

The UNEP Magazine for Youth

TUNZA



for young people · by young people · about young people

SUSTAINABLE WORLD

Young innovators
Forgotten diversity
Carbon farming
Building bridges
Sharing is caring



TUNZA

the UNEP magazine
for youth. To view current
and past issues of this
publication online,
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**Partners for Youth
and the Environment**



UNEP and Bayer, the German-based multinational involved in health care, crop protection and high-tech materials, have worked together to strengthen young people’s environmental awareness and engage children and youth in environmental issues worldwide.

The partnership, originally signed in 2004 and renewed in 2007 and 2010, ran for 10 years. During the course of the partnership, UNEP and Bayer implemented a wide variety of projects including TUNZA Magazine, the International Children’s Painting

Competition on the Environment, the UNEP Tunza International Youth and Children’s Conferences, youth environmental networks in Africa, Asia Pacific, Europe, Latin America and the Caribbean, North America and West Asia, the Bayer Young Environmental Envoy Program and a photo competition, ‘Ecology in Focus’, in Eastern Europe.

The long-standing partnership between UNEP and Bayer became a public-private partnership that served as a model for both organizations.

Times are changing



This is TUNZA magazine's first totally electronic issue – coming out on <http://tunza.mobi> and www.ourplanet.com, where we're publishing new stories two or three times a week.

Then, we'll produce a compilation volume – like this one – for reference, which will also appear on www.unep.org/publications.

TUNZA magazine is for youth, by youth and about youth – so there'll be lots about what YOU and other young people are doing, what you and they have achieved, and ideas about what you could pick up and run with.

We'll also look at issues of concern to us all – from mega concerns such as climate change, resource use and food waste, to things like green jobs, green opportunities and how we can move to a green economy.

This new issue is all about opportunities. We are majoring on young innovators – the Bayer Young Environmental Envoys, all of whom are working to make our world more sustainable. Some of their work

focuses on research, some is about raising awareness and provoking change, while other efforts explore using waste as a resource.

We have a saying here: "ideas have legs". Many of these innovations are replicable where you are. Some are potential business ideas that you could take up. Or perhaps the research interests you. So could you contribute or help in some way? Whatever you can do, if you want to talk to any of these young innovators and benefit from their experience and imagination, please contact us through these pages or through Facebook (www.facebook.com/TUNZAmagazine) and we'll put you in touch.

And of course, we want to hear about what you are doing too, what you are thinking and what you are concerned about. So, please, tell us – using the same communications channels.

We made a resolution this year to be positive. So don't be weighed down by problems. We want to make TUNZA magazine a resource for ideas that, together, will walk us into a sustainable world.





“We will never forget ...”

THAT SENTIMENT was palpable at the closing party of the 2013 Bayer Young Environmental Envoys field trip to Leverkusen, Germany, in November 2013 as the 46 young people from 19 countries danced the night away. These enthusiastic young Envoys had been selected from among 1,900 applicants in a rigorous process, organized by Bayer, that included regional eco-camps.



M. Rennertz/Bayer

Each of the Environmental Envoys had won their place on the field trip by making a difference. Some are involved in game-changing, practical research – developing concrete from wood waste, working to produce coatings for growing fruit that needs protection from direct sun-light, extracting aluminium compounds from wastewater sludge, or finding ways of using a catalyst synthesized from cobalt phosphate to extract hydrogen from water as an energy source. Others are already making and selling sustainable products and services – including building materials made from recycled toothpaste tubes, applying a polymer-accelerated hot compost technique to provide farming communities with soil-enhancing compost and hot water, or running a social enterprise making soap from recycled cooking oils.

During a week-long field trip, Envoys were able to meet and learn from experts in the fields of recycling, water purification, waste disposal and sustainable solutions for managing the world’s food supplies – including new packaging to minimize food waste. “It was mind-blowing,” said Wallace Chwala from the University of Nairobi, “and I found the session on how to turn a project into a business particularly useful ... it’s totally expanded my horizons.”

The Bayer Young Environmental Envoy Programme has been a key element of the UNEP-Bayer Partnership for encouraging youth involvement in environmental issues. Started as a local project in Thailand in 1998, by 2013 it had galvanized youth in 19 countries on three continents: Argentina, Brazil, Chile, China, Colombia, Costa Rica, Ecuador, India, Indonesia, Kenya, Malaysia, Peru, the Philippines, Republic of Korea, Singapore, South Africa, Venezuela and Viet Nam.

Sadly, all good things must come to an end. After 10 years of working closely together to promote young people’s involvement in environmental and sustainable development, the successful, supportive and dynamic partnership between Bayer and UNEP is winding down. “These are truly inspiring young people whom we hope will continue their great work in helping to make sustainability a reality,” commented Michael Preuss of Bayer Corporate Communications. “It has been truly refreshing for us to work with them over the years.”

All that’s left to do is express thanks to Bayer on behalf of all of us who have been touched by their generosity in making so much available to so many for so long.

Young leaders



EACH YEAR, Bayer Young Environmental Envoys get the opportunity to present their projects, which vary from conceptual scientific research to totally practical, hands-on work. The most innovative, sustainable and easily replicable projects win Leadership Awards that include a seed-corn cash prize and development support from Bayer.

If you are interested in any of these projects, could help develop them, or would be interested in doing something similar where you are, please contact us through Facebook (www.facebook.com/tunzomagazine) and we'll put you in touch.

You can find details of the other 41 young innovators at

<http://tunza.mobi>

Win-win-win-win-win



Wallace Chwala, from the University of Nairobi, Kenya, has developed a way of making compost in just 12 days using his community's organic waste. He sells the compost to local farmers, and teaches them about improving their soil. That's three wins. The fourth? He runs water pipes through his compost pits to heat water for the community. And the fifth is that he provides jobs for local people, too. Now Wallace has a difficult choice – does he develop his project to become the Compost King of Nairobi? Or does he travel the country teaching communities how to do it on their own? Go, Wallace!



M. Rennertz/Bayer

Light-transmitting concrete



M. Rennertz/Bayer

Soumyajit Paul, from SRM University, Kancheepuram, India, has found a way of transmitting light through concrete: embedded optical fibres in the concrete take in sunlight from outside and pass it into a building. This could be revolutionary for village and shantytown homes and large office buildings alike – reducing the need for electricity – as well as for road marking. It is not quite a commercial proposition yet, Soumyajit tells us, but he's aiming to take his research forward.

Sustainable energy



M. Rennertz/Bayer

Claudia Escobar of the University of Costa Rica is developing REALLY low-cost solar cells – allowing more people to access this renewable technology. She's coating the surface of a titanium dioxide film with charge-transferring dye from fruit, flowers and microorganisms from species common in tropical regions. It's all biocompatible, and costs a fraction of the solar cells made from silicon. Research is well advanced and she'll start scaling the process up during 2014.

All you need is a tolerant mum



M. Rennertz/Bayer

The trouble with toothpaste tubes is that they combine plastic with aluminium, so traditional recyclers don't want them. But **Felipe dos Santos Machado** from Brazil's Universidade Feevale has found a way of turning them into a material for making furniture and playground equipment and even for building. It all started in 2010 with an experiment in his family kitchen, using his mum's oven. It has grown a bit since then, and Felipe uses his engineering background to define manufacturing parameters, carry out strength and endurance testing and get quality certification. And now, he's ready to scale up his activities – after all his raw materials are available everywhere!

Cement from wood waste



M. Rennertz/Bayer

Dream on? "No way," says **Kevin Lee** from Singapore's Temasek Polytechnic. He's done it. Depending on what strength you need, he has worked out how you can reduce the cement, sand or gravel content in a cement mix, replacing them with different types of wood waste. As making cement is one of the largest sources of carbon dioxide, this could be a major contribution to climate-change mitigation, quite apart from providing a ready use for forest and horticultural waste. GREAT innovation, Kevin, this could be the beginning of a revolution.

