

The UNEP Magazine for Youth



TUNZA



for young people · by young people · about young people

TUNZA 2009 YOUTH CONFERENCES - What we want from Copenhagen

2010 - INTERNATIONAL YEAR OF BIODIVERSITY



‘We have to protect the Earth, not just for us but for future generations.’

Yugratna Srivastava at the UN High-Level Summit on Climate Change

TUNZA

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CONTENTS

Editorial	3
Big ask	4
What next?	6
Trees, not words	7
Vote for a voice	8
Meet the TYAC	8
Natural mimicry	10
Nature's R&D	11
So you think we know it all?	12
Keeping the pieces	14
Diversity counts	15
Life in depth	16
End of the line	17
The big ideas	18
Youth in the field	20
The forgotten kingdom	21
Seven invasive species	22



Partners for Youth and the Environment



UNEP and Bayer, the German-based international enterprise involved in health care, crop science and materials science, are working together to strengthen young people's environmental awareness and engage children and youth in environmental issues worldwide.

The partnership agreement, renewed to run through 2010, lays down a basis for UNEP and Bayer to enlarge their longstanding collaboration to bring successful initiatives to countries

around the world and develop new youth programmes. Projects include: TUNZA Magazine, the International Children's Painting Competition on the Environment, the Bayer Young Environmental Envoy in Partnership with UNEP, the UNEP Tunza International Youth/Children's Conference, youth environmental networks in Africa, Asia Pacific, Europe, Latin America, North America and West Asia, the Asia-Pacific Eco-Minds forum, and a photo competition, 'Ecology in Focus', in Eastern Europe.

International Year of Biodiversity



With more than half of us living in towns and cities, spending less and less time in direct touch with the natural world, it is not altogether surprising that a recent UK survey revealed that children have trouble identifying common wild creatures. Thirty-seven per cent could not identify a bee – more than a third mistook it for a wasp and some even confused it with a fly. And worryingly, only 26 per cent often go for walks in the countryside. They are not alone. Another survey found that two thirds of European citizens didn't know the meaning of 'biodiversity', the term we use to describe the variety of life on Earth and the natural patterns it forms.

That's why the Convention on Biological Diversity (CBD) supports UNEP's highly successful Billion Tree Campaign, and encourages hands-on learning experience through its Green Wave initiative.

Part of The Green Wave is a campaign for youth world-wide to plant a tree at 10 o'clock in the morning local time on 22 May – the International Day for Biological Diversity – creating a 'green wave' across time zones. Another part of The Green Wave is a biodiversity photo contest that aims to help young people take an interest in nature on the eve of 2010, the International Year of Biodiversity.

The goals of this significant year are to raise awareness of the importance of biodiversity and of steps that can be taken to prevent its loss. As Ban Ki-moon said in a June 2009 message: 'There is no better place to start raising awareness and inspiring action than in schools and families... I encourage students, parents and teachers to ride The Green Wave and spread the word.' I would like to second the Secretary-General's words and call on youth everywhere to join in the fight to save our most precious resource: biodiversity.

Dr Ahmed Djoghlaif
Executive Secretary
Convention on Biological Diversity

For more info, see <http://greenwave.cbd.int>

EDITORIAL

Five times in the last half billion years or so of the Earth's history, its entire web of life has been ripped apart by a mass extinction, in which up to 95 per cent of its species may have been lost. After each one, it took the natural world millions of years to recover and, when it did, it was fundamentally different from what had gone before. Mammals got their chance to flourish, for example, after the last mass extinction – some 65 million years ago – finished off the dinosaurs. In the words of the great paleoanthropologist and conservationist Richard Leakey, such catastrophes 'restructure the biosphere'.

Now it is happening again. But whereas all the previous ones had natural causes – such as a massive meteor strike as with the death of the dinosaurs, or sudden global warming or cooling – this time we are responsible. For the first time ever, one species is threatening all the others, as humanity increasingly takes over and destroys the world's natural habitats. Extinctions have, of course, always happened; only about 3 per cent of the species that have ever lived are alive today. But now they are occurring at 1,000 or even 10,000 times the natural rate. Half of all the world's current species are expected to disappear by the end of the century. To say that the effects would be devastating does not even begin to do justice to the consequences.

Early this century the world's governments repeatedly promised to avert this growing disaster within the decade. European heads of state resolved in 2001 that 'biodiversity decline should be halted with the aim of reaching this objective by 2010'. The following year, Parties to the Convention on Biological Diversity – now made up of over 190 countries – committed themselves to 'a significant reduction' in the rate of biodiversity loss by the same date, and the world's governments adopted the same target at the World Summit on Sustainable Development in Johannesburg.

Yet we now stand on the threshold of the target date and nothing has changed. If anything, the rate of loss has increased; the approach of the sixth great extinction has speeded up. This whole-scale failure is a betrayal of the planet and of our, and succeeding, generations. We must do everything we can to ensure that this wasted decade is not repeated, that the world finally slows and then halts the appalling rate of artificial extinction, for the sake of life on Earth itself.



Big ask

The vast conference room buzzed with the energy and voices of 800 young people between the ages of 10 and 24, representing more than 100 countries. As they huddled at circular tables in groups of 10, language, age and cultural barriers disappeared as they focused on a single task: finalizing a statement asking world leaders – on behalf of the world's 3 billion young people – to take decisive action against climate change at the Copenhagen talks in December 2009.

The week-long Tunza International Children and Youth Conference, in Daejeon, Republic of Korea, in August, was one of the largest ever international gatherings of young people calling for climate change action. UNEP combined its children's conference and its youth conference for this Global Town Hall to support the United Nations-led Seal the Deal campaign.

Seal the Deal set out to galvanize public and political support for a fair and comprehensive global climate agreement in the last few months before Copenhagen. It included an online petition and rallies in 100 capitals around the world.

'Young people's voices will and must be heard because they will inherit the outcomes of our actions,' says UN Secretary-General Ban Ki-moon.

Future leaders

During the Tunza Conference, UNEP's Executive Director Achim Steiner led a dialogue between young people and a panel that included Korean Prime Minister Han Seung-soo, Environment Minister Lee Manee and eco-adventurer David de Rothschild.

'I believe you, the future leaders of the world, will do the best job of looking after our fragile planet Earth,' said the Prime Minister. 'There is an old Chinese adage, "A crisis poses danger, but it also presents opportunity". I hope we will all make the wise choice to seize the moment and turn this crisis into an opportunity.'

Mr Steiner then opened up the discussion to the youth, asking what they already do, and what young people could offer.

Marisol Becerra, from the United States of America, told how her community youth project in Chicago maintains a Google map documenting the city's toxic sites, such as coal-fired power plants, and the health problems they cause. 'I hope that everyone here and in Copenhagen makes public health a priority,' she added.

'In my province, a company proposed building a coal-fired power plant, which my organization then stopped by actively opposing it,' said Edgar Geguinto. 'Then our province was struck by an oil spill, the biggest in the Philippines, which destroyed much biodiversity. But for three years afterwards, local youth organized and cleaned up the river. We have the power to change the world.'

When Mr Steiner asked what young people would do if negotiations at Copenhagen failed, the answers from around the room were swift and forceful. All agreed that giving up is not an option.

'Intergovernmental conferences have never greatly influenced my work,' said Linh Do, who started a campaign to change a million light bulbs in Australia. 'If nothing comes out of Copenhagen, I will feel even more motivated to continue my current environmental work – it will be that much more urgent.'

Building steam

During the eight weeks before the Global Town Hall meeting, young people around the planet had hammered out a draft statement using the new web-based networking platform <http://uniteforclimate.org>. Then, in Daejeon, participants considered each item in the draft, debating changes and additions. More than 200 young people in 15 cities around the world – including Cuernavaca (Mexico), Nairobi (Kenya), Canberra (Australia), Bangkok (Thailand), Vancouver (Canada) and Athens (Greece)



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– contributed to the proceedings in real time via the web.

As each table agreed on changes, volunteer facilitators sent them via laptops to a designated group – the 'Theme Team' – who collated comments and redrafted the statement on the spot. After three hours, the revised document was ready. Wireless keypads let the entire room vote on each change, and the final version was read out to a cheering crowd.

Hannah Aulby, from Australia, appreciated how the process and technology gave each participant an equal voice. 'It was very democratic. At other conferences I've attended, the strongest personalities, loudest voices or most sophisticated lobbying powers got their way.'

Delegate Joon Ho Yoo, from Busan, Republic of Korea, enjoyed the opportunity to work directly with younger people. 'I was surprised that, although they were younger than me, they had so many innovative ideas. I learned a lot from them.'

Finalizing the statement was the culmination of a day filled with impassioned discussion about climate change, the active role youth are already playing, and their hopes for the future.



Karen Eng



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'In many ways this process of coming to an agreement on a final text mirrors what will happen in December in Copenhagen,' said Achim Steiner, who pledged to take the statement to the September 2009 High-Level Summit on Climate Change convened by the UN Secretary-General Ban Ki-moon. The statement was also sent to government leaders throughout the world.

'It is very important to include the voice of children and youth in every environmental decision. It is our request to all politicians that they please take this statement into consideration in Copenhagen,' said 13-year-old Yugratna Srivastava from India (pictured with Al Gore on the front cover), who addressed the High-Level Summit on behalf of the world's young people, and presented the statement.

Never give up

'Sealing the Deal is important, because it would acknowledge climate change to be a critical global issue,' said Walid Amrane, from Algeria. 'But if nations can't agree, civil society – particularly young people – will have to initiate a bottom-up process. Individuals will have to spread information, support innovation and change minds. We must not be victims, but actors.'

The youth statement is made on behalf of the world's 3 billion people under the age of 25, and asks governments, citizens and youth to commit to taking action on climate change. Here are some excerpts. For the full text, visit www.unep.org/tunza.

Listen to our voices

The future needs strong vision and leadership.

We, young people – 3 billion of the world population – are concerned and frustrated that our governments are not doing enough to combat climate change. We feel that radical and holistic measures are needed urgently from us all.

We request our governments to:

- have strict laws and enforcement against those who pollute and degrade the environment;
- transition toward a green economy;
- make engaging environmental education mandatory in schools and universities.

We appeal to all citizens of this planet to:

- develop and promote the infrastructure and use of public transportation and eco-friendly alternatives;
- engage in environmental campaigns and education;
- commit to sustainable lifestyles to reduce carbon footprints.

