenfeld-england.jpg

Key

1.
The chicken's benefits of the protection from the trees against potential predators (animal welfare), also they benefit from the shadow in hot summer days.
The trees benefit from the excrement as an animal fertilizer.
2.
They benefit from the increased shading in the summer -reduced evaporation, also from the cooling effect thanks to the evaporation of the trees. And from the supply of free fertilizer.
On the following two pictures you'll see an agroforestry yield and a conventional yield. Please call two benefits and two disadvantages that both have in a mind-map.
3.
Picture 1: Biodiversity, less erosion, extra effort, increased manoeuvring effort
Picture 2: Less effort, less manoeuvring effort, less biodiversity, erosion

Worksheet 22 UPCYCLING FROM PLASTIC WASTE TO A USEFUL PLANTING PRODUCT

AERES University of Applied Sciences Wageningen, The Netherlands Specialization: Green care

There is much talk on television about the widespread use of plastic in the world. More and more people are becoming aware of the effects of plastics on the environment. However, more than 5 million tons of plastic waste do end up in the sea every year. (WWF, 2019) People throw away their waste just on the street, but also fish nets are a threat for the environment. (What is plastic soup?, 2019). Every year it takes life of fish, turtles, birds, dolphins and whales. Many plastics are hurtful to the environment, because it does not digest in the water. A result is that the plastics split into small pieces. These small pieces are toxic, but they are made of hazardous substances. (WNF, 2019). But we also pollute the oceans by washing synthetic clothing and by brushing our teeth. All these different types of plastics create the plastic soup in the oceans. (What is plastic soup?, 2019)

Why do we use so much plastic? Petroleum is used to make plastic. We use so much plastic in the world because it is easy to develop. Just think about plastic packaging for apples: it is cheap, lightweight, transparent and there is a lot possible in terms of appearance, such as stickering. (Kunstofoveral, 2019). We do not only use a lot of plastic for food, but also for plants (pots), clothing, frames, eye lenses, heart valves, computers, etc. Plastic has many advantages and disadvantages. Beside the low price, furthermore a major advantage is that it is lightweight. The major disadvantage is that it produces a lot of waste. When it is not in use anymore, many harmful substances are released during the process of waste burning. (NRK Verpakkingen / Denksatt, "The impact of plastics on life cycle energy consumption and greenhouse gas emissions in Europe", 20 19)

Reuse of plastic as a gardener, we often get in touch with plastics. Of course plastic can also be reused. For a number of years there have been companies that melt plastic packaging and then reuse it for new packaging. Companies are already doing this, but the main question is: How can we, as human beings, stimulate the reuse of plastic, and in what way can we start?

1. How much plastic waste in grams do you produce in one day?

_____

2. How much plastic waste in kg is that for one year?

_____

3. Do you also use plastic in your profession as a gardener? If so, how much?

_____

4. There are many kinds of plastics that are in production. Find at least 3 types of plastics that a gardener also finds in his daily life, and describe their characteristics for which they are mainly used.

_____

5. Which of these plastic types do you use? And what is the purpose of these plastics?

_____

Get started!

Upcycling from plastic waste to a useful plant production.
Step 1: Collect plastic waste;
Step 2: Think of an idea in a direction that you as a gardener can contribute to the reuse of plastic. Work out your idea in a mind map;
Step 3: Implement your idea, construct it by using plastic waste;
Step 4: Try out your creation, reflect on the product and process by yourself;

Step 5: Ask other students for feedback on your creation.

6. What will you do differently as a gardener with regard to the use of plastic?

_____

7. What will you do as human being, after fulfilling this task, with regard to the use of plastic?

_____

Sources

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Key

1. Answer is variable (in normal circumstances, 50 to 250 grams).
2. Ooutcome of question 1 in kg / gram x 365 days = (answer) in kg / gram.
3. Answer is variable.
4. Types of plastic
PET, polyethylene: Bottles.
HDPE, polyethylene: Crates, bins, buckets, barrels, jerry cans, toys, cars.
PVC, polyvinyl chloride: Water or electrical wiring.
LDPE, low-density polythene: foil, household foil, shrink-wrap, agricultural plastic.
PP, polypropylene: Carpets, plastic furniture, buckets, crates, pipes, filter materials.
EPS, Expanded polystyrene: Styrofoam or tempex.
5. Answer is variable.
6. Answer is variable (note the future goal aimed at gardener).
7. Answer is variable (note the future goal oriented as a person).

