ENSITE

Environmental Socio-Scientific Issues
in Initial Teacher Education

Module 11

Worksheets

SCAFFOLDING

Content

Worksheet 1.1a: Pictures of forests

Story telling		30 min

The trainer shows pictures with different forests. The students have some five minutes to think about, then choose the picture of their favourite forest and tell a story about it.
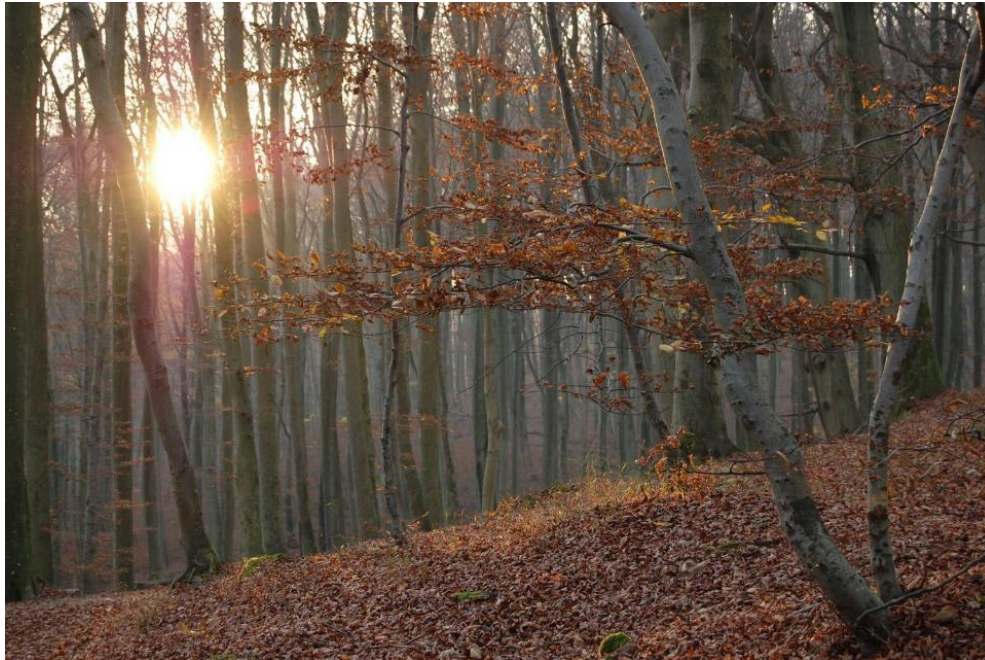
European beech forest (Photo: Hanns Kirchmeir)

Coniferous forest (Photo: Michael Huber)

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Cloud forest, Uganda (Photo: Hanns Kirchmeir)

Mangroves, La Mancha/Mexico (Photo: Michael Huber)

Eukalyptus plantation, South Africa (Photo: Hanns Kirchmeir)

Oil palms (Photo: Hanna Kirchmeir)

Timber transport, Ghana (Photo: Hanna Kirchmeir)

Wildfire (Photo: Michael Huber)

The trainer asks the students to label their story with some keywords (1-5) and then assign them to one of the five posters located in the room. These posters have the headings: ecology, economy, society, culture, one is empty and offers space for everything that cannot be assigned to any of the others.

Worksheet 1.1b: Forest quiz

Group work/game	30 min

Suggested terms

Forestry	Wood
Timber industry	Forest walk
Blueberry	Forest owner
Tree top	Moss
Deadwood	Tree rings
Chainsaw	Recreation

Mushroom	**Carbon cycle**
Squirrel	**Deer**
Conifer	**Hunter**
Lichens	**Insects**
Birds	

The trainer hands out cards to the learners. Each card shows one of the terms above. Each student tries to draw, explain (without using the term) or pantomime his or her forest term, the others try to guess the term. The guessed terms are assigned to one of the four dimensions of the forest.

(Suggested) dimensions of forests

Term	Dimension			
	ecological	economical	societal	cultural
Forestry	✓	✓	✓	✓
Wood	✓	✓		✓
Timber industry		✓	✓	
Forest walk			✓	✓
Blueberry	✓	✓		
Forest owner		✓	✓	
Tree top	✓			
Moss	✓			
Deadwood	✓			
Tree rings	✓			
Chainsaw		✓		
Recreation			✓	✓
Mushroom	✓	✓		
Carbon cycle	✓	✓	✓	
Squirrel	✓			
Deer	✓	✓		
Conifer	✓	✓		
Hunter		✓	✓	✓
Lichens	✓			
Insects	✓	✓		
Birds	✓			

Worksheet 1.2a: Who knows about forest?

