



# TUNZA



for young people · by young people · about young people

## FOOD



**Waste not**

**Want not**

## TUNZA

the UNEP magazine  
for youth. To view current  
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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, are working together to strengthen young people's environmental awareness and engage children and youth in environmental issues worldwide.**

A partnership agreement, originally signed in 2004 and renewed in 2007 and 2010, runs through 2013. It lays down the basis for UNEP and Bayer to implement the projects under the partnership. These include: 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 has become a public-private partnership that serves as a model for both organizations.

# EDITORIAL



**T**HE FOOD AND AGRICULTURE ORGANIZATION of the United Nations (FAO) reports that today there are 130 million fewer hungry people than there were 20 years ago. In 1990-92, there were about 1 billion undernourished people in the world, now there are 870 million.

The Millennium Development Goals set out, between 1990 and 2015, to halve the proportion of people going hungry. And according to the FAO, even if the number of hungry people is still too high, we're making real headway: the proportion of undernourished people fell by a third between 1990-92 and 2010-12. Is this just hiding the plight of the hungry behind proportions and percentages?

Actually, the world's farmers have done amazingly well in the last 50 years. The world's population has risen from around 3 billion to more than 7 billion today. But approximately the same number of people has remained hungry, which means we are feeding around 4 billion more people – and without really increasing the area of cultivated land.

But there's a scandal behind the numbers. UNEP Executive Director Achim Steiner explains: 'We produce more than 4,000 calories per person per day, but on average only 2,800 reach consumers; the rest is either lost, wasted or discarded. We could feed everyone, including our growing population, just by making the human-managed food chain more efficient. No more land needs to be converted for agriculture – good news for the survival of wild animals, birds and fish.'

Think what many of us load on to our plates, leave and then junk – that's the fate of 35 per cent of the world's school meals. Or the food we buy, leave in the fridge, and never eat. In the UK a staggering 177,400 tonnes of potatoes, 328,000 tonnes of bread, 178,800 tonnes of apples and 161,000 tonnes of meat and fish meals are thrown away whole and untouched each year. In all, 45 per cent of all food by weight or 61 per cent by cost bought in the UK ends up in a bin. It's a little better in the USA, where up to a quarter of all fresh fruit and vegetables is lost between field and table, and overall losses and food waste amount to around 40-50 per cent of what's harvested. These figures raise questions of whether, in the developed world, food is just too cheap.

But food losses in the developing world are also considerable, although the main culprits there are spoilage and pests. In Africa, for example, around 30 per cent of fish landings are lost through discards, post-catch loss and spoilage, while losses of field crops, between planting and harvesting, could be as high as 20-40 per cent of the potential harvest.

'We desperately need innovation in the way we distribute, sell and consume food,' says Achim Steiner, 'as well as in how we grow it. For millions that could make the difference between life and death.'



Thirteen-year-old Diana Fan from the United States won the 21st International Children's Painting Competition on the Environment with her image (above). In the words of Bayer's Dr Michael Preuss, it 'expresses the hopes and fears of the younger generation'.



The cover of this issue of TUNZA features the 5th prize-winning image, by Chanta Chaiyapol (aged 14) from Thailand.

# How much is enough?



**HUNGER, OBESITY, WASTE – it’s a conundrum. At the same time as getting reports of hunger and food insecurity, we hear that obesity is an increasing global health problem. And even as we learn of drought-stricken fields and over-harvested fisheries, we are told that vast quantities of food are being wasted between the field and the fork. It just doesn’t seem to add up.**

**In fact, we do produce enough food to feed everyone. At the moment, the world generates more than 4,000 calories per person per day, although the average that reaches consumers is around 2,800 calories per day. The USA has the highest average at 3,770 calories per person per day, whereas in India it is 2,300 per day. Only in three of the world’s countries do people have less than the internationally agreed minimum for a healthy and productive life of around 1,800 calories a day.**

**S**o why do people go hungry? The problem is uneven distribution and access, within countries as well as between them. Almost a billion people live without the food they need to thrive, and everywhere those truly at risk from hunger are the poor, as well as victims of catastrophes. The rural poor tend to be subsistence farmers in developing countries subject to drought, pestilence and erosion, often with no access to electricity, clean drinking water or sanitation, and with little or no health care or education services. In cities, the urban poor lack the money to buy food and produce none of their own. Such poverty knows no national boundaries: even in the USA, more than 50 million people, that’s twice the population of Malaysia or three times that of the Netherlands, experience food insecurity or lack access to proper nutrition.

Hunger is real enough now, and climate change, depleted agricultural resources and overfished oceans all threaten future food security – something we must pay attention to as the world’s human population continues to grow.

## Too little... or too much

What is malnutrition? When talking about hunger, it’s the lack of calories

and protein necessary for key bodily functions, muscle development and maintenance. And at the other end of the spectrum is a different kind of malnutrition: obesity. That’s not a matter of too few calories, but too many – usually due to poor food choices and nutrient imbalance.

There are many contributing factors but, again, poverty is a leading one. Those who lack resources often have more access to highly processed, calorie-rich but nutrient-poor foods – a situation made worse by lack of education about nutrition. Then there’s biology: humans are hard-wired to eat for survival. We have a hunter-gatherer’s urge to consume food whenever it happens to be available for fear that it will be a while until we eat again. But this is at variance with our increasingly sedentary modern lifestyles. And, in much of the world, the overwhelming availability of inexpensive ready-made food and drink has seemed to free people from the need to learn about well balanced diets and how to prepare food – much less grow, raise or hunt their own, all of which are activities that require extra calories.

But there’s no arguing that too many of us are eating much more than we need. Indeed, the World Health

Organization warns that by 2015, one in three of us will be overweight. Of these, more than 700 million will be obese, reducing well-being and life-expectancy. Together with the 850 million who go hungry, that means that one in five of the world’s population will be malnourished.

## Waste not, want not

And then there’s waste. In general, up to half of all food produced is lost. Due to poor storage, packaging and processing, 1.3 billion tonnes of food perish between the field and the plate – and that’s not to mention what consumers, that’s you and me, throw away in leftovers and unused food. At what point in the production, processing and distribution chain the waste happens varies from place to place. In industrialized countries large amounts are wasted by consumers, while in the developing world, proportionally more waste happens between the farm and the consumer.

It all amounts to a complex problem that will require thoughtful, systemic and systematic change. The world must find a way to value and distribute the food we have more equitably, while taking care of the ecosystems that provide it.

**H**owever you look at it, the fundamental role of food is to provide energy and nutrients to allow the body and brain to function. Beyond this, ‘how much is enough’ becomes highly subjective.