Sustainability= common sense

There's no way around it: the 7 billion human inhabitants of Earth have the resources of just one planet. The problem is, we are currently consuming the resources of 1.5 Earths – and there are more of us coming. So, given that population is growing and everyone wants to live a secure and fulfilling life, how can we live well within the capacity of our planet and make One Planet Living a reality?

The good news is that we already have much of what we need in terms of technology, we know what the problems are, and we know what we need to do. Environmental issues have evolved from being a fringe interest to headline news in mainstream papers. Renewable energy technologies have developed and are now more accessible than ever. Industry and business are taking the initiative to make their supply chains more sustainable. Designers and engineers are incorporating the principles of the circular economy into their designs – starting with the end in mind so that nothing ever becomes waste.

Cities all over the world are making their own efforts to become greener. More people are aware of how and why soil and freshwater are being depleted, and we know it's better to eat locally produced food. Everyone is becoming more interested in making things with their own hands, participating in sharing economies, and experiencing things rather than consuming items in a virtual rather than material world, such as online film and music – even face-to-face telecommunication. Consumers and shareholders are also increasingly holding companies accountable for environmental degradation and ethical business practices.

So we've come a long way. But how can we gather further momentum? The transition to One Planet Living will take long-term planning, patience, focus and flexibility as we continue to learn, innovate and

Environment
Environnement
Medio ambiente

Sustainability
Durabilité
Sostenibilidad

Society
Société
Sociedad

Economy
Économie
Economía

implement solutions. In the meantime, we need to ramp up public engagement and debate to reach as many minds as possible, and adapt policy as circumstances change.

We also need to engage more directly with our leaders – particularly in industrialized countries, where footprints are much higher than in less developed nations. For example, if you live in Europe, you will be using more than your share of the planet's capacity even if you choose to ride a bike, recycle and grow your own vegetables, simply because you don't have direct control over decisions dictated by the state, such as transport infrastructure, electricity production and so on. These can, however, be influenced by public discourse and political pressure.

And lifestyle choices do still matter. It can be easy to feel too small to make a difference, but consumers have the power to demand products that meet our needs and reflect our values. And every movement starts with the individual: it all comes down to moment-by-moment choices: how we spend our time and money, our careers, what we eat and wear, how we communicate our values to others and take the lead from where we are with our actions and words. As we experience and demonstrate how pleasurable and rewarding it can be to live sustainably, minds will be changed. Maybe One Planet Living will become known as "common sense" sooner than we think.

Waste to treasure

SANGA MOSES explains how he went from working as a banker to being a green entrepreneur in Uganda, turning agricultural waste into fuel and fertilizer, and organizing reforestation projects.



Photos: Sanga Moses

“**I used to work** for one of the biggest banks here in Uganda, and that meant that I was away from my home village. One day, on my way to visit my mother, I met my little sister carrying wood. When she saw me, she started crying, saying: ‘I’m supposed to be at school but mother told me to go get wood.’ When I asked mother about this, she said: ‘I’m old and can’t survive without her.’

“This conversation haunted me. My sister was on the verge of losing the only opportunity she had for a better life – education. And there are so many girls like her.

“Uganda has already lost 70 per cent of its forests – and, according to the UN, it will have none left by 2052 if nothing is done. Things have really changed in the last ten years. When I was young, we could care for our cows because the seasons were stable, rains were predictable and we had water in the village. Now droughts are persistent, there’s no water left in the village and we have had to move our cattle away from where we live.

“My first idea was to sell solar cookers. I bought a few and gave one to my mother, but she complained: ‘I can’t use it at night, sometimes the dust blows into the food and when it rains, we can’t eat.’ So I went to see the head of the renewable energy department at Makerere University. From him I learned about using plentiful farm and municipal waste to make clean cooking fuel and organic fertilizers to revitalize soils.

“Together we made two simple things. One is a portable kiln made of an old oil drum. We give these to farmers, and teach them to carbonize and sieve agricultural waste, producing a powder called char. We buy this, and the farmers keep the residues as fertilizer. We also created simple machines to compress char so that it burns in the stoves that people have. No one has to change the way they cook: our fuel looks exactly like wood charcoal, but burns slightly longer and, crucially, is not as smoky.

“We founded Eco-Fuel Africa in June 2010, and now we have 25 full-time staff and a network of 2,500 farmers who produce the char for around \$30 a month. We sell this through 260 women franchisees, each of whom earns about \$5 a day.

“We use some of our income for planting trees. We work with schools, which are very excited about teaching sustainability through scout-like clubs called I Am For Trees, and provide the tree seedlings they need. So far, we’ve planted close to 150,000 trees, but that is just a beginning. Our plan is to expand as quickly as we can to restore Uganda’s forest.

“But, to be honest, I don’t think we can fix the problem alone. We need to keep working with communities to demonstrate our technology, and we need government support, too.”



Sharing is caring: the new economics?

A major evolution is taking place in the ways we create and consume. Such platforms as YouTube, Twitter, Soundcloud, Flickr and Kickstarter already allow us to share video, ideas, music, photographs and money. Now, the trend has jumped offline, with people increasingly sharing, renting and bartering real-world goods, services and experiences – everything from food to cars to rooms in private houses to tools and education – using the internet and social media to facilitate the process. It's the collaborative economy and it's gaining momentum.

So what's driving this? Are we fed up with buying and owning stuff? Are we discovering that experiences and community make us happier than things?

One driver is people's need to save money. People are looking for ways to share instead of buy, and put to use what otherwise might be sitting idle. Another driver is our growing environmental understanding. As more and more of us become aware that we need to be careful with Earth's resources, we're realizing that sharing makes sustainable sense. But one of the most interesting and perhaps unexpected drivers is that people are longing to connect and feel part of a community. Rather than finding fulfilment in shopping, people seem to be finding satisfaction in pooling resources and, in the process, connecting with others and building community.

There are some basic requirements for the system to work. First, it helps to have a resource that can be shared – a seat in a car, a spare room, a rarely used lawn mower, garden



space, a few spare hours and some skills. Look around. You're bound to think of something!

Then there's a communications platform – you could use Facebook, a dedicated website or, for local exchanges, a community bulletin board. But the main currency in the collaborative economy is trust – the faith that no harm will come from hosting a stranger in your house, for example, or that the person giving you a ride is a safe driver. Social networks help facilitate trust, as the number of friends, particularly mutual friends, who will vouch for you serves as a safety net – and conversely you can rapidly spread news of unethical behaviour.

In our materialistic world, the idea that something as intangible as goodwill is valuable may seem strange, but perhaps the rise of collaborative systems is a positive indicator that things are changing.

Sharing is caring: a starter pack

Need a ride?



YOU'VE HEARD ABOUT car-sharing services like Zipcar? That's old news – the new trend is for people to share rides on an ad-hoc basis for donations. For example, peer-to-peer ridesharing company Lyft connects riders with drivers using an app after registering with Facebook and credit card information. The rider makes a donation – an amount is suggested by the app based on how long the trip takes – and Lyft takes a cut. While Lyft and similar ride-sharing services have been criticized – perhaps not surprisingly by cab companies – and transport regulators are just starting to come to terms with how to regulate them, they are proving popular.

Similar platforms around the world include

iCarClub in Singapore, which matches car owners with those who want to “rent” one temporarily, as does OliveTrips in India. This can work where you least expect it – Chile, Iceland, Israel, Oman and Cuba all have schemes. Bayer Young Environmental Envoy Fabrizio González set up Easyways – a car-sharing website – in Bogotá, Colombia. The city is not known for its safety, so he sells his service to large companies and universities who then promote car-sharing among employees or students. Meanwhile, Simeon Oriko in Kenya started a Twitter hashtag initiative in Nairobi that allows anyone looking for or offering a ride to tweet with #CarPoolKE. **Could YOU organize a scheme for your university or school campus?**



Want to learn?