As young people, we will:

- engage in environmentally friendly activities especially planting, nurturing and protection of trees;
- communicate environment and climate change through the media and social networks like uniteforclimate.org, Facebook and Twitter, and develop environmental websites;
- support and promote the efforts of the UN Secretary-General to Seal the Deal in Copenhagen.

What next?



Conferences are one thing, but what happens once they are over? After the Global Town Hall (see pages 4-5), Tunza youth delegates got down to working out what to do next. They held regional and sub-regional meetings, where they caught up on each other's projects and discussed action plans for the next two years.

'It's good to find out about the environmental concerns and youth projects in Asia-Pacific,' said Alok Basakoti from Nepal. 'Water pollution was mentioned a lot, as were melting glaciers and the unwise use of water.' He added: 'When I return to Nepal, I will organize a Seal the Deal seminar, petition and rally.'

Nolana Lynch, from Tobago, said the Latin American regional meetings helped her gain perspective on the effects climate change is already having on her country. 'Coconut trees are being uprooted by seawater and the changing seasons mean mangos ripen in January instead of June,' she reported. 'As a region, we have much to do, made harder because we speak English, French, Portuguese and Spanish, so we are all translating for each other.'

Each region's plans reflected on the last 100 days before December's Copenhagen Conference, including educating and mobilizing young people, asking governments to Seal the Deal, and spreading the word through the internet.

Delegates also found out what their peers were doing in other parts of the world. They heard, for example, about Ella Bella Constantinides' striking Miss Earth pageant in South Africa, recognizing young women's environmental commitment and involving them in activities like planting community vegetable gardens and conserving wildlife.

like a spider's web: if some parts are destroyed, the whole web loses balance,' said Kyu Hwan Lee, from the Republic of Korea.

Field trips – such as to Uam Historical Park and a cultural centre that taught traditional tea making – rounded off the



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week. Heather Smith from the United States went to a local river to learn about freshwater fish. 'We used traditional nets made of bamboo and string to catch fish. One person holds the net under the water, while the other splashes to herd fish into it. The guide told us about the individual species and explained their roles in the ecosystem.'

Emilio Perez from Argentina said. 'When I go home, I'll visit the education minister to ask for environmental education to be added to school curricula. I had this idea before I came, but attending the Tunza conference has given me resources and tools such as contacts, the youth statement and printed materials like TUNZA magazine. Being associated with UNEP means I am more empowered. Maybe now I'll have a voice.'

SPOTLIGHTS • SPOTLIGHTS • SPOTLIGHTS

Crafty solution

Margaret Koli works alongside wardens in Kenya's national parks, clearing wire snares laid by poachers to catch elephants and antelope. 'My group, Youth for Conservation, takes the snares to craftspeople, who twist them into decorative animal figures and sell them to fund the project.' The group hopes that youth action will inspire Kenyans to appreciate the country's natural heritage. See www.youthforconservation.org



Karen Eng



Karen Eng

Svetlana Unru, from Tajikistan, spoke of helping poor mountain village communities build solar greenhouses and energy-saving wood stoves, while Canadians Darrick Lee and Michael Darnel performed an award-winning rap about reducing ecological footprints.

Workshops on sustainable cities, youth and climate change, environmental governance, climate change and biodiversity offered a chance to take on new ideas. 'In the biodiversity workshop, I was struck by the idea that the environment is

Platform heals

Anne Walraven, the European Tunza Advisor from the Netherlands, has just launched an online platform that consolidates details of youth environmental initiatives in one place. 'The idea originated in the European regional meetings at the 2007 Tunza Youth Conference,' she says. 'I met someone who was doing a similar project but we didn't know about each other. Now the project has gone global.' See www.bigamma.net

Fishy business

Maribel Ramos works with a Bolivian youth environmental organization, Quanrakyu, which focuses on protecting one of the country's most important wetlands, Lago Uru Uru. 'The lake used to be full of fish, but now local people can't eat them, thanks to litter and mining waste,' she said. 'My group visited schools, talking about ecological hazards. The local government took notice and decided to clean up the lake, with our help. We also teach school children how to make things out of recycled rubbish.'

Sprouting bulbs

Richard Merritt, from the United States, calls his Let's Raise a Million campaign an 'urban ecological student project'. Students replace incandescent bulbs with energy-saving ones



Juventud Ecologista en Accion

(CFLs) in the homes of low-income, ethnic minority families, free of charge, and return after three months to see how much they've saved on energy bills. In the first phase, Richard's team replaced 1,200 light bulbs in more than 130 homes. In the second, with the help of high-school volunteers, they changed more than 5,000 bulbs in 400 homes. 'People from ethnic minorities are the least represented people in the climate talks,' he says. 'We want to help those who can't afford CFLs because they are more expensive than incandescents.' See www.letsraiseamillion.org



Let's Raise a Million

Trees, not words



Achim Steiner, Executive Director of UNEP, along with the United Nations, supports 11-year-old Felix Finkbeiner, who has pledged to plant a million trees in Germany. You too can join his quest for climate justice. Visit www.plant-for-the-planet.org



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'Children want to plant millions of trees worldwide: one million in each country,' say 11-year-old Felix Finkbeiner from Germany and 13-year-old Yugratna Srivastava from India.

The two were among the most active participants at the Tunza International Children and Youth Conference, tirelessly promoting their new campaign: 'Stop Talking, Start Planting'. It asks children worldwide to organize tree plantings to draw attention to climate change, especially in the run-up to Copenhagen.

'On 29 September, we announced the campaign at a press conference in Austria, and children between the ages of 10 and 14 all over the world started planting in their countries,' said Felix.

Yugratna added: 'That day, I asked the children in my own country to plant trees too. India's quite big, so I hope I'll get the support we need.'

Felix founded the campaign after seeing *An Inconvenient Truth* when preparing a school presentation about climate change. 'Then I found out how Wangari Mathaai planted 30 million trees in 30 years, and about UNEP's Billion Tree Campaign,' he recalls.

'Stop Talking, Start Planting' supports the UNEP campaign, which encourages individual people, communities, business and industry, civil society organizations and governments to plant trees. UNEP's most recent goal is to plant a total of 7 billion trees by the end of 2009. So far, nearly 6.5 billion have been pledged, and 4.3 billion planted.

Felix explains: 'Each tree takes up 10 kilograms of carbon every year. Trees also help supply us with freshwater, and protect biodiversity.'

'If we get a network of children planting millions of trees in say 50 or 100 countries,' added Yugratna, 'politicians and environmental leaders will listen.'

Vote for a voice

'You are giving these young people a mandate to represent you,' said Theodore Oben, Head of UNEP's Children and Youth Unit, to 220 youth delegates assembled in Daejeon, Republic of Korea, as they prepared to elect the new Tunza Youth Advisory Council (TYAC).

The election, which took place at the Tunza International Youth Conference, generated excitement. After getting to know each other over the course of the Conference, delegates selected two peers from each of UNEP's regions – Africa, Asia and the Pacific, Europe, Latin America and the Caribbean, North America, and West Asia – for two-year terms of office. Global indigenous youth also won representation for the first time, bringing membership of the council to 14.

Among their responsibilities are raising environmental

awareness among young people, advising UNEP on ways to better engage youth, and helping to build and facilitate networks around the globe. They also lead youth direct-action campaigns in their regions.

Meanwhile, UNEP works to give the TYAC – and through it the youth of the world – a voice at international environmental negotiations, such as its annual Governing Council meetings.

'The people you are electing today speak at most of these forums,' explained Oben. 'Young people have a seat, just like every minister, and make their voices heard, telling leaders things that they usually don't hear.'

'So you need to make sure to choose a group who will speak on your behalf – and keep you informed afterwards.'

Meet the TYAC: just after the election, the new members spoke to TUNZA.

GLOBAL INDIGENOUS

Yaiguili Alvarado García (Kuna), Panama



Indigenous people are very connected with nature, so everything that is lost in biodiversity affects us. There are networks of indigenous organizations, but they're not connected to UNEP and youth

movements like Tunza. Engaging the world's indigenous youth won't be easy: every other region has a UNEP office, for example, but we don't. The first step is to start making links.

Lea Simma (Sami), Sweden



It will be exciting to see how indigenous representation will make a difference, because we've never had it before. This will be a good opportunity for indigenous youth to start working together more for

the environment. Rallying them has been a challenge, as we live all over the globe, making communication difficult.

AFRICA

Walid Amrane, Algeria



I plan to promote more youth participation at the decision-making level at intergovernmental climate negotiations. I will also actively support the Seal

the Deal campaign in the run-up to Copenhagen. But my first priority is to consolidate the African network, improving communication and exchanging information on lessons learned.

Kevin Odhiambo Ochieng, Kenya



Africa is one of the regions most vulnerable to climate change, yet one of the most innocent of causing it. Therefore, as a TYAC member, I plan to promote the

idea of climate justice, starting with fair representation for African youth on international platforms. I hope to help increase African youth participation during the climate

change negotiations, as well as afterwards. Whatever decisions are made there, it will be just the beginning.

ASIA AND THE PACIFIC

Linh Do, Australia



One of my goals is to engage more with the indigenous people of Australia, to help their voices be heard. I also want to make sure that the Pacific islands

– often forgotten about in Australia – are always given consideration in environmental discussions.

Edgar Geguiento, Philippines



I would like to involve more youth, especially from developing countries, in environmental projects. I also want the many environmental organizations for

youth in Asia and the Pacific to receive global recognition. And I want to set a good example for others.

EUROPE

Joeri Lagrou, Belgium



I am already planning a meeting of young European environmentalists. Building networks helps everyone stay focused and motivated. Governments are also more likely to

listen to young people if we gather in greater numbers. In the run-up to Copenhagen, we organized a tree-hugging campaign for 350.org's day of action on 24 October. We're also looking for ways to engage the media, an important way to get in touch with many people at once.

Diego Le Gallou, France



I plan to go to Copenhagen and send information from within the Climate Conference to activists. Many decisions are made behind closed doors, and it's important for citizens to know

what governments are doing.

LATIN AMERICA AND THE CARIBBEAN

Alonso Lizaraz, Venezuela



I hope that I can help create a more unified network of youth within the region. I know I have the support of my peers; together we're going to do a great job.

