**A glacier in Serrahn!**

During the last ice age, about 12,000 years ago, glaciers stretched from the Scandinavian Mountains as far as the Serrahn region. Around a kilometre west of here, parallel to the forest discovery trail, there is a hill that marks the maximum advance of the ice. The hills formed by a glacier are known as the ‘terminal moraines’. They consist of rock and other debris that has been pushed ahead by the glacier during the glacial period. The changing of the seasons during the glacial period causes melt water to form, and leads to the creation of sand in front of the terminal moraine. Glacial periods and warm periods alternate many times. During warm periods, the ice masses melt, leaving behind a flat landscape entirely free from plants: the ground moraine.

**Built on sand**

Serrahn’s beech forests are rooted on the meltwater sandur left behind by the ice age. Over the course of 10,000 years, sandy brown soils have formed on the sandur. These are known as ‘brown earths’. The picture from the year 1958 shows a soil profile from the Serrahn region. In the middle you can see a broad seam made up of sand and humus. This is where the trees have their roots. The ends of the roots are easy to recognise. The top layer of soil consists of plant and animal debris: it is known as raw humus and is the result of the decomposition of dead plants and animals by fungi and bacteria. The quantity and composition of the humus is determined by the type of vegetation.

**Return migration and repopulation**

When the glaciers began to melt, there were no trees here. Because of the ice masses and low temperatures, they had retreated to southern Europe. After the climate had warmed up again, the seeds of the trees slowly began their journey back home.

This succession of tree species is only able to occur in entirely undisturbed areas. We humans have always had an interest in using the forest, however, and have encouraged certain tree species. By doing this, we have interfaced with the natural succession and formed forests according to our own interests. Old beech forests are therefore rare in Europe.

10,000 years ago, the climate warmed up considerably, bringing the last ice age to an end. Birch and pine trees were the first to populate the expanse left by the retreating glacier. The oak arrived in Germany in 5,000 years ago, accompanied by many other tree species. Together they formed a mixed oak forest, yet this was only temporary. For well over 3,000 years now, the oak has been gradually replaced by the beech, which ultimately threatens to wipe out the oak entirely.

**Spruce is not rooted here!**

Take a closer look at the roots of this fallen spruce. Strong horizontal roots form a plate-like root system. Weaker vertical roots stem from the strong roots. The common spruce has a sinister root system. The spruces here were planted in 1907 to quickly satisfy the demand for good wood. On the sandy earth of the Serrahn region, the common pine is highly susceptible to storms because of its flat root system. Most of the spruces in front of you fell victim to storms. That can be disastrous in areas where people live. In the National Park, it is regarded as an opportunity. After a storm, trees that are better adapted to the site start to grow.

**Sinker root system Taproot system Heart root system**

e.g. common spruce e.g. common pine e.g. beech

**Pioneers!**

Follow the short path. How many and what type of young trees are growing here? Up until 2005, an above-ground power line led to Serrahn. In 1988, the areas under the power line were planted entirely with spruces, so that these could be harvested as Christmas trees. In 2013, the National Park Authority decided to remove all of the spruces. Rapidly spreading and quickly growing tree species will quickly fill the gap in the forest. These are known as ‘pioneer trees’. In a few metres, you will discover how many and what types of pioneer trees there are.

**Sessile oak – just passing through or here to stay?**

In Mecklenburg, birch and common pine are normally replaced by common and sessile oak or copper beech, depending on the availability of nutrients in the soil. The sessile oaks in front of you were cultivated for their valuable wood. Acorns from good seed trees were planted in tree nurseries, pulled up and then planted systematically. You might still be able to see where the trees were planted in rows.

The oak provides high calorie nutrition for pigs. Humans protected it because of its acorns and practiced traditional forest grazing until 150 years ago. Isolated mighty oak trees in Serrahn’s beech forests are proof of this.

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**All oaks?!**

You will find 3 different oak species very close by! If you want to know what species they are, look closely at the length of the leaf and fruit stalks, and at the leaf shape.

