

From the moment we wake up, to the time we go to bed, we rely on plants. We drink stimulating cups of tea, eat energy-giving fruits and vegetables, live in houses built and furnished with timber products, drive in cars with rubber tyres and sleep between cotton sheets. Plants are our life support, providing us with food, medicines, building materials, clothes and environmental services such as clean air and water.

To highlight the vital contribution that plants and ecosystems make to our lives, the United Nations has designated 2010 as the International Year of Biodiversity. Hundreds of organisations around the world, including Kew, will be holding events to raise awareness of how biodiversity underpins humanity. The aim is to encourage everyone to make an effort to

safeguard the rich variety of life on Earth, at a time when ecosystems are critically threatened by over-exploitation, environmental destruction and climate change.

'We rely on plants in virtually every facet of our lives,' explains Paul Smith, head of Kew's Millennium Seed Bank Partnership (MSBP) at Wakehurst Place, which last year achieved its initial target of banking seeds from 10 per cent of the world's flora. 'Some 30,000 species of plant are eaten, and 10,000 species are used in medicines in China alone. Plants are also the primary producers that underpin ecosystems. We can't live without them.'

Biodiversity is defined as the amazing variety of life in any environment, or on Earth as a whole. From the tiniest life forms, such as bacteria and algae, through to the impressive giant redwood tree and

blue whale. It's often used as a measure of the health of an ecosystem – a single hectare of Amazon rainforest can contain 1,500 species of higher plants, including 750 trees. According to the UN's Millennium Ecosystem Assessment in 2005, however, habitat clearance, over-exploitation and climate change have rendered a quarter to a third of plant species at risk of extinction.

One of the reasons that conserving biodiversity is important is because the plants and animals that exist within an ecosystem have developed intricate interdependencies as they've evolved over millions of years. The pioneering research by former Kew director Sir Ghilleen Prance into such relationships has helped scientists understand the devastating impact of wild timber logging and the importance of conserving biodiversity to save individual species.

Saving a world of diversity

As Kew celebrates the International Year of Biodiversity, **Carolyn Fry** explores what biodiversity is, why it's so important, and how Kew's scientists are working around the world to help preserve it

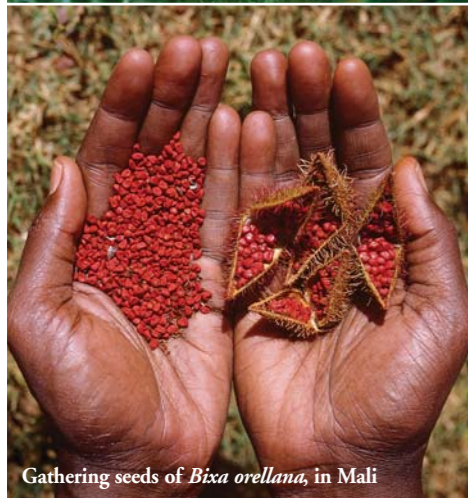
ILLUSTRATIONS BY ANDY POTTS



Coffee (*Coffea* species)



Brazil nut (*Bertholletia excelsa*)



Gathering seeds of *Bixa orellana*, in Mali



Lady's slipper orchid (*Cypripedium calceolus*)



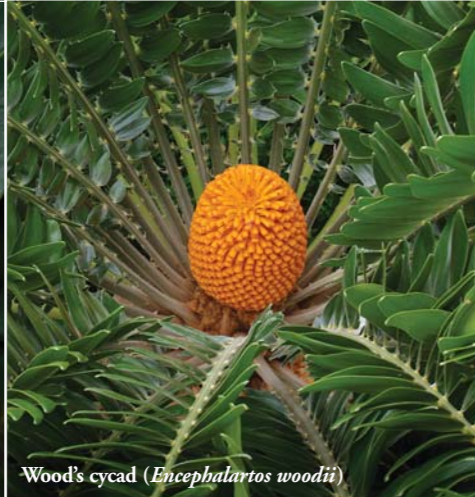
Madagascar periwinkle (*Catharanthus roseus*)



Giant Amazon waterlily (*Victoria amazonica*)



Café marron (*Ramosmania rodriguesii*)



Wood's cycad (*Encephalartos woodii*)

He realised, for example, that a successful wild harvest of the commercially valuable Brazil nut was dependent on the health of the surrounding Amazon rainforest. This is because the tree requires female euglossine bees to pollinate it, and they will only mate with males that successfully gather a cocktail of scents from several orchid species, all of which only thrive in undisturbed forest.

