THE UNESCO
Courier
July-September 2023

- The **Congo Basin** forest, a fragile treasure
- **Mexico:** Women lead the way in saving the mangroves
- Learning among the trees in **Denmark**
- **Indigenous peoples,** a solution to halt deforestation

OUR GUEST
Akira Mizubayashi, writer • The music of words

The **call** of the **forest**

ISSN 2220-2285
9 772220 228014 32023

unesco

Receive a print copy of the latest issue every quarter or subscribe to the 100% free digital version.

Discover our offers

https://courier.unesco.org/en/subscribe

Follow the latest news from the *Courier*

unescocourier@

Facebook Twitter Instagram

Read and share

Share *The UNESCO Courier* with your network by promoting it, in line with the Organization's Open Access publishing policy.

2023 • n° 3 • Published since 1948

The UNESCO Courier is published quarterly by the United Nations Educational, Scientific and Cultural Organization. It promotes the ideals of UNESCO by sharing ideas on issues of international concern relevant to its mandate.

Director: Matthieu Guével

Editor-in-Chief: Agnès Bardon

Associate Editor: Katerina Markelova

Section Editor: Chen Xiaorong

Promotion: Laetitia Kaci

Editions:
- **Arabic:** Fathi Ben Haj Yahia
- **Chinese:** Chen Xiaorong and China Translation & Publishing House
- **English:** Anuliina Savolainen , Gina Doubleday (proofreader)
- **French:** Christine Herme (proofreader)
- **Russian:** Marina Yartseva
- **Spanish:** Laura Berdejo

Digital edition: Mila Ibrahimova

Photographs and illustrations: Danica Bijeljac

Translation co-ordination: Hélène Menanteau

Administrative and editorial assistance: Carolina Rollán Ortega

Production: Eric Frogé, Senior Production Assistant

Translation: Peter Coles, Gina Doubleday, Cathy Nolan

Design: Jacqueline Gensollen-Bloch

Cover illustration: © Sylvie Serprix

Printing: UNESCO

Intern: Wang Wenjin

Co-editions:
- **Catalan:** Jean-Michel Armengol
- **Esperanto:** Chen Ji

The UNESCO Courier is published thanks to the support of the People's Republic of China.

Information and reproduction rights:
courier@unesco.org
7, place de Fontenoy, 75352 Paris 07 SP, France

© UNESCO 2023

ISSN 2220-2285 • e-ISSN 2220-2293

Periodical available in Open Access under the Attribution-ShareAlike 3.0 IGO (CC-BY-SA 3.0 IGO) licence *(http://creativecommons.org/licenses/by-sa/3.0/igo/)*. By using the content of this publication, the users accept to be bound by the terms of use of the UNESCO Open Access Repository *(https://en.unesco.org/open-access/terms-use-ccbysa-en)*. The present licence applies exclusively to the texts. For the use of images, prior permission shall be requested.

The designations employed in this publication and the presentation of the data do not imply the expression of any opinion whatsoever on the part of UNESCO concerning the legal status of any country, territory, city or area of its authorities, or concerning the delimitation of its frontiers or boundaries.

Articles express the opinions of the authors and do not necessarily represent the opinions of UNESCO and do not commit the Organization.

Contents

4 **WIDE ANGLE**

The call of the forest

Winds of change 5
Patrick Greenfield

The Congo Basin forest, a fragile treasure 9
Coralie Pierret

Learning among the trees in Denmark 12
Mie Olsen

"There is a fundamental connection between poetry and forests" 14
An interview with Robert Pogue Harrison

China's "heavenly pits", a dive into the unknown 16
Tang Jianmin

Papuan chief Mundiya Kepanga: The voice of ancient trees 18
Anuliina Savolainen

Carbon credits, the tree that hides the forest? 21
Tin Fischer

An indigenous solution to deforestation in the Amazon 24
Liz Kimbrough

Discovering life in the canopy 26
An interview with Nalini Nadkarni

In Canada, nature by prescription 29
Guy Sabourin

"I wanted to capture the feeling of anger in the face of wildfires" 31
An interview with Jens Liljestrand

Mexico: Women lead the way in saving the mangroves 33
Alejandro Castro

36 **ZOOM**

Our lives in Technicolor 36
Photos: The Anonymous Project

46 **IDEAS**

Viking women in a new light 46
Leszek Gardeła

50 **OUR GUEST**

The music of words 50
An interview with Akira Mizubayashi

54 **IN DEPTH**

UNESCO World Heritage Sites: Key to biodiversity conservation 54

THE UNESCO Courier

Editorial

The paradox is staggering – just as we are beginning to understand the vital role of forests in sustaining life on Earth, they are disappearing before our eyes. Forests are hotbeds of biodiversity, harbouring over 70 per cent of all terrestrial animal species. We now know just how essential they are to water cycles and climate regulation. But this precious ecosystem – which supports 1.6 billion people – is under threat through massive deforestation, fires, and diseases caused by the proliferation of pests.

Solutions exist to halt this decline. But they must be commensurate with the importance of forests to our common humanity, and combine contributions from science, culture and education.

The UNESCO study, *World Heritage forests: Carbon sinks under pressure*, published in 2022, outlines ways in which these ecosystems can be preserved. It puts forward measures for adapting to climate change and recommends establishing ecological corridors. In Indonesia, for example, the introduction of fire warning systems has considerably reduced the time taken by the authorities to intervene. Another example is the Sangha Trinational World Heritage Site, located between Cameroon, the Central African Republic and the Democratic Republic of the Congo. The creation of a buffer zone within the site is helping to preserve this important carbon sink. Forests within UNESCO biosphere reserves are also implementing initiatives to forge a new relationship with living organisms.

Another solution is to give indigenous populations greater rights in forest management. Numerous studies have shown that the rate of deforestation is much lower in the areas they manage.

It's not just the future of the planet that's at stake – it's the future of humanity itself. Forests have always had a profound influence on our collective memory and imagination. From the *Epic of Gilgamesh* to Dante's *Divine Comedy*, from the nymphs of classical literature to the tales of the Brothers Grimm and the sacred groves of Africa, in our yearning for the marvellous we project our fears and fantasies onto them. Indeed, the fate of the forests seems irrevocably linked to our own. In the words of Mahatma Gandhi, "What we are doing to the forests of the world is but a mirror reflection of what we are doing to ourselves and to one another".

Agnès Bardon
Editor-in-Chief

Giant Sequoia sempervirens *in Redwood National Park (United States), inscribed on UNESCO's World Heritage List in 1980.*

© Aurora / hemis.fr

Patrick Greenfield

Journalist for The Guardian *(United Kingdom)*

The call of the forest

Nearly 10 million hectares of forest disappear in the world every year, according to the Food and Agriculture Organization of the United Nations (FAO). Agricultural expansion, urban sprawl, mining and logging all contribute to this decline. However, forests are vital to life on our planet. They play a crucial role in the water cycle, climate regulation and biodiversity preservation. They are also closely linked to human history. It is urgent to preserve these irreplaceable ecosystems.

In 2015, the United States National Aeronautics and Space Administration (NASA) published a time-lapse of the Earth "breathing". From April to September, boreal forests in Siberia, Scandinavia and North America burst into life, turning much of the northern hemisphere green, only to fall back with the arrival of winter. In the southern hemisphere, the process happens in reverse, the graphic showed, the green waxing and waning on the map with the movements of the sun. The world's three largest rainforests in the Amazon, the Congo Basin and Indonesia are deep-green and ever-present around the equator.

Along with oceans, forests are the lungs of the Earth. There are dozens of competing definitions for where a forest starts and stops. In general, while trees are the dominant life form, forests are an indivisible mass of fungi, insects, bacteria, birds, bats, and amphibians that rely on each other to survive. They house three quarters of terrestrial biodiversity, including some of the planet's strangest creatures like sloths, killer fungi that turn ants into zombies, and the nocturnal aye-aye lemurs native to Madagascar.

For humans, around 1.6 billion of us live within five kilometres of a forest. They feed us, provide shelter and regulate the climate. And yet, they are vanishing, often cleared for timber, agriculture and mining.

The world has lost a third of its tree cover over the last 10,000 years as human populations have grown, but most of that destruction has taken place in the last century. Yet, we will not limit →

global heating or slow biodiversity loss if we fail to protect forests.

"Wood Wide Web"

For the scientists that study them, forests remain places of mystery that continue to surprise, and there is much still to be discovered and understood. A growing body of research indicates that trees in forest ecosystems share food, water and even signal warnings to each other through an underground network of fungi – dubbed the "wood wide web".

They can generate their own rainfall and include enormous creatures like the General Sherman giant sequoia in California.

In 2015, a study by ecologist Thomas Crowther that used new counting methods to map the world's forests found that there were around three billion trees on Earth, seven times the figure previously thought. Now a professor at the Swiss Federal Institute of Technology in Zürich, his lab studies the impact of forests and global ecosystems at scale to help address climate change and biodiversity loss.

"Getting a handle on the scale of these forest ecosystems helps us to put them in context. With this information, we can identify the pressures that are damaging them around the world. We could see that we've almost halved the global forest system and the vast majority of the remaining ecosystems are heavily degraded," he said.

Spread of monoculture

While estimates of the loss vary, the world's forests are being cleared at a relentless pace. Between a third and a half of the world's trees are at risk of extinction, according to the most recent report by the British organization Botanic Gardens Conservation International. Thousands of plant and animal species that rely on them could also disappear, many of which are likely unique species or still unknown to science.

The consequences of destroying forests can be disastrous for humans: the spread of deadly diseases like Ebola are linked to clearing rainforests, while the breakdown of healthy ecosystems upon which half of the global GDP relies is a growing risk to global economic security, warns the World Economic Forum.

Conservationists are concerned about the spread of monoculture plantations which have one species of tree and are far less rich in life than natural forests, such as the vast palm oil plantations of Borneo (Indonesia) that have eradicated orangutan habitat.

> **"Forests house three quarters of terrestrial biodiversity**

"They say, 'you don't know what you've got until it's gone', but if we remain on track to lose one of four trees in the rainforest by 2050, we might never sufficiently understand what was even lost," says Victorine Che Thoener from Cameroon, a senior advisor for Greenpeace International.

Industrial-scale destruction

The destruction of primary rainforest – mainly found in the Amazon, the Congo Basin and Indonesia – is particularly damaging. In 2021, 3.75 millions of hectares dissapeared, producing 2.5 gigatons of carbon dioxide emissions, equivalent to the annual fossil fuels of India, according to Global Forest Watch.

"The large-scale destruction of the forest [in the Congo Basin] dates to colonial times. Yet today deforestation and degradation of the forest continue – and at an industrialized scale," says Thoener.

There is rarely a simple explanation for deforestation but almost everywhere, forests are worth more dead than alive. Their benefits sit outside the global economic system apart from their raw material value.

Whether it be logging for valuable woods like mahogany or making space for cattle ranching, the economic incentives to destroy them are vast and grow stronger with increasing demand for red meat and raw materials. The destruction is highly regional.

Many European countries cleared their forests long ago. Brazil, the Democratic Republic of the Congo and Bolivia were in the top three for forest loss in 2021. Agricultural expansion, especially for palm oil, beef and soya, are key drivers in Latin America and Asia, while timber and forest fires are the main reasons in boreal forests.

Products we love to eat and drink are often linked to deforestation. The production of cacao, peanuts and coffee have led to large-scale forest loss in some areas.

Encouraging examples

During the UN Climate Change Conference of the Parties (COP26) in Glasgow in 2021, many world leaders vowed to halt and reverse deforestation by the end of this decade in a promise that covered more than 90 per cent of the world's forests. But that promise will be hard to deliver: at least US$130 billion (around €118 billion) a year is needed to protect the most at-risk areas of tropical forest by 2030, more than 50 times the current rate of funding.

All hope is not lost, however. Some countries like Gabon and Guyana have found ways to keep hold of their trees, with both losing only around one per cent of their forest cover in the last 20 years.

Another encouraging example comes from Costa Rica, the only tropical country that has successfully halted and reversed deforestation. In the 1970s and 1980s, the tiny central American state had one of the worst forest loss rates on the planet. Within just a few years, its forest cover decreased from three quarters to one third of the territory. But a revolutionary policy in 1996 that paid citizens to keep forests standing had a dramatic impact, and Costa Rica is on track to have 60 per cent of forest cover once again.

Sculpture by Italian artist Giuseppe Penone entitled Continuerà a crescere tranne che in quel punto *(It Will Continue to Grow Except at That Point). View taken in 2008.*

It takes a total mindshift

Despite being hailed by many as a possible solution to climate change, the carbon credit trading system has not proven to be very effective in reducing greenhouse gases.

Enthusiastic support for tree planting from major companies and governments has been controversial and produced mixed results: simply planting a few trees can never replicate the diversity of life in a natural forest, and few schemes monitor how many saplings survive. Giving space to forests to grow and regenerate naturally may be the best way, but it is a slow process.

A recent investigation by *The Guardian*, *Die Zeit* and *SourceMaterial* found that this financing mechanism, which aims to provide private funds to protect primary forests, has reduced deforestation only in a very small number of cases. Ninety-four per cent of the credits would have had no benefit to the climate.

Many forest experts say nothing short of a total mindshift in how we treat forests is required by following the example of indigenous communities around the world; just 5 per cent of the

“We’ve almost halved the global forest system and the vast majority of the remaining ecosystems are heavily degraded

human population, their lands nurture 80 per cent of the world's biodiversity.

Kawsak Sacha, the Living Forest proposal from the Kichwa people of Sarayaku in the Ecuadorian Amazon, puts forward an alternative vision for humanity living alongside nature and ensuring the survival of forests for future generations. It involves putting the forest at the heart of economic and social systems, creating areas that are free from extraction, and ensuring rights for humans and nature.

As environmental activist Nina Gualinga from Sarayaku put it in an interview: "[In the Living Forest proposal], everything is recognized as a living being, beyond what our eyes can see in the Amazon rainforest and everywhere else. Perhaps it sounds complex and far away for many, but I think it's really necessary right now." ■

> **"We will not limit global heating or slow biodiversity loss if we fail to protect forests**

© Ellie Davies (elliedavies.co.uk)

◥ *A piece from the series* Stars *by British artist Ellie Davies combining images of the Milky Way with forest landscapes.*

Coralie Pierret

Journalist based in Goma (DRC)

The Congo Basin forest, a fragile treasure

The green heart of Central Africa is one of the largest carbon sinks in the world. But this natural heritage, vital for the future of the planet, is under threat. In the Democratic Republic of the Congo, citizens and institutions are taking action to try to halt deforestation.

The old colonial buildings of the University of Kisangani in the Democratic Republic of the Congo (DRC) were not always dedicated to the study of environmental sciences. Until the 1970s, the decrepit red brick buildings housed tobacco warehouses. It was then that the first shrubs were planted in the courtyard of this former factory, by a Polish biologist.

"He collected plants from all over the country and transplanted them here," explains professor Pionus Katuala, who looks tiny among the fifty-year-old trees. Today, the botanical garden has become a veritable sample of the Congo Basin forest, where students can observe how vegetation regenerates.

The global challenge is to restore and preserve this natural treasure, which is vital in the combat against climate change. This forest area alone, which stretches across Gabon, Congo, the Democratic Republic of the Congo, Central African Republic, Equatorial Guinea and Cameroon, represents a stock of carbon dioxide (CO_2) equivalent to ten years of global emissions. In the DRC, the forest covers around 60 per cent of the country's surface area.

In the province of Tshopo, where the university is located, there are still some primary forests with thousand-year-old species. "If we want to preserve it, we need to train people to exploit the forest without destroying it completely," continues Pionus Katuala. Every year, 25 to 30 young people graduate in "renewable natural resource management". But for the dean of the faculty, time is running out. By 2020, 491,000 hectares of primary forest will have disappeared from the country.

© Coralie Pierret

Elassi Ramazani is a botanist at the Yangambi research centre. His herbarium, the largest in Central Africa, contains samples of nearly 40 per cent of the country's vegetation.

