

MY PLANET

by The Navigator Company

The importance of forests

They are a home to people, plants and animals.
They create jobs. They help us breathe. They regulate the temperature.
They block the wind. They muffle air pollution. They give us food. They cure us.
They give us natural raw materials for the most varied products.
It's likely that the human species could not live without forests,
and it's our responsibility to care for them, so that we never have to try.

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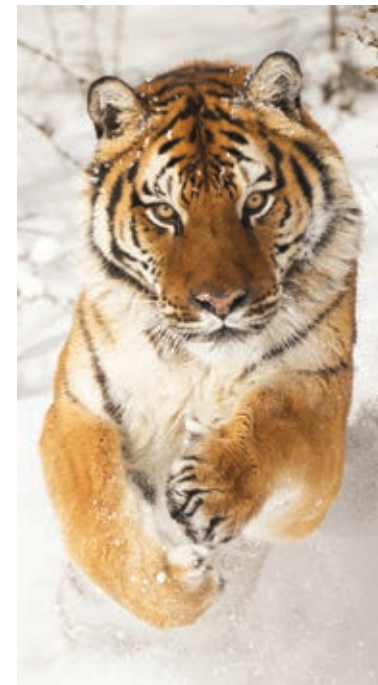
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At the heart of change

No one knows what the future holds, but it seems increasingly clear that the current moment offers a unique opportunity to shift the paradigm of global development towards greater sustainability in the three key areas: economic, social and environmental. With forests in the spotlight.

The Covid-19 pandemic has rapidly become one of the most pressing global challenges that mankind has faced in recent history. Countries are striving to shore up their overloaded health systems, at the same time as they scramble to cushion the collateral effects of the health crisis on livelihoods and the world's economies.

On the one hand, the United Nations Food and Agriculture Organisation (FAO) estimates that forestry products provide food and income for around twenty per cent of the world's population, especially in the most vulnerable segments of society, and recent UN studies show that the loss of jobs and income associated with Covid-19 will probably have pushed 34.3 million people into extreme poverty in 2020. At the same time, a growing array of estimates and research findings⁽¹⁾ point to the link between deforestation and the occurrence of this type of infectious diseases. As society takes these messages on board, forests emerge as a potential launchpad for the recovery and reconstruction that the world currently needs.

"Sustainable forestry management can play a vital role in taking millions out of poverty and building resilient economies and societies, able to withstand pandemics, climate change and other global challenges", reads a [policy brief from DESA](#), the UN Department of Economic and Social Affairs. In order for this to happen, "steps need to be taken to build sustainable forest-based solutions in responses to Covid-19".

The foundations and the action plan, DESA continues, are already set out in the United Nations Strategic Plan for Forests 2030. What is needed now is "political will, international solidarity and rapid action at all levels, to fulfil the promise of a greener future".

Policy briefs are summaries of more detailed reports on a given matter, which provide background and information and recommend where to act.

Seeing the wood for the trees

We tend to undervalue and take forests for granted, underestimating how essential they are for everyone on the planet. If we were left without them, we would soon miss them, and our attitude would change. But that is a scenario that mankind would very likely not survive, and so we need to find other ways of learning the lesson.

We recognise the obvious benefits of forests as a backdrop to our daily lives, because of the beauty they lend to the landscape, the shade offered by trees or some of the products they provide: firewood, paper, fruit and nuts. But many other benefits go unnoticed.

"Forests work away silently in the background, secretly cleaning our water, filtering our air and protecting us from climate change. They are guardian angels for more than a billion people, supplying food, medicine, and fuel for those unable to access these resources elsewhere. They are home to more than three quarters of all terrestrial biodiversity and to many of the world's poorest people", says the FAO. Forests play a fundamental role in our lives and are an endangered ecosystem.

Do remember the story of Lorax, the famous book by Dr. Seuss that showed us a world where there are no more trees, and everything is artificial? Just as the central character eventually comes to understand, a problem like deforestation has everything to do with indifference. "Unless someone like you really cares a lot", wrote Seuss, "nothing will get better".

Indifference is often the child of ignorance. So, in order to improve the prospects for the world's forests, we should learn more about their benefits. Shall we? ♦

Forests play a fundamental role in our lives and are an endangered ecosystem.

Forests are VERY important because...

They help us breathe

Through photosynthesis, forests release oxygen and absorb carbon dioxide. They are an important contributor to air quality, because trees absorb a wide range of airborne pollutants, including carbon monoxide, sulphur dioxide and nitrogen dioxide.

They are much more than just trees

80% of all terrestrial biodiversity is found in forests. They are teeming with life.

People live there too

Around 300 million people live in forests, including 60 million indigenous people, whose livelihood is entirely forest dependent.

They cool us down... and keep us warm

Trees help to control the temperature of buildings and cities, and large forests can even have an influence on the temperatures in a given region. In addition, forest biomass is a natural and renewable source of heating: fuel wood provides forty per cent of the global supply of renewable energy - as much as solar, hydro and wind power combined.

They keep the Earth cool

According to the FAO, the world's forests store around 296 giga-tons of carbon in their biomass above and below the soil. In Europe alone, some 400 billion trees are able to absorb almost nine percent of all the continent's greenhouse gas emissions, helping to mitigate global warming.

They boost rainfall

Large forests can influence regional climate patterns and even create their own micro-climates. The Amazon rain forest, for example, generates atmospheric conditions that bring regular rainfall.

They combat flooding and protect against soil erosion

Tree roots are important allies in coping with heavy rainfall. They help to absorb sudden surfeits of water, reducing soil loss and damage, by staunching the flow.

They replenish aquifers

Forests are like giant sponges, but they can't absorb all the water. It runs down their roots into aquifers, replenishing the water table.

They block the wind

They are many advantages to growing crops in the vicinity of woodlands, such as the presence of bats and birds that feed on insects, and of owls and foxes that feed on mice. But they also serve as a windbreak, protecting sensitive crops against the elements.

They clean the soil

Forests use phytoremediation to clean away certain pollutants: trees are able to sequester or break down certain toxins, making them less hazardous.

They muffle air pollution

Trees are a natural barrier against noise. The muffling effect is largely due to the rustling of leaves and other white noise from the forest, such as birdsong. Just a few trees will bring down background noise by between 5 and 10 decibels.

They give us food

Trees don't just product fruit, nuts and seeds. They nurture life and their branches shelter mushrooms, berries, rabbits, wild boar, deer...

They cure us

Forests provide us with a large number of natural medicines and are increasing the inspiration for synthetic derivatives. And of course, a woodlands walk can also offer health benefits, relieving stress and reducing blood pressure.

They enable us to produce things

We use renewable resources from forests to make everything, from paper and furniture through to houses and clothes. And thanks to the growth of production forests and sustainable silviculture, it is getting easier all the time to find responsibly sourced forest products.

They create jobs

More than 1.6 billion people depend on forests for their livelihood, according to the UN. And ten million are directly employed in managing or conserving woodlands.

They are beautiful

Natural beauty is the most obvious and also the least tangible benefit provided by forests. But it has concrete advantages. Our fascination with their beauty inspires us to value forests and to preserve them for generations to come.

They are in our genes

Our innate attraction to forests stems from a phenomenon known as biophilia, that scientists are just starting to unravel. It explores the emotional connection that humans feel with nature and our instinctive desire to make contact with other forms of life.

They are the pillars of communities

Forests tie everything together. Our species could probably not live without them, and it is our responsibility to ensure we never have to try.

Forests are life, forests are alive

It's well known that forests mitigate climate change, preserve biodiversity, provide water and energy, give us oxygen and absorb carbon dioxide. But they also furnish the means of subsistence for millions of people around the world, generate employment and are a way of stemming the exodus from the countryside.

It's hard to believe, but mankind is "insignificant" on Earth: a study conducted in 2018 by the Weizmann Institute of Science, in Israel⁽¹⁾, shows that the 7.6 billion people alive in the world represent only 0.01% of all living beings on the planet. In an unprecedented mapping of life on Earth, plants are clearly the leading force, with 82% of all living matter, followed by bacteria, accounting for 13%, and then other creatures, which include human beings, fungi, insects, and fish, and which together represent just 5% of the world's biomass.

These figures underline the "smallness" of mankind, in contrast to the grandeur of forests, whose combined ecosystems are home to most of the species on the planet, including around 60 thousand species of trees, 80% of all amphibians, 75% of birds and 68% of mammals. And in addition to this they supply other forms of bounty, some of which go unnoticed.

The United Nations Food and Agriculture Organisation (FAO) has listed the seven "secrets" of the forests⁽²⁾: they are vast storehouses of food (almost 50% of the fruit we eat comes from trees, as well as nuts and spices); around 40% of the people in extreme poverty who live in rural areas - approximately 250 million - live in (and off) forests and savannahs; they supply a large proportion of the drinking water for more than a third of the

world's largest cities; around one third of the world's population uses wood as a source of energy for cooking, boiling water or keeping warm; they are fundamental in the fight against climate change, making cities more sustainable, cooling the air and removing pollutants; they absorb the equivalent of around two billion tons of carbon dioxide each year; nature-based tourism, growing at three times the pace of tourism as a whole, accounts for approximately 20% of the global market.

Living off the forest

As well as all this, forests are vital for sustainable agriculture and food security, generating jobs and wealth, which makes this a strategic sector for the economy. The numbers speak for themselves. In Portugal, industries based on forestry raw materials support 10 049 companies, representing 2.5 billion euros in Gross Value Added and turnover in the order of 10 billion euros. The forestry sector itself accounts for around 24 thousand companies, which are in turn responsible for 100 thousand jobs (direct employment). Forest-based industries recorded growth between 2014 and 2018, with 8 313 new jobs created⁽³⁾.

At the same time, it is significant that the agro-forestry sector is found mainly in inland regions of Portugal, meaning that forests make an important contribution to territorial cohesion and have unique potential for stemming

The world's human population is today greater than 7.8 billion, but that makes little or no difference to the results of this study.



Forests are the planet's most successful scenario for terrestrial life.

Worldwide, forests are home to around 60 thousand species of trees, 80% of all amphibians, 75% of birds and 68% of mammals.



Around 40% of people in extreme poverty who live in rural areas, live in (and off) forests and savannahs.



migration from the countryside to the cities. In other words, investing in forests can be a way of combating desertification and the ageing of the population in interior regions, with clear economic benefits for local communities.

The urgency of preserving forests

These are more than enough reasons for preserving woodlands, at a time when global threats offer more and more cause for concern. The latest edition of the State of the World's Forests report, issued by FAO in partnership with the United Nations Programme for the Environment⁽⁴⁾, shows that around 420 hectares of forest have been lost since 1990, alerting us to the need to take urgent steps to protect the biodiversity of forests, in view of alarming rates of deforestation and degradation.

The Living Planet Report 2020, the most emblematic publication of the WWF (World Wide Fund for Nature) on the health of the planet, has also confirmed this stark reality: forests, oceans and rivers are at risk. According to the report, global populations of fish, birds, mammals, amphibians and reptiles decreased by 68% between 1970 and 2016, and the main

threats to species are directly connected to human activities.

Another recently published WWF report⁽⁵⁾ reveals that 43 million hectares of forest were lost between 2004 and 2017, a situation which, the organisation points out, endangers the vulnerable ecosystems found in forests, thereby jeopardising the survival of many species. The report also points out that deforestation encourages contact between wildlife and human beings, making it possible for diseases to pass from animals to man.

"Poor management of the world's forests increases carbon emissions, destroys biodiversity, destroys vital ecosystems and undermines the livelihood and well-being of local communities and societies in general", warned Marco Lambertini, director-general of the WWF, a propos of these figures (cited by AFP), whilst the head of the French branch of the organisation, Véronique Andrieux, underlined the importance of "protecting nature and, in particular, protecting forests". Because, she explained, "without living forests, we won't have a healthy planet or healthy people". ♦

(1) <https://www.pnas.org/content/115/25/6506>

(2) <http://www.fao.org/forestry/article/en/c/1144016/>

(3) Direcção-Geral das Actividades Económicas (maio de 2020)

(4) <http://www.fao.org/3/ca8642en/ca8642en.pdf>

(5) <https://wwf.panda.org/?11225966/WWF-report-COVID-19-could-give-rise-to-radical-change-needed-to-stop-deforestation-once-and-for-all>

Carlos Pais, aged 38

“People are neglecting forests”



He studied management at university, but ended up working with his father in producing and selling timber. “We grew up with this.” He believes the forest is being neglected and complains of the lack of raw material, but he can't see himself working in anything else.

It all started in the early eighties, when his father “had to opt for a profitable sector”, recalls Carlos Pais. After a number of false starts in other areas, and having seen how the business worked, “my father bought a truck and started to transport timber”. From then on, “he started to produce his own, and to buy in from others, and the business gradually grew”. Today, Armindo Pereira Pais Lda, based in Mortágua, employs around 30 workers and has annual turnover of 3.5 million euros.

“My brother and I grew up with all this. And although we went off to the university, we decided to join the business”, said Carlos Pais, currently in charge of the administrative side of the company. He has no regrets about the decision: “Today, I can't imagine doing anything else”, he says. “It's something we can leave to our own children”.

The business means he has to “take care of the forest”, but he is aware that the picture is not the same everywhere. “At the moment, producers, and especially the smallholders, are neglecting the forest. There's no support for them, the rules on plantations are very strict, maintaining woodlands is very expensive... and people don't invest”.

In addition, Carlos Pais explained: “Most of the properties in this area are inherited, and they're still well looked after, but the younger people aren't interested in buying, because the rules on woodlands maintenance are pretty strict”. This means he has fears for the future, and that “it's getting harder to buy raw material”. That, he admits, “is our greatest concern”. Because it



has affected business “In the past, it was much easier, but at the moment it's a bit difficult buying the wood”, he tells us, explaining that the scarcity of raw material is a problem throughout Portugal.

The solution, according to Armindo Pereira Pais, involves help from the State, but also “a different way of managing the sector, engaging more with the smallholders and the business people, especially on the question of competitive pricing and management support”. ♦

Paulo Ribeiro, aged 37

“Working in the forest is a pleasure”

Paulo Ribeiro grew up in Barreiro, a suburb of Lisbon, but his parents are originally from near Salavessa, Montalvão, and so he has always had a strong connection with the countryside. His father was an amateur beekeeper, and although, when he was little, Paulo was not keen on the bees, he started to get interested as he grew up. When the time came for him to go to university, he opted for mechanical engineering but, he told us, “the course left me cold; it was all very abstract and theoretical, and I started to lose interest”. This led him back to the countryside, in what he calls a “natural step” - at the age of twenty-five he took up beekeeping as a business.

It proved to be a wise choice. “I would have found it hard to work in an office”, he says, admitting that he finds beekeeping more of a pleasure than just a job: “When I go out into the country (I live in Barreiro because of the family, but I spend a lot of time alone in Montalvão), I don't feel like I'm going to work; it's not like an obligation”. What's more, he tells us, “the world of bees is fascinating”. And a challenge.

“As beekeepers we try to manage the hive so that we can get something from it (honey, propolis, pollen...), but each colony is an individual, it has its own behaviour, a personality”, he explains. In other words, “although they behave similarly, they don't all respond in the same way”. This is a doubly difficult challenge given that bees are subject to a number of threats, that potentially jeopardise their survival.

The most complicated problem is climate change. “Bees have a cycle, they grow when conditions are favourable, and then production diminishes when the conditions deteriorate”, explains Paulo Ribeiro. “In recent years,” he

continued, “there haven't been intermediate seasons, there has been a short spell of spring and a long summer, and for the hive that is very stressful, because the bees don't have anything to gather from the countryside”.

But that's not all. The Asian hornet (*vespa velutina*), which attacks hives, entered Portugal through the Minho in 2011, and is expanding over the country's territory. “In my area, we saw them for the first time in 2017, then they disappeared, but in 2019 and 2020 we saw them again”, he says, explaining that “although it's not an ideal area for them, they are very good at adapting, which is a worry”. Another cause for concern is the varroa destructor, another parasite originally from Asia. It first appeared in the late eighties, and although “it takes its time, it can seriously weaken a hive, which can actually collapse when the infestation is severe”. The problem, he stresses, is that “there has been little progress in treatments”.