	Group work/game		30 min

The class is divided into groups of three to four people. Each group is assigned a letter (A, B, C, ...) or a number (1, 2, 3, ...). The teacher trainer reads a term related to the topic of forests aloud to the whole class. The groups each have a few minutes to formulate their own definition of this term and write it down on a blank sheet of paper with the name of the group. Then the trainer collects all answers and reads out the correct and the students' definitions in random order in plenary. Each group gives a hint as to which definition they think is correct. They receive one point for each correct tip. Some examples of terms and definitions are given below. In practice, many terms will find their way into the quiz that are common in the respective national language and forestry practice.

Agroforestry: is the combination of arable or grassland use and forestry use on the same land.

Economic forest: An economic or commercial forest is used for forestry purposes and serves the production of wood.

Ecosystem services: are the benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as regulation of floods, drought; supporting services such as soil formation and nutrient cycling; and cultural services such as recreational, spiritual, religious and other nonmaterial benefits.

Invasive species: an organism that causes ecological or economic harm in a new environment where it is not native.

Neobiota: are species that have become established with human influence in an area where they were not previously native.

Plant society: is the term for a plant population with a typical composition of species. They have similar demands on the site and are interrelated.

Protective forests: protect against natural hazards or are forests with a welfare function for which special legal regulations apply.

Worksheet 1.2b: Forest tales

		60 min

Forest news WWF: Living Forest reports from 2011 to 2015 with basic facts, appealing graphics and in addition continuously new articles on the topic of forests:
https://wwf.panda.org/discover/our_focus/forests_practice/forest_publications_news_and_reports/?

Zeit online Waldwoche: A somewhat older website (from 2011), but one that addresses many aspects of forests (only available in German):
https://www.zeit.de/serie/waldwoche

For more scientific news refer to

ScienceDaily.com: Updated several times a day with breaking news and feature articles, this website covers discoveries in all fields of sciences.
https://www.sciencedaily.com/
A choice of articles:
Ancient Indigenous forest gardens promote a healthy ecosystem:
https://www.sciencedaily.com/releases/2021/04/210422181902.htm
Beetle outbreak impacts vary across colorado forests:
https://www.sciencedaily.com/releases/2021/03/210330092527.htm
Deciduous trees offset carbon loss from Alaskan boreal fires:
https://www.sciencedaily.com/releases/2021/04/210415142638.htm
Mapping the best places to plant trees:
https://www.sciencedaily.com/releases/2021/03/210311085321.htm
Turning wood into plastic:
https://www.sciencedaily.com/releases/2021/03/210325190243.htm

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Worksheet 2.1a: Forest and site – plant growth

👥👥 2 +		🕐 15 **15 min**

What does a plant need to grow?

- Light
- Air
- Water
- Nutrients
- Space to grow

This website provides a very low-threshold basic knowledge on the subject of plant growth: https://letstalkscience.ca/educational-resources/backgrounders/needs-plants

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Worksheet 2.1b: Tree profiles

		45 min

Example: social media profile of tree

FORESTNET	new profile
Name: rowan, also known as *Sorbus aucuparia*	

My look (photo)	**Create post** (video, photo, event)
A sunny late summer day	About me: I am slim and grow 15 to 20 metres high. During the summer season I wear pinnate leaves which turn from green to red in autumn. From May to June, I adorn myself with white flowers, which are replaced by bright red berries over the summer. I am friendly, sociable, and not very demanding, when it comes to where I grow, though I prefer sunny places.
Age: 31, but hopefully I will reach my eighties **Place of residence**: native to large parts of Central Europe; from the lowlands to alpine altitudes	**Status – What are you doing right now?** It's spring and I'm outgrowing myself right now.
Family: Rosaceae **Groups**: forests, gardens, parks **I like**: birds and insects	**What do you want to share with your friends?** I am happy that animals and people appreciate my sweet fruits and my pretty appearance.

Template

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FORESTNET	new profile
name	
my look (photo)	**create post** (video, photo, event)
	about me:
Age:	**Status – What are you doing right now?**
Place of residence:	
Family:	**What do you want to share with your friends?**
Groups:	
I like:	

For information on tree species refer to:
https://forest.jrc.ec.europa.eu/en/european-atlas/atlas-download-page/

Temperate zone forests: a distinctly cold season (average temperature in the coldest month < 0°C), vegetation period (>10°C) longer than three month, decreasing day length triggers leaf shedding

Beech forest, Kranjska Gora (Photo: Hanns Kirchmeir)