"Our supermarket is the forest"

The cause of this depletion lies in agriculture, infrastructure development and population density, which accelerate the deforestation process. "Our supermarket? It's the forest. Our pharmacy? It's the forest. It's the only way we can live," says Jean Akaluko, President of the Turumbu people, one of the many communities living in the Congo Basin. By 2050, the number of inhabitants will have doubled to almost 370 million.

On the banks of the majestic Congo River, around a hundred kilometres from Kisangani, Ikongo Romain is one of the few villages where ecological awareness is taught from an early age. In front of the classrooms, the pupils break into →

their favourite song: "Baté la zamba", which means "protect the forest" in Lingala, one of the local languages. In the school nursery, 50 coconut palms are being transplanted. "We chose to plant species that are used every day here. Our aim is to show the children the importance of trees," explains teacher Emile Bouli Bongosso.

In this locality, the villagers are fighting with the local authorities to obtain ownership rights to a portion of the forest. The aim is to still use the forest, but sustainably. "To do this, the first step is to secure the land. The community has to seek authorization from the State to become the legal owner. And the process is tiresome – it began in 2019", says Oulda Ruiziki, the agricultural engineer who is supervising the "community forestry" project at CIFOR, the Center for International Forestry Research.

The Yangambi Biosphere Reserve, a biodiversity sentinel

In 1976, the Yangambi Biosphere Reserve, situated in the heart of the Congo Basin in the northeastern part of the Democratic Republic of the Congo (DRC), was one of the first to join the UNESCO World Network of Biosphere Reserves.

Today, it is again being a pioneer. In March 2022, an initiative was launched thanks to funding from Belgium to make this biosphere reserve a hub of knowledge on climate and biodiversity. The University of Ghent (Belgium), one of the main partners in the project, has installed the 55-metre-high Congoflux tower there. It rises 15 metres above the forest canopy and collects data on the exchange of water vapour and greenhouse gases such as carbon dioxide, nitrous oxide and methane between the atmosphere and the forest. These data will improve our knowledge of the role that forests play in sequestering carbon and therefore in limiting climate change.

This information is particularly important for climate change adaptation planning at the local level, but also worldwide. The University of Ghent has obtained validation of the data by the European Integrated Carbon Observation System (ICOS), which allows it to share them globally.

The project also calls for the Centre for Biodiversity Surveillance (*Centre de surveillance de la biodiversité*, CBS), located in nearby Kisangani, to monitor ecosystem health using thermal cameras and drones and by collecting environmental DNA (eDNA) samples, a non-invasive technique for identifying species in natural environments.

Coordinated by UNESCO, the project is being implemented with the Regional Postgraduate School for the Integrated Management of Tropical Forests and Lands (*Ecole régionale postuniversitaire d'aménagement et de gestion intégrés des forêts et territoires tropicaux*, ERAIFT); the National Institute for Studies and Research in Agronomy (*Institut national des études et recherches agronomiques*, INERA); and the Man and the Biosphere Programme department in the Ministry of Environment and Sustainable Development.

> **"The Congo Basin forest represents a stock of CO_2 equivalent to ten years of global emissions**

The institute's other challenge is to combat the abusive production of the famous *makala*, which means charcoal in the local language. "Until a few years ago, the wood used to make it was available close to the villages. Now you have to travel five kilometres, sometimes seven, to find it", says George Mumberé, a researcher at CIFOR. In a country where less than 10 per cent of the population has access to electricity, the use of firewood, mainly for cooking, is a matter of survival. For CIFOR, there is no question of preventing the inhabitants from using the forest for their supplies. Rather, the Centre is seeking to encourage them to plant or use so-called improved carbonization techniques to save raw materials.

Isolated initiatives

But these initiatives are still too isolated to have a global impact. To reverse the trend and effectively combat deforestation, international mechanisms have been put in place. Such is the case with REDD – Reducing Emissions from Deforestation and Forest Degradation – which promises to remunerate countries that fulfil the contract by valuing the carbon stored in the forests. In the DRC,

© Axel Fassio

The Congoflux tower in the Yangambi Biosphere Reserve (DRC) collects data to gain a better understanding of how carbon is sequestered.

a number of private individuals have embarked on the adventure of selling "carbon credits" on the voluntary market to companies, institutions or individuals wishing to offset their CO_2 emissions.

In Yafunga, a locality in Tshopo province, the inhabitants are still waiting for the benefits promised by Jadora. In 2009, the company's directors succeeded in convincing them to stop clearing the forest. Nearly 780,000 carbon credits were sold, notably to Delta Air Lines and the Italian energy company Eni. But the benefits were slow in coming. As a result, the old practice of slash-and-burn agriculture, which involves clearing a wooded area by fire in order to sow it, is being revived. "What do we, the local population, gain from preserving the forest?" asks one teacher. This experience has left a bitter taste in the mouths of the local people, who felt that their land no longer belonged to them and that they were denied access to it.

In the DRC, the compensation or alternatives offered to local communities are often unconvincing. In the meantime, scientists are carrying out more in-depth studies. The Congo Basin forest is far from having revealed all its secrets. Even its surface area is open to debate. Depending on the estimate, it covers between 180 and 230 million hectares.

Understanding in order to preserve

In 2020, the Yangambi research centre, located in the heart of the Congo Basin forest, will be equipped with a flow tower to gain a better understanding of the contribution of tropical forests to mitigating climate change. Standing 55 metres high and positioned just above the canopy, the tower collects data to study the exchange of greenhouse gases between the forest and the atmosphere (see box on page 10).

In a building left over from the colonial era, Elassi Ramazani has been collecting, storing and preserving plants for several decades in his herbarium, the largest in Central Africa. "This is where we find our memories", insists the botanist in front of his shelves of files, carefully arranged in alphabetical order. Almost 40 per cent of the Congo's vegetation can be found here. But time is running out. "The imminent danger is not from outside, but from within, from us Congolese. There are so many of us! How are we going to slow the destruction of the forest?" asks Elassi Ramazani.

The DRC has proclaimed itself to be a "solution country" for the climate crisis, thanks to the carbon sink its forests represent. In 2021 the Central African Forest Initiative (CAFI) pledged US$500 million to the DRC. But the sale of oil and gas concessions in July 2022 is a cause for concern, especially as some of the exploration licences are located in the central Congolese basin, which is rich in peat bogs. This fragile carbon sink could be released into the atmosphere if its ecosystem were to be disturbed.

Mie Olsen

Journalist in Copenhagen, Denmark

Learning among the trees in Denmark

Improved self-esteem, curiosity and teamwork skills are some of the many recognized benefits of forest schools, which are booming in Nordic countries.

At the Danish forest kindergarten Krudthus, about 30 kilometers north of Copenhagen, children spend most of their time in the forest.

Discovering beetles and insects under rocks and fallen branches and naming them. Witnessing the seasonal changing of the leaves. Observing how earthworms decompose dead plants and animals to understand the circle of life. And finally, jumping up to go fishing or cycling between thimbleweed groves.

It is as idyllic as it sounds, and the secret of the pedagogy lies in an open, no-pressure and no-expectations approach. "In nature, there aren't so many strict guidelines for good behaviour. Children can socialize in new ways and be happy, curious and calm. We encourage them to be adventurous and explore their surroundings in an open way. Or in other words – to be world-facing instead of inward-facing," explains Hildur Johnson, teacher at Krudthus in the North Zealand region of Denmark.

> **"In nature, there aren't so many strict guidelines for good behaviour**

Outdoor activities also teach children civic responsibility. Even the youngest members of society are engaged in sustainability through small actions such as collecting plastic waste.

An "old" invention

Krudthus is just one among roughly a thousand forest kindergartens in Denmark. The Scandinavian country has been at the global forefront of forest schools. Seeds were already laid in the 1950s, when the Austrian Rudolf Steiner movement, known for its alternative body-and-soul-are-one teaching methods, opened the first private outdoor kindergarten in Stuttgart, Germany.

© Lillian Erud

Krudthus kindergarten children in Denmark embarking on a jump challenge.

© Lillian Erud

After learning to recognize and name their feelings, the two children spontaneously joined hands.

© Lillian Erud

Flower-picking activity combines different learning approaches, from developing dexterity to enhancing social skills.

© Lillian Erud

The practice of mindfulness combined with deep breathing has a calming effect on children.

At the time, moving children from classrooms into "the wild outdoors" may have been controversial. But as more women began working full-time in the 1970s and 1980s, childcare needs increased. Private providers sprung up all over the country, and the fact that these providers had limited indoor areas available turned out to be a blessing in disguise.

In the 1990s, a small group of dedicated teachers transformed the forest kindergarten concept into a new educational approach for primary schools. Maths, language and physics classes were no longer taught only via blackboards and books. Instead, students would now be asked to measure a tree's height with congruent triangles or examine how seawater conductivity causes ships to rust faster.

Risky play

According to Niels Ejby Ernst, Ph.D. in education and pedagogy and an expert on the history of forest kindergartens, it is no coincidence that the tradition has developed faster in Denmark. "In the Danish school system we give children a lot of innovative learning and playing opportunities. We don't hesitate to take a few liberties and place trust in our children," he says.

However, this style of teaching calls for a certain level of risk tolerance. A child can fall from a tree or hurt a leg when jumping between rocks. They may get cold or scared. "Children benefit from 'risky games'," Ernst argues. "When they feel subjectively on the edge of something dangerous, it strengthens their robustness. It is a well-known fact that children who play in forests and green areas are better off both physically and mentally than peers at the same age without access to such activity."

During 2013-2017, Copenhagen University conducted an extensive, interdisciplinary TEACHOUT-study on traditional schools versus outdoor schools. It concluded that by developing a more flexible mindset, lessons in the forest improved children's ability to cope with unpredictability in everyday life. Their learning motivation and reading abilities also improved. Furthermore, children with behavioural challenges benefitted from the natural environment.

Learning through curiosity

"Forest schools apply a bodily, sensory and close-to-life teaching approach rather than an abstract and cognitive approach. It is all about meeting the world and getting to know the people, artefacts and places we want to learn about," says Karen Seierøe Barfod, a research leader at Copenhagen University and one of the pioneers in the development of didactic teaching outside the classroom.

The location does not necessarily have to be a forest; it can also be a meadow, the seashore, a marsh or agricultural land. Parents need to accept their children getting dirty, catching animals and cutting wood. According to Barfod, it is important to acknowledge that there are many ways to learn about a subject.

> **"Lessons in the forest improve children's ability to cope with unpredictability in everyday life**

She explains how forest schools foster critical thinking, systems thinking and collaboration abilities. It is easier to put these competencies into play if you take children out to "investigate" an actual case in the real world, with all of its complexities and nuances.

Conscious of the benefits of this approach, more and more parents send their children to forest schools today. Traditional institutions, influenced by the positive outcomes, are also increasingly taking activities outdoors. There's a growing interest in "forest pedagogy" in neighbouring countries such as Norway and Sweden, while education specialists from all over the world are paying visits to learn more about outdoor learning methods. ■

Interview by
Anuliina Savolainen
UNESCO

Robert Pogue Harrison: "There is a fundamental connection between poetry and forests"

In his book *Forests: The Shadow of Civilization*, Robert Pogue Harrison, Professor of Literature at Stanford University (United States), explores the ambivalent representations of forests in the Western imagination.

Where do Western 'forest mindscapes' originate from?

They originate from the deep history of Western culture's relation to the forested environment in which it cleared its places of habitation. The forest has always had an ambivalent place in the cultural imaginary in the West. On the one hand, it's a place of danger, otherness and perdition. It's subhuman, animal; yet at the same time it's the place of mystery and enchantment. It's profane but also sacred. In the forest you both lose yourself and find yourself. It's very difficult to maintain the stability of oppositions when you're talking about forests in the Western imagination.

Since the ancient Greek and Roman societies had just recently evolved from out of the forest, the forest as a place of origins was still very present in their myths. It was sometimes associated with the "golden age", other times with human bestiality. In the myths you get a strong sense of some remote kinship between the human and the animal. In the Greek myth of Actaeon, for example, the hunter becomes the hunted; a man is transformed into a stag. They suffer the same fate.

How did the symbolism and meaning of forests evolve throughout history?

Everything changed with the advent of Christianity. The Church, very suspicious of vestiges of paganism such as worship of the forest gods, had a certain hostility towards the forest. Yet here too we find that saints would go into the forest in order to detach themselves from human society and find God. So in the forest you could descend into the level of a beast or you could elevate your soul to commune with the divine.

In the Middle Ages, many forests had already come under the jurisdiction of law. The word *forest* (from the Latin *foris*, outside) was originally a judicial term referring to a land that had been placed off limits by a royal decree. Nothing was more offensive to the peasants than the privilege of the king and the noble to hunt in the forests where they were no longer allowed to enter.

> **"Since antiquity, the forest has symbolized both the "golden age" and human bestiality**

The forest was also a place of outlaw, an asylum for the outsiders, the bandits, the poets and the insane. Robin Hood lived hidden (or hooded) in the forest fighting the corruption of justice in the cities. In the tales of the Knights of the Round Table, forests are a place of initiation for knights: in the forest they rediscover their own primitive wildness that makes them powerful warriors.

When the Italian poet Dante finds himself lost in a dark forest at the beginning of *The Divine Comedy*, the forest can be read as an allegory for sin, alienation from God, error. From this dark wood, Dante has to go down into hell and then climb the mountain of Purgatory to end up in another forest. This forest is essentially the same space as the dark forest, except it's been purged of its wildlife and is now like a domesticated park under the governance of the City of God. So there again, forests are between the sacred and the profane.

Rationalism emerged in the 17th century with the optimistic belief that by applying scientific method, the ignorance and superstition of the past could be overcome. In his *Discourse on Method* (1637), the French philosopher René Descartes lays out a mathematical approach to achieve mastery and possession of nature. In his famous analogy he says: If you're lost in a forest, you should choose one direction arbitrarily and walk in a straight line, and eventually you will find your way out. Even if it's not where you want it to end up, you'll always be better off outside of the forest than inside it. The straight line is the scientific method.

With the advent of romanticism, towards the end of the 18th century, the forest gets re-mystified by poets as a place of deep spirituality, a place hospitable to reverie.

How does deforestation affect our collective imagination today?

Forests have always served as a boundary. Places of habitation usually had a fringe of forests defining the inside place. They mark a limit or perimeter. What happens when there's no more limit? The loss of forests provokes a sense of placelessness. If the whole Earth has become nothing but a clearing without an edge, we lose all sense of containment.

Forests are also the stronghold of cultural memory. When they burn, the archives of cultural memory also go up in smoke. It's like provoking the loss of access to the resurgence of cultural memory. Forests naturally activate some preconscious, ancient cultural memories.

Until recently we have associated nature with permanence – the permanence against which we can measure our own finite sojourn on Earth. Nature was there before and it's going to be there afterwards. However, we've come to realize that our human history can actually bring about the downfall of the setting we assumed to be stable and permanent. Think about it in terms of theater: in ancient Greece people would go to see the dramas and watch a hero whose downfall, a tragedy, would occur in a permanent setting of mountains and the sea of the outdoor stage. Today we know that the setting itself, with the hero on stage, can become a victim of destruction. And forests are the most vulnerable setting of nature.

In your writing, a parallel can be found between literature and forests: they can both be a medium for 'depth perception'. Is literature also at risk of desertification?

Literature and forests are very much related. There's overwhelming evidence from myth and religion and literature that the poetic word is associated with forest. The *logos* – which is the larger category for language – is that edge where language goes and explores the limits of what is sayable, and what can be said poetically.

Before I began writing my book I went to visit Andrea Zanzotto, one of the most important poets of the post-war generation in Italy. He lived in the pre-Alps region in northern Italy, where the Montello mountain still had a patch of old forests. He brought me there, almost as if to show me where his poetry comes from. That's when I realized there's some fundamental connection between the poetic word and the forest environment.