But despite all these threats, the business has thrived. With 300 hives, in Montalvão and on The Navigator Company's woodlands in Pegões, Paulo Ribeiro, who works in conjunction with two other beekeepers, exports around 14 tons of honey a year to Europe, above all to Germany. He points out that “business has gone well because I'm producing organic honey”, and the demand is greater, at least on the foreign markets, as well as commanding a higher price. “There's a very big difference between producing organic honey, which demands more work and time, and conventional products”, he explains, “but fortunately consumers are increasingly aware and value this”.

Paulo Ribeiro has no complaints. “Despite all the stress, and the extra work involved in this form of production, because less treatments are used and so greater attention has to be paid to the bees, when I'm around the hives I feel very calm. I love to be surrounded by nature...” ♦



Producing honey isn't easy. Bees are endangered, and then each hive has its own “personality”. But the relationship with the forest makes up for everything. “When I go out into the field, I don't think that I'm going to work. It's a pleasure...”



Daniel Eduardo Costa, aged 34

“This is a different world”



He's always worked in the forest. "It's a passion you get from previous generations", he says. Above all, he likes the open air, but he also appreciates the direct contact with people and the peaceful vibe of the countryside.

Daniel Eduardo Costa was born and raised in Arco da Memória, a village near Rio Maior. His father worked all his life in forestry, and when he finished secondary school, he ended up joining the business. "Originally, my father bought timber, cut it and sold it on. Later, in 1988, he started his own company, and I ended up joining him", he told us. Today, "we do everything: replanting, felling and transporting the wood to the mill". Eduardo & Costa owns 180 hectares of eucalyptus and operates mainly in the areas around Rio Maior and Caldas da Rainha. Its annual turnover is 1.14 million euros, and it has a workforce of six.

The work is anything but easy. "Forestry work is very tough physically, as well as needing brainpower and involving risks", he explained, tell us that "to work in this area, you need to really like it". Which he does. "I enjoy the whole process, from planting to delivering the wood to the client... I get a great kick out of seeing the wood grow (it takes about 12 years on average)".

And then it's a question of "liking the countryside", he says. "What attracts

me most is the fresh air." But that's not all. "I like to see people face to face, and when you work in the country that's what happens", he told us. This might explain why he can't imagine living in a city, where "the way of life and attitudes are different", much less working in a different business.

"Working in the country can be monotonous, but there's a great sense of peace", he confesses. Of course, "we also have to meet targets, but we don't need to rush, we don't have to contend with heavy traffic", he pointed out. "It's a different world out here". In his opinion, this attraction for the countryside "is something you get from previous generations, you're born with it". His face breaks into a proud smile: "Even my five-year-old son already likes to be out here! He takes every chance he can to come with me: he loves to go into the woods, the machinery, the people working...".

And if, in future, his children want to earn their living from the forest, he promises not to discourage them by dwelling on the hardships: "The important thing is to do what we enjoy and to be good at what we do". ♦

Mário Luís Issa Nacuada, aged 36

“I'm already able to employ four people”



He has gone from forestry engineer to entrepreneur and is proud to be able to create jobs for others. He's now thinking of broadening his expertise and "would like to take a specialist course in geographical information systems".

In Mozambique, the forest offers opportunities for people to grow, personally and professionally. And it sometimes takes them down roads they never imagined. This is what happened with Mário Nacuada, who studied forestry at the University of Zambeze, in Mocuba. His first job was as a trainee in a company providing services to Portucel Moçambique and, when his internship came to an end, Mário rolled up his sleeves, embraced the spirit of enterprise and set up his own business.

He continued to work in forestry, providing silviculture services, and he evolved from a forestry engineer to having management responsibilities and decided to approach Portucel. His previous contact with the company, during his internship, opened a few doors, and the first small jobs he was contracted to do grew into a trusting relationship.

Working with Portucel, he told us, "changed a lot of things in my life". His company now has four full-time employees, as well as field foremen and casual labourers, hired for specific jobs. Away from work, he's managed to buy a plot of land and, he told us proudly, "I'm getting ready to build my own house".

None of this happens without hard work and challenges. Managing people, without ever having been trained for the job, is one of the challenges, but Mário is unperturbed and has no doubt that he prefers having his own business to having a job. "It's better (to have my own business), but it's perhaps harder to manage people in the field. But as I worked with people before, I think I'm managing to do a good job", he says.

Mário Nacuada's company has worked in the teams for Portucel's forest defence and fire-fighting teams during the most critical season of the year, adapting to the procedures and to the new approaches that Portucel is always implementing, in order to work more effectively. He would like to employ more people, but he's also eager to honour his existing commitments, so he prefers

to go slowly. "I'm already able to employ four people; it might not seem a lot, but they're people with education, one is a forestry engineer, two have vocational qualifications and the other completed basic schooling", explained Mário. Who knows whether the future will allow him to expand his business? For the time being, he is keen to invest further in education: "If I had the chance, I'd like to do an MA somewhere abroad. Maybe in two years' time I'll be able to do that. I'd like to take a specialist course in geographical information systems". ♦



Nature and business hand in hand

When production forests are well managed and correctly located, they improve biodiversity levels and the ecosystem services in their local area. The aim of forestry activities is to arrive at a balance between yields and the need to preserve resources. But investment in conservation is only possible if it's profitable.

In 2020, due to the pandemic and the consequent downturn in the world economy, we exhausted the world's natural resources on 22 August, almost a month later than in 1029. In Portugal, we exhausted the country's natural resources on 25 May, a day later than in the previous year.

Faced with this scenario, there's a growing consensus that business has to make a commitment to the natural world. The European Union Biodiversity Strategy explains that the balance of nature is essential for life, but "nature also helps business: half the world's Gross Domestic Product (GDP), more than 40 billion euros, depends on nature."

If there is one sector where business is sustainable, where these considerations make sense and which has a nature-based solution (as economic and environmental studies have advocated) for facing up to the main challenges for the future of the planet (cutting greenhouse gas emissions,

mitigating climate change, promoting the bioeconomy and the circular economy), that sector is forest-based industries.

Production forests, when well managed and certified, are essential for a transition to the "green economy", based on biomass planted in a sustainable way, to replace out current model based on fossil fuels. In addition to producing renewable and recyclable raw materials, trees also produce oxygen and retain carbon dioxide. Good forestry management protects the soil, water and biodiversity, in a symbiosis between business and the environment.

Economically, tree plantations that are properly planned and managed are an alternative source of livelihood for rural producers, free from negative impacts on food production, deforestation or substitution of natural forests. In reality, planted forests represent only 7% of the world's tree cover, and yet supply 33% of our commercial wood needs.

According to The Living Forests Report, issued by the WWF (World Wide Fund for Nature), ending deforestation and the degradation of forests will actually require expansion in plantations, projected at a total of 251.8 million hectares worldwide, 11 million of these in Europe. Every year, for example, the pulp and paper industry plants more trees than it cuts down: an average of five for every tree used to make paper (figures from TAPPI, the Technical Association of the Pulp & Paper Industry).

Certification and conservation

Well-managed production forests are set up in a mosaic system, where conservation areas exist side by side with areas of forest. Protected areas are a key component in the forest conservation strategy: around 44% of the territory of the European Union belongs to the Natura 2000 network, and half of this consists of woodland habitats, covering an area of around 37.5 million hectares.

Investment in forestry certification is here a tool for conservation. More than 60% of forests in the EU are certified, mostly under the FSC® and PEFC™ systems; this is well above the average global rate of 12%.

In Portugal, certification also results in ecological value, and much more. At the PEFC™ Portugal Meeting, on the theme of Forests and Sustainability, Luís Sarabando, of the Lower Vouga Forest Certification Association, pointed out: "Building a forest with different species, with different

Production forests, when well managed and certified, are essential for a transition towards a "green economy".

functions, brings countless advantages. In the Aveiro region, which we all associated with eucalyptus production forests, we also have many areas given over to conservation and leisure. These conservation areas are important to generating more biodiversity, safeguarding water resources, helping to improve the public perception of production forests and creating buffer areas that can help to slow the spread of forest fires."

Luís Braga da Cruz, chairman of Forestis, the Portuguese Forestry Association, was interviewed in late 202 by Jornal de Negócios and said: "Forests have to yield more than just wood. We have to find ways to cover the cost of the other resources that benefit society as a whole. This would make up the shortfall in forestry income for producers and encourage landowners to manage their properties better."

Income generates investment

According to the IUCN (International Union for Conservation of Nature), preserving and restoring nature has costs that are not being met. In 2018, this organisation calculated that the annual global funding needs stand between three and four hundred billion euros per annum, whilst the current flow is fifty billion, most of it from public authorities.

In a country like Portugal, where, according to the Institute of Nature Conservation and Forests (ICNF), around 86% of woodlands are owned by individuals and the rest is divided between common land (6%), companies belonging to Celpa (Paper Industry Association, 5%), and the State (3%), investment in conservation is only possible if forestry operations are profitable. ♦

Tree plantations that are properly managed are an alternative source of livelihood for rural producers, free from negative impacts on food production, deforestation or substitution of natural forests.



The Navigator Company is investing in improving the conservation status of cork oak woodlands.



Every year, the pulp and paper industry plants more trees that it cuts down.

Leisure and production in symbiosis

"The benefits multiply when production forests are planted side by side with conservation woodlands and recreational areas, because some of these provide an economic return. Conservation cannot be supported without investment capacity. When investment and know-how are shared and people work together towards common goals for the region and their communities, it's the best way of contributing to the Sustainable Development Goals and to making a difference in this Decade of Action." Paula Guimarães, The Navigator Company's sustainability manager, was speaking at the company's last Sustainability Forum, and her words sum up the importance of the project that provided the theme for the meeting: the new Serras do Porto park, in Valongo, geared to recreation and conservation.

João Melo Bandeira, Navigator's northern region manager, agreed at the meeting that production forests, and eucalyptus in particular, provide an opportunity for long-term intervention in the fields of conservation and protection: "When correctly planted, production forests provide funding support for projects with better silviculture practices, both in terms of improved quality and allocation of genetic materials, and also better soil preparation, allowing for an economic balance between production and other uses". An example of this is the production forests managed by the Company in the six thousand hectares of the Serras do Porto park, representing around 25% of the protected area.

This was what enabled Navigator to invest around 320 thousand euros in the park, between spring 2020 and spring 2021, over a total of 238 hectares, which includes work on around 150 hectares of eucalyptus and 57.5 hectares of other species. ♦



The production forests managed by Navigator in the six thousand hectares of the Serras do Porto park enables it to invest in conservation in the area.

Investing in conservation is a way of protecting business

The income that The Navigator Company obtains from forests enables it to invest in specific conservation, restoration and maintenance projects. Find out about some of them.



Navigator has been installing nesting boxes on the Espirra estate to boost the breeding numbers of birds such as blue tits and wrens.

In the 108 thousand hectares of Portuguese woodlands managed by Navigator, 100% certified under the FSC® and PEFC™ schemes, 25% of the area is occupied by species other than eucalyptus, such as cork oak, maritime pine, umbrella pine or conservation interest areas, which account for 11% of the total area and are managed so as to conserve biodiversity and ecosystem services. And 4 100 hectares are habitats classified as protected by the Natura 2000 network.

Around 300 thousand euros was invested in promoting habitat and plant-cover restoration in these areas between 2013 and 2020, explained Nuno Rico, the Biodiversity Conservation manager. However, because Navigator is a forest-based business, its Biodiversity Conservation Strategy is built into its management model, meaning that conservation work is carried out on a daily basis that is impossible to quantify in monetary terms. One example is the assessment of wildlife and the potential impact of all operations, the mapping and classification of conservation interest areas, planning and implementation of conservation management work, enriching or restoring local functions, and the monitoring programme, followed up by measures to mitigate impacts and correct accidental occurrences.

Restoration and maintenance

In its constant quest for a balance between high yields and preserving resources, Navigator has been working on restoration projects up and down the country. It is currently investing in particular in the south-west Alentejo and Monchique. Since 2016, at the Águas Alves Estate (Natura 2000 Network, Monchique), work has been progressing on improving the state of conservation of natural habitats and on planting indigenous vegetation. From 2014 to 2020, a total of around 48 thousand euros has been invested in promoting cork oak, arbutus and oak habitats. The flagship project has been the planting of *Quercus canariensis*, using saplings grown in nurseries (at an unquantified cost). This is because the Monchique oak is a relic from a paleoclimatic era, and is classified as critically endangered in the Vascular Flora Red List for Mainland Portugal.

The Company is also working on improving the state of conservation of cork oak (*Quercus suber*) woodlands and areas of Iberian oak and Portuguese oak (*Quercus faginea*) in Vale de Beja and Roncão, estates located within the South-West and Costa Vicentina Natural Park, where around 62 500 euros was invested between 2015 and 2020.

Another protected habitat, willow woods, and also other areas forming ecological corridors have received investment of around eleven million euros in the past five years, at the Caniceira Estate in Tramagal.

The diversity of fauna has also not been overlooked. In Espirra, an estate used for a range of purposes and containing large variety of species and natural and semi-natural habitats (homes to many species of fauna, such as otters, wild boar and more than sixty bird species), Navigator has been installing nesting boxes on cork oaks, maritime pines and eucalyptus trees, to boost the breeding numbers of insect-eating birds, such as blue tits, wrens and nuthatches. This is a natural method for controlling pests in cork oaks.

Navigator's experience has shown that biodiversity is found both in conservation and production forests. This was the focus of the Wildforests project, at the Lisbon University Science Faculty and the University of Aveiro, which set out to assess the presence of mammals and micro-mammals in eucalyptus plantations. The project generated data for MA dissertations by using a network of cameras on eight forest holdings, seven of which are managed by Navigator. Each site had twenty-five cameras.

Another project, also involving the Lisbon University Science Faculty, led Navigator to acquire a further fourteen camera traps, making a total of thirty-six, which were positioned on the Caniceira and Zambujo estates to monitor mammals.

Partnerships with academe have resulted in many other projects, such as that with the Water Laboratory at the University of Évora for monitoring the ecological quality of five streams on the company's properties: at Caniceira, Serra D' Ossa, Valongo, Vale de Beja and Espirra, involving annual investment of 4 300 euros.

Fighting deforestation

Navigator has taken its sustainable forestry project

to Africa, through Portucel Moçambique. Official figures suggest that deforestation in Mozambique is proceeding at more than 250 thousand hectares a year, mostly in areas around rural communities, due to itinerant agriculture (which explains 86% of the problem), and also to the growing use of wood for construction, heating fuel, charcoal and building infrastructures. In this context, the company is investing in the production and planting of native species, to benefit the environment and support the economy of local communities.

In addition, prevention of deforestation is a recurrent theme in the company's efforts to raise environmental awareness. "Conservation and reforestation areas need to be increased. The company is eager not to plant only eucalyptus woods, The idea is to help preserve native forests and to add to people's quality of life", explained António Cananão, manager of the Luá Nurseries, owned by the company in Mozambique. For this reason, since 2018, the nurseries have been producing native plants and fruit trees (such as tangerine, orange, lemon, mango and lichee) for local communities. At the same time, in 2020, it planted several thousand plants belonging to four native timber species: chanfuta, umbila, umbaua and panga-panga

Hugo Canha, forestry project coordinator at Portucel Moçambique, told us that these have been planted in the districts of Mulevala and Ile. More than 5 000 fruit trees and 10 000 timber trees are currently being produced for future planting.

Navigator is committed to continued investment in projects of this type over the years ahead, with the aim of conserving all the different functions of woodlands, wherever its operations may be. As Nuno Rico explained, "the products provided, the cork, pine cones, honey and also the wood are all part of the ecosystem services, just like the sequestration of carbon, the water and soil quality, recreation and protection against fires". That is why conservation is in everyone's interest. ♦



In Mozambique, the Luá Nurseries also produce native plants and fruit trees, to support communities.

11% of the woodlands managed by Navigator belongs to conservation interest areas

4 100 hectares of Navigator forests are occupied by 46 habitats classified in the Natura 2000 Network

238 species of fauna and 800 species and sub-species of flora have been identified on land managed by Navigator

“We will surely turn around our current tendency towards degradation of natural capital”

During the Portuguese presidency of Council of Europe, a new Forestry Strategy Committee is due to be presented for the EU. Humberto Delgado Rosa, director for Capital Natural at the European Commission Directorate-General for the Environment, unveils the road ahead: social and economic issues will not be overlooked, but climate and biodiversity will climb up the agenda.