Winter cold coniferous forest, boreal forest, taiga: The cold season lasts 6-8 months, vegetation period (>10°C) 30-120 Tage
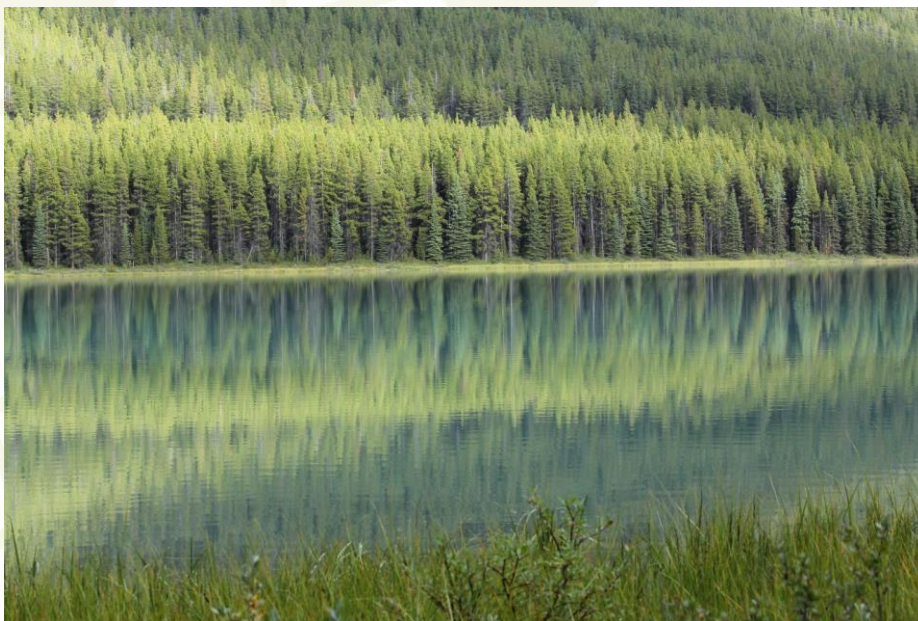
Banff National Park, Canada (Photo: Hanns Kirchmeir)

Mediterranean forests, woodlands and scrubs

Rainy winters, dry and hot summers, average winter temperature <= 10°C, rarely frost, main growth in spring; hard foliage is an adaptation to drought and frost
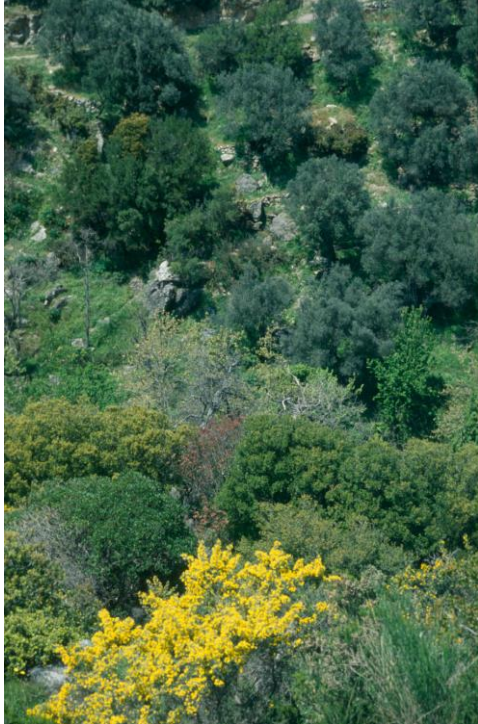
Mediterranean scrub forest, Kreta (Photo: Michael Huber)

Mediterranean forest, Mali Losinj (Photo: Hanns Kirchmeir)

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Warm temperate evergreen forests: could not reestablish itself in Europe after the ice age, fragmentary occurrences in Portugal; widespread on the west coast of the USA

Redwood, USA (Photo: Michael Huber)

Sequoia sempervirens, Big Basin Redwoos State Park, California (Photo: Hanns Kirchmeir)

(Sub)tropical seasonal forests: clear annual variation in temperature, heavy rainfall in warm season, dry cool season; upper tree layer sheds leaves in the dry season, smaller trees and shrub often evergreen

Blyde River Canyon, Soth Africa (Photo: Hanns Kirchmeir)