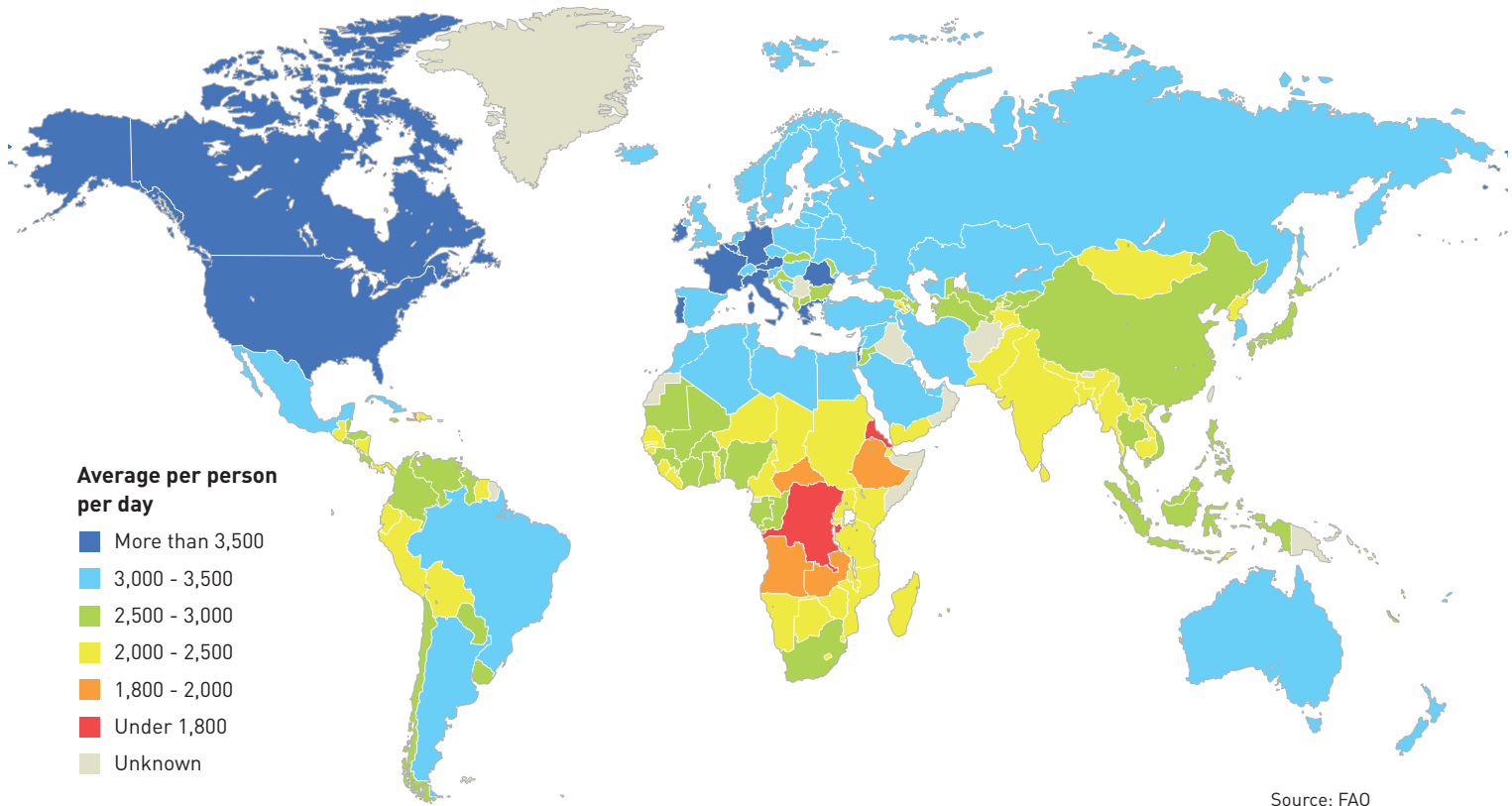
*‘When a person’s basic needs have been met, economic, cultural and social factors become priorities, and this shifts the focus on food to a means of personal satisfaction rather than nutrition. With rising affluence and the myriad of food choices available in most countries, the possibility*

*of food consumption exceeding safe physiological limits has become a reality, to the detriment of an individual’s survival and to overall food security in the long term.*

*‘From an ecocentric standpoint, although individuals are significant, the wider world, or ecosphere, is of greater importance, as we humans are only part of the Earth system. So we must remember we are also eating for the health of the planet.’*

**Ramanathan Thurairajoo, Singapore**

# How many calories?



Source: FAO

## Making the most of waste

Young Londoners Jenny Dawson and Sophie Gore Browne are determined to tackle the twin problems of food while providing employment opportunities for women in need. Their social enterprise, Rubies in the Rubble, is a chutney and jam company that makes good use of fresh fruit and vegetables that would otherwise be sent to landfill or composted while providing training and jobs to other young but unemployed women. Jenny and Sophie first came up with the idea when they saw the market tip at London's wholesale market stuffed with perfectly good produce – including mange-tout peas flown in from Kenya. At the end of each day, they pick up the high-quality but surplus produce, paying the traders a small amount, and take it to an on-site commercial kitchen to transform it into preserves. Ultimately, these young entrepreneurs hope to diversify into soups, and believe their two-year-old model for reducing waste and offering training opportunities could be replicated in many other places.



## Food loss and waste, kilos per person per year

	Production and retail	Consumer	TOTAL
Europe	190	90	280
North America and Oceania	185	110	295
Industrialized Asia	160	80	240
Sub-Saharan Africa	155	5	160
North Africa, West and Central Asia	180	36	216
South and Southeast Asia	110	15	125
Latin America	200	25	225

Source: FAO

# Choosing a life on the land



Young farmer Julia Boorinakis-Harper has dedicated her life to making her great-grandfather's farm a productive, organic family enterprise – and to inspiring others to live off the land.

Photos: Julia Boorinakis-Harper



**M**y great-grandfather George Boorinakis emigrated to San Francisco, California, from Smyrna in Asia Minor – now Izmir, Turkey. In 1918, he left the city and bought a farm in the tiny town of Auburn, California, and grew fruit for a living. My grandfather, mother and uncle, cousins, and I all grew up here.

'The farm was semi-dormant when I was small. In the 1960s, a virus had damaged most of the fruit trees, and my grandfather could no longer make a living from the remaining ones. We'd sell what fruit we could, but it was mostly a labour of love.

'But as housing crept up and around us, it became increasingly important to us to honour and preserve this 6-hectare historic farm. So about 10 years ago, we decided to get serious again – with my parents and I doing just about everything ourselves, by hand. On about 2 hectares we grow apples, pears and plums for sale. We also keep bees for honey and to pollinate the orchard and our vegetable garden, where we produce our own food. We also raise free-range chickens for eggs.

'About five years ago, we decided to go organic – a notion that just didn't exist in my grandfather's time. But, as we'd never used a lot of chemical pesticides or fertilizers, it seemed like a logical step. A farm is a little ecosystem; there are beneficial insects and pests, "good" and "bad" weeds. But with care, you can keep your ecosystem fairly well-balanced in your favour.

'Instead of using conventional pesticides we use integrated pest management (IPM), which involves monitoring for pests and encouraging beneficial insects with hedgerows and cover crops under the trees like clover and mustard, which also reduces runoff. We encourage natural predators like bluebirds, bats and owls, and use carefully timed organic-spray treatments only when necessary. This takes up far more time and effort than conventional farming, but it's very effective.

'We mostly sell our fruit and honey at local farmers' markets. That's the most gratifying part: talking to customers about our practices, sharing stories and recipes. People appreciate fresh, local food, and connecting with those growing it. In fact, we're seeing an incredible revival in traditional skills: people want to learn to cook, garden, preserve foods and even raise animals for themselves. My mother and I co-host the *Homestead Radio Hour*, a show about backyard farming, urban gardening and do-it-yourself-ing. We encourage people to start small. You can produce lots, even in an urban setting.

'My goal is to keep our ranch as a successful, self-sustaining small family business, and to help others become more self-sufficient, closer to their food, connected with nature. It's an exciting time to be involved with food and farming.'

For more about the goings-on at the Boorinakis-Harper Ranch, visit [www.bhranch.net](http://www.bhranch.net).



## Mo Farah: 'It touches my heart'

**MO FARAH** became an instant hero at the London 2012 Olympics when he won gold in both the 10,000 and the 5,000 metre races. He is the seventh man ever to win both events at the same Games – and that showed extraordinary determination. 'I was feeling tired coming into the 5,000-metre race, but when I took the lead, I knew I had to hold on. It's been a long journey, working hard and grafting. With that, anything is possible.'

Mo has come a long way, literally. Born in Mogadishu, Somalia, his early life was 'comfortable, not easy but not hard'. But with the civil war, 'the city descended into lawlessness – shooting, killing and kidnapping happening every day. My family was torn apart. Some moved to the north of Somalia; others, including me, went to live with my grandmother in Djibouti. Then when I was eight, my father and I moved to the UK.'

Mo has never forgotten his roots. Last year he and his wife, who met the 13-year-old at school, travelled to Somalia. He and Tania were deeply affected by seeing famine at first hand: 'It was shocking seeing people where I was born simply not having enough food to eat. We came back determined to do what we could to help people rebuild their lives and fulfill their potential.'

The result is the Mo Farah Foundation. 'It doesn't have to be so bad,' Mo explains. 'As athletes, we know how essential nutritious food is for people to flourish physically and mentally. Our world has enough food for everyone, but one in seven of us goes to bed hungry every night and children are often hit hardest. There are kids out there who need our help. That really touches my heart.'

With the help of supporters including fellow Olympians Paula Radcliffe and Steve Cram, Mo is working to provide emergency aid in the form of a month's supply of food for a family; making safe drinking water and sanitation facilities available by installing wells and improving water catchment and supply systems; and establishing medical and much-needed mother and child healthcare clinics providing free care across Somalia. But Mo believes that 'families and communities need help to establish cultures of self-sufficiency and self-determination'. As a result, the foundation is also supporting income generation programmes for farmers through cereal aid and livestock supply schemes.