Today, the need to understand, conserve and restore biodiversity lies at the core of Kew's endeavours, and is the basis of the new *Breathing Planet Programme*. Its taxonomists add to our knowledge on the planet's biodiversity by seeking out, naming and describing the unique characteristics of species that are new to science (see *Kew* magazine, spring 2010). Experts estimate that 270,000 plant species exist on Earth. However, with some 2,000 new species being uncovered every year, we are far from knowing the exact figure.

'Biodiversity is important because there's simply so much we don't know about it,' says Bill Baker, head of Kew's palm research programme. 'We can't risk squandering biodiversity in an ad hoc manner. It's impossible to prioritise plants that are more important than others, as we don't have a clear picture of how these different species interact. The interactions are undoubtedly so complex that the loss of one thing can be catastrophic.'

At the MSBP, seeds arrive daily for banking in the subterranean store. The curation staff clean every new collection, and germinate a selection of seeds from each one to ensure they are viable. This process is helping to increase knowledge about the unique environmental conditions required by each species to germinate and grow. 'Through the germination testing, we're learning a great deal about how to ensure the survival of different species,' explains Paul Smith. 'It's not just a matter

Kew scientists research a huge diversity of plants and fungi, including those pictured left, in pursuit of everything from cancer cures to habitat restoration, sustainable crops to conservation

of banking the seeds, it's about turning those seeds into plants.'

The MSBP uses this knowledge to work around the world on projects that reduce wild harvesting and preserve biodiversity, by helping communities cultivate species that are of value to them. For example, its Useful Plants Project is working with communities in South Africa, Botswana, Kenya, Mali and Mexico to propagate useful plants in community gardens. This project is combining traditional knowledge about each plant's uses, with horticultural expertise on how best to grow it. This also reduces pressure on wild populations and makes more plants available to the local community.

A long-term aim for Kew is to use its knowledge of cultivating plants to help restore damaged ecosystems. Some of the Earth's most damaged ecosystems are those on islands. Their isolation means that many have endemic plants – species that don't grow anywhere else. However, their limited area and environmental conditions make it hard for plants to compete with introduced, non-native species or adapt to climate change. Kew's UK Overseas Territories team works to try to deliver the Global Strategy for Plant Conservation (GSPC) within the UK's 16 overseas territories. The GSPC, adopted in 2002, aims to halt the loss of plant diversity.

'Conservation of biodiversity underpins the work we do,' says Martin Hamilton, Co-ordinator of the UK Overseas Territories (UKOTs) Programme. 'We identify threatened species and then work to get them established in 'ex-situ' conservation. Some of the plants in the UKOTs are on the edge of extinction, so we work to get those re-established in suitable, preferably protected, areas in the wild. We're a long way from being able to re-establish biodiverse ecosystems. The difficulty is that once you've changed the landscape, you'll never get it back 100 per cent. But we hope, in time, to be able to establish functional natural systems. For example, we've helped to set up native plant nurseries in the Falkland Islands, Turks and Caicos Islands and St Helena to provide plants for future restoration work.'

Closer to home, Kew is working to protect the diversity of our native plants. With half of all European plants threatened with extinction, one of the MSBP's early achievements was to collect and bank seeds from virtually all the UK's 1,400 native species. More than 250 people from 37 organisations helped gather the seeds, and their efforts have ensured that seeds from the 300 or so endangered species are now safely stored for posterity. In Kew's Jodrell

Why does biodiversity matter to me?