SKILLSHARE

glovico.org

WHAT DO YOU WANT to learn? Do you have something to teach? Skillshare is a peer-to-peer learning platform that hooks up people with something to teach – maths, cooking, logo or app design, website building, audio mixing and beyond – with those who want to learn. Skillshare started out facilitating offline, in-person local classes, but now offers online classes, allowing students to work from wherever they are and learn at their own pace.

Glovico.org hooks up language teachers with anyone in the world wanting to learn a language – say Arabic, Portuguese or Tagalog – one-on-one via Skype. Glovico isn't just a business, it's a social enterprise: its primary mission is to offer people from developing countries a chance to make an income by teaching their language.

So, what are YOU waiting for? Get active ... we know you'll enjoy it!



Want to travel?

airbnb

WHEN COUCHSURFING WAS LAUNCHED in 2004, it really was something else! The online platform allows travellers to connect with hosts, allowing people to avoid hotels and hostels and be accommodated for free as well as experience their destination from the perspective of a local. Four years later, online service AirBnb, which allows users to list spare rooms, flats and houses for rent – added the incentive of income, and suddenly a fringe phenomenon became mainstream. It can be quite profitable: one man in San Francisco reportedly saved enough money renting out his flat on AirBnb – he stayed with his girlfriend whenever it was let – to buy a house of his own. But it's not just about the money. AirBnb encourages hosts and travellers to get to know each other, and the platform is connected to Facebook so that friends and acquaintances can vouch for each other. Other similar services include Sinbad Travel in South America and Sejourning in France. **Fancy a jaunt?**



Getting things done

peopleperhour

NEED SOMEONE TO HELP with your to-do list? Or do you have some spare time and skills and need temporary work? Services like TaskRabbit and People Per Hour help people get the job done, however big or small. People Per Hour, which works worldwide, lets anyone list a job, for which potential employees bid. Freelancers can create profiles and offer services. Payment is via the platform, and the company makes its profit by taking a small percentage of the job's fee. TaskRabbit focuses local jobs – matching people who need help with someone who can help, whether it's errands, laundry, painting, gardening, cooking or putting together flat-pack furniture. The creation of such peer-to-peer job platforms is allowing people to get an income at a time when jobs are scarce. **If there isn't a scheme where YOU are, could you found one?**



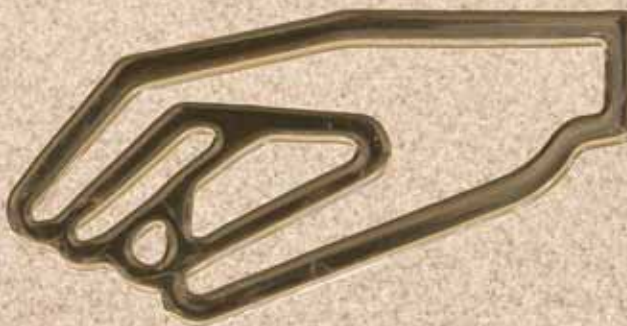
Digging in

landshare
Connecting growers to people with land to share

MORE AND MORE PEOPLE are looking for ways to try urban gardening, but few would-be gardeners actually have access to land. In 2009, an online service called Landshare was launched to help connect people with extra garden space with those who want to grow food. Now a community of 55,000 members, Landshare operates in the UK, Australia and Canada, with plans to branch out around the world. Then there are more local examples, such as Volvo Adventure Finalists from Hristo Botev Secondary School, Bulgaria, who clear up organic waste, compost it for their school veg garden, and give the surplus to local farmers to improve their soil. Teacher Nina Tsoneva has got more than her students involved – the local community has joined in too, encouraged by local media coverage. **What could YOU do where you are?**



WHAT A WASTE!



Around a third of the food produced globally for human consumption is wasted or lost – a whopping 1.3 billion tonnes of it. In developed nations manufacturers and food retailers waste large quantities due to inefficient practices and quality requirements that over-emphasize appearance, while consumers throw away edible food because of over-buying, inappropriate storage, confusion over labelling – particularly concerning ‘best-before’ dates – and preparing meals that are too large. It’s a common problem: across Europe, North America

and Oceania each consumer wastes 95–115 kilos of perfectly good food every year.

But food is also wasted in developing countries. The consumers themselves waste much less – on average just 6–11 kilos each per year – but much more waste occurs between the field, the food processors and the retail outlets due to lack of infrastructure, technology or coordination.

It isn’t just about squandering calories and nutrition. It’s also a waste of the precious freshwater needed to grow crops: agriculture accounts for 70 per cent of our freshwater use. It’s also a waste of the chemicals used for pest control and fertilization (not to mention any negative effects these may have on the natural world), a waste of fuel used to transport and preserve food on its way to our tables, and a waste of the labour of those who produce and sell our food. And food discarded in landfills produces methane, a potent greenhouse gas, contributing to global warming.

A NEW PROTOCOL

At a time when human population is growing exponentially and a third of the world’s population faces starvation daily – according to UNICEF, 2 million children die of hunger every year – how can we square the amount we waste with the need to feed the hungry? “If we reduce food loss and waste to zero it would give us enough additional food to feed 2 billion people,”

says FAO Director-General José Graziano da Silva, who is calling for a new global protocol to measure and cut global food loss and waste.

But the question remains: how do we get the food currently being wasted in fridge and field to the mouths of the hungry?



FIGHTING FOOD WASTE

GLOBAL Feeding the 5000

A British campaign with global aspirations, Feeding the 5000 aims to raise awareness of food waste by holding events that feed the public with delicious meals using only ingredients that would have otherwise been binned. At a recent event in Marseille, France, volunteers gathered enough discarded food to feed more than 4,000 people with a vegetable curry made from produce deemed too big, too small, or too funny-looking, and rice that was past its expiry date but perfectly edible. In 2013, they also provided a dinner for delegates to UNEP’s Governing Council entirely made from discards of the Kenyan export food industry. www.feeding5k.org

Big and small projects to combat food waste are popping up all over the world. They’re full of ideas about how you can help.

GLOBAL Food security

At the end of 2013, three organizations – the Food and Agriculture Organization of the United Nations (FAO), the International Fund for Agricultural Development (IFAD) and the World Food Programme (WFP) – teamed up to launch a \$2.7 million project, funded by the Swiss Agency for Development Cooperation, to tackle food loss in developing countries, starting in Burkina Faso, the Democratic Republic of the Congo (DRC) and Uganda. The projects will focus on staple grains and pulses to address such issues as ineffective harvesting and handling, storage moisture levels and pest damage.

Fake meat – friend or foe?



In August 2013, Dutch scientist Mark Post and his colleagues made headlines when he presented a lab-grown burger cultured from bovine stem cells, cooked it and ate it. Coloured with beetroot, bulked up with breadcrumbs and flavoured with saffron and caramel, the burger was the result of two years of research that cost more than \$300,000. Could this, as scientists think, mean that lab-grown meat could be on supermarket shelves within a decade?

Why would we eat synthetic meat? First, mass meat production is hard on the environment, requiring land, grain and water to produce while generating a significant share of the world's greenhouse gas emissions. And as it becomes more of a challenge to feed the planet's growing population, it makes some sense to look for alternative, more sustainable ways to produce food. After all, lab-grown meat uses 45 per cent less energy, generates 96 per cent less greenhouse gas emissions and requires 99 per cent less land.

