



Model a forest landscape

You can find a lot of information about trees in textbooks and voluminous tables but true understanding comes from practical experience. That's why we're going out to a sandpit.

Goal: The pupils will find out that each tree has its own specific characteristics and will model a forest based on an assignment. They will discover how forests change as the climate changes and will be able to describe the expected changes.

Note: The tree species and their habitats in the Central European region were used to illustrate this lesson. You can easily adapt the lesson to your geographic area.



A. Forest typology



1. PREPARATION

Print the cards in the attachment on cardstock paper so that you have:

10x spruce, beech, oak

5x fir, linden, maple

3x birch, pine, poplar, willow, alder, hornbeam, scrub pine



2. MODEL

Create a landscape model with the children in a sandpit. Represent mountains and valleys, scree slopes (using gravel and small rocks), streams and rivers (using sticks or blue ribbons). Mark significant altitudes (200, 400, 600, 800, 1000 m).



3. AFFORESTATION

Give each student two to three tree cards at random. And let them place the trees on the sand model where they think they belong.

Then find the cards which the pupils had placed correctly. Remove any tree cards that are planted in the wrong places with a comment (there is too little water for this tree here, it is too hot, too cold, or too much water for that tree).

Then briefly comment on the characteristics of individual tree species and climate zones (e.g. alder likes water, moisture, swamp; birch grows everywhere, but could eventually get pushed out by other woody plants...).

Have the pupils place the trees they had removed back into their model. Then they can describe a part of the model, e.g. what a mountain forest, highland forest, forests around water – wetland, rocks or scree slope forest look like.

4. CLIMATE CHANGE

After creating a model of the current situation, try with pupils to estimate or even model how the layout of the trees will change if the climate changes.

Let the pupils come up with answers to the following questions:

What happens when the climate warms up in the long run (1–3 °C)?

- How will the trees' locations shift?
- How will the forest boundaries change?

What happens if you plant spruce in the lowlands or even in the highlands?

What happens if you straighten a river?

Pine: Generally grows at places where other trees fail: dry sands, rocky terrain, wetlands (mountain pine), mountain tundra (scrub mountain pine), Scotch pine thrives among rocks

Birch: A pioneer tree, grows everywhere, pushed from new territories by climax trees, it remains on rocks.

Hornbeam: Grows with oak, or on scree slopes due to the fact that it regrows well from stumps, hornbeam was used in the oldest commercial forests (coppice forests).

Alder, willow and poplar: Generally grow close to streams and rivers, wetlands, springs.

Reference:

Oak: Altitude up to 450 m, but will be forced higher with increasing temperatures due to climate change. The English oak will grow lower, the sessile oak will grow higher, the downy oak in sunny forest-steppe habitats.

Beech: Grows at anywhere between 450–1000 m with optimal at about 500 metres where it grows mostly in natural monocultures (in today's conditions), by far the most common naturally occurring tree species in most of the Central European region.

Fir: Grows at altitudes between 600–1000 m, grows mostly alongside beech, recently in decline and are planted as a substitute for spruce.

Spruce: Found at 700–1000 m in wetlands and wetter places, otherwise at 1000 m and higher. Man has made this the most widespread tree which is being driven higher into the mountains due to climate change, has been widely affected by pests in recent years.

Scrub mountain pine: Non-original and invasive. Grows at altitudes over 1200 m or naturally over 1300 m.

Linden, maple: Occurring on scree slopes and in pockets of other habitats (linden and the Norway maple lower altitudes and the sycamore maple higher).

Summary:

200–300 m oak
300–450 m beech and oak
450–600 m beech
600–700 m beech and fir
700–1000 m beech spruce, fir
Over 1000 m spruce
Above 1200 m scrub mountain pine
Scree: linden, maple and hornbeam
Rocks: birch and pine
Wetlands: alder, willow, poplar

B. Trees in the landscape

1. MICRO-LANDSCAPES

Trees in the landscape form not only forests, but also copses, tree alleys, in-field strips, forest edges. Trees in the woods are to be found in old growth forests and also in commercial forests.