I'm very worried about the increasing disconnection of human experience from the natural world, and I'm afraid that poetry is going to be – or is already – the first victim of this loss of this immediate connection. A forest is a place where you enter and anything can happen. There's an edge of mystery to it, a kind of penumbra or darkness. Poetry enters this penumbra and brings the unknown, the recessive and the distant closer to us. Along with the disappearance of this important source for poetry, we risk ending up where the only mode of language is prosaic and conceptual and abstract. Then we're in the desert. ■

© Hélène Menanteau

Monotype (detail) from the series Lisières, *2021. The imprint painting technique of French artist Hélène Menanteau evokes the impermanence and poetry of life.*

Tang Jianmin

Associate Researcher at Guangxi Institute of Botany, Chinese Academy of Sciences, he focuses on conservation biology and sustainable use of endangered plants in karst tiankeng. *He has published the first monograph on* tiankeng *plants in China,* Research on the Sustainable Utilization of Karst Tiankeng Plant Resources in Guangxi.

China's "heavenly pits", a dive into the unknown

The discovery of a forest in a 192-meter deep sinkhole in China made international headlines in 2022. Although an important find, it isn't the first of its kind: to date around 300 *tiankengs* have been discovered. A gold mine for researchers, these giant sinkholes serve as underground sanctuaries for unique animal, plant, and microbial species.

In 2016, in Baise Leye County of Guangxi Zhuang Autonomous Region of China, my team and I rappelled down with a rope to the bottom of the Dashiwei Tiankeng, 600 metres under the ground. The term *tiankeng*, "heavenly pit", refers to large sink-like negative terrains with steep walls, formed over millions of years and developed in carbonate rock strata.

This *tiankeng* is the largest of its kind and yet has only been known to the outside world since 1998. It is part of the Dashiwei Tiankeng Group, a rare geological wonder with 29 sinkholes distributed in an area of 20 square kilometers. The scene down there was stunning: an underground pristine forest with no trace of human activities, with 40 metre-high ancient trees and a group of endangered wild plants from the times of dinosaurs.

Our team works on the establishment, breeding and preservation of strategic seed banks in *tiankeng* areas. The Guangxi Zhuang Autonomous Region is home to about 30 per cent of the world's *tiankengs*. Moreover, Guangxi karst formations have been inscribed on the World Heritage List since 2007. We have investigated and introduced *tiankeng* plants in 41 counties and districts of 6 cities in Guangxi, collected nearly 1,000 plant species and set up a nursery of living and *in vitro* plants in Guangxi Institute of Botany, Chinese Academy of Sciences.

Steep terrain and sharp stones make exploring underground forests very difficult. It is common to encounter poisonous snakes and mosquitoes. But every discovery of a new sinkhole or a valuable plant makes the research team so happy that we tend to forget all the tiredness and risk.

A sanctuary for rare species

Tiangkengs emerge when the roof of an underground chamber enlarges and collapses. Rainwater flows through the cracks in the bedrock, turning them into tunnels and voids. Karst *tiankeng* is a relatively closed environment with high humidity, low temperature and a high concentration of negative oxygen ions. Its bottom is connected with the underground water flow, nurturing a lush green oasis all year round. Primitive ecosystems with unique animal, plant and microbial resources are formed there.

In 2001 Chinese professor Zhu Xuewen published the definition of *tiankeng* in *Science & Technology Review*, thus introducing the term into the palace of science. In total, 300 *tiankengs* have been discovered, with China accounting for two-thirds of them. They have also been found in Papua New Guinea, Malaysia and Madagascar, Slovenia, Croatia, Italy and Spain, among others.

During the plant surveys in China, we have discovered many rare, endemic and endangered plants. In our 2022 survey covering the whole Guangxi area we found 72 species of wild plants under state key protection, indicating that the *tiankeng* area serves as a refuge for endangered plants and primitive forest ecosystems, and provides a natural germplasm bank of biodiversity.

In September 2021, Dr. Zhang Ting from Kunming Institute of Botany, Chinese Academy of Sciences discovered two critically endangered species during his field investigations in the Yunnan Province – *Petrocosmea grandiflora* and *Elaeagnus bambusetorum* – long thought to be extinct. There is also a good chance that previously unknown species will be discovered in these environments.

Man-made threats

Tiankengs have also become tourism hot spots, sometimes to the detriment of the ecological environment; human

Lush vegetation deep within the Luoquanyan karst sinkhole in Hubei Province (China).

“The scene was stunning: an underground forest with a group of plants from the times of dinosaurs

© Song Wen

activities endanger plant biodiversity and cause destruction of underground freshwater sources and forest in these areas. For example, in 2018, the development of Tiankeng Scenic Spot in Dashiwei resulted in serious damage to biodiversity in close-by Baidong Tiankeng, including endangered plants being cut down and destroyed.

It is clear that if the development of such tourism and promotion projects is solely based on economic interests, the unique ecological environment of karst *tiankeng* will be irredeemably lost. Therefore, it is very important to include plant resource protection in the environmental assessment of major *tiankeng* projects.

Five years ago, I led an investigation in Liuxing Tiankeng, situated in Leye county in the Guangxi area. It has a vertical depth of 300 meters. We started early in the morning and arrived at the bottom of the crater at noon. After a short break, we carried out the journey, equipped with snake tongs to ensure the route was safe. By 4:30 p.m. it was already dark at the bottom. We had to return to the ground with our mobile phone flashlights, each of us carrying 15-20 kilograms of soil and plant samples.

Endangered species

During these sometimes dangerous investigations we have found endangered plants such as *Toona ciliata* and *Cypripedium henryi*, as well as rare medicinal materials such as *Dysosma versipellis* and *Paris polyphylla*.

Through the collection of genetic resources, we carry out conservation biology work of endangered *tiankeng* plants. We have focused in particular on *Manglietia aromatica*, a rare species which is almost nonexistent in other environments. By revealing the plant's mating system patterns and spatial variation rules, its evolutionary history and the changes in its geographical distribution in response to climate and geological environment changes, our study provides a scientific basis for effective protection.

The atmospheric, mineral, biological and water resources of karst *tiankeng* are key in maintaining the stability of their ecosystems. The groundwater they contain is increasingly used for domestic and drinking water and irrigation. Sinkholes, with their wild plant resources, serve the local economies and are an important source of living and survival resources for people in the karst mountain areas. Therefore, their protection should not only focus on the plant resources, but also on their ecosystems as a whole. Additionally, it is important to minimize the negative effects of human activities while taking into consideration the basic needs of local populations. In some cases authorities have proposed voluntary relocation of people to places with better living conditions.

More broadly, proctors and policy-makers should strengthen their communication and education efforts to raise awareness on the development and use of rare and endangered plant resources. Researchers should carry out scientific and reasonable *ex situ* conservation work and strengthen research on endangered plants in *tiankeng* areas and on the evolution laws of their vegetation ecosystems. Systematic, large-scale and multidisciplinary research will help reveal the formation mechanism of sinkholes and increase our understanding of their unique systems. ■

Anuliina Savolainen
UNESCO

Papuan chief Mundiya Kepanga: The voice of ancient trees

A native of Papua New Guinea, where one quarter of the forests have been destroyed in the past 30 years, customary chief Mundiya Kepanga travels the world to pass on the message of his ancestors: the forest is the mother of all living things. Every time an ancient tree is cut down, a part of humanity dies.

Tari, Papua New Guinea, 1965. A boy is born on a carpet of ancient ficus leaves in the high deepland forest. Mundiya is his name, pronounced "Mudeejay".

A tree is planted, as it is for every birth and death in the village inhabited by the Hulis, indigenous people whose diet consists mainly of sweet potatoes. The hut village is surrounded by forests, home to paradise birds, tree-kangaroos and other rare animal species. Everybody here in Tari knows that the forest is the mother of all living things. If all the trees die, then humans will die too, so goes the prophecy.

The boy later leaves his village to live in the forest as part of an initiation rite, letting his hair grow for four years to use in later days to make head-dresses, and learning all about nature and the wisdom of the ancestors.

Brother of the trees

Paris, France, 2022. In a fully packed auditorium at UNESCO headquarters, over 1,300 spectators applaud as the indigenous customary chief Mundiya Kepanga takes the stage.

"I assume that in this room there are people who don't know where Papua New Guinea is. You people invented maps, so I suggest that you take a look and you will see that it's located north of Australia", he quips.

Orange paradise bird feathers waggle in the head-dress of hair and plumes. At home, as a traditional leader, Mundiya Kepanga strives to find peaceful solutions to local conflicts like livestock thefts or territorial disputes. But since the mid-2010s, he has also travelled as an environmentalist, from his remote village to international forums. "In COP21 [Paris climate conference], in 2015, I realized that the whole world is facing climate change, not only us Papuans. I understood that there is an interest for the whole of humanity to hear the message of my ancestors."

This time he is on a two-month tour in France, attending festivals, visiting schools and meeting with media and mayors to promote the upcoming film about indigenous peoples' fights for their land and forests: *Les Gardiens de la forêt* [The Guardians of the forest].

Behind the scenes, press officers try to keep up with the busy schedule of a man who says that where he comes from, time doesn't matter much.

Fight against illegal logging

The New Guinea island hosts the world's third biggest tropical forest and Papua New Guinea harbours probably more than five per cent of the world's biodiversity.

But according to the international NGO Wildlife Conservation Society, one quarter of Papua New Guinea's forests have been destroyed in the past 30 years. Deforestation, orchestrated mainly by foreign companies, has drastically accelerated over the past decades in the eastern half of the island. In 2015, the country became the world's biggest exporter of tropical logs. The result can be observed on a satellite map: bald patches and pale veins of logging routes crisscrossing the forest blanket.

"It makes me very sad. As these trees fall, unique giants of humanity disappear," he sighs. "We will never see them again. And now, with climate change, we don't know whether such trees will ever grow again."

The film *Frères des arbres* [Brothers of the Trees], released in 2016 and directed by French documentary filmmakers Marc Dozier and Luc Marescot, follows Mundiya traveling across the country to observe the sacred forests being demolished by local men in need of work. Thousands of ancient tree logs are loaded onto ships every day.

How did this happen? In the early 2000s a mechanism known as a Special Agriculture and Business Lease (SABL) was launched, which allowed

companies to lease the land and apply for permission to clearcut an area of forest. According to the local NGO ACT Now, from 2002 to 2011, over 50,000 km^2 of land, mostly belonging to indigenous communities, were handed out, accompanied by promises of agriculture and development. Work was promised too.

> **I understood that there is an interest for the whole of humanity to hear the message of my ancestors**

In reality, foreign companies used SABLs to quickly harvest the timber in a given area and then close up shop or sell their stake. "The companies were supposed to help us build roads, hospitals and schools. All they did was cut down trees," Mundiya says, adding that landowners who complained about the abuses were also sometimes victims of intimidation.

© UNESCO / Christelle ALIX

Mundiya Kepanga at the Université de la terre *event held at UNESCO headquarters in November 2022.*

Damning report

After a strong outcry at their abuse, the government set up a Commission of Inquiry to review the legality of the leases. The further issuance of SABLs was halted after the damning results, showing, for instance, that almost 40 per cent of timber exports through 2014 came from leases issued illegally. International pressure was also growing. In 2018, the United Nations expressed their concern about racial discrimination related to the use of these leases to illegally occupy customary land.

Since 2019 the new government has committed to ban the export of raw logs and develop the local wood processing industry.

However, Mundiya is convinced that without development, deforestation will continue. "The only thing the landowners possess is forest and trees. If you don't offer them economic alternatives, they will be obliged to cut the trees down to survive. So it's very important to develop projects for people to earn money."

He believes that one solution is to develop secondary forests. There are also sustainable agroforestry initiatives around cocoa, vanilla, fishery and coffee. "The principle is to develop such projects in the areas that have already been damaged and not to touch the primary forests," he stresses.

The reverse exploration

Marc Duzier first met Mundiya Kepanga in the early 2000s when he visited the remote village of Kobe Tumbiali. This encounter led to a series of photo stories and gave rise in 2007 to the feature film *L'Exploration inversée* [The Reverse Exploration] in which Mundiya and his cousin Polobi were invited to France to explore the Western way of life.

The cultural encounters led to accurate interpretations of Western culture, such as excessive consumerism, busy lifestyle and urbanization.

"When I was little, I grew sweet potatoes and I planted trees, just like my parents. I used to go to the river to catch small animals and fish," Mundiya recalls. "We ate bananas and sweet potatoes grown in our own gardens, which did not require any money changing hands. With globalization our

relationship to money has changed. We sell wood for fire, we make money from mushrooms, from butterflies, from our land, and even from what lies underground."

In his village children now desire smartphones and urban living. "Youth want modernity, but on the other hand they remain very bound to their land, their mountains, their forests, their spirituality," he says and adds; "Please don't think that I oppose development. Today the life expectancy and quality of life are better thanks to hospitals, medicine and schools. In the past, a simple case of diarrhoea could destroy a whole village."

The effects of climate change are tangible in the land of the Hulis. Sweet potato crops are being invaded by non-native parasites, temperatures are rising, rainclouds becoming scarcer and water sources and swamps drying up. "You can really feel a change in the last decade or so," Mundiya tells us.

Another threat looms over the Huli forest. In the Hela province, a huge liquefied natural gas project has been developed recently by a multinational giant. This resource extraction project has been a source of intense anger for the Huli landowners, who have yet to see any benefits from the extraction and sale of gas from their land.

While Papua New Guinea seems to be making progress against illegal logging, it takes the whole world to control the devastating effects of environmental destruction and global warming.

"During these COPs and such, people talk a lot, but what really matters is to act. I invite you all to do something in your garden, in your village, in your city, province, community, country, wherever. Only if everyone acts can we achieve a result." ■

© DOZIER Marc / hemis.fr

Mundiya Kepanga in Popondetta, eastern Papua New Guinea.

Tin Fischer

Journalist based in Berlin, Germany

Carbon credits, the tree that hides the forest?

To reduce their climate impact, companies can generate forest "carbon credits" by financing projects that prevent the exploitation of areas at risk of deforestation. However, the mechanism's effectiveness on climate change mitigation remains to be seen.

The worth of a felled tree is easy to quantify; currently, lumber is worth about US$350. But what is the value of a standing tree? It is obviously valuable for biodiversity, for the climate, for humans and agriculture: a forest provides habitat for birds, stores carbon, casts shadow and regulates rainfall. But these are not financial values, therefore leaving forests vulnerable for clearance. So a new idea emerged.

During the 2005 UN Climate Conference in Montreal, a proposal by Papua New Guinea and Costa Rica made the rounds. It stated that developing nations had "little incentive to prevent deforestation", because of "the absence of revenue streams from standing forests". As a solution it suggested "a more complete market valuation" for such standing forests.

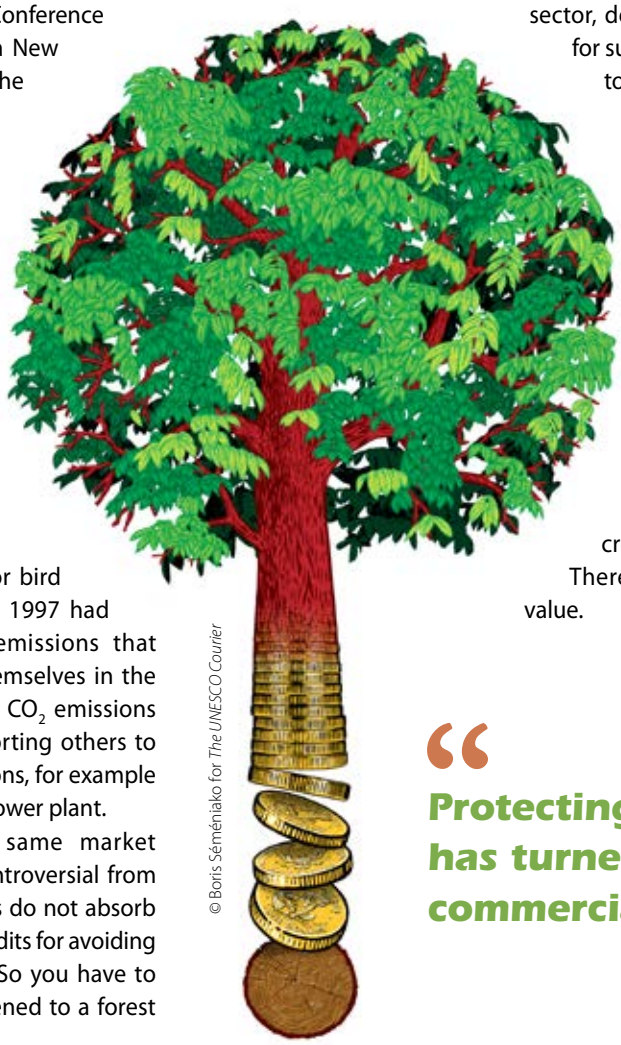
To put more simply, a price tag for standing trees.

