

THE UNESCO Courier

July-September 2021



Restoring
BIODIVERSITY,
Reviving
LIFE

- Mountain gorillas make a comeback in **Africa**
 - **Islands:** Fragile showcases of biodiversity
 - Protecting **cetaceans in the Yangtze**
 - **Australia:** After the bushfires
 - **Cities:** Wildlife thrives in concrete jungles

OUR GUEST

Olivette Otele

explores the little-known history of African-Europeans

ISSN 2220-2285
9 772220 228014

unesco

Subscribe to the print version

1 year (4 issues) : 27€

2 years (8 issues) : 54€

Subscription fees cover printing costs.
There is no profit motive.



Subscribe to the digital version



It's 100%
FREE

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

2021 • 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.

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

Director: Matthieu Guével

Acting Editor-in-chief: Agnès Bardou

Associate Editor: Katerina Markelova

Section Editor: Chen Xiaorong

Editions

Arabic: Fathi Ben Haj Yahia

Chinese: Sun Min and China Translation & Publishing House

English: Shiraz Sidhva

French: Christine Herme, proofreader

Russian: Marina Yartseva

Spanish: Laura Berdejo

Digital edition: Mila Ibrahimova

Photographs and illustrations: Danica Bijeljic

Translation and layout co-ordination:

Marie-Thérèse Vidiani

Administrative and editorial assistance:

Carolina Rollán Ortega

Production and promotion

Ian Denison, Chief, UNESCO

Publishing and Branding

Eric Frogé, Senior Production Assistant

Digital production:

Denis Pitzalis, Web Architect/

Developer

Communications: Laetitia Kaci

Translation:

Peter Coles, Cathy Nolan

Design: Jacqueline Gensollen-Bloch

Cover illustration:

© Agnieszka Ziemiszewska

Printing: UNESCO

Interns:

Lang Meizhi, Li Yihong (China)

Judith Pons Manes (Spain)

Co-editions

Catalan : Jean-Michel Armengol

Esperanto: Chen Ji

Korean: Soon Mi Kim

Portuguese: Ivan Sousa Rocha

Information and reproduction rights:

courier@unesco.org

7, place de Fontenoy, 75352 Paris 07 SP, France

© UNESCO 2021

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

Restoring biodiversity, reviving life

Pandemics: Humans are the culprits 7	John Vidal
Indigenous peoples: Informed custodians of biodiversity 10	Peter Bates and Prasert Trakansuphakon
“History will not be kind to those who deny the facts” 13	An interview with Edward Norton
Species migration: A silent revolution 16	Jonathan Lenoir
“The protection of species suffers from a lack of resources” 18	An interview with Remco van Merm
Africa: Mountain gorillas make a comeback 20	Baker Batte Lule
Islands: Fragile showcases of biodiversity 23	Dena R. Spatz and Nick D. Holmes
Protecting cetaceans in the Yangtze 25	Wang Ding
Australia: After the bushfires 28	Gary Nunn
Cities: Wildlife thrives in concrete jungles 30	Loïc Chauveau

32

ZOOM

Titicaca: The sacred lake reveals its secrets 32	Photos: Teddy Seguin/Université Libre de Bruxelles
---	--

42

IDEAS

What our favourite TV programmes say about us 42	Dara Greenwood
---	----------------

46

OUR GUEST

“The history of Europe’s blacks has been struck by a partial amnesia” 46	An interview with Olivette Otele
---	----------------------------------

50

IN DEPTH

The state of science across the globe 50	
---	--

Editorial

Year after year, scientific studies are condemned to chronicle the sixth mass extinction – the decline of living organisms, the loss of species, the over-exploitation of resources, and the degradation of natural habitats.

Ecosystems, which provide services that are essential for our existence, are declining at an unprecedented rate, against the backdrop of the climate crisis.

However, it is not too late to (re)act. Long-term conservation measures are successfully halting the decline of some threatened species. Protected areas, which today represent seventeen per cent of the earth’s surface, serve as a brake on urban and agricultural encroachment.

The goal is to reach thirty per cent by 2030. But 100 per cent of humanity must be reconciled to living alongside all living beings right now.

The knowledge of indigenous peoples – with its mythological and cosmological dimensions – is based on a more harmonious coexistence with nature, and can inspire practices that are more respectful of biodiversity. Because, if the sharing of scientific data is essential, if large-scale political action is necessary, change also requires – perhaps first of all – an awareness of the deep and multiple links that unite us with nature. Nature has been presented as the antithesis of culture for too long.

It is now time to question the utilitarian conception inherited from Descartes, which presents humans “as masters and owners of nature”.

“Cultural diversity is as necessary for humankind as biodiversity is for nature”, proclaims the UNESCO Universal Declaration on Cultural Diversity. Since its creation, the Organization has worked to promote the reconciliation of humans with their environment – through its actions in favour of world heritage, and its Man and the Biosphere (MAB) programme, which celebrates its fiftieth anniversary this year.

This issue of the *Courier* is an invitation to become more aware – to be re-enchanted by nature, to reconnect with it, to be open to new ways of being alive, to marvel. It is a call to reinscribe ourselves fully in our environment, to recognize ourselves as living beings among other living beings. It is an attempt to disprove the maxim stated by French palaeoanthropologist Pascal Picq, that “Man is not the only animal that thinks, but he is the only animal that thinks he is not an animal.”

Agnès Bardón

WIDE ANGLE



▼ The forest of Wadbilliga National Park in New South Wales, photographed two months after deadly wildfires ravaged the area in December 2020, shows some signs of regrowth. The bushfires in 2019-2020, the worst-ever experienced by Australia, scorched 13 million hectares of vegetation.



Restoring BIODIVERSITY, reviving LIFE

Agnès Bardon

UNESCO

The decline of species, the shrinking of natural areas, soil and water pollution, and the modification of ecosystems due to climate change. The ills plaguing the planet are well-known, and have been documented for a long time. And yet, significant actions on a global scale have been slow to be implemented.

The United Nations Decade on Ecosystem Restoration (2021-2030) has been announced to accelerate efforts to curb this phenomenon.

The degradation of life on the planet will also be at the heart of several key meetings planned in 2021, including the World Conservation Congress organized by the International Congress for Conservation of Nature (IUCN) in Marseille, France, in September.

Another crucial meeting, the Conference of the Parties to the Convention on Biological Diversity, COP 15, will be held in Kunming, China, in October.

The 196 parties to the Convention will have the task of defining a post-2020 Global Biodiversity Framework. They will set the course for the international community to improve the protection of ecosystems by 2050.

An unprecedented decline

The situation is urgent. In May 2019 at UNESCO, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) presented an alarming assessment in its landmark *Global Assessment Report on Biodiversity and Ecosystem Services*.

Using figures to back up its conclusions, it presented overwhelming evidence that the health of ecosystems is deteriorating at an unprecedented rate.

Human activities are now threatening more animal and plant species with extinction worldwide than ever before in history, the experts of this "IPCC (Intergovernmental Panel of Climate Change) of biodiversity" noted.

Humans have significantly modified no less than three quarters of the terrestrial environment and almost sixty-six per cent of the marine environment. And of the 8 million species listed on the planet, 1 million are already threatened with extinction. This means that one in eight animal or plant species is likely to disappear in the coming years.



Integrating the environment into school programmes by 2025

Biodiversity is often neglected in school curricula worldwide. This is one of the findings of a study, published by UNESCO, ahead of the World Conference on Education for Sustainable Development held in Berlin, Germany, in May 2021.

Called *Learn for our Planet*, the report examines the education plans and curricula in some fifty countries around the world. Over half of them make no reference to climate change, and only nineteen per cent mention biodiversity. In an online survey of 1,600 teachers and education officials, a third of respondents added that environmental issues were not part of teacher training.

This is why UNESCO has set a new goal – to make environmental education an essential component of the school curriculum in all countries by 2025.

The idea is to ensure that everyone, from an early age, acquires the knowledge, skills, and values they need to make positive changes for the planet.

Human actions are squarely to blame for this. The conversion of natural environments – particularly for agriculture or urban development – is the primary cause of the destruction and fragmentation of natural habitats. This is followed by the exploitation of natural resources and the pollution of soil, water, and air.

Long considered an aggravating factor, climate change is now identified as a growing risk. Among other effects, it causes the displacement of some species, as they move towards the poles, mountain tops, or the depths of the ocean. Invasive species are another factor behind the massive extinction – especially on islands, where they are particularly damaging for the native flora and fauna.

Forging new links with nature

The loss of biodiversity undermines our capacity to achieve many of the goals of the United Nations' 2030 Agenda for Sustainable Development. In short, it puts our future at risk. Nature provides the services that are essential for human existence. A single figure sums up this dependence – almost seventy-five per cent of food crops depend, at least partly, on pollination. And the ocean, soils and forests absorb sixty per cent of greenhouse gases emitted by humans.

When it comes to environmental change, the poorest populations are on the front line. As the guardians of at least a quarter of the planet's land, and over a third of the areas that have not yet been altered by human activities, indigenous

Species threatened by extinction: 1 million



- 25% of mammals
- 19% of reptiles
- 33% of reef-forming corals

peoples are watching over their heritage – but even that is increasingly coveted for its natural resources.

Yet, these indigenous communities are often the custodians of knowledge and practices that deserve to be better preserved and promoted – as is the case with the actions within the framework of UNESCO's Local and Indigenous Knowledge Systems (LINKS) programme. The knowledge of the Inuit about Arctic ice floes, the shifting agriculture practised by the Karen people of northern Thailand, the meteorological knowledge of the herders in East Africa – all bear witness to the relevance of this know-how, which enables humans to live in harmony with nature.

Trusting the resilience of species

In spite of several red lights, there is some good news. An update of the International Union for Conservation of Nature's IUCN Red List of Threatened Species shows that

some species are recovering as a result of effective conservation policies. Other species are showing unexpected resilience by adapting to environments – such as urban areas – that are very different from their native habitats.

The designation of an increasing number of protected areas allows humans to preserve ecosystems, such as UNESCO's network of World Heritage Sites, Biosphere Reserves and Geoparks, which cover almost 10 million square kilometres – an area the size of China.

The Convention on Biological Diversity goes even further. In an updated "zero draft" that will serve as the starting point for future negotiations, it proposes that the 196 countries that are party to the convention commit to protecting at least thirty per cent of the planet by 2030. The document also calls for a reduction of at least fifty per cent in chemical and plastic pollution, and to halve the spread of invasive species in some priority sites.

The stated objectives are ambitious. They are in line with the challenges. ■

Biosphere reserves: Fifty years of celebrating life

Jeju Island in the Republic of Korea, Mount Huangshan in China, the Saloum Delta in Senegal, Lac Saint-Pierre in Canada, and the São Paulo Green Belt in Brazil – all these sites are part of UNESCO's World Network of Biosphere Reserves (WNBR).

Launched in 1971, the Man and the Biosphere (MAB) Programme celebrates its fiftieth anniversary in 2021, with Jane Goodall, the renowned ethologist and conservationist, as patron.

This pioneering programme was one of the first to promote the idea of sustainable development. Biosphere reserves aim to safeguard natural ecosystems such as dry lands, mangroves, and tropical forests, while improving the livelihoods of local people and promoting research, education and awareness-raising.

Since the first designations in 1976, new biosphere reserves have been designated every year by the MAB International Co-ordinating Council, which consists of thirty-four UNESCO Member States elected by rotation.

The WNBR currently has 714 sites in 129 countries worldwide, including twenty-one transboundary sites. It covers an area of over 7 million square kilometres, or more than five per cent of the planet's surface.

Pandemics:

Humans are the culprits

The destruction of ecosystems is not just bad news for the planet, it's also harmful for the health of humans. The emergence of the Covid-19 pandemic in 2020 is just one manifestation of the proliferation of zoonoses – diseases transmitted from animals to humans.

John Vidal

Journalist, author, and former environment editor of *The Guardian*.

In 1997, I went to Borneo to investigate fires which had been raging uncontrolled for months across a vast area of pristine tropical forest. An intense El Niño event had triggered a deep drought, and a thick yellow haze had settled over much of Indonesia, Malaysia, and beyond.

The ecological and human damage was immense. Some of the most undisturbed, nature-rich forest on earth was burning, and thousands of species of plants, birds, and rare animals like orangutans were at risk. The sunlight had dimmed, the temperature had dropped, trees were not flowering, crops barely grew, and millions of people were suffering from severe respiratory diseases.

Months after monsoon rains finally doused the fires, a mysterious, deadly disease broke out hundreds of miles away – near a town called Sungai Nipah, west of Kuala Lumpur, Malaysia. Here, tens of thousands of pigs were being farmed among commercial mango and durian orchards. For no discernible reason, first the pigs, and then many humans, were struck down by seizures and headaches. To stop the new, highly infectious disease spreading, nearly a million pigs had to be destroyed – but not before 105 people had died.



▼ Cattle-raising in an embargoed area in the Amazon, Brazil, 2015.

It took six years for disease ecologists to link the destruction of the forest in Borneo with the disease in the Malaysian pig farms. What had happened, it emerged in 2004, was that certain species of fruit bats which usually foraged on flowering and fruiting trees deep in the Borneo forests, had been forced by the 1997 fires to seek new food sources.

Bats as virus reservoirs

Some of these bats had gone to Sungai Nipah, where they had been observed roosting in the trees and dropping pieces of half-eaten fruit into the many pigpens below. Bats are well-known reservoirs of many viruses and – just as they have been linked to the emergence of deadly →

diseases like Ebola and Marburg in Africa – scientists found that bats arriving in Malaysia carried the Nipah virus, which they had passed to the pigs in the fruit and their urine.

Nipah is just one of many hundreds of animal-borne, or zoonotic diseases, which

have jumped from animals to humans in the past fifty years. Increasingly, it is believed, many have done so as a direct result of the human devastation of nature – which now sees one million species threatened with extinction.