Now model different woodland habitats. Give flowerpot trays to groups of 2–3 students and have them produce the following woodland and non-woodland units as described in the attachment:

- Old growth forest
- Monoculture
- Coppice forest

Forest edge
- Scree forest

Mountain tundra
- Copse
- Solitary tree

- Orchard
- Park

Following the instructions, the pupils will create a landscape element on the trays (using sand, stones, twigs, leaves,...). The teacher checks the models and gives comments (missing dead wood in an old growth forest, contemporaneity in monocultures, shrubs in a forest edge).

2. QUIZ

Others try to guess what each model represents. Older students can guess without help while younger ones can choose from a list of options offered.

3. RUNNING BETWEEN MICRO-LANDSCAPES

At the end of the lesson, place the models some distance from each other and run between them choosing a stand that:

is natural, without human intervention
is designed for growing trees for lumber
has the most varied number of species
has the least number of species
is a typical agricultural landscape
is most altered by man
lies on the forest floor
has usually only one or very few tree species

REFLECTIONS AND SCIENTIFIC CONCLUSIONS

In the end, have the pupils share what they experienced outside and what surprised them. End the lesson with evaluating the condition of the forests in your country.

- Which woodland is the most stable and best able to withstand climate change? (They are natural, diverse and ancient woodland.)
- What will happen when the climate warms up? (Forest boundaries will shift, the heat will push beech and spruce higher into the mountains, the oak will spread, but there is also a risk of woodlands failing because of water shortages.)
- Where is the landscape most full of life? (Ecotones full of shrubs and transitional ecosystems in general and, secondly, forests full of dead wood and cavities.)

Take pictures of the creations, display the models on the school premises, make a record of the outdoor lesson with the children.

Write an article about your unconventional teaching on a pile of sand in a school magazine.

WHAT CAN BE EVALUATED (EVIDENCE OF LEARNING):

The pupils:

- Co-created a forest and landscape model.
- They found that each tree has its own special growing conditions.
- They discussed how the forest will change during the climate crisis.

Lesson attachments:

Appendix 1. Illustrations of woody plants by Lucie Buchbauerová (separate appendix)

Appendix 2. Habitat descriptions

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MONOCULTURE

Artificially created contemporaneous and single-species plantations. Spruce, larch or pine are very common but deciduous stands are also planted in monoculture. The trees are regularly spaced and harvested in hectares.

COPPICE FOREST

Young forests, more commonly hornbeam, maple or linden, where the trees are cut down and new forest grows out of the stumps. Trees grown out of the stumps form clusters of thinner trunks. It is the oldest type of cultivated forest.

SCREE FOREST

Natural forest vegetation consisting mainly of linden and maple, or hornbeam. It grows on steep rocky and scree slopes and is not affected by the movement of rocks or by landslides.

MOUNTAIN TUNDRA

Natural spruce forests in Central European mountains turning into low scrub pine forest as elevation increases with trees naturally disappearing at the very highest parts of the mountains.

FOREST EDGE

Natural habitat located at the edge of forests, on the border between a forest and a meadow, also known as an ecotone. It is made up of a varied composition of trees and shrubs. It protects the forest from winds and, because it borders two habitats, the ecotone is varied in terms of both plants and animals.

COPSE

Small wood between fields sometimes forming boundaries. Mostly left in the agricultural landscape in places where there are rocky outcrops or where stones have accumulated from farming fields. They are also formed where it is too damp or difficult to cultivate with regular agricultural technology.

SOLITARY TREE

Trees in an agricultural landscape, in a city or elsewhere growing outside a forest and alone. Usually shorter and thicker than forest trees (must withstand wind, but has a lot of sun and has no competition that would drive it upwards). It often has branches reaching down to the ground.

OLD GROWTH FORESTS

Mostly species-diverse natural forests, with abundant dead trees and places where the forest naturally rejuvenates. Oak dominates in the lowlands, beech in the highlands and spruce in the mountains.

ORCHARD

Artificially planted stands that serve as a source of agricultural production of fruit trees (apples, pears, plums, cherries, apricots and peaches) and also nut trees (almonds, walnuts, chestnuts). Old tall-stemmed orchards full of old and traditional fruit varieties are highly valued from both a historical and landscape standpoint.

PARK

Artificially composed landscapes mostly in cities and surrounding areas. Larger landscape units around former manors and spas (English parks) are very valuable from a landscape and ecological standpoint (even in terms of biodiversity).