Market logic

There is no market for shadow or bird nests. But the Kyoto Protocol in 1997 had created a market for carbon emissions that countries could trade among themselves in the form of so-called carbon credits. CO_2 emissions could be compensated by supporting others to avoid the same amount of emissions, for example by building a renewable energy power plant.

The idea was to use the same market mechanism for forests. It was controversial from the start. Existing standing forests do not absorb additional carbon; they receive credits for avoiding emissions by not being cleared. So you have to measure what would have happened to a forest without your protection. And you have to guarantee that a forest keeps standing and storing this compensated carbon for decades like a solar or wind farm does.

Up until today important certification bodies like Gold Standard do not certify "avoided deforestation" carbon credits. Countries often avoid them too. They never made it to the market of the Kyoto Protocol. But in 2006 an organization called Verra, backed by players of the private sector, decided to establish a standard for such forest credits – a set of rules to statistically predict what would happen to a forest without protection. In addition, Verra established an "insurance system" to address the issue of permanence. Say, for example, a protected forest, which has already generated carbon credits, gets destroyed in a wildfire. All carbon that the forest has stored is back in the atmosphere. But it too can now be compensated with credits from the insurance pool. Therefore the credits keep their value.



© Boris Séméniako for *The UNESCO Courier*

> **Protecting forests has turned into a commercial enterprise**

A standing tree finally got a price tag. It was turned into a tradeable commodity, built on complex statistics. What is actually traded is a piece of paper – or entry in a database – that confirms that a hypothetical scenario did not occur.

A billion dollar industry

Forest protection projects were set up in developing countries, from Peru to the Democratic Republic of the Congo to Indonesia. There are now around 90 worldwide. Some projects are run by environmental organizations and agencies, some even by private companies. Protecting forests has turned into a commercial enterprise, or so it seems.

However, in the beginning, carbon credits – intended to cool the climate – were just warming shelves. Market demand was low. Companies would buy carbon credits to compensate for their emissions voluntarily, but political and public pressure to do so was low.

With the climate strike led by Swedish activist Greta Thunberg in 2018, the climate movement gained momentum. Voluntary carbon offsets soon became a booming commodity. Companies from all sectors wanted to become climate neutral, or at least demonstrate that they were making an effort. A large part opted for avoided deforestation credits. In 2021 the avoided deforestation credits accounted for almost a third of the voluntary carbon market, now a billion dollar industry.

> **“There is no market for shadow or bird nests**

Discouraging impact

But did the projects really reduce deforestation? Thales West, environmental scientist and assistant professor at the Free University in Amsterdam, compared a sample of protected forests to forest areas with similar characteristics, but without

© Boris Séméniako for *The UNESCO Courier*

protection from carbon credits. I was part of a team of journalists from *The Guardian*, *Die Zeit*, and *SourceMaterial* who analyzed West's results further. We found that 94 per cent of the carbon credits from projects we examined were worthless for the climate. It became apparent that projects often exaggerated their what-if-scenarios about what would have happened to these forests.

I think what went wrong is simple: when the climate value of "standing forests" is calculated, nobody at the table has a natural interest to keep numbers low. Those who protect the forests want to generate as many credits as possible. Those who buy the credits want to get as many credits as possible. Those who seal the deal earn a fee from every credit. The nature of this virtual product leads to the bizarre situation that all parties involved – seller, re-seller, standard bodies, buyers – want big numbers. So they got big numbers.

> **94% of carbon credits examined were worthless for the climate**

New political framework

A solution for this conflict of interest could be a new political framework which is about to be established. After the Paris Climate Agreement in 2015, every country in the world will define climate goals. This means creating forest inventories and quantifying deforestation. If forest protection projects want to generate credible carbon credits, they will have to go to a national environmental agency and ask for these credits to be subtracted from the national carbon accounting. This may be crucial in the future, because it finally brings to the table a party that has a natural interest in keeping the number of credits for standing forests low: us, society, represented by the state.

On the market side there are now countless startups and initiatives to establish more robust calculations for forest projects. The availability of easy-to-use digital technology could also make it easier for owners of smaller forests to convert them into carbon credit projects.

But why stop with carbon? In his dystopian satire *Venomous Lumpsucker* British novelist Ned Beauman imagines a world where companies buy "extinction credits" which give them "bulldozing rights to any species on earth". Every wrong that's done to nature can be compensated in a zero-sum game. It is a novel, but not entirely fictitious. "Biodiversity credits", which quantify improvements to natural habitats, are an emerging concept. Bird nests in trees? They could finally become a commodity too. ■

World Heritage forests: carbon sinks under pressure

When protected and managed properly, forests in UNESCO World Heritage sites act as strong carbon sinks and stores, according to the 2021 report *World Heritage forests: carbon sinks under pressure*.

The research found that World Heritage forests absorbed 190 million tons of CO_2 from the atmosphere each year – an amount comparable to roughly half the United Kingdom's annual CO_2 emissions from fossil fuels. Moreover, their carbon sequestration over long periods has led to total storage of approximately 13 billion tons of carbon. If all this stored carbon were to be released into the atmosphere as CO_2, it would be akin to emitting 1.3 times the world's total annual CO_2 emissions from fossil fuels.

However, 10 World Heritage forests out of 257 released more carbon than they sequestered. At some sites this was caused by the clearance of land for agriculture. Wildfires, often linked to severe periods of drought, are also a predominant factor. Other extreme weather phenomena, such as hurricanes, contributed at certain sites. The findings also indicate that sequestration and carbon sinks are likely to be affected at a growing number of sites in the coming years.

The report urges strong and sustained protection of UNESCO World Heritage sites and their surrounding landscapes to ensure their forests can continue to act as strong carbon sinks and stores for future generations. To achieve this, the report recommends rapidly responding to climate-related events, as well as maintaining and strengthening ecological connectivity through improved landscape management.

The report represents a first-ever scientific assessment of the climate benefits of UNESCO World Heritage forests. By combining satellite data with site-level monitoring, researchers at UNESCO, World Resources Institute (WRI) and the International Union for Conservation of Nature (IUCN) were able to estimate the gross and net carbon absorbed by and emitted from the forests between 2001 and 2020 and determine the causes of some emissions. Ranging in size from 18 hectares (Seychelles) to more than five million hectares (Central Amazon Conservation Complex, Brazil), UNESCO World Heritage forest sites around the world cover over 69 million hectares.

Liz Kimbrough

Journalist for Mongabay, a nonprofit conservation and environmental science news platform based in the United States

An indigenous solution to deforestation in the Amazon

The world's best protected tropical forests are those inhabited by indigenous peoples. Under the Brazilian Constitution, indigenous communities have exclusive access to natural resources in certain parts of their territories. But the procedure is long and currently concerns only a tiny part of the Amazon rainforest.

"If the forest is still standing, it is thanks to the presence of indigenous peoples. And today, this is the most important mission of our planet. Because it is a mission that not only guarantees our lives but guarantees the lives of all people," Txai Suruí, activist of the Paiter Suruí people and coordinator of the Indigenous youth movement of Rondônia, Brazil, said in a recent statement.

She is part of the global movement that calls for all indigenous territories in the Amazon, particularly in Brazil, to be officially recognized by the government, a process known as demarcation.

The principle of demarcation (*demarcaçao*), laid down in the Brazilian Constitution of 1988, establishes the rights of indigenous peoples to the lands that they have traditionally occupied.

The traditional practices of indigenous peoples promote sustainable forest management – these groups do not typically practice extensive cattle ranching or use large machines. Although indigenous peoples comprise only five per cent of the world's population, they protect 80 per cent of global biodiversity, and the world's healthiest tropical forests are located in protected indigenous areas.

Between 1990 and 2020, indigenous lands recognized by the government in Brazil experienced only a one per cent loss of their native vegetation, twenty times less than in private areas, according to data from research collective MapBiomas. Another report by Monitoring of the Andean Amazon Project (MAAP) showed, in March 2023, that protected areas and indigenous territories in the Amazon rainforest experienced just one-third the amount of primary forest loss as non-protected areas.

> **"Although indigenous peoples comprise only 5% of the world's population, they protect 80% of global biodiversity**

Prior consultation

"To say that land is indigenous land is to say that on that land, no mining is allowed, no individual private property is allowed, and everything that affects that land will need to go through the process of free prior and informed consultation and consent with indigenous peoples," Ana Carolina Alfinito, a Legal Advisor for the United States-based NGO Amazon Watch, says.

The demarcation process in Brazil, where most of the Amazon lies, is long and involved. After the indigenous group submits a report that attests that the land is traditionally held or is necessary for their people to live according to their forms of life, approvals are needed from the President of the National Foundation for Indigenous Peoples (FUNAI), and by the newly created Ministry of Indigenous Peoples. Finally, the process is validated by the President of Brazil.

After demarcation comes the most difficult part: removing the non-indigenous occupants from the land and ensuring that the land will be available for the indigenous peoples to whom it belongs. This process can be long, complicated and violent.

© Genilson Guajajara

Young Guajajara activist Djelma Viana from the indigenous territory of Rio Pindaré in northern Brazil. The leaf she holds is used for healing in traditional medicine.

Small victories

Brazil currently has 733 indigenous territories, of which the government recognizes 496. The remaining 237 are in different stages of the demarcation procedure.

"These victories, these formal steps in recognizing the traditional character of the land are important," Alfinito says, "but this is a continuous and permanent battle."

It's important to remember that demarcation doesn't create anything new but rather officially recognizes the rights of indigenous people to their land that already exist.

Indigenous lands, even those that are officially recognized, face various problems. Nearly 10 per cent of the officially demarcated lands do not have the protection guaranteed by the constitution; these lands are affected by various issues, including overlapping claims, invasions, land seizures, and illegal activities like mining, logging and drug trafficking.

"We will continue monitoring our lands while they continue to attack us," says Maria Leusa Munduruku, leader of the Munduruku people. "It doesn't matter if the territory is demarcated or not, the territory is ours!"

> **Protected areas and indigenous territories in the Amazon rainforest experienced just one-third the amount of primary forest loss as non-protected areas**

Interview by
Katerina Markelova
UNESCO

Discovering life in the canopy

Long considered inaccessible, the canopy is starting to reveal some of its secrets now that scientists have the tools and technology to explore its complex ecosystem. Nalini Nadkarni, a professor of biology at the University of Utah (United States), describes a treetop world teeming with a tremendous variety of plants and animals.

You have spent four decades studying the forest canopy. What do you see and feel when you leave the dark forest floor and mount to the summits of the trees?

What has always amazed me about climbing into the canopy is that there are such dramatic differences, both in microclimate and biology just 30 meters above the forest floor. To reach my study trees in Monteverde, Costa Rica, I must first walk along the dark and humid forest floor for about an hour. The forest appears as a group of tall cylinders with the canopy that seems to be a big blob of green. The colors are muted. The sounds are muffled. There's no wind.

But when you ascend, what you feel is this gradual change in the surroundings as you emerge into the treetops. There is a different microclimate up there: more sunlight, higher temperatures and more wind. Sounds are very present with a hummingbird whizzing by or the howler monkeys calling to each other. Orchids and bromeliads are abundant and incredibly lush. And there is a huge diversity of canopy invertebrates. All these species of plants and animals that we would never see on the forest floor have evolved over millennia to adapt themselves to this different microenvironment and architecture.

> **"The insect diversity discovered in the forest canopy led scientists to call it the last biotic frontier**

Until quite recently, forest ecologists studied complex canopy ecosystems without leaving the ground. What has changed since scientists penetrated the canopy forty years ago?

In 1983, the entomologist Terry Erwin from the Smithsonian Institution (United States), used insecticidal fog to study the beetles and insects that live in the forest canopy. He would basically shoot this fog up into the canopy at dawn and the insects would fall to the forest floor. What he learned was that there was a tremendous amount of insect diversity up there that people never knew about. That led him to call the forest canopy the last biotic frontier.

Later on, a few pioneers started to use mountain climbing techniques to get up into the forest canopy. That was a real turning point in terms of our understanding of these ecosystems because it allowed studying the organisms where they live. Other methods rapidly developed, such as walkways between forest canopies to observe arboreal mammal and bird behavior, and the use of construction cranes to get above the forest canopy to study the interface of the atmosphere with the living biota. A French group headed by Francis Hallé invented the canopy raft, a hot air balloon with a raft that could be lowered on the top of the trees, and the canopy bubble that could navigate its way around the trees. And most recently, we've been using remote sensing, satellite imagery and drones.

Epiphytes – plants that grow on other plants, such as orchids, mosses or ferns – are your main field of scientific research. What role do they play in the forest ecosystem?

Epiphytes are a very diverse group of plants that get support from the trees, but, unlike parasitic plants, don't have root connections to vascular systems of their hosts. Over evolutionary time, epiphytes have evolved the physiological and anatomical capacity to intercept and retain the atmospheric nutrients present in droplets of rain and mist.

They capture nutrients from outside the ecosystem and then make them available to plants and animals that

are inside the ecosystem. One of our studies showed that one third of all foraging visits for nectar, sugar and mosses by birds and arboreal mammals aim at the epiphyte resources. And six bird species turned out to be epiphyte specialists, because they use them for over 90 per cent of their foraging visits. Our conclusion, corroborated by other studies, was that epiphytic plants fulfill a critical role in terms of nutrient cycling.

You've conducted studies of forest canopies on four continents. What have been your most striking discoveries?

Epiphytes, by decomposing, create the canopy soil, which can reach a meter deep. They're rich in nutrients and are populated by invertebrates, microbes and even earthworms. Some trees can actually put out roots from their own branches and trunks that permeate these mats of canopy soils and take up nutrients and water from them. The fact that trees are capable of growing roots high above the forest floor literally blew my mind.

I also learned that although epiphytes seem so vibrant and amazingly powerful, they are not resilient to physical disturbance. In 1987, I carried out a series of experiments in which I stripped branches of epiphyte mats for a meter in length away from the branch to see how the epiphyte would come back. I anticipated that they would grow back very rapidly and that they would encroach from the outside like grass. But I was wrong on both counts. It wasn't until 13 years after that I saw the first signs of recolonization and 22 years later, only 40 per cent of the original cover was restored.

What new species have been discovered in the canopy?

We're continually finding new species, especially orchids and invertebrates. But it's really difficult and probably impossible at this point to estimate how many more are yet to be discovered. That's really partly due to our ignorance of what's already up there. We can do that for other plant groups, for trees, →

Nalini Nadkarni on a branch 35 metres above the ground, near the top of a strangler fig in Costa Rica's Monteverde forest.

for example. According to a 2022 study published in the American scientific journal *Proceedings of the National Academy of Sciences,* out of an estimated 73,000 tree species in the world probably 9,000 still remain unknown. The canopy researchers just don't have that kind of foundational database at this point.

> **We're continually finding new species in the canopy, especially orchids and invertebrates**

© Sybil Gotsch

The high branches of tropical mountain forests are covered with abundant vegetation.

Since the mid-1970s you have focused on the Costa Rican cloud forest in Monteverde. What makes it special?

Although cloud forests make up a very small proportion of woodlands, they have a unique structure, composition and function. They grow on tropical mountains and their major climatic characteristic is the presence of wind-driven mist and cloud. When the warm water, which forms over the ocean, moves inland by the trade winds, it encounters mountains and cools down, becoming mist and clouds. This moist air provides nutrients to cloud forests. With climate change, it takes a longer time and a higher elevation for the condensation to happen. As a result, the forests get less exposed to the nourishing clouds that, in some cases, are moving all the way up and over the mountains without encountering the forests at all.