“The more we destroy nature, the more likely we are to see fearsome diseases like Covid-19 emerging,” says Kate Jones, professor of ecology and biodiversity at University College London (UCL). The coincidence of the new diseases with the destruction of biodiversity is highly significant, according to her.

They include some of the most deadly diseases ever encountered by humans – like HIV, Ebola, Lassa fever, Marburg, and Simian foamy virus, which originated in Africa; Nipah virus in South East Asia; Chagas disease, Machupo and hantavirus

in Latin America; Hendra in Australia; Middle East Respiratory Syndrome (MERS) in Saudi Arabia; Severe Acute Respiratory Syndrome (SARS) and coronavirus disease (Covid-19) in China.

Some, like Ebola, have been linked to deforestation; others, like Lyme disease, occur where suburban areas sprawl into newly-cleared land. Many more are believed to have been caused by hunting, or are associated with wildlife markets and the intensive farming of animals.

Deforestation on a massive scale

“Biodiversity loss is becoming a big driver in the emergence of some of these viruses. Large-scale deforestation, habitat degradation and fragmentation,

“

Two-thirds of emerging infections and diseases now come from wildlife



© Marizilda Cruppe / Greenpeace

agriculture intensification, our food system, trade in species and plants, anthropogenic climate change – all these are drivers of biodiversity loss and also drivers of new diseases. Two-thirds of emerging infections and diseases now come from wildlife,” Jones says.

“The loss or reduction of biodiversity is not the culprit. It is the interactions between humans and biodiversity,” insists Sean O’Brien, president and CEO of NatureServe, a non-profit headquartered in the United States, with scientists working with global conservation organizations.

Intensive farming – especially the clearing of forests to expand farming – can increase the frequency of contact between humans and wildlife, and expose us to diseases never encountered before

by humans, O’Brien explains. “We are bringing together wildlife that would never naturally encounter each other in nature, creating bizarre links in a chain that can allow a disease to jump from one species to humans via another species, even if that disease might not be able to get to us directly.”

Disturbed ecosystems

“Pathogens circulate in wildlife hosts, and some have the potential to jump to humans, but they rarely do, in undisturbed, natural ecosystems. But when people degrade or destroy natural habitats, the animal community changes dramatically,” says Richard Ostfeld, Senior Scientist at the Cary Institute of Ecosystem Studies in Millbrook, New York, who researches how diseases like Lyme emerge in degraded places.

“Some of the most important zoonotic hosts – the rodents, and sometimes, bats – often increase in abundance as their predators and competitors are driven away. Biodiversity loss increases the contact rates between the rodents or bats and people, so increasing the threat of infectious diseases,” Ostfeld says.

Carlos Zambrana-Torrel, Associate Vice President for Conservation and Health at EcoHealth Alliance, and a researcher at the Bolivian National Herbarium, works on the links between biodiversity and human actions with the United Nations’ Convention on Biological Diversity (CBD). “The present Covid-19 pandemic is not the first time we have seen these epidemics and pandemics coming from wildlife and causing very high mortality. HIV jumped from primates to humans, haemorrhagic fevers like hantavirus and Machupo virus in Bolivia jumped from rodents into humans,” he points out.

▼ *The intensive agribusiness in the Matopiba region of northeast Brazil is responsible for the massive deforestation of the Cerrado, one of the world’s most diverse tropical ecosystems.*

More species, fewer diseases

Whether biodiversity loss increases the number of viruses passing to humans, or reduces them, is complex. Logically, the richer the biodiversity, the more pathogens and viruses will be circulating in animals, and are therefore more likely to jump to humans. However, many studies show that more species mean less diseases – and that a rich biodiversity acts to protect species which evolve together. It is only when a natural system is disturbed that viruses like coronavirus or Ebola are passed on.

Felicia Keesing, a disease ecologist at Bard College in Annandale, New York, has studied twelve diseases, including West Nile fever and Lyme disease, in ecosystems around the world. In every study, she found that diseases became more prevalent as biodiversity was lost.

Species which are crammed together in biodiversity-poor habitats can also spread emerging diseases, says Eric Fèvre, Chair of Veterinary Infectious Diseases at the University of Liverpool in the United Kingdom. “Farmed animals are often the end product of a loss of biodiversity. As we select for better cows, chickens or pigs, we create populations of animals that often live in intensive conditions, but where the genetics are very similar. This creates risks for the emergence of diseases, because if these genetically-uniform large populations are susceptible, disease can spread very quickly,” he explains.

The expert is backed by Christine Kreuder Johnson, who leads the EpiCenter for Disease Dynamics of the One Health Institute at the School of Veterinary Medicine, University of California, Davis. In a new four-year study, she shows how it is the animals that humans hunt, and whose habitats we destroy the most, which are the ones with the most viruses dangerous to humans.

“The consequence is, they’re sharing their viruses with us. It is actions by humans which simultaneously threaten species survival and increase the risk of spillover. In an unfortunate convergence of many factors, this brings about the kind of mess we’re in now,” said Johnson.

By breaking down the natural barriers between species and destroying biodiversity, she argues, we have opened the door – not just to Covid-19, but potentially to many more viruses and pathogens. ■



It is only when a natural system is disturbed that viruses like coronavirus are passed on

At least a quarter of the world's land area is traditionally owned, managed, used or occupied by indigenous peoples. But while their knowledge is increasingly being recognized, it is rarely taken into account by researchers and policymakers.

Indigenous peoples: **Informed custodians of biodiversity**

Peter Bates

Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) Technical Support Unit on Indigenous and Local Knowledge, UNESCO.

Prasert Trakansuphakon

Pgakenyaw Association for Sustainable Development, Thailand.

The Karen inhabitants of the village of Hin Lad Nai, nestled in the lush forests of Chiang Rai province in northern Thailand, have practised rotational shifting cultivation for centuries. This sustainable slash-and-burn cultivation technique – once mistakenly criticized for contributing to climate change – has been used around the world to regenerate the land and support biodiversity.

Small patches of forest are cleared of trees and shrubs, before controlled burns are undertaken, to put nutrients back into the soil. A diverse range of crops is then planted for a limited period, after which the area is left fallow, or allowed to rest. Eventually, the forest grows back, and the cycle is repeated.

In this way, the community creates a mosaic of habitats in the forest, with different stages of farming and regrowth. At a time when honeybees are declining worldwide, three different species of wild bees are thriving in Hin Lad Nai. The honey harvested from fallow areas is of a higher quality than that from the forest, and is sold at markets across Thailand.

The case of the villagers of Hin Lad Nai is just one example of many. Environmentalists are becoming increasingly aware of the role that indigenous peoples play in defending their natural heritage. The importance of harnessing their traditional ecological knowledge to defend the earth's depleting biodiversity was clearly recognized by the *Global Assessment Report* of the IPBES, released in May 2019.

UNESCO has long supported this initiative, particularly through the LINKS programme, which hosts the IPBES technical Support Unit on Indigenous and Local knowledge.

Centuries of knowledge

Many indigenous communities live in isolated and often highly biodiverse areas, where living in balance with nature

is crucial for survival. As keen observers of their environments, indigenous peoples often possess knowledge linking various phenomena to ecosystem change – changes in weather patterns, for example, or the impacts of new species coming into their territories.

For example, centuries of knowledge about tsunami waves allowed the Moken or "sea nomads" of the Andaman Sea along the west coast of Thailand to stay safe when the deadly tsunami struck their villages in 2004.

This knowledge is also used to make seasonal forecasts and predict weather patterns. The pastoralists of East Africa are able to predict when and where the rains will fall – by observing the flowering patterns of trees, and the behaviour of insects and birds. These biological indicators are observed by scouts roaming the landscape, to determine where and when the cattle herds should move.

This indigenous knowledge is not static. It is constantly being enriched to include knowledge of new phenomena that affect the environment.

The First Nations communities in northern Canada have observed changes in the hunting behaviour and pack dynamics of wolves, and consequent

declines in caribou populations. These changes are attributed to the roads and pipelines that now dissect their forests.

Animals, plants and spirits

Indigenous knowledge systems include values for managing the relationship of humans with biodiversity. In their conception, “nature” often includes animals, plants, the earth, humans and spirits – all tied in reciprocal kinship relationships. Humans are not considered superior to nature, and nature does not exist to serve humans.

For some indigenous communities, animals are believed to present themselves as gifts to hunters – gifts to be respected and cherished through rituals. The meat is shared with other community members and animals, as seen notably in whaling communities in Alaska. A complex system of customary institutions, regulations and taboos serve to inform and regulate their relationships with their environments.

However, today indigenous peoples globally find themselves on the front lines of environmental and social change. Agriculture, logging and industrial development increasingly damage or destroy highly biodiverse areas, and ancestral lands are often seized or invaded and converted to farms and monocrop plantations.

These interventions are sometimes accompanied by violence. Waters are increasingly polluted, and animals and plants are harvested at unsustainable



▼ *The Baka hunter-gatherers in Cameroon live in the forest that supplies all their needs. The large leaves collected by these women will be used to build a hut.*

Biosphere reserves: Mobilizing against deforestation in the Amazon

UNESCO has partnered with LVMH, the luxury goods group, to fight against the direct and indirect drivers of deforestation in the Amazonian region.

Based on participatory approaches that combine scientific, local and indigenous knowledge, the programme will be monitored by teams in eight biosphere reserves – in Bolivia (Pilón-Lajas, and Beni); Brazil (Central Amazon); Ecuador (Yasuni, Sumaco, and Podocarpus-El Condor); and Peru (Manu, and Oxapampa-Ashaninka-Yanesha).

The aim of the initiative is to promote the rehabilitation of degraded lands, while ensuring sustainable employment for local populations. In the Beni biosphere reserve, for example, the programme plans to build a greenhouse, and provide families in four communities with high-quality seeds of native timber species (mahogany) and local forest species (banana, coffee, cocoa, and citrus). These will be used to create plots under agroforestry systems, in fallow land traditionally used for agriculture.

“ The importance of harnessing traditional ecological knowledge has been recognized



▼ Fishermen from the Moken community living on the Surin Islands in the Andaman Sea and off the west coast of Thailand create artificial underwater reefs with palm leaves to lure fish.

rates, leaving little for indigenous communities to eat, and disrupting traditional livelihoods.

Efforts to integrate indigenous populations into national societies also threaten their way of life. Formal education with teachers in classrooms can reduce opportunities to learn on the land with elders.

Paradoxically, efforts to conserve biodiversity, such as establishing protected areas or imposing bans on harvesting some species, can also prove to be a threat – as they can prevent indigenous people from accessing food and traditional spaces.

Educated by the elders

Indigenous communities have much to teach us. But efforts to integrate indigenous knowledge into western science are often unsuccessful, as it is largely oral or experiential. Researchers and decision makers tend to consult

written records of indigenous knowledge, rather than engaging with the people themselves.

Even so, there are a growing number of good examples and best practices for collaborations with indigenous peoples around biodiversity research, education, management and decision-making. But these examples often hinge on indigenous peoples being considered equal partners.

Rather than subjects to be researched, indigenous communities can be supported

“
**There are a
growing number
of collaborations
with indigenous
peoples**

to be designers of research projects – developing questions, methodologies and results that make sense to them.

The Exchange for Local Observations and Knowledge of the Arctic (ELOKA) project, which works with the indigenous knowledge of the Inuit around sea ice, is an example of this.

School curricula can be developed by and for indigenous peoples, to encourage and facilitate learning on the land from elders, rather than only in classrooms. This approach is being increasingly explored by Canada’s First Nations communities, and the Native communities of Hawaii in the United States.

It is now time for indigenous peoples to have full control over decisions affecting their lands, water resources and communities, so that they can directly apply their knowledge to implement decisions that are biodiversity-friendly. Where this can be achieved, the benefits to people, the planet, and biodiversity will be considerable. ■

Edward Norton:

“History will not be kind to those who deny the facts”

The decline in biodiversity puts the very future of humanity at stake. And yet, in spite of repeated warnings, we continue “the race to the bottom, for the short-term bottom-line” and to “wreak extensive destruction on other living things”.

Edward Norton, actor, filmmaker, activist, and United Nations Goodwill Ambassador for Biodiversity, calls for a change of course.

Interview by **Mila Ibrahimova**

UNESCO

● **One million animal and plant species are threatened with extinction. How does the threat of this mass extinction make you feel on a personal level?**

Dismayed and angry, because the question is, more appropriately: ‘How does the threat of mass extinction driven by human activity

make you feel?’ One can only be dismayed to learn what a violent and extensive destruction we’re wreaking on other living things. But it has to be acknowledged that we’ve now known about this impact in a deep, data-supported framework of confirming science.

And yet we continue, in the face of all the evidence, including the clear evidence that this behaviour threatens the stability of our way of life and our economies – the

large majority of our industries continue the race to the bottom for the short-term bottom line. This “I’ll be dead, you’ll be dead, so let’s financially maximize in the short term and leave the problem to our grandkids” attitude... that’s what makes me angry. History will not be kind to those denying and obfuscating for personal gain, and we need to call them out.

● **What have you learned from your commitment to protect biodiversity?**

Biodiversity sometimes has an academic ring to it. I like to characterize it as the “richness of life”, because that encompasses both the spiritual value, to all of us, of the magically complex web of life on this planet that we live on – the true miracle of life’s wild incarnations – while also acknowledging that our whole economy is tied to healthy biodiversity.

I like the example of bees and butterflies. A trillion dollars of investment in a human technology to pollinate our crops cannot replicate what pollinators do for us for free. But we’d rather let chemical companies keep making pesticides that are causing a collapse of the populations of pollinators. This is suicide, both economically and in terms of food security.