Florencia Caminos, Argentina



I have been working with Tunza since 2007, and the Latin American region has a lot of things to say about environmental protection. As a TYAC member,

I look forward to the opportunity to work with the other global regions to exchange project ideas.

North America

Marisol Becerra, United States of America



My priority is to establish communication with environmental justice organizations. I'd also like to strengthen the

North American youth environmental base. My region emits much of the world's pollution, which affects the rest of the world. Yet there's very little representation from this region here at the Tunza Conference.

Lisa Curtis, United States of America



I'm looking forward to gathering youth leaders in North America to work with Tunza youth from all UNEP's regions. There is quite a strong

climate movement in the United States right now, PowerShift, but it's not linked with the UNEP youth movement, so I'll be making this a priority.

WEST ASIA

Mirna Haidar, Lebanon



My hope is to help the youth of my region to get involved in the environment, rather than violence and conflict. Unfortunately, because of the

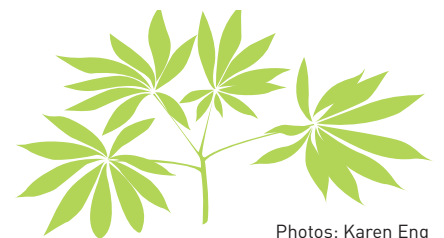
political situation, it's difficult for them to work together. But children and youth have the spirit of peace and hope. When it comes to the environment, we should all be present.

Shaikha Alalaiwi, Bahrain



My priority is to lead my region by organizing workshops and conferences, as education and information are key. I also want to encourage ties between youth

of different countries in my region, so that together we can help resolve climate change issues peacefully.



Photos: Karen Eng

2007-2009 TYAC members say **farewell**

Sara Svensson (Sweden) Europe

Before I became a TYAC member, I had been involved in environmental work for a long time. But my experience as a TYAC taught me how to participate at a more global political level. Tunza was also a springboard for me to become involved with the global UNFCCC International Youth Climate movement, which is something I encourage everyone to do.

Margaret Koli (Kenya) Africa

Serving on the TYAC has helped me gain confidence and skills through presentations, creating networks, lobbying and doing research on climate change issues – which will help me in my future environmental work. I have learned a lot about how closely economic and environmental concerns are linked; I plan to explore this further in my graduate studies.

Natural mimicry

Fabrics that respond to changing temperatures by opening and closing like pine. Strong fibres produced without heat or toxins, just as a spider spins its web. Films that help capture water on buildings by mimicking the bumpy shell that the Namib desert beetle uses to collect water from fog.

Such is biomimicry, just a few examples of this emerging discipline that studies nature and applies its designs and processes to meet human needs, sustainably.

And what better teacher? 'Animals, plants and microbes are consummate engineers. They've found what works, what is appropriate and – most important – what lasts on Earth,' says Janine Benyus, president of the Biomimicry Institute based in the 'garden city' of Missoula, Montana.

'The natural world is the result of 3.8 billion years of research and development. What surrounds us are the success stories. And fossils,' she notes, 'are failures.'

Inventors have long been inspired by biology. The Wright brothers watched birds flying as they invented and built the world's first successful aeroplane. The hooks of the burs that stuck in his dog's fur inspired George de Mestral to invent the familiar hook-and-loop fasteners of Velcro.

'But much human innovation has been characterized not by copying but by conquering and exploiting nature,' says Benyus, who received one of UNEP's Champions of the Earth awards this year. 'Materials scientists call industrial processes "heat, beat and treat" – heat materials up, beat them with high pressures and treat them with chemicals. They end up with 4 per cent

product and 96 per cent waste. That's how we make things.'

This approach has caused biodiversity loss, climate change, water shortages and agricultural systems that rob soil of nutrients. Destroying its own habitat doesn't bode well for the continuing success of the human species.

'That's why we should ask, "how does life meet our needs?";' says Benyus. Nature works at optimum efficiency, she points out, taking and expending only as much energy as necessary, and emitting waste into a system where it is recycled to nurture something else.

'The secret is that life creates conditions conducive to life. It builds soil, cleans air, cleans water and mixes the cocktail of gases that we need to live. That's what ecosystems do: they create more and more opportunities for life, while meeting their own needs.'

Valuing nature as a source of ideas rather than just goods both provides ways of adapting better to life on Earth and offers endless possibilities for life-enhancing innovation.

Studying the roots of a mangrove tree could provide an efficient way to desalinate seawater. Examining microbes that remove metals from water could teach us how to make the most of industrial waste. Watching chimps choosing plants to eat when they feel ill could uncover useful medicines, while learning how corals build with carbon dioxide might lead to construction methods that sequester the gas, not emit it. Cities could be modelled after healthy ecosystems, and agriculture after the perennial polycultures of prairies.

But it's not just a matter of stealing the blueprint and running away with it. Biomimicry also sets a standard by

which any innovation can be judged. Does it promote life? Does it fit with the environment? Will it last?

'Organisms have figured out a way to do the amazing things they do while taking care of the place that will take care of their offspring,' says Benyus. So could humanity.

Why is such a common-sense idea only now catching on? Benyus thinks it's a convergence of several factors. First is scientific capacity. 'Biological knowledge is doubling every five years,' she says, 'and for the first time in history, we have instruments to observe the shiver of a neuron in thought or to watch in colour as a star is born.'

Another factor is communication technology, facilitating exchange across disciplines. The Biomimicry Institute's asknature.org, for instance, aims to organize biological information according to its design and engineering function, making it freely available to designers, architects, engineers or students – anyone looking to solve a design challenge.

Besides, she says, biomimicry is now catching on because it must. Earth has reached its capacity to sustain humanity, presenting 'an opportunity for us to leap to a new phase of coping, in which we adapt to the Earth rather than the other way around,' she says.

'I think biomimicry's greatest legacy will be more than a stronger fibre or a new drug. It will be gratitude, and from this, an ardent desire to protect the genius that surrounds us.'

www.biomimicryinstitute.org
www.asknature.org

Janine Benyus' path to biomimicry

1. Quieting human cleverness: acknowledgement that nature knows best.
2. Listening to nature: the best way to learn from nature is to immerse oneself in it.
3. Echoing nature: trying to mimic what is discovered. This requires collaboration across such disciplines as biology and technology.
4. Protecting the wellspring of good ideas through stewardship: seeing nature as a source of inspiration, a mentor, leads to safeguarding naturalness.



Bryony Schwan

NATURE'S R&D

◀ Termite mounds remain at a near-constant 31°C, while outside temperatures range from 3°C to 42°C. Architects and engineers modelled their ventilation system on this when building the nine-storey Eastgate Building in Harare, Zimbabwe, which needs no air-conditioning and uses 90 per cent less energy than conventional buildings of the same size.

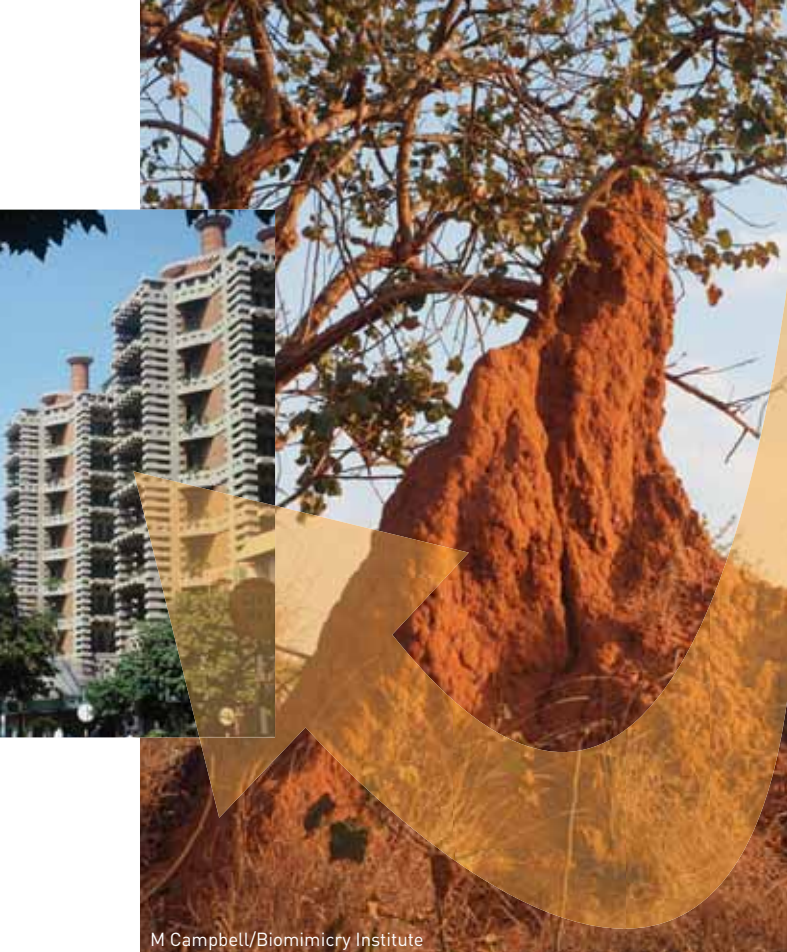
When Japan's Shinkansen Bullet Train emerges from tunnels at 322 kilometres per hour, the change in air pressure creates a loud boom. The train's chief engineer Eiji Nakatsu, a bird watcher, noticed that kingfishers travelled at great speed through two substances – air to water – with no splash. When the front of the train was remodelled to the shape of a kingfisher's beak, it became quieter, faster and more energy efficient.

◀ The leaves of the *Nelumba lucifera*, a lotus known for its water-repellent properties, look smooth, but in fact have tiny crevices that trap air on which water droplets float. A tilt in the leaf then causes them to roll off along with particles of dirt. Microscopic surface additives mimicking this effect now help paint, glass and fabrics repel water and stains, reducing the need for environmentally harmful cleaning products.

Trees arrange their cells to maximize strength and flexibility while minimizing the use of energy and resources. The engineers at GM Opel reproduced the pine tree's material and structural properties in car components, making its 'bionic car' 25 per cent lighter – and therefore more energy efficient – than others in its class, while still crash-safe.