Tropical rain forest: no seasonality, continuous leaf shedding (event. astweise), 1-2 generations of leaves per year
High diversity in tree species (40-100 species per ha), for comparison: There are a total of 70 tree species in Austria. The floristic differences between South America, Africa and Asia are great.
Structure: 50-60 m high, upper tree layer not closed, individual giant trees, lower layers form a dense canopy of leaves
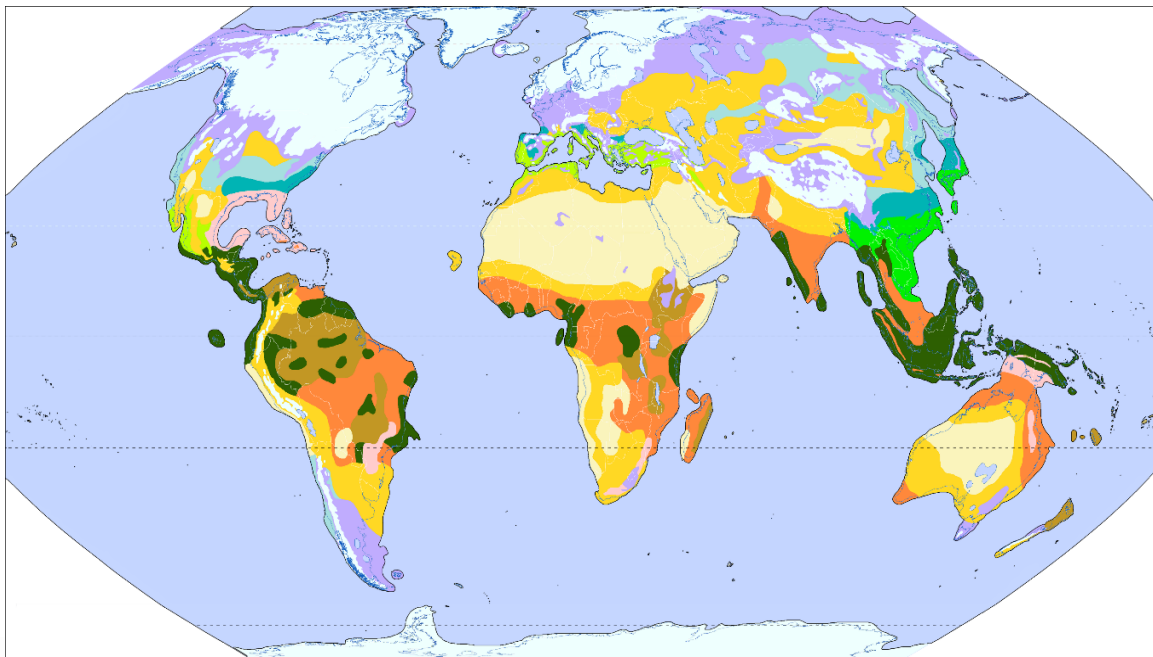
Rain forest, Ghana (Photo: Hanns Kirchmeir)

Rain forest, Ruwenzori Uganda (Photo: Hanns Kirchmeir)

Worksheet 2.2a: Forests in change

15 min

Vegetation zones 18,000

- Inland ice
- Tundra
- Forest
- Coniferous
- Decid. forest
- Forest steppe
- Steppe
- Desert
- Savannah
- Hard-leaf forest
- Dry forest
- Rain forest
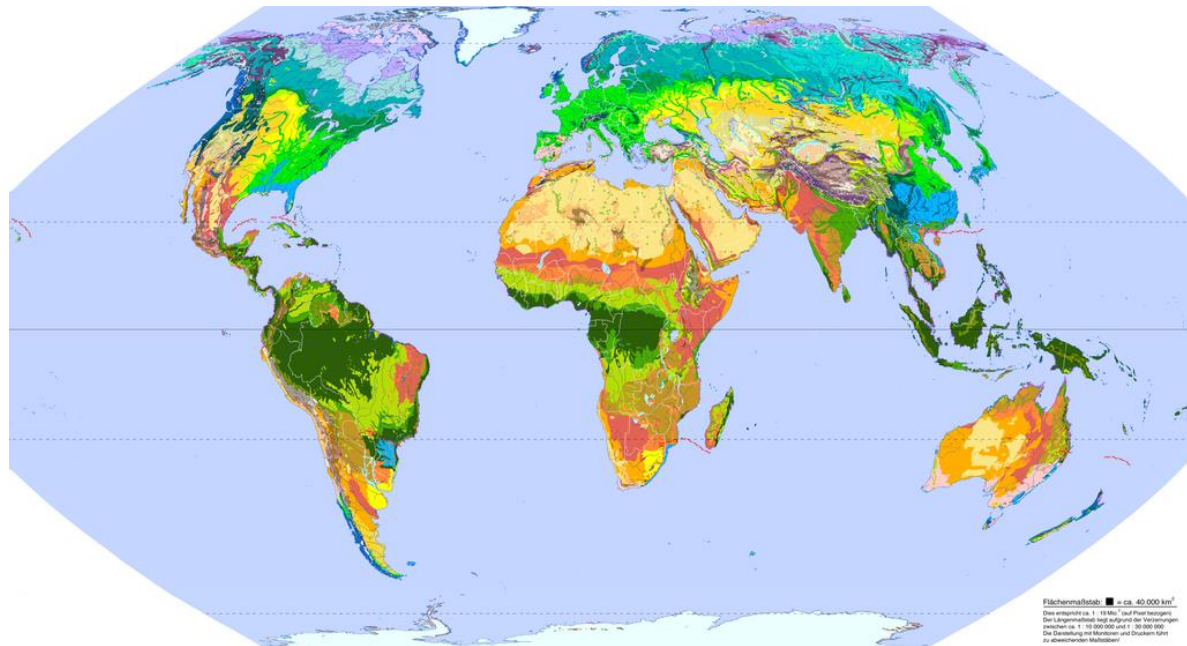
Legend (English)