© Trond Larsen / Conservation International

▼ *Butterflies are among the pollinating insects that are vital to over seventy-five per cent of the world’s food crops.*



● **Climate change and its consequences primarily affect the world's poorest. Have you personally witnessed climate change and biodiversity loss?**

Yes, in many places and many ways. Pastoralist herders and farmers in sub-Saharan Africa – where I've spent a lot of time – are facing intensifying cycles of drought and floods directly stemming from global warming and the clearing of forests. And in places like the Coral Triangle of Indonesia – where my father worked with the Nature Conservancy for many years – overfishing is devastating the livelihoods of many poor communities. Same in West Africa. And that increase of food insecurity driven by overfishing is leading to more killing of wildlife. This directly leads to more exposure to the zoonotic [diseases passed from animals to humans] transfer of viruses which – as we're now experiencing – affects everyone.

● **One of your top priorities as UN Goodwill Ambassador for Biodiversity is to increase "people's focus on the fact that human well-being is intertwined fundamentally with biodiversity". Do you feel that your voice is being heard?**

Sometimes it's very frustrating to feel that voices all over the world are getting very loud about these issues and yet, the political will to act boldly is stymied by entrenched industries who put the brakes on the policy shift we need.

I don't really assess 'my success specifically' in terms of awareness. I look at myself as part of a generational chorus of voices trying to insist that this becomes the most important issue of our time. And I do think awareness and concern grows

greater in each subsequent generational demographic.

● **What have been your greatest successes in terms of raising awareness?**

I feel personally successful when something I've been working on for many years, like the development of the Chyulu Forest Carbon Project [in Kenya], is realized as a goal. It took us over six years of work – a partnership between the Maasai Wilderness Conservation Trust and Conservation International – to get that project certified as a REDD+/VCS (Verified Carbon Standard)* project, generating about 650,000 tons of offset per year. And now we're selling those credits to fund community conservation and development. That's a tangible success.

● **You have travelled the world to raise awareness about making the way we live sustainable for our planet. What have you learned from the people you met along the way?**

I've learned that this is a challenge that is truly understood across cultural, racial, economic, and religious lines. It transcends all of that and unites us. I have young Maasai friends in Kenya who are every bit

as passionate about this as my Indonesian friends and my American friends. That gives me hope.

● **The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) report finds that global goals for nature conservation cannot be met by current trajectories. How do we change course?**

Our national political leaders have to stop taking credit for incremental measures that are ultimately irrelevant. We need an economic policy that forces the massive social cost of carbon and environmental degradation in all forms to be borne by those doing the damage. Until we stop socializing those costs and make the "free market" bear its authentic costs of doing business, non-sustainable practices will not end.

● **Finally, how do you see the future?**

It's daunting, but we have to remain determined. And I think human ingenuity has created solutions to complex problems over and over again – often in ways that were unpredictable even just on the cusp of their emergence. We can do it. ■

“
Our whole economy is tied to healthy biodiversity

*REDD+ stands for countries' efforts to reduce emissions from deforestation and forest degradation, and foster conservation, sustainable management of forests, and enhancement of forest carbon stocks. The Verified Carbon Standard, Verra or VCS, is a standard for certifying carbon emission reductions.

For the love of bees

Empowering women while caring for bees sustainably – that is the aim of the five-year Women for Bees programme launched in 2019 by UNESCO and Guerlain, the French perfume and cosmetics house.

The result of a partnership between Guerlain's parent, the LVMH luxury goods group and UNESCO's Man and the Biosphere (MAB) programme, the initiative involves training women to care for bees in biosphere reserves. This includes knowledge-sharing, and the establishment of a scientific and technical support network – while ensuring a steady income.

Women bee-keepers working in twenty-five biosphere reserves in as many countries will benefit from the programme by 2025.

“

**The challenge of
living sustainably
transcends
all differences,
and unites us**



▼ Edward Norton, UN Goodwill Ambassador for Biodiversity, addresses the dangers of global biodiversity loss at a press conference at UN Headquarters, New York, in 2010.

Less spectacular and not as well-known as retreating glaciers or melting Arctic ice – obvious indicators of global warming – the changes that modify the distribution of species are also less perceptible. Besides affecting biodiversity, these changes have direct consequences on our food and health.

Species migration: A silent revolution

Jonathan Lenoir

Researcher in ecology, French National Centre for Scientific Research (CNRS), at the University of Picardie Jules Verne in Amiens, France.

There are changes taking place all over the planet, at all latitudes. Most often, we are unaware of them. And yet they are altering the distribution ranges of the species on which we depend directly. This redistribution of living things is the tangible manifestation of the invisible movement of isotherms – imaginary lines of the same mean temperature that move towards the poles and mountain peaks like waves, driven by global warming.

The identification of these changes in the distribution of living things requires large amounts of data, both historical and recent. By meticulously documenting biodiversity over time, scientists can map the distribution of past and present species in an attempt to detect potential migrations.

For terrestrial environments, scientists have identified migrations that are mainly oriented towards the poles in latitude, and towards mountain peaks in altitude. This includes mammals, birds,

amphibians, freshwater fish, insects, and even organisms that are less mobile, such as plants. The average migration speed of these organisms in the lowlands is largely slowed down by the fragmentation of habitats linked to human activities.

This is not so much the case in mountain areas, where the impact of human activities is reduced, and the isotherms are closer together.

In France, forest plant species migrated at an average speed of thirty metres per decade, between 1971 and 1993. Driven by rising temperatures and the shifting of isotherms, many plant species have already reached the summits of several European mountain ranges. Observations made on 302 mountain peaks in Europe show that the number of plant species that have colonized the summits is increasing over time – this trend is becoming more

“
The movement of fish species has a direct effect on human nutrition

pronounced with the acceleration of global warming.

On average, the gain in species – affecting eighty-seven per cent of the European summits studied – was five times greater between 2007 and 2016 compared to the period between 1957 and 1966.

New cohabitation of species

These phenomena have led to a new cohabitation between species endemic to certain peaks – such as the ciliated androsaceus, which is only present in the eastern Pyrenees – and more competitive species found at lower levels, such as mountain Arnica or Alpine meadow grass. The increase in biodiversity at the summits of European mountain ranges may at first seem like good news. However, in the long term, there is a risk that competition between colonizing and endemic species will be to the detriment of the latter, and lead to the total disappearance of some of them.

This phenomenon of extinction has already been noticed in the Peruvian mountains – eight of the sixteen species of birds observed in 1985, and living on





mountain ridges above an altitude of 1,300 metres, could no longer be found in 2017.

In the marine environment, most organisms are much more sensitive to a rise in temperatures. The poleward movement of species is therefore much more rapid and significant in the seas and the ocean than on land. The average poleward migration of marine organisms is around sixty kilometres per decade – five to six times faster than that of terrestrial organisms.

Some studies have also shown vertical migrations of several species of marine fish to deeper waters, to escape the temperature increase in surface waters. In the North Sea, for example, fish in the demersal (seabed) zone migrated to the depths at an average speed of four metres per decade between 1980 and 2004. These rapid shifts in marine biodiversity are more spectacular, and therefore more easily perceptible than in terrestrial environments. They make the seas and the ocean the best monitors of the consequences of global warming on the redistribution of life.

Humans depend on biodiversity for food, health, well-being, production activities, recreation and cultural

enrichment. Therefore, a global redistribution of this biodiversity will have an impact on all these aspects.

The movement of species that affects our halieutic (linked to fishing) resources are particularly striking, and has a direct effect on human nutrition. This is particularly the case in the northward migration of mackerel schools in the North Atlantic – which by 2010, had led to major economic and geopolitical conflicts between different European countries fishing in the area.

A source of conflict between countries

Since biodiversity knows no borders, we can expect an increase in the number of conflicts and tensions between neighbouring countries related to the movement of commercial species from one economic zone to another. The geographical distribution of all the goods and services provided by biodiversity will be completely reshuffled on a global scale.

The same applies to the redistribution of vectors of pathogens, and therefore, diseases. With global warming, the emergence of new disease vectors (mosquitoes and ticks) at latitudes and altitudes previously free of these species is already a reality – with health, social and economic costs that must be anticipated.

In South America and East Africa, populations living in mountainous regions are more affected by malaria than in the past. Rising temperatures favour the altitudinal migration of mosquitoes carrying the parasites causing the disease.

In northern Europe, drier summers and milder winters are modifying the abundance and distribution of small mammals such as rodents – the main hosts of the *Ixodes ricinus* tick, vector of the bacterium *Borrelia burgdorferi*, the Lyme disease pathogen.

Beyond these direct impacts on human well-being, the redistribution of living organisms also has an indirect effect on the very dynamics of global warming. In the Arctic, for example, in the same way, melting sea ice, tundra shrub expansion and the advance of the boreal forest towards the North Pole are factors that reduce the albedo (reflectivity) of the North Pole and thus accentuate warming.

A response to global warming

This redistribution of living things is not necessarily synchronous with global warming. In general, the average speed of movement observed towards mountain summits is eighteen metres per decade, half as fast as the speed at which isotherms moved upwards over the same period – forty metres per decade, on average. In forest plant species, for example, reproduction is the only way to displace the next generation – by dispersal, in the form of seeds.

Only seeds that have been displaced under favourable climatic conditions germinate and allow the establishment of a new population beyond the initial distribution range. Species with a long and slow life cycle, such as trees, thus show even greater delays in response to climate forcing. These delays mean that even if warming were to stop today, we would continue to observe changes in the distribution of life for decades to come.

The redistribution of living organisms in response to global warming poses new challenges. There is, therefore, an urgent need to step up efforts to support research to improve our understanding of the consequences of this phenomenon – and to take it into account while making political and economic decisions. It is through appropriate international governance integrating this global dynamic, that we will increase the chances of minimizing the potential negative consequences that this redistribution of living things could have on our well-being.

Remco van Merm:

“The protection of species suffers from a lack of resources”

While many species are now threatened, others are seeing their populations increase as a result of conservation measures. To be successful, conservation actions require a long-term approach, resources, and political will, as Remco van Merm, Species Conservation Grants Coordinator at the International Union for Conservation of Nature (IUCN) explains.

Interview by **Agnès Bardon**

UNESCO

● **What are the conditions for efforts to halt the decline or disappearance of threatened species to yield positive results?**

There is no silver bullet to prevent extinctions or achieve population recoveries. Successful efforts depend on a number of factors, including the biology of the species, the threats it faces, social factors, etc. In fact, it is the combination of different efforts that usually makes a difference.

For example, in the case of the Guam rail – a bird endemic to Oceania, which has been the subject of a captive-breeding programme since 1984 – several reintroduction attempts were required to enable the establishment of a self-sustaining population on Cocos Island, off the southern tip of Guam in the Pacific Ocean. The adoption of measures to control the invasion of the brown tree snake also continues to be key.

The latest update of the IUCN Red List of Threatened Species shows the success stories of the echo parakeet in Mauritius, and the trout cod (*Maccullochella macquariensis*), a large carnivorous fish found in the fresh waters of New South Wales, Australia. The echo parakeet has been the subject of a conservation programme since 1973. The dramatic increase in its population in recent years owes much to the intensive management of the wild population, combined with a successful captive-breeding programme launched in 1993.

In the case of the trout cod, a breeding programme was established in the 1980s in an attempt to reintroduce the species to the Ovens River, where it was once abundant. In 1997, and in every following year to 2006, juvenile hatchery-reared trout cod were released into the river. This programme may have

been successful because fingerlings and one-year-olds were reintroduced annually for ten years, whereas shorter-term programmes in smaller waterways have had limited success.

These cases demonstrate that successful conservation requires long-term efforts, and collaboration between different stakeholders.

● **Does the same apply for the conservation of plant species?**

For plants, it should in general be easier to get recovery, provided that the threats are adequately addressed. A combination of *in situ* and *ex situ* conservation is often needed. However, very few



© Olivier Ploux / Cartoon Movement

▼ Animal extinction is not a game, by French cartoonist Olivier Ploux.

plant conservation successes have been recorded in recent years. An example of a promising project is work on the restoration of threatened trees in the Araucaria forests in Brazil, including the critically endangered Paraná pine (*Araucaria angustifolia*). But it will take a few years to be able to measure its success, as these trees are long-lived species.

● **What are the main obstacles to be overcome to protect threatened species?**

One of the first priorities should be to address the threats a species is facing. Unless those threats are removed, or at the very least, reduced to a manageable level, any efforts to increase species populations are likely to fail.

One of the main obstacles to the protection of species is the lack of resources, both financial and human. Another is the lack of political will. Globally, biodiversity conservation objectives are still rarely integrated into land-use planning, which leads to further degradation and fragmentation of important habitats for threatened species.

● **Can conservation success stories be duplicated in other areas?**

Yes, success stories can be duplicated elsewhere, as each Red List update demonstrates, by highlighting success stories from different parts of the world.

Having said that, a solution that works for a certain species in one location may not necessarily work for the same species in another location – let alone for another species. This is because the success of conservation efforts also depends on the local context, including local cultural values and social norms. We see this very clearly in situations of human-wildlife conflict, for example. A solution that works to address human-elephant conflict in one scenario may not be suited to another context.

● **Does tourism always have a negative impact on species conservation?**

Not necessarily. In some cases, tourism can be positive for conservation. In fact, IUCN works with the World Economic Forum (WEF) to track travel and tourism



© Justin Hofman

▼ A ban on commercial whaling has allowed the western subpopulation of grey whales, historically threatened by over-exploitation for their blubber, oil, and meat to recover – and move from Critically Endangered to Endangered on the IUCN Red List. Big Sur, California, 2017.

“
Biodiversity conservation objectives are still rarely integrated into land-use planning

sustainability metrics. IUCN also recently published some best practice guidelines for *Tourism and visitor management in protected areas*.

Tourism can contribute to conservation through the economic benefits it generates. These revenues can, and should, contribute to the protection of species – particularly where tourism depends on healthy wildlife populations and natural habitats. ■

Africa: Mountain gorillas make a comeback

In the Virunga Massif, an area of about 450 square kilometres straddling the Democratic Republic of the Congo, Rwanda and Uganda, the mountain gorilla population was threatened with extinction by poaching, disease and deforestation. Effective conservation measures involving local communities have led to an increase in the numbers of this iconic species.