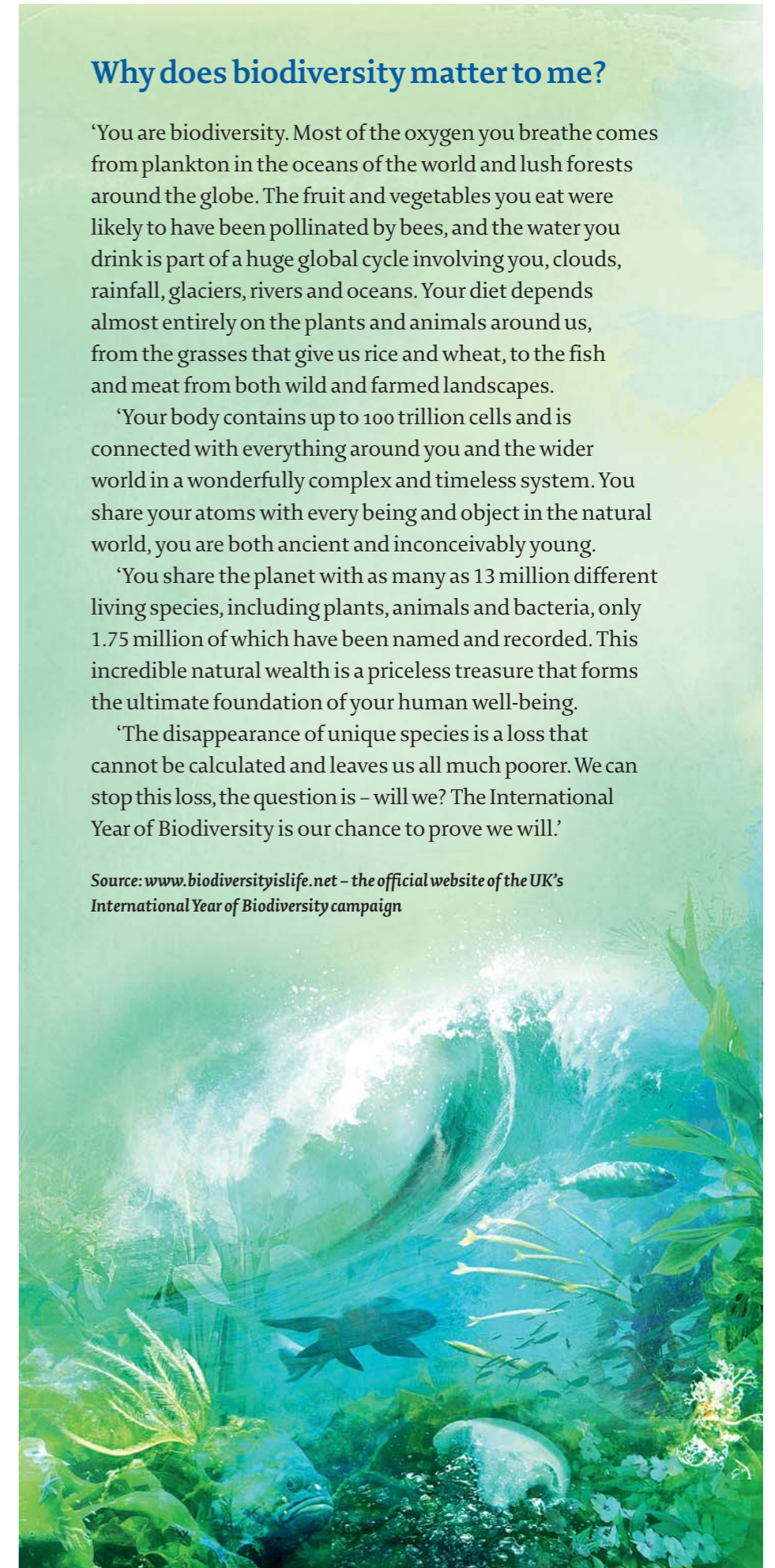
'You are biodiversity. Most of the oxygen you breathe comes from plankton in the oceans of the world and lush forests around the globe. The fruit and vegetables you eat were likely to have been pollinated by bees, and the water you drink is part of a huge global cycle involving you, clouds, rainfall, glaciers, rivers and oceans. Your diet depends almost entirely on the plants and animals around us, from the grasses that give us rice and wheat, to the fish and meat from both wild and farmed landscapes.'

'Your body contains up to 100 trillion cells and is connected with everything around you and the wider world in a wonderfully complex and timeless system. You share your atoms with every being and object in the natural world, you are both ancient and inconceivably young.'

'You share the planet with as many as 13 million different living species, including plants, animals and bacteria, only 1.75 million of which have been named and recorded. This incredible natural wealth is a priceless treasure that forms the ultimate foundation of your human well-being.'

'The disappearance of unique species is a loss that cannot be calculated and leaves us all much poorer. We can stop this loss, the question is – will we? The International Year of Biodiversity is our chance to prove we will.'