◀ Humpback whales can swim in tight circles despite their size, producing nets of bubbles to catch krill. Such agility is attributed to tubercles – large, irregular bumps found on the leading edge of their fins, which help maintain channels of fast-moving water across the flipper, improving lift by 8 per cent and reducing drag by 32 per cent. Similar structures are now being applied to wind turbines to increase efficiency, and could improve aeroplane performance and safety.

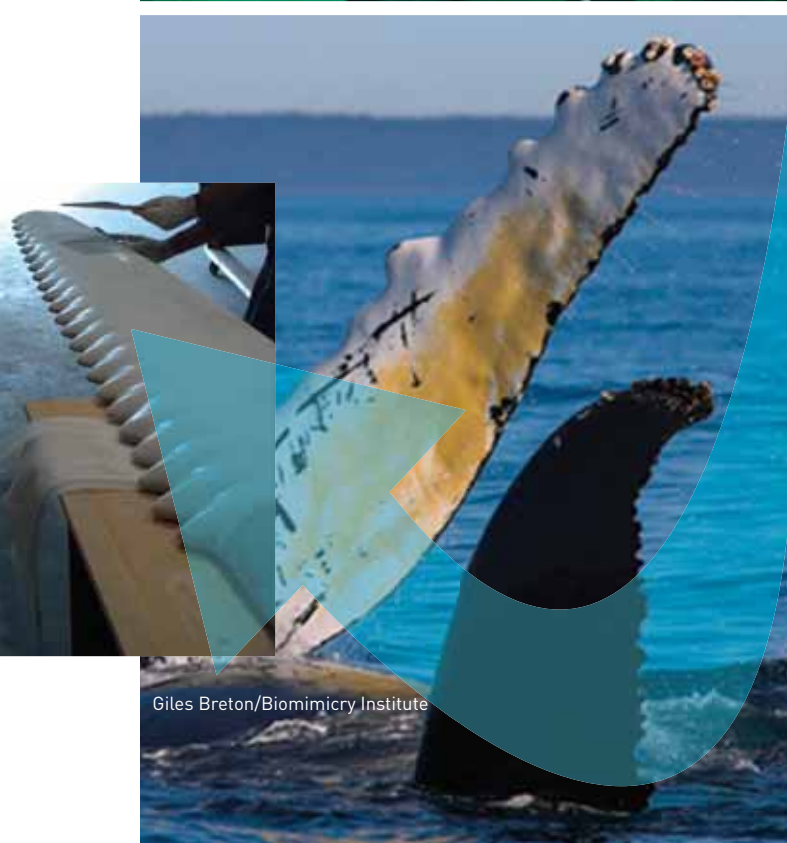
The Galapagos shark repels bacteria with denticles – small tooth-like structures on its skin. A surface developed to mimic this phenomenon is used in hospitals to minimize the need for chemicals and address the problem of infection without contributing to bacterial resistance.



M Campbell/Biomimicry Institute



Sto Corporation/Biomimicry Institute



Giles Breton/Biomimicry Institute

So you think we know it all?

Biological diversity (or biodiversity in its abbreviated form) is a term used to describe the complexity of life on Earth. Not only does it refer to the variety of species, but also the diversity of genes and of ecosystems. Although we have just begun to familiarize ourselves with the vastness of the natural world, human activities are putting biodiversity on the line.

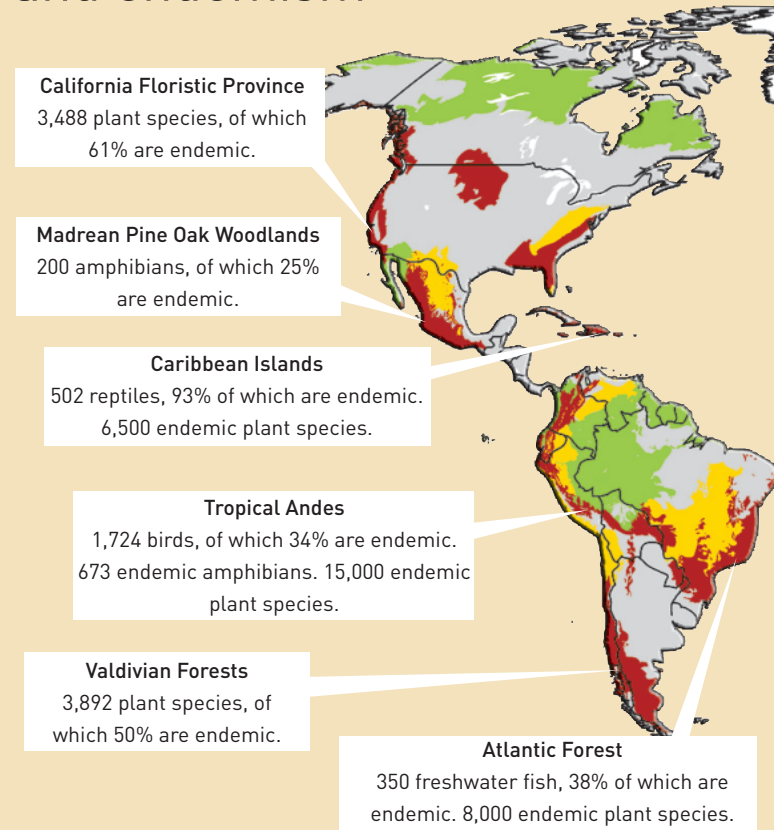
Knowns and unknowns

Estimates suggest that science is familiar with a small fraction of the world's biodiversity. Some ecosystems are relatively untouched by science – only 5 per cent of the deep sea has been investigated – and new species still reveal themselves in more familiar territories. This comes as no surprise when we consider that a typical patch of tropical rainforest, just 10 kilometres square, contains up to 1,500 species of flowering plant, 750 species of tree, 400 types of bird and 60 species of amphibian. Insects are super-abundant, with as many as 42,000 species to a single hectare: a study in Panama found 1,200 species of beetle in 19 trees that were new to science.

	Described species	% of estimated total	Level of accuracy
Viruses/bacteria	8,000	< 1	very poor
Protozoa/algae	80,000	< 15	very poor
Vertebrates	52,000	> 95	good
Insects/myriapods	960,000	< 15	poor
Arachnids	75,000	< 15	moderate
Molluscs	70,000	c. 40	moderate
Crustaceans	40,000	c. 30	moderate
Nematodes	25,000	< 10	poor
Fungi	70,000	< 5	moderate
Plants	270,000	> 80	moderate
	c. 1,650,000	< 15	poor

Source: UNEP-WCMC/AAAS

Status of terrestrial ecoregions and endemism

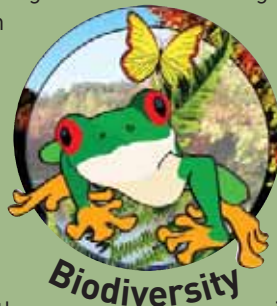


What's reducing biodiversity?

With rates of extinction 1,000 times higher than normal rates in the fossil record, human activities today are causing a sixth mass extinction of life on Earth – the fifth referring to the disappearance of dinosaurs 65 million years ago.

From sabre-tooth cats 10,000 years ago to the passenger pigeon in the 20th century, humans have hunted species to extinction. We have introduced alien species to ecosystems, thereby exterminating the indigenous species that have evolved no defences against them. In the 1960s, for instance, the predatory Nile perch was introduced to East Africa's Lake Victoria, wiping out 50 species of indigenous cichlid fish. Over the last century, an estimated 75 per cent of crop genetic diversity has disappeared, as plant breeders worldwide grow only the most economical

varieties of crop at the expense of other varieties. China now grows just 1,000 wheat varieties compared to 10,000 in the 1950s.