Baker Batte Lule

Journalist based in Kampala, Uganda.

There was a time, not long ago, when communities around Uganda's Bwindi Impenetrable National Park and the Mgahinga Gorilla National Park were the mountain gorillas' worst enemies. When the gorillas crossed their gardens, the inhabitants living close to these dense green rainforests would sound an alarm to confront the animals, who were viewed as a menace. This almost certainly resulted in the deaths of many endangered mountain gorillas.

Twenty-five years later, these great apes – of which the silverbacks, the males of the species, can grow to six feet tall and weigh up to 500 pounds – still wander through local gardens. But now if there are alarms, they only serve to alert park rangers. In fact, the numbers of these giants, who are gentle and shy unless threatened, have jumped from 620 individuals in 1998 to 1,063 today.

This dramatic increase led the International Union for Conservation of Nature to downgrade the threat level for the gorillas on its IUCN Red List of Threatened Species – from "critically endangered" to "endangered" in 2018.

The largest living primate – one of two subspecies of the smaller, more ubiquitous, eastern gorillas – the *Gorilla*

beringei beringei inhabits high altitudes. Mountain gorillas are distinguished by their thicker, darker fur that protects them from the cold and incessant rain of their habitats.

Poaching, deforestation, and disease

The gorilla population has suffered decades of extensive threats including poaching, habitat deforestation, disease transmission from humans, and civil conflict. Active conservation strategies – which include continuous monitoring and veterinary attention, the treatment of respiratory diseases, and the removal of snares set for other small animals which trap baby gorillas – have also helped the population increase.

The increase in numbers is also due to the links forged between the gorillas and the local communities. "In the past,

the conservation strategy was based on constraints. But now, the inhabitants look at parks as part of their heritage, and hence contribute to their survival, expansion and management," says Andrew Seguya, Executive Director of the Greater Virunga Transboundary Collaboration (GVTC), which protects the mountain gorillas.

A consortium of the governments of the three countries – Uganda, Rwanda and the Democratic Republic of the Congo (DRC) – where the gorillas live and non-governmental conservation organizations, one of the main tasks of the GVTC is conducting censuses for these and other species in the region.

Routine censusing is a crucial part of adaptive management strategies, experts say. The exercise helps determine whether a population is increasing or decreasing in size, and assessing whether conservation efforts are effective, or need to be modified.

Encouraging numbers

The coalition's latest census, the Bwindi-Sarabwé 2018 Surveys, was released in December 2019. It shows that the Bwindi-Sarabwé ecosystem – that includes Uganda's Bwindi Impenetrable National Park, which is about 321 square kilometres, and the Sarabwé Nature Reserve in the DRC, spanning about nine square



“
The number
of gorillas has
jumped from 620
individuals in 1998
to 1,063 today

▼ *Matabishi, a young male gorilla orphan, shares a special moment with park ranger Mathieu Shamavu at the Senkwekwe Centre for Gorilla Orphans, at the Rumangabo headquarters of Virunga National Park, DRC, 2016.*



kilometres – had 459 gorillas divided in fifty groups, and thirteen solitary individuals. The Virunga Massif – that includes Uganda’s Mgahinga National Park, Rwanda’s Volcanoes National Park (a UNESCO Biosphere Reserve since 1983), and the Virunga National Park of the DRC – had 604 gorillas as of 2016.

Inscribed on the World Heritage list in 1994, the Bwindi Impenetrable Forest is a typical tropical rain forest with an outstanding richness of biodiversity. Situated at an altitude between 1,160 metres and 2,600 metres above sea level, the thick tree cover gives the forest its name. The park’s volcanic hills are home to roughly half the world’s mountain gorillas.

The Mgahinga Gorilla National Park, on the other hand, is the smallest national park in Uganda – spread over just thirty-four square kilometres of land, and bordering both the DRC and Rwanda.

© Gorilla Doctors



▼ A mountain gorilla infant, Bwindi Impenetrable National Park, Uganda, 2019.

The benefits of tourism

All these parks are popular destinations for gorilla tracking. The improved security in their habitats has also contributed immensely to the increased numbers. Rebels in the area in the late 1990s had devastating effects on the gorillas and on tourism, explains Seguya, who was executive director of the Uganda Wildlife Authority (UWA) for six years till March 2018. “The development of tourism has helped the governments to earn resources which they can plough back into conservation,” he says.

Tourism is Uganda’s biggest foreign exchange earner, accounting for \$1.6 billion in 2017, and \$2 billion in 2018. Earnings are expected to decline by over fifty per cent in the 2020-2021 (July to June) fiscal year, due to the pandemic.

Referring to the latest attack on 24 April 2020 – the deadliest in the Virunga National Park’s recent history – when seventeen people, including thirteen rangers, were killed by suspected armed rebels, the park said in a statement that the tragic event would “not be allowed to undermine the Park’s commitment to economic and humanitarian development programmes in partnership with, and for the benefit of, the communities that surround the Park. More than ever, the communities aspire to live in a climate of stability, justice and peace.”

Although Uganda has ten national parks and a number of game reserves, the gorilla parks fetch more money from tourism than all the other parks combined. Gorilla tracking permits – which are rationed to curtail the number of visitors, and are in high demand – cost \$700 per person for a group of eight people, for one hour a day. Permits in Rwanda cost \$1,500, while the DRC charges \$400.

To encourage community partnership, Uganda’s government has passed a law that makes it mandatory for the UWA to share twenty per cent of all gate collections from tourists with communities neighbouring the parks.

This money is passed on to local governments as conditional grants to improve the livelihoods of the area’s inhabitants. According to Godfrey Kiwanda, Uganda’s Minister of State

for Tourism, Wildlife and Antiquities, “The revenue-sharing has improved our relationships with the communities near these parks. They now know that if we have many visitors, it will result in more money for community projects. We have built schools, hospitals and improved the road network in their areas.”

Besides revenue sharing, the UWA has also helped communities to start other income-generating activities.

Before they were gazetted national parks, the Bwindi and Mgahinga forests were home to the Batwa tribe – driving them out of their traditional habitats meant providing them with alternative sources of livelihood. The wildlife authority helped them to start growing coffee, tea and holding craft workshops, and selling the products to tourists.

Other organizations, like the African Wildlife Foundation (AWF), have teamed up with the Nkuringo community near Bwindi to construct an eco-lodge there, with profits shared every year.

“This community now has alternative sources of income which are connected to the gorillas. Once you have that environment, the gorillas will multiply,” Sudi Bamulesewa, AWF’s Uganda country director said. ■

“
**In Uganda,
twenty per
cent of all gate
collections
are shared with
communities**

Islands represent only a small fraction of our planet's land-mass, yet they host a disproportionate amount of the world's biodiversity. Today, many island species are threatened with extinction by invasive species. Measures are now in place to preserve their exceptional natural wealth.

Islands: **Fragile** **showcases of biodiversity**

Dena R. Spatz

Senior Conservation Scientist at Pacific Rim Conservation, Hawaii.

Nick D. Holmes

Lead Scientist, Island Conservation Terrestrial at the Nature Conservancy, California.

Islands all have distinct ages, geographical locations, and degrees of isolation. These characteristics make each island unique – allowing them to house ecosystems with concentrations of flora and fauna found nowhere else. Some of these species evolve rare traits – such as gigantism, dwarfism, and flightlessness.

Although islands account for just five per cent of the world's land-mass, they are home to approximately seventeen per cent of the world's bird and plant species. Some tropical coastlines are home to coral reefs that are among the most biologically diverse ecosystems in the world – sustaining the livelihoods of millions of people. Many island species are found only on one island or island group, and are thus considered endemic to that location.

Madagascar, one of the world's largest islands and recognized as a global biodiversity hot spot, is home to 15,000 native species of land plants – eighty-five per cent of which are endemic, including over 1,000 species of orchids. In the Hawaiian Islands, a small continental bird



© Irene Espinosa / Island Conservation



▼ The Juan Fernández Firecrown hummingbird, found only on Robinson Crusoe Island off the coast of Chile, is critically endangered.

has adapted to island life and eventually gave rise to nearly half of all Hawaiian land-birds. Its descendants, the Hawaiian honeycreepers, have more than fifty species, each with a different bill and tongue shape that is specially adapted to different food sources – seeds, fruit, insects or nectar. These birds provide a remarkable narrative of evolution in an island environment.

Dodos, giant tortoises, and pipistrelles

Since the beginning of the fifteenth century, sixty-one per cent of the global loss of species to extinction has occurred on islands – due to poaching, habitat loss and predation from introduced species. We know the fate of the famous dodo, a kind of flightless pigeon from Mauritius, which has disappeared forever. But it is just one of nearly two dozen native island species lost from the Mascarene Islands in the south-west Indian Ocean – including the extraordinarily large and long-lived giant tortoise.

Yet, extinctions are not just a thing of the past. In Kiribati, the Kiritimati Island pipistrelle, a tiny bat weighing less than five grams, was declared extinct in 2012. Conservation measures taken to save it were too late – the bat's last call was detected in 2009.

A study of nearly 3,000 birds, mammals, reptiles and amphibians – classified as endangered or critically endangered by

“ A staggering concentration of extinctions have occurred on islands

the International Union for Conservation of Nature's IUCN Red List of Threatened Species – found that forty-one per cent of these endangered animals breed on islands. This highlights the staggering concentration of species threatened with extinction on such a small area of the planet.

Invasive species are a major driver of extinctions. Whether they are deliberately or accidentally introduced to areas outside their natural range, they can adversely affect native species and entire ecosystems. Only thirty invasive species have been linked to the extinction of 738 animals worldwide. These losses were concentrated on islands, where the invasive species were implicated in eighty-six per cent of known extinctions.

Invasive mammals are particularly devastating – predators such as cats and mongooses prey upon native species, while herbivores, such as goats and pigs, alter landscapes and contribute to habitat loss. Island species often evolved in the absence of predation, competition, or herbivory. This resulted in the evolution of

flightless birds or thornless plants, and an overall naive disposition of native island animals, which are especially vulnerable to these aggressive invasive species.

On Gough Island in the Atlantic, Marion Island in the Indian Ocean, and Midway Atoll in the Pacific, the grey-brown house mouse, the smallest invasive mammal, has learned to prey upon and kill the albatross, the largest of seabirds. Unaware of this threat, breeding adults and their chicks stay in their nests in spite of relentless, often fatal, attacks by the mice.

Fighting invasive mammals

There are ways to save certain species from extinction, using conservation techniques. In New Zealand, the control or complete eradication of invasive mammals has been successful. On Palmyra Atoll in the South Pacific, eradicating the Pacific rat, an invasive species which fed on native seedlings, resulted in a 5,000 per cent increase in native forest growth.

In another example, the eradication

“ Invasive species are a major driver of extinctions

of rats from an islet off Antigua in the Caribbean led to a twenty-fold increase in the population of the endemic *Alsophis antiguae*, or Antiguan Racer, the world's rarest snake. A recent study found that hundreds of threatened native species rebounded following the eradication of invasive mammals.

Fences can also be effective to keep out invasive species – especially on large, populated islands where conservationists are now creating “islands within islands”. Building a fence at the Ka'ena Point State

▼ *The tiny Rabida Gecko, once thought to be extinct, was rediscovered on Rabida Island in the Galapagos archipelago, Ecuador, once rats were successfully eradicated from the island.*



Park in Hawaii has created a safe and predator-free habitat for Laysan and Black-footed albatrosses to breed and thrive. The broadcasting of albatross calls using sound systems and deploying albatross decoys in courtship displays has boosted population recovery at these sites.

Due to its elevation, Ka'ena Point is one of the last remaining native coastal ecosystems in Hawaii that is safe from sea-level rise. Climate change is also exacerbating the plight of threatened island species. Yet, solutions such as managing invasive species on high elevation sites and moving threatened species to these sites when necessary, is improving the prospects for the survival of island biodiversity.

The last remaining wild spaces

Establishing conservation databases is another way to help endangered species. The Threatened Island Biodiversity Database (TIB), for example, documents the distributions of critically endangered and endangered birds, mammals, reptiles, and amphibians around the world. These species occur on just 1,288 islands, representing only 0.3 per cent of islands worldwide.

This data allows ecologists to identify and prioritize feasible conservation actions. The Database of Island Invasive Species Eradications (DIISE) documents the methods and outcomes of invasive species eradication projects on islands worldwide. It contains information on eradication efforts for 1,400 invasive species on 940 islands – eighty-eight per cent of which were successful. This tool can help conservation managers evaluate past successes, plan new projects, and measure progress towards targets set by the United Nations Convention on Biological Diversity.

There is a real urgency to protect unique island habitats, which represent the last remaining truly wild places on earth. Experience shows that allocating limited conservation funds to islands generates high returns – promoting the recovery of species on the verge of vanishing, and the rediscovery of species once thought to be extinct. These successes highlight the vital conservation opportunities that islands hold for our planet. ■

Protecting cetaceans in the Yangtze

Since Qi Qi, the last-known baiji, a freshwater dolphin, died in captivity in 2002, the long-nosed white-bellied Yangtze River dolphin is thought to be extinct.

The author, a leading baiji expert and Secretary General of China's National Committee for UNESCO's Man and the Biosphere (MAB) Programme, outlines the Chinese government's efforts to ensure that other threatened freshwater cetaceans, like the finless porpoise, do not suffer the same fate.

Wang Ding

Professor at the Institute of Hydrobiology (HIB) of the Chinese Academy of Sciences, he is a member of the International Union for Conservation of Nature Species Survival Commission (IUCN-SSC) Cetacean Specialist Group, and the Chinese National Committee for DIVERSITAS.

As part of my work at the Institute of Hydrobiology in Wuhan since 1982, I spent twenty years with Qi Qi [pronounced chee-chee], the world's only captive baiji Yangtze River Dolphin (*Lipotes vexillifer*, "the flag-bearer who was left behind").