Worksheet 23 THE IMPORTANCE OF BEES

AERES University of Applied Sciences Wageningen, The Netherlands Specialization: Nature and communication

In this worksheet you will learn about the importance of bees and you will think about how to help the bees to survive. First, please read the article below. Then answer the questions afterwards. It will take 30 minutes to finish the first part of the worksheet. After the first part you visit a farm to ask some question to the farmer.

What Would Happen If All The Bees Died?

They have already been declared an endangered species... what would happen next?

In the past several years, the bee populations have been steadily declining. However, within the past 3 years, there has been a rapid decrease of the bee population. The reason this is happening is still a huge question in the field of ecological research.

The primary suspect is a pesticide call neonicotinoid. This pesticide is used to kill off crop eating single celled organisms and bacteria; however, when a bee pollenates the plant sprayed with neonicotinoid, the pesticide is absorbed and affects their central nervous system. The bee will then head back to the hive, where he will infect more bees. This ultimately causes mass confusion, and will cause bees to wander away from their hive never to find it again. Due to their weekend state, once on their own away from the hive, they will die.

Because bees have already been claimed an endangered species, the main worry is that bees will fall into extinction within the next 100 years. So if the bees did go extinct, what would be the repercussions?

Without the bees pollinating crops, there will be whole food chains and food webs under total collapse. For example, bees pollinate almond trees, grounded almonds are used as feed for livestock, the livestock then produces milk, eggs, cheese, and meats. No bees, less almonds, less, feed, less livestock, less food for human consumption.

Coffee? Nope, bees pollinate the plant Arabica, the coffee bean bearing plant. Do you like nice clothes and toiletry paper products? Nope, bees pollinate cotton, which is the basis of 95% of the world's fibres.

This same process will happen to many different plant communities and other food chains.

However, aside from the decrease in food, a decrease in bees will cause an economic decline. With there being less livestock product availability, prices will rise, and human consumption will decline due to the steep prices. This will also lead to deficiencies of essential vitamins and minerals such as calcium. Calcium is necessary for a healthy skeleton and nervous system as it is a key neurotransmitter.

Without bees, it is easy to say that world would not be like how we know it today. Our diets will consist of rice and grains (since those are wind pollinated plants), clothes would be very expensive, and our level of economic living would be at a third-world country's level. (Broad, 2017)

1. Except for the pollinating, we use some more products created by bees. Name three ways to use bee products.

_____ _____

2. Think of some ways you can help the bees live. Name three interventions that you can undertake to support the bee (they can be small).

_____ _____

3. Visit a farm in your village. Ask the farmer whether he or she supports the bees. If yes, how does he or she do that? Formulate at least five questions for a short interview with the farmer and write down the answers.

_____

_____

_____

_____

_____

_____

_____

_____

_____

4. Think about an advice to give to the farmer. Do you think there are some interventions that he or she can undertake to support the bees in a better way? Think of three things the farmer can improve.

A. _____

B. _____

C. _____

Sources

Broad, A. (2017, February 6). What would happen if all the bees died. Opgehaald van Odyssey: https://www.theodysseyonline.com/what-would-happen-all-the-bees-died

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Key

1. The students can come up with different things. Honey for human consumption, honey for cosmetic products. Wax for food production. Propolis for health benefits, it works antibiotic. Propolis is also used with making instruments and chewing gum.
2. There are lots of things to think about. Maybe plant more flowers, plant more herbs, don't use pesticides that will kill the bees, don't kill them if not necessary.

Worksheet 24 BIRDS AND BIOMIMICRY

AERES University of Applied Sciences Wageningen, The Netherlands Specialization: Nature and communication

Often we look to nature to get examples for inspiration. We can use these examples for innovation. Finding sustainable solutions for human challenges by emulating nature's patterns and strategies is called *biomimicry*. It's about learning from nature instead of learning about nature. Nature has already solved many problems humans are dealing with. A few examples of typical biomimicry-inventions are:

Many species of animals have developed skills or attributes that give us humans ideas of how we can improve our way of living. The different shapes and sizes of bird beaks all have different functions. In the image below you can see a few examples of bird beaks and how they compare to human tools.