Cloud forests' contribution to world biodiversity is disproportionately high, because they are home to many endemic species. When I was a graduate student, one of those amazing cloud forest endemics was the golden toad. You could only see these brilliantly colored creatures during the very dry season when they were going out to breed. El Niño, which occurred in Costa Rica in 1988, caused their extinction.

You dedicate a part of your time to raising public awareness of the crucial role played by forests. Is your message being heard?

Beyond just their ecological value, forests touch a wide spectrum of other crucial values, be it aesthetic, economic or spiritual ones. When we engage with the forest, we physically feel better, our stress and anxiety are reduced. I have spent many years trying to bring science lectures and conservation projects outside of academia, for example, to incarcerated populations who are denied access to nature. We've seen evidence of improvements in their mental health.

Forests inspire art, poetry and music. When I bring artists to the canopy, they create pieces of visual arts, rap songs and poetry that they then perform in poetry readings or modern dance performances. If we can bring the values of nature to those places, we might have a better chance of expanding the audience and contributors to forest conservation. I think that scientists have a part to play in this. ■

Guy Sabourin

Journalist in Montreal, Canada

In Canada, nature by prescription

Since 2020, some Canadian provinces have allowed trained physicians to prescribe forest walks to anxious patients in order to reduce their stress levels and improve their quality of life.

Vincent Beaubien needs to go to the forest regularly. He goes there to picnic by a fire, sleep or simply walk. The 33-year-old construction foreman, who lives in Delson, a suburb of Montreal, feels the benefits of this contact with the trees after taking just a few steps in the woods. "It gives me the peace and serenity I need. These are the feelings I take away with me."

"Away from the noise and distractions, you become aware that you are part of a whole," adds Danièle Allaire, retired director of an early childhood centre who lives in Bromont, some 80 kilometers east of Montreal. "Even though I have trouble explaining this occurrence, living in the middle of the forest comforts me."

Beyond the benefits that can be felt empirically during a walk in nature, forest bathing seems to be beneficial to our health. So much so that it is now possible in Canada to have it prescribed by your doctor. Launched for the first time in 2020 in British Columbia, the pilot experiment has since been extended to other provinces such as Ontario, Manitoba and Quebec. It allows practitioners to offer their patients walks in the forest as part of a specific programme called Park Prescription. It can also provide free access to national parks.

© Carla Indipendente for *The UNESCO Courier*

Effect on stress

"The scientific literature is substantial enough to encourage us to prescribe this," adds Claudel Pétrin-Desrosiers, a family doctor in Montreal, who prescribes contact with nature to her patients. Going to the forest assiduously – at least two hours a week – seems to significantly reduce cortisol, the stress hormone. Advocates of this approach also point to a beneficial effect on such phenomena as blood pressure, heart rate, mood, and the ability to concentrate in children.

© Carla Indipendente for *The UNESCO Courier*

> **Being in the forest helps us to reconnect with our biological rhythm**

The nature prescription seems particularly apt for people suffering from depression or anxiety disorders. While it is not a miracle cure and is not intended to replace medical treatment, this therapy can be an alternative or complementary approach. "I bring up the subject with my patients who suffer from anxiety or depression, just as I talk to them about psychotherapy, medication, meditation and physical activity," explains Ms Pétrin-Desrosiers, who also trains peers in this young science. "It's an additional option."

But why do you need a prescription when anyone can go for a walk in the woods? "Because studies show that a written prescription is stronger than oral advice," she explains. "I note it in the medical file and I question the patient during the next consultation."

Meditate, feel, touch

The idea of forest baths as allies of our good health may seem surprising. It is not new, however. In Japan, the practice of *shinrin-yoku* has existed since the early 1980s. More than an actual therapy, it is akin to preventive medicine, a healthy way of living. "It generally consists of a slow, often guided walk, during which participants are invited to explore sounds, to meditate, feel and touch," says Ms Pétrin-Desrosiers.

Forests calm us down and give us a sense of physical and mental well-being, confirms François Reeves, a cardiologist at the *Centre hospitalier universitaire de Montréal* and clinical professor at the *Université de Montréal*'s faculty of medicine. The specialist, who has studied the influence of environmental factors on cardiovascular health for 15 years, states that being in the forest helps us to reconnect with our biological rhythm and improves the quality of recovery after a bout of illness.

For those who live far from the forest, going to a park or to the banks of a river can be a good alternative. During three months of medical leave due to a mood disorder, high school teacher Simon Poutré found salvation in long daily walks in a large park near his home. "On these walks, I felt my breathing calm down and I came back to the present moment," he says.

"It's after 20 minutes that you start to experience the benefits on heart rate, blood stress levels and blood pressure," says Ms Pépin-Desrosiers. "Around two to three hours per week brings the maximum return on investment."

The effect of forest bathing is further amplified if it is combined with physical activity, such as walking or biking. But passive exposure, consisting of looking at the trees while sitting on a park bench, also produces positive effects. "It's valuable for people with mobility issues or a fear of exercise," says Ms Pétrin-Desrosiers. But, she adds, we still need to have a certain awareness of our relationship with nature to reap the benefits.

> **Going to the forest seems to significantly reduce cortisol, the stress hormone**

And what is good for us is also good for the forest. It has been shown that people who spend time in nature are also more likely to protect it. ■

Interview by
Anuliina Savolainen

Jens Liljestrand: "I wanted to capture the feeling of anger in the face of wildfires"

Swedish author and journalist Jens Liljestrand paints a dystopian picture of a near-future Sweden devastated by massive fires in his recent novel *Even if Everything Ends* (2021).

In your novel* Even if everything ends, *Sweden is hit by a climate disaster. How did the idea for this story come about?

The novel was influenced by the historic forest fires of summer 2018. Throughout Sweden there were giant wildfires of a scale that no one had ever seen before. And of course these fires are just a prelude to what we all know is going to come. So in 2019 I started writing a dystopian novel that takes place in the future. At the time it was all the talk about how we only had a dozen years to limit climate catastrophe. This was the point of departure for my novel: What's life going to be like in 12 years? This would be around 2030, a decade from the moment I started writing. But every week the moment came closer, and when I finished the book, I realized that this is not the future, this is now. So it ended up being a contemporary novel.

© Terje Abusdal

From the series Slash & Burn *by Norwegian artist Terje Abusdal.*

A lot happened during the two years of the writing process. Climate disasters such as massive wildfires in Australia, California, and Northern Canada but also, after the book was finished, in France and Spain. However, my main inspiration remained the 2018 summer in Sweden. How people were shocked and couldn't believe that this was happening. And this despite the fact that scientists had been warning about the effects of climate change for decades. I wanted to capture this feeling of disbelief, frustration and anger.

Amid wildfires and societal chaos, the characters continue to navigate their private life turbulence as best they can. Why did you choose to focus on ordinary people's experiences?

The story follows the reactions of a couple of characters who are not all directly involved in the fires, but they are affected by the consequences. I wanted to depict the very complex set of feelings climate change creates. It's scary, it's frightening, and it's shocking. It also makes you sad. It makes you angry, wishful, melancholic. It can also make you want to do something, react, get involved – or to deny that this is happening at all, or say that maybe it's not so bad, maybe there's just nothing we can do about it.

I think all of us have, to some degree, some of these emotions. So each of the main characters sort of encapsulates one set of those feelings. One reacts with shock and panic, desperation. Another one, arrogant and in denial. And then there's the sad and angry person who feels that someone should pay the price. And finally, there's the one who acts in a constructive way and represents resistance.

> **"There's a false sense of safety that collapses because people see that even as a rich country we are not excluded from the effects of climate change**

There's a false sense of safety that collapses because people see that even as a rich country we are not excluded from the effects of climate change.

Against the bigger picture, the disappointment, shock and bewilderment become almost comical, but it's also amazing also how quickly people stop caring. Just like in the novel: suddenly the rain falls and the fires are extinguished, people move on.

Now more than ever, novelists are facing up to the climate crisis with 'climate fiction'. Do you see fiction as a means of combating climate change?

This novel is not a wake-up call. If you still don't believe in climate change, fiction is not going to help you. I did not write the novel to educate or to be part of the climate debate; the debate should be scientific or political. But it's important that climate change is talked about.

Obviously, journalists should be the ones reporting about dying coral reefs and telling stories about melting glaciers. But to put words on experiences such as how it feels to tell your child that they're never going to see a coral reef – that's where you need a different set of tools. That's where art comes in. To help people put words or images on what they're feeling and experiencing and to create a space for a dialogue. Art can influence a mentality and help us to understand in a deeper way. Through this novel, I wanted to contribute to the development of a culture that helps people cope with climate change.

I'm surprised that there is not more climate fiction. We are in the middle of the worst challenge that humanity has ever faced, but this apocalyptic feeling is not resonating in culture. I think that there is a mission there for artists of all kinds to try and grasp that sense of fear, panic, desperation, sadness, anger, longing and nostalgia.

Since the novel is out I have also been invited to talk in schools where I have met young people with a great deal of climate-related stress. What I'm trying to tell them is that although they will very probably live in a world with huge challenges, they will also have enormous opportunities to do things and to live in a way that is more respectful of ecosystems. These are going to be hard times, but I think there's also a lot to be hopeful about.

When I was a child, there were no longer wolves in Sweden. Now they are back. In southern Sweden, where I grew up, there was one single eagle on an island, and now there are eagles everywhere there. People are also realizing the incredible value of green areas – there's a huge trend to make inner cities green. So these things are happening as well. There's a possibility to live on a planet where humanity is reconstructing ecosystems. We shouldn't give up. ■

> **"We are in the middle of the worst challenge that humanity has ever faced, but this apocalyptic feeling is not resonating in culture**

Alejandro Castro
Journalist in Mexico

Mexico: Women lead the way in saving the mangroves

Essential to the existence and security of coastal populations, mangrove forests in Mexico are in decline. Women's groups like the *Chelemeras*, in the Yucatán, are working to restore these ecosystems threatened by tourism development and urbanization.

© Gladys Serrano / Ediciones El País, S.L.

The Chelemeras *deposit mud at the bottom of the water to plant mangrove seeds. The women's collective has brought 100 hectares of mangrove forest back to life on the northern coast of the Yucatán.*

Since she was a small child, Erika Barnett, from the Seri community in northeastern Mexico, watched mangrove seedlings be carried away by the waves. She would then gather young shoots to take back to her home on the coast.

The daughter of fishers, she is now 31 years old and the director of one of the most important coastal restoration projects in Mexico, cultivating and planting mangroves in a desert region that has one of the harshest climates in the country.

More than 18 million Mexicans live in coastal communities. In addition to the mixed-ethnicity population, four ethnic groups live along the coast: the Seri (northeast); the Mayas (southeast); the Huaves (south-central) and the Cucapás (north). What do they have in common? They all depend on natural resources, particularly mangroves, to live.

"The infrastructure, economy and food security of hundreds of coastal communities depend on these flooded forests," says Claudia Teutli Hernández, biologist and professor at the National School of Advanced Studies of the National Autonomous University of Mexico (UNAM).

A link between land and sea

Along Mexico's 4,600-kilometre coastline, tangled roots emerge from the swampy soil. Twisted branches and evergreen leaves form labyrinths linking the land and the sea. They are mangrove forests, considered to be among the most productive ecosystems in the world.

According to the National Commission for the Knowledge and Use of Biodiversity (CONABIO), Mexico is home to six per cent of the world's mangroves. In terms of the extent of these ecosystems worldwide, the country ranks fourth after Indonesia, Australia and Brazil.

Mangroves form a particularly precious ecosystem for coastal communities. This green belt reduces erosion of the coast by forming a protective barrier against severe weather events such as hurricanes. The roots of the mangroves, submerged in mud and brackish water, serve as

nesting and survival shelters for young fish and crustaceans. Their branches are also home to various species of wildlife, including birds, monkeys and felines. Mangroves are also greenhouse gas sinks, absorbing even more carbon dioxide than tropical forests.

But these woody, dense, arborescent plant formations are more and more threatened. Data from the *Global Mangrove Watch* platform indicates a loss of 44,788 hectares of mangroves in Mexico between 1996 and 2020.

Tourism and urban spread

"Their destruction correlates to the economic development of each region," explains researcher Claudia Teutli Hernández. On the peninsula of the Yucatán, for example, the explosive growth of hotel complexes and urban spread are the main threat.

Holbox, an island in the Mexican Caribbean, illustrates the deterioration of the mangroves linked to the growth of tourism and real estate, the streets and construction eating away at this unique ecosystem.

Claudia Teutli Hernández also points to road infrastructure development as the reason for the destruction of mangrove ecosystems in Baja California and Baja California Sur. In the Tamaulipas region (northwest), however, the extraction of hydrocarbons is one of the main threats. In other regions like Veracruz, in the middle of the country, livestock, along with tourism, is another factor leading to deforestation.

> **"Mangroves form a protective barrier against severe weather events**

The speed of the destruction of Mexican mangroves is much faster than the ability to restore and reestablish these ecosystems, according to Jorge Herrera Silveira, researcher at the Center for Research and Advanced Studies of the National Polytechnic Institute (IPN), Mérida Unit.

The conservation challenge is immense. In several locations across the country, communities are organizing to work on restoration, surveillance and to raise awareness. For example, Herrera Silveira has been working for ten years with 13 women on the northern coast of the Yucatán, a group known as the *Chelemeras*.

The group, made up of homemakers, mothers, wives and carers, has been recognized at the national level for bringing new life to 100 hectares of deteriorated mangroves in their town, Chelem. Hence the name of the collective.

The fight of the *Chelemeras*

Their restoration technique consists of reconnecting the hydrological systems so the mangrove can start to grow again on its own. For the last ten years, the *Chelemeras* have been putting on their rubber boots, hats, gloves and

Biosphere reserves caring for mangroves in Latin America

Since September 2022, the La Encrucijada biosphere reserve in Mexico has been spearheading a project to assess the state of mangroves and to restore them in seven biosphere reserves in Latin America and the Caribbean, located in Colombia, Cuba, Ecuador, Panama and Peru.

Latin America and the Caribbean are home to almost 26 per cent of the world's mangrove forests, but these have been in decline nearly everywhere since the 1980s. Mangroves provide crucial ecosystem services to many coastal populations, particularly indigenous ones, by serving as fish nurseries and sources of wood. They also constitute a natural coastal defence. By breaking waves, mangrove forests protect against coastal erosion and storms. In addition, they provide habitat for numerous species of birds, reptiles and amphibians and are highly effective carbon sinks.

Good news – mangroves have an exceptional capacity to restore themselves. But to do so, they need help. To achieve this end, the UNESCO project, funded by Belgium's Government of Flanders, draws on the knowledge of local communities, indigenous peoples and scientists. In its first phase, the project will seek to ascertain the causes of mangroves' disappearance.

At the same time, technical workshops will be organized at the local level, to determine the threats to mangrove forests and provide appropriate responses. The project also aims to identify mangrove species that can be reintroduced and the places where they can be replanted and restored, in order to initiate a cycle of natural regeneration that can be sustained over the long term.

The mangroves of Celestún in the Yucatán have been almost completely regenerated thanks to an initiative launched in 2007.

long-sleeved T-shirts, and sinking into the mud for more than five hours to dig ditches with picks and shovels.

The collective was born from a restoration project started by Jorge Herrera Silveira, then followed up by the women, according to Keila Vázquez, one of the managers. "It was not easy," she admits. "The restoration efforts required funds to buy appropriate clothing, pay for travel, food, etc. The funds trickle in, sometimes from universities, other times from civil society organizations."

At the other end of the country, in the city of La Paz, in Baja California Sur, a similar group of 14 women protects one of the last mangrove zones in the urban area. They are called the *guardians of the Conchalito,* another name for the mangrove. They live in El Manglito, a working-class neighbourhood located directly opposite.