Are people in Portugal aware of the importance of natural capital?

No more or less aware than elsewhere. There's a growing understanding, as people realise we've gone too far in degrading the biosphere, nature and biodiversity. As we start to feel the lack of the services that nature provides, we pay greater attention to this dimension of natural capital, which should stand shoulder to shoulder with the importance of human and financial capital.

Is the inclusion of nature in business strategies and model still just a matter of good intentions?

Fortunately it's already more than just that. It's not the general rule, but I've still been positively impressed by the number of companies, some of them large, that have a strategy for accounting for natural capital. In other words, they try to see what risks they face and how their business depends on natural capital, and then to assign it economic value, so it can be taken into account in business management strategies.

How will companies be helped to quantify natural capital in their accounts?

We're not providing financial aid, but there is help, on the EU "Business and Biodiversity" platform, where you can find a number of Portuguese companies. Work is proceeding on identifying and comparing different methods for quantifying the impact of and dependency on biodiversity, in a way that is helpful for companies. It's much easier to measure CO₂ in the atmosphere than to measure species, ecosystems and their services, but science

has been helping and there are several metrics on the table. We have a project called TRANSPARENT, funded by the LIFE programme, in which businesses are working together on methods for including natural capital in their accounts.

When will this be available?

It will still take some time, but for companies that are interested there are already pointers to what they can do, such as the Natural Capital Protocol, provided by the Natural Capital Coalition. It's still incomplete for biodiversity, but very helpful. There are several methodologies on the table, currently being explored. A lot of companies have realised that it's not just "emissions and that's that". There's much more: water, soil, biodiversity itself and land use, which have to count.

How can businesses be attracted to integrating biodiversity, natural capital and ecosystem services?

The most effective way is through their own perception that their businesses need this approach. A major factor is the growing attention paid by public opinion to environmental and climate issues. We've all witnessed a series of events, such as forest fires and their impact on wildlife, flora and everyone's lives. And then there's plastics in the oceans, with an impact on marine life, from birds to turtles and whales. Or another example is the decline in insect populations, including pollinators, in many parts of the world. This sets off alarm bells in public perception, and people

“Natural capital should stand shoulder to shoulder with human and financial capital.”



demand political action. When public opinion makes itself felt, companies realise that people want something different and move in that direction. And there are those that understand that their operations are strictly dependent on products and services that come from the natural world. And that's where methodologies for accounting for natural capital come in.

Are you saying that, when it's possible to go further, the safest path is to convert consumers to the need for sustainability?

We have to go down both roads. It's not enough to wait patiently for consumers to wake up. But it's true, some of them are waking up. At the same time, in the corporate world, we need the pioneers, who can see in advance that it's in the interest of business to take the sustainability approach into account. We're taking both paths, until we reach the point where we'll surely turn around the current tendency for degradation of natural capital.

The European Green Deal has set the target of having 30% of our territories and seas protected by 2030. What does that mean for Portugal?

Science has clearly identified that this is the minimum level that the world as a whole should aim at in order to safeguard our own existence and quality of life. What we're proposing is that the European Union should lead by example and

set itself the target of protecting 30% of its seas and territory. This doesn't necessarily mean that each country has to meet this target individually. On land, we're not far from achieving it, if we add the Natura 2000 network, created under European directives to the national protected areas.

Portugal is slightly above the European average in this.

In terms of designated areas, Portugal is at a comfortable level. Whilst, on land, as Europe, we're not far from this 30% target, at sea we've further to go. This is where I have an interesting suggestion: Portugal has a large maritime area. More than half the European Union's Exclusive Economic Zone (EEZ) is Portuguese. Between the autonomous regions and the mainland, it would be interesting to explore avenues for designated more protected maritime areas. Not least because it's been proven that they benefit fisheries. By imposing restrictions in certain areas, the fish grow larger, they breed more. I see that as an opportunity for Portugal.

The Green Deal has brought a new dimension to the concept of "restoring nature". What does it specifically aim to do?

It aims to put things back. In other words, because it's clear that we've seen dramatic degradation of the natural world, in different

types of habitats and ecosystems, the word "restoration" has the political advantage of showing people an avenue of hope. Where species don't go extinct, where not everything has vanished, we can put things back. Look at the example of Portugal and the degradation of forest ecosystems, which became so vulnerable to huge fires and everything that ensues. There's a major opportunity to build stronger ecosystems, that can withstand forest fires, with a different combination of species, more diversity. The United Nations Decade on Ecosystem Recovery is about to start, and the Biodiversity Strategy is a major commitment to this issue. This year, for the first time, we'll have mandatory targets for restoring nature, still to be defined as to terms and the ecosystems selected.

By the end of the year?

It's been announced in the Strategy for Biodiversity. These will be legally binding targets, to be presented by the end of the year, in the light of an impact assessment currently under way.

Growing out of the Biodiversity Strategy for 2030, will the European Strategy for Forests be approved during the Portuguese Presidency of the Council of the European Union?

The challenging timetable we have points to approval in the first quarter. Even if there's a

Is it possible to anticipate how the criteria for forestation, reforestation and silviculture will most affect Portugal?

Alongside the Forestry Strategy, we'll present guidelines for biodiversity-friendly forestation and reforestation and for a silviculture that's closer to nature. There are components of great importance for Portugal. The frequency of forest fires has been increased by climate change, but in addition to this effect it's clear that our forest ecosystem is not well managed in broad swathes of the country. It's too fragile, too uniform, too much of the land has been abandoned, it's lacking in diversity, in order to withstand the risk of fires and for it to act itself as a force for prevention. Portugal has a lot to gain from this silviculture that is more attuned with nature, as it will lead to forests that are more resilient and more diverse.

Is preserving natural capital a business with a future?

Yes, of course. The more scarce it is, the greater the demand. The world is facing an ecological crisis. I'll quote a figure: 96% of all terrestrial vertebrate biomass consists of human beings and domestic animals, and wildlife is the remaining 4%. We've gone too far in humanising the land. People like to have natural countryside, wildlife that is appreciated. There are activities that can be developed around preservation and restoration, with simple management and visits to protected areas, often combined with tourism, which generates income.

Is there potential for growth in this area in Portugal?

Yes. The European Investment Bank (EIB) piloted a financial instrument (the Natural Capital Financing Facility), which ran until 2020, supporting business ventures that used nature, with highly favourable rates. One of these projects, geared to bringing visitors, has a component in Portugal, to give an example. Portugal has great potential for making better use of nature, including from a sustainable economy perspective.

Knowing that money from the European Union will now be awarded on ESG (environment, social and governance) criteria, do you believe that this is the impetus we were missing for a more sustainable development model?

More than just criteria for awarding funds, it's the whole Green Deal and what it means that's the real trigger for change. The Deal is a strategy not just for climate and the environment. It's a strategy for the European Union's development. An economic and social strategy too. It has sufficient components within it to ensure that, if properly applied, it will bring a wave of change. The example I'll give you is "do no harm". It's the assurances that Community funds and initiatives will be scrutinised, will not harm the climate and the environment and will be applied in a sustainable economy. This links up with the ESG criteria and applies to the recovery and resilience plans drawn up for post-Covid recovery. ♦

“It's to be expected that the Forestry Strategy will continue to pay attention to social and economic issues, the livelihoods of a lot of people and many industries, but climate and biodiversity will claim a larger share.”

slight delay, we'll be presenting it during the Portuguese presidency. That will be followed by debate.

What is the main thrust of this strategy, setting a target of an extra three billion trees planted in Europe by 2030?

What society demands from its forests has evolved. Society wants materials, biomass, wood, it wants other services, from recreation to sources of food, but what it expects as regards climate and biodiversity has grown increasingly important. It's to be expected that the Forestry Strategy will continue to pay attention to social and economic issues, the livelihoods of a lot of people and many industries, but climate and biodiversity will claim a larger share.



Forest in (nearly) everything



Environmental concerns, increasingly a factor in consumer choices, are leading brands to use natural raw materials that are renewable and biodegradable. A lot of these are forestry products.

Young people born in this millennium will accelerate a consumer trend in which environmental responsibility is crucial to consumer choices. Brand agendas are a growing consideration and already compete with the price factor when it comes to buying a product.

First Insight, a market research firm specialising in younger generations and predictive analysis, looked at a sample of one thousand Americans and concluded that 73% of their respondents are willing to pay an extra 10% to buy environmentally friendly products.

A global study of nineteen thousand consumers in 28 countries, conducted by the IBM Institute for Business Value, in partnership with the US National Retail Federation, reported early last

year the inference that consumers give priority to companies that are sustainable, transparent and aligned with their values. One third of respondents said that they will forgo buying their favourite products if they lose trust in the manufacturer, and one in three said that, in 2019, they had actually given up on favourite brands for this reason.

Companies are therefore trying to adapt to the new demands from consumers. And their concerns are not limited to preserving and protecting the environment. Young people are willing to adopt conscious consumer habits, and pay growing attention to the source, production method and end disposal of each product they buy, attaching value to brands that require suppliers to respect these concerns and that tend to reduce waste.

Eucalyptus and maize trainers

Allbirds has created **Tree Dashers**, trainers made from eucalyptus fibres, with a small amount of wool around the ankles, a sugarcane insole and natural rubber sole. Everlane has a different approach: it uses recycled plastic bottles to make sports shoes that are more environmentally friendly.

A Canadian company, Native Shoes, has gone one step further, creating 100% biodegradable footwear, with all the components made from plant matter. The trickiest part in designing these Plant Shoes was finding materials for the soles, supplied by Reltex, in France, which creates them from the sap of the rubber tree, using an exclusive process. The inner sole is made from eucalyptus pulp viscose and the insole combines kenaf (a kind of hemp), felt, linen and maize. The uppers also incorporate organic cotton and pineapple leaf fibres.

The greatest secret is in the avoidance of non-biodegradable glues from the petrochemical industry. The solution was to sew the shoes, in Portuguese factories, with locally sourced braided jute, soaked in olive oil, to make it more flexible.

When exposed to the bacteria and natural composting agents present in rubbish dumps, Plant Shoes start to decompose after a month and a half. Interestingly, Native also offer free returns of other models it produces, so they can be recycled into flooring for children's playgrounds. ♦



Allbird Tree Dashers

©Allbirds



©Allbirds



Native Plant Shoe

©Native Shoes

Waterproofed by bees

The amount of plastic in our kitchens is cause for concern. Seeking to reduce consumption of single-use plastics, the Brazilian company Zum Tecido de Cera has developed a cloth waterproofed using products sourced from forests: beeswax, natural resin and vegetable oil.

Although the fabric itself is 100% cotton, Zum's breakthrough is in the impermeabilisation, which is effective for a whole year. The cloths are made by hand and are customisable, washable and biodegradable.

Used to package food and cover jars, replacing clingfilm and aluminium foil, the wax cloths are produced with an eye to sustainability. Once they lose their impermeable characteristics they make a fun toy for children, as the wax means they can be modelled into shapes. ♦



Watch the video.



©Zum Tecido de Cera

A full meal just from acorns

Bread, paté, chorizos, pastel de nata and coffee. What if all these foods were derived mainly from a forest product we tend to overlook, like the acorn?

The owners of the Freixo do Meio estate near Montemor-o-Novo believed it was possible. And so it was. Using an ancient, long forgotten recipe, you can today make bread from acorn flour. Or serve an acorn pastel de nata with a coffee substitute, also made from the fruit of different oak species, such as the cork and holm oaks.

Acorn products have established themselves in a number of market niches, such as those receptive to organic, vegan and gluten-free foods with a low glycaemic index (for diabetics and athletes, for example). In the specific case of the products from the Herdade do Freixo do Meio, consumers are also helping to preserve the biodiversity of traditional cork and holm oak woodlands. ♦



©Herdade do Freixo do Meio

Natural, renewable and biodegradable

Even before there was proof that responsible practices add value to brands, many had already initiated changes with a positive ecological impact, by reducing water and energy consumption or by reusing materials.

As the market raises the bar on these issues, there is a growing willingness to use natural, renewable and biodegradable resources, opening up new possibilities for forestry products, which of course meet all the right requirements.

Forests provide us with more than just wood for furniture, construction or pulp and paper. But these industries, as well as encouraging responsible forestry management, have invested in innovation to make better use of resources. Paper manufacturers, for instance, have evolved into biorefineries that process biomass, waste materials and by-products into energy, biofuels, glue, chemicals and even essential oils used in cosmetics and pharmaceuticals.

Scientific research has multiplied the uses of raw materials that previously appeared limited. In Portugal, the Leiria Polytechnic Institute, which has already patented eco-foams for insulation produced from pine resin, makes it look likely that medicine will soon be able to regenerate human bones using material from the same source.

Cork, a forestry product for which Portugal is renowned around the world, has long ceased to serve only for bottle stoppers or insulation materials in construction. Now used in suitcases and handbags, hats, decoration, office articles and mobile phone covers, as well as in textiles

and the space industry, the new possibilities for cork seem unending.

New, greener clothes

Clothing is an industry in the sights of the new eco-friendly consumers. As well as the problems caused by modern throw-away culture, the traditional textile industry, for example, uses large quantities of water in its production processes. Hence the great efforts being made by the sector to improve sustainability, which has also involved forests. According to the European Forest Institute, cellulose-based fibres now account for 7% of all textile fibres.

In Portugal, there are several examples of good practice, such as Tintex which, since 2002, has been a European pioneer in knitwear made from lyocell, a cellulose fibre derived from wood. At present, this company based in Vila Nova de Cerveira incorporates at least 60% sustainable materials into its products, including regenerated cellulose materials and cork.

Inovafil also uses lyocell and is investing in innovation and distinctive features. This textile manufacturer in Guimarães has responded to environmental concerns by weaving fabrics from nettles and hemp. The resulting product is ideal for sportswear, with anti-allergic dermatological properties.

Ecovero fibres, manufactured by Lenzing in Austria, incorporate the entire output of Filasa, another company in Guimarães. This wood-based viscose can be made with savings in water consumption and greenhouse gas emissions in the order of 50%, in relation to conventional viscose. ♦

And wine from oak leaves?

Technically speaking, wine is an alcoholic beverage produced by fermenting grape juice. But the Scottish brand Cairn O'Mohr has adapted the technique for making cider to produce "wines" from a range of fruits, including strawberries, raspberries, cherries, redcurrants and blueberries. Their experimentation with berries soon led them to elderflower wine and, strangest of all, oak leaf wine.

Curiously, this alcoholic beverage, made from an infusion of oak leaves freshly picked from the forests of Perthshire, is no recent innovation. There are people willing to share their grandparents' ancestral recipes, and who explain that it's extremely easy to make at home. The fact is that Cairn O'Mohr started by making local sales of its oak leaf wine, with leaves picked in spring and autumn, to produce distinct wines, and now takes its products to more than two hundred wine and spirits fairs ever year. ♦



©Cairn O'Mohr

Eucalyptus is a good neighbour

The proof is in the variety of projects that combine it with other crops, ranging from symbioses created with vineyards, using the wood to germinate other species and agroforestry products that grow vegetable produce within eucalyptus woods.

Eucalyptus forests are the foundation of the pulp and paper industry, but they're also much more than this. In a world eager to find sustainable solutions, eucalyptus wood is helpful in creating innovative products and approaches.

In the form of logs or wood chips, eucalyptus has become a popular substrate for cultivating vegetables. This is a fully sustainable solution, as it makes use of wood obtained from clearance and thinning of plantations, whilst contributing to first rate produce.

Aromas e Boletos is a biotech firm in Leiria that works in the fields of mycology, the environment and sustainability, supplying packs of inoculated eucalyptus and oak wood to mushroom producers. Norberto Costa, one of the company's founders, spoke of the advantages of using eucalyptus wood to grow shitake mushrooms: "As well as being plentiful, the trunks are fairly straight, making it easy to create packs, and they have plenty of lignin, meaning they sustain production well".