Don't forget, many of the things we eat are cultured: cheese, wine, yoghurt and even other fake meat such as Quorn, which is cultured in vats from a fungus. And anyway, shouldn't we be trying to overcome our squeamishness in the name of sustainability? After all, while some people say they would never eat insects, they are a valuable source of animal protein in many cultures, and the World Health Organization is encouraging development of insect-based foods as a way to meet world food demand. Much waste could also be avoided if people would be willing to eat off-cuts of meat that are now often thrown away, such as liver, kidneys, skin, brains, tongue, tail, trotters and so on.

Others argue, however, that simply cutting down on the meat in our diets – and focusing on efficient and/or organic agriculture – would solve the problem. What do you think? Should we look to synthetic meats to meet world food demand? Would you eat a lab-grown burger? Or would you choose to eat less meat?

“Insects are a valuable source of animal protein...”



GLOBAL Think.Eat.Save

In 2011, UNEP partnered with the FAO and Messe Düsseldorf to launch the Think.Eat.Save campaign to offers tips and ideas for rethinking how we use food. The programme offers consumers, retailers, leaders and citizens tips and advice for preventing waste. www.thinkeatsave.org

NETHERLANDS Save Food from the Fridge

Founded by Korean designer and food-preservation expert Jihyun Ryou, this passes on traditional methods for keeping food fresh for longer without the need for modern technology. www.savefoodfromthefridge.com

ITALY Last Minute Market

Last Minute Market reclaims food from farmers, grocery stores, farmers, processing centres and donates it to more than 40 communities in need. www.lastminutemarket.it

CHINA Clear the Plate

A government initiative to save food, Clear the Plate encourages restaurants to cut serving sizes, and a media campaign educates the public about improving food habits. Meanwhile the Chinese military has started to pickle surplus vegetables and recycle undercooked rice by incorporating it into new dishes. www.youtube.com/watch?v=7yu-l-kdn4M

USA Sanford and Son

This father-and-son business run by Ray Sanford and his son Nigel makes organic compost as well as biodiesel from food waste gathered from residents and restaurants, and distributes the compost to urban farms. <http://sanfordandson.org>

We all **NEED** bees



Since ancient times we have relied on bees. They pollinate about a third of our food – crops including beets, onions, tomatoes, cabbages, coffee, squashes, all kinds of nuts, cherries and apples. We get this service for free, yet it is worth billions to trade and is priceless when it comes to human survival. As Einstein said: “If the bee disappeared from the face of the Earth, man would only have four years left to live.”

Bees are incredibly efficient: one hive of 50,000 bees can pollinate half a million plants in a single day. Even though humans can and do hand-pollinate when necessary – such as in China, where the insects that pollinate pear trees have become extinct – the cost of doing this would significantly raise the cost of the food.



Sajjad Sherally Fazel/CC-BY-SA 3.0

Trouble

YOU CAN'T MISS THE HEADLINES – within the last decade, there have been a number of episodes of bee populations disappearing or dying, particularly in the USA and Europe. This first came to light in the USA in 2006, when up to a third of the nation's honeybees died, with about 10 million hives dying since. And in the UK around a third of all honeybees died over the winter of 2012–2013.

No one yet knows for sure what causes colony collapse disorder, as this phenomenon is known, but the truth may lie in a combination of things, including nutrient deficiency caused by exposure to monocultures rather than a variety of wild plants; parasite infections; exposure to disease; and exhaustion as industrial farmers ship hives over huge distances to pollinate distant farms; as well as toxins – pesticides and fungicides.

Perplexingly, some pesticides have been identified as having a toxic effect in the field even though laboratory trials have shown them to be safe to bees, while fungicides not meant to have an effect on bees may be reacting with other chemicals in the environment to make the insects more vulnerable – researchers have found cocktails of up to 21 different chemicals in pollen samples.



Louise Docker/CC-BY 2.0

To facilitate untangling this complexity, the European Union has invoked the precautionary principle, enacting a temporary, but contested, restriction on neonicotinoids, a class of pesticides, so that more research can be done. Nonetheless, the fate of bees may be a stark and humbling lesson that the responsibility for not doing harm lies well beyond the lab, and that nature is not a controlled environment.

Bees: making a comeback!

THE RECENT GRIM NEWS about bees gives all the more reason to celebrate the sighting of a bee thought to have disappeared. Resident Megan O'Donald found the first western bumblebee (*Bombus occidentalis*) to be seen in Washington State, USA, for more than a decade. Known for pollinating tomatoes and cranberries, more examples of this species, recognizable by tufts of white on its head and bottom, have subsequently been sighted, prompting excited conservationists to track down the site of the colony, using GoogleEarth to help identify possible bee-friendly habitats in the area. The bee colony is now being monitored carefully.

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KB Hemalatha/UNEP

US-DA/PD



Can YOU help?

CREATING URBAN BEE HABITATS doesn't just help make any space greener, it CAN provide delicious honey – some say urban honey is even better than rural honey because of the diversity of plants available to bees in parks and gardens.

Over the past decade, honeybee hives have been popping up in unusual places: on rooftops, back gardens, highway and railway sidings, abandoned lots, schools and more. A rich diversity of flowers, plants and trees in gardens in these places helps bees thrive, giving them a wider range of plants to feed from. One scheme, promoted by Solarcentury in partnership with the Bumblebee Conservation Trust, is planting British native plants and creating nest boxes at UK solar-energy sites, where the presence of panels helps nurture flora and fauna by providing a range of dry and wet, shaded and sunny areas.

Would YOU like to give beekeeping a go? There are loads of informative sites out there. **Omelet** (www.omlet.co.uk/guide/bees/) offers a good basic guide, as does the Daily Green (www.thedailygreen.com/environmental-news/latest/diy-backyard-beekeeping-47031701). It's a great way to reconnect with nature, learn about the relationship between the ecosystem and food, and get some terrific honey!



M. Chédel/PD

Quinoa – that's 'kinwa:

From an unknown to a superstar with a Facebook page – no, not a musician, not a sports wonderkid, just a humble grain that's delicious ... and good for you.

For the last 15 years, this Andean staple, cultivated for seven millennia, has steadily risen in status as a nutrient-dense, low-fat, environmentally friendly, nutty-flavoured food. Quinoa can be eaten as a cereal, prepared like rice or couscous, or ground and baked into bread. And it's a complete protein, rich in minerals, vitamins and fatty acids, making it a valuable food, especially for vegetarians.

Quinoa was passed over by Spanish colonists in favour of wheat, barley, maize and potatoes. As a result, until recently, it was only cultivated by small farmers in the high Andes. FAO Director-General José Graziano da Silva, however, declared 2013 the International Year of Quinoa, saying that it could play "an important role in eradicating hunger, malnutrition and poverty". The designation

honoured the indigenous people of the Andes for their role in protecting quinoa and championed the sustainable development of the crop around the world.

But as the popularity of quinoa soared, a controversy emerged: the farmers who grew it could no longer afford to eat it, and were turning to less nutritious and cheaper foods. And in response to global demand, other farmers began cultivating quinoa rather than grazing llamas, pushing the traditional agricultural practice out of balance and depleting the soils, as there was no longer enough llama manure to use as fertilizer for the crop.

The hope now is that international cultivation of quinoa will take the pressure off its traditional cultivators, allowing them to continue to profit, but also making good use of the plant in alleviating food insecurity around the world. Thanks to quinoa's ability to thrive in a wide variety of conditions, it is now being grown beyond the Andes – in Canada, Denmark, England, France, the Himalayas, India, Italy, Kenya, the Netherlands, Sweden and the USA.

Want to try?

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Salad

Simply rinse the quinoa and boil it, in a ratio of about 2:1 water to quinoa, for around 20 minutes; when a little tail pops out of each grain, it's done. Fluff it up, let it cool, and add chopped cucumber, onion, tomato, parsley, mint, olive oil and lemon juice.