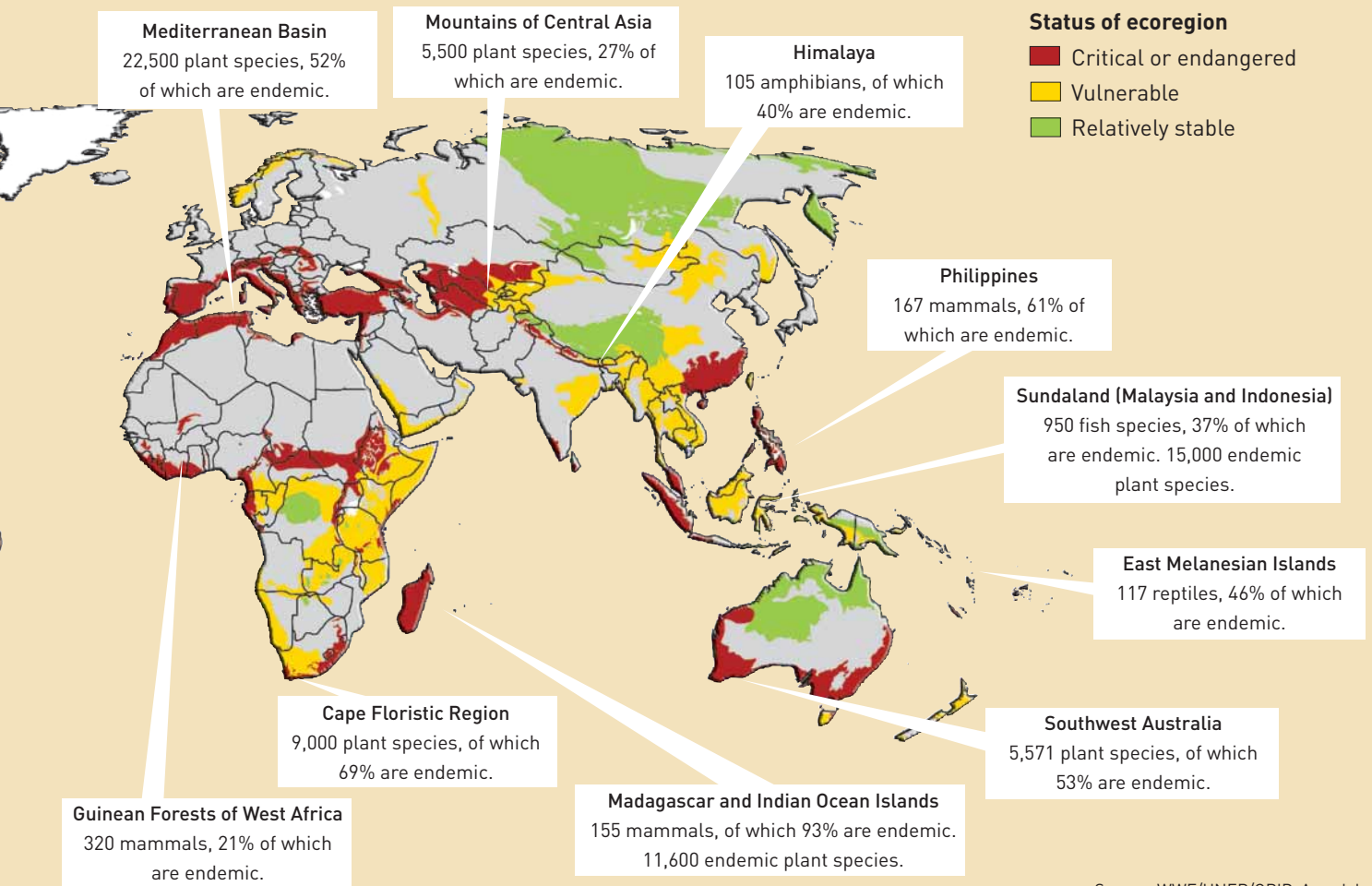


By far the greatest cause of species extermination today is habitat destruction. Tropical rainforests, thought to contain half of global biodiversity, are disappearing at an alarming rate. New Guinea, which boasts 8 per cent of the world's biodiversity on just 0.5 per cent of its land, is losing up to 1.7 per cent of its rainforest annually. Meanwhile, heat-sensitive ecosystems are finding it difficult to cope with rising global temperatures. By the year 2000, warmer oceans were instrumental in degrading 27 per cent of the world's coral reefs – species-rich marine ecosystems that harbour over a quarter of all known fish.

Terrestrial ecoregions

WWF, the global conservation organization, identifies 200 terrestrial ecoregions – defined as ecosystems with wide varieties of endemic species (those found nowhere else on Earth) and a priority for conservation. The WWF study found 47 per cent of these terrestrial ecoregions to be endangered or in a critical condition, 29 per cent to be vulnerable and the rest stable.

Just 45,000 known species have been assessed for their conservation status and 38 per cent of these are threatened with extinction. But efforts to conserve biodiversity are being made. Around 12 per cent of the world's land surface lies within a protected area, and species like the grizzly bear, the bald eagle and the green sea turtle have been brought back from the brink of extinction.



Source: WWF/UNEP/GRID-Arendal

What we stand to lose

The genes, species and ecosystems of today are the ones alongside which humans have developed, and on which we continue to depend. Plants, for example, stabilize soils, sequester carbon dioxide and provide us with fibres, resins and building materials. In particular, biodiversity makes an incalculable contribution to human health and food security.

Roughly 80 per cent of the developing world relies on biodiversity for remedies, while the majority of drugs can be linked to plants, fungi and bacteria. Most food crops depend on genetic diversity to provide them with a regular infusion of wild genes to maintain their resistance to ever-evolving pests, or the ability to adapt to changing climatic conditions. Biodiversity loss reduces the likelihood of deriving new medicines from the natural world. It also threatens our food security, as the genetic resources which could help major crops adapt to a changing world diminish.

Major drugs derived from plants		
Origin	Plant	Function
Amazon	Amazonian liana	Muscle relaxant
Asia	<i>Artemisia annua</i>	Anti-malarial
Europe and North Africa	Autumn crocus	Anti-tumour agent
Tropics/subtropics	Coca	Local anaesthetic
Europe	Common thyme	Anti-fungal
Europe	Foxglove	Cardiotonic
North America	Mexican yam	Birth control pill
North America	Pacific yew	Anti-tumour agent
Madagascar	Rosy periwinkle	Anti-leukaemia
Asia	Velvet bean	Anti-parkinsonian

Source: UNEP-WCMC

Keeping the pieces

Through the ages, people have relied on more than 10,000 plant species for food. No longer. Barely 150 are now cultivated, and only 12 provide 80 per cent of all humanity's supplies.



Photos: Mari Tefre/Global Crop Diversity Trust



Crop biodiversity is disappearing fast. Mexico, where corn was first developed 7,000 years ago, has lost 80 per cent of its varieties. India has lost 90 per cent of its rice varieties and China 90 per cent of its wheat varieties. And in the United States, nine out of ten varieties of vegetables and fruits grown a century ago have vanished. That's not to mention the extinction of a staggering 6,800 of the 7,100 named varieties of apple cultivated there in the 1800s.

Such losses could have devastating effects on the world's food security, says Cary Fowler, Executive Director of the independent Global Crop Diversity Trust (GCDT), especially as climate change, water shortages, population and consumption increase. 'Diversity,' he explains, 'gives us what we need in an era of uncertainty: options.'

Nearly all food results from 10,000 years of tinkering, as farmers crossbred varieties to obtain the best traits for their circumstances. 'Natural selection', in Fowler's words, 'at the hands of men and women.'

But those farmers had access to genetic raw material that's now disappearing. Over time, they instinctively selected high-yield, commercially popular varieties, neglecting others, a process which was accelerated by the spread of chemical fertilizers and pesticides. And as agriculture and seed production have become more commercialized, farmers have saved fewer seeds to plant in subsequent years, causing the precipitous decline of countless crops adapted to local conditions.

Meanwhile, many of the world's 1,500 seed banks – where much of the world's crop biodiversity is stored – have been hit by unstable funding, equipment failure, war, natural disaster and mismanagement. And the future of food is

becoming ever more uncertain. 'Current projections,' says Fowler, 'suggest that within a few decades the coldest growing seasons in many countries will be warmer than the hottest of the past.'

'In the temperatures likely in Southern Africa by the 2030s, currently grown maize varieties, which provide half the region's nutrition, would see a 30 per cent production decrease. This would be a catastrophic food crisis, especially in light of population growth,' he says. The solution is to breed heat-tolerant maize, but the two decades before 2030 represent only two breeding cycles. 'We have two rolls of the dice to get it right.'

This underlines the need to save as much genetic material as possible, as does the fact that relying on fewer varieties makes food supplies vulnerable to pests and diseases. 'I often get asked why we need 7,000 apples,' Fowler says. 'Well, today's "best" variety is tomorrow's lunch for insects or diseases, which aren't in the business of becoming extinct themselves.' A single characteristic in a little-known, economically unviable variety could be bred into a crop to provide resistance, which might mean the difference between life and death for millions of people.

Last year the GCDT – based at the Rome headquarters of the Food and Agriculture Organization of the United Nations – opened the Svalbard Global Seed Vault. Deep inside a Norwegian Arctic mountain, the vault already holds around 425,000 samples of unique crop varieties from the world's seed banks. Norway owns the facility, but depositors own the seeds, which are kept naturally frozen by the cold. Just a little extra power is needed to keep the temperature steady at -18°C, at which many seeds can survive for at least 1,000 years.



Diversity counts

What isn't counted is often thought not to count. And adding up the world's wildlife can provide a good measure of the Earth's well-being.

WWF's *Living Planet Report* monitors population trends in wild animals through its Living Planet Index. In this way it reveals how quickly we are losing biodiversity – some 30 per cent since 1970. Meanwhile, its Ecological Footprint measures how much of the world's resource base humanity is consuming.

While the Footprint shows consumption increasing, the Index shows species – and therefore ecosystems – declining at much the same rate. In 2002, the international Convention on Biological Diversity adopted both as measures to assess the rate of biodiversity loss.

The Index isn't exactly trying to save animals: it's counting them in order to draw conclusions about the health of ecosystems. 'We could measure an ecosystem's area instead, but areas can stay the same while species decline,' says Jonathan Loh, the report's editor. 'So we measure the abundance of species living within ecosystems: in the tropical forest, for example, this could be parrots and primates. All we ask is: did this species population decline, stay the same, or rise?'

'We're making the assumption that trends we see in vertebrates will be the same for other species in that habitat; that if these decline, all biodiversity – trees, plants, insects – in that biome is declining too. But this is a reasonable assumption given that the causes of decline, including overexploitation, habitat destruction and climate change, tend to be common to all species.'

To do the count, the Index trawls thousands of biologists' reports in journals and online, adding information to a database. The data are categorized and numbers averaged to show how, say, freshwater fish populations in temperate or tropical regions are faring.

'The Index started with 30 species; we're now up to 10,000,' says Loh. 'And it doesn't include all kinds of animals, just vertebrates – fish, mammals, birds, amphibians and reptiles – for which we can get population data. There are not enough data on invertebrates or plants to include them.'

Loh says the 2010 edition of the report will also try to make clear connections between cause and effect: how our growing consumption of palm oil leads to an increase in plantations, a decline in habitat, and thus fewer orang-utans, for example.

'That's the message: our rapacious consumption is causing this loss of global biodiversity. We can't deal with them as separate issues,' he concludes.

'It doesn't look like much, but if you know what's there, it's pretty emotional,' says Fowler. 'We have seeds from nearly every country in the world. There are 70,000 samples of rice varieties, for example. A year from now, we'll have more than half a million.'

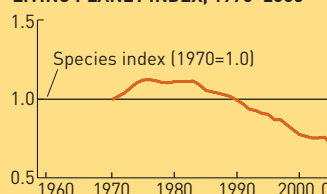
The vault, which acts as a global genetic safe-deposit box securing a back-up copy of agricultural information, already contains over half the world's crop genetic diversity, and will eventually hold samples from every crop species that can be stored frozen. Yet Fowler stresses that up to 100,000 endangered crop varieties – including varieties of potato, cassava and yam – are so close to extinction that samples of them cannot be sent to Svalbard. 'Populations must be re-grown under controlled conditions first,' he says. The GCDT plans to rescue these varieties over the next two years.

It is also working on an information system to let researchers search quickly for traits they need. 'This library of life needs a card catalogue,' he explains. 'A plant breeder seeking rust-resistance for wheat now has to look gene bank by gene bank, which is ridiculous when we're facing something as threatening as climate change.'

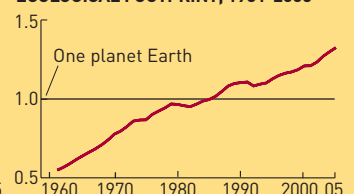
Could Svalbard's seeds be used to create genetically modified (GM) crops? Fowler says Svalbard contains only non-GM seeds, but decisions on how to use them rest with their depositors. 'Genes are the raw material for both traditional breeding and genetic modification. Whichever side wins, we will have made that possible. As American environmentalist Aldo Leopold said, "The first rule of intelligent tinkering is to save all the pieces."