The inoculation process is relatively simple. "We take a trunk, generally around a metre long and a diameter of eight to twenty centimetres, and inoculate it with the spawn. From then on, the wood will start monthly production cycles for nearly four years, without needing any further procedure", explained Norberto Costa. The result is fleshier mushrooms, with a stronger aroma and a firmer texture.

As well as to commercial producers, Aromas e Boletos supplies packs to consumers. "We've seen demand grow significantly in the last year, as more and more people are interested in growing mushrooms at home", Norberto told us. Because all you need to do is put the trunk somewhere shady, so that it stays damp, and you'll have mushrooms ready to pick for a month.



At Quinta da Póvoa, vineyards thrive side by side with a eucalyptus plantation, which has improved the pH of the soil and serves as a buffer against pests and diseases.



At Quinta da Cholda, where maize is grown in among the forest, vegetable produce will be grown between rows of eucalyptus.



The substrate is made from sawdust and wheatgerm, and then inoculated with mushroom spawn.



Shimejito sells a business model for setting up farms where mushrooms are grown in pots.



Agro-forestry is a production system inspired by the dynamics of natural ecosystems, where perennial forest species are planted alongside agricultural crops.

©Shimejito

At Aromas e Boletos, eucalyptus and oak trunks are inoculated with mushroom spawn, and then undergo an incubation period of four to six months.



This also works for people who just want to grow mushrooms for their own kitchen: all you need to do is put the trunk somewhere shady, so that it conserves the damp, and you'll have mushrooms all month long.



©Aromas e Boletos

Agriculture 4.0

In Fundão, a start-up called Shimejito has also started out from cultivating mushrooms, but with a different business structure. In line with the emerging agriculture 4.0 model it offers several complementary products: it sells a business model for setting up farms where mushrooms are products in pots, its factory produces an inoculated substrate made from sawdust and wheatgerm, which is then supplied weekly to the farms, and it acts as an intermediary in selling the mushrooms, serving as a bridge between producers and their customers.

In Brazil, where the project started out, its founder, Adriel Rodrigues, used eucalyptus sawdust because it was easily available and had a high lignin content, beneficial for growing mushrooms. In Fundão, Shimejito has established a partnership with the civil parish council in Alcaide, the region's cultivated mushroom capital. The council supplies organic pine wood from clearance work in the parish woodlands. But expansion of the business is dependent on eucalyptus wood, for the sawdust use in the substrate made in the factories that the companies is planning to open around Portugal and abroad: "Global scalability is a possibility thanks to eucalyptus", explained Adriel.

Improving the soil

Close to Torres Vedras, on the same hillside from which Wellington's troops kept a watch on the French invaders, a eucalyptus plantation has been established in line with agro-forestry principles. Quinta da Póvoa is a farm that has embraced innovation, while keeping to ancestral principles. Miguel Vasconcelos Guisado's grandfather was a pioneer in growing eucalyptus in the Torres Vedras region, when he established the first plantations on the Serra do Socorro. Sixty years on, when Miguel replaced the eucalyptus woods, he decided to convert one of the plots to a vineyard and planted a new area with eucalyptus.

The conversion from eucalyptus to vines went ahead without a hitch. And the new eucalyptus woods, established on areas of the hillside where the pH of the soil was very high, were planted "just like a vineyard", recalls Miguel Vasconcelos Guisado. There was no mobilisation of the soil, and the undergrowth has been controlled mechanically or, as happened this year, by using the cows from a neighbouring farm.

The experiment couldn't have gone better. "I've managed to create a microclimate and the pH has been coming down. At the moment we have a much more interesting balance in the soil and the eucalyptus trees are thriving", the farmer told us. "Where it's located, the eucalyptus plantation creates a barrier between the orchards and the vineyards, which acts as a buffer zone for pests and diseases. On my oldest vines, which date from 2015, I've never used insecticide", he says. In the meantime, a new apiary was been set up near some of the older eucalyptus woods on the farm, to secure the presence of bees to pollinate the vineyards and orchards.

Intercropping

At Quinta da Cholda, in Golegã, vegetable produce will grow between the rows of eucalyptus. Nuno Coimbra, the owner, is opting for an agro-forestry approach on his farm which, in addition to eucalyptus woods, consists of maritime and umbrella pine woods and fields of maize. "We have an area of around 40 hectares of eucalyptus that was planted in 1992 and harvested for the second time in 2019. It was then that we opted for planting in strips. We planted a continuous area of around 30 to 35 hectares, and left about 10% of the area that we didn't plant completely, with a three-span gap between planting rows: eight metres planted, 16 without planting", explained Nuno Coimbra.

Now, with the eucalyptus trees planted, Nuno is working with the Higher Institute of Agronomy to determine what species would best coexist with them. Almond, walnut, some vegetables, cereals or even some pasturage are among the possible choices. "It's an idea that's come over from Brazil, where they do a lot of this type of combining eucalyptus with agricultural crops", said Nuno Coimbra, who also sees these strips serving as areas to conserve and preserve biodiversity, as well as protecting against fire. This was a consideration in choosing the location. "As the area around this eucalyptus plantation is forested with umbrella pines, I thought I could include a protection strip for the pinewoods, and for the eucalyptus plantation itself", he explained.

Up and down the country, eucalyptus is growing in natural symbiosis with neighbouring crops. ♦

Eucalyptus cover

Four years ago, a new system for growing potatoes was tried out at the Freixo do Meio estate, in Montemor-o-Novo, where Alfredo Cunhal Sendim, an enthusiast for the agro-forestry approach, opted for BRF (Bois Raméaux Fragmentés, or woodchip) technique. Instead of being buried, the potatoes are laid out on the soil, and a 10 centimetre layer of eucalyptus woodchip laid on top of them. As well as acting as a blanket that protects the soil, the woodchips help to retain moisture and, because they hosts fungi that obtain nutrients and water from the atmosphere, allow for more efficient water use. ♦





In my neighbourhood

“My neighbourhood’s climate” is a project designed to show citizens “that problems may be global, but the solutions have to be local”, António Saraiva Lopes told us, explaining that a pilot project has been conducted in the Alvalade district of Lisbon, as the result of an MA thesis. This consisted of showing a group of residents the results of the most severe scenarios. “And many of them were very receptive to the ideas that will allow us to mitigate the urban heat islands, including management of green areas and changing consumption habits”. An example to follow. ♦



Trees against urban heat

Urban heat islands, where the temperature rises in particular areas of a city, are harmful to the environment and to our health. Trees are fundamental in combating this phenomenon.

This phenomenon occurs mainly in highly built-up areas of cities and is due above all to the removal of plant cover and the construction of large urban agglomerations, that reflect the light and radiation from the sun and stop the air from circulating. This is exacerbated by the heat absorption capacity of surfaces such as asphalt, brick or concrete, as well as of clay and asbestos tiles. Other factors that contribute to heat islands are pollution, which prevents heat from being dispersed, and energy use by vehicles running on internal combustion engines, by homes and industrial facilities.

Bad for the environment because they help to boost global warming, urban heat islands are also prejudicial for human health, because of the deterioration of the air quality and all the associated consequences, as proven by research in this area⁽¹⁾. Despite these effects, there are ways of minimising temperature peaks in cities, and the role of trees is “the most interesting issue

from a scientific point of view and in practical applications”, noted António Saraiva Lopes, coordinator of the Zephyrus research project into climate change and environmental systems at the R&D unit of the Institute of Geography and Territorial Planning of the University of Lisbon.

An article he co-authored entitled “Evaluating the Cooling Potential of Urban Green Spaces to tackle Urban Climate Change in Lisbon” explains that “it was discovered that the cooling power does not extend far beyond the garden, and so treeless streets are substantially hotter”. This led to the conclusion that “it is absolutely fundamental that all outdoor urban areas should contain trees in order to combat urban climate change. Because “proximity alone is not sufficient to secure the desired cooling effect”.

However, António Saraiva Lopes told us that although trees are “fundamental for combating climate change in an urban environment, they must be carefully chosen to minimise the risk of falling”.



“To find out which species are most vulnerable and exposed to this risk we worked with specialists to identify the species most prone to falling”, he went on, “and the results are surprising”.

They discovered, for example, that “certain species such as Tipuana tipu [tipuana or tipa] or Populus [poplars], widely used in the city of Lisbon, are well adapted to the Mediterranean climate but live much shorter lives than those in the wild, most likely because of the ‘poor’ soils. Not to mention other problems, such as the pollen, which can be harmful to people, especially those with respiratory disorders”.

Strategies for the future

And how do things look in Portugal’s cities? Although research has not yet been conducted throughout Portugal, and there is still “a lot to do”, the Zephyrus research group has worked for more than twenty years with several municipalities, including Lisbon, Cascais, Loulé and Leiria, on developing urban climate maps and designing strategies and measures for adaptation to climate change. One example of this is the newly-approved climate change adaptation plan for the Lisbon Metropolitan Area.

The researcher explained that, in the case of Lisbon, for example, the project entitled “Thermal Vulnerability Cartography - Mapping the effects of heat waves in Lisbon, in the light of climate projections”⁽²⁾ and the urban climate maps have already made it possible to identify “the districts

of the city where the heat risk is greater for human health, and also where extreme temperatures are projected in the future, such as in Parque das Nações”. These are areas “where the construction density is higher, where the soil has been completely impermeabilised, in dark colours, with poor ventilation and impoverished air quality, and where green areas are absent or insufficient to combat the heat”.

Even so, he noted, we do not have “a climate situation that is cause for concern throughout the whole city”. On the contrary. Lisbon benefits from several factors related to “the city’s proximity to two large water masses (the Atlantic and the Tagus estuary), which produce cooling breezes and provide an essential bio-climatic service, and also the very regular wind, generally blowing from the north, that also cools down the city”.

But he had a word of warning: “We have to pay attention to new urban development and urban design. If the construction index is high, resulting in a dense urban fabric, the built-up areas can block off breezes to a certain extent, creating situations of poor ventilation and bio-climatic discomfort, both in riverside areas and in the city centre”.

It is essential to plan tree planting in expanding urban areas, to that they can do what they do best: improve the quality of the air, mitigate climate change, increase energy efficiency and make our cities safer, healthier and more attractive places to live. ♦

(1) <https://www.scielo.br/pdf/ea/v30r86/0103-4014-30-86-00067.pdf>. (2) <https://www.lisboa.pt/cidade/urbanismo/planeamento-urbano/teste-outros-estudos-e-planos/ondas-de-calor>



Natural therapy

The forest is good for our health. It relieves stress, boosts immunity and improves the quality of life. To help us enjoy these scientifically proven advantages, there are guides and "bathing".

The pace of urban life, the frantic race against time and the pressure of technology, to which we now have to add the weight of isolation and digital fatigue, are all frequent sources of stress, anxiety or even panic and depression. This evil of modern societies can be treated by a therapy that is simple, accessible and affordable: forests. And there's nothing magical or supernatural about forests' therapeutic powers, according to an array of scientific research which has recently sought to understand their "miracle" effect.

The idea is not new. In the mid-nineteenth century, two German doctors, Peter Detweiler and Hermann Brehmer, founded sanatoriums for patients with tuberculosis deep in the forests, speculating at the time that the pines extracted a curative balm from the air. The idea has been revisited more recently by a number of scientists, in particular by the immunologist Qing Li, directors of the Japanese Society for Forestry Medicine, who for over two decades has researched the effects of walking in the woods.

Qing Li, professor at the Nippon Medical School, has managed to prove that woodland walks lower blood pressure and blood sugar levels, improve cardiovascular health and even aid concentration and memory. Thanks to his experiments, it has also been possible to establish a causal link with cancer prevention. This is because the essential oils from trees, known as phytoncides, discovered by a Russian scientist, Boris Tokin, which protect them against diseases, insects and fungi have the result of causing a substantial increase in humans in the NK cells responsible for destroying tumours, [as Qing Li has demonstrated](#). But the advantages are not limited to our physical well-being. Another study coordinated by the same Japanese researchers has shown that these walks are also linked to low levels of sadness, anxiety and hostility.

Anti-stress bathing

These discoveries have confirmed the benefits of Shinrin-Yoku - meaning bath (shinrin) and forest (yoku). This is a practice introduced in 1982 by the Japanese Forestry Agency as part of a national health programme designed to reduce stress levels in the population. The practice of "bathing" encourages people to open their senses to the forest atmosphere, to enjoy its air and to encourage an emotional connection with the landscape.

In Japan, this therapy is recognised by the national healthcare system and is regarded as one of the most effective ways of dealing with "karoshi", the phenomenon known as "death from overwork", responsible for thousands of fatalities each year. It has also led to further research into the physiological effects of exposure to the whole forest ambience and to certain elements, such as the smell of wood, the sound of running streams or the landscape⁽¹⁾.

This therapy has been widely studied and written about in Japan⁽²⁾, and Shinrin-Yoku has attracted followers around the



world, including in Portugal [see the article “The most important thing is to switch off”], resulting in a large volume of research into the matter, organised walks and training programmes. The work and expansion of the Forest Therapy Institute or the Nature & Forest Therapy association, which organises forest therapy programmes and trains guides all over the world, are a good example of this.

But there are more. In Scotland, doctors have been officially authorised since 2018 to prescribe “nature”, an example that is being studied in other countries, in particular in Spain. And in France, a tree-hugging therapy, known as silvotherapy⁽³⁾, has emerged, seeking to demystify the spiritual “formula” of Shinrin-Yoku: “It’s not a question of spiritual ravings, esoteric or magical approaches”, explained the movement’s mentor, the biologist Jean-Marie Defossez, who claims that “woodlands are therapeutic”.

Happier

The truth is, in part because of the growing number of stress-related diseases, the topic has continued to attract interest from the scientific community, with several studies seeking to unravel the mechanisms underlying this relationship between forests and physical and mental well-being.

For example, research conducted by the Max Planck Institute, in Germany, has found that living near a forest may have a positive effect on the brains of city dwellers, especially in the amygdala, a region of the brain that is important for processing stress.

According to researchers, people who live in cities run a greater risk of psychiatric illnesses, such as depression, anxiety issues and schizophrenia, than those who live in the country. “Research into the plasticity of the brain backs up the assumption that the environment can shape

the structure and function of the brain”, explained Simone Kühn, the psychologist heading the project.

Contact with woodlands can even affect the rate of happiness, as concluded by other research, published late last year by the German Centre for Integrative Biodiversity Research, showing that the greater the biodiversity of birds, the happier people are.

Better in the morning

So what’s the best time to enjoy the benefits of nature? Albert Bach and a team from the Universidad Autónoma de Barcelona decided to study the variability of volatile organic compounds given out by plants to which beneficial effects are ascribed (in particular, anti-inflammatory, neuroprotector and anti-cancerous properties), in a holm oak forest, such as is very common in the Mediterranean region⁽⁴⁾.

The findings show significant variability in the concentration of these compounds, depending on the season and the time of day: the highest concentrations were recorded in the early morning (from six to eight o’clock) in early summer, and in the early afternoon (from one to three), in the same period. These peaks in concentrations were not identified in other months of the year, when the emissions of compounds increased with radiation from the sun, reaching their highest level at around two o’clock in the afternoon.

The lesson to take home - or into the country - is that the best time for “bathing” in the forest is the early morning, in summer. And if you live a long way from any woodlands, there’s no excuse: city parks and gardens have the same effect. ♦



“The most important thing is to switch off”

It is one thing for science to tell us that nature and the forests are good for our health, it is another for the participants to say they feel more relaxed, they understood how to improve their relationship with a loved one, that they had an idea for how to change something in their life or, more simply but importantly, that they switched off from their daily lives and had time for themselves”. We went to talk to Alex Gesse, Shinrin-Yoku guide and founder of the Forest Bathing Institute in Portugal.