The woodpecker's beak (top right) is like a hammer, because it has to be able to find its food (and make its nest) in trees. The flamingo (bottom left) uses its beak to sift through water to find its food. And the robin (bottom right) has a tiny beak so it can pick out small insects from the ground skeleton and nervous system as it is a key neurotransmitter.

Without bees, it is easy to say that world would not be like how we know it today. Our diets will consist of rice and grains (since those are wind pollinated plants), clothes would be very expensive, and our level of economic living would be at a third-world country's level. (Broad, 2017)

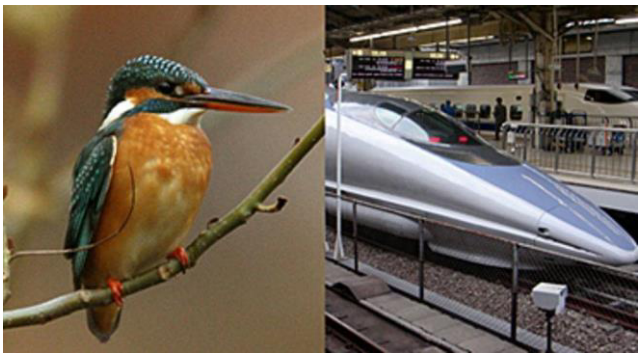
Picture 1
Image source: Wikimedia Commons

Picture 2

Picture 3

1. What species of birds do you see in the pictures above? Find out why their beaks have these unique shapes and sizes. To answer this question you can think about what kind of food the birds eat and how they use their beaks to collect the food.

Name:	*Name:*	*Name:*
Explanation:	*Explanation:*	*Explanation:*



2. In the picture to the left you see a kingfisher with a beak that is specially adapted to the way the bird catches its food. Next to the kingfisher you see the human invention, a Japanese bullet train. Can you think of the problem and why the bird's beak was the inspiration for the solution? What effect(s) does this shape have on the environment?

Picture 4 Image source: core77.com

_____

_____

_____

_____

3. Design a bird with a specially adapted beak. Why does its beak look like this? What are its functions? How can this design be an inspiration to humans for a solution for an existing problem? Explain (or draw) how.

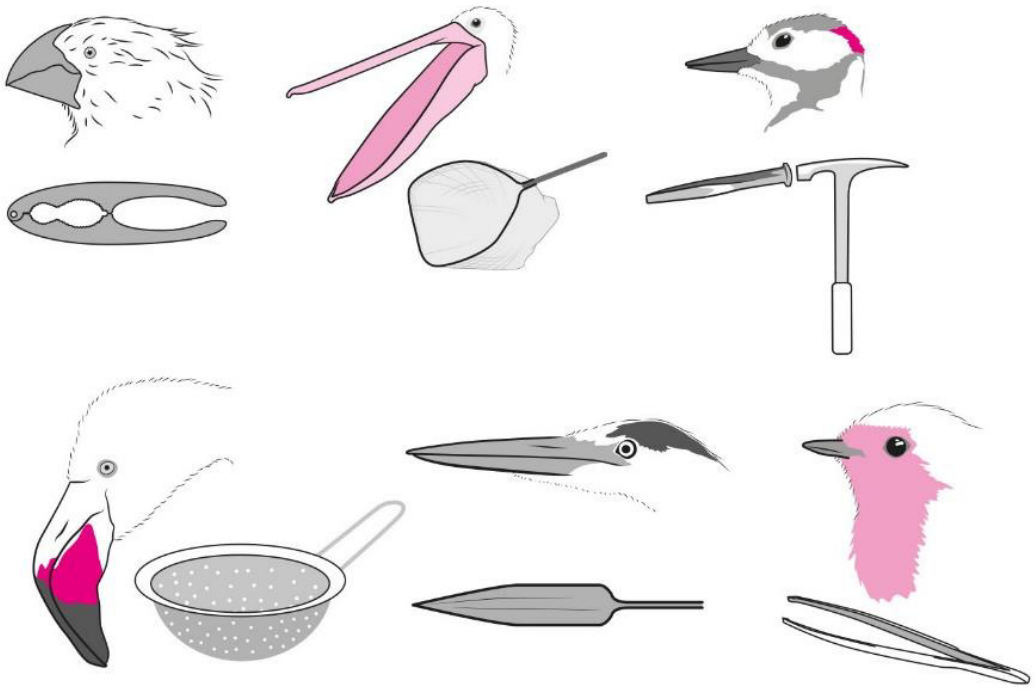
_____

_____

_____

_____

_____



Picture 5

Sources

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Key

1.