> **"In several locations across the country, communities are organizing to work on the restoration and surveillance of mangroves**

To put an end to poaching in their town, these women decided to organize themselves to watch over more than 40 hectares of land which their husbands and sons could not access with their *pangas* (small boats), says Martha García, one of the founders. Their strength is in their numbers, she explains. In the beginning, they chased away illegal fishermen by throwing stones at them, but with time they have developed protection and restoration objectives for the area, which had become an unauthorized dumping ground.

Environmental education also plays a central role in the work of these two groups of women. It is one way to anchor their efforts to preserve the mangroves in the future. ■

Photos:
The Anonymous Project

Text: Agnès Bardon,
UNESCO

Our lives in Technicolor

They are both foreign and yet familiar. Photos from before the digital age and selfies, before Instagram. Their vintage colours and gelatin-silver grain give off a curious air of innocence – and melancholy. The protagonists have no names. We know nothing about them, or the person who, one day, captured these scenes of ordinary life on film. All we know is the country and the year (the pictures presented here were taken between 1950 and 1980 in the United States and the United Kingdom).

Yet the child smeared with ice cream, the grandfather dozing in his armchair, the young girl in a bathing cap on the beach could all be our relatives. We have never seen them before, but we recognize them. They could be in one of those albums that every family used to make, even just a few years ago, to record memories of birthday parties, laughing babies or picnics by the roadside.

"The Anonymous Project" was started by British filmmaker Lee Shulman. Since 2017, he has been collecting films and slides taken by unknowns around the world and exhibiting selections in London, New York, Paris and Seoul. Many of the images date from the 1950s and 1960s, when colour photography was becoming widely available. Carefully preserved, they have ended up becoming orphaned as their protagonists disappear.

Deprived of their original meaning – documenting personal memories – they nevertheless transmit an unexpected emotion, fantasy and aesthetic force. It is no coincidence that some of the great names in photography have seized upon these archives, such as the British photographer Martin Parr who, in his book *Déjà View,* places his images in conversation with those from Lee Shulmann's collection, blurring the distinction between amateur and professional photographs. As well as being a reflection of our own personal memories, the photographs in the Anonymous Project collection also delve into our collective memory, documenting the advent of post-war consumer society. ■

KODACHROME
TRANSPARENCY
Kodak

UNITED STATES, 1962

UNITED KINGDOM, 1958

UNITED KINGDOM, 1956

UNITED STATES, 1954

UNITED STATES, 1954

UNITED STATES, 1956

UNITED STATES, 1957

UNITED STATES, 1960

UNITED STATES, 1967

UNITED KINGDOM, 1970

UNITED KINGDOM, 1969

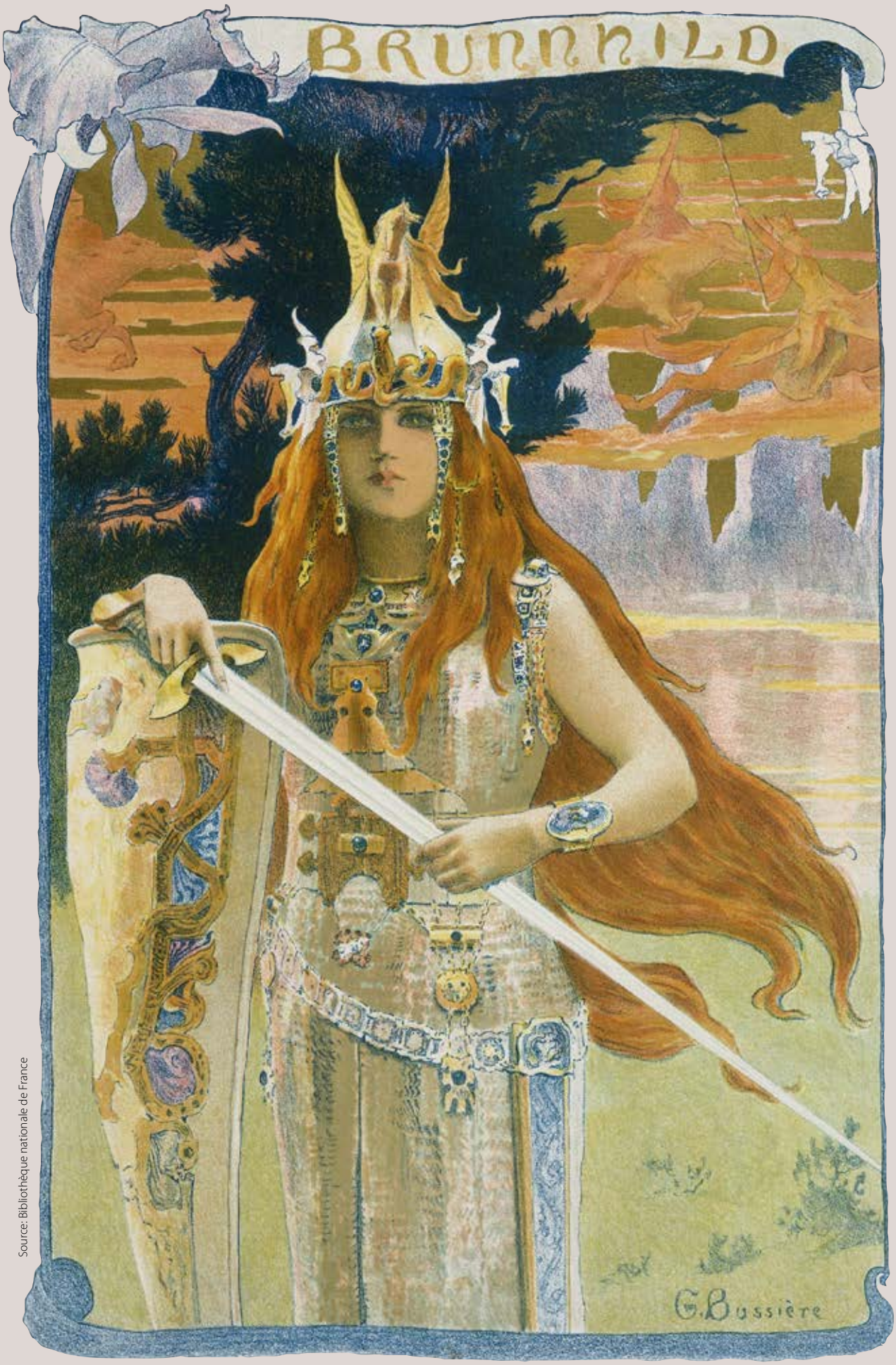
UNITED STATES, 1964

UNITED STATES, 1959

UNITED STATES, 1961

UNITED STATES, 1970

UNITED KINGDOM, 1970



Source: Bibliothèque nationale de France

Brünnhilde, a warrior princess in medieval Germanic and Nordic epic literature, by French painter Gaston Bussière (circa 1898).

Leszek Gardeła

Senior Researcher at the National Museum of Denmark and leading expert on the early medieval period in Northern and Central Europe, he is author of Women and Weapons in the Viking World: Amazons of the North *as well as numerous academic articles pertaining to pre-Christian religion, magic, warfare and identity in the past.*

Viking women in a new light

Valkyries, wives… or warriors? Powerful female figures occupy a central role in Old Norse mythology, but until recently historians accorded Viking women only a marginal role. A new perspective on their role in Viking society has emerged as a result of advancements in archaeological sciences and a shift in scholars' gender-related assumptions.

The word "Viking" has long been associated with tall and muscular man wielding a razor-sharp weapon, wearing a helmet and standing boldly on the prow of a ship, ready to pillage and burn. Today, however, in the age of interdisciplinary research, and when medieval history is omnipresent in museums and universities but also on social media and the silver screen, our visions of the Vikings are changing.

The period known as the Viking Age dates roughly from the 8th to the 11th century. During this turbulent time old power structures across Europe fall or undergo transformations on a scale previously unseen. Settlements and towns grow in size, attracting craftsworkers, merchants and fortune-seekers from faraway locations. Advances in maritime technology transform long-distance travel.

People originating from an area known today as Scandinavia become active players in this new socio-political reality. Having learned how to master the wind, overcome roaring waves and avoid fierce river rapids, their journeys take them to the farthest corners of the world. On their voyages they come across a plethora of peoples who differ from them in regards to language, customs, religion and appearance. Some of these cross-cultural encounters are peaceful, others hostile or even brutal.

Patriarchal biases

The masculine part of Scandinavian society dominated the studies of Viking Age historians and archaeologists until relatively recently. In classic overviews of this pivotal period, women were portrayed as housewives or caretakers of farms, primarily responsible for cooking, spinning, weaving as well as taking care of children and animals. Since no child could survive without food and no ship could ever reach distant lands without a handwoven sail, these roles were by no means peripheral, but the average reader might conclude that women's position was somewhat weaker than men's.

What were the reasons for positioning Viking Age women on the margins of history and viewing them as "appendices" to their male counterparts? One of them surely lies in the socio-political context of early Viking studies. In the 19th century, antiquarianism and medieval history were mainly the domain of wealthy estate owners, collectors and other representatives of the highest echelons of society. Needless to say, the majority of them were male, automatically applying patriarchal ideologies to distant historical periods. It is through this lens that Viking Age history was initially perceived, written and presented.

Supernatural powers

In the works of 19th and early 20th century academics, writers, composers and artists we find prominent Viking Age women – however not really in human but in supernatural guises. Artists like German composer Richard Wagner and his contemporaries were particularly captivated by the figures of Valkyries – proud, beautiful, and weapon-wielding females that populated the Old Norse mythological stories and poems. With their deeds and dramatic love affairs with legendary humans, Valkyries fed the imaginations of viewers who filled opera houses and art galleries and – in line with the *Zeitgeist* – were hungry for the "fantastic". Even though women's agency was restrained in Europe back then, it appears to have been perfectly acceptable to *imagine* women in the roles conventionally ascribed to men. We should keep in mind, however, that Wagner's Valkyries, as well as those that appear in the work of Scandinavian →

artists like Peter Nicolai Arbo or Stephan Sinding, were *not* human and thus could not pose any threat to the social order established and maintained by men.

Another reason for the marginalization of women in the early days of Viking Age research was the problematic nature of the sources available. Old Norse sagas, which were often regarded as windows to the distant past, conventionally illuminate the deeds of men and leave women in the shadowy background. Prominent female personae that occasionally appear in the saga-world usually share close affinity with the sphere of the supernatural, and thus past scholars considered them merely as figures of human imagination.

Also archaeological data had (and continues to have) a significant role in shaping perceptions of past women's lives. In Norway, for instance, hundreds of Viking Age graves were found to contain martial equipment in the form of swords, spearheads, axes and arrowheads. In the 19th and early 20th century many such graves were discovered by accident – for instance during road or house construction – and unearthed by farmers and amateurs.

Their lack of experience in handling archaeological finds and documenting them, coupled with the general disinterest in collecting and re-assembling bone remains, meant that the collections eventually donated to museums would comprise artefacts that were forever "divorced" from the humans they had originally been buried with. Even the results of professional excavations were often hampered by the lack of human/osteological context of the artefactual material. This was due to the unfavourable soil conditions in Northern Europe which often led to the complete eradication of organic remains.

Until recently, therefore, graves with weapons were generally regarded as belonging to men, while graves with jewellery and household utensils were thought to belong to women. It is plain to see how – either deliberately or subconsciously – Victorian attitudes to gender roles fuelled these interpretations, cumulatively solidifying the idea that the Viking world "belonged" to men who played commanding roles in most spheres of life.

Revisiting the past

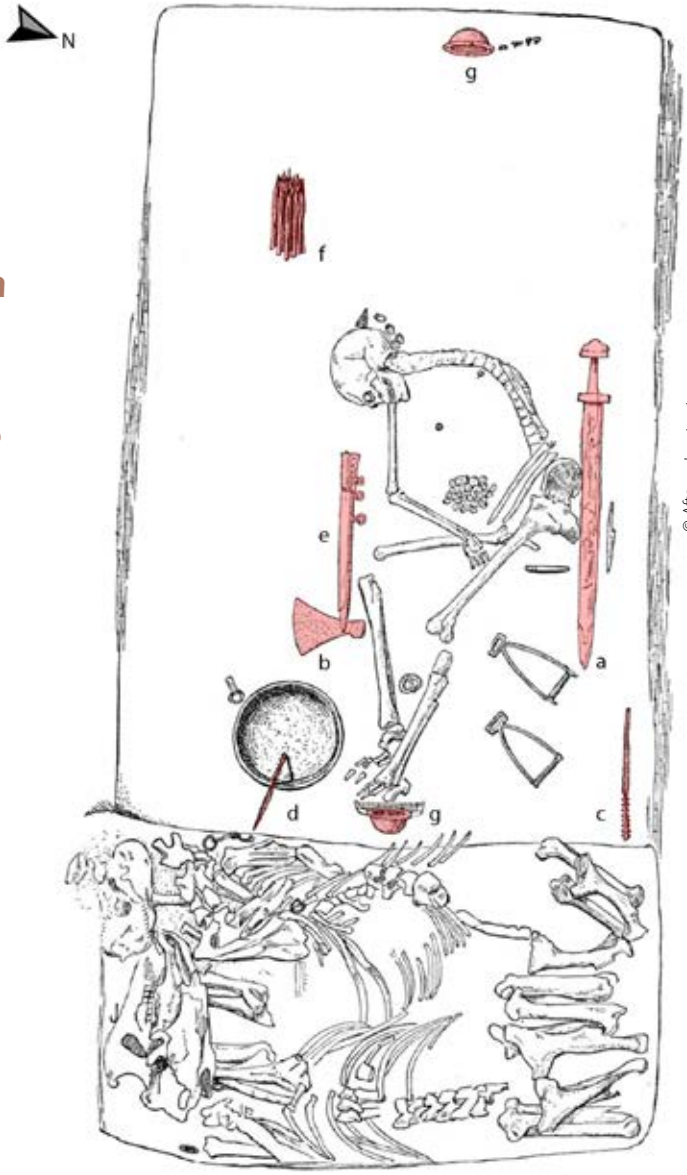
In recent decades, new advancements in archaeological sciences as well as the sophistication of scholarly approaches to gender have led to significant transformations to the perception of the Viking Age. New cutting-edge scientific methods, such as ancient DNA analysis, make it possible to determine the biological sex of the

> **"Wagner's Valkyries were not human and thus could not pose any threat to the social order established and maintained by men**

Public domain / photo: Nationalmuseum

Valkyrie *by Norwegian painter Peter Nicolai Arbo, 19th century. In Old Norse mythology, the Valkyries, with their supernatural powers, determined which warriors would perish on the battlefield.*

> **Genetic analyses revealed in 2017 that the deceased person found in a grave with an array of weapons in Birka, Sweden, was actually a female**



© After a drawing by Holger Arbman (1943), with edits by Leszek Gardela

The Birka grave in Uppland, Sweden. Weapons surrounding a female skeleton's remains are highlighted in red.

deceased even when the bones are poorly preserved. Such methods can also generate hints concerning the ancestry of past individuals and their places of origin. Sometimes it is even possible to determine the colour of their eyes and hair. Coupled with stable isotope analyses that can reveal details of an individual's mobility in different stages of their lives, such investigations can help paint a much more nuanced picture of past realities.

The re-investigation of a richly equipped grave originally excavated in the 19th century at Birka in Uppland, Sweden, provides a recent example of this new approach. The grave held the skeletal remains of a single individual surrounded by an array of weapons: a sword, a battle knife, two spearheads, two shields, a set of arrowheads and an axe. At the feet of this person lay two horses, a mare and a stallion. When the grave was discovered, it was immediately assumed that it belonged to a male Viking warrior. In 2017, however, genetic analyses conducted by a team of international researchers revealed that the deceased person was actually biologically female. The publication of these results became a global sensation. While many specialists and history *afficionados* were eager to accept the idea that this was the grave of a "female Viking", others remained sceptical.

Regardless of the groundbreaking results of genetic and osteological investigations, one crucial fact must always be kept in mind when dealing with past funerary remains: the dead do not bury themselves. A wide plethora of reasons may have led to interring this particular individual with weapons – while the deceased may have been a female warrior, it is equally possible that through the act of depositing an entire set of weapons the mourners wanted to convey some symbolic meanings that are difficult to grasp today.