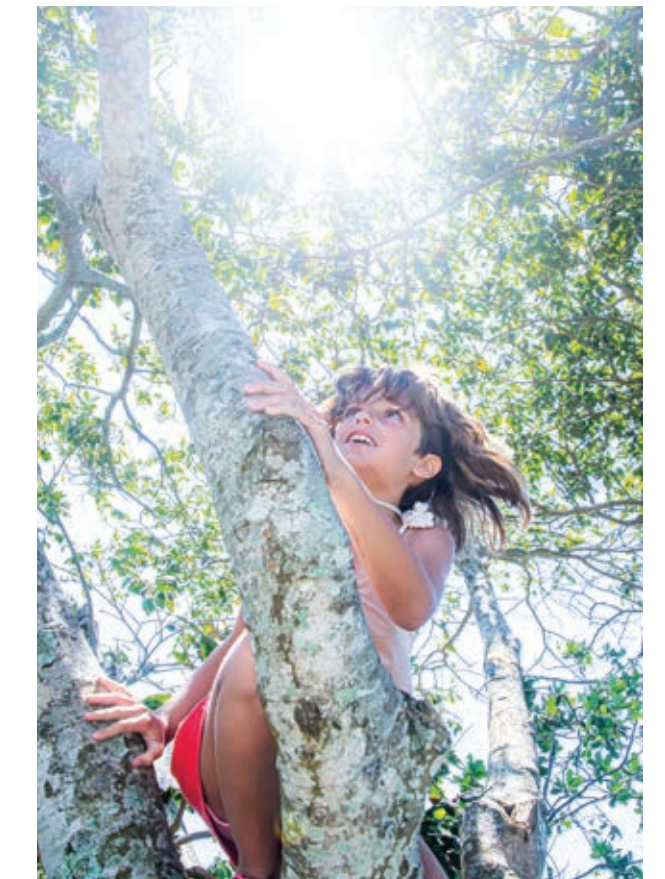
The main aim of these walks, he explains, “is to create a safe environment, physically and psychologically, so that the participants can slow down their daily lives and, through their senses, establish a relationship with a space that science tells us has a therapeutic effect on our health”. In other words, the idea is “to find another way of being in nature, to connect with the forest”, so that “by improving this connection, we improve our well-being”.

Founded in 2016, the Forest Bathing Institute has pioneered this concept in Portugal. It currently organised walks (in Costa da Caparica, Monsanto and Buçaco) and workshops that allow people to “learn techniques for forest bathing and to improve their well-being, but also to improve corporate communication and develop creative solutions”, explained Alex Gesse, who is also a training officer at the Forest Therapy Institute and an international consultant.

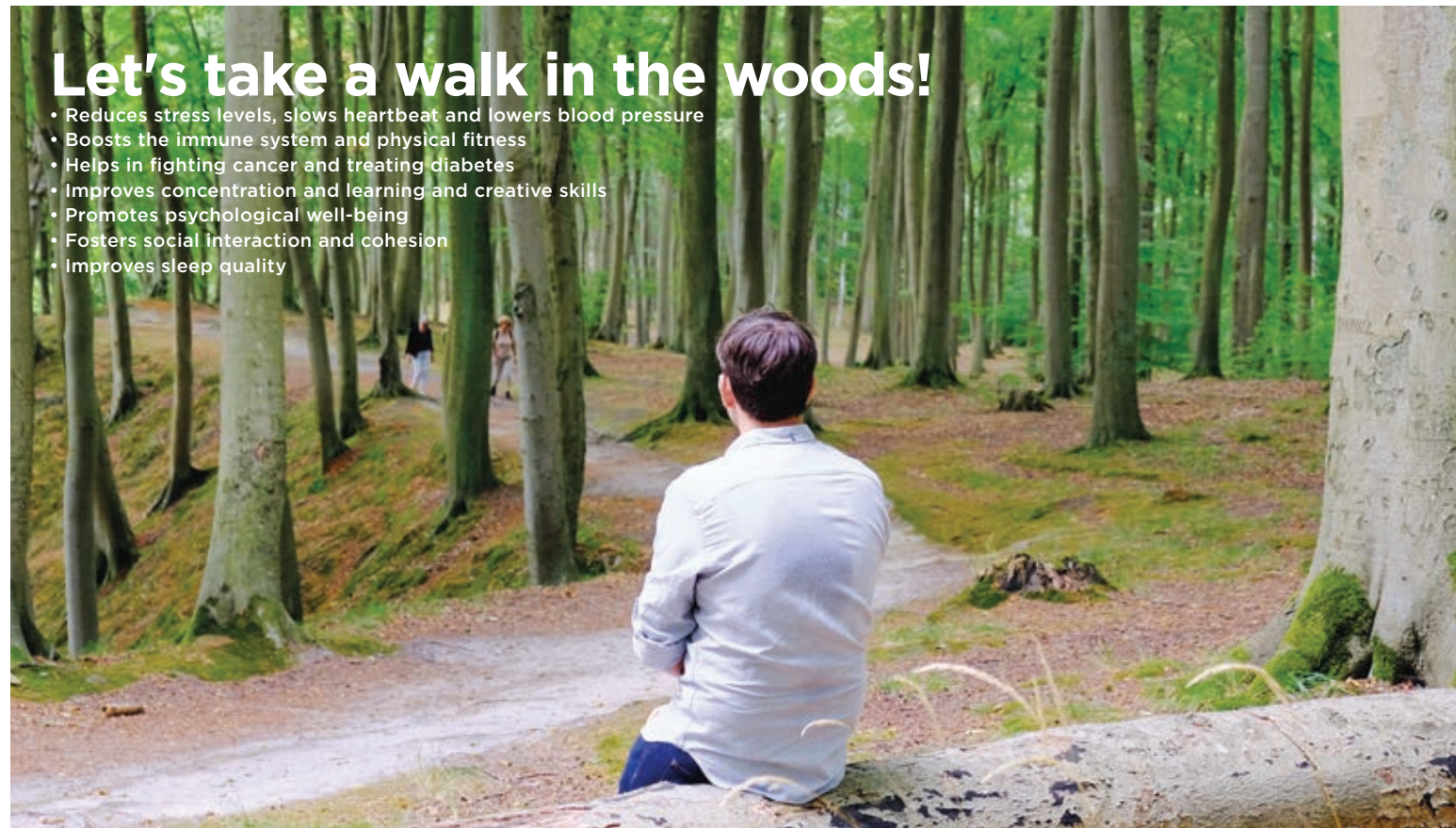
The participants in the forest bathing walks are “as varied as can be”, pointing out that the institute is currently geared to “helping companies and organisation, so that their staff can not only reduce their stress levels but also find other ways of relating to each other and finding solutions to the everyday problems of the organisation”, meaning that they have “a more social impact”. ♦

Nature deficit in children

Richard Louv is a journalist and author of several books on the impact of reduced contact with the natural world. In the nineties, when he was researching his book Childhood’s Future, he realised that a lot of parents complained they couldn’t get their children out of the house. In 2005, in his book, The Last Child in the Woods, he coined a new term: “nature deficit”. As one of the founders of the Children and Nature Network, which disseminates research and organises campaigns encouraging contact with less built-up environments, he believes that this nature deficit, which also affects adults, is particularly worrying in children, not just because they spend more and more time indoors, but because this can harm their development. For example, he says, bringing nature into school can improve learning in different areas, in particular in languages and mathematics. He also argues that it appears that child obesity and psychological disorders can also be mitigated, citing research from the University of Chicago that found improvements in children with attention deficit after short walks in parks. ♦



In children, a lack of contact with nature can harm their development.



Let’s take a walk in the woods!

- Reduces stress levels, slows heartbeat and lowers blood pressure
- Boosts the immune system and physical fitness
- Helps in fighting cancer and treating diabetes
- Improves concentration and learning and creative skills
- Promotes psychological well-being
- Fosters social interaction and cohesion
- Improves sleep quality

(1) <https://environmentalhealth.biomedcentral.com/articles/10.1007/s12999-009-0091-z>
 (2) Qing Li e Yoshifumi Miyazaki, principais sumidades em Shinrin-Yoku. 16m livros editados em português
 (3) “Silvotherapie : le pouvoir bienfaisant des arbres”, Jean-Marie Defossez, editore Jouvence
 (4) https://www.researchgate.net/publication/242300546_Human_Breathable_Air_in_a_Mediterranean_Forest_Characterization_of_Monoterpene_Concentrations_under_the_Canopy



Clean-ups in woodland areas or planting trees are activities that can run alongside the treasure hunt.

The "caches" are airtight boxes containing a logbook, and sometimes a small object.

Photos: Groundspeak Inc. (dba Geocaching)

Treasure hunt

Setting off in search of a cache can be great entertainment for all the family, an excellent opportunity for getting out into the country and even a way of assessing the quality of ecosystems.

Hunting and finding unknown "treasure" is an exciting thing to do, which is the main reason why geocaching has won a huge following around the world.

An outdoor activity, geocaching is closely connected with nature, and also helps to raise people's environmental awareness. In many cases, the hunt for the cache (the word used for the "treasure" chest) serves to nudge people of all ages into exploring and preserving the natural world. A variant of the craze consists of CITO events - Cache In, Trash Out. This is when people combine geocaching with a clean-up of a given area, planting trees, removing invasive species or maintaining paths.

Sport, game or simple recreational activity, geocaching is hard to define, except for one thing: it succeeds in getting people into the outdoors to explore and discover the delights of the countryside. As a result, in less than twenty years, there are more than three million active caches in 191 countries, of which 30 thousand in Portugal, including seven thousand in the Lisbon region.

Not for muggles

But what do these caches have that attracts fifty thousand Portuguese geocachers and thousands of others from abroad? The traditional caches are small airtight boxes (like a Tupperware) containing a logbook and, in some cases, a small object that the person finding them keeps and replaces with something else of similar value. But the huge popularity of geocaching has resulted in an imaginative variety of caches, which can involve riddles or paper chases, increasing the excitement of discovery.

The caches are hidden by the players, in keeping with a series of rules set by Geocaching HQ (see the guidelines at www.geocaching.com/play/guidelines). An important point is that caches should not be at the mercy of muggles, a term taken from the Harry Potter to refer to non-geocachers. Out of ignorance or ill-will, muggles are the greatest threat to the longevity of caches, especially those which are most accessible. Location is graded in terms of the difficulty involved, in other words, the total effort needed to find the cache: from 1 (easy) to 5 (extremely difficult). The caches may be



behind a stone or hanging from a tree, or else involve climbing or diving.

Technology and science in action

Geocaching came into existence in May 2000, when ordinary people first had access to GPS signals and satnav devices. With the help of the internet, it became possible to announce a precise location to a vast audience. When smartphones with geolocation systems became common, it meant that anyone could become a geocacher.

In Portugal, although urban parks are often chosen as locations, geocachers prefer open landscapes, with water, and their favourite forests are montado (cork oak savannahs). This was the finding of a study published in April 2019 in Ecological Indicators, in which five Portuguese researchers made scientific use of the assessments and photographs posted on the official geocaching site (www.geocaching.com), in order to assess the cultural services provided by ecosystems.

Without suspecting it and while they were having fun, the Portuguese geocachers made another vital contribution to the design of more effective countryside management and conservation strategies, that take cultural and leisure services into account. ♦

Step by step

1. Create a free account at www.geocaching.com
2. Look for a location on the map
3. Choose a cache and click to see the details
4. Take the coordinates and enter them in your satnav/smartphone
5. Set off to find the place and discover the cache
6. Sign the logbook and leave everything as it was
7. Share the experience and photos online

There are "diamonds" buried in the forest

Can a woodlands fungus be as expensive as a jewel, be sought after as the most delicate and special gastronomic experience, and a status symbol? The answer is yes, and that fungus is the truffle.



Truffles are really a fungus. A kind of mushroom, that grows underground, at a depth of between 15 and 40 centimetres, never surfacing. This is one of the characteristics that makes them difficult to gather: they are like buried, invisible treasure.

To find them, truffle hunters use the sharper senses of smell of pigs, or dogs especially trained for this purpose. There's another difficult task: unearthing them without piercing their surface, getting them out whole and intact from their underground hiding place. Only then will their market value be guaranteed.

Because of the delicacy of the operation, when we talk about professional and organised truffle hunting, in parts of the world where the best white truffles are found (the white truffles are the most expensive, worth almost their weight in gold), dogs are used because, unlike pigs, they

find the truffles, but don't eat them.

These fungi grow around roots of host plants, establishing a symbiotic relationship, benefiting both. They are almost always wild, found in woodlands where all the countless ideal conditions are met for them to grow. The best harvests are in rainy years, as they need a lot of humidity.

The best loved and most sought-after species are *Tuber magnatum* and *Tuber melanosporum*, known respectively as the white and black truffle. The first is considerably rarer and is one of the most valuable ingredients used in the world's most exclusive restaurants. It only exists in the wild, and cannot be farmed. The season is short, from October to December/January. The best white truffles are found in northern Italy, above all in Piedmont, around Alba and Asti. The black truffle can be cultivated. Or rather, it can form in plantations of trees established



A dog of any breed can learn to hunt truffles. He just needs to be trained.

A kilo of white truffles can cost between four and seven thousand euros. But there are cases of such perfect specimens that they are auctioned for absurd prices. In 2006, an Italian restaurant in Hong Kong paid 97 542 euros for three truffles, weighing a total of 1.59 kg.

A different hunt

It's the smell that takes the dogs to the truffles. Sometimes, they go to the same place several times, and find nothing, until, one day, they locate there a fine white truffle. This means that the truffle was not previously ready to be harvested, and was not yet giving off its typical scent.

In reality, pigs, or rather, female pigs, are better truffle hunters than dogs. Their superiority appears to be related to the fact that truffles contain a pheromone and steroid called androsterone, which is also produced in the saliva of male pigs. So the females, especially when in heat, "go crazy" when they smell a truffle.

But dogs are easier to train, in particular not to eat the truffle when they find it. So it's the dogs that follow the truffle hunter into the woods, on their uniquely exciting treasure hunt. ♦

Are there truffles in Portugal?

Despite many reports from "hunters" claiming to have found truffles in Portugal, specialist mycologists (scientists who study fungi) say there are no scientific records to prove this. What does exist in Portugal is something called túberas (Terfezia arenaria and Choiromyces gangliformis), closely related to white truffles. They are popularly known as criadilhas, batatilhas ou silarcas, and are found above all in the Alentejo and Ribatejo. ♦

Just as beer is to Bavaria or mustard to Dijon, white truffles have become synonymous with Alba, in the Italian region of Piedmont, and are often called "Alba truffles".

specifically for this purpose, with the roots colonised by the fungus. But this involves heavy investment and significant risks: a lot of things can go wrong. And even if all goes well, the first truffle will appear only seven to fifteen years later.

The black truffle grows around the roots of holm oaks, other oaks or hazel. It is plentiful in France, in the Périgord region, but is also found in Italy and Spain. As they are more plentiful and exist over a longer period of time (from November to March), the price is also less prohibitive. What's more, they can be frozen, unlike their white cousins, meaning they can be savoured at any time of year.

On the plate

White truffles have a delicate flavour, more intense, and an unequalled aroma and texture. For chefs working in haute cuisine, there is nothing to compare to them, and so they put all their talent into creating dishes that underline their unique qualities.

They are cut into the finest slivers - the finer the shaving, the more aroma and flavour they release. And they are never cooked. They go well with eggs, but can also make an unforgettable dish out of a risotto, pasta, a cheese fondue or a humble slice of good bread.

Are they worth their price? After you've savoured their unique flavour, you'll find your own answer to that question. But, personal tastes aside, one thing is certain: the white truffle is one of the most extraordinary ingredients found in woodlands, and it's included on many a gastronomic bucket list. ♦



The flavour of white truffles is unique, but it's their aroma that makes them both unmistakable and unforgettable.



Recently, the search for white truffles extended into Istria, in north-west Croatia, where a number of noteworthy specimens have been found. Istria is around 600 km from Alba, the white truffle region par excellence.

In the kingdom of ice

The boreal forest accounts for one third of the world's forest cover. It's the planet's largest store of CO₂. And the habitat of the famous Siberian tiger.



Often known by its Russian name, Taiga, the boreal forest represents 30% of the world's forest cover, spread over an area of 16.6 million km². It's a surprise to many of us that this is three times the size of the Amazon rain forest. This is **one of the world's largest terrestrial biomes**, and so it is vitally important in balancing the environmental ecosystem.