Popped

Pop the grains in a hot dry pan, much as you would with popcorn, only without oil. The result is tiny crunchy bits that can be eaten as a snack.

As quinoa has travelled around the globe, people have experimented and incorporated it into all sorts of dishes. Here are a few to try.

Pancakes

Cooked quinoa can be incorporated into your traditional pancake recipe for added texture and nutrition. Try one cup of cooked quinoa to 225 grams of flour, 2 teaspoons of baking powder, an egg plus an egg white, a tablespoon of melted butter and 300 millilitres of milk. Mix the wet ingredients together first, then the quinoa with the flour, baking powder and a couple of pinches of salt. Then cook like a normal pancake.

Pilaf

Simply sauté chopped onion and garlic for a few minutes in olive oil, then add a cup of quinoa and stir until it is slightly browned. Pour in 2 cups of stock or water, and bring to a boil, then simmer with a lid on for about 15 minutes till the grains are tender and have absorbed all the liquid. You can add vegetables to the pilaf – but it's lovely on its own.



Immersia/CC-BY-SA 3.0

Carbon farming?

We all know that planting trees is one of the best things that we can do. Besides sequestering carbon dioxide (CO₂), trees prevent erosion, improve soil nutrients, increase precipitation and draw moisture into the ground.

Now, a new study suggests that deliberate tree-planting on a large scale can absorb CO₂ as efficiently as high-tech carbon sequestration solutions such as carbon capture and storage.

German researchers demonstrated that 1 hectare of jatropha (*Jatropha curcas*) – a plant adapted to arid con-

ditions that is already sometimes grown for its oil-rich seeds, from which biofuels are made – captures up to 25 tonnes of CO₂ annually. The report extrapolates from this that a plantation covering 3 per cent of the Arabian desert could absorb all of Germany's car and truck CO₂ emissions.

The trees could also help green the deserts, say the researchers, and seeds harvested for biofuels would provide a source of income. There's a catch, of course: jatropha needs a source of water, so the plantations would need to be located near coasts and desalination plants, and the trees do not appear to thrive quite as well as was once believed.

Earning carbon credits

THE AUSTRALIAN GOVERNMENT has launched a programme called the Carbon Farming Initiative, part of the nation's overall climate protection scheme. It offers farmers and land managers the chance to earn Australian carbon credits – which can be sold to companies wanting to offset emissions – by storing carbon or reducing greenhouse gas emissions on their land. Acceptable activities include planting trees or native vegetation, but also restoring wetlands, applying biochar to soil, and reducing methane emissions from livestock by changing their feed-stuff and/or by flaring the methane from their manures.

Bogdan/CC-BY-SA 3.0



US-FWS/PD

Improving soils



IN CALIFORNIA, a different sort of carbon farming research is being trialled. A pilot project begun in the mid-1990s near Sacramento has been researching how such wetland rushes as tules and cattails (bulrushes) absorb CO₂ and then form rich peat soil as they die and decompose. The idea is to build up soil to shore up the embankments that protect California's water source, as well as sequestering CO₂.

The Earth system: the good news



We scan headlines to gauge the well-being of the world we live in, looking at news of economic crashes, crime, political intrigue, war, sport, celebrity scandal and so on, for signs of how we're doing. But underpinning all that human activity is the Earth itself – the system that generates and regenerates life's fundamental needs: air, water, soil ...

Working as one, the Earth system gives us oxygen and absorbs our carbon dioxide, regulates humidity and keeps temperatures appropriate for life. Because the sun shines, plants photosynthesize and fungi and bacteria break down organic material to make fertile soil. Because trees direct clean water into the ground and bees and birds pollinate our crops, we have food and medicines, and materials for clothing and shelter.

Microorganisms living inside our bodies help us break down foods and absorb nutrients, and help keep us free from infection. Without us really noticing, the planet's ecosystems regulate disease, keep pests in balance, stabilize deserts, provide us with fresh drinking water. And that's not to mention the spiritual

and recreational value we derive from making contact with nature.

We get all these invisible and valuable services – without which we would not be able to live – for free. They are invisible, that is, until they start to go wrong. Then we find out the hard way how much we take them for granted.

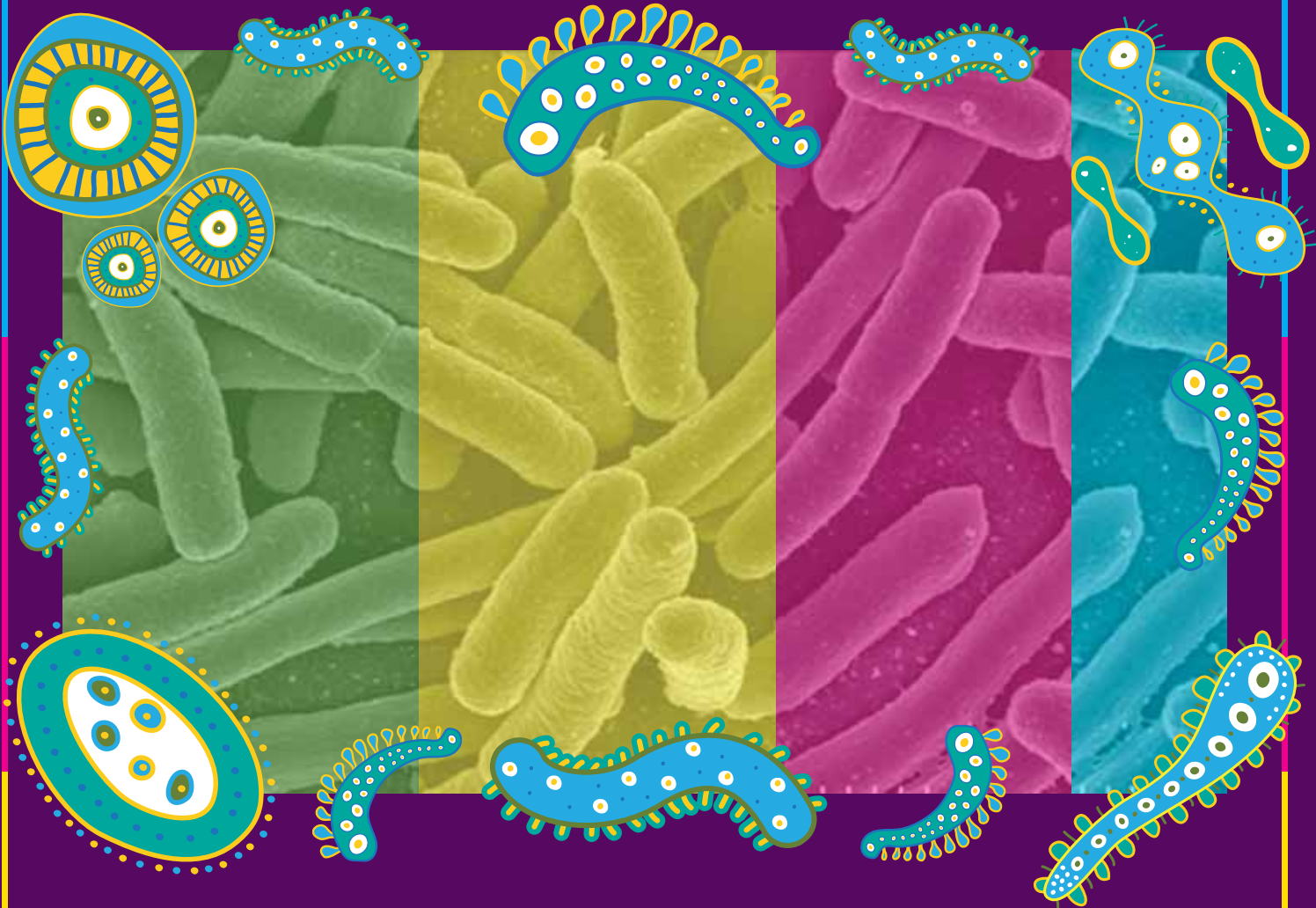
One hope for bringing the value of ecosystem services to public awareness is by putting a monetary value on them, incorporating such costs as pollution and biodiversity loss into the price of everyday products. This is what the G8-led initiative, The Economics of Ecosystems and Biodiversity (TEEB), is working on.