The Birka case certainly shows that there is great potential in employing interdisciplinary methods to illuminate the distant past. Historians, archaeologists and other researchers should therefore be willing to step beyond their academic comfort zones and to regularly test and question former assumptions. In the search for "real" Viking warriors, whether male, female or representing other genders, academics should exercise the same level of caution and scrutiny.

Although many aspects of the past still remain veiled in mystery, it is now clear that the Viking Age was not at all dominated by men. We should therefore revise the images that appear before our eyes when uttering the word "Viking", and keep in mind that women have always constituted half of the world's population. Beneath the helmet, the Viking warrior standing on the prow of a ship may reveal a face quite different from what one might expect. ■

© UNESCO / Christelle ALIX

Interview by
Agnès Bardon
and Laetitia Kaci
UNESCO

Akira Mizubayashi: The music of words

Akira Mizubayashi, a Japanese academic specializing in the literature of the Enlightenment, has the peculiarity of writing in his adopted language – French. Since the publication of his essay, *Une langue venue d'ailleurs* [A language from elsewhere] (2011), he has published several novels, including the highly acclaimed *Âme brisée* [Broken soul] (2019) where music, which permeates all his stories, forms the framework of the book.

You often say that you 'inhabit' French. What do you mean by this?

It is a way of indicating a feeling of closeness to this language, which was not mine at the beginning, but which has been in me for almost 50 years. It is also a way of saying that I do not live in France. I live in Tokyo, where I have always worked. During my formative years, I lived in France for a while, first in Montpellier and then in Paris. Since then, I return to Paris at least once a year. Although I don't live in France, I do live in the language of this country.

Why did you choose this language rather than another?

It is a long story, which goes back to my encounter with the Japanese philosopher Mori Arimasa. When I was about 18 and preparing for my exams, I came across one of his writings. It was a revelation. He was living in Paris at the time, which had led him to give up the extremely prestigious status of professor of French literature at the University of Tokyo, and he kept a kind of personal diary. The way he spoke about the French language – and European culture in general – made a deep impression on me. Indeed, although he had been practising French since childhood, taught it, and was a specialist in Pascal and Descartes, he wrote in his diary that, basically, he did not understand French and had to start learning it again from scratch.

When I read this sentence, coming from this teacher who had more than 40 years of French practice behind him, an infinite space opened up. I realized how deep a foreign language can be. That's when I decided to follow in his footsteps. Even before I studied French at university, I started listening to the daily lessons that were being broadcast on Japanese national radio at the time. My delight started there.

How does one come to write in a language that is not one's native tongue?

For me, French is a kind of musical instrument. I grew up in a family where we listened to a lot of music. My brother played the violin. I played the piano myself for a few years. As I had first learned French through lessons on the radio, my initial contact with the language was auditory, almost bodily. It was through music that this language entered my ears, my whole body.

Since I decided to make French my instrument, I have led the life of a music student, practising 14 hours a day, without it ever being a discomfort. On the contrary, it is a source of joy. Very soon, I started to write by imitating the phrases and examples given in the lessons. So, from the beginning, writing became a form of daily practice.

> **"For me, French is a kind of musical instrument**

At first, a foreign language is like an obstacle, a rock that has to be broken, using a dictionary. The first step is observation. You notice recurring elements, such as the use of a tense. As soon as I discovered a few characteristic traits of a writer, I would reproduce them. So, I wrote a series of pastiche notebooks imitating the style of certain writers like Zola or Flaubert.

I filled my notebooks with the feeling that I was leading a secret life, because I →

Akira Mizubayashi at UNESCO headquarters in spring 2023.

was living in Japan. My studies also led me to write a dissertation and then a thesis in French. I also wrote articles on Enlightenment authors. But although I had always written, I had never thought of publishing anything. It was beyond my dreams.

During a dinner at the home of my friend, the writer Daniel Pennac, whom I had met in Tokyo, I met the French philosopher and psychoanalyst Jean-Bertrand Pontalis. He asked me a lot of questions about my background. He was curious to know why a young man living 10,000 kilometres from Paris should want to learn French. I answered all his questions very carefully and at the end of the dinner, as he was also a publisher, he suggested that I write a book about my relationship with the French language. At first I thought he was joking, but he was very serious. Back in Tokyo, I started to write *Une langue venue d'ailleurs*, which is a kind of linguistic autobiography, with an acute awareness that these pages were going to be published. It was liberating. I felt that I was leaving a kind of prison imposed by my first language and was being born into another world.

Your first books,* Une langue venue d'ailleurs *and* Mélodie, chronique d'une passion *[Melody: Chronicle of a passion], are stories. How did you make the transition to fiction?

I have never written fiction in Japanese. I have published literary criticism and reflections on the Enlightenment. I have only dared to venture into fiction in French. After the unexpected success of *Une langue venue d'ailleurs*, I already had the idea of writing about Mélodie, a dog I lived with for 12 years and 3 months. She was a very important part of my life. After she died, she came back to see me every night and was extremely present in my dreams. I had to write something about this animal, to thank her in some way. Jean-Bertrand Pontalis not only didn't try to dissuade me; he encouraged me. So, I wrote *Mélodie, chronique d'une passion*.

I had also long had the idea of writing about Mozart, who is a great love of mine. I already had some ideas for this book, which I had imagined as a narrative essay, but the death of Jean-Bertrand Pontalis interrupted this project. I felt orphaned. That is when the French writer and journalist Roger Grenier, at Gallimard, introduced himself to me and suggested that I turn it into a novel. That's how I decided to transform my essay on Mozart into a project for a novel, centred around *the Marriage of Figaro*. And that's how I moved, very gently, into fiction.

© Gallimard

Cover of the book Une langue venue d'ailleurs *(A language from elsewhere), published in 2011.*

Akira Mizubayashi at UNESCO, spring 2023.

> **If I translated my books into Japanese, I would be tempted to betray myself, to deviate from my own text**

Music plays an essential role in your work, both in the narration and in the composition of your books. Is writing another way of composing?

Yes, writing a novel is, for me, like composing a piece of music. With Mozart, Beethoven or Brahms, some themes are laid down from the start. Sometimes the composer has to grope around, looking for the seeds of a theme, until, after a more or less long wait, that theme emerges. This is the case in Beethoven's Second Symphony. Once established, these themes give rise to variations. They return in other forms, different yet recognizable, as in Bach's Goldberg Variations, which advance the same theme, while weaving in an

© UNESCO / Christelle ALIX

infinite number of differences. In my books, I like to set out a theme at the beginning and pick it up again later. I think it's like in music. When I succeed, it is a moment of pure pleasure.

Are the books you write in French translated into Japanese?

No, not at all. I exist in Japan as a professor of French language and literature, as a researcher, but not as a French-language author. I would be happy for them to be translated, but I don't want to do it myself, because my books were conceived directly in French, without passing through the mediation of the Japanese language. If I were to translate them, I would be tempted to betray myself, to deviate from my own text. I would feel torn between the desire to rewrite and the duty to translate. *Ame brisée* is the only novel to have been translated into Japanese, in 2021. I agreed to translate it at the request of a producer who wanted the book to be adapted by a Japanese filmmaker.

Do you see yourself as a bridge between Japanese and French cultures?

That was not my original intention. It's not the reason that I decided to write in French. Having said that, I was born Japanese, to parents who don't know a word of French, I grew up in Japan, I went to school there. The Japanese language is inscribed vertically within me. I live with Japanese social, family and friendship memories. In my novels, Japan is very present. I can't do it any other way. I live in Japanese and French at the same time.

Since Japan opened to the Western world in 1868, during the Meiji period, it has introduced many elements of European culture. I am therefore doubly determined by my personal history, which makes me exist through the intermediary of two languages, as well as the history of my country, which chose to open to the world. Unconsciously, elements of Japanese aesthetics, culture and linguistic sensibility inevitably shine through in my books in French. Without intending to be, I am certainly a kind of boatman, ferrying between the two cultures. ■

IN DEPTH

UNESCO World Heritage sites:

Key to biodiversity conservation

Mila Ibrahimova

UNESCO

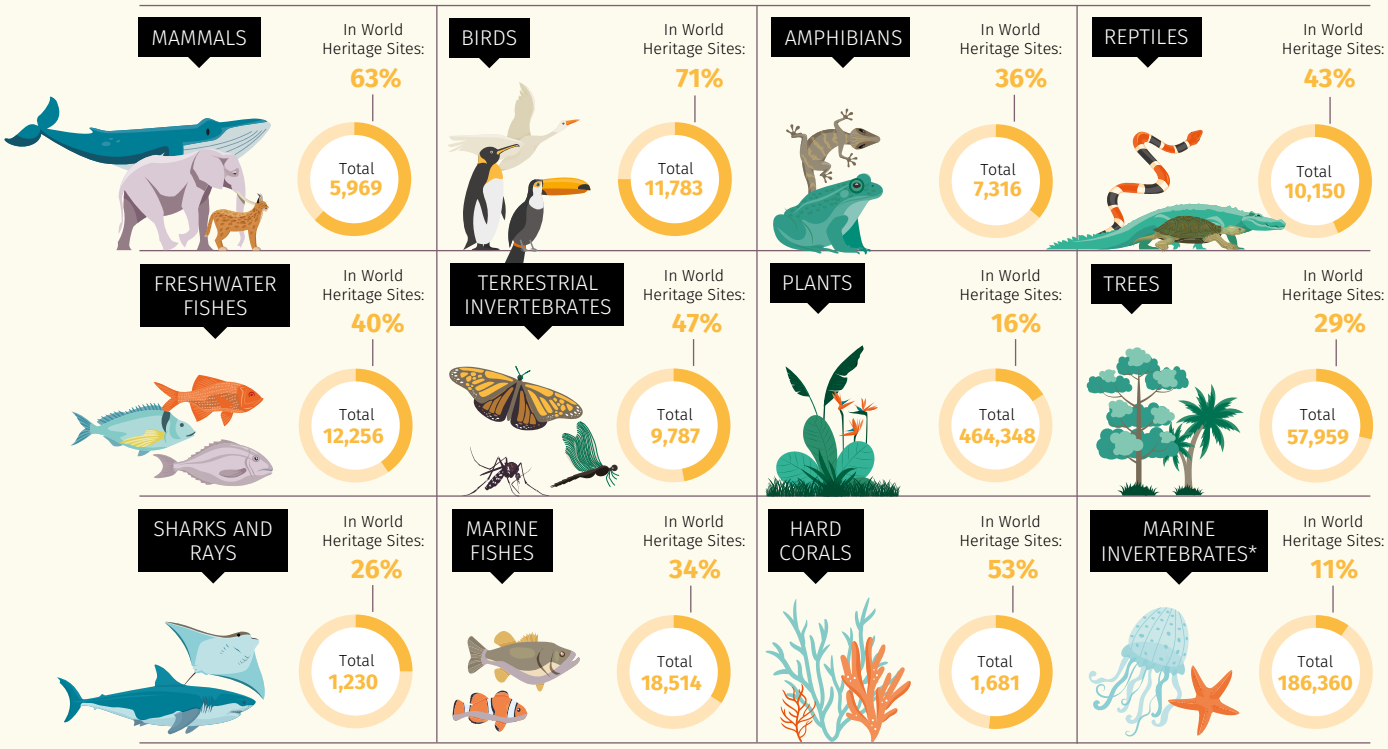
Biodiversity loss is a critical issue that threatens the survival of countless species and the stability of our planet's ecosystems. The issue is of particular concern for UNESCO World Heritage sites, which are representative of more than a fifth of global biodiversity.

With more than 75,000 species of plants and trees, as well as over 30,000 animal species identified, UNESCO World Heritage sites are a refuge for iconic species. Today, up to 1/3 of the last remaining elephants, tigers and pandas and 1 out 10 great apes, lions and rhinos are found in these sites. However, World Heritage biodiversity is threatened by climate change and human pressures. At least 1 in 10 species is already at risk of extinction, and every 1°C increase in temperature could double the number of endangered species, according to UNESCO and IUCN's first-ever global assessment of biological species in World Heritage sites. Urgent action is needed to protect these precious habitats and the species that call them home. ■

WHERE DO WE STAND?

WORLD HERITAGE SITES COVER LESS THAN 1% OF EARTH'S SURFACE YET HOST MORE THAN 20% OF GLOBAL SPECIES DIVERSITY

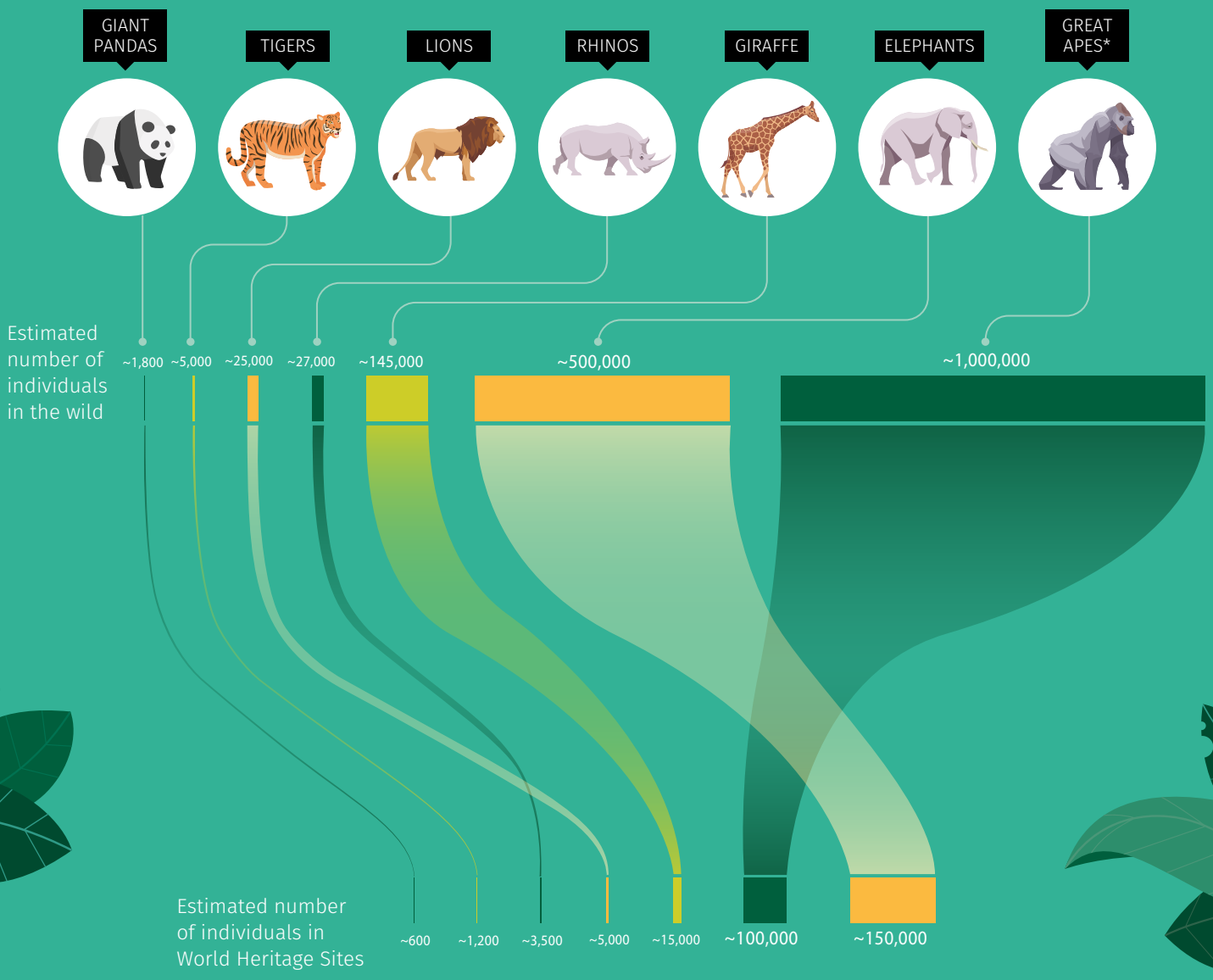
Total number of assessed species globally and percentage of species in World Heritage sites



*Including jellyfish, sea stars, molluscs, sponges, shrimps, crabs, lobsters.