'Education is the key to children and adults gaining the skills required to support their families,' Mo adds, 'but people who need it the most are usually the ones who can least afford it.' To change that, the foundation is both supporting existing community schools and setting up new ones in remote areas 'to help provide poor and orphaned children with hope for a brighter future'.

The race has only just begun, but in a few short months Mo and his foundation have built 50 wells and eight water canals; supplied ten farms with livestock and tools; provided medical support to 40,000 people and distributed a month's food to 22,000 people. Legendary activist and musician Bob Geldof cheered on Mo's ambition: *'Go Mo! Your foundation will make life Mo' better for thousands of Somalians. Mo' Farah, Mo' Fastah, Mo' Somalia!!'*



# Once upon a time...

Once upon a time, there was such a thing as seasonal food. In Europe, for example, summer heralded the strawberry season and autumn the time for apples, while some foods – mangoes, pineapples, avocados, oranges and bananas – were unusual and exotic treats. But today, the miracle of modern transport and the globalization of trade mean that, in theory – especially for the rich – anyone on the planet can eat anything they want, any day of the year, anywhere.

The food sector accounts for about a third of the world's total energy consumption and for more than 20 per cent of total greenhouse gas emissions. Of course, transport makes up only a fraction of food's carbon footprint. In fact, more than 80 per cent of food's greenhouse gas emissions comes from growing, fertilizing and harvesting the produce. Processing accounts for about 16 per cent of food's energy use, including chilling and freezing, while packaging accounts for 7 per cent, and retailing for 4 per cent. Even how people get to the shops adds to food's carbon footprint. Effective strategies to lower the footprint of food must take all these factors into account.

Julia Boorinakis-Harper



Julia Boorinakis-Harper



Julia Boorinakis-Harper

## What can be done?

Canadian journalists Alisa Smith and James MacKinnon experimented with a '150-kilometre diet', only eating food produced within 150 kilometres of home. They discovered that it was expensive and difficult to stick to, but the approach does at least raise awareness of how far food has travelled.

To some degree, it makes sense that food should be grown where the necessary inputs are most readily available. For example, tomatoes grown in a warm climate and then transported may require less energy than growing them in a local artificially heated environment. Weighing the balance isn't always easy, but consistently making more conscious choices about where your food comes from and how it has been transported could deliver big carbon savings. Can it, for example, make sense that surplus European wine is turned into biofuel, while shops

in Europe are full of wines imported from Australia, South Africa and Latin America?

The argument is not straightforward. Some say that farmers in developing countries such as Kenya and Ecuador need the income made from the food choices of consumers in the wealthy North, and this may be true in the short term. But others argue that over the long haul, precious agricultural resources in poverty-stricken countries should be developed to bolster their own food security, not other people's preferences. This is especially true as the climate changes, with global food costs expected to rise while freshwater supplies dwindle.

And what if you're confronted with a choice of locally grown non-organic produce versus organic goods flown in from Chile, South Africa or New Zealand? The answer may seem straightforward if you're exclusively committed to org-

anics, but in fact, no produce that is air-freighted from half a world away can be considered sustainable. The problem is so acute that the British Soil Association, for one, has considered not granting organic status to any air-freighted produce.

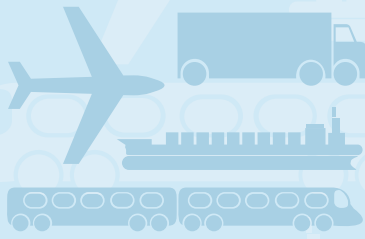
## Keep it simple

There are no easy answers, and keeping track of what you consume can be hard. Much animal feed, for example, travels huge distances, so even local pork, chicken or beef could have been raised on soy from the other side of the world. The best guideline is to keep it simple: it really is satisfying to eat what's in season – and it gives you something to look forward to, so buy whole, unprocessed foods when possible, and look for sources of locally grown food such as farmers' markets. And why not grow some of your own? You'd be surprised what you can grow in pots, and even if it is only herbs, eating something you've grown is exciting.



# HOW much carbon dioxide, exactly?

Here's an example of how much carbon dioxide is generated by food travel, comparing distances and transport modes from relatively near to very far away. These are for each tonne of freight to the UK, and for general information only! And bear in mind that even a more efficient car travelling 100 kilometres generates 10 kilograms of carbon dioxide.



epSos.de/flickr

From France  
344 km

by plane: 172 kg  
by truck: 20-51 kg  
by train : 10-35 kg

From Spain  
1,266 km

by plane: 633 kg  
by truck: 76-190 kg  
by train: 38-127 kg

From New Zealand  
18,809 km

by plane: 9,405 kg  
by ship: 188-750 kg



## Carbon dioxide emissions: grams of CO<sub>2</sub> per tonne of freight per kilometre travelled

This table will allow you to do your own calculations.

Aeroplane/air cargo	500 grams	Modern lorry/truck	60-150 grams
Modern train	30-100 grams	Modern ship	10-40 grams

Source: <http://timeforchange.org/co2-emissions-shipping-goods>

## Changing tastes

Due to evolving patterns of global food production and consumption, gastronomic culture in Venezuela has completely changed. Annual per capita consumption of meat products has increased from 16 kilos to 24 kilos in the last 10 years, and we rely much more on imported products. Meanwhile, avocados, which used to be plentiful in every Venezuelan household, have started to disappear. Avocados used to be called 'poor butter' because they made a cheap spread to eat with bread, *arepas* (corn cakes) and so on. The fruit used to be sold in street trucks and markets. Now, lower demand has made it more scarce and expensive. My mother says that 20 years ago, it used to cost about \$1 per kilogram; today, the price of avocado is more than \$5 per kilogram – and at average rates it takes three hours of work to earn that!

Oscar Alejandro Luna Alvarez, BYEE 2010, Venezuela

## Traditional fare

Among many mouth-watering local foods here in Bicol, Philippines, my all-time favourite is *pinangat*, a luscious blend of locally grown taro leaves, hot chilli, organic meat and coconut milk wrapped in young taro leaves and tied securely with coconut leaf. What I most like about this dish is the story behind it. When Mayon Volcano erupted in 1814, the Cagsawa Church in between the municipalities of Daraga and Camalig in Albay was destroyed. A father lost his wife, his two sons and two daughters. But the father had to continue living. So every time he cooked the taro leaves, he poured into it all his love for his lost family. He even wrapped the taro leaves with coconut leaf, just as he longed to wrap his children in his arms.

Dandee Bitancor, BYEE 2009, Philippines



Fred lleito



# As the world warms...

Fred Pearce

The 2011 drought in the southern US state of Texas was the worst in living memory, said the local farmers. They watched their corn being destroyed by the heat and lack of rain. But 2011 held the record for one year only: 2012 was even worse.

Something has been going wrong with the weather in North America. The reason, say scientists, is probably man-made climate change. It's not certain. These things have happened before. But according to NOAA, the US government research agency, global warming makes this weird weather 20 times more likely.

This matters way beyond the cornfields of Texas. North America is one of the breadbaskets of the world, so its crops sell everywhere, and are the vital back-up when there are shortages or a famine in Africa.

And what is happening in North America looks like part of a global trend and a sign of unpredictable

and more extreme weather, all of which will make our lives sometimes uncomfortable – and farming more difficult. It could even empty our shops of food.

Scientists now say that global warming is going to involve much more than a bit of extra heat. With our pollution trapping more of the sun's energy inside the Earth's atmosphere, there will be more weather of all sorts – heat waves and cold snaps, floods and droughts and hurricanes, says Jim Hansen of NASA's Goddard Institute for Space Studies, a top climate research outfit in New York. This year he proved statistically that weather around the world is already getting more variable, more jittery and more just plain weird.

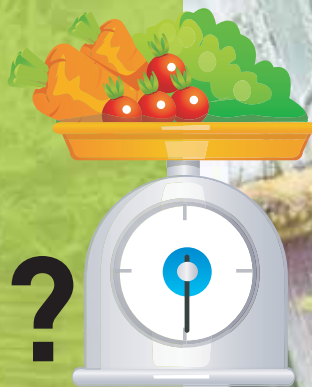
In 2010, record monsoon rains in Pakistan brought floods that covered a fifth of the country. Places that are usually desert were covered in water. And so many fields were flooded that two-thirds of the country's population went hungry that autumn.