There's a long way to go with this idea, as it's no easy task to consistently value natural capital across industry, governments and other stakeholders. Meanwhile, the good news is that by learning about how ecosystems work, we can each act in support of the systems upon which we, and all life, depend. With knowledge and care, we can make a difference.



NASA

Microbes: forgotten diversity



In recent years, thanks to advances in DNA sequencing technology, our ability to identify and study microbial ecosystems has changed our perspective on microbes and their contribution to human health.

No surprise, then, that some scientists are now turning their attention to the ways in which microbes play a crucial role in maintaining balance in the ecosystem. In fact, some microbiologists are now asserting that we need to pay as close attention to bacteria, fungi and viruses as we do to pandas, tigers and whales.

Microbial ecologist Gareth Griffith recently noted that only 2 per cent of papers in mainstream conservation journals are about microbes, and these usually refer to the dangers they pose to larger organisms. This is partly because we don't yet have enough data on microbes to include them in the Convention on Biological Diversity, but it also reflects a bias towards life forms we can see.

Yet humans cannot live without microbes. Take fungi, for example. They are responsible for decomposing dead plant material, turning it into nutrient-rich soil. And recently isolated protective bacteria that live symbiotically with animals could prove a highly efficient

tool for saving the world's endangered species. Some microbes that live in mammalian digestive tracts – including ours – are crucial to maintaining health, while 90 per cent of the world's plants are entirely interdependent with mycorrhizal fungi that live at their roots, increasing water supply to the plants and helping them to absorb essential nutrients such as nitrogen and phosphorus.

There's no time to waste: as pollutants spread and climate and habitats change, we may lose species and the microbes that live in close symbiosis with them – and who knows how pivotal they might be for conservation, health care and beyond. Even the ancient microbes frozen 4 kilometres under Lake Vostok, Russia, are at risk – we don't know how exposing them to life on the surface will harm them, or what the implications might be.

Griffith calls for the support of microbiologists and the conservation movement to create a Global Strategy for Microbial Conservation to study threatened microbes, a strategy to protect microbe-rich environments – particularly endangered soil habitats – and education programmes to counter negative attitudes towards microbes.

Bugs, they're good for you!

When we think of microbes – bacteria, viruses, fungi and other organisms too small to see without a microscope – we very often link them to disease. TV advertisements tell us to buy cleaning products that kill “99 per cent of all known germs”, but we don’t yet know the full truth about how microbes affect our well-being. What if by killing the microbes, we are harming ourselves?

Microbes are everywhere and play a vast diversity of roles in Earth’s ecosystems – generating oxygen, cleaning water, breaking down waste, to name just a few. They also live inside us, and we couldn’t live without them. In fact, 90 per cent of the cells in our bodies are microbes – each human body has up to 10,000 different types of organism in its own unique microbiome, helping us digest food, keep our skin healthy and our breath fresh.

TUNZA spoke to Jessica Green, a biologist, ecologist and engineer working with the University of Oregon, USA, who is researching the role of microbes in human health and our built environments.

TUNZA: Are microbes a vital part of us and our ecosystem, and how do they provide ecosystem services?

Jessica: Microbes play a fundamental role in regulating our immune system and our metabolism, and research on mice has shown that microbes might help regulate our moods and levels of stress.

People are talking more and more about personal microbial makeup, and beginning to recognize microbes as a fundamental ecosystem service. For example, there’s an interesting conversation happening right now about how microbes are going extinct in developed world urban centres, and how the loss of particular microbial taxa and the lowering of microbe diversity might be linked to the rise of immune disorders, allergies and asthma.

TUNZA: Isn’t there a link between green spaces and mood disorders?

Jessica: We know that humans have evolved to be happier, less depressed and healthier when surrounded by green space. But innovative researcher Graham Rook is also starting a conversation about how nature provides immunological benefits – that our immune systems need to be trained by “old friends”, microbes with which our bodies have evolved in

partnership. He suggests that we, people, are losing microbial diversity due to an overuse of antibiotics, and because our urban spaces don’t have many of the natural materials that humans have lived with on an evolutionary timescale.

TUNZA: How does your work with sustainable building design consider microbes?

Jessica: At the Biology and Built Environment Center (<http://biology.uoregon.edu/biobe/>) we’re interested in how building design impacts microbes that live inside buildings. Because people spend 90 per cent of their lives indoors, they are colonized by the microbes that are in the buildings. We are looking in to the use of natural building materials, as well as the way we let air in and out of buildings, aiming to use more direct sources of air from outdoors rather than filtering and treating it through air conditioning systems. We’re also considering landscape architecture and urban spaces in general, asking whether the way we plan the outside of buildings is important. What is the microbial effect of having a green space or garden in a building plan? A rooftop garden, perhaps? I think this is important because

airborne microbes that are usually outside can then get inside and colonize people indoors.

TUNZA: What’s the sustainability angle of the work you do?

Jessica: Our planet is getting hotter and hotter, and building designers are trying to get to grips with how to deal with it. It’s becoming ever more resource-intensive to use mechanical ventilation to cool buildings while also filtering the air – keeping the outdoors out. And it’s going to get harder as it gets hotter outside, as well as contributing to global warming. So we consider how to use natural ventilation strategies, and how that could change the microbes we’re bringing inside – those growing on trees or in soils, the ones we evolved with.

Some people, however, are making buildings tighter and tighter. There’s something called the skin of a building, or a building envelope, and if you let less outdoor air in and have fewer air changes per hour, it saves energy. But nobody really knows about the consequences of that. We have a lot to think about in terms of designing buildings to cope with global climate change, and how that might impact our health. We should be thinking about microbiology when considering these issues.

A frog's life

MICROBES CAN HELP preserve the health of wildlife. Recently, researchers discovered a bacterium that, in the wild, protects certain species of salamanders and frogs – and might, with the assistance of science, help save them from extinction.

All over the world, amphibian species have been laid low by the chytrid fungus, *Batrachochytrium dendrobatididis*, whose spores block respiration and nutrient absorption. This fast-spreading infection, called chytridiomycosis, may be the worst-ever infectious disease of vertebrate species as it rapidly devastates populations. Already, it has driven two species – the Costa Rican golden toad and the Australian gastric brooding frog – to extinction, and scientists fear that the disease may be responsible for around 100 other extinctions, with more to come.

The good news is that amphibians do have protective anti-fungal bacteria that naturally occur on their skin – even though this is not always enough to keep a virulent infection from overwhelming them. Researchers isolated one of these bacteria, *Janthinobacterium lividum*, from yellow-leg frogs of the Sierra Nevada mountains of California and brewed quantities of it in a laboratory. Then, they applied the solution to frogs in the lab, and exposed them to chytrid fungus. All of the treated frogs survived, and testing in the field got the same result: of a population of frogs in the wild, only those that were inoculated with the bacterial solution survived when the chytrid fungus swept through the habitat.

The fact that we can amplify the power of protective microbes is great news, and not just for amphibians. Researchers working with mosquitoes have successfully inoculated a species of mosquito with *Wolbachia* bacteria, making mosquitoes immune to the malaria parasite and therefore preventing transmission of the disease. A similar experiment was successful in preventing the transmission of dengue fever.