'And we will need them all,' adds Fowler. 'If our agriculture doesn't adapt to climate change, neither will we.'

LIVING PLANET INDEX, 1970-2005

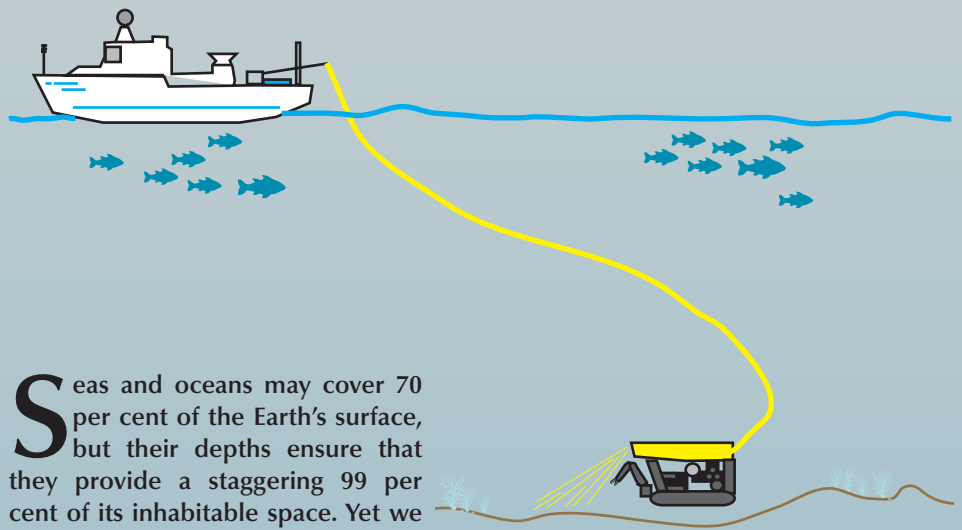


ECOLOGICAL FOOTPRINT, 1961-2005





Photos: NERC/National Oceanography Centre, Southampton



Seas and oceans may cover 70 per cent of the Earth's surface, but their depths ensure that they provide a staggering 99 per cent of its inhabitable space. Yet we know almost nothing about the life of the deep sea, further, that is, than 200 metres down. And it plunges at its deepest point – in the Mariana Trench near Guam in the northwest Pacific – to 11,000 metres, deeper than Mount Everest is high.

'Some experts say we know less of the deep sea than the moon's surface,' says Stefan Hain, Head of UNEP's Coral Reef Unit. That is hardly surprising, for the moon is almost as inhospitable as the deep sea: sunlight does not penetrate down there and temperatures fall as low as 4°C.

Humanity has so far only explored about 5 per cent of the deep sea. 'But,' says Hain, 'this unknown world is starting to open up through such technological developments as remotely operated vehicles (ROVs), which can photograph and video at as much as 4,000 metres down.'

Deep-sea creatures, however, are well adapted to life in silence and darkness. So, Hain points out: 'Using an ROV is like driving a jeep into a jungle to observe animals with headlights blazing and music on full-blast. The larger, more mobile organisms are long gone before they are in range.'

But the new technology has had no difficulty in revealing a huge amount of deep-sea litter, from rubber boots to plastic bags, even cars. 'Lost fishing nets go on trapping and killing fish,' he adds. 'More fish come to scavenge and get trapped, and this can go on for months.'

Deep-sea fish stocks are declining as fishing fleets – after depleting traditional species – increasingly exploit deeper waters. 'Deep-sea species

tend to live longer and reproduce less frequently, so they take much longer to recover from damage,' says Hain, pointing out that an orange roughy (otherwise known as deep-sea perch) now caught and eaten could easily have hatched in Napoleon's time.

Acidification of the oceans caused by rising emissions of carbon dioxide is making it increasingly difficult for plankton and crustaceans to make shells. 'This will have a huge impact on marine life,' he says, adding: 'What will become of the organisms that depend on them, including us?'

Scientists continue to make important discoveries. Cold-water corals, for example, provide habitat for thousands of previously unknown species. Potent chemicals in deep-sea sponges may hold anti-cancer drugs. Such findings just scratch the surface of what is yet to be revealed – providing one more reason to protect the deep seas.

Attempts to establish marine protected areas are gaining momentum, concentrating on the most biologically significant areas. The strategy, Hain points out, is to design networks of protected areas, making them more resilient to such stresses as overfishing, warming waters and acidification than single sites would be.

He concludes: 'We need an integrated ecosystem approach. But we still lack the knowledge we need to create flexibility. Nearly everything we see has some kind of undiscovered aspect or mystery. It's a whole new world down there.'

Life in depth



End of the line



Photos: The End of the Line

Cod used to be so plentiful off the Newfoundland coast that early European visitors reported that they 'hardly have been able to row a boat through them'. They found that if they just lowered a basket over the side of a boat they could pull it up thick with the fish.

Now these waters are empty. The cod fishery – which peaked at 810,000 tonnes a year in 1968 – suddenly collapsed and had to be closed in 1992, throwing some 30,000 people out of work. And it still has not recovered. Indeed the very ecology of the sea seems to have changed, becoming dominated by shrimp and crab, rather than by fish.

Scientists now fear that overfishing is doing to the world's oceans what it did to the sea off Newfoundland, and to a host of species besides cod. A team led by Dr Boris Worm of the University of Dalhousie in nearby Nova Scotia, concluded in 2006 that global fish stocks had been in steep decline for almost 20 years. If the trend were to continue, it added, the oceans could be empty of edible fish by the middle of the century, a disaster for the more than a billion people who rely on them for protein.

Put simply, there are too many people – and too many boats – hunting too few fish. A new film, *The End of the Line*, based on a best-selling book by British journalist Charles Clover, reports: 'Global fishing capacity could catch the world catch four times over.'

Modern technology, like radar and vast nets, mops up fish. So-called 'bottom trawling', which drags nets along the

seabed, damages it and destroys corals. Clover, a farmer's son, likens it to ploughing fields seven times a year, pointing out that not many crops would survive such treatment.

The film devotes much attention to the bluefin tuna, which is increasingly threatened with extinction. It shows the European Union setting a bluefin tuna fishing quota of 29,500 tonnes a year, twice the 15,000 tonnes that scientists recommend as the maximum if collapse is to be avoided, and three times the 10,000 tonnes that they believe would allow the species to recover.

And it also shows how Mediterranean fishermen flout even these lax limits to take 61,000 tonnes of bluefin a year – equivalent to a third of the entire population of the fish. Too generous quotas, and illegal fishing beyond them, bedevil other fisheries too, such as in the North Sea.

But when fishing is properly controlled, stocks can recover. So-called 'no-take zones', for example, do not just allow fish to recover inside them, but often repopulate surrounding waters. And a new paper co-authored by Dr Worm shows that good management is rebuilding stocks off California, Chile, New England, northwest Australia and Mexico, among other places. Though these remain drops in the proverbial ocean, he sounds an optimistic note. 'When people understand crises, changes start to happen,' he says.

Consumers can help by choosing to eat only sustainably sourced fish and by pressurizing governments to set sensible quotas and then enforce them.



To join the campaign, visit <http://endoftheline.com>

For guidelines on what fish to eat, visit the Marine Stewardship Council: www.msc.org

The **BIG** ideas

Martin Jenkins

Almost everyone agrees that the world at the start of the 21st century is not in great shape. Many sober-minded scientists argue that we stand on the brink of environmental catastrophe, with only a decade or two to put our house in order, or face the consequences. How we respond to the challenges – climate change, deforestation, pollution, overfishing to name a few – depends not only on our political will but also on our scientific understanding of how the world works. In the past two centuries two scientists have played a huge part in improving this understanding. One has had such a profound impact on the way we think that it is hard to imagine how people saw the world before. The other, much more recent, presented ideas that many people, including many scientists, still find hard to grasp, but which may have an even more direct bearing on what we should be doing in the face of environmental crises.

Charles Darwin and the descent of man (1859)

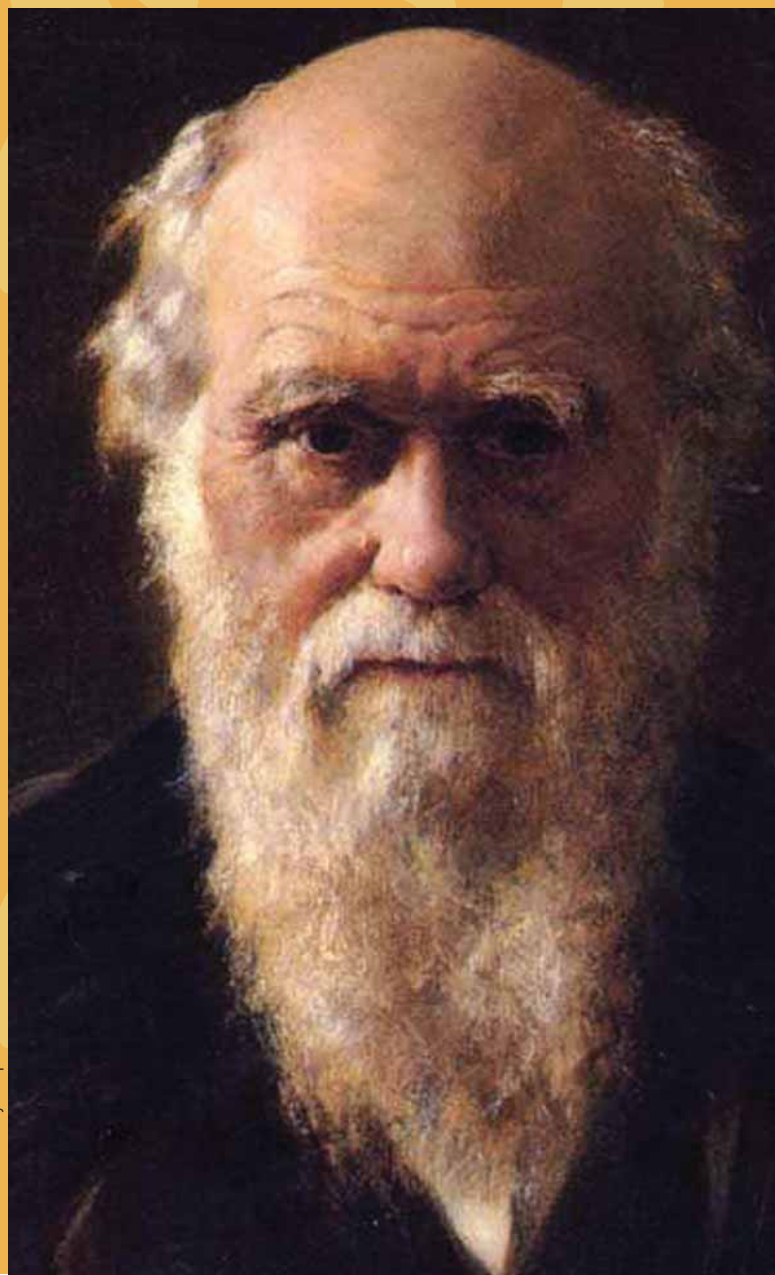
Throughout history, people have held marvellously varied views of how the world came to be, how old it is, and of how humans and other living things fit into it. For all their variety, many of these worldviews had quite a lot in common. It was generally believed that after some phase of creation, and perhaps some catastrophic upheavals – such as the biblical flood – the world settled down to be essentially unchanging. The same kinds, or species, of animals and plants were believed always to have existed in a world that was probably only a few thousand years old and that had always looked very like today's. Of all parts of creation, man (it's almost always man, not woman, or humankind) was the most important, usually made in the likeness of god or the gods and having dominion over the rest of creation. Everything else was essentially there to serve, and we could do what we liked with it, within limits.