At the same time, an unprecedented heat wave was setting in across Russia. It lasted for two months and killed more than 10,000 people, set off immense forest fires and destroyed a quarter of the country's grain harvest.

More recently, Chinese scientists blamed the massive floods in the north of the country in 2012 on global warming making the air there wetter, while back in the USA the east

Erna Lammers/UNEP/Topham

## Food or fuel?



Biofuels are a great idea in theory. After all, fuels derived directly from living, growing matter – such as ethanol from maize and sugarcane and biodiesel from soy, rapeseed and palm oil – are renewable, and absorb atmospheric carbon as they grow. Brazil was the first to create a sustainable bioethanol industry, using sugar cane as feedstock. Then the USA followed suit, using maize to become the world's largest producer of ethanol fuel in 2008.

But biofuel crops, many of which are also food commodities, use up the land, water and energy resources that we also

coast was hit by Hurricane Sandy, the largest Atlantic storm on record.

Extreme weather of all sorts is the future. From Europe and North America – where crop-destroying heat waves and cold snaps alike will last much longer than before – to new unpredictability for the Asian monsoon rains, on which 3 billion people depend for their food, nobody can be sure exactly what will happen and when. The one big certainty is that the weather will be less predictable.

Climate change was always going to be bad news. Studies predict that higher temperatures could cut harvests in some places by as much as half.

Of course, farmers will fight back by adapting, choosing different seeds and planting at different times. But the new research says that, as the world warms, the day-to-day weather itself will also change. Wild and weird weather will sometimes come out of a clear blue sky. And, for farmers trying to work out what to plant and when, that is the biggest problem of all.

Kenichi Fujimoto/UNEP/Topham

Kadir Kir/UNEP/Topham



Tim Alipala/UNEP/Topham



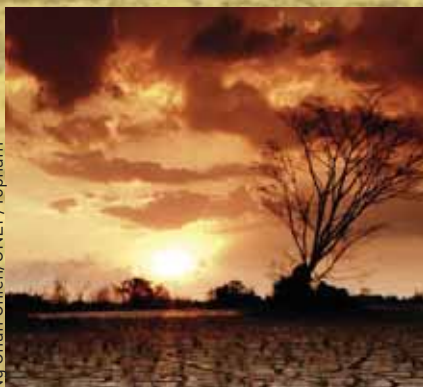
Michael S. Nolan/Specialist Stock



Neil Cooper/Lineair/Still Pictures



Ng Chan Chien/UNEP/Topham



Nebraska Soybean Board

need to grow food – at a time when our rising population is already putting pressure on food supplies. Nonetheless, government mandates to use a minimum percentage of biofuels blended with petrol means that fuel often takes priority. In the USA, for example, a renewable fuels mandate requires oil refiners to blend a percentage of ethanol into gasoline, and maize farmers are given subsidies to produce and sell maize for fuel production. This is resulting in around 40 per cent of the 2012 maize crop being used as fuel. This might not pose a major problem, except that the drought of summer 2012 destroyed a large portion of the US maize crop, pushing its price up to 60 per cent higher than normal.

This will have a huge knock-on effect on world food prices: the USA not only depends on maize for its own food supply, but exports it to the rest of the world. Maize is a staple animal feed too, so the price of meat and dairy products will also go up, as well as the cost of other grains. Higher prices may mean that people in poorer countries that rely on imports will be less able to afford to eat.

In addition, questions remain about whether food-based biofuels ultimately save enough in greenhouse gas emis-

sions to justify competing with food in the first place. Biofuels require the same resources and pose the same environmental problems as food crops, and clearing land for new fields to grow both food and fuel releases long-sequestered carbon into the atmosphere and contributes to deforestation. In Brazil, for example, demand for fuel is pushing farmers to cut into the already fragmented Atlantic Forest. Meanwhile, a recent German study reported that the greenhouse gas savings of European-produced biodiesel fell well under the expected 35 per cent mark – while poor grain harvests also pushed up food prices.

This doesn't mean that the biofuels idea should be discarded altogether, and researchers are pursuing new forms. One hope lies in next-generation, cellulosic biofuels produced from agricultural wastes like cornhusks and rice hulls. Growing non-food, drought-resistant crops like jatropha and switchgrass on marginal land also holds promise. Other possibilities include creating fuels from wood harvested from fast-growing trees, algae, waste wood from industry, or even human waste. All of these options are scientifically feasible; the difficult bit is making production viable on a vast commercial scale.

D. Harms/Wildlife/Still Pictures



# Another way

There's more than one way to grow food sustainably. Here are just a few unique but powerful methods for making agriculture meet our needs while working with those of nature.



D. Harms/Wildlife/Specialist Stock



John Novis/Greenpeace

www.greenpeace.org/international/en/campaigns/agriculture

## The mulberry dykes

In southern China, the Pearl River Delta region is famous for its mulberry-dyke fish-farm system – an artificial ecosystem that combines fish aquaculture with silkworm cultivation and agriculture. Introduced in the 16th century, the system makes smart use of wastes in an area that would otherwise be too wet for farming, and helps sustain a densely populated region with food and income from fish sales.

First, a pond up to 6,000 square metres in area and 3 metres deep is dug, and the removed soil used to build raised dykes around it. The pond is fertilized with local inputs and then stocked with aquatic plants and several fish species. Ponds are drained a few times a year and the nutrient-rich mud is taken for mushroom cultivation, and to fertilize vegetables, fruit and mulberry trees, and elephant grass that's used to feed the fish and livestock. Meanwhile, mulberry leaves are harvested to feed silkworm farms, and the silkworm wastes are used to fertilize the pond and feed the fish. This continuous cycle of water, waste and food is labour-intensive, but the only other energy required is sunshine.

## Small is beautiful

In the Indonesian village of Dosan in eastern Sumatra, one community is managing a palm oil plantation without destroying virgin forest. The village converted 700 hectares of degraded land to oil palm cultivation and uses environmentally friendly practices such as no burning, replacing herbicides with manual weeding, and building dams to keep the soil moist.

Dosan's efforts have proven successful: higher yields without encroaching into the forest mean they can market their palm oil as 'sustainable', and poverty and unemployment have been eradicated. If the efforts of these smallholder farmers can be replicated in other communities, this village's small leap of faith could result in huge environmental, economic and social benefits. Indonesia has tens of millions of hectares of degraded land that could be used to cultivate oil palm in this way.

# Farmification

LISA MA is a young designer based in London who is fascinated by the 'fringe' – the geographical and social spaces that fall between established structures. In 2011, she spent the summer amongst factory workers in China to investigate how they live and work, an experience that inspired a part-time farming scheme that brings together agriculture and industry, urban lifestyles and rural skills.

'On the edges of large cities in China, factory complexes are constructed to accommodate a growing global demand for products like electronics. The workforce is made up of people who migrate from the villages, forming communities that can be as large as small towns.

'The factories then buy food to feed the workers – and so food producers

become consumers. However, when workloads fluctuate, some of the operations are too big to close down, and it becomes expensive for factory owners to feed their workers. Meanwhile, partly as a result of this shift in workforce from agriculture to industry, China is increasing its food demands, relying more on imports. After all, 230 million migrant workers equals 230 million fewer farmers.

'As a way of addressing these issues, I came up with an idea: part-time farming on plots of land just across the road from the factory complex, as part of the factory workers' shift. The produce could not only be used in the canteen but sold for profit at local markets and street-food vendors. The idea was not only to make feeding the factory more local and sustainable, but also to contribute



## The one-straw revolution

One day, as Japanese farmer Masanobu Fukuoka walked past an unploughed field on the island of Shikoku, he noticed rice growing amongst the weeds. He decided to copy nature, and stopped flooding his rice fields as tradition dictated. From this first step he developed a farming system that interfered with nature as little as possible.

His principles included: 1) No tilling. Fukuoka believed that tilling the soil gives weeds a foothold. 2) No fertilizer or prepared compost. Fukuoka added nutrients to the soil using only straw and some poultry manure and by growing a ground cover of white clover. 3) Low-impact weeding. Fukuoka's clover ground cover, straw mulch and only brief flooding kept weeds down, and he rotated grain and rice crops, leaving no fallow periods to encourage weeds. Using these methods, he still managed to produce a comparable amount of food to other Japanese farms.