- Sessile oak (Quercus petraea)
- Common oak (Quercus robur)
- Red oak (Quercus rubra)

**Common pine – the ‘bread tree’**

The region’s landscape is dominated not by the copper beech, but by the common pine, however. It covers 62 per cent of the Müritz National Park. For the most part, the pine forests were planted on deciduous forest sites following forest degradation and intensive use.

The pine forest you are standing in was planted on undevolved land after the Second World War, when there was a shortage of wood. This was also sensible from an environmental perspective because the pine would have colonised the devastated areas anyway, as it is a pioneer tree.

**An American in Serrahn?**

What does the bark on a red oak feel like? Compared to the sessile and common oaks, the red oak has a smooth, grey bark. It only forms thin scales later on in its life. The red oak can live for up to 400 years, by which time it has a trunk diameter of up to 2 metres. The red oak originates from eastern North America and extends south from Canada into the USA. Because of its attractive leaf shape and reddish autumn colouring, it has been planted in parks and avenues in Central Europe since the start of the 18th century. And it is still used for forestry purposes, since it grows much quicker than the native sessile and common oaks. Most red oaks in the Serrahn region were planted during the time of the Grand Ducal game park (1849 - 1945). The acorns from the red oak are a nutritious treat for bears, red and fallow deer, and roe.

**A adult pine ...**

produces up to 30,000 seeds annually from the age of 30.

Thanks to its scale-like shape, the seed is carried up to 1000 metres per year.
Which animal planted the little trees?

‘The ... next will guide you in the right direction! If you look closely, you will discover the young trees of a completely different, new generation of trees under the large pine trees. These trees were planted by an animal. The difference between them and the pine trees planted in around 1960 by forest workers is obvious. Those trees were planted very close together to encourage them to grow as straight as possible and form trunks free of knots.

The feathered gardener of the forests!

The young oaks were “planted” as seeds by squirrels, mice and jays. If you are lucky, you might be able to spot a jay from here.

It is no surprise that the jay is sometimes referred to as the “acorn jay”. It can transport up to 7 acorns at once in its throat. It buries these in the soil (up to 300 acorns a day) to provide food during the winter, when food is scarce. It doesn’t eat all of the acorns it hides, however. In the spring, some of them grow into little oak seedlings.

The jay’s breeding season is in the spring. At this time, it picks the seed leaves from the oak seedlings and feeds them to its young. And so the hidden acorns not only provide a supply of food for the adult birds, but also for the nestlings. This has barely any impact on the young oak trees’ vitality and growth.

Sponges on beech!

True tinder fungus (Fomes fomentarius)

The true tinder fungus occurs most frequently in deciduous forests. It grows on older beech trees and feeds on lignin, part of the wood’s structural substance. This causes the trees to become unstable and often break at a height of several metres in stormy weather. The fungus continues to grow from year to year, however. It forms hoof-shaped fruiting bodies that remain on the trunk for up to 30 years. Young fruiting bodies that have not yet overwintered are coloured brown on top.

Later, they turn light or dark grey. Older fruiting bodies can even become almost black. The last year’s growth is coloured yellow to rusty brown.

Red edge tree sponge (Fomitopsis pinicola)

The red edge tree sponge or red banded polypore is the tree fungus found in coniferous forests. It grows primarily on the common spruce, but will also grow on the copper beech. Its spores force their way into living trees through lesions in the trunk and cause the cellulose in the wood to decompose. It can also feed on the substrate of trees that are already dead. The fine pores on the underside of the fungi have a roundish shape. At first they are pale lemon yellow to ochre in colour, then later they become greyish brown. When pressure is applied, the pores of young fruiting bodies turn grey to violet in colour. Numerous droplets (guttation) can also be found on the growth edge and on the underside of young specimens.

Race for the light

Look up into the tree canopy and see for yourself how much light the pine trees of different ages let through.

Common pine, born 1788

The forest to the left of you is the heart of the Mûntul National Park. Virtually no harvesting took place in this forest for decades. This allowed the pines to reach an age of over 200 years. And yet they are still young because pines can live for up to 600 years. Their large canopies took up so much space that newly growing pines died out over time. Now, sufficient space and light is available. Trees that require less light than the pines are able to grow under them.