Advances in geology and biology in the 18th and 19th centuries, culminating in the revolutionary work of Charles Darwin and his contemporary Alfred Russell Wallace, changed that forever. From the study of rock strata and the fossils they contained, it became clear that the world was older than usually believed – perhaps much older – and that at different times different species had been present, very many of which had become extinct. From this, and their observations of the natural world, Darwin and Wallace concluded that species were not fixed entities, but that over time one could evolve into another, or several others. The mechanism that drove this evolution was natural selection.

Struggle for existence

Central to this notion was the struggle for existence. All individuals competed with others of their own and other species to survive and reproduce. Individuals varied in how successful they were depending on how well they were adapted to their environment. Some of the reasons for this variation lay in characteristics that could be passed on from one generation to another. The best adapted individuals naturally tended to have more offspring than the less well adapted, so that gradually individuals with particularly successful traits would become much commoner in the population. The others would eventually die out, having been out-competed by their more successful relatives.

One conclusion from this was that extinction was natural; it was a fact of life. Another was that all living species, including humans, were the descendants of now extinct forms. We were just another species, subject to the same rules as all other living things (including the possibility of extinction), something that many people with strong religious convictions find hard to accept to this day.



Gary Haq



Bruno Comby, Creative Commons

James Lovelock and the ascent of Gaia (1979)

The world seen from the point of view of Darwinian natural selection is a pretty tough and individualistic place: its central idea can be taken bluntly as a combination of 'every creature (or plant or alga) for itself' and 'adapt or die'. Thanks to Lovelock and his colleagues, we are beginning to understand that this is not the whole story. They have shown that rather than merely adapting to and reacting to changes in their environment, living things themselves play a vital part in moulding that environment, and do this on a planetary scale.

Lovelock first began to realize this when he compared the composition of the atmosphere of Earth with that of nearby planets, particularly Mars and Venus. From a strictly chemical standpoint, Earth's atmosphere is very peculiar and unstable, particularly in containing a significant proportion of that highly inflammable gas, oxygen. It has long been known that any significant amount of oxygen in the atmosphere is entirely thanks to the action of living things, namely photosynthesizing organisms such as plants and algae. But Lovelock pointed out that the precise concentration of oxygen was pretty nearly ideal for living things: any higher and destructive fires would continually break out; any lower and oxygen-breathing organisms (the great majority of living things) would not be able to function.

It is not just the composition of the atmosphere that is maintained at an ideal level: Lovelock argues that through geological history the global temperature has remained more constant – and at nearer the optimum temperature for life – than would be expected if the Earth behaved as a passive physical object. He has concluded that the entire biosphere – the atmosphere, the world's seas and the upper part of the Earth's crust, along with the ecosystems they support – behaves in some ways as a single living entity that tries to regulate itself to maintain conditions as ideal as possible for the kinds of life present at the time. Following a suggestion from the writer William Golding, he named this world-system Gaia, after the Earth goddess of Greek mythology.

Gaining acceptance

Many conventional scientists have had huge problems coming to terms with this idea. They could not see how the biosphere could behave as a self-regulating entity and still obey the laws of physics, chemistry and biology as they understood them. In particular, they could not square the idea with Darwinian notions of natural selection acting on essentially selfish individuals. However, Lovelock and his colleagues have used simple models, most famously Daisyworld – a planet populated by two kinds of daisy – to show that it is perfectly possible for organisms behaving in a normal Darwinian way to have a Gaia-like effect. With the help of Daisyworld and other models and studies, the Gaia hypothesis is gaining ground, although it still meets with some resistance.

Try as hard as we can

Lovelock's view is very unsentimental. He believes that Gaia looks after itself with no concern for any particular components or individual species, including us. He also argues that Gaia is struggling to maintain itself in its current state in the face of a concerted onslaught by us humans, chiefly through increasing greenhouse gases but also through our many other environmentally destructive actions. In particular, he thinks that the models used to predict how the world climate will change in the next century, with a gradual increase in temperature proportionate to the increase in greenhouse gases, are flawed and simplistic because they do not adequately take into account the kinds of interactions predicted by the Gaia hypothesis.

Lovelock thinks that unless drastic action is taken very quickly, Gaia will almost inevitably move towards a new stable state, with global temperatures about 6°C higher than today's. What evidence is emerging from actual observations – notably of sea-level rise and the rapid decrease in summer Arctic ice – certainly seems to support his view that the climate is changing much faster than conventional models have predicted. He is not optimistic that we can alter our behaviour quickly enough to halt the slide to a much hotter planet but, like many people, he thinks that is no excuse not to try as hard as we can.

Bud Andrews/UNEP/Topham



Martin Jenkins, author of *The World Atlas of Biodiversity*, is a consultant to the UNEP World Conservation Monitoring Centre.



Biosphoto/N-A Petit/Still Pictures

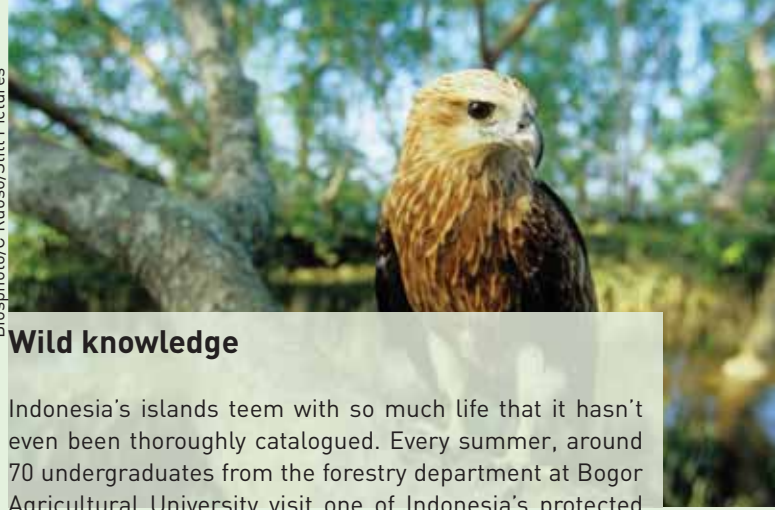
Hatching turtles

Imagine walking sandy beaches, the sea lit by the moon. A trail of footprints appears, but from turtles, not people. Following them leads to treasure: their eggs.

Last summer I led eight Rover Scouts from Singapore to the Setiu Wetlands in Malaysia to help WWF conserve turtles. The wetlands are an important nesting ground for two endangered species, the painted terrapin and the green turtle. When we spotted eggs, an experienced WWF ranger dug them out carefully to incubate them in a hatchery protected from poachers and pollution.

By day, we planted 1,000 mangrove trees along the banks of the Setiu River, and helped locals with much-needed building work. Biodiversity loss is often related to human needs, so finding sustainable ways to meet them is crucial. But the best moments were watching newly hatched turtles emerging from the sand, and releasing them to the sea. Sometimes, nature needs a helping hand.

Tan Sijie, Singapore



Biosphoto/C Ruoso/Still Pictures

Wild knowledge

Indonesia's islands teem with so much life that it hasn't even been thoroughly catalogued. Every summer, around 70 undergraduates from the forestry department at Bogor Agricultural University visit one of Indonesia's protected areas to help collect biodiversity data. The students focus on lesser-known species important to maintaining ecosystem balance, especially birds, small mammals, rare and medicinal plants, and insects.

I was at Betung Kerihun National Park, West Kalimantan. We identified wildlife, monitored species population and density, and identified and measured vegetation. We also interviewed local indigenous people to collect traditional knowledge about uses of plants and animals for medicine, food and fuel.

Student explorations yield up-to-date information that universities and conservation organizations can use, while giving young people important field-research experience.

Gista Rukminda, Indonesia

YOUTH IN THE FIELD

Three for one

Poverty has forced many people in my community of Victoria Falls to overexploit natural resources, harming local biodiversity. They often, for example, cut down the endangered mukwa tree (African teak *Pterocarpus angolensis*) for fuel and to carve sculptures to sell to tourists, who also buy the fur and ivory of poached animals.

In 2007 I initiated a campaign to increase community awareness. The term biodiversity is relatively new here, so I used accessible approaches like storytelling, nature walks and tree planting, using the slogan 'for every tree you cut, plant three'. I also organize drawing competitions in local schools, and have produced a play.

My message is: 'Taking from nature is not enough, we must give back.'