In 1975, Fukuoka's book *One-Straw Revolution* was translated into 25 languages and made him a leader in agricultural sustainability. He also travelled through Africa, India, Southeast Asia, Europe and the USA to figure out how to rehabilitate degraded landscapes through low-irrigation techniques, publishing his findings in *Sowing Seeds in the Desert*. He farmed until his death at the age of 95 in 2008.

## Perennial choice

When human beings started cultivating wild plants 10,000 years ago, we chose annuals: wheat, rice, corn and so on, which sprout from seed and die after harvest every year. There was a good reason for this: because annuals need to be replanted every year, they are good candidates for selective breeding, allowing us to choose favoured traits, such as larger grains and higher yields.

But perennial plants have benefits too, including root systems that access water and nutrients deep in the soil, reducing rainwater runoff, the need for irrigation and polluting fertilizers. Unlike annuals, which leave the soil bare for part of the year, perennials help to keep the topsoil intact and reduce the spread of weeds. And they save labour and energy because they don't need to be replanted every year.

Plant breeders are now working on developing perennial versions of staple grains by cross-breeding their wild perennial relatives with our domesticated annuals. Progress is being made thanks to modern gene-sequencing technology. A wheat-wheatgrass hybrid has been grown, harvested and made into flour under test conditions, for example. And with adequate funding, scientists estimate we could have field-testable perennial maize within a decade.

to the well-being of the workers by giving them a sense of connection to their farming backgrounds, making their situation more economically secure, and helping them maintain their agricultural skills and knowledge even as they learn and integrate new manufacturing skills. The proposal was received with interest, and we created a series of experiments.

'The factory was forced to downsize after I left and I'm not sure whether they persisted with the Farmification

scheme. But I can say that since then, the idea has entered discourse in industrial China: many large iron factories have been reported as starting to rear pigs to tide over the lack of demand for raw materials after the property bubble had burst. This move has been seen with mixed feelings among the Chinese public, many of whom still view agriculture with prejudice.

'The notion of "reverting" to agriculture may be seen as disempowering, but such attitudes can be changed. Now is a good time to re-examine the relationship between industrialization and farming, and to start a conversation about how our technological demands affect the global food economy.'

# Food needs bugs and beasts!



Think farming is a way of producing food that only needs people? Think again! If it weren't for wild bees, butterflies, moths, beetles, bats and other animals helping us pollinate our crops, the world would surely go hungry. According to the Food and Agriculture Organization of the United Nations (FAO), of the more than 100 crop species that provide 90 per cent of food for most of the world's countries, more than 70 per cent are pollinated by bees. But it's not just bees: other insects – moths, flies, wasps, beetles and butterflies – as well as birds and mammals, are necessary for the reproductive process of most of the world's flowering plants, including more than two-thirds of food plants.

Until recently, we've taken this essential, valuable and freely provided service for granted. Animal pollinators have done their job so invisibly and well that, in many cases, we don't even know the full extent of the role they play. But now there's evidence that pollinator populations are declining, threatening farmers' livelihoods and putting pressure on world food security.

Not all flowering plants require animals for pollination – some, such as cereals, are pollinated by wind – but for those that do, seed production is affected, as well as fruit development: watermelons that are more frequently visited by pollinators have better colour and flavour, for example. And so harvests are affected: a study of Costa Rican coffee ecosystems showed that pollination by wild bees living in nearby forest contributed to 20 per cent higher yields. And pollinator-plant relationships affect food prices: vanilla is expensive because when cultivated outside Mexico, it must be pollinated by hand, as it's away from its natural pollinator, the *Melipona* bee (see page 23).

Today, evidence shows that all over the world, pollinator populations are in decline. Honeybee populations in Europe and North America are collapsing, and many wild bee colonies are vanishing. European butterflies are threatened by intensive agricultural methods and changing land-use practices. Many mammal and bird pollinators are considered threatened or extinct, too, including at least 45 species of bats, 36 species of non-flying mammals, 26 species of hummingbirds and 70 species of perching birds.

Recognizing that there's much we don't know about the state of pollinators, the United Nations Convention on Biological Diversity in 2002 established an International Initiative for the Conservation and Sustainable Use of Pollinators. The FAO leads the initiative, running a programme to gather data on plant pollination needs, trends in pollinator populations, what they require in terms of habitat and corridors, identifying and promoting alternatives to negative human impacts associated with land-use practices, pesticides, and so on. This information is used to encourage pollinator-friendly practices to help ensure they thrive. One thing's certain: while it's difficult to put a dollar value on the services animal pollinators provide, we now recognize we simply can't do without them.

H.C. Kappel/UNEP/Topham



Brocken Imaglory/CC-BY-SA-3.0



K.B. Hemalatha/UNEP/Topham



# Windows on the world of pollination

## Palms and weevils

When West African oil palms were first cultivated in Malaysia in the 1960s, plantation owners discovered a major problem: the trees, though they seemed healthy, produced barely any fruit because they weren't getting pollinated. Farmers had to resort to expensive and time-consuming hand-pollination. Subsequently, researchers learned that in Cameroon, where the plant originated, the weevil *Elaeidobius kamerunicus*, which feeds on the pollen, fertilized the plant. In 1981, this weevil was introduced to Malaysia's oil palm plantations, and production rose by 10 million tonnes within about five years.



Marco Schmidt/CC-BY-SA-2.5



## Figs and wasps

It's a relationship that goes back around 60 million years: the 2-millimetre fig wasp (of the family Agaonidae) can't breed anywhere but inside a fig, and the fig cannot be pollinated by anything other than the wasp. (There are around 900 fig and wasp species, which are specifically and mutually adapted to each other.) The flowers of fig trees are hidden inside the cavity of the fig. Female wasps enter the fig through an opening called the ostiole, pollinating the stigmas and laying eggs. Once the eggs hatch, the new females mate with the males, who chew holes in the fruit to let the pollen-covered females out to find new trees – the males dying soon afterwards. Once the wasps have left the fruit, it ripens and is ready for eating.



Simon van Noort/Iziko Museums of South Africa



## Bats and cactus

The Mexican long-nosed bat (*Leptonycteris nivalis*), which migrates between its native country and the southern United States, is an important pollinator of various desert plants, particularly the century plant. Also known as agave, this historically important cactus is harvested for its nectar and its juice, which is fermented into a beverage called *pulque* and distilled into the spirits tequila and mescal, as well as for its fibres, called *pita*, which are used for weaving rope, mats and other textiles. The bat feeds at night, identifying open flowers by smell. Scientists believe that the bat and agave may have coevolved, and that the survival of each depends on the other. They are also a keystone species: many other animals, including bees, moths, lizards, hummingbirds and field mice depend on plants pollinated by these bats, and because they migrate from region to region, habitat disruption in one area could have a knock-on effect on ecosystems elsewhere. Destruction of bats in Mexico could, for example, affect agave populations and biodiversity in Texas. And of course we also have fruit bats to thank for pollinating and dispersing the seeds of wild bananas, mangoes and guavas!



Marc Ryckaert/CC-BY-SA-3.0



## No bees, no food

That's an exaggeration, but it's true that without bees, we'd be without much of the food we take for granted: apples, peaches, strawberries, cherries, chocolate. In fact, honeybees pollinate around 80 per cent of the fruits and vegetables we eat. But 'colony collapse disorder', a term describing the decline of honeybee colonies around the world within the last decade, has been making headlines as a subject of serious concern. No one can point to a specific single reason why this is happening, but according to UNEP, researchers believe there may be multiple factors contributing to the problem, including:

- climate-change-induced shifts in growing seasons and rainfall patterns, parasites and pests
- herbicides and pesticides that reduce the availability of insect food plants
- insecticides and fungicides – including those used to treat animals (certain chemicals in combination form a cocktail which can become 1,000 times more toxic to bees)
- air pollution, which may impair bees' ability to find plants
- electromagnetic fields from sources such as power lines.

John Severns/PD



**W**e know of 50,000 edible plant species, of which just three – maize, rice and wheat – are the staple foods of nearly two-thirds of Earth's people. But some of the grains of ancient times are now making a comeback. While they are unlikely to replace the three main staples in the near future, here are some that are increasingly appreciated for their culinary versatility, health-giving properties and environmental hardiness. Give them a try!