Source: www.biodiversityislife.net – the official website of the UK's International Year of Biodiversity campaign





Laboratory, staff study these native plants to find ways to cultivate those that are wild-harvested, such as elderflower for cordials, and to identify any compounds in them that might be economically valuable for use as medicines or cosmetics.

People have long placed monetary values on commodities such as timber, tea, coffee and rubber. But we've given little attention to placing monetary values on the ecosystems that supply us with useful plants and provide environmental services such as clean air and water, carbon sequestration and protection from floods. To remedy this, Kew scientists are seeking ways to assess the value that biodiversity has on human well-being, with the aim of encouraging people to truly appreciate the plants and animals that support humanity.

'We often think of plants' economic significance, but we don't tend to consider their social value,' says Monique Simmonds, deputy keeper and head of the Sustainable Uses of Plants group at Kew's Jodrell Laboratory. 'We need to also value the pleasure plants give, for example through their beauty, scents and spiritual impacts on people.'

Fifty per cent of people questioned in a Defra survey in 2009 said they knew nothing about biodiversity and had never heard the word. The aim of the International Year of Biodiversity is to raise awareness, through initiatives that range from nature-themed festivals and commemorative stamps to encouraging people to photograph species they don't recognise in their back gardens.

Events at Kew include an exhibition on how plants are pollinated, 'Thinking Walks' for families exploring biodiversity, and photographic exhibitions showcasing plants and wildlife (for more details, see *What's On*, p60). By taking action in our everyday lives, such as buying tea and timber products from sustainable sources and choosing organic foods and fabrics, we can all contribute to maintaining the rich biodiversity that we need in order to survive. ♣

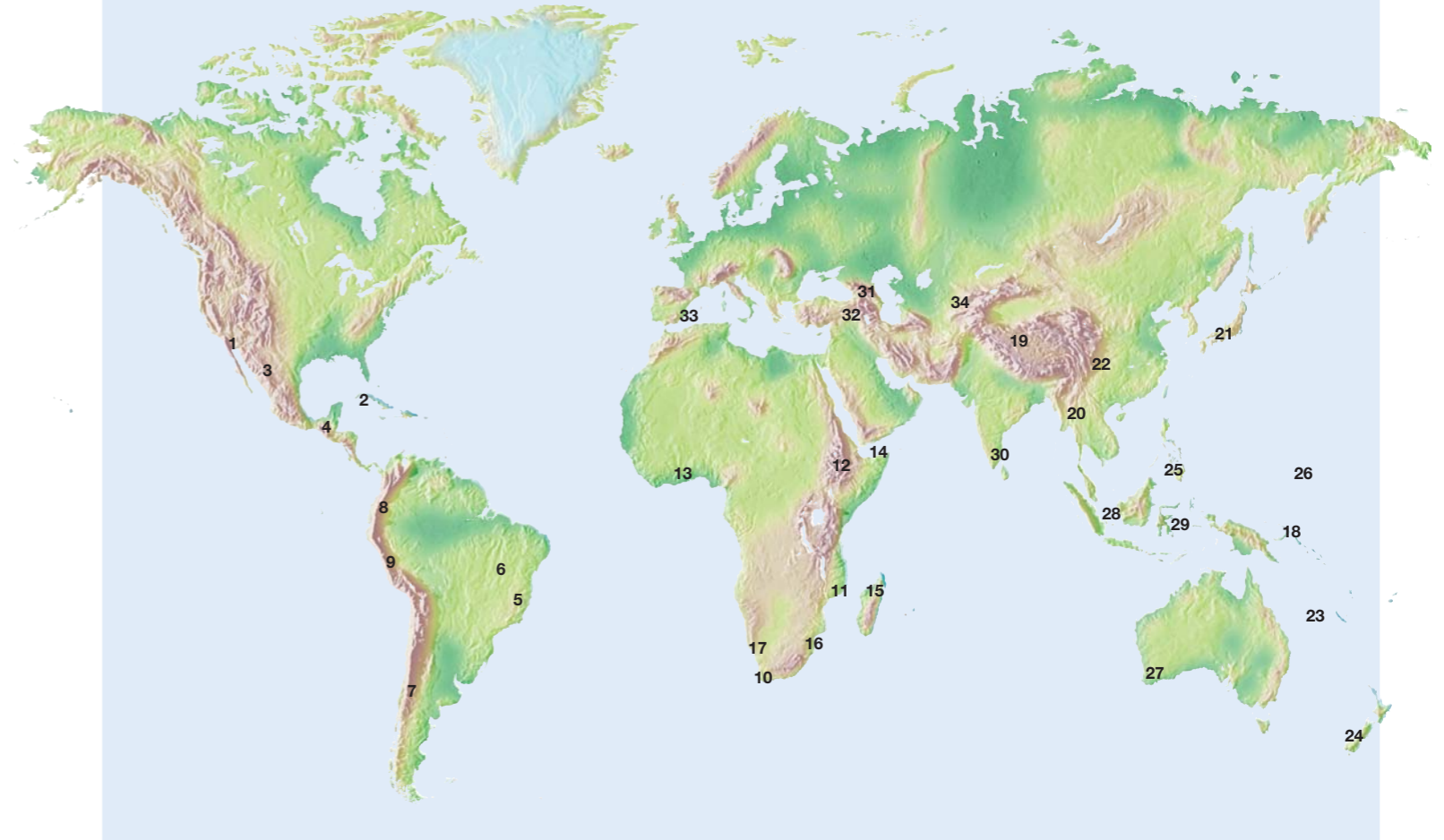
Carolyn Fry is author of the award-winning book The Plant Hunters, available at shop.kew.org and from the Kew shops at the special price of £20