Ice Sheets and Glaciers	Evergreen Taiga	Winter-cold Semidesert
Cold Deseert	Temperate Mountain Forest	Winter-cold Desert
Lichen and Moss Tundra	Temperate Coastal Rain Forest	Sclerophyllous Vegetation
Dwarf Shrub and Meadow Tundra	Mixed Forest	Hot Semidesert
Alpine Tundra	Temperate Broadleaf Forest and Riparian	Hot Desert
Subpolar Meadows, Heaths and Mires	Forest Steppe	Highland Steppe and Desert
Broadleaf Forest-tundra and Riparian Taiga	Grasslands and Salt Marshes	Subtropical Mountain Forest
Coniferous Forest-tundra	Shrub and Dry Steppe	Subtropical Moist Forest
Deciduous Taiga	⚯ = Desert without Vegetation	⚯ = Oasis

Dry Savanna
Xeric Shrublands and Succulents
Trop. and Subtrop. Dry Forest
Moist Savannas
Trop. and Subtrop. Moist Forest
Trop. and Subtrop. Rain Forest
Tropical Mountain Rainforest
Marsh and Swamp
••• = Mangrove

≡ = Mountain Ranges

Worksheet 2.2b: Forests in change

45 min

Compare the change in forest cover in Europe in 1938 and 2011 for selected countries:

Country	Degree of forest cover 1938 (1)	Degree of forest cover 2011	Forest area 2011 in 1,000 ha (2)	National territory 2011 in 1,000 ha
Czechoslovakia	33,2%			
Yugoslavia	30,5%			
Austria	37,8%	46,8%	3 857	8 245
Belgium	17,2%	22,4%	678	3 028
Bulgaria	26,2%	36,1%	3 927	10 864
Denmark	7,5%	13,8%	587	4 242
Estonia	20,9%	52,0%	2 203	4 239
Finland	65,0%	72,6%	22 084	30 408
France	18,0%	29,0%	15 954	55 010
Germany	27,0%	31,8%	11 076	34 877
Greece	11,7%	30,3%	3 903	12 890
Hungary	1260,0%	22,8%	2 039	8 961
Ireland	1,3%	10,7%	737	6 889
Italy	17,4%	31,1%	9 149	29 411
Latvia	26,4%	53,8%	3 354	6 229
Lithuania	15,4%	34,5%	2 165	6 268
Netherlands	6,1%	10,8%	365	3 388
Norway	24,0%	33,7%	10 250	30 427
Poland	23,7%	30,4%	9 319	30 633
Portugal	21,2%	38,1%	3 456	9 068
Romania	24,2%	28,6%	6 573	22 998
Russia	24,5%	49,4%	809 090	1 638 139
Spain	9,9%	36,4%	18 173	49 919
Sweden	51,7%	69,7%	28 605	41 031
Switzerland	23,6%	31,0%	1 240	4 000
United Kingdom	5,2%	11,9%	2 881	24 250
Albania		28,3%	776	2 740
Belarus		41,4%	8 600	20 748
Bosnia-Herzegovina		48,3%	2 472	5 120
Croatia		34,3%	1 920	5 592
Czech Republic		34,4%	2 657	7 726
Luxembourg		33,6%	87	259
Macedonia		39,2%	998	2 543
Moldova		11,7%	386	3 288
Montenegro		33,8%	467	1 382
Serbia (incl. Kosovo)		31,0%	2 713	8 746
Slovakia		40,3%	1 938	4 810
Slovenia		62,2%	1 253	2 014
Turkey		14,7%	11 334	76 963
Ukraine		16,8%	9 705	57 938
	(1) Hilf, R. B. (1938): Der Wald in Geschichte und Gegenwart. Akademische Verlagsgesellschaft Athenaion		(2) Ministerkonferenz Oslo (2011) State of Europe's forests.	

Source: ZEIT ONLINE Bewaldungsgrade und Waldflächen in Europa. URL:
https://docs.google.com/spreadsheets/d/1NgQFyJx1xX9tlruhUo3auxIBmpfxJaz3vTHPjvQUSWI/edit#gid=0 (accessed:
2nd May 2021)

The map shows the forest cover of European countries in 2019. Are there significant changes compared to 2011?