Specialist Stock

## Amaranth

Originating in Central and South America, amaranth was a sacred crop to the Aztecs. Gods were represented in ritual ceremonies with idols made of amaranth grains and honey, which were worshipped, then broken up and eaten. This was so much like a Christian communion practice that Spanish conquistadors tried to ban not only the ceremonies, but also the cultivation of the plant. Thought to have been domesticated up to 8,000 years ago, the fast-growing, drought-tolerant, frost-resistant leafy plant with bright flowers produces highly nutritious seeds and leaves that are an important source of nutrients in Africa, Asia and Russia. Amaranth contains high levels of protein, and four times the calcium found in wheat – important for bone health. In South America, the leaves are cooked like spinach, and the grains prepared like rice or as a breakfast porridge. Amaranth flour can also be added to breads, pancakes and other baked goods. In Mexico, the ancient practice survives of amaranth-seed skulls made of popped amaranth mixed with honey as a treat for the *Día de los Muertos* – a day of remembrance for friends and family who have died.



P. Rocher/Biosphoto/Still Pictures

## Quinoa

Native to the Andes, quinoa – which comes from the goosefoot plant – was eaten as a staple by the Inca people and is still eaten today. An annual that thrives at high altitudes in well-drained sandy soil, it's a hardy crop that grows in cool conditions with low rainfall, and in areas that are otherwise marginal farmland. Quinoa, which is prepared like rice or couscous, is a rare vegetarian source of complete protein – it contains all the amino acids needed by the human body. This makes it something of a wonder food, and its popularity has grown spectacularly in recent years – so much so that the FAO has designated 2013 as the International Year of Quinoa, which will recognize the role played by quinoa's biodiversity and nutritional value in providing food security. Farmers in the USA and Europe are now investigating the possibility of growing varieties of quinoa for both human consumption and animal feed in similar high-altitude environments. And the Space Agency NASA is considering quinoa as a food source for Mars-bound astronauts.



M. Gunther/Biosphoto/Still Pictures

## Spelt

A cousin to wheat, spelt was cultivated in ancient Europe and the Middle East, but fell out of favour because of its relatively low yield and its hard-to-remove outer husk. Today, machinery allows spelt to be processed at a commercial level, and the grain, with its bran and germ, offers a wider spectrum of nutrients than modern wheat. High in fibre but also highly water soluble, spelt is easier to digest than wheat, and contains B-complex vitamins. A cup of cooked spelt has about the same number of calories as rice, but twice the protein and iron. Spelt also lowers the risk of Type II diabetes thanks to its magnesium content. The grain is agriculturally robust: it removes fewer nutrients from the soil, is resistant to frost and disease and thrives without fertilizers even on poor soils, while its thick husk protects it from pollutants and insects. Now popular in health-food stores, spelt is used as a substitute for wheat in breads, and the cooked, nutty spelt grains are a great rice substitute or basis for a salad.



# Wondergrains



PD-USDA-ARS

## Millet

Millet is thought to be one of the first cultivated cereals, dating back as much as 7,000 years to ancient Asia and Africa, where it still grows wild. There is evidence it was cultivated in Switzerland during the Stone Age, and it has been eaten in Northern Europe since the Iron Age. Indeed, during the European Middle Ages, it was the staple grain of the region. Millet is the small, round seed of several varieties of grass, most popularly *Pennisetum glaucum*, which is extremely hardy in hot and dry climates and poor soils. Now mostly grown in Africa and India, millet is still found in many cuisines around the world: in South Asia it is made into flatbreads such as chapatti and roti. It has a soft, creamy texture and is easy to digest, is higher in calories than wheat, and is full of heart-protecting nutrients like magnesium and phosphorus. Studies have shown that magnesium is also effective in protecting against Type II diabetes, and millet promotes a steady rise in blood glucose levels.



Stefan Auth/Imagebroker/Specialist Stock

## Teff

Teff means 'lost', so called because of its tiny 1-millimetre diameter grain. Yet about a kilo of grains is enough to sow a 1-hectare field – about 100 times less seed than is needed for wheat – and it cooks quickly. This lovegrass thrives in a vast variety of environments – from sea level to high altitudes, from dry to waterlogged land – and is also resistant to disease. Thought to have been first domesticated in Ethiopia 6,000 years ago, teff is made into a spongy flat bread, *injera*, used as an edible plate in Ethiopia and Eritrea. Today, its fame is spreading because of its nutrient value: it is almost as high in protein as quinoa, contains the highest calcium of all grains and also provides Vitamin C. Today, teff is being cultivated in Australia, Canada, India and the USA, where it is used in breads, pancakes and other products, and its potential for other parts of the world is being investigated.

## ...and other opportunities

### THE GRASS PEA

It can save the hungry in the short term, even if it can ruin health in the long term. The drought-tolerant, flood-tolerant grass pea (*Lathyrus sativus*), first cultivated around 8,000 years ago in the Mediterranean and today used in Bangladesh, Ethiopia, India and Pakistan, is extremely high in protein. Because it's so hardy, it's often the only food source available when other crops fail. The problem is, overconsumption can lead to permanent paralysis in adults and brain damage in children due to a neurotoxin present in the plant. Researchers are now trying to breed a low-toxin variety.



Bisayan Lady/CC-BY-SA

### THE PRICKLY PEAR

Nothing survives dry conditions like cacti. The prickly pear (*Opuntia ficus-indica*) is native to Mexico, where it is cultivated on a large scale. Both the fruits, known as *tunas*, and the pads, *nopalitos*, are delicious. The thirst-quenching young pads can be prepared as a green vegetable, and the fruit is eaten fresh or made into jams and drinks. Prickly pear has been found to lower blood cholesterol and provides large amounts of Vitamin A, important for eye health. Once sacred to the Aztecs, the prickly pear is easy to grow, gaining popularity in dry areas around the world. It is also the host to cochineal insects, which are used for red dye and food colouring.



T. Castelazo/CC-BY-SA 2.5

# Are we asking the right questions?

**E**nvironmentalist and sustainability campaigner **TONY JUNIPER** was Executive Director of Friends of the Earth in the UK for eight years. Today, he advises international food companies including Danone and works with HRH Prince Charles' International Sustainability Unit. A long-time advocate of organic farming practices, Tony talked to TUNZA about why organic-style agriculture is not a luxury, but a necessary part of how we'll be feeding ourselves into the future.

'We have built our current society on the exploitation of the Earth's natural resources. But they are limited, so this can't go on forever. I think organic farming will be one of our responses, changing the way we live. Discussions about organic farming often focus on nutritional health rather than looking at environmental health, which also affects human health, by the way. But the real argument in favour of organic farming is about resilience – a concept that is beginning to come into thinking about food security. Resilience is about the strength of agricultural systems and their ability to keep going under shocks and pressure. There are two imminent shocks:

water scarcity and high prices for fossil fuels – both essential for industrial-scale farming. If you're seeking a system that can be more resilient, inevitably you'll move towards organic and near-organic systems, which rely less on fossil fuels and use methods that work with nature – including crop rotation, the use of animals, and ploughing organic matter into the soil to retain water and build fertility.

'Arguments against organic farming tend to focus on yields and productivity. Of course we need to feed people – though there are issues about what and how much many of us eat – but perhaps the efficiency question we are asking is too narrow. If we're considering the long-term survival of humanity, we must think about whether applying vast amounts of chemicals to the land – which can lead to soil depletion, water pollution, damage to pollinating wildlife and climate change – will ultimately harm our ability to feed ourselves. When you weigh up the full range of costs, it could be argued that organic is by far the more efficient method.

Justin Treharne/LoveTextures/CC-2.0



H. Gaines/UW-Madison/USDAgov/CC-BY-3.0



Pleasantview Farm/USDAgov/CC-BY-3.0

**W**heat, maize and rice: there was a time when their ancestors only grew in the wild. Over thousands of years, however, through selective breeding, humankind domesticated them, to make them healthier and more productive.

'We are all committed to ending world hunger,' says Oxford University's **PROFESSOR CHRIS LEAVER**, 'but the UN is forecasting an increase in population from 7 billion today to 9 billion by 2050. We need to double the amount of food we produce this century, all the while maintaining the vital biodiversity and ecosystems on which we depend, and in the face of decreasing water availability and a changing climate.

'Since the 1960s, the world's supply of food has kept up with the doubling of the human population. Much has been achieved through improved farming methods and the application of scientific techniques to the breeding of plants and animals. But our challenge is to do that again without increasing the area of land being used for agriculture.