More research and testing is needed: a bacterium that works for one species doesn't always work when transferred to another, suggesting that for each species and habitat, just the right bacteria may need to be isolated. But the initial successes point to a hopeful future in which we may be able to use microbial biodiversity as an invaluable resource for protecting other life forms – and that includes you!



J.L. Gasparini/UNEP



R. Arno/UNEP



L. Minnick/UNEP



Wildlife superhighways



Imagecom/Dreamstime.com

Whenever an Ice Age engulfed planet Earth during the last 2.4 million years (the last one was 10,000 years ago) how did animals and plants survive to carry on populating the planet, evolving to what we see now? Scientists believe that they migrated to isolated, environmentally stable regions known as refugia, and re-emerged to colonize the planet as the ice fell back. These ancient stomping grounds included parts of Europe such as the Italian and Balkan peninsulas, Greenland and other Arctic islands, Australia and the forests of Gabon in West Africa. Today, certain richly biodiverse regions with high instances of endemism are considered refugia, including the Madrean pine-oak woodlands of Arizona and northern Mexico and a ginkgo refugium in China. Conservationists are also discussing the possibility of creating refugia in order to help protect biodiversity.



TWildlife/Dreamstime.com



Alemond/Dreamstime.com



Surz01 | Dreamstime.com

NOW, AS THE CLIMATE CHANGES and the world warms, making environmental conditions less predictable, the world's animals and plants may, once again, have to migrate to more hospitable environments to survive. But isolated wildlife refuges will not be enough; we also need corridors – interconnected stretches of unbroken wilderness and protected land – running between them so that wildlife can move freely and safely from one zone to another.

All over the world, conservationists are working to create these wildlife highways that will allow unimpeded connection across vast distances. The Meso-American Biological Corridor established in 1998, for example, spans an area of uninterrupted wilderness from Mexico to Panama, which serves to protect 106 critically endangered species. The stretch that crosses Belize, alone, makes space for vulnerable big cats like jaguars and pumas to roam from one protected area to another – essential if they are to escape extinction.

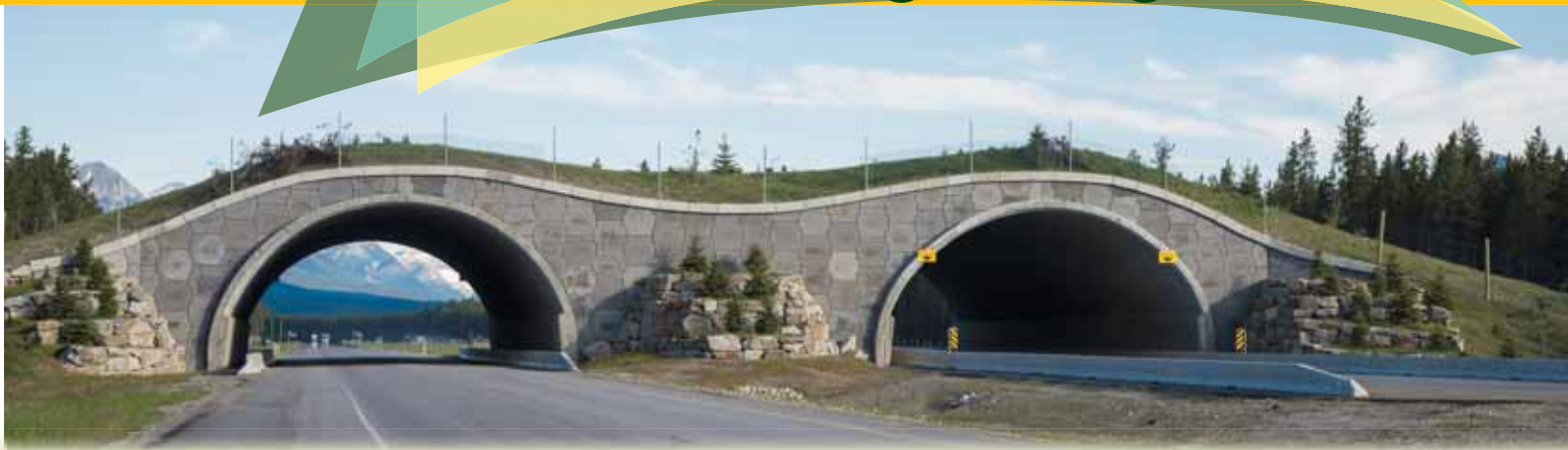
In Turkey, plans are under way to create a

23,470-hectare wildlife corridor that connects the Sarikamis National Park's endangered lynxes, bears and wolves with the richly biodiverse Kars region – which features hundreds of plant, bird and large mammal species, many of them found nowhere else. Meanwhile, in India, the Siju-Rewak Corridor lets elephants move between protected areas. And conservationists have also proposed an 8,000-kilometre-long corridor spanning eight countries, from Bhutan to Myanmar, to allow tigers to move between habitats.

Of course, while corridors help give biodiversity a fighting chance of surviving climate change, they are not a simple, single fix to a far-reaching problem. As conditions and populations shift, humans have to consider such issues as what to do if more animals than expected move to a region that is not big enough to sustain them, or if newly arrived species threaten local species. But the best course of action to protect biodiversity is to curb our own, anthropogenic, greenhouse gas emissions.



Building bridges



Rcphoto/Dreamstime.com

Some animals need something larger and more elaborate than a wildflower-planted verge to cross from one habitat to another, meaning that man-made structures are needed.

In the Netherlands an 800-metre “ecoduct” serves as a green superhighway across a motorway, railway and golf course. In Canada, large mammals in Banff National Park – bears, coyotes, elk, mountain lions and wolves – are protected by six wildlife bridges and 38 underpasses spanning the highways.

Not all wildlife crossings are for mammals. Fish ladders, for example, help migrating fish to get past dams blocking their way to upriver spawning grounds. The structures differ for different species, but they are typically a series of pools arranged in ascending steps so that fish can leap or swim from one to another. In Florida, USA, underpasses allow crocodiles to avoid road traffic. And each year on Christmas Island, north of Australia, rangers build bridges to allow more than 100 million terrestrial red crabs to migrate to the sea to lay their eggs.

Caution:
wildlife
crossing!

THE MORE THE HUMAN POPULATION grows, the harder it is for wildlife to thrive. Sprawling cities, towns, roads, factories and farms use up open forest, prairies, meadows and wetlands, driving plants and animals into ever-decreasing areas. Even in places where there are pockets of green space, sometimes known as habitat islands, these spaces are cut off from each other, making it difficult for animals – insects, birds, mammals, amphibians – to move around in search of food, shelter and breeding grounds.

Isolating animal species in a small area makes them more vulnerable to predation, disease and inbreeding. And if one species disappears, it can affect the entire local ecosystem. In addition, animals in search of food or mates can wander on to roads, endangering both themselves and drivers, or into human settlements, bringing them into conflict with people. In Africa and Asia, elephants and tigers that have been backed into forest parcels too small to sustain them sometimes enter villages and farms, destroying houses, crops and livestock.

So how can we offer wildlife safe passage to help preserve and promote biodiversity?

The road to recovery



Kenneth Dwain Harrelson/CC-BY-SA 3.0

While roads are often part of the fragmentation problem, they can also offer a solution. Roadside verges planted with native wildflowers help support important pollinators such as bees and butterflies, while ponds become homes for amphibians and a watering hole for birds and other small animals. So there’s now a whole new movement in roadside landscaping – planted and maintained as purpose-built living spaces and green corridors for plants and animals. In the USA, for example, conservationists are encouraging roadside planting of milkweed, on which monarch butterflies depend, to help the recovery of this magnificent but endangered species. And near Oxford, UK, a green corridor linking two woodlands has been created along the side of a motorway, allowing species to migrate back and forth.