https://commons.wikimedia.org/wiki/File:European_countries_by_forest_cover.jpg
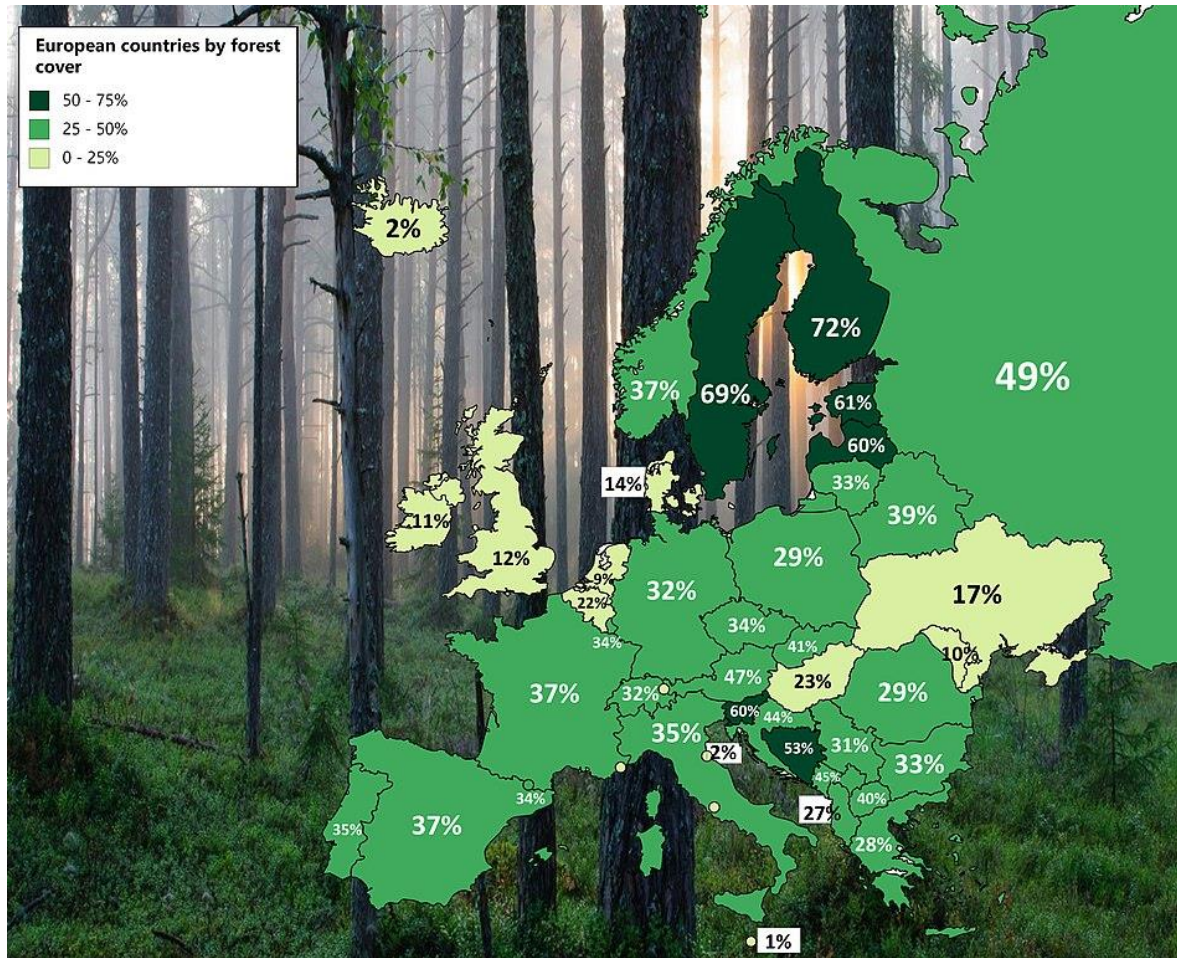
For a global view on the change of forest area between 1990 and 2019 (in million ha) refer to this link:

https://ourworldindata.org/grapher/forest-area-km?tab=table&time=latest&country=~OWID_WRL

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Worksheet 2.2c: Forests in change

30 min

Changes in tree species composition in Central Europe (after Firbas in Kral 1995)

Phase	Dominant tree species
Phase 1 (approx. 7.500 BC)	pine and birch
Phase 2 (approx. 6.000 BC)	mixed oak forest, hazel
Phase 3 (approx. 4.000 BC)	mixed oak forest
Phase 4 (approx. 1.500 BC)	mixed oak forest, beech
Phase 5 (approx. 1.000 AD)	beech

Primeval Beech Forests: https://www.youtube.com/watch?v=u-ScUvhTLcs

Alte Buchenwälder Europas: https://www.youtube.com/watch?v=yXiGyytVs70&t=63s

Worksheet 2.3a: Forests and climate change

45 min

Measure and compare temperature and humidity at different locations and discuss the results

Location	Date	Time of day	Temperature	Humidity
Urban area				
Park				
Edge of forest				
Forest				

Worksheet 2.3b: Forests and climate change

15 min

Exercise 1 (see also presentation, p. 30)

Site

Zone: Central Europe ; Altitude: 700m above Sea level

Precipitation: 1100 mm/year, annual average temperature: 7°C

Soil: gravel materials of mixed sources, medium acidity, sandy loam; soil moisture: fresh

Beech (*Fagus sylvatica*):

Distribution: in Central Europe 300-1000 m ASL;

Annual precipitation: 450-2000 mm/year; mean annual temperature: 4-12°C

Soil: nutrient-rich, slightly acidic to calcareous, cohesive sandy to loamy; soil moisture: moderate moisture

Special feature: young trees tolerate shade; old trees are very competitive in the fight for light and therefore often displace other tree species

Pine (*Pinus sylvestris*):

Distribution: in Central Europe up to 2000 m ASL

Annual precipitation: ≥ 400 mm/year; mean temperature: summer 9-20°C, winter -20-0°C