Located in the northern hemisphere, it is spread over Asia (Siberia, Japan), North America (Alaska, Canada, southern Greenland) and Europe (part of Norway and Sweden) and the climate is sub-Arctic: a very cold winter, long and dry, with temperatures dipping to -50o, and a short, wet summer, with longer and "warmer" days (when the ice thaws, forming lakes and marshes). It consists mainly of coniferous

plants (pine, fir, larch and spruce), but it is home to birch and beech trees. The soils are largely acidic (lower down it is permanently frozen) and covered with pine needles, making it difficult for other plant species to grow. This means that ground-level vegetation is sparse, comprising only moss, lichens and certain shrubs. The trees grow very close to each other, forming a dense cover which prevents bright sunlight from reaching the forest floor. There is also very little rain in the boreal biome. Precipitation comes in the form of mist and snow, with only a little rain during the summer months.

Due to the low temperatures, these forests grow very slowly, and they are difficult to regenerate.

However, the vegetation presents a number of curious adaptations which help it to

Biome

Ecological community stretched over a large geographical area and characterised by a dominant type of vegetation.

The stoat (small carnivorous animal that belongs to the weasel family) has a curious way of defending itself from predators: it changes the colour of its fur. It is dark brown in summer and turns white in winter, to camouflage it in the landscape.



survive the cold temperatures: the conical form of the trees enables them to withstand snowfall without their branches breaking, the leaves (small, to reduce transpiration losses) are alive all year round, so that photosynthesis can start as soon as the sunlight increases, and they are covered in a resin that protects them against the cold.

Animals in the Taiga

The boreal forest is not particularly famous for the diversity of its fauna, especially in comparison with warmer and wetter regions, in lower latitudes. But although it cannot rival the ecological abundance of a tropical forest, it still has a good variety of animals.

Grizzly bears, black bears, wolves, beavers, pine martens, caribou (a species of reindeer), elks, the Canada lynx and Arctic

fox. And there are also crows, crossbills, salmon and even mosquitoes.

The boreal forests are also the main home of the great grey owl, native to North America, Scandinavia, Russia and Mongolia. This bird of prey, considered the world's largest owl, in length, glides silently between the trees in search of its prey.

The Siberian tiger also hunts in the Taiga. An endangered species, this large wild feline is a vital component in the forest's ecosystem. It normally hunts ungulates, such as the Siberian musk deer, wild boar and elks, as well as smaller prey such as rabbits, hares and even fish.

These animals are sufficiently tenacious to make a home in this unwelcoming habitat, as hostile as it is beautiful. ♦

Serious threats

The boreal forest stores vast quantities of carbon, possibly more than temperate and tropical forests combined, much of it in peat bogs⁽¹⁾.

Its ecosystem is also essential to regulating the climate, as well as air and water quality. But these capacities are under threat from climate change: the latitude occupied by the boreal forest experienced some of the most dramatic temperature rises in the last quarter of the twentieth century, especially in the winter⁽²⁾.

And whilst until recently scientists believed that one of the few positive consequences of global warming would be to allow forests to colonise colder areas of the planet, such as the region occupied today by the boreal forest, their perception today is rather different.

A recent study, published in a scientific journal (*Ecology Letters*), showed that pollution is making the atmosphere in the Arctic more opaque, blocking out sunlight and reducing photosynthesis. As a result, since 1970, thousands of square kilometres of boreal forest have died or are dying. Researchers have analysed hundreds of dead and some living trees within a radius

of 150 kilometres of Norilsk, a city in central Siberia, which is one of the world's largest mining complexes. The study found high concentrations of metals and sulphur in the wood of dead trees, as well as contaminated soils, making it difficult for new plants to replace them.

In addition, the research showed that the pollutant emissions are darkening the atmosphere, interrupting the normal cycle of photosynthesis. And Norilsk is only a small part of the problem, because "this phenomenon has been observed in many regions of the boreal zone", warns Alexander Kirilyanov, an ecologist at the Federal University of Siberia and co-author of the study. This means that "at other high latitudes of the North, throughout the boreal forest, trees are also suffering". ♦



(1) "The Carbon the World Forgot", Matt Carlson, Jeff Wells, Dana Roberts; (2) "The Future of the Boreal Forest", NASA

Climate change and pollution are having dramatic consequences for the boreal forest.



Other forests

In addition to the Taiga, there are two other main types of forest in the world, each with its particular characteristics and specific biomes:

Temperate – a temperate in four seasons, with a cold winter and moderate summer. These are found in cooler regions such as North America, northern Europe, Japan, South America, southern Africa and southern Australia.

Tropical – with tall trees, a hot and humid climate and abundant precipitation. Located in areas of Central and South America, Africa, Asia and Oceania. ♦



Curious facts about forests

Trees first appeared on Earth more than four hundred million years ago, marking an important turning point for terrestrial life on our planet. As forests grew and expanded, nothing was ever the same again. Learn some curious facts about forests and the trees that grow in them.

There are three billion trees in the world

Some numbers are so big that our brains are ill-equipped to cope with them. The quantity of stars in the sky, the grains of sand on a beach and, it turns out, the number of trees on Planet Earth: three billion⁽¹⁾. But the pace of deforestation means we are losing millions of trees each year, so it's essential that we carry on planting.

The Earth has more than 60 000 known species of trees

Until recently, a detailed census of trees had never been conducted. But in April 2017, the findings of a huge scientific endeavour were published in the Journal of Sustainable Forestry⁽²⁾, together with a searchable online archive called GlobalTreeSearch⁽³⁾.

Scientists compiled data from museums, botanical gardens, agricultural centres and other sources, and concluded that 60 065 tree species are currently known to science.

More than half of all tree species exist in just one country

This census in 2017 concluded that almost 58 per cent of tree species are endemic to a single country, in other words, they occur naturally within specific geographical frontiers. Brazil, Colombia and Indonesia have the largest totals of endemic tree species, which makes sense, in view of the wider level of biodiversity found in their native

forests. "The countries with most of the endemic tree species reflect broader trends in plant diversity (Brazil, Australia, China) or islands where geographical isolation has resulted in species formation (Madagascar, Papua New Guinea, Indonesia)", write the authors of the study.

The enemies of trees' enemies are their friends

Trees may look defenceless, but they are skilled in protecting themselves against certain threats. They are able not only to produce certain chemicals locally, to combat insects that feed on their leaves, for example, but can also emit chemicals that transmit information, attracting their enemies' enemies. Research conducted in 2013⁽⁴⁾ showed that apple trees attacked by caterpillars release chemicals that attract birds to feed on the caterpillars. "We demonstrated that attraction of birds by infested trees was mediated mainly by chemical clues from the tree", write the authors of the study.

The Alentejo has the largest woodland area in Portugal

There are 1.3 million hectares, representing more than 40% of Portugal's forests. The central region comes second, with more than a million hectares (33.7% of the country's woodlands). And northern Portugal is in third place, with 584.9 thousand hectares (18% of the total)⁽⁵⁾.



Nature, one of world's most highly respected scientific journals, has published a map of the Earth showing the location of these trees.



The tallest tree in Europe is in Portugal

It's a *Eucalyptus diversicolor* F. Muell, 73 metres high and 140 years old, planted in the Mata Nacional de Vale de Canas, near Coimbra⁽⁶⁾. It is similar in height to the Torre dos Clérigos in Porto.

Wattieza and Archaeopteris are the earliest trees of which we have fossil records

The first of these is the oldest: it was identified from fossils which are 385 million years old, in what is now Gilboa, in New York State⁽⁷⁾. It belongs to a family of prehistoric plants believed to be ancestors of ferns, growing to a height of eight metres. The second is thought to have appeared around twenty million years later, and is closer to trees as we know them today, with buds, branching trunks with reinforced branch-trunk joints⁽⁸⁾.



Fossil (partial frond) of Archaeopteris, found in the Svalbard archipelago, Norway.



An illustration of the ancient Wattieza tree, based on fossils found in what is today New York.

Falconhurst / Wikimedia Commons / CC BY-SA 3.0

Ghedoghebb / Wikimedia Commons / CC BY-SA 3.0



Akerheltz / Wikimedia Commons / CC BY-SA 3.0



See the BBC video showing how trees communicate.

In a forest, the trees "talk" to each other and share nutrients through an underground network of fungus

Like most plants, trees have symbiotic relationships with mycorrhizal fungi that live in their roots. The fungi help the trees to absorb water and nutrients from the soil, and the trees pay back the favour by sharing with them sugars from photosynthesis. But this mycorrhizal network also functions on a much wider scale, as a kind of underground internet that connects whole forests. The fungi connect each tree to others nearby, forming a vast platform in the forest for communication, defence and sharing resources.

More forest than built-up areas in the Lisbon region

Compared with other regions of mainland Portugal, woodlands occupy only a small part of the Lisbon region. Even so, they represent a larger area (22%) than urban zones (20.8%)⁽⁹⁾.

Tree cover has a direct influence on biodiversity

It's no secret that trees encourage biodiversity. In order to quantify this effect, researchers at Stanford University have developed a way of

estimating biodiversity on the basis of tree cover. They recorded 67 737 observations of 908 species of plants and animals and displayed this data on detailed maps from Google Earth; they concluded that four of the six groups analysed (plants, non-flying mammals, bats and birds) presented a significant increase in the number of species in areas with more tree cover⁽⁹⁾. The findings of this research in Costa Rica were validated by 90 other studies in Latin America that enabled them to create a planning tool to guide investment in forest biodiversity in the tropics.

Even when they die, trees are of enormous value to the forest

Trees can live for hundreds of years. Some for even thousands - the oldest tree known to man is a specimen of Pinus longaeva and is 5 602 years old. Even when a tree finally dies, it still plays a fundamental role in its ecosystem: the dead wood is of great value to the forest, creating a slow and constant source of nitrogen, as well as micro-habitats for various types of animals. It is estimated that around 40% of forest wildlife - ranging from fungi and lichens to mosses and birds - depends on dead trees⁽¹⁰⁾.

From the age of dinosaurs

Wollemia nobilis was only discovered in 1994, in the Wollemia National Park, in Australia. But it has ancestors in the Jurassic period, and there are widespread examples of similar plants in fossil records in Australia, New Zealand and Antarctica⁽¹⁰⁾. It is frequently described as a living fossil and is listed as critically endangered by the International Union for Conservation of Nature.

Only discovered in 1994, it dates back to the Jurassic period.

Many countries have tried to plant "Portuguese eucalyptus" in their forests, but without success

Originally from Australia, like nearly all species of eucalyptus, but *Eucalyptus globulus* found its ideal conditions in the Iberian peninsula, especially in the mild climate of coastal areas of Portugal, north of the Tagus. It is averse to frost, snow, very cold temperatures and tropical climates, meaning that it does not survive in other areas of the world where people have aspired to growing it, attracted by the quality of the wood, ideal for making paper. The United States, Brazil and France are some of the countries that have tried unsuccessfully to cultivate the species.

Living close to green areas can boost longevity

City dwellers with access to wooded areas are more likely to live longer than if they were surrounded by concrete, shows a study published in Lancet Planetary Health⁽¹²⁾. The researchers found that access to trees, shrubs and grass meant longer life expectancy: "We found evidence of an inverse association between green surroundings and general mortality. Intervention to increase and manage green areas should therefore be regarded as strategic intervention for public health".

People who live near trees find it easier to give up smoking

Research conducted in England, late last year, concluded that smoking cessation rates were higher when people lived in areas surrounded by grass and trees⁽¹³⁾. English people who lived further from green areas were also more likely to smoke.

Almost 22% of Portugal's woodlands are protected

21.8% of Portuguese woodlands are protected areas with the main purpose of conserving biodiversity and protecting landscapes and specific elements of nature⁽¹⁴⁾. Portugal has a good variety of forest species, with montados - cork and holm oak savannahs - accounting for a third of all the country's woodlands⁽⁵⁾.

There are almost two billion trees within the Sahara Desert



Martin Brandt

With the help of high-precision satellite images and AI technology, European scientists have located a green area in an arid region of the African continent with 1.8 billion trees⁽¹⁵⁾. This is most likely an underestimate, insofar as the satellite is unable to separate and identify trees with a crown of less than three square metres.

To find out more

- 1) <https://www.nature.com/articles/nature14967>
- 2) <https://www.tandfonline.com/doi/full/10.1080/10549811.2017.1310049>
- 3) https://tools.bgc.org/global_tree_search.php
- 4) <https://onlinelibrary.wiley.com/doi/abs/10.1111/ele.12177> (<https://digital.csic.es/bitstream/10261/124406/4/EcolLet%2016%2811%29%201348-1355%20%282013%29%20POSTPRINT.pdf>)
- 5) http://www2.icnf.pt/portal/florestas/ifn/resource/doc/ifn/ifn6/IFN6_Relatorio_completo-2019-11-28.pdf
- 6) <https://www.monumentaltrees.com/en/heightrecords/europe/>
- 7) <https://www.sciencedaily.com/releases/2007/04/070418130435.htm>
- 8) <https://www.thoughtco.com/archaeopteris-the-first-true-tree-1341519>
- 9) <https://www.pnas.org/content/113/51/14544>
- 10) <http://anpsa.org.au/w-nob.html>
- 11) <https://treesforlife.org.uk/into-the-forest/habitats-and-ecology/ecology/dead-wood/>
- 12) <https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196%2819%2930215-3/fulltext>
- 13) <https://www.sciencedirect.com/science/article/abs/pii/S0277953620306675?via%3Dihub>
- 14) https://foresteurope.org/wp-content/uploads/2016/08/SoEF_2020.pdf
- 15) <https://www.nature.com/articles/s41586-020-2824-5>

Portugal's forests were planted by man

Population growth accelerated the degradation of Portugal's forests from the fourteenth century onwards. The original forest was gradually destroyed to build villages, to create farms and pasture lands, and wood from the different native species was used as a source of fuel and raw material for construction and ship building. Woodlands gradually gave way to pasture, to meet the needs of agriculture. As a result, in the early nineteenth century, Portuguese woodlands occupied less than 10% of the country.

Today, most of the country's forests are semi-natural in origin, combining native with other planted species. Planted forests account for around 70% of Portugal's forests: production forests, mainly pine and eucalyptus, represent 20% of the total area of woodlands, and other planted areas make up the remaining 50%, including forest parks and national woodlands. Examples of these are Buçaco, Gerês and Sintra. And there are many other forests that only exist because of human intervention. Here are some of the best known cases:

Choupal National Forest

The aim was to mitigate the effects of silting in the River Mondego, at a time (late eighteenth century) when the flooding of surrounding land was a cause for concern. The planting of forestry species that resulted in the Choupal National Forest started in 1791, helping to mark out a new bed for the Mondego and to fix and protect its banks.

Covilhã National Forest

Located in the Estrela mountains, the Covilhã National Forest grew out of a tree-planting operation that started in 1903, designed to create a green area for public use. Today, 90% of this area is wooded, and includes picnic areas and a children's playground, as well as hiking trails.

Amarante Forest Park

Located on the banks of the River Tâmega, planting started in 1916, as a nursery, with the aim of reforesting the Marão and Meia Via uplands. In 1922, the Quinta de Codeçais was donated to the State as a home for the park.



Monsanto Forest Park

It might look like it's always been there, but this park in central Lisbon, occupying a quarter of the city, started to be planted in 1938, on the initiative of Eng. Duarte Pacheco. The original woodlands on the Monsanto uplands area probably started to be destroyed in the Barbarian and Roman invasions, clearing space for wheat fields and pasture, and later for vegetable gardens, olive groves and livestock. Only in the late nineteen seventies did Monsanto start to look like a forest.



Leiria Pine Forest

This forest dates back to the thirteenth century, in an attempt to halt the advance of the coastal sand dunes, which were invading agricultural fields, rivers and even population centres. The process was started during the reign of Dom Afonso III, but it was in the reign of Dom Dinis that maritime pines were planted on a large scale. ♦



Learn more about Portugal's forests in Florestas.pt.

Art rooted in nature

In the hands of the right artist, condemned trees enjoy a glorious second life, as artworks sown in the natural landscape.

Sometimes we look at a tree and we see many things, including things which are not there. Just as with clouds, you don't need a very fertile imagination to see something completely different in the trunk, exotic foliage or a curious perspective on the branches, something that our fancy suggests to us.

And you don't always need to imagine it. There are trees that transport us to unreal worlds that only art can reach, for the simple reason that the art is not in what we think we're seeing, but rather in the tree itself. In other words, the tree is actually the work of art. Not because nature made it look "artistic", but because a human artist has been at work.