Rescued from a fisherman's net in 1980 after he had been accidentally hunted when he was only 2 years old, the injured Qi Qi lived in the Wuhan Dolphinarium for over two decades. The death of this "living fossil" from old age in 2002 was an emotional blow, personally. I couldn't accept that the species, which is believed to have flourished in the Yangtze for over 20 million years, could soon be labelled "extinct".

Revered in China as the "goddess of the Yangtze", the baiji has been described in the *Erya*, the oldest surviving Chinese dictionary, dating back to 200 BC. This only strengthened our resolve to protect Qi Qi's fellow creatures before they completely disappeared. Unfortunately, we found that it was already too late. →

A unique species

In 2006, I led a thirty-nine-day expedition to search the Yangtze River for any trace of the last remaining baiji. A team of over sixty leading marine biologists – from China, Japan, Switzerland, Germany, the United Kingdom, Canada, and the United States – used the most advanced detection techniques available at the time, but failed to find a single baiji. A year later, the graceful creature was declared functionally extinct by *Biology Letters* of the Royal Society of Biology, UK.

Even though unconfirmed sightings of the baiji continue to be reported, there is very little chance that this long-snouted dolphin – that relies on sonar rather than on its eyes to navigate the murky river waters – will ever be found again.

This unique freshwater dolphin, who was believed to protect fishermen and boatmen along the 1,700-kilometre waterway from central China all the way to the Pacific in ancient times, was found only in the middle and lower reaches of the Yangtze, and its connected big lakes.

According to incomplete statistics, human activity was to blame for ninety per cent of known baiji deaths before 1985. Industrialized fishing, illegal and harmful overfishing, and the unbridled growth of container ships, coal barges and speed-boats are the main causes of the river dolphin's population decline and range contraction during the last several decades.

Scientifically speaking, the role of river dolphins as an indicator is particularly important because it can be used to monitor the status and trends of freshwater biodiversity in rivers.

Protecting the “river of life”

Another cetacean in the Yangtze, the finless porpoise (*Neophocaena asiaeorientalis* ssp. *asiaeorientalis*), shares almost the same habitats as the baiji, and therefore faces the same threats. Also known as “Yangtze mermaids”, these smaller bath-tub-sized cetaceans – which lack a proper dorsal fin and have a small dorsal ridge on their backs instead – have been listed as critically endangered on the International Union for Conservation of Nature's IUCN Red List. Their number has been decreasing rapidly – with only 1,012

individuals still living in the wild in 2017, in spite of conservation efforts.

There is hope, however. Over the past few decades, the environmental management of local governments has improved significantly. While China's economic development took priority in the 1980s, the government and local authorities began to realize its environmental impact in the decades that followed, and have started to take measures to protect the environment.

The longest river running through only one country, and the third-longest in the world, the Yangtze is known as the “river of life” for obvious reasons. Accounting for forty per cent of China's fresh water, it is literally the source of life for millions of people, and wildlife such as ancient sturgeon, snub-nosed monkeys and giant pandas. Its drainage basin comprises only a fifth of China's land area, but generates as much as one-third of China's gross domestic product (GDP).

To restore the ecosystem and to preserve biodiversity, a ten-year fishing moratorium in all the natural waterways along the Yangtze River was introduced in January 2021. Two months later, in March, the *Yangtze River Protection Law* came into effect, further strengthening the ecological protection and restoration of the river basin. Besides promoting the implementation of the fishing ban at the legislative level, the new law emphasizes the need for sustainable socio-economic development at the national and regional levels.

An elevated conservation status

Nine national and local nature reserves – some of them comprising river sections and semi-natural *ex situ* reserves – have also been established along the river for the conservation of freshwater dolphins.

“**The death of this ‘living fossil’ was an emotional blow, personally**”

Originally established as a sanctuary for the baiji in the last century, the Tian-e-Zhou Oxbow Nature Reserve – a twenty-one kilometre oxbow lake described as “a miniature Yangtze” – an area of wetlands near Shishou in Hubei province, now holds approximately 100 finless porpoises. These creatures profit from *ex situ* conservation measures originally designed for the baiji.

▼ With only 1,012 individuals still living in the wild in 2017, the finless porpoise has been listed as critically endangered on the IUCN Red List.



© Huigong Yu

In a major boost for the critically endangered mammals, the Chinese government upgraded the protection of Yangtze finless porpoises in February 2021, to national first-level protected species – the country’s highest level of protection for wild animals.

Today, nearly twenty years since Qi Qi died, over twenty non-governmental organizations (NGOs) are involved in

the protection of its smaller cousin. The participation of the public has been encouraged, with local volunteers patrolling day and night along the middle and lower reaches of the river, and in the Poyang and Dongting Lake areas, to protect finless porpoises.

In a bid to preserve intangible local culture, efforts are being made to ensure that the local memory, traditional culture

in the form of Chinese legends and folktales, and ecological knowledge of the baiji are kept alive. Stories about Qi Qi are published and read by children across China. I am hopeful that memories of these unique and elegant dolphins will remain forever. ■



“
To restore the ecosystem, a ten-year fishing moratorium was introduced along the Yangtze

Millions of hectares of vegetation destroyed and 3 billion animals killed or displaced. The toll of the bushfires that ravaged New South Wales and Victoria in 2019 and 2020 is even more horrific than earlier estimated. Experts say the regeneration of Australia's lost biodiversity will take many, many years, and will require human intervention – especially if weather conditions remain unfavourable.

Australia:

After the bushfires

Gary Nunn

Freelance journalist, based in Sydney.

“When you walk into a forest that's been burnt this badly, the overwhelming thing that hits you is the silence. No bird-song. No rustling of leaves. Silence.” This is how Mike Clarke, professor of zoology at La Trobe University, Melbourne, described Australia's many forests that were recently decimated by the country's worst bushfires.

“This stands out as the worst disaster in Australia's recorded history,” Clarke says. The figure of the area that has been burnt – 13 million hectares – is “hard to get your head around.” For scale, this is an area bigger in hectares than Holland, Denmark and Switzerland combined. All burnt to a crisp. Homes, forests, animals, plants – all gone.

The timing is also significant in understanding the scale of the impact. “This comes on top of Australia's driest

years on record,” Clarke adds. “Populations of animals were already on their knees due to the drought. Australia's weather conditions in the next three or four years will be critical to what recovery looks like.”

Unprecedented losses

Three billion animals were killed or displaced in the bushfires, according to a July 2020 study by ten scientists from five institutions commissioned by the World Wildlife Fund for Nature (WWF). Christopher Dickman, professor in terrestrial ecology at The University of Sydney and fellow of the Australian Academy of Science, who oversaw the project, said the study's main findings came as a shock, even to the researchers. “Three thousand million native vertebrates is just huge. It's a number so big that you can't comprehend it,” he told *The Guardian* newspaper.

This figure is conservative, Clarke believes. “That's just mammals, birds, reptiles. If we added invertebrates to that, the numbers would be astronomical.”

One thing that must be clear, though, is that Australia's bush has always burnt quite severely. “The severity isn't unprecedented,” says Alan York, professor of Fire Ecology at the University of Melbourne. “What is unprecedented is their earliness in, or before, the usual fire season, and the volume of fires in so many places, which is far more unusual.”

The impact on Australia's threatened species is potentially devastating. Seventy nationally threatened species have had at least half of their habitat burnt, Clarke says. These include animals such as the long-footed potoroo and the Kangaroo Island's glossy black-cockatoo – “a rare and spectacular bird,” he adds. Fires have burnt their food sources, shelter, or both.

Koalas in northern New South Wales have had most of their habitat burnt. The iconic nature of these animals sometimes overshadows other ecosystem horrors, Clarke says. “They're the poster child of this crisis. But in reality, a whole suite of wildlife – large possums, all sorts of plants that live in alpine ash, whole communities of organisms – are all at risk now.”

How resilient is the Australian bush?

It may take years for these species to recover. And that may require human assistance – with captive-bred frogs in Australia's zoos, for example. “Otherwise, we're hoping animals survived in unburnt pockets,” York explains. He remains somewhat optimistic, saying the Australian bush has a “dramatic capacity to recover.”

There are, however, caveats. Rainforests and alpine areas of Tasmania, for instance, don't have much experience of fires, so they're more vulnerable to repeated fires, he says. And under the current

“

Seventy per cent of the rainforest has been burnt

“

Under the current climate change model, increasing fires are inevitable



▼ *The deadliest on record, Australia's wildfires could lead to real change on the climate action front.*

climate change model, increasing fires are inevitable.

Some of several “human interferences” that’ll most likely hamper recovery include habitat removal from land clearing, and a lack of urgent political action on climate change.

But is the Australian bush really resilient enough to recover? Not everyone shares the fire ecology expert’s tempered optimism. “Seventy per cent of the rainforest has been burnt – it’s the bit of the landscape not adapted to fire – so it’s really unclear how, and if, it’ll come back,” Clarke says.

A recovery could take centuries

The problem is, lots of critical resources have been incinerated. For example, many fauna – cockatoos, parrots, possums, bats – rely on hollow logs on the ground, or on trees to den in or breed in. Not only have those logs now gone, Clarke predicts that it will take one to two centuries for them to appear again, hollowed out. “What could disappear in hours in bushfire could take centuries to replace. Ecologists would call this a ‘complete state change.’”

An essential ingredient to recovery is soil. More soil than usual was burnt in these fires, as the droughts in recent years removed the pre-existing moisture. This means the essential nutrients held in the soil are no longer there either.

Immediate measures needed

Experts say some immediate steps are being taken to help along the recovery of this vast area. A moratorium on logging has been proposed, and pressure is building to act more aggressively on the pest control of feral cats and foxes, in addition to introducing weed removal. “Weeds recolonize areas disturbed by fire. They use resources that native plants and animals might need,” York explains.

Identifying and protecting areas that did not burn is also an important subject for debate. Specifically, some are arguing that cultural burns may be better than the hotter, more intense, hazard reduction burning. Cultural burns are cool-burning, knee-high blazes that were designed to happen continuously and across the landscape, practised by indigenous people long before Australia’s invasion

and colonization. The fires burn up fuel like kindling and leaf detritus, so that a natural bushfire has less to devour.

Since Australia’s fire crisis began in 2019, calls for better reintegration of this technique have grown louder. But they may be of limited value at this crisis point, according to Clarke.

“We need to appreciate how different things are now. Cultural burns happened to enable people to move through dense vegetation easily, or for ceremonial reasons. They weren’t burning around 25 million people, criss-crossed by complex infrastructure and in a climate change scenario,” he estimates.

Concrete measures to combat climate change are indeed crucial for the future of biodiversity. In spite of green shoots of optimism in some quarters, the prognosis of whether the bush will ever recover its biodiversity is looking somewhat grim.

Breaking it down, Clarke surmises that “A chunk of it will be good – a third will be able to bounce back. A third is in question, but a third is in serious trouble. I’ve been studying fire ecology for twenty years, but we’re dealing with uncharted territory changing before our eyes.” ■

Cities: Wildlife thrives in concrete jungles

It's a paradox. Urbanization is one of the main causes of the destruction of biodiversity, and yet, cities today serve as a refuge for wild species whose natural ecosystems have been degraded. They could become centres of biodiversity conservation in the future, provided that preservation policies are put in place.

▼ Some species are able to acclimatize more quickly than others to the urban milieu, like these parrots perched on a railing in Paris.



CC BY-NC-ND 2.0 photo: Patrick Loste

Loïc Chauveau

Journalist specializing in environmental issues, based in Paris.

Parakeets in the parks of Brussels, Amsterdam and London, wild plants thriving on asphalt, industrial buildings invaded by bats or birds of prey – recent studies show the astonishing ability of certain species to acclimatize to the noisy and densely populated environment of a city.

It is true that their survival is at stake. Cities, where two out of three people will be living by 2050 – according to figures from the United Nations Department of Economic and Social Affairs (DESA) – are growing steadily at the expense of natural areas, forests and farmland.

The destruction of natural habitats, soil and water pollution, and the use of pesticides are all factors that disturb – or even destroy – ecosystems and the species they shelter. According to projections

by researchers at the University of Pennsylvania in the United States, ninety per cent of natural areas that host endemic species could disappear in the coming years as a result of urban sprawl.

The fact that cities harbour wild species is not surprising when as many as 423 cities worldwide, with more than 300,000 inhabitants, have developed within environments rich in biodiversity – according to a study conducted by researchers at Yale University in the

US. Jakarta in Indonesia, for example, which is expected to grow by 3 million inhabitants by 2030, is located in the heart of Sundaland, a region with some of the richest biodiversity on the planet.

The threat to biodiversity caused by urban growth is therefore very real. Yet nature does not always surrender in the face of advancing concrete. The reduced presence of pesticides, the absence of poaching, the diversity of habitats, milder winters, and the availability of water and food throughout the year, favour the establishment of animals and plants in search of new spaces. But not all species are suited for city life. Only those with the genetic disposition to adapt, animal species with rapid reproductive cycles or a varied diet, have a chance.

The ingenuity of species

“There is a natural dynamic of plant and animal species to take over this new environment by adaptation, either by changing its habits or by evolving genetically,” says Pierre-Olivier Cheptou, an ecologist at the French National Centre for Scientific Research (CNRS).

In an article published in the US journal, *Proceedings of the National Academy of Sciences of the United States of America* (PNAS), he shows that the *Crepis sancta*, a weed that grows around trees and along sidewalks in Mediterranean cities, has made major efforts to adapt to an environment that was not its own.

Within a few generations, this weed belonging to the Asteraceae family has changed its breeding strategy – by giving priority to the production of heavy seeds that would allow it to reproduce at short distances, rather than light seeds that would not be able to germinate on concrete.

The animal world also displays ingenuity in conquering environments that should be hostile to it. Some birds are able to change their habits, and even their morphology, in order to adapt.

Among coal tits, it is the most alert and aggressive individuals that colonize cities. These birds lay their eggs earlier and have smaller chicks because access to food is easier. Another difference is that the more active and stressed urban tits sing louder to be heard above the urban noise.