Nigel Chitombo, Zimbabwe

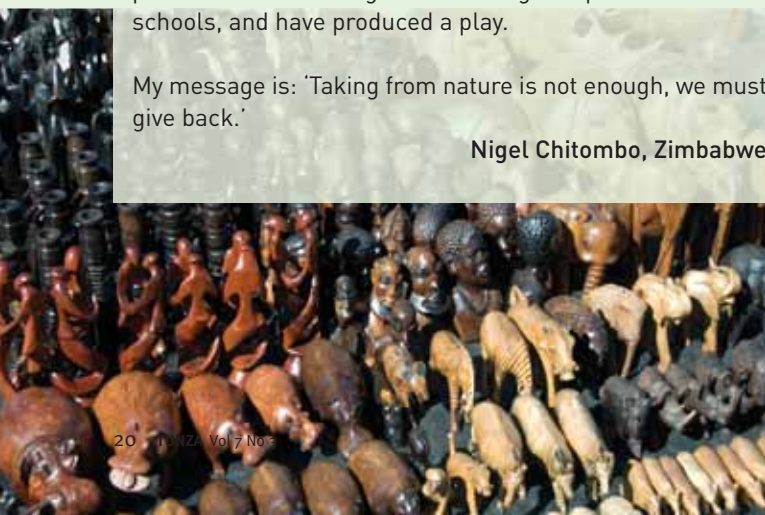
Pandas close up

WWF has worked in China to protect the giant panda for decades. I joined a project in the Minshan region that focuses on restoring giant panda habitat while preserving the culture and livelihoods of local people. My job was to edit reports and newsletters.

I learned a lot about strategies to protect pandas, including reconnecting corridors between their habitats that had been blocked by human activity, and strengthening local people's capacity to manage resources sustainably.

I did once see pandas close up, during a photography workshop. It was an unforgettable experience. I feel honoured to have been given the chance to help protect this beautiful animal.

Alex Hirsch, United States of America



Mephoto/Still Pictures



Biosphoto/M Gunther/Still Pictures

The forgotten kingdom

Kate de Mattos-Shiple



Wong Teck Hong/UNEP/Topham

Fungi – an estimated 2 million species including mushrooms, toadstools, yeasts and moulds – form a forgotten kingdom of life, often overshadowed by more conspicuous and celebrated plants and animals. Though often associated with decay and disease, they are an enormously diverse and vitally important group of organisms without which the giant ecosystem we call home could not function.

They are best known as the yeast for bread and fermenting beer, or the wonderful collection of mushrooms and truffles that tantalize the taste buds. But such services are just a hint of what fungi really provide.

They are vital in medicine, producing some of the top-selling antibiotics, including penicillin. They also provide drugs to control cholesterol, to stop rejection of transplanted organs and to help with childbirth. And now, the morel, long prized by cooks, is being studied for its pain-relieving and even cancer-curing properties.

We've all been warned about eating poisonous mushrooms, but actually they cause fewer deaths than bee stings or lightening strikes. And some of their toxicity can be usefully harnessed as biocontrol agents against specific insect pests.

Fungi also provide nature's own recycling plant. Without them everything would be buried under piles of animal and plant remains. In fact they will decompose any organic matter – whether a cardboard box, paint, a leather jacket, jet fuel or even the TNT used in explosives – and offer huge potential for cleaning polluted land, even of radioactive waste.

Between 80 and 90 per cent of plants rely on symbiotic fungi to break down their food for them. But these fungi are being harmed by air pollution turning soils acidic; their resulting

loss has killed millions of trees and is believed to be a major factor in the decline of forests.

Fungal species in Europe – and most likely elsewhere – are themselves declining catastrophically, even suggesting that a mass extinction is under way. Understanding the threats to fungi, and how they can be protected, is essential if this is to be reversed.

With each species lost, humanity loses sources of potential new medicines, chemicals and food, as well as links to the food webs and ecosystem processes that are essential for clean water, clean air and healthy ecosystems. Fungi may not look too good on a poster, but without them the human race could not – and would not – exist.

FACTS ON FUNGI

Unlike most animals and plants, which have only two genders, some mushrooms are known to have over 28,000!

For every human on the planet it has been estimated that there are more than 2 tonnes of fungi.

The largest organism in the world is an *Armillaria ostoyae*, or honey mushroom, in the Malheur National Forest in Oregon – a fungus the size of 1,665 football fields. Experts estimate it to be at least 2,400 years old, but it could be 7,200.

The Jack o'Lantern mushroom (*Omphalotus olearius*), like fireflies and some marine bacteria, is bioluminescent. People have even used the mushrooms as lights.

Kate de Mattos-Shiple is researching fungi at the University of Bristol, United Kingdom.

7 invasive species

Invasive species are the second most important threat to biodiversity, after habitat loss: 80 per cent of all the world's endangered species are thought to be threatened by them. The problem is as old as travel itself: rabbits, which originated in Spain and Portugal, were spread around the Mediterranean by Phoenician traders 3,000 years ago. Many alien species were deliberately introduced to new habitats, but modern trade and transport have vastly increased the pace and range of this biological pollution. Species arrive as stowaways on planes, boats, in cargo and especially in the ballast water carried by tankers.

Fisheries in the Black Sea collapsed in the 1980s and 1990s thanks to the arrival of a small, attractive marine creature, Leidy's comb jelly from the western Atlantic. A voracious consumer of plankton, it can double in size in a day, grow to maturity in two weeks, and then produce 8,000 offspring daily. By late 1988 – less than a decade after it first arrived – a single cubic metre of Black Sea water could contain as many as 500 jellies; in all, the sea contained about a billion tonnes of them and most of the fish that made up the sea's traditional catch had disappeared. Introducing a particular plankton has now helped control them, but they have also hit the Caspian Sea.



R Dirscherl/WaterFrame/Still Pictures

A mosquito



Biosphoto/Eritja Roger/Still Pictures

Used tyres have spread the disease-carrying Asian tiger mosquito round the world from its native Southeast Asia; it now inhabits Europe, both Americas, the Caribbean, Africa and the Middle East, though surveillance programmes in Australia and New Zealand have managed to stop it becoming established there too. It travels as eggs, larvae or pupae in the small pools of rainwater that accumulate inside tyres carried around the world in ships, and can transmit a host of pathogens including yellow fever, west Nile virus, dengue fever, St Louis encephalitis and chikungunya fever.

At home in eastern Asia, where it is naturally controlled by other species that evolved alongside it, the Japanese knotweed is treasured. Its stems are eaten as a spring vegetable, it is used as a laxative in herbal medicine, and its flowers provide important nectar for bees at a time of year when little else is out. But abroad in Europe and North America – where it was introduced as an ornamental plant – it is a menace. Able to grow 3 metres high in just a few months and so tough it can sprout through pavements – it quickly forms dense thickets, stifling other plants on which insects depend, and damaging buildings, flood defences and drainage systems.

A knotweed



WILDLIFE/D Harms/Still Pictures

An ant



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Hide your i-Pod! Lock up your computer! The 'crazy Raspberry ants' are coming. The tiny reddish-brown ants – which get their name from their fast, random movements and an exterminator called Tom Raspberry who first noticed they were a problem – are spreading through Texas after arriving on a cargo ship, nobody knows from where. They are not attracted to ant baits and are immune to over-the-counter poisons. Most remarkably, they head for anything electronic and eat its insulation, knocking out computers, electricity meters, burglar alarms, telephone exchanges, even a sewage works, and are now heading towards NASA's Johnson Space Center.

It may only be the size of a fingernail, but the zebra mussel causes \$5 billion worth of damage every year in the United States alone. The striped molluscs spread by attaching themselves to the bottoms of boats, including leisure craft, crossing seas and making their way across land when the vessels are moved on trailers. Originally from lakes in south-east Russia, they now plague North America, the United Kingdom, Sweden, Spain and other countries. In moderation they are beneficial, removing pollution as they filter feed. But with each female producing up to a million eggs a year they quickly foul boats, clog up pipes, block water intakes and stifle other underwater life.



Wolfgang Poelzer/WaterFrame/Still Pictures

A mussel

A snake



Coordinating Group on Alien Pest Species/CGAPS-Hawaii

Sometimes it travels in the wheel well of aeroplanes, sometimes in ships' cargo holds, but the brown tree snake is a particularly destructive stowaway. Native to northeast Australia and Papua New Guinea, it first arrived on the Pacific island of Guam as a result of US military operations after the Second World War. Since then it has driven to extinction all the island's breeding seabirds, 10 out of its 13 species of native forest birds, two out of its three indigenous mammals, and six out of its 12 lizard species. It is now spreading to other vulnerable Pacific islands and has reached as far as Japan, Singapore, Spain and the United States of America.

Starlings are only mentioned once in Shakespeare, in *Henry IV Part I*. But that one line was responsible for a continent-wide invasion. In the late 19th century a group called the American Acclimatization Society introduced the birds mentioned by the bard into the New World. A hundred starlings were released in Central Park, and quickly spread. Now there are some 200 million of them, competing with native species, harming crops and shorting electric power lines with their copious droppings. But as an article in *The New York Times* concluded: 'It is not their fault that they treated an open continent much as we ourselves did'.



Ashley Cooper/Still Pictures

A starling

‘I choose the happy life, do you?’



That's the title 9-year-old Ludmila Balovneva (left), from Novosibirsk, Russia, gave her painting (above) – a weeping planet encircled with smoke, or a smiling Earth encircled with flowers. ‘Where I live, everything is polluted,’ said Ludmila. ‘There is broken glass and rubbish everywhere. And the trees get cut down. I wanted to depict two ways of developing the world. The clean way and the dirty way. It’s about the future.’



Ludmila's picture was the overall winner of the 18th International Children's Painting Competition on the Environment – organized by UNEP, the Foundation for Global Peace and Environment, Bayer and Nikon – which attracted a record 2.4 million entries from children in 89 countries. The winners were unveiled at the Tunza International Children and Youth Conference in Daejeon.

‘What we see in these paintings is that children are aware of the challenges facing the planet,’ said UNEP Executive Director Achim Steiner. ‘Given the opportunity, they can contribute to solutions. We can all learn a great deal from the insight children have about our world and our responsibility.’

Get painting!

The theme for the 19th competition, also announced in Daejeon, is **Biodiversity** – to mark 2010 as the International Year of Biodiversity. Entries may be submitted to the UNEP regional offices up to 15 April 2010.

For more information see: http://www.unep.org/tunza/children/inner.asp?ct=competitions&comp=int_comp&int_comp=19th