

Includes
a HUGE
fold-out
tree!

Under the Starlit Sky

Explore the forest
layer by layer

James Aldred

Illustrated by

Good Wives and Warriors

B
I
G
P
I
C
T
U
R
E
P
R
E
S
S

COVER NOT
FINAL

Mycorrhiza Network

Plants and fungi share a close partnership. In ancient forests, mycelium intertwines with plant roots to form webs known as mycorrhiza, which can connect hundreds of trees. Plant and fungi both benefit: fungi receive food from sap carried in plant roots; plants receive minerals and nutrients that only the fungi mycelium can absorb from the soil. Trees also share nutrients and transmit chemical messages to each other via the mycorrhizal network.

Fly Agaric Mushroom

This striking toadstool pushed its way up through the leaf litter under cover of darkness. This fruiting body produces dart-like spores that float away on the wind to grow into the next generation elsewhere in the forest. Be careful not to touch this fungi – it may be beautiful, but it is also deadly poisonous!

Fungi Mycelium

These fine fluffy threads are called 'mycelium' – the roots of fungi. Fungi are not plants. Neither are they animals. Capable of growing far bigger than the largest tree, they can spread through the soil for hundreds of meters in every direction. They break down and gather rare nutrients and minerals using chemical enzymes.

The Forest Floor

Sooner or later, everything living in the forest's upper layers ends up back down here. Even the mightiest trees eventually die, returning to the soils from which they grew. But this is not the end. In fact, it is just the beginning, because this rich organic material is slowly broken down and turned back into food for the next generation of living things. The earth is a recycling powerhouse – packed full of countless organisms, all busily converting yesterday's dead material into tomorrow's life-giving energy.

A rich, musty aroma rises as you kick through the leaves on your way to the tree. Beneath your feet lies a secret, mysterious world inhabited by millions of microscopic organisms. By walking through the forest you have become part of its vast, ancient ecosystem. Each footstep is felt by countless other living things

Dor beetle

Dor beetles are only found where there are large mammals to provide them with lots of fresh dung. Here they have discovered a bison cowpat and are busily digging burrows beneath. Females lay eggs on pellets of rolled dung, stored in special food chambers at the end of each tunnel.

After hatching, young beetle grubs feast upon faeces before pupating into adult beetles, ready to begin the cycle again.

Germinating Acorn

This acorn dropped from the branches of its parent last autumn. The arrival of spring has caused it to germinate. The hard protective shell, or 'cupule', has split; a delicate green shoot pushes up into the light; a third of its root wobbles down into the soil. With time and luck, this tiny capsule of life will one day grow into one of the largest living things in the forest – a mighty Oak.

Woodlouse

The humble woodlouse is actually one of the most important creatures in the forest. Closely related to sea-dwelling shrimp, these crustaceans breathe through gills and live in moist, dark places. Mothers keep their newly-hatched offspring safe inside pouches. But what makes them really special is their role in recycling forest nutrients: rotting wood, soggy leaves, poisonous fungi, dead animals, and poo are all on the menu. Yummy.

Bumble

A queen bumble bee sways gently side-to-side as she flies over the leaf litter in search of a safe place to nest. Once she's chosen – an old mouse burrow, perhaps – she will lay her eggs in the warm chamber. She sees her furry body to keep the eggs warm, patiently waiting for her daughters to hatch as the tips flower nectar from a tiny way-out beside her.



Earthworm

The lowly earthworm is one of nature's unsung heroes! Emerging at night, they drag fallen leaves and other dead material into their burrows to feed on. The waste they leave behind is rich in nutrients that would otherwise remain inaccessible to other organisms.

Tree Root

Over countless years, the roots of ancient trees twist slowly through the soil, providing essential support and stability. They also play a vital role in resource gathering: these massive roots become thinner, dividing into complex networks of hair-thin fibres until – at their very tips where surface area is at its greatest – they absorb water, minerals and nutrients from the surrounding soil.

The Herb Layer

Unlike tropical rainforests such as the Amazon, which are bathed in 12 hours of warm sunlight every day of the year, forests here in the North must make do with a much shorter growing season. Winter comes early and stays long. Bialowieza is often covered with snow for three months every year. Daylight hours are short, and winter temperatures plummet to -30 degrees Celsius. Streams freeze, and the forest is ice-locked for weeks on end. But something magical happens when spring arrives, and with only around 150 days to flower, fruit, grow and reproduce, the race is on!

Around 450 years ago, a single acorn germinated on this exact spot. Growing slowly up through the fallen branches of its dying parent, by the time it was 30 years old, it was safely beyond the reach of browsing deer. Now, it rises more than 40 metres into the canopy and contains more than 80 cubic metres of wood. This is the mighty 'Maciok' Oak, the biggest in the forest. And as you peer up its tall, straight trunk, you realise that you have a very long climb ahead!

Wildflowers

Even before the last of the snow has melted, the first springtime flowers are sending their delicate green shoots up from bulbs and rhizomes hidden deep within the soil. Within weeks, there is a low green haze of fresh foliage. There follows a riot of colour as hundreds of thousands of flowers bloom, opening their vibrant petals to attract hordes of bumblebees, butterflies and other insect pollinators. By early June, the springtime flowering is over for another year!

Wood Ant

This heaving pile of twigs and spruce needles is actually a thriving wood ant nest, home to around 400,000 sister workers busy foraging and moving debris around to maintain a constant, warm temperature. Much of their vast home is hidden underground, and somewhere down there lies their queen, whose job it is to lay hundreds of eggs every single day. Don't get too close though – the workers protect their home by spraying formic acid from their abdomens at intruders!