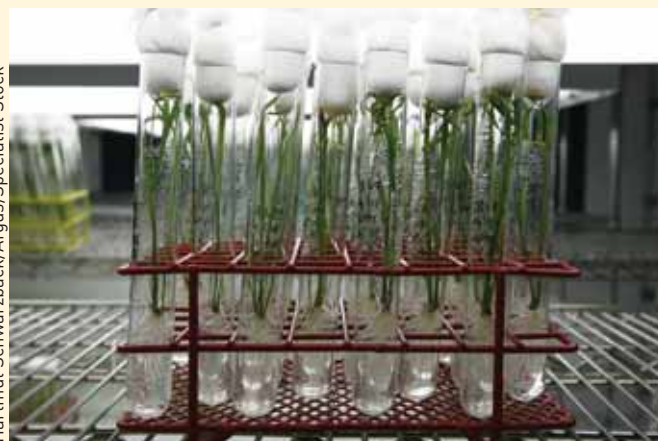
'Today's science has a lot of tools that, appropriately applied, can improve many of the processes that farmers

'It's all about a style of farming, not simply saying organic is the only way to go – the term organic, I should add, covers a number of different methods. Technology certainly has a role to play. Some genetic technologies could help accelerate the process of selective breeding, for example, although I worry about the intellectual property rights claimed and the pesticides required for transgenic GMOs – those that move genes between species – both of which reinforce the industrial farming model. Considerable food-security gains, as well as societal ones, could be achieved by encouraging some local, labour-intensive organic ways of farming. In Ethiopia, for example, these are highly productive.

'Looking at recent assessments of food security – especially on the heels of the 2012 US drought – I think it's not really a question of whether we do organic and near-organic farming; rather, it's a question of when we shift away from high-input, low-resilience farming to low-input, high-resilience farming. In the meantime, we've got a choice: would we like to plan for that changing world, or are we going to wait for catastrophe?'



Lance Cheung/PD-USDA



Hartmut Schwarzbach/Argus/Specialist Stock

## Making the most of what we've got

have been using for centuries. Modern plant breeding and gene technology allow us to reliably and safely breed characteristics we need into a plant, or breed out ones we don't, in just a few years.

'When these techniques were first developed, the emphasis was on making plants resistant to specific herbicides, allowing farmers to increase yields by controlling weeds more easily. A major success has been the launch of insect-resistant crops that improve yield and quality in cotton and maize and reduce the need for insecticidal sprays. But today we are working to breed plants that have increased yields and flourish with less water or fertilizer and have natural disease and pest resistance, reducing the need for the application of agrichemicals.

'We're also working to increase the nutritional value of food and reduce waste – around 40 per cent of all food grown is lost between the field and your fork. Cassava, a staple for hundreds of millions of people across Africa and Latin America, for example, is very susceptible to pests and disease; in some areas up to 80 per cent of the crop is lost. As a result, scientists are using genetic breeding techniques to introduce disease resistance, to improve cassava's storage qualities and to increase its nutritional

value by raising the levels of zinc, iron, protein and pro-vitamin A it contains while reducing the level of harmful compounds that occur naturally in the crop.

'But not all the techniques used in the biosciences involve making changes to plants. Careful observation and analysis of the characteristics of plants – repelling some insects, for example, while encouraging other wildlife – have allowed farmers to interplant different crops, improving pest resistance and providing additional food and fodder.

'All of us involved in the biosciences are extremely concerned to maintain, and not damage, biodiversity. It is there that we will find solutions to existing and emerging challenges. It is not enough just to maintain seedbanks – we need living, vibrant plants and communities of plants. The wonderful bounty of the natural world is what all bioscientists learn from and are dedicated to enhancing for the benefit of humankind.'

*Professor Chris Leaver, Emeritus Professor in the Department of Plant Sciences, University of Oxford, is the Senior Scientific Advisor to the Bioscience for Farming in Africa initiative ([www.b4fa.org](http://www.b4fa.org)), supported by the Templeton Foundation.*

# The last wild catch

**T**he world faces the nightmare possibility of fishless oceans by 2050.' That was the message of a 2010 UNEP report that concluded that 30 per cent of the world's fish stocks have already collapsed. And according to the Food and Agriculture Organization of the United Nations (FAO), more than 70 per cent of the world's fish species are either fully exploited or depleted. In the North Atlantic region, for example, commercially exploitable populations of cod, hake, haddock and flounder have fallen by as much as 95 per cent – and may require a zero-catch policy to allow them to regenerate. Some species, like bluefin tuna, are close to extinction. These are potentially catastrophic warnings for world food security: a billion people, mostly from poorer countries, rely on fish as their main source of animal protein.

Jorgen Freund/Aurora/Specialist Stock

## An oversized fleet

Part of the problem is that there are simply too many of us fishing. According to the United Nations, there are 35 million people fishing around the world on 20 million boats – that's a fleet that's two and a half times larger than the oceans are able to support without depleting stock. This is exacerbated by the fact that we are such efficient hunters. Big, government-subsidized fishing fleets of ever larger boats are technologically capable of harvesting too many fish at once from previously hard-to-reach deep-sea environments. Because deep-sea fish species such as monkfish, Patagonian toothfish (often sold as Chilean sea bass) and orange roughy grow and reach sexual maturity slowly, they are particularly vulnerable to intensive fishing. Once populations are damaged, recovery can take generations. In the last 50 years, numbers of large predatory fish in the deep oceans, such as marlin, swordfish and sharks, have dropped by 90 per cent.

## Wasteful habits

Another problem is waste: fishing fleets haul up and throw away 20 million tonnes of unwanted 'by-catch' every year, killing and discarding unprofitable species, and surplus or juvenile fish. By-catch also includes such endangered wildlife as dolphins, porpoises and small whales, loggerhead and leatherback turtles, sharks, seabirds and corals, sponges, starfish and more. Such practices damage not just individual species but the marine ecosystems that support them.

## Poor management

Governments and ministries try to implement fishing quotas and sound fisheries management, but it's very difficult to monitor activities – much less enforce guidelines or laws governing fishing practices – out at sea. In the case of the high seas, there are very few international fishing regulations in place. And while

scientists propose catch limits to help keep populations sustainable, management bodies don't necessarily heed their advice, often setting limits that far exceed the recommended quota.

## Setting waters aside

One logical solution is to set aside marine areas for conservation, and there are some such areas. But so far, only 1.2 per cent of the world's oceans have been designated marine protected areas (MPAs) as defined by the International Union for Conservation of Nature (IUCN): 'A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values'. Even within this definition, it's not always clear whether a reserve can really be considered an MPA. The IUCN strives to create strong guidelines, but the truth is that some reserves called MPAs include areas exploited for tourism or for harvesting fossil fuels or wind energy, for example. In any case, of those currently recognized as MPAs, less than 1 per cent have been designated 'no-take' (fishing-forbidden) zones protecting young fish so that they can grow to maturity.

## Eating wisely

Unfortunately, there's no easy way of knowing whether a particular seafood item comes from an unsustainable source – though that is the case for the majority of what is available for us to buy. But there is a growing movement for identifying sustainability. The Marine Stewardship Council (MSC) is a non-profit organization that encourages seafood harvested within sustainable limits using sustainable methods, and that minimizes the impact on marine ecosystems. Consumers who buy seafood with the MSC logo – including both fresh products and processed foods such as tinned tuna – can be assured that they are supporting sustainable fishing, voting with their dollars while enjoying guilt-free meals.



## From wild to farmed

There has long been argument about whether aquaculture – the alternative to wild-harvested fish – is better or worse for the environment. While farmed fish like salmon or prawns take some of the pressure off wild fish populations, they also raise such environmental issues as wastewater pollution; the loss of wild habitat such as mangrove forests; pharmaceuticals such as antibiotics; concerns that farmed fish escape and compete with wild species; the spread of parasites and diseases; and the use of wild-caught fish for fish feed. The newly formed Aquaculture Stewardship Council (ASC), like its cousin the MSC, works with the aquaculture industry, setting standards for sustainable aquaculture, and likewise gives its seal of approval to fish farms and their products that meet strong environmental sustainability requirements. So far, ASC standards for abalone, bivalves, tilapia and the catfish pangasius have been finalized, while standards for trout, salmon and shrimp will be completed by the end of 2012, followed by standards for seriola (also known as amberjack) and cobia (also known as ling).