Picture 1) Spoonbills feed with their bills open. They sweep them from side to side through shallow water in search of small aquatic creatures. This enables the bird to feel for their food rather than look for it.

Picture 2) The flamingo has a large lower beak and a small upper beak. The large lower beak allows the bird to scoop up and filter water with a lot of tiny organisms.

Picture 3) The Northern fulmar spends most of its life at sea. It has tubes on its beak that filter the salt when it has to go into the water to dive for food.

2. Before the kingfisher-design of the Japanese bullet train, trains were rounder and louder. When they entered a tunnel a loud bang emerged called the "tunnel boom". This tunnel boom would be so loud it caused damage to the structure. When a kingfisher dives into the water to catch fish it doesn't make any sound because of the shape of its beak. By designing the nose of the train like the shape of the kingfisher's beak, the tunnel boom disappeared when the train entered a tunnel, making it better for the environment.

Worksheet 25 THE NECESSITY OF LOCAL FOOD

AERES University of Applied Sciences Wageningen, The Netherlands Specialization: Food and communication

Local food is now a mainstream trend, with more and more people seeking out fresh, local options for produce and other foods. And more restaurants are sourcing locally grown ingredients as well, often using the term farm-to-table.
Eating more local food reduces CO2 emissions by reducing food miles — the distance food travels from farm to consumer. The average piece of produce in the U. S. travels 1,500 miles, while local food may only travel 100 miles (or less), according to researcher Rich Pirog at the Leopold Center for Sustainable Agriculture at Iowa State University.
There's no formal definition of the term local food. But one common definition of "local" food is food grown within 100 miles of its point of sale or consumption. Eating more local food can be one part of the solution. But, local is not the whole picture of food sustainability. The impact our food choices have on the environment includes many factors.

Picture 1

Picture 2 Honeycutt, 2017

1. Please write down answers to these questions:

A) What's your favourite fruit and your favourite vegetable?

_____

B) Where does it come from? Where do they produce it?

_____

C) By which means of transport does it get to your country?

_____

2. In table 2 there are 9 different kinds of fruits or vegetables. Use your smartphone or laptop to find in which country the products are produced. Fill in the name of the country in table 1. Enter in the last column the colour corresponding with the amount of energy you estimate it takes to transport it to your plate.

Table 1

Name of fruit or vegetable	***Which country does it come from (Country of origin)?***	***How much energy do you think it takes? Choose the color you think it will fit best.***
Coconuts		
Strawberries		
Beans		
Bananas		
Oranges		
Appels		
Blueberries		

Name of fruit or vegetable	***Which country does it come from (Country of origin)?***	***How much energy do you think it takes? Choose the color you think it will fit best.***
Spinach		
Mashrooms		

3. At the start you've read an article about the necessity of local food. And you've made some tasks about the necessity of local food.

A) What have you learned about your favourite products?

_____

_____

B) What have you learned about the necessity of local food?

_____

_____

C) What is an environment-friendly product to buy in your country? And can you buy it the whole year or in a special season?

_____

_____

D) Now you know more about the necessity of local food. Is there something you would like to change when buying fruits and vegetables?

_____

_____

Sources

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Key

Fruits or vegetable	**Country**
Coconuts	Ivory Coast / Sri Lanka
Strawberries	Spain
	The Netherlands
Beans	Marocco
	Spain
	Egypt
	Kenya
Bananas	Colombia
	Costa Rica
	Ecuador
Oranges	Uruguay
	South Africa
	Spain
Apples	France
	The Netherlands
Blueberries	Argentina
	Chili
	New-Zealand
Spinach	Spain
	Belgium/The Netherlands
Mushrooms	The Netherlands

(centraal, 2019)

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