Common pine, born 1977

In the pine forest to the right of you, every tree is competing with its neighbour for a place in the sun. They are all trying to push their heads towards the light. The tops of the pine trees are narrow because there is little space available for them to grow. The trees that prevail in the future will then be able to spread in all directions.

A new generation is waiting in the wings!

The signs show which small trees are seeking light under the large pines!

A number of different tree species have seeded themselves here without outside help. Every species has its own strategy for establishing itself. Trees such as the common pine can grow quickly at a young age, even without much light. If they do not reach the light after a few years, they will die, however. Others, like the copper beech, do not invest their energies in quick growth. They wait until an old tree falls down, leaving a pool of light, and only then do they start to grow.

Birch - always first

You are standing on the shore of a former lake. Until around 160 years ago, this lake filled the basin in front of you. The settlers at that time needed pastures and meadows, however. Later, they wanted to operate water mills and build on the Neumarkener Wöldigekir Chausten. And so they drained the water from the lake. The water level fell by 1.2 metres. The former expanse of water became land. This provided an ideal seedbed for birch seeds.

Birch produces a large number of seeds. They are so light that they can fly a long way. The seeds can withstand lots of sun, but also heavy frost. They require few nutrients and will grow on nutrient-poor sands or, like here, silted-up lake beds.

The birch does not like lots of wet feet, however:

Map from 1780

The oystercatcher stands at home in the densely wooded landscapes of the Mûntul National Park. It is a migrant bird and spends its summers in the region — arriving in mid-March and leaving again at the end of September.

Large dead trunks and old pines as — as well as electricity pylons — offer suitable series for the oystercatcher. You can see an aerial on the opposite shore. Mostly, the adult birds sit down on a dead pine, however, and watch for prey.

What is a tree fungi made of?

The part that is clearly visible on trees is the rotting body of the fungi. It forms spores which are then dispersed. Inside the tree is the other part of the fungi: the mycelium. This consists of fungal filaments that form a web. Part of the web is visible to the human eye. The places where the fungal filaments force their way into the plant cells are only visible with a microscope. Various fungi species are involved in destroying a tree completely over several years.

Lignin degradation = white rot

The true tinder fungus breaks down lignin, i.e. the concrete. This reduces the strength of the wood significantly. It becomes fibrous and brittle before it eventually breaks. The wood itself that is left behind becomes very pale. For this reason it is said that the true tinder fungus causes white rot on wood.

Rare tree fungi found on the copper beech, such as the porcelain fungus, hericium coralloïdes, or oyster mushroom also feed on lignin.

Cellulose degradation = brown rot

The red edge tree sponge breaks down the cellulose, i.e. the steel rope, in the wood. Because the remaining wood with the rigid lignin cracks into roughly cubic pieces, this type of rot is also known as brown cubical rot. The cellulose-free wood is brown in colour.

Birch polypores, pine dye polypores or sporassis crispa specialise in breaking down cellulose.

The beech’s time has come!

If an old tree with a large canopy dies after 300 years, it leaves behind a sunny clearing. Young trees that have lived in the shadows finally have light and space to grow. The beech can withstand over 200 years in the shade before it grows tall. This gives it a crucial advantage over other trees.

The giant fallen trees play host to fungi, bacteria and insects. What is left is the humus, which serves as a seedbed for young trees. A new life cycle can begin in the forest!

The dominant copper beech

Once the copper beech has taken root, it barely lets any other tree species live alongside it. Only a few specially adapted plants are able to grow in the shade of the beech canopy. Early flowering plants and trees use the time before foliation to blossom. At just under 4000 years old, the copper beech forest is a purely European and relatively young ecosystem, and one that is still expanding.

The forest you are standing in has not been used for 50 years! Sooner or later, it will develop into a pure copper beech forest. You can find out more about Serrad’s beech forests in the exhibition at the National Park Information Centre in Serradus.

A copper beech... produces up to 20,000 beech nuts at very irregular intervals (usually every 5 - 6 years) from the age of 50.

The beech nuts are not distributed by the wind, but instead by animals such as the yellow-necked mouse or the chaffinch, which carry them up to 100 metres per year.