Ecologist Ana Catarina Miranda compared the behavioural differences

“

The animal world displays ingenuity in conquering environments that are hostile to it

between urban and rural blackbirds in a study which appeared in the journal, *Global Change Biology*, in September 2013. It concluded that the urban birds reacted more cautiously towards new objects, and were less inclined to approach even places familiar to them, compared to their forest counterparts.

Brambles and wild grasses on sidewalks

In order to develop, urban biodiversity will require special attention from decision makers. “Urban planning will have to change completely,” explains Philippe Clergeau, an ecologist at the National Museum of Natural History in Paris.

“It’s no longer a question of planting rows of a single species of tree, or artificial landscaping. We need to recreate genuine ecosystems, similar to those of fields and forests.”

Bramble bushes, fruit trees and wild grasses will then have to take over the sidewalks. A real continuity of plant life between the countryside and the city will have to be created, with actual “corridors” of nature. The façades of buildings and roofs will also have to be covered with vegetation.

Ecologists see the emergence of two urban planning models – land sparing and land sharing. The first model involves creating a solid boundary between densely populated residential areas and vast natural spaces.

The Sanjay Gandhi National Park – with 104 square kilometres of forest and lakes, teeming with biodiversity – is located in the suburb of Borivali, barely forty kilometres from the city centre of Mumbai, India’s largest megapolis.

The twenty or so leopards that live there tend to prey on the domestic dogs living at the park’s edge. Attacks on humans have also been known to occur, but protective measures, like limiting the

number of large felines, now allow for cautious cohabitation.

Land sharing, on the other hand, involves diluting nature within the urban environment by introducing a succession of grassy passages, small gardens, and neighbourhood green spaces.

Kevin Gaston, a researcher at the University of Exeter in the United Kingdom, set out to quantify the relative conservation benefits of these two urban models for biodiversity. It was in Tokyo, Japan, that a sufficiently varied research environment was found, to compare dense and spread-out habitats for two insect populations – ground beetles and butterflies.

“In highly urbanized areas, it’s the economy of space that makes it possible to better preserve these species,” says Gaston, whose study and its findings appeared in the *Journal of Applied Ecology*. “But in reality, it all depends on urban pressure. Where demand is high, the city must be dense and have a barrier separating it from nature. Where there is less pressure, sharing can be more favourable.”

Such research will have to inform the decisions urban planners make to design the cities of tomorrow. Some municipalities, such as Melbourne, Singapore and Cape Town, have already started.

Urban biodiversity provides significant services to city residents. It makes it possible, in particular, to combat heat islands and flood risks, and to improve the quality of air, water and soil.

Green spaces contribute to well-being

There are also proven health benefits. In a 2016 study, the World Health Organization (WHO) showed that green spaces in cities contribute to psychological well-being, reduced stress and increased physical activity.

However, urban ecology still has many unanswered questions about the ability of species to adapt, particularly with the effects of global warming. It should not overshadow a major challenge in the years to come – that of preserving the biodiversity of natural environments. ■

ZOOM

Titicaca: The sacred lake reveals its secrets



Photos: **Teddy Seguin / Université Libre de Bruxelles**

Text: **Katerina Markelova, UNESCO**



Diving in the bay of Sampaya,
on the shores of Lake Titicaca.

It has been lying at a depth of six metres for nearly five centuries. Yet the Inca stone offering box found in Lake Titicaca in 2014 emerged almost intact from the water. Inside the box was a miniature shell figurine of a llama, and a rolled cylindrical gold sheet – signs of religiosity and power in the Inca Empire.

Located in the Andes mountains between Bolivia and Peru, at an altitude of 3,810 metres, Lake Titicaca occupied a central place in the mythology of two powerful pre-Columbian states – the Tiwanaku civilization, which reached its peak between 600 AD and 1050 AD, and the Inca Empire, which was at its height in the fifteenth and sixteenth centuries.

Since 2012, the lake has been the focus of underwater archaeological excavations by the Free University of Brussels (ULB) and an international team of archaeological divers led by Christophe Delaere.

Carried out with the support of the Bolivian authorities and in collaboration with the local inhabitants, the operations have led to the discovery of twenty-five new submerged sites – including shrines for offerings, ancient dwellings, and the earliest-known pre-Columbian port. Over 20,000 objects have been catalogued and studied.

To provide access to this exceptional heritage, the Titicaca project plans to build the Museo Subacuático Titicaca, an underwater museum, with UNESCO's expertise.

Underwater archaeological remains are an irreplaceable testimony to the history of humanity. Yet, much of this heritage is exposed to looting.

The UNESCO Convention on the Protection of the Underwater Cultural Heritage, adopted in 2001, provides a legal framework for the preservation of remains that have been lying underwater for over a hundred years. ■

This photo-reportage is published to mark the 20th anniversary of the UNESCO Convention on the Protection of Underwater Cultural Heritage, adopted on 2 November 2001.



Underwater surveys at the K'anaskia site of the Tirasca community, with the excavation boat in the background.



Protecting the K'anaskia site at the end of the 2017 season.



A Pacajes ceramic bowl (1150-1400), discovered at the Santiago de Ojjelaya site of the Yampupata community.



Christophe Delaere, who heads the Université libre de Bruxelles underwater excavations in Lake Titicaca, in conversation with Carmelo Quispe Limachi, a leader of the Tirasca community, 2017.



Leaders of the Ojjelaya community visit the archaeological site in Sanka Putu.



The official handover of archaeological objects to members of the Yampupata community, two years after they were discovered in 2016.



An Inca offering box (1400-1530) made of andesite, a local volcanic stone, was discovered intact in 2014 near the K'akaya reef located to the west of Lake Titicaca's Escoma Bay.



ZOOM

Underwater Tiwanaku offerings discovered in 2013 at the K'hoa Reef site, near the Island of the Sun, Bolivia.







What our favourite TV programmes say about us

Identifying with fictional characters and stories can help us feel connected to others, or to find joy, meaning, and comfort in times of stress. It can also do the opposite. But this phenomenon can be a force for good when it allows us to reduce prejudice against marginalized groups.

Dara Greenwood

Social psychologist and associate professor of Psychology at Vassar College, New York, she studies the social and emotional implications of media engagement.

This past year, many of us have turned to familiar or absorbing television shows as a soothing diversion from the daily threat and isolation of a worldwide pandemic. At a basic level, our media “diets” reflect our desire to be entertained, or to escape, however briefly, from personal stress, tedium, or loneliness.

But beyond their ability to allow us to escape from our daily lives, the programmes and characters we spend our time with, matters. Indeed, research shows that our favourite programmes and characters often reflect fundamental aspects of who we are. Further, the particular ways in which we engage with these are relevant to our psychological well-being.

Do we typically feel immersed in the shows we watch, or develop strong emotional bonds with characters? Rather than being arbitrary or frivolous, our media affinities are meaningful, and offer a window into our socio-emotional needs and tendencies. A body of empirical evidence finds that what we watch impacts our thoughts, emotions, or behaviours.

Two key concepts of the psychological motivations that draw us to entertainment media have been studied by psychologists: transportation, and parasocial interaction.

Transportation – a concept devised by American social psychologists Melanie Green and Timothy Brock in 2000 – is the process by which we become immersed in a story, including our identification with characters. Some of the pleasure that may accompany transportation includes an expanded sense of self that incorporates characters’ experiences and perspectives.

“**Our favourite programmes and characters often reflect fundamental aspects of who we are**”

Parasocial interaction is defined as the imagined friendship we develop with media characters as we “get to know” them over time. The term was originally coined – by the anthropologist Donald Horton and sociologist Richard Wohl, in 1956 – to describe the bonds that audience members developed with media personalities like talk show hosts. Since then, the idea of a pseudo-relationship with a media personality has been applied to a broad range of media figures, both real and fictional – from athletes, musicians, and politicians, to TV and movie stars, to social media influencers and YouTubers.

Compensating for negative feelings

Our tendencies to become engaged with the media exist on a spectrum. Some of us are more likely to feel transported into TV shows and connected to characters than others. In my research, I have found that individuals who score higher on transportability and report more intense parasocial relationships also tend to have emotional vulnerabilities such as →



impulse control difficulty or relationship anxiety. The media they consume may be an attempt to compensate for negative feelings, in addition to complementing real-life preoccupations.

In an increasingly diversified media landscape, in which a Netflix or other streaming service might offer anything from “Irreverent TV Comedies” to “Asian Anime” to “TV War and Politics” or

“Programmes Based on Books”, it can be difficult to see genre as more than an infinite array of categories.

However, when broad genres are considered, some synchrony emerges between our own temperaments and our media preferences. For example, if you are someone who scores high on sensation-seeking, you may be more likely to consume thrillers or horror movies,

according to Danish horror researcher and author, Mathias Clasen, in research done in 2020. Or, if you are someone who scores high on the “need for affect” – the motivation to approach or avoid emotion-inducing situations – and doesn’t shy away from strong emotions, you may be more likely to consume dramatic fare. This was initially studied by social psychologists Gregory Maio and Victoria Esses in 2001.



Cause or effect?

Beyond gender, those with more aggressive tendencies also tend to consume more violent media. My own research finds that aggressive and Machiavellian traits predict increased affinities for anti-hero films and programmes and their characters – like the sardonic and violent eponymous character in the 2016 action comedy film *Deadpool*, or the meek science teacher turned vicious meth king, Walter White, of the American TV series *Breaking Bad*. I also found that young women with increased body anxiety report more “wishful identification” with favourite female characters.

Much of the above work is correlational, which means it is difficult to tease out which direction the causal arrow points – from media to self or from self to media? However, experimental and longitudinal research suggests the answer is usually both. A series of studies conducted by psychologist Lynda Boothroyd among residents of seven Nicaraguan villages (2016) found that viewing slim body ideals via TV or print was associated with an increased endorsement of a thin ideal body – both over time, and in the immediate aftermath of exposure.

Although transporting to fictional worlds and developing bonds with fictional characters may sound bizarre, both processes are theorized to be natural outgrowths of our evolved capacity to derive value from vicarious experience – and to seek affiliation with liked and like-minded others.

After all, we learn to navigate our social world by observation and co-operation. Importantly, emotional engagement with the media is strongly encouraged by the entertainment industry. As cultural anthropologist John Caughey has pointed out, “it would be peculiar if the audience did *not* respond in kind”.

Reducing prejudice

Transportation and parasocial interaction can have important benefits for marginalized groups in society.

Research by social psychologists Sohad Murrar and Markus Brauer finds that exposure to a sitcom featuring “diverse and relatable” Arab/Muslim characters reduces prejudice among white non-

Muslim American viewers – especially when they identify with the target character.

Similarly, research by Bradley J. Bond, an associate professor in communication studies at the University of San Diego, California, in 2020 finds that sustained “parasocial contact” with LGBTQ characters in the British series *Queer as Folk* decreased homophobia among heterosexual participants – particularly among those who began the study with higher levels of sexual prejudice.

Therefore, once a television character becomes a “friend”, it is easier for the viewer to believe they should be treated fairly. Further, seeing diverse and positive representations of your own social group on TV can have powerful implications for psychosocial well-being.

“ Identifying with the target character reduces prejudice

Attaching to particular shows may also expand our social horizons. My own pandemic-coping strategy included transporting into the fictional landscape of *Outlander* – a time-travelling romance/adventure saga, in which a Second World War nurse finds herself in eighteenth-century Scotland. I am apparently late to the party – the ongoing TV series which started in 2014 has a vast fan community, partly derived from the fan base of the original book series by Diana Gabaldon.

Some *Outlander* fans have even raised hundreds of thousands of dollars for charities endorsed by the stars on the show – illustrating its potential for prosocial behavior and the power of attachments to beloved characters or actors.

Our media habits are woven, in varying patterns and degrees, into the fabric of our daily lives. Our engagement with media is, in many ways, no less complex than our engagement with the concrete realities of lived experience and relationships. ■

Some media tastes may be emblematic of cultural traits in addition to individual ones. Also, women are more likely to consume romantic-themed media than men, which may reflect gender role socialization and the increased frequency of female protagonists. Men, on the other hand, are more likely to consume violent media for analogous reasons.

Olivette Otele:

“The history of Europe’s blacks has been struck by a partial amnesia”



The presence of people of African descent in Europe is generally viewed through the prism of slavery and colonization, obscuring a much older shared history.

Interview by **Agnès Bardon**

UNESCO

● ***The title of your book is African Europeans: An Untold History. It is unusual to refer to people of African descent living in Europe as African Europeans. Why did you choose to use this term?***

The term 'African European' or 'Afro-European' is not widely used in Europe, whereas its equivalent – African American or Afro-American – is common across the Atlantic. I used it somewhat provocatively but also, and more importantly, to highlight the fact that people of African descent have a plural identity.

African Americans have appropriated the term, but African Europeans are more reluctant to use it because of the historical context; as in Europe they are often referred back to their African origin – even if they were born on European soil, and hold the nationality of the country in which they grew up. However, I think this designation has the merit of reflecting the diversity of origins, experiences and backgrounds of people of African origin.

● ***The history of black people in Europe is generally considered to begin in the seventeenth and eighteenth centuries. You show that they have been there for much longer.***

When we talk about the migration of people from Africa to Europe, we tend to trace it back to the slave trade. But it is much older. People from the African continent have been present in the Roman Empire since antiquity. In the absence of a census, it is difficult to assess their numbers today. But what we do know is that some of them became illustrious figures – such as the emperor Septimius Severus [145-211], who was born in what is now Libya, or some thinkers, such as Saint Augustine [354-

430], or Apuleius [124-170], who came from North Africa.

This presence continued over the centuries. Frederick II, king of Sicily and Holy Roman emperor from 1220 to 1250, welcomed Africans into his court and employed them in his service. He even made one of them, John "the Moor", his chamberlain. Until the end of the fifteenth century, Arab and North African Muslims ruled over most of the Iberian Peninsula. And from the mid-fifteenth century onwards, wealthy families in central and northern Italy began to employ servants from Africa. Many Renaissance paintings bear witness to this.