Source: *World Heritage: A unique contribution to biodiversity conservation*, 2023

REFUGE FOR ICONIC SPECIES

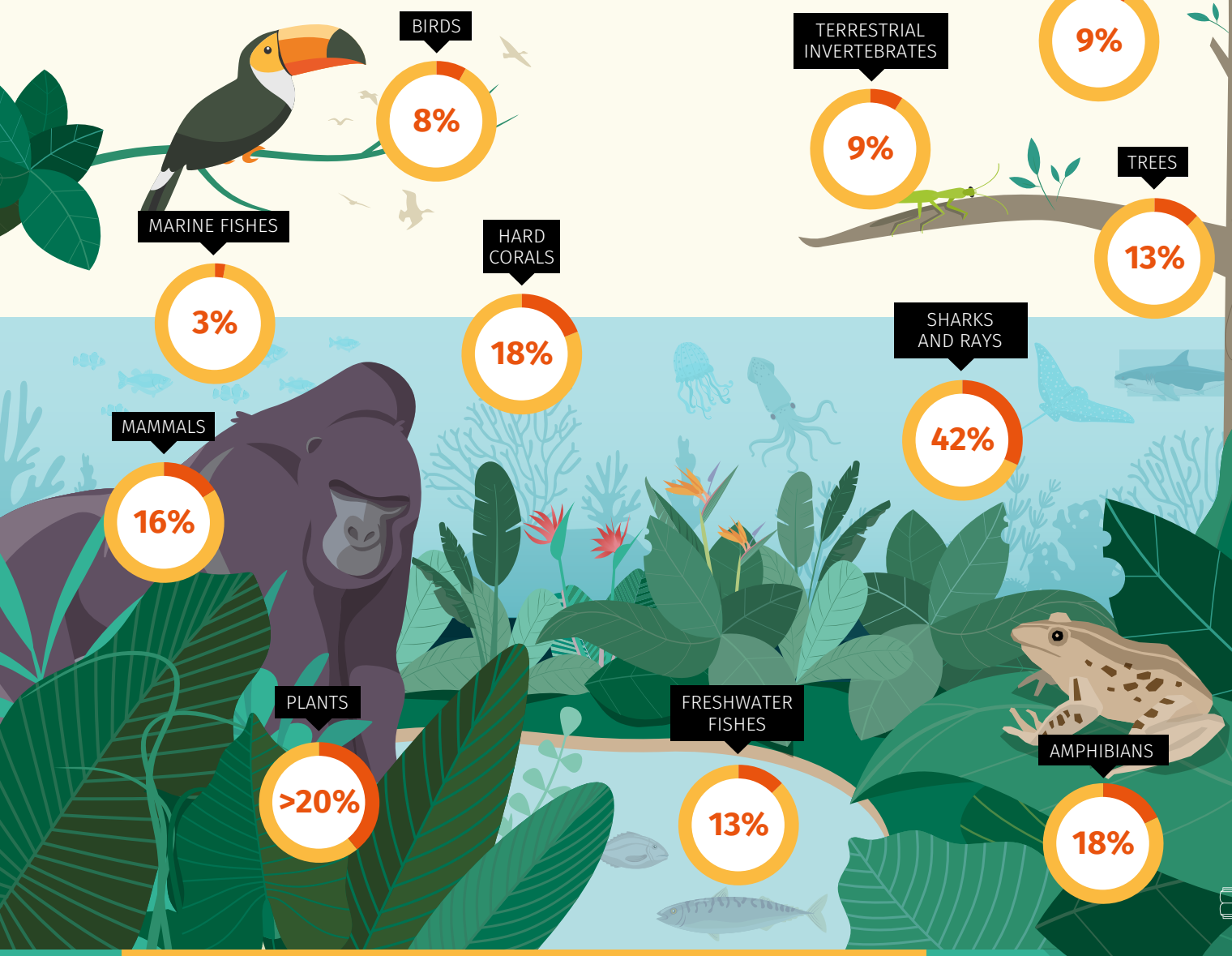


* Including gorillas, orangutans, chimpanzees and bonobos.

World Heritage sites are home to **up to 33% of the last remaining elephants, tigers and pandas,** and 10% of the great apes, giraffes, lions and rhinos.

AT LEAST 1 IN 10 SPECIES IN WORLD HERITAGE SITES IS THREATENED

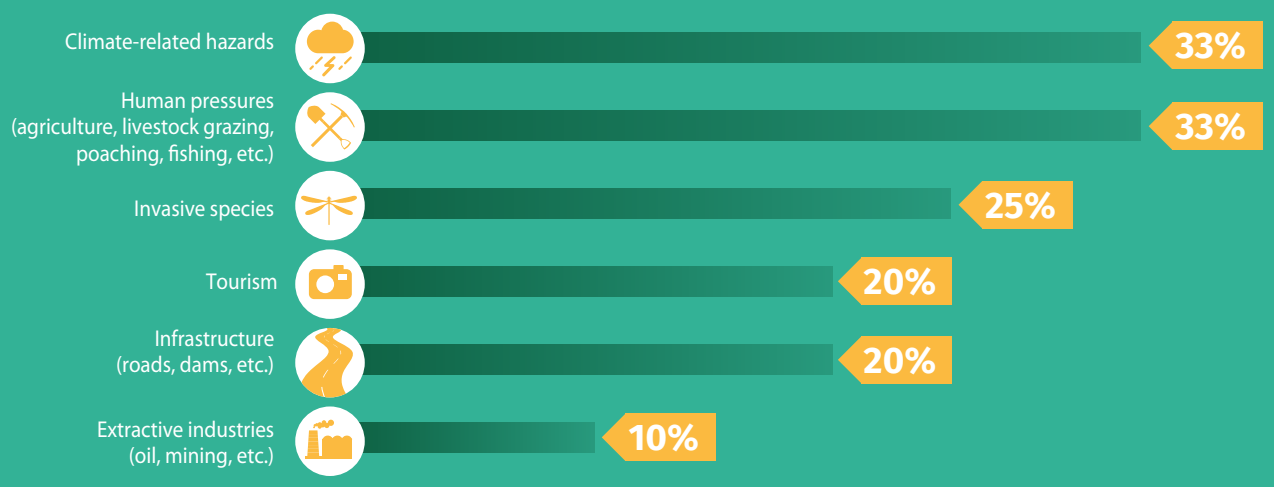
Percentage of threatened species in UNESCO World Heritage sites



Source: *World Heritage: A unique contribution to biodiversity conservation*, 2023

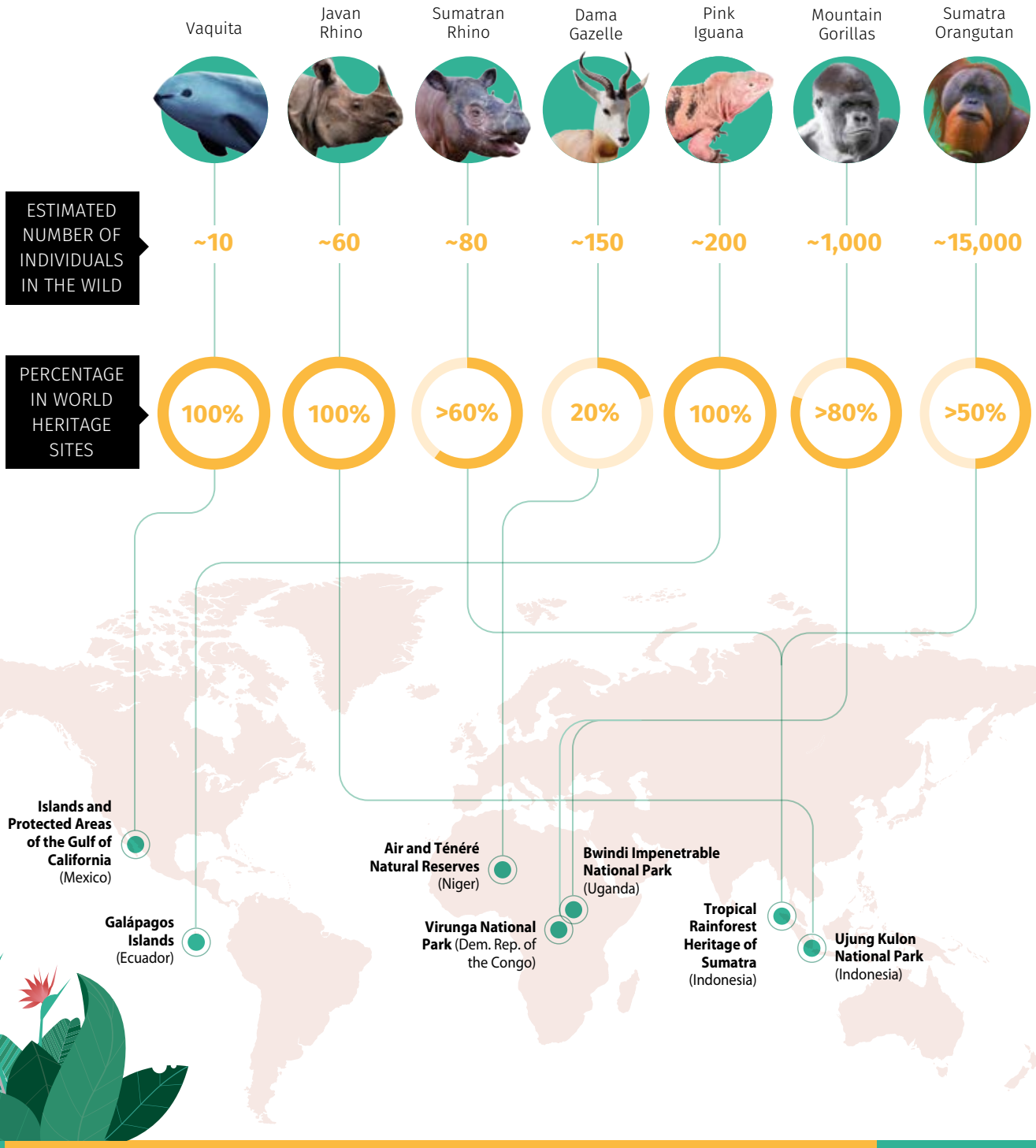
THE CLOCK IS TICKING FOR IMMEDIATE ACTION

Percentages of sites that are at high risk from:



Source: *IUCN World Heritage Outlook*, 2020

SAFEGUARDING SOME OF THE MOST ENDANGERED SPECIES



EVERY 1°C TEMPERATURE INCREASE COULD DOUBLE THE NUMBER OF THREATENED SPECIES

Climate change impacts are projected to increase, potentially largely outpacing land-use pressures and invasive species as the main threat to biodiversity.

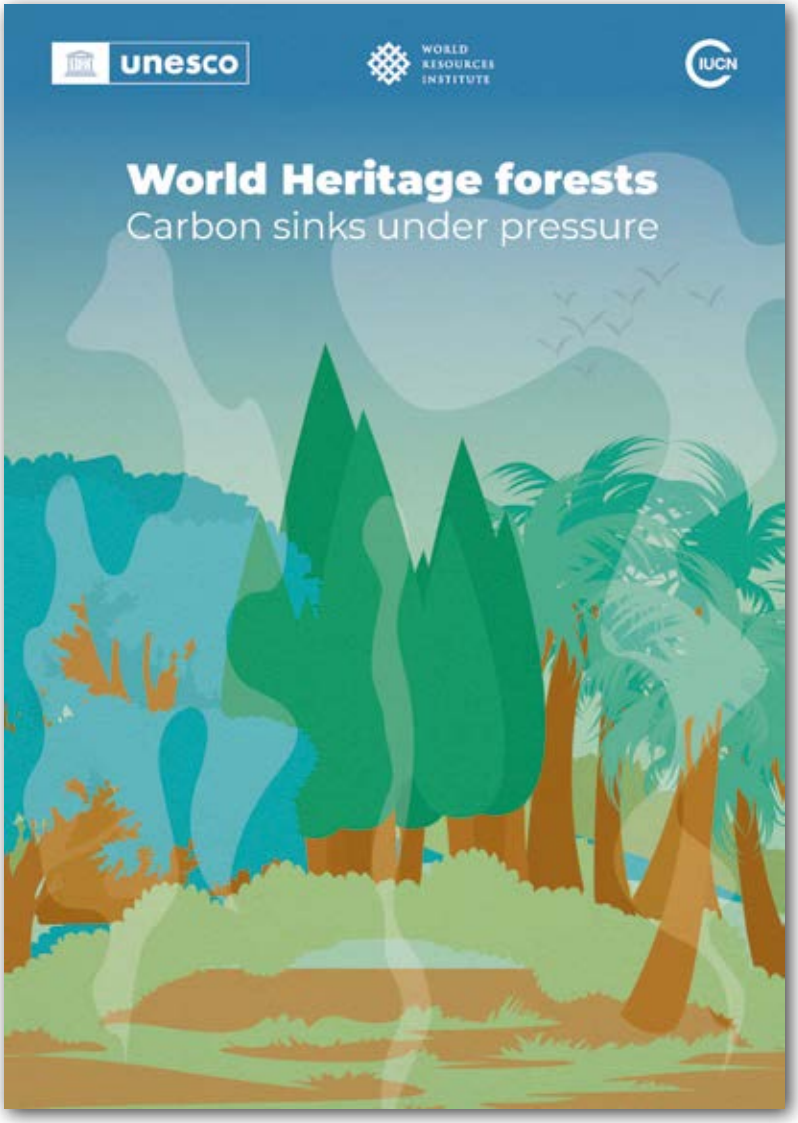
Every 1°C temperature increase could double the number of species exposed to potentially dangerous climate conditions.

Abrupt biodiversity loss due to climate change could be widespread in the tropical ocean by 2030s and tropical lands by 2050s as species are more sensitive to temperature changes in these regions.

unesco

World Heritage forests

Carbon sinks under pressure



Forests are some of the most biodiverse habitats on Earth and play a crucial role in climate regulation by absorbing carbon dioxide (CO_2) from the atmosphere.

Forests in UNESCO World Heritage sites cover 69 million hectares (roughly twice the size of Germany) and are collectively strong net carbon sinks responsible for absorbing approximately 190 million tonnes of CO_2 from the atmosphere each year, equivalent to roughly half the United Kingdom's annual CO_2 emissions from fossil fuels.

However, despite their global recognition and protection status at the national level, ten World Heritage forests were net carbon sources between 2001 and 2020 due to anthropogenic stressors, including land use and climate change. Resource use and more intense and increasingly frequent disturbances such as wildfires are likely to weaken World Heritage forest carbon sinks in the coming years.

It is therefore essential to ensure strong and sustained protection of World Heritage forests and their surrounding landscapes.

Read the publication in open access

978-92-3-100480-3
36 pp, 210 x 297 mm
UNESCO Publishing/World Resources Institute/IUCN

Many voices, one world

The UNESCO Courier is published in the six official languages of the Organization, and also in Catalan and Esperanto.

Receive a print copy of the latest issue every quarter or subscribe to the 100% free digital version.

Discover our offers

https://courier.unesco.org/en/subscribe

https://courier.unesco.org/en • https://courier.unesco.org/fr • https://courier.unesco.org/es
https://courier.unesco.org/ar • https://courier.unesco.org/ru • https://courier.unesco.org/zh

unesco

IUCN

World Heritage

A unique contribution to biodiversity conservation

World Heritage: A unique contribution to biodiversity conservation, published by UNESCO and IUCN in 2023, is the first-ever assessment of the state of conservation of biological species in World Heritage sites. With more than 75,000 species of plants and trees, as well as over 30,000 animal species identified, UNESCO World Heritage sites are a refuge for iconic species. However, at least 1 in 10 species is already at risk of extinction.