Find out more about biodiversity on a special guided tour at Kew – see p60 for details

To support any of the projects mentioned in this article, go to www.kew.org/support-kew; for more information on Kew's Breathing Planet Programme, go to www.kew.org/breathing-planet; for further details about the International Year of Biodiversity, go to www.biodiversitylife.net and www.teebweb.org

What is a biodiversity hotspot?

Scientists have identified 34 so-called 'biodiversity hotspots' around the world, which host especially high numbers of species that are endemic (not found anywhere else) and are also under threat. More than 50 per cent of the world's plant species and 42 per cent of all terrestrial vertebrate species are endemic to these 34 biodiversity hotspots, even though they cover just 2.3 per cent of the Earth's land surface. In all, 86 per cent of the hotspots' habitat has already been destroyed, making them high priorities for conservation. Find out more at www.biodiversityhotspots.org, and on page 22.



'We should preserve every scrap of biodiversity as priceless while we learn to use it and come to understand what it means to humanity'

EO Wilson, biologist, conservationist and author

'When we protect the places where the processes of life can flourish, we strengthen not only the future of medicine, agriculture and industry, but also the essential conditions for peace and prosperity'

Harrison Ford, actor

'The greatest danger to our future is apathy'

Jane Goodall, primatologist and anthropologist

Where are the world's biodiversity hotspots?

The locations of the world's 34 biodiversity hotspots are indicated on the map above

- | | | |
|--|---|---------------------------------------|
| North and Central America | 15 Madagascar and the Indian Ocean Islands | 24 New Zealand |
| 1 California Floristic Province | 16 Maputaland-Pondoland-Albany | 25 Philippines |
| 2 Caribbean Islands | 17 Succulent Karoo | 26 Polynesia-Micronesia |
| 3 Madrean Pine-Oak Woods | | 27 Southwest Australia |
| 4 Mesoamerica | | 28 Sundaland |
| | | 29 Wallacea |
| | | 30 Western Ghats and Sri Lanka |
| | | |
| South America | Asia-Pacific | Europe and Central Asia |
| 5 Atlantic Forest | 18 East Melanesian Islands | 31 Caucasus |
| 6 Cerrado | 19 Himalaya | 32 Irano-Anatolian |
| 7 Chilean Winter Rainfall-Valdivian Forests | 20 Indo-Burma | 33 Mediterranean Basin |
| 8 Tumbes-Chocó-Magdalena | 21 Japan | 34 Mountains of Central Asia |
| 9 Tropical Andes | 22 Mountains of Southwest China | |
| | 23 New Caledonia | |
| Africa | | |
| 10 Cape Floristic Region | | |
| 11 Coastal Forests of Eastern Africa | | |
| 12 Eastern Afromontane | | |
| 13 Guinean Forests of West Africa | | |
| 14 Horn of Africa | | |