“

Theories about racial inferiority were developed to justify the slave trade

So there is a shared history between Africa and Europe, much older and richer than one might imagine. But part of this history has not been considered relevant enough to be taught in schools. We have become accustomed to viewing history through the prism of the slave trade. This historical moment has somehow eclipsed, or masked, what came before. As a result, this history has been struck by a partial amnesia.

● ***How has the perception of people from Africa changed over the centuries in Europe?***

Before the seventeenth century, colour prejudice against Africans did exist, of course. But from the Middle Ages and into the Renaissance, the divide between

The author of *African Europeans: An Untold History*, Olivette Otele is a Professor of History of Slavery and memory of Enslavement at the University of Bristol in the United Kingdom. Born in Cameroon and raised in Paris, she is the first black woman to be a History professor in the UK.

Christians and Muslims outweighed most other considerations. Moreover, this prejudice was also directed virulently against other white-skinned groups, such as the Irish, who were perceived as savages by the English.

The real turning point was the development of the slave trade, when the Portuguese, French, English, Dutch, Spanish, Swedes, and Venetians became embroiled in this frenzied race for profit. Theories about the racial inferiority of Africans were then developed by Europeans to justify the slave trade.

This had a lasting effect on the perception of Africans after 1700. It was at this time that black people were dehumanized and regarded as commodities. This is well-documented from a historical point of view. We have numerous log-books, registers and account books that attest to this.

From that moment on, European identities were perceived as superior because of their economic power. Indeed, the slave trade changed people's perceptions, but it also shaped and sedimented identities, by accentuating

▼ *Saint Maurice, oil on linden, by Lucas Cranach the Elder, circa 1520-1525, Metropolitan Museum of Art, New York. Originally from Egypt, Maurice was a Roman legion commander who was executed around 286 AD near Aguanam (present-day Switzerland) for refusing to slaughter Christians.*



Public Domain

the separation between whites on one side and blacks on the other.

● **Is the work of historians bringing to light chapters in the history of people from Africa in Europe that have been little explored or overlooked until now?**

Yes, I am very optimistic about this. Just the fact that I have been able to publish a book like mine, and that it has had such a response is significant. It is a very exciting time to be a historian, because you can sense that the lines are shifting – that a reflection is taking place that is leading to a different view of this aspect of history. And this reflection is also beginning to be translated into teaching.

In the UK, we are currently trying to integrate what we call ‘Black History’ into the school curriculum. At the moment, it is only an optional subject. But in Wales, where I live, the Welsh Assembly has already decided to incorporate it into the curriculum. This is an important step.

In France, since the Taubira law – which introduced the teaching of the slave trade into the primary school curriculum in 2002 – part of this history is already being taught. The situation varies a lot from country to country, and there is still a lot to be done, but it is moving in the right direction.

At this stage, I think it would be useful to provide teachers with tools so that they feel comfortable teaching these chapters of our history – which are not just about the history of slavery, abolition, or migration, but cover a much broader field of study.

“
Young Afro-Europeans are freer and more comfortable with having several identities

● **How have approaches to the memory of the slave trade in Europe evolved in recent years?**

The memory of slavery still meets with strong resistance. We see states oscillating between two extremes: victimization on the one hand, and amnesia on the other. States resist because this memory challenges their national narrative. And even when they celebrate personalities from the African continent who have left their mark on history, they fail to recognize the role that Afro-Europeans play today in everyday life.

As a result, I am uncomfortable with an approach that canonizes some at the expense of others, though I recognize that



© Matteo Roma / Shutterstock

this is obviously preferable to complete amnesia. Also, when we celebrate abolition, the historical aspect of black resistance is usually obscured.

Yet this resistance took place, particularly in southern Europe, where slave brotherhoods, initially founded to discuss religion, were, from the fifteenth century onwards, places of exchange and struggle against enslavement by their white masters. For example, the brotherhood of Nossa Senhora do Rosário dos Homens Pretos (Our Lady of the Rosary of Black People), was set up in Lisbon in 1470. The role of those who fought alongside the abolitionists is also often forgotten. The historical reality is therefore much more complex than what is usually presented.

● **What is the link between this history and the violence – particularly by the police – against black people?**

Discrimination and police violence have their origins in colonial history. The way black bodies are treated has to do with this history.

The Black Lives Matter movement was born out of anger but also out of pain, out of a feeling of powerlessness in the face of this discrimination. It has found an echo in Europe simply because this police violence echoes the discrimination suffered by black people.

In this respect, I notice that my children's generation has a very different approach to that of previous generations.

It is also a generation that is not afraid to defy the system or challenge the established order.

When I was a student, people thought that working hard to succeed would be enough to silence the racists. But it turns out that this is not enough.

Young people today no longer hesitate to speak out loud against the racism and discrimination they are subjected to. They are also freer and more comfortable with the fact that they have several identities – that of their parents, their origins, and of the society in which they are growing up.



▼ Black Lives Matter protesters in London, outside the American Embassy, May 2020.

The state of science across the globe

Mila Ibrahimova

UNESCO

In 2015, countries pledged to spend more on research as a share of gross domestic product (GDP) when they committed to the Sustainable Development Goals. According to the *UNESCO Science Report: The race against time for smarter development*, released in June 2021, research spending actually increased by 19.2 per cent between 2014 and 2018 – with almost half of this growth driven by China alone.

In spite of this progress, four out of five countries are still spending less than one per cent of their GDP on research.

The report also reveals that countries of all income levels now share a common agenda to transition to digital and green economies. But this will require a massive investment in modern infrastructure, such as high-performance computing, data centres, and solar and wind farms.

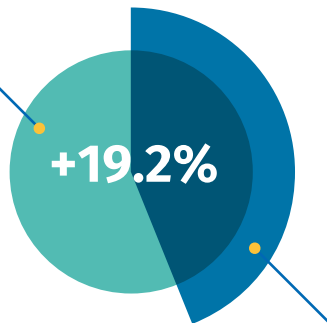
Energy is at the heart of this dual transition. In fact, renewable energy was the only energy sector to see growth in 2020, at the height of the Covid-19 pandemic.

WHAT DO YOU KNOW ABOUT THE STATE OF SCIENCE?

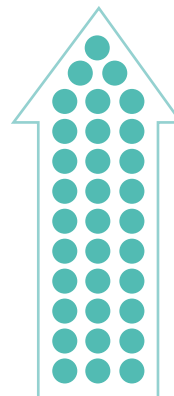
GLOBAL RESEARCH SPENDING

Between 2014 and 2018, global research spending grew

This outpaced the growth of the global economy



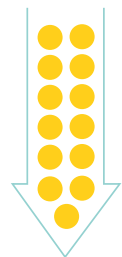
44% of growth in global research spending in 2014-2018 was driven by **China alone**



32
COUNTRIES

raised their research spending by 0.1% of GDP or more between 2014 and 2018, but research spending dropped in another

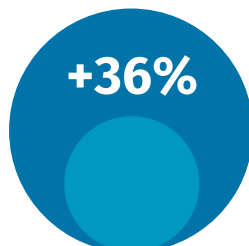
13
COUNTRIES



RESEARCHERS IN LOW-INCOME ECONOMIES

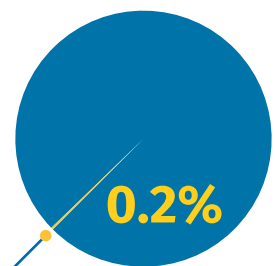
Fastest growth

Low-income economies have witnessed the fastest growth (+36%) in the number of researchers per million inhabitants since 2014 (in full-time equivalents)



Under-represented in global science workforce

Low-income economies account for only 0.2% of the global researcher pool (in full-time equivalents)



WHERE DO WE STAND?

EXPENDITURE



93% of global research expenditure was accounted for by the G20 countries in 2018

80% of countries still spend less than 1% of GDP on research

PUBLICATIONS



21% increase in **global scientific publishing** between 2015 and 2019

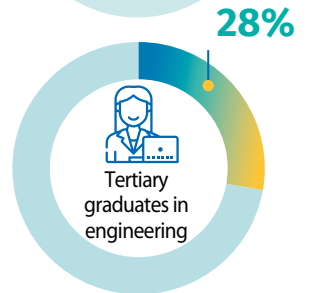
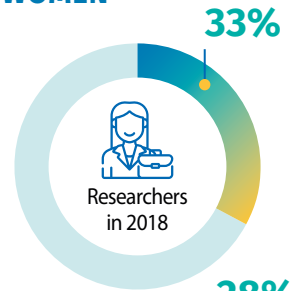
RESEARCHERS



13.7% increase in **global researcher pool** between 2014 and 2018 (in full-time equivalents)

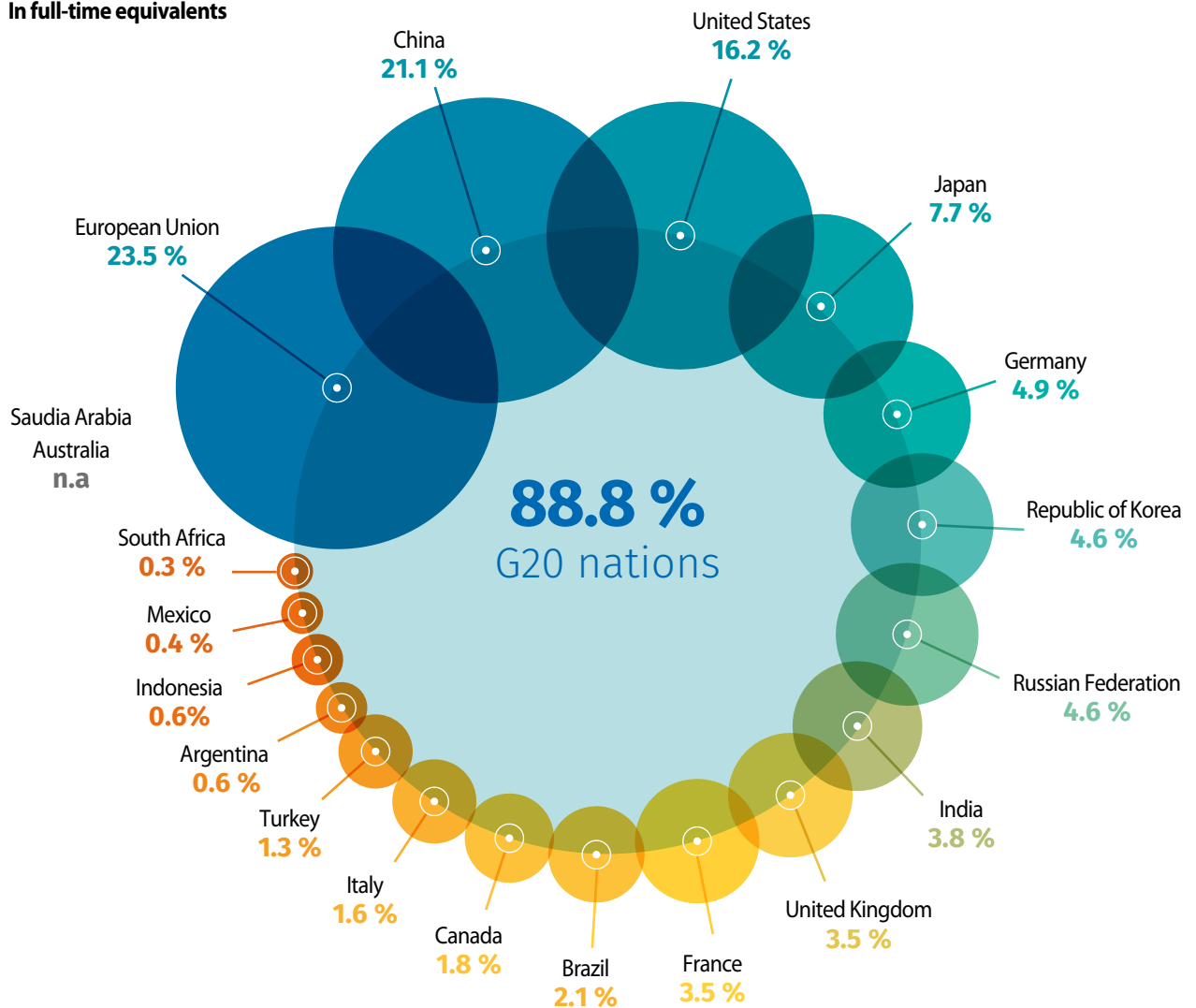
The researcher population grew almost three times faster than the global population in 2014-2018