Soil: no special demands; soil moisture: dry or wet

Special feature: undemanding tree species, tolerates many soils and climates, weak competition at good sites
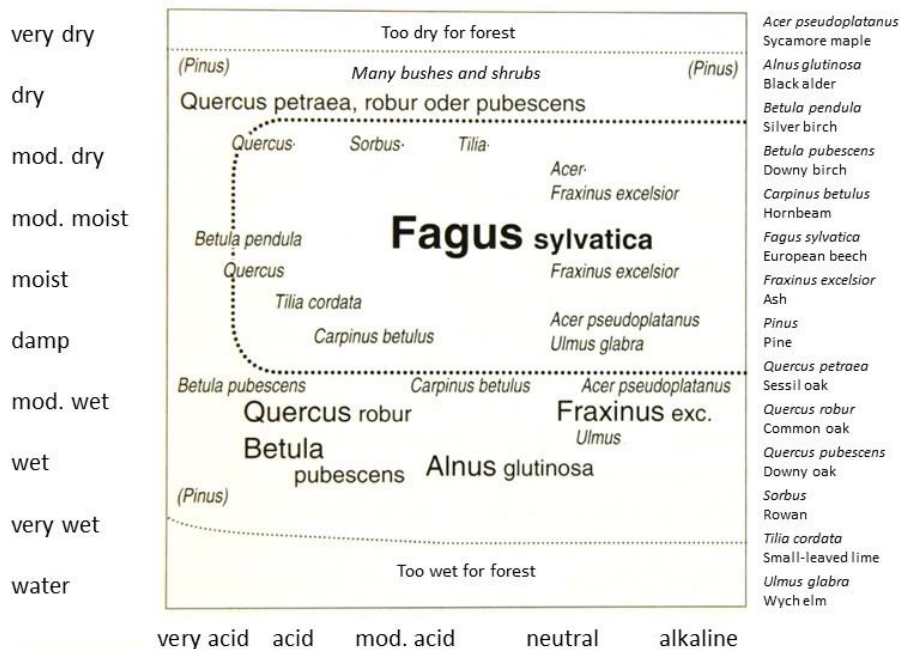
Ecogram of the most important forest-forming tree species in Central Europe. On the x-axis, the soil changes from very acidic to alkaline, on the y-axis from very wet to very dry (from Ellenberg 1983).

For information on tree species use added materials or refer to:
https://forest.jrc.ec.europa.eu/en/european-atlas/atlas-download-page/

Worksheet 2.3c: Forests and climate change

	20 min

Exercise 2 (see also presentation, p. 31)

Site: Alpine foothills, Burgenland, Austria
300m above seal level, mean temp. 9°C, precipitation 800m/a; soil: loam,
Tree species: spruce, oak

Spruce (*Picea abies*):

- Yearly yield: 11m³/ha/a
- Plan age for harvesting: 80 years
- Average price per m³: 95 €
- Risk: High risk caused by bark beetle, windthrow (loamy soils with low oxygen content leads to very flat root system near to surface).

Oak (*Quercus petraea*):

- Yearly yield: 6m³/ha/a
- Plan age for harvesting: 120 years
- Average price per m³: 115 €
- Risk: low risk of windthrow (deep rooting system), low risk of bark beetle, medium risk of other insects.

Worksheet 2.3d: Forests and climate change

30 min

Exercise 3 (see also presentation, p. 32)

A heavy storm knocked down a large part of the tree population. This is a protective forest, which is supposed to protect the soil and prevent rockfall and mudslides. In order to fulfil this function, the area must be reforested as quickly as possible.

A number of aspects must now be taken into account in order to initiate suitable measures. One possibility is to leave the fallen trees lying and let succession take its course. This has many advantages: the soil is always protected and the rough surface offers few points of attack for erosion, the regeneration is protected by the old trees. Game tends to avoid such areas, so there is hardly any browsing. Finally, the deadwood remaining at the site provides habitat for many protected and rare species.

However, whether this option can be taken depends on the general conditions:

- Legal framework: Which tree species occur in the protection forest? If it is a pure spruce stand, natural regeneration is not possible or permitted. In Austria, for example, the Forest Act prohibits leaving such areas of litter because the danger of bark beetle infestation, which can also spread to the surrounding areas, is too great.
- Site conditions: Do the tree species correspond to the growing area and the site? Only then is it likely that there are enough different species and suitable old trees in the area to ensure spontaneous regeneration with species appropriate to the site. A spruce monoculture in the foothills of the Alps offers poor conditions.
- Economic framework: What is the economic importance of the forest for its owner? If the owner depends on the timber yield, he will remove the fallen trees from the area and try to get as good a price for them as possible. Are there any subsidies or compensation?