The strength of wood, but at the same time the ease with which it can be worked, have made it one of the favourite raw materials for sculptors since time immemorial. For example, in religious art.

More recently, alongside the use of parts of trees, unaltered, as art objects, a new trend is gaining followers all over the world: sculptures made in trees where they stand.

This variant of wood carving has seen the modern countryside welcome versions of native North American totem poles, and it is increasingly common to find sculpted trees in natural parks, including in Portugal.

The totem at Quintinha de Monserrate speaks of biodiversity.



© PPSA/HEMING

The strength of wood, but at the same time the ease with which it can be worked, have made it one of the favourite raw materials for sculptors since time immemorial.

In Sintra, for example, motorists don't need to leave the Estrada Nacional 375 to be surprised by the majestic Bonelli's eagle topping a totem 7.5 metres high and 3 metres wide planted in the Quintinha de Monserrate. It was sculpted by the Welsh artist, Nansi Hemming, in the trunk of a eucalyptus nearly a century old.

In the Azores, walkers on a trail around the Lagoa das Furnas (on the island of São Miguel) can discover a dozen or so sculptures by Emmanuel Courtot, a French artist based in Portugal. These were created during three editions of a wood carving festival organised there, as part of the Action Plan for Terras do Priolo under the European Charter for Sustainable Tourism (ECST).

Unlikely as it may seem, the main tool used by a wood carver is a chainsaw. Carvings can be finished in different ways, either with a grinder, a chisel or even with sandpaper. When rooted trees are used, treatments with linseed oil or Xylophene (against insects) are applied to ensure durability.

With this growing art form, ailing trees, which would otherwise be cut down, are given a new lease of life in a glorious form, often attracting greater admiration than they enjoyed in their first incarnation. ♦

On São Miguel, in the Azores, the Lord of the Rings saga is evoked in this carving of Gandalf.



Imagination runs loose in the forest

Woodlands are one of the most common settings for fairy tales. Symbolising the natural world, they are simultaneously a magical kingdom and a place where danger lurks, and also where the imagination takes flight.

When fairy tales were told for the first time, and even when this oral tradition was recorded in writing, northern and western Europe were covered in dense forest. It was a time when forests represented the frontiers of civilisation and very real dangers, such as bandits and wild animals, both ready to attack unwary travellers.

Mirroring fictional forests in real forests (such as the German Black Forest, the setting for many of the famous tales of the Brothers Grimm), the forests function in these stories as a symbol of the natural world, representing something more primitive and untamed, in contrast with the world of humans. It is somewhere beyond the safety and familiarity of the village, city or town, where the "normal" rules do not apply and anything can happen.

A path to the subconscious

When fairy tales found their way into writing, they became texts that specialists could analyse. And several of them did so, including Freud, Jung and Bettelheim.

For Freud, fairy tales originate in the same place as dreams, and the use of images such as forests and thorns points to repressed desires and unrealised fantasies.

The father of analytical psychology, Carl Jung, asserted that the frightening aspects of forests that figure so prominently in fairy tales symbolise the dangers of the unconscious, in particular its tendency to overshadow and repress reason. Symbolically, therefore, characters who lose their way in the forest are losing their way in life, leaving behind their consciousness and travelling into the realms of the subconscious.

Bruno Bettelheim, one of the great child psychologists of the twentieth century explored the meaning of the forest in fairy tales in his best known book, *The Uses of Enchantment: The Meaning and Importance of Fairy Tales*, in which he writes: "Since ancient times, the forest where we lose our way symbolises the dark, hidden and almost impenetrable world of our unconscious. If we lose the structure that gave organisation to our past time, we must now find our own way in order to become independent, and on entering this wild place with a relatively undeveloped personality, when we manage to find the way, we emerge with a much more developed humanity."

In other words, in these fairy tales, the forest symbolises the place where inner darkness is confronted and explored, where the uncertainty about who we are is resolved. It is in the forest that we start to understand who

In his book, *An Illustrated Encyclopaedia of Traditional Symbols*, J.C. Cooper writes that "going into the Black Forest or the Enchanted Forest is a symbol of threshold: the soul entering the dangers of the unknown, the secrets of nature, or the spiritual world into which man must break through in order to find meaning".



we want to be. And it is also there that the hero often finds the realisation of his dreams and longings.

Shelter and safety

All the heroes who are sent into the unknown world of the forest end up finding their way out, which implies that, although the forest functions in the story as a significant obstacle, it is never one that cannot be conquered and overcome. It is a road that the character has to travel. Not only does the forest stand between defeat and success, but, very often, it is the same forest that makes it possible for the characters to triumph: they go into the forest knowing little or nothing about how to proceed, what to do, but they come out with self-awareness and end up achieving their aims and attaining happiness.

It is this image that Dante also evokes at the start of the *Divine Comedy*: "Along the journey of our lives, I found myself in a dark forest where the true path was lost." It is there that he finds a "magical" helper, Virgil, who offers his assistance in this pilgrimage that takes Dante through hell and purgatory until, at the end of the journey, he reaches heaven.

The forest is therefore a place of transformation, where the hero overcomes various difficulties and finds his or her way home. But it also represents a safe hiding place, where characters can take shelter.

In stories like *Robin Hood*, for instance, the forest becomes almost a sanctuary. It offers refuge for heroes who, after a period of forced exile, re-emerge into the world of men to fight for justice. Time spent in the forest can be interpreted as a rite of passage or as a period of personal development.

In addition, in fairy tales just as in real life, forests have always been a source of food and other raw materials essential for mankind's survival - or that of other anthropomorphised figures.

Even today, the forest still holds its magic. It is a refuge from the established order, from the stress of daily life and from overwork. It's a detox from the digital world, the "always on" and the concrete of cities. In the forest, we can leave our troubles behind and, in communion with the trees and nature, return to our primordial selves. In each of us lives a Little Red Riding Hood willing to ignore the rules and face the wolf, or a Hansel and Gretel smart enough to beat the witch at her own game.

Down the ages and in storyland, many have found refuge in the forest. Not only fugitives and exiles, but also gods, holy men and women, poets and, of course, animals who talk, cats who wear boots, witches, elves and fairies. ♦

Mirror, mirror on the wall, who's the fairest tree of them all?

It's as if Mother Nature had woken up one day and decided to compete with the best of the post-impressionists. A dab of colour here, another there, and there you have the rainbow eucalyptus, the artistic masterpiece of the tree kingdom.

Most of the hundreds of eucalyptus trees in existence are natives of Australia, but *Eucalyptus deglupta* is special in this respect too. It has been identified as the only gum tree native to the northern hemisphere, originating on the island of Mindanao, in the Philippines.

It is the only eucalyptus to have naturally crossed the Equator, naturally spread between the two hemispheres. Today, it is almost ubiquitous in the tropics, and can be seen from Papua New Guinea and Indonesia to Brazil, China and Hawaii.

The rainbow eucalyptus has a smooth bark, which peels off as the tree grows. When a layer starts to peel off, it reveals new bark, which is bright green, rich in chlorophyll. As that bark ages, it turns a darker green and then to tones of blue, lilac, pink and orange, as it starts to come off the trunk, ending as a deep brown, almost bordeaux.

As in other eucalyptus trees that shed their bark, the bark does not fall off in a uniform way, but instead in small strips, in different parts of the tree, and at different times. The result is a stunning trunk, with a profusion of colourful stripes, in patterns that are never repeated. These colours grow

more intense with the rain, and at this time become as clear as the brightest rainbow.

In its scientific name, the epithet *deglupta* refers to the process of bark shedding: it originates from the Latin "degluptere", which means, literally, "to shed bark". The bark is shed because of the need for renewal (in order to expose the living layer) and, most likely also to prevent lianas and other **epiphytes** growing up the trunk.

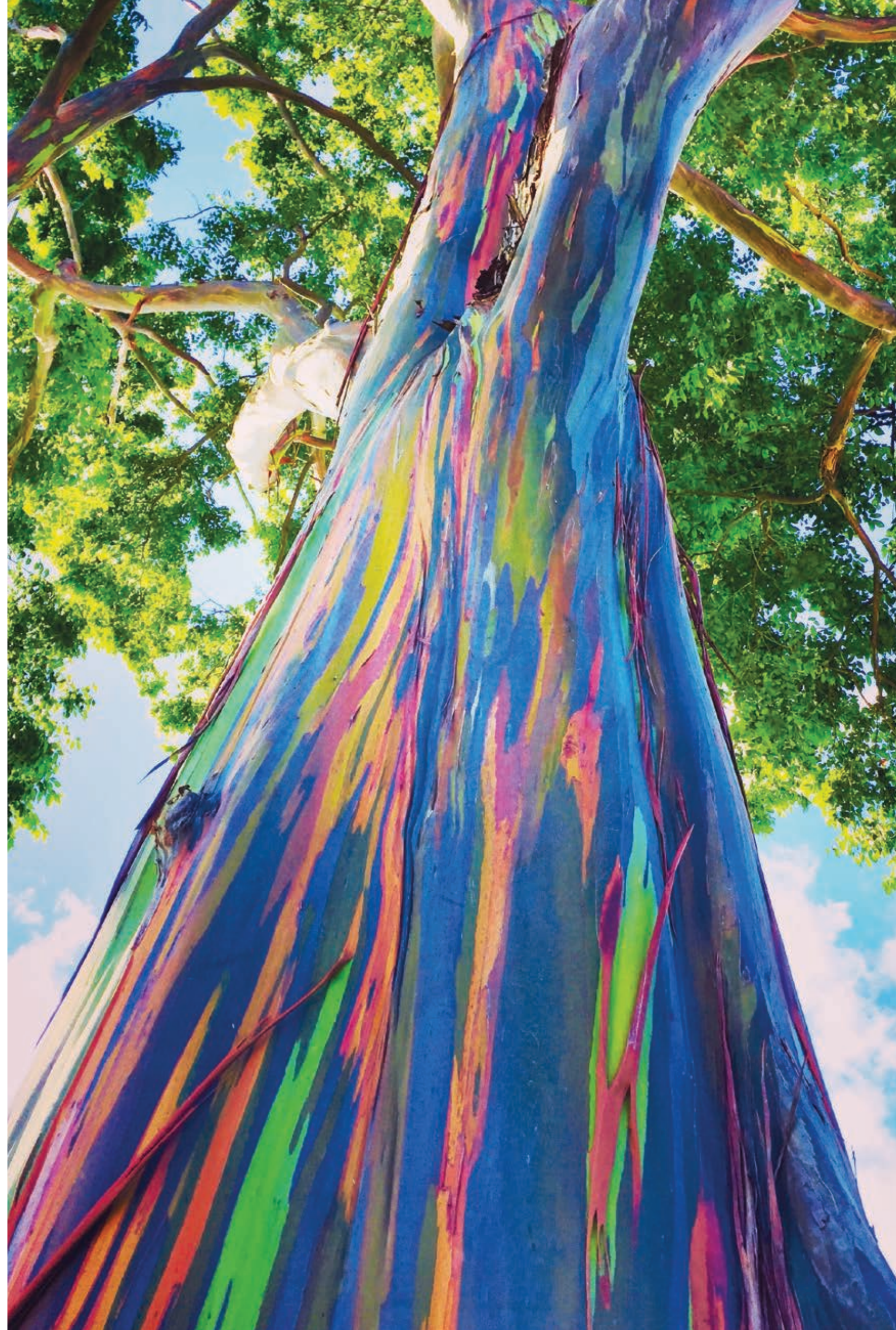
The size of the rainbow eucalyptus is also impressive. In its natural habitat, it can grow to a height of 75 metres and a trunk diameter of almost two and half metres. Cultivated specimen generally attain a more modest twenty to forty metres.

It is widely planted in countries where the climate permits (it thrives at temperatures of 20-32°C and precipitation in the order of 2.500-3.500 mm), because of its rapid growth and the excellent quality of the wood fibre for producing cellulose pulp. But the colourful bark is what makes it an eye-catching element of the landscape.

The rainbow eucalyptus could have leapt off the pages of a book by Dr. Seuss and would not be out of place in Alice's Adventures in Wonderland. But it's nature's handiwork. ♦

Epiphytes

Plants that grow up others, but without taking nutrients from them (as opposed to parasites).



Distant "cousins"



In Portugal, we have no rainbow eucalyptus trees, because our climate is not tropical. But there are other eucalyptus species, such as *E. globulus subsp. globulus* and *E. grandis*, that can occasionally show a palette of different colours on their bark, for the same reasons of ageing and renewal.

These can be seen at the Quinta de São Francisco, an estate belonging to The Navigator Company and home to its forest and paper research institute, RAIZ.

Indeed, although the local climate is not exactly ideal, the Quinta de São Francisco has announced that it is making efforts to add a specimen of the colourful *E. deglupta* to its collection. Because "no eucalyptus arboretum is truly complete without a rainbow eucalyptus". ♦

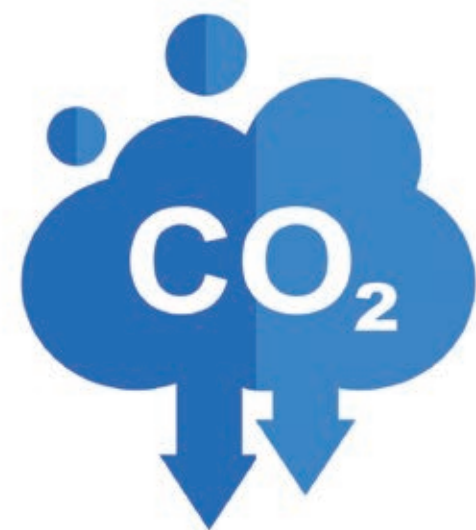
With the focus on sustainability

Top marks for environmental action

The Navigator Company has once again impressed the CDP in its assessment of the steps taken to address climate change, securing its place on the organisation's A-list for the second year running.

This international recognition of the company's environmentally responsible operations is from CDP, an international non-profit charity with the slogan Disclosure Insight Action, previously known as the Carbon Disclosure Project. Independently and using its own methodology, it assesses the environmental performance of corporations and cities, and is an important indicator for investors.

Cuts in emissions, reduction of climate risks and the low carbon impact economics implemented by Navigator are the reason by CDP has placed it among the 300 world leaders in the fight against climate change. ♦



Among the best in the world

The Navigator Company's sustainability performance has again attracted international interest with the score of 17.2 awarded in the ESG Risk Rating 2020 by Sustainalytics, the specialist auditor.

This result represents an improved assessment in relation to previous years, with Navigator retaining its classification as an ESG Low Risk Company for investors. Navigator was ranked fifth out of a total of 79 global companies in the Paper & Forestry industries cluster, and fourth out of 62 global companies in the Paper & Pulp cluster.

These ratings measure companies' sustainability performance, assessing exposure to material ESG risks, related to environmental, social and corporate governance factors, and also their management performance.

Navigator's rating and excellent ranking reflect its ongoing efforts to integrate sustainability as a priority in its business model, demonstrating its capacity to anticipate and manage ESG risks in the conduct of its operations. ♦



Environmental investment in 2020 not affected by pandemic

Despite the troubles caused to world economy by the Covid-19 pandemic, Navigator has pressed ahead with its investments in decarbonisation.

According to the 2020 results announced by the company, investment stood at € 80.6 million. This figure includes € 25 million in the environment, notably the new biomass boiler at the Figueira da Foz industrial complex, and approximately € 17 million in projects to recondition assets, part of its roadmap to decarbonisation and modernisation.

This investment is part of the Company's decarbonisation strategy, reflecting the decision taken in 2019 to meet the national and European targets fifteen years ahead of schedule, in 2035, and so achieve carbon neutrality at all its industrial complexes, entailing a reduction of 86% in its CO₂ emissions. Achieving this will involve total investment of 154 million euros.

In the financial year of 2020, Navigator recorded turnover of € 1 385 million, with paper sales accounting for around 68% of turnover, pulp sales 11%, tissue sales 10% and energy sales also 10%.