WOMEN



GLOBAL SHARE OF RESEARCHERS FROM G20 COUNTRIES

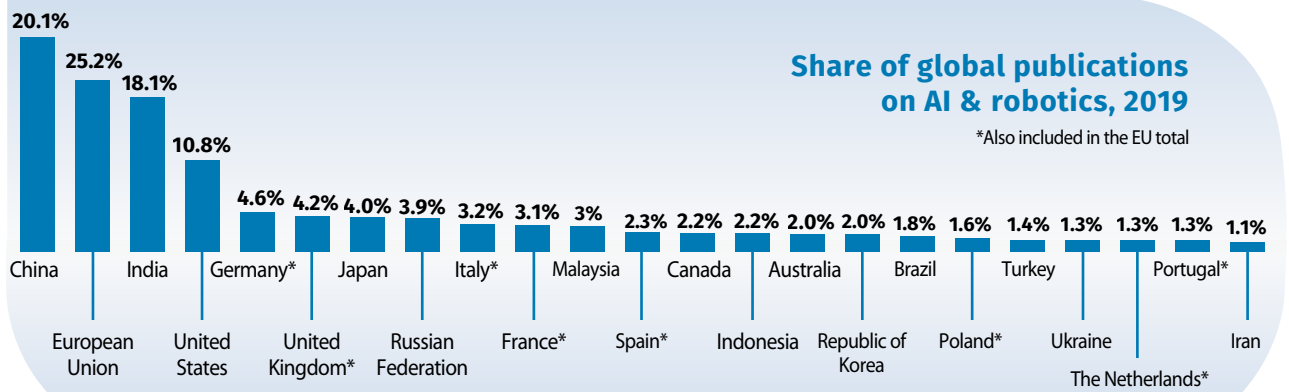
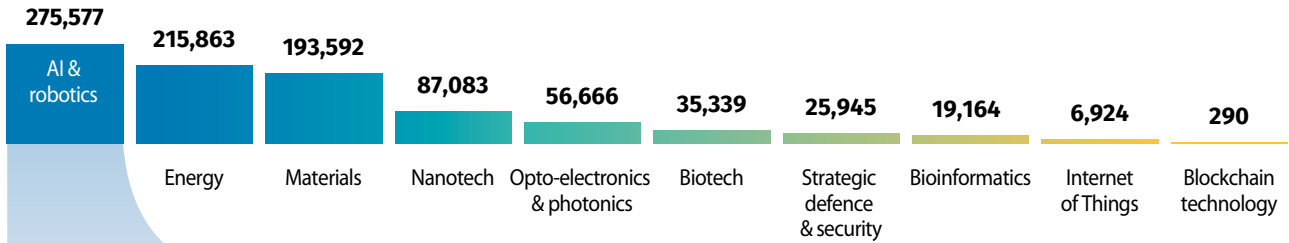
In full-time equivalents



Source: UNESCO Science Report, 2021

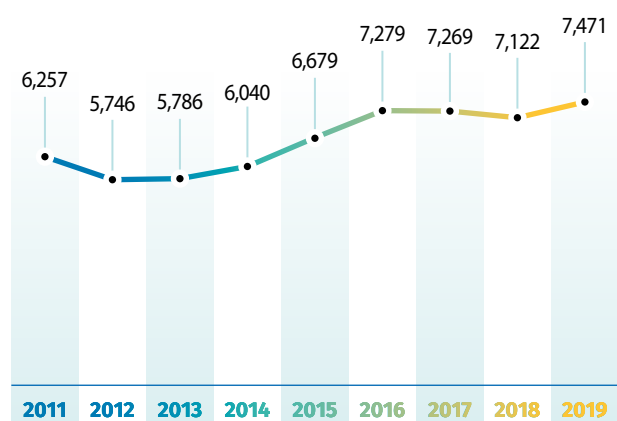
HOW SCIENCE SUPPORTS GREEN AND DIGITAL ECONOMIES

TOP CROSS-CUTTING TECHNOLOGIES IN GLOBAL SCIENTIFIC PUBLISHING, 2018–2019



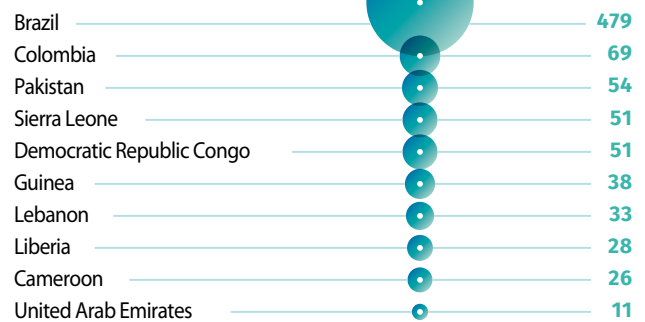
All countries listed contributed at least 1% of publications

There was little global research before Covid-19
Global trend in volume of publications on new or re-emerging viruses that can infect humans, 2011-2019



Top 10 countries for growth in scientific publishing on new or re-emerging viruses, 2019

For countries with at least 100 publications

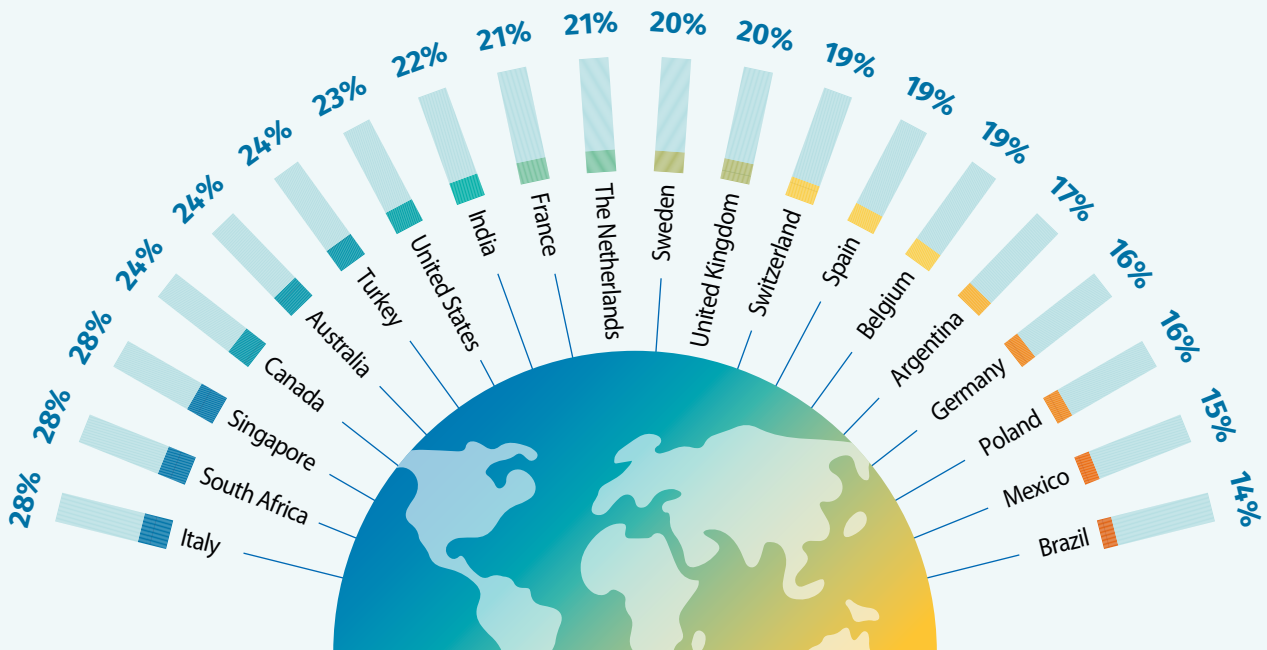


Reactive science

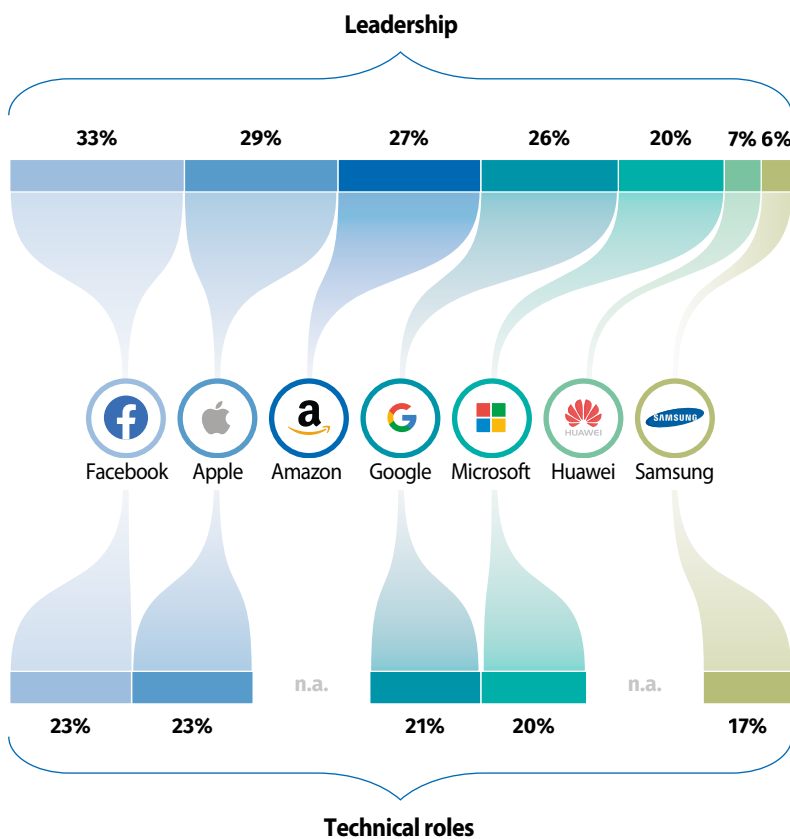
The top countries for growth in virus-related research had experienced an epidemic in the last decade

SCIENCE NEEDS MORE WOMEN

SHARE OF WOMEN IN TOP 20 COUNTRIES FOR SHARE OF PROFESSIONALS WITH AI SKILLS, 2017

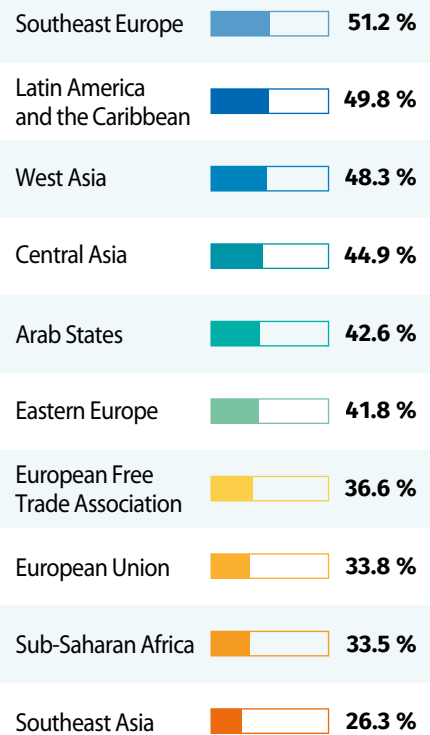


WOMEN IN LEADERSHIP AND TECHNICAL ROLES IN SELECTED TOP MULTINATIONAL TECHNOLOGY COMPANIES, 2018-2019



REGIONAL SHARE OF FEMALE RESEARCHERS, 2018

Data unavailable for a sufficient number of countries to obtain an average for South Asia



Source: UNESCO Science Report, 2021, using company data

Source: UNESCO Science Report, 2021

New publications



UNESCO Science Report

The race against time for smarter development

ISBN 978-92-3-100450-6
690 pp, 210 x 297 mm, paperback, €55
UNESCO Publishing

It is striking how development priorities have aligned over the past five years. Countries of all income levels are prioritizing their transition to digital and green economies, in parallel. This dual transition reflects a double imperative. On the one hand, the clock is ticking for countries to reach their Sustainable Development Goals by 2030. On the other, countries are convinced that their future economic competitiveness will depend upon how quickly they transition to digital societies.

This seventh edition of the report monitors the development path that countries have been following over the past five years from the perspective of science governance. It documents the rapid societal transformation underway – which offers new opportunities for social and economic experimentation but also risks exacerbating social inequalities, unless safeguards are put in place.



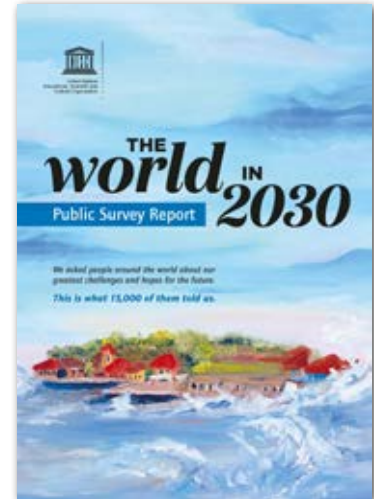
World Heritage No.97

People protecting World Heritage

ISSN 1020-4202
EAN 3059630101967
80 pp., 220 x 280 mm, paperback, €7.50
UNESCO Publishing/Publishing
for Development Ltd.

The World Heritage Convention is a unique legal instrument, protecting both cultural and natural sites. It has a broad reach, but it is only effective because of the people who implement it: site managers, local communities, young people, city authorities, heritage experts – the list goes on.

Part of UNESCO's role is bringing these people together and supporting the work they do. This issue features individuals who dedicate their careers – and sometimes, even their lives – to taking care of these precious and fragile sites.



The world in 2030

Public survey report

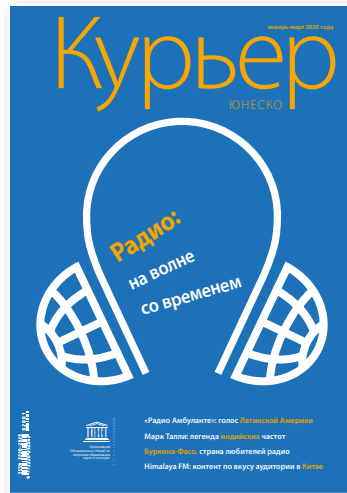
ISBN 978-92-3-100439-1
68 pp, 210 x 297 mm, PDF
UNESCO Publishing
Publication available on
<https://unesdoc.unesco.org/>

What are the biggest challenges to a peaceful society in 2030? What are the solutions most needed to address them? How confident do people feel that the challenges will be overcome, and how important is international co-operation for responding to them?

This survey collected responses from 15,000 people from all regions on these fundamental questions for the direction of our world over the next decade. From climate change and biodiversity loss, to discrimination and inequality, to violence and conflict, the results provide a systematic framework for action on the global challenges being faced around the world.

Many voices

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



Subscribe to the print version

1 year (4 issues) : 27€

2 years (8 issues) : 54€

Subscription fees cover printing costs.
There is no profit motive.

Subscribe to the digital version



It's 100% FREE

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

The 20th anniversary

of the UNESCO Convention
on the **Protection** of the
Underwater Cultural Heritage

Since its adoption in 2001, the Convention has served as the global legal framework for preserving historical remains that have been lying on the seabed for over a hundred years.



unesco

Protection of
the Underwater
Cultural Heritage