Kosiak, Austria (Photo: Hanns Kirchmeir)

Worksheet 2.3e: Forests and climate change

60 min

Exercise 4 – Roleplay

- Forest manager national park: interest in natural forest dynamics, knows the international criteria for national parks, knows the different actors in the national park and their interests very well
- Forest owner in the national park: has above all an economic interest in the forest and fears bark beetle infestation if the wood is left lying around
- Hotel owner in national park community: accommodates mainly hiking guests who want to spend an active holiday in a beautiful landscape using safe paths.
- Representative of NGO WWF: suspects that rare and endangered species will find their way into the area if the deadwood is left lying around.
- Climate scientist: is particularly interested in how the forest can contribute to CO2 storage. His forecasts on climate development could provide clues as to which tree species will thrive here.

Activity 3.1: Analysis of forest lesson

45 min

Scaffolding techniques

Scaffolding requires teachers to create lessons that are at the perfect difficulty level. Too hard, and the students won't be able to achieve anything. Too easy, and the students won't learn at all!

Visual Aids: Flash cards on student's desks, posters on the walls, graphic organizers/charts, checklists

Breaking up learning to chunks: A *roadmap* outlining a step-by-step path to completion, *Covering up* the parts of the task that don't need to be focused on yet, *Learning stations* where students do one small part of the bigger task at each learning station, *Checkpoints* where the teacher asks students to check-in after each 'chunk' of learning is completed

Modeling allows the teacher to demonstrate how to complete a task while students observe. The main critique of modeling is that it creates passive learners. To offset this, encourage students to ask questions and ask the students questions yourself while you model the task: Fishbowl activities (A <u>fishbowl activity</u> is a task where a whole group of students stand or sit in a circle and watch a small group in the middle of the circle complete the task. It's an activity that promotes active listening and close observation of a task), *Filming* (The teacher films themselves completing the task, allowing the students to re-watch how the task was done as they attempt to copy it themselves)

Thinking aloud: *Students recording themselves* talking about their thoughts on a topic, *Teacher encouraging speaking* during an activity, *Questioning* students of what they're doing at each step. A good start is to have your students explain to you what they're doing. Sit with the student and tell them what they're thinking. Ask questions like: "What are you doing at this step?", "Why did you just make that decision?", or "How did what you just did help you to complete the task?"

Using prior knowledge: When scaffolding a lesson, the teacher can help students by asking them to reflect on past knowledge and use it to solve a current problem. This might include: *Using a strategy the student knows* and applying it to this new task, *Using analogy* to make the new knowledge relevant (and make sense) to the student's life, *Relate the idea to the student's interests* in sports, gaming or literature.

Gradual release of responsibility: The gradual release of responsibility model starts with modeled instruction and ends with students' independent practice of a task. The *four steps* in the gradual release of responsibility model are: *Modeling* – The teacher demonstrates how to do the task in front of the students. *Co-Construction* – The students instruct the teacher on how to do the task. *Facilitation* – The teacher supports the student as they complete the task. *Independent Practice* – The students complete the task with out teacher guidance. At each stage in this model, the teacher needs to *assess* student knowledge to determine whether to move on to the next step, re-do the current step, or regress to the previous step.

Open-ended questioning: Questioning is one of the most important scaffolding tools we have. But, a teacher needs to learn how to ask the right types of questions at the right point in time. Primarily, a teacher needs to make sure a student answers any question with a

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detailed explanation. To do this ensure: *Questions are open-ended* meaning they cannot be answered with a simple 'yes' or 'no'. *Questions encourage reflection* so students can think deeper about why they did what they did (and if they could do differently to achieve a better outcome next time). *Questions direct students* toward the important and pivotal aspects of the task, and away from trivial or distracting elements.

Pre-Teaching Vocabulary: A task that has a lot of new vocabulary is made difficult because the student has to wade through the vocabulary and the concepts. We have this problem a lot at universities when we ask students to read difficult journal articles, only for them to lose interest because of the verbose language. Pre-teaching vocabulary involves learning the new words and phrases before moving on to engaging with texts that have that vocabulary in it. For example, a teacher could set for homework a vocabulary list that students need to learn the week before using those term in texts for a future unit of work.

Formative and Summative Assessment: Teachers need to conduct ongoing assessments of students' knowledge so they know how much scaffolding to apply and when to withdraw it. Assessment is baked into scaffolding theory: without it, we do not know when to or how to apply appropriate support for students. Conduct formative assessment (which is ongoing assessment while students are learning) to identify how well students can complete tasks alone. For students who are struggling, you can implement differentiated instruction, in which you provide different supports for different students.

Activity 3.2B: Planning a forest lesson

120 min +60 min of homework

Examples for curriculum objectives according to the Austrian curriculum, which should be achieved in lower secondary biology lessons:

- The pupils should learn to see principles, connections, cycles and dependencies and gain an understanding of scientific ways of thinking and working.
- They should understand the dependence of human beings on nature and the environment and acquire the knowledge to deal with them consciously.
- They should acquire a basic understanding of biology that will enable them to participate in social decisions.
- They should develop positive emotions for nature and the environment.

-