Biomass reduces CO₂ emissions by 30%

The biomass boiler that recently went into service at the Figueira da Foz industrial complex will allow the Group to cut its fossil carbon dioxide emissions by 30% in 2021. This power generation plant is more efficient and involved investment of 55 million euros. It will eliminate emissions of between 150 and 200 thousand tons of CO₂ each year. It will also make the Figueira da Foz mill the first in the Group to be powered entirely from renewable sources. ♦

Responsible solidarity



The My Planet project has donated paper bags to Refood Almada for distribution of meals, aligning the initiative with both social solidarity and environmental concerns. Refood is a voluntary organisation that avoids food waste, collecting food and distributing it where it is needed, now in a more responsible way, using an excellent alternative to plastic. ♦

Portuguese paper at the Council of the European Union

Paper is a natural, renewable and biodegradable material, and using it is an example of sustainable behaviour at every level. That is why, as a partner of the Portuguese Presidency of the Council of the European Union, in the first six months of 2021, Navigator has contributed office materials made from paper manufactured in Portugal, in the form of notebooks and notepads for high level meetings to be held in Portugal and Brussels over this period. ♦



Reading without barriers

Visão magazine is continuing its project to produce a free monthly edition in Braille, and is this year again supported by The Navigator Company. The company has donated 238 reams of Soporset Offset paper (120 grammes) for the printing of this special edition, which is distributed to blind readers, libraries, homes and special needs schools. ♦

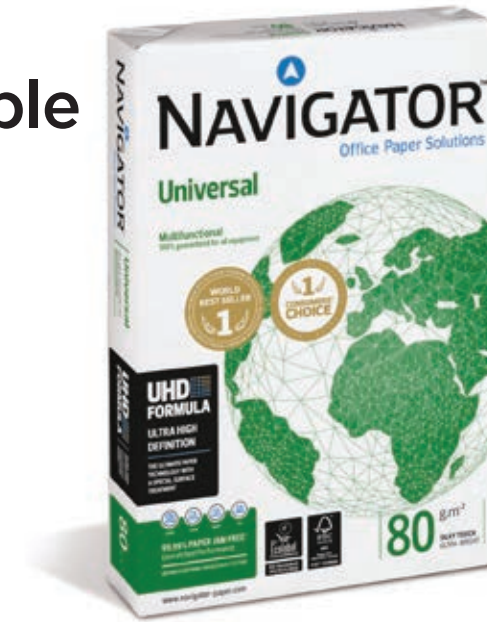


Portugal has potential for the bioeconomy

The Bio-based Industries Consortium (BIC), a European association whose mission includes circularity, innovation and sustainability as the central priority of the bioeconomy in Europe, has said that Portugal has everything to become one of the strongest countries in the bioeconomy, pointing to the country's economic power, innovation and biomass raw materials. A report drawn up by this association has identified opportunities for a transition to the green economy and to sustainable development. It acknowledged the important role of the agro-food, forestry, maritime and chemicals industries as driving forces in the Portuguese economy, and the leadership in biology-based sectors, in terms of production

value, of the food and drink, paper and paper pulp and wood processing industries. It concluded that the bioeconomy in Portugal already accounts for annual turnover of almost twenty billion euros, but that the opportunity exists for accelerating the country's green economic growth. "The sustainable bioeconomy has an increasingly crucial role to play in Portuguese and European society. Now is the time to pursue the benefits of this model and to find the best opportunities and solutions for helping companies to create more sustainable products and services", commented João Pedro Matos Fernandes, Minister for the Environment and Climate Action. ♦

Creating sustainable value



The Navigator Company, Portugal's forest-based company, held on in 2020 to its position as the country's third largest exporter, according to figures from the National Statistics Office. It is also the exporter that creates the most National Value Added, thanks to the large volume of local materials incorporated into its products. In all, more than 5 600 Portuguese suppliers work with the company, making it possible for the country's premium products to reach 130 countries. Creating sustainable value is one of the fundamental challenges facing companies around the world, at a time of growing awareness of climate change. Paper, Navigator's main product, has won itself a prominent place in the sustainability paradigm and the circular economy, based on products sourced from natural and renewable raw materials. ♦



Forest in a vertical spiral

Amazon's new headquarters in Arlington, Virginia (EUA), will consist of a mirrored tower, 106 metres high and a "forest in a vertical spiral", ornamented by trees and other natural plants to the very top of the building, carrying further the "biophilia" (the human desire for contact with nature) concept already inherent in the company's head office in Seattle, Washington.

As well as visually spectacular, as can be seen in the plans unveiled by Amazon, the building, called The Helix, has been designed to be environmentally friendly. All the power will come from a solar facility and there will be a surrounding area reserved for pedestrians and cycle lanes, where not even electric cars will be allowed. Buses and public transport will only have underground access.

The Helix has been conceived to be shared between employees, residents and tourists. It features large open spaces, shops, restaurants and even an amphitheatre for fairs, cinema and concerts. Even the offices, indoors, with a total area of 260 thousand square metres, will be open to visitors at the weekend. This will be the second most valuable corporate headquarters in the world. Construction work will start next year and is due to be completed in 2025. ♦



Video competition for young people

Forests, woodlands conservation and wildlife and/or combating forest fires are the themes for the short video film competition, for young people aged 13 to 18, promoted by Lousada Municipal Council, in association with ASPEA, the Portuguese Association for Environmental Education, as part of the Erasmus + CareForest project.

The videos must be no longer than 3 minutes, and may be developed individually or in groups. The deadline for submissions is 20 April. There will be a national prize for the winning film in each country, and three international prizes.

The competition is running in Portugal, Spain, Norway and Romania, and is designed to raise young people's awareness of the importance of woodlands conservation. ♦



Use this QR code to check out the competition rules.

A FLORESTA PELA TUA LENTE

CONCURSO DE CURTAS-METRAGENS

DESTINATÁRIOS: JOVENS ENTRE OS 13 E OS 18 ANOS

PRÉMIO NACIONAL	PRÉMIOS INTERNACIONAIS
Vencedor: 400€	1º lugar: 600€
	2º lugar: 400€
	3º lugar: 200€

SUBMISSÃO DOS VÍDEOS ATÉ 30 DE ABRIL DE 2021

Os vídeos deverão abordar o tema da floresta, da conservação das florestas, vida na floresta e/ou luta contra incêndios.

Os mesmos vídeos concorrerão automaticamente às duas categorias.

Os prémios são atribuídos em cheque-oferta para material fotográfico ou informático.

More bees in the forest

Bees are responsible for around 80% of the pollination of food available to man and animals, and, as pollinators, are essential to conserving biodiversity. With the balance of the ecosystem in mind, The Navigator Company has signed a cooperation agreement with FNAP (Portuguese National Beekeepers' Federation), allowing members free use of areas of its woodlands for installing their hives. Eucalyptus blossoms in winter, when bees are challenged by the scarcity of food, making this tree a secure source of nutrition, as well as contributing to honey production and defence of beekeeping as a business. ♦



Florestas.pt provides training with specialists



Deep Atlantic hiding 12 species

The Atlas project has discovered 12 new species in the deep waters of the North Atlantic, four of them in the Azores. Among bryozoans, molluscs and cnidarians, a bivalve was discovered and given the name *Myonera atlasiana*, as tribute to the project, which has brought together over eighty researchers from countries bordering on the North Atlantic.

A cnidarian called *Epizoanthus martinsae*, colonising skeletons of black corals in the Azores, was discovered in the channel between the islands of Faial and Pico, at a depth of 360 metres. The name is a homage to the retired Norwegian researcher, Helen Martins, who has lived at Horta (on the island of Faial) since 1976.

With European funding, the Atlas project has carried out 45 scientific expeditions in four years, significantly enriching our knowledge of these undersea ecosystems. Marina Carreiro Silva, a researcher at the IMAR/Oceanos R&D Centre at the University of the Azores, who is heading the project in the archipelago, admits that "the newly discovered animals may be under threat from climate change".

According to the international coordinator of the Atlas project, J. Murray Roberts, of the University of Edinburgh (Scotland), the challenge for the next decade is to "take this new social and scientific knowledge and use it to create better policies and plans for human activities in the ocean, in a truly sustainable way." ♦



The Florestas.pt Academy is a new initiative of the flagship online platform for disseminating technical and scientific knowledge about forestry and the related sector, providing 20-minute training videos with contributions from Portuguese experts in keys areas of forest know-how. As well as the vast store of contextualised information on the different dimensions - natural, environmental, social and economic - of forests, people interested in forest ecosystems can now have access to training, provided by acknowledged experts.

The topics offered include "Rural and forestry dynamics", "The forest we have and the forest we want" and "Forests and climate change", addressed by specialists such as the landscape architect, Henrique Pereira dos Santos, the silviculture engineer, Teresa David Soares (researcher at INIAV, the National Institute for Agrarian and Veterinary Research) and Cristina Máguas, coordinator of the Centre for Ecology, Evolution and Climate Change (cE3c).

Watch and learn at www.florestas.pt ♦

Forests: an opportunity

All crises offer a great opportunity – to learn from our difficulties, to correct past mistakes and to make qualitative progress. The history of mankind abounds in adversities, critical moments that required individuals and societies to rise to challenges. Not infrequently, this has led to change, and the discovery of new approaches. The courage to embrace these signs of renewal is almost always the difference between prosperity and decline. The pandemic which has engulfed the world is one of those difficult moments that has called everything into question and which, if we are willing to see, has shown us that nothing is guaranteed, not even everything we have come to regard as certain in our lives. And the question we must face, for those prepared to do so, is this: how far has this global health crisis resulted from the way we have dealt with natural resources, or with fundamental values such as the preservation of biodiversity? To what extent is the emergence of a new virus a sign alerting us to the need for more sustainable development models, to the urgency of taking a decidedly holistic and responsible approach to natural capital?

The news has been full of reports of initiatives for reform, such as the European Union's Green Deal, and the United Nations Decade of Action, designed as a push to ensure that organisations speed up implementation of the targets contained in the Sustainable Development Goals. It is beyond dispute that business has to function as a driving force for change towards sustainable development models, precisely to the extent to which they are able to centre and conciliate their purpose with the creation of environmental, social and economic value for society as a whole. Never as in this crisis have we seen so clearly the urgency of adopting models that promote a positive and symbiotic relationship between business and the public domain, or the certainty that this is the path to a better future for the planet and for generations to come.

For reasons that are obvious, I shall take

the forest as an example, a topic of critical importance for Portugal's development. It covers 36% of our territory, according to the last National Forest Inventory, but it still labours under structural problems resulting from both its exceptionally fragmented ownership and from the scourge of abandoned or unmanaged land. Forests are Portugal's main CO₂ sink that can be increased, in order to face up to the challenges of the countries decarbonisation ambitions. It is therefore our best opportunity for change. An opportunity for developing the countryside and retaining the rural population, an opportunity for jobs, an opportunity for conserving natural resources and biodiversity, an opportunity for fighting climate change, an opportunity for new materials for everyday products, and an opportunity for leisure and our mental and physical health.

In Portugal, as we are well aware, the forest gives us a lot, but it can potentially give us significantly more. That is why it is fundamental to have a national strategy for this crucial part of our territory, with a comprehensive approach that is able to recognise, without ideological preconceptions, that the more income we can obtain from the forest, the better able we will be to combat abandonment and to invest in protecting and restoring woodlands, as well as in expanding these ecosystems over more of our territory. In a country where, according to the Institute of Nature Conservation and Forests (ICNF), approximately 98% of woodlands are private or common land, in other words, where only 2% belongs to the State, a resilient and efficient forestry sector can only be achieved by supporting private landowners. Likewise, only with private forests will Portugal be able to achieve the CO₂ targets to which it is committed.

We are, we stress, at a critical point in our lives and the challenge is to make real use of our capacity to overcome adversity, which is where we excel in difficult situations.

And if the need to rethink models and to make choices was already clear before the global health crisis, it is now upon us in all its urgency. ♦

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Cellulose, a supermaterial for the future

Forests cover around 30% of the terrestrial surface of the planet, i.e. around 8% of the Earth's surface. 93% of forests are natural, 7% are planted forests. But these 7% supply 70% of the needs of all forest-based industries, for the production of materials derived from wood. These industries include the paper and cardboard sector, which is estimated to consume only around 13% of the wood felled each year.

Forests play a critical role in the terrestrial ecosystem. They are the second largest carbon sink (after the oceans), absorbing 20% to 30% of global CO₂ emissions. Photosynthesis converts the CO₂ captured in the atmosphere into biomass (tree trunks, roots, branches, twigs and leaves) and releases oxygen. In addition, forest waste (such as from fallen leaves or from forestry operations) and roots are slowly incorporated into the soil, in the form of organic matter.

It is estimated that the carbon in the world's forests amounts to 500 billion tons, as compared with an estimated 850 billion tons in the atmosphere today.

Forests regulate not only temperature, providing a cooling effect through transpiration and shading the soil, but also flows of fresh water, helping at the same time to retain water in underground aquifers, avoiding erosion and increasing the fertility of the soil. Forests contribute to conserving atmospheric humidity and to regulating rain patterns over land, by means of "evapotranspiration", i.e. evaporation from the soil and plant surfaces and transpiration of water by plants. Around 40% of precipitation over land areas originates from evapotranspiration.

In addition, forests are home to around 80% of all terrestrial species of animals, plants and insects.

They also play a significant economic role, creating wealth for around 1.6 billion people, one fifth of the world's population, and more than the population of any single country on Earth. When properly established, forests are currently and the best and most economic technology for removing and storing carbon. Planted forests, with species with a shorter rotation period and greater silvicultural care, are generally first-rate "machines" for sequestering carbon, because this contributes to the growth of biomass. In addition, these forests make it possible for the carbon stored in biomass to be transformed on a continuous basis into wood products, enabling the start of a new carbon capture cycle, in other words, a new forestry production cycle. National policies geared to prioritising slower growing species, investing in the very long term in larger carbon stocks per hectare, undervalues sequestration and therefore the urgency of combating greenhouse gases. Above all, they run the serious risk of leading to a focus on relatively unproductive forests, without economic use within a reasonable time horizon (one or more generations). This may lead in future to land being abandoned and becoming more vulnerable to the negative impacts of climate change. This means they are not sustainable on a large scale.

One of the fundamental keys to the future of the planet should be in the equilibrium between natural forests and planted forests, investing in those with shorter rotation cycles. This equilibrium allows natural forests to play their role in

biodiversity and permanent storage of carbon, whilst at the same time recognising the role of timber products derived from sustainable planted forests as substitutes for synthetic materials with a large carbon footprint.

In addition, both natural and planted forests provide a series of positive externalities, which should be remunerated, including, among others, production of O₂, improved air and water quality, provision of a habitat for wildlife, stabilisation and improvement of soils, territorial cohesion and opportunities for recreation.

There is growing recognition in scientific and business communities that new wood-based materials and solutions can be used for everyday products, replacing carbon-intensive materials, such as plastic and other derivatives of petroleum, and construction materials, such as steel.

For example, micro and nano fibrillated cellulose, the elementary structure of wood fibres, possesses unique strength and surface properties that make it potentially suitable for a vast number of applications. It is already used, for instance, to improve the properties of paper, adding to its strength and barrier properties. It has great potential in several other applications, including biocomposites, packaging, hygiene, cosmetics, medical applications and electronics.


Biologically-based raw materials that feed the bioeconomy come from three main sources. More than 80% come from agriculture, 18% from silviculture and 1% are from aquaculture. At present, 70% of biologically-based raw materials are used for the food industry, whilst the other 30% are used to produce energy and other products. Farming-based industries today represent a significant source of raw material for the production of biofuels and bioproducts, such as bioethanol and bioplastics, like PLA, obtained from cereal starch. These products can instead be obtained directly from wood and woody biomass. This means that sustainably managed forests represent an alternative to the biomass obtained from certain agricultural crops, releasing arable land for the increasingly necessary production of food.

Portuguese industry has been particularly active in this field of the alternative uses of wood and forest biomass, beyond the traditional production of pulp, paper and tissue. The work done by RAIZ and a number of leading Portuguese and international universities, who are our partners, has been a prime example of this.

Cellulose, an important structural component of the cell walls of plants, has already been dubbed the supermaterial of the future. Let us all work to ensure that the ideological preconceptions that have unfortunately been reflected in many recent legislative decisions are set aside and that these decisions can be based on technical and scientific criteria and a clear strategic visions of the crucial role of planted forests in Portugal's future growth. ♦

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