Can cities help the globe go green?

Cities are home to more than half the world's people – and in the developed nations that figure is nearly 80 per cent. Given that urban centres are responsible for a whopping 75 per cent of the world's greenhouse gas emissions, they are clearly in a fantastic position to make a difference to the climate change problem. And for the last several years, cities have been taking the lead. As the world's nations continue to seek consensus on emissions agreements, cities, led by mayors, have been spearheading the sometimes unglamorous, on-the-ground work of becoming more sustainable.

What makes this possible? For one thing, city residents are more likely to back long-range plans for infrastructure change – like new bridges or neighbourhood redevelopment – as they can picture tangible results that will benefit them and their families for generations to come.

Then, as mayors have concrete knowledge of how floods, rising seas and heat waves would affect their cities,

they are well equipped to tackle green initiatives. And mayors have to put pragmatism before propaganda – if streetlights stop working or subway systems break down, they are held directly accountable. This hands-on role puts mayors in a unique position to implement real changes.

Decisions and innovations at the city level can add up to pragmatic mainstream lifestyle changes that make it easy and normal for people to live green. To name just a few of these initiatives, there are safe, walkable mixed-use neighbourhoods; efficient public transport that uses renewable energy; energy standards and green innovation for commercial and residential buildings; bike lane infrastructure and bike-share programmes; recycling schemes; green spaces for recreation and habitat corridors; farmers' markets; emissions limits and congestion charges ... The list goes on.

Best practices

THERE IS PLENTY OF URBAN INSPIRATION all over the world. In Bogotá, for example, Mayor Hernando Durán Dussán started a worldwide, decades-long movement of car-free days when he supported the launch of the Ciclovía in the 1980s. Today, the city is celebrated as one of Latin America's greenest, with recent dramatic improvements in air quality and water supply and an increase in planted vegetation. In 2007, Mexico City's mayor Marcelo Ebrard Casaubón launched his Plan Verde to make the city sustainable within 15 years. The strategy includes citizen education and tackles air pollution by modernizing the taxi fleet with environmentally friendly cars, extending the subway system, and a public transport system specifically for schoolchildren. Not only has the city planted 1.4 million

trees, it has also created a special police force of 1,500 officers to protect the city's conservation areas from illegal logging, development and fires.

Cape Town, South Africa, protects urban biodiversity and endemic vegetation habitats by creating a network of ecological corridors. High-density Singapore leads Asia in planned green space, while London is trialling a system to use waste heat from its subway trains to heat nearby households. Trang, Thailand, integrates biodiversity conservation into urban planning, such as conserving wildlife in urban canals, while Tokyo encourages energy-efficient building with a cap-and-trade programme, part of its plan to reduce carbon dioxide emissions to 25 per cent below 2000 levels by 2020.

Local benefits, global impact

Not only do urban improvements make an impact on the planet's overall environmental well-being, cities are also banding together to take the lead in climate change mitigation. In late 2013, more than 50 mayors from 30 countries met for a World Mayors Summit on Climate Change and pledged to tackle climate change through organizations like the C40 – a network of megacities working to reduce greenhouse gas emissions, Asia's city network CityNet and the International Council for Local Environmental Issues. And at COP-19, the recent UN climate conference in Warsaw, there was a full-day session called the Cities Day. Perhaps it won't be long before it is mayors, not national leaders, who are mapping humanity's path towards sustainability!



One voice for clean air

It's not often that a famous 78-year-old opera singer becomes an environmental activist. Famed Peking Opera master Mei Baojiu recently called on the city government to take action about levels of smog in Beijing, revealing that he had been forced to take medication for an irritated respiratory tract. "My voice no longer sounds perfectly smooth and clear," he said. "Air pollution has ruined the voices of Peking Opera performers." Peking Opera is a highly stylized, classical art form that requires male singers such as Mei to play the parts of women, singing high, silky notes in long runs.



@miniharm

WHILE MEI'S COMPLAINT highlighted public concern, the problem was already impossible to ignore, with Beijing's air pollution levels making headlines. In January 2013, air quality monitoring showed particulate matter (PM) levels in the air to be almost 35 times higher than what the World Health Organization considers hazardous. Hospitals reported greater numbers of respiratory problems, and flights were grounded for a day when visibility levels dropped due to smog.

The source? Beijing's 5 million cars contribute, but the real culprits are China's coal-fired power plants, which have fuelled the nation's rapid economic development. The smog is even drifting to Japan, where PM levels are climbing beyond accepted limits, forcing the government to issue health warnings. Meanwhile, more and more Chinese citizens are staying indoors when possible and buying masks and air purifiers.

The good news is that the situation has forced the authorities to respond. In the immediate term, Beijing's government suspended operation of the most polluting factories and reduced its own car use by a third. Long-term solutions include increasing public transport, capping the number of private cars on the road at 6 million by the end of 2017, restricting the numbers

of new car sales, and asking 1,200 factories to either shut down or upgrade their facilities.

As China's newly elected prime minister Li Keqiang declared in his first press conference: "We shouldn't pursue economic growth at the expense of the environment. Such growth won't satisfy the people."



Azure Lan/CC-BY 2.0

Fighting malaria



US-CDC/PD

Malaria is one of the world's biggest public-health concerns, killing around 700,000 people a year – many of them children, and many in Sub-Saharan Africa, although the disease is also common in Southeast Asia. Efforts to halt or even slow the spread of malaria include preventing the breeding of the *Anopheles* mosquitoes that carry the *Plasmodium* parasite, using protective nets, and anti-malarial medicines such as artemisinin. While medicines help, an ongoing problem is that the parasite becomes resistant to treatment.

One hope may lie in the root of a creeping plant, *Cryptolepis sanguinolenta*, indigenous to Ghana. TUNZA spoke to Alexandra Graham – President of the St Karol School of Nursing in Ghana and founder of PhytoSearch, a company that seeks development of African indigenous medicines – about *Cryptolepis*. She explained that, even when there is plenty of plant diversity available, it can still be a struggle to exploit it to help alleviate disease.



“*Cryptolepis sanguinolenta* has been used for generations in Ghana as an anti-malarial medicine. It is unique because it has anti-malarial properties as well as fever-reducing and pain-relief properties. Traditionally, it has been used as a decoction – the root is boiled and the liquid drunk. Now, clinical trials have been done on delivering the root in the form of a teabag, which is easier to prepare – and it works perfectly.

“But a major problem is that the root tastes very bitter. Typically, patients take it on the first day, but on the second, when well-being returns and the fever has gone, they stop taking it and get sick again.

“We hope to take the root through the usual clinical trials for a botanical

medicine that would be available as an easy-to-ingest capsule or tablet. In this form patients would be more likely to complete the three- or four-day course of pills required for recovery.

“But such development takes funding, which is difficult to source, in part because the root is a natural, not a synthesized, medicine, and many trials – for example those funded by the Gates Foundation – are only interested in unique molecules. But it should be remembered that artemisinin, which is the primary drug currently used against malaria, was originally derived from a plant discovered in China thousands of years ago. It is now also widely grown in Southeast Asia and East Africa.”



Ulrich Mevel/www.westafrikanplants.senckenberg.de

Thinking ahead

“Once resistance to any antimalarial medicine gets under way – and the parasite is now becoming resistant to artemisinin in Southeast Asia – what should our backup be? My company is working to find medicines that might prevent malaria across the Sahelian region, looking at using the indigenous knowledge that we have in Africa. I think there's great hope of developing this root that cures malaria, offering a backup to what we have in the system right now. The scary thing is that the medicines we have now could become ineffective before we have developed anything new, and we'll be left with nothing.”