Eurasian Woodcock

A female woodcock sits low on a nest, incubating her eggs as her mate uses his long beak to probe the leaf litter for worms. A woodland-dwelling wader, these secretive, perfectly camouflaged birds have almost 360-degree vision to warn them of approaching danger. The upper tip of their beak is flexible to help them search out food hidden in the soil.

Rhino Beetle

This large white grub is the immature larvae of a rhino beetle. Hidden safely within the decaying tissues of a fallen tree, it uses powerful crunching jaws to feast on the rotting wood previously broken down by fungi. It will spend up to three years in here before pupating and emerging as an adult.

European Bison

Known as the Emperors of the Forest, this European bison or 'wisent', is Europe's largest native land mammal. Bialowieza is one of their last remaining strongholds and there are signs of them everywhere. From the deep, cloven hoof prints in the muddy banks of streams, to the steaming piles of fresh dung so loved by insects, these are true architects of the forest, fertilising the soil and keeping it free from unhealthy growth.

Cauliflower Fungus

Not all fungi are beneficial to trees. Some, like this spectacular Cauliflower fungus, kill and consume living tissue. Over time, they break down lignin and cellulose, the woody substances that give trees their strength. Some trees can survive for decades, others succumb quickly, but sooner or later the tree will die and return to the leaf litter. A tragedy for the tree, but a feast for those organisms in the soil.

Wild Boar

Two wild boar use their strong yet sensitive snouts to root deep in the undergrowth for food. They will eat almost anything: worms, insects, fungi, flower bulbs, rodents, bird eggs – even dead animals. By churning up and aerating the ground, boars mix the soil and help plant seeds to germinate. With poor vision, they rely on an excellent sense of smell, and as one of them lifts its head to taste the air, you catch a glimpse of its two formidable tusks. Maybe it can smell you!

Small-Leaved Lime Tree

Protected from hungry deer and bison by the surrounding fallen timber, this young lime tree is now safely above the browse line the maximum height that herbivores can reach. Its young, tender leaves are now out of reach from even the tallest elk, but still provide food and cover for many other smaller creatures.

European Tree Frogs

Two European tree frogs call from a leafy branch with strange, rhythmic croaks. Their inflated throat sacs tell you that these are males trying to attract mates. If successful, the female will lay her eggs in rain-flooded root hollows left by toppled trees.

Norway Spruce Seedlings

These tiny spruce seedlings have taken root on a fallen tree. Safely above the reach of browsing deer, boar and bison, their young stems push up quickly towards the light gap created by the fallen tree. Moss provides their roots with water, whilst nutrients are absorbed from the decaying timber beneath. By the time this nursery log crumbles away, the young spruces will be large enough to support their own weight.

Northern Eurasian Lynx

Supreme predators, European lynx require large territories in which to live – Bialowieza is home to around forty individuals. They hunt birds and mammals, from small rodents to wild boar and young elk. This one ambushed a Roe deer. Leaping down onto its prey's back, the lynx killed the deer with a bite to the neck before dragging its carcass onto a fallen tree, safely out of the reach of other predators such as wolves that would not only steal its food but also kill the lynx.

Carpenter Ant

With queens measuring 20 millimetres in length (about as long as a paperclip), carpenter ants are Europe's largest ant species. This colony has taken up residence inside a felled spruce. By chewing away the soft summer wood lying between the hard growth rings of winter, they have created a rambling network of tunnels and chambers to raise their young.

The Brushwood Layer

Large areas of Bialowieza forest remain completely wild and untouched by humans. Unlike commercially managed forests where deadwood and wind-blown timber is often cleared away, here it is allowed to lay where it falls. It may look untidy, but such debris provides shelter and food for countless insects, fungi and epiphytes. In turn, these support large and diverse populations of birds and small mammals, as well as the predators that feed on them. Deadwood is key to maintaining a healthy forest ecosystem and high biodiversity.

Taking a rest from climbing, you spin slowly round on your rope to take a good look at your new surroundings. The air feels less muggy, and a cloud of tiny stingless bees buzz around you to lick salt from your sweat-soaked t-shirt.

Eurasian Sparrowhawk Plucking Post

This pile of discarded songbird feathers tells you that these woods are home to a pair of sparrowhawks. Small but deadly woodland hunters, these raptors often bring prey to the same place to pull out feathers prior to eating. These plucking posts are a record of which birds the hawks are targeting; a quick reveals the remains of thrushes, blackbirds, robins, tits and finches.

Yellow-necked Mouse

This yellow-necked mouse is just as at home in the trees as it is on the ground. Excellent climbers, they can be found foraging for seeds, nuts and berries high amongst the branches at night. This one has found a tasty fungus lower down, but it had better be careful; small rodents like this are the menu for many predators, including owls.

Eurasian Wren

This wren loves hunting for spiders, grubs and insects amongst the fallen timber. Males build several domed nests and females chose their favourite to lay eggs in. A single male can have three or four active nests, all belonging to different females. In European folklore, this tiny bird is the king of all birds and has a loud, beautiful song to prove it!

Mosses and Ferns

Mosses, ferns and bryophytes don't grow very tall. Instead they grow as epiphytes upon the surface of other larger plants. Deep crevices of tree trunks and the soggy, rotting wood of fallen branches are perfect. By soaking and storing rainwater like a sponge, they help to create suitable conditions for other damp-loving organisms, such as slugs, snails and woodlice.