C. Gomersal/Wildlife

## It really can happen...

For centuries, fishermen in the North West Atlantic, off Newfoundland, relied on the seemingly plentiful cod stocks for their livelihoods. But in 1992, after decades of overfishing using trawlers, the cod disappeared, leaving 10,000 fishermen without jobs overnight. Today, the cod have still not recovered, and scientists believe that the ecosystem has been damaged to the point where they may never return in high enough numbers to sustain an industry.

# BOUNTY OF THE SEA

Some unusual foods we get from the sea...

## Samphire

Samphire, also known as glasswort, is a sea vegetable that grows plentifully on coastal shorelines and tidal mudflats. There are several species that grow in the United Kingdom, across Eurasia and in Australia, but all are edible. Crunchy and tasting of the sea, it can be eaten raw in salads or sandwiches, or gently cooked like asparagus to accompany seafood dishes.



D. Harms/Wildlife

## Jellyfish

As ocean ecosystems change, threatening biodiversity, at least one creature seems to be thriving – jellyfish. They're plentiful, hardy, and even survive in oceanic dead zones. The Chinese have long eaten jellyfish as a traditional delicacy, and despite their reputation as stingers, about a dozen jellyfish varieties are edible. The tentacles are removed before the jellyfish is soaked in brine, and then dried. Jellyfish is typically served as a cold appetizer, shredded and tossed with soy sauce, vinegar and sesame oil. It has an elastic crunch and a slight flavour of calamari (squid).



Dan90266(CC-BY-SA-2.0)

## Seaweed

Known as laver in Wales and slake in Ireland, *zicai* in China and *nori* in Japan, this edible coastal alga has been eaten for centuries. Belonging to the family of red algae, it is particularly high in dietary minerals like iron and iodine, giving it a flavour reminiscent of olives. It can be boiled to a pulp and eaten with toast in the traditional Welsh way, added to Chinese and Korean soups, or used to wrap parcels of sushi, Japanese style.



GameKeeper/PD

# 7 spices

PEOPLE have been using spices to enhance and preserve food and to treat ailments for more than 50,000 years. Those that controlled the trade in such highly prized goods grew rich. But over the millennia, widespread cultivation has made them increasingly available. Much of their scientific value is well known, though many of their traditional medicinal uses are still being investigated. Here are just seven that are widely used, greatly valued and, frankly, good for you.



Daniel Risacher/GFDL/CC-BY-SA-2.5

## Chillies

Almost all the world's cuisines use chillies – several species of the genus *Capsicum* – to provide kick and flavour: pipiri in Africa, Middle Eastern harissa, ají in South America or Scotch bonnets in the Caribbean, for example. Chillies originated in the Americas, where evidence of cultivation goes back at least eight millennia. Now they're cultivated the world over, and are eaten fresh, dried, powdered or crushed. Chillies work as an appetite suppressant and metabolism booster, and lower cholesterol. Medicinally versatile capsaicin, the substance that makes chillies hot, relieves pain when applied externally to wounds, and releases pain-killing endorphins when eaten. Cayenne helps stop internal and external bleeding, while eating it is reputed to regulate blood pressure. Chillies are also an excellent source of Vitamin A and are richer in Vitamin C than citrus fruit. And in East Africa, farmers build chilli-impregnated fences to prevent elephants from harming their crops.

## Black pepper

Native to the state of Kerala in India, black peppercorns have been traded for at least 4,000 years. In 1213 BC, the Egyptian pharaoh Ramses II was mummified with a black peppercorn in each nostril, and pepper was so highly valued in medieval Europe that it was used as currency. Black peppercorns, which can be stored for years without losing their pungent aroma, are the unripe, fermented and dried fruits of *Piper nigrum*, a vine that can grow to a length of more than 10 metres. The same fruit, differently processed, also produces fragrant white peppercorns and fresh green ones. Pepper's antibacterial properties were valued prior to refrigeration as a way of preserving meats and making rancid food more palatable. In ayurvedic medicine, it's used to relieve symptoms of diabetes and anaemia and to aid digestion. Recent research discovered that pepper's active compound, piperine, has pain-relieving, anti-inflammatory properties, and might be useful in the treatment of vitiligo, a skin pigmentation condition.

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## Cinnamon

Native of Sri Lanka, cinnamon is harvested from the inner bark of the tree *Cinnamomum zeylanicum*. So prized was it that Arab traders kept its source secret, spinning tales of giant birds building their nests with its branches. Today, it's widely used in desserts and confectionery, as well as in savoury Middle Eastern dishes. Cinnamon has great medicinal properties, too – it's been found to stimulate brain function, allowing people to process information more quickly; a Japanese study suggested cinnamon helps prevent stomach ulcers, while a German one found it suppresses the bacteria that cause urinary tract and candida infections. In India, a molecule extracted from the cinnamon plant has been found to help keep HIV-infected people healthy, while in the USA, scientists accidentally discovered that, rather than raising blood sugars, apple pie actually lowered them due to the cinnamon content.



Chillapple Group

## Cloves

Native to the Molucca Islands of Indonesia, cloves are the dried flower buds of the evergreen *Syzygium aromaticum*, which can grow to around 6 metres tall. Resembling small black nails, the spice was used in China as a breath freshener, and is a crucial ingredient in culinary mixtures including Chinese five spice, India's *garam masala* and the Moroccan *ras el hanout*. Cloves also feature in European apple pies and mulled wine. Medicinally, clove oil is a local antiseptic and anaesthetic: its numbing effect makes it a popular remedy for dental problems. Its warming qualities are used to relieve aching muscles, and it's known for easing digestion. Clove is also used as an ingredient in incense, valued for both its flammable properties and its fragrance. The Sultan of Oman introduced cloves to the East African islands of Zanzibar in the 19th century, and still today Pemba Island boasts more than 3 million clove trees.

## Ginger

Prized for its warming properties, the rhizome of the ginger plant (*Zingiber officinale*) is used extensively in Thai and Indian curries, as a delicate Japanese pickle, as flavouring for British and American ginger beer and wine, in African cakes, and much more. Medicinally, it is used extensively to alleviate joint pain and travel sickness and to improve digestion. Researchers are also investigating the plant's effectiveness in preventing bowel and ovarian cancer. No one is quite sure where ginger originally came from as it's no longer found in the wild. Biological clues point to India, and the 4th century Hindu epic, the *Mahabharata*, mentions a meat dish stewed with ginger. It has been traded since the 5th century, and reached Africa and the Caribbean by the 16th century.

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Everglades National Park/PD-USgov

## Vanilla

It's hard to imagine a world without vanilla – the world's most popular ice-cream flavour – not to mention the host of cakes and desserts that rely on its rich, sweet fragrance. The vanilla pod or bean comes from *Vanilla planifolia*, a climbing tropical orchid native to Mexico, where it was first used by the Totanoco indians. The Aztecs used it to flavour their chocolate, and it was brought to Europe by the Spanish conquistador, Cortez. But because vanilla is only naturally pollinated by hummingbirds and the *Melipona* bee, attempts to produce the pods outside Mexico failed until, in the 19th century on the island of Réunion, 12-year-old slave-boy Edmond Albius figured out how to hand-pollinate the flowers with a bamboo skewer. A similar technique is still used for vanilla cultivation today.

## Bay

Bay (*Laurus nobilis*) has been associated with honour and glory since the days of Ancient Greece and Rome. Poets and emperors were crowned with bay, while athletes at the Olympic Games were awarded bay garlands. Today, the aromatic leaf, fresh or dried, is used to flavour meat, soups, stews and even puddings. Ancient Greeks used it to soothe bee stings, and it is still used to aid digestion. It is also a great source of Vitamins A and C as well as iron and manganese, while its oil is used to relieve sprains and other muscle aches. Bay also contains parthenolides, compounds that have been found to relieve migraines. But be warned, legend has it that the prophetic priestesses at the Temple of Apollo in Delphi inhaled the smoke of burning bay to stimulate hallucinatory visions.

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# A BIG VOICE AGAINST HUNGER

Photos: WFP/Rein Skullerud



When **CHRISTINA AGUILERA** was a child performer growing up in Staten Island, New York, she was known as the 'little girl with the big voice' – still an apt description for the diminutive singer whose extraordinarily powerful voice has inspired generations of young singers and won four Grammy Awards. She has been hailed by *Rolling Stone* magazine as one of the greatest singers of all time.



**N**ow the singer is using her status as one of the world's biggest stars to help alleviate hunger. In 2010, the UN World Food Programme (WFP) named her an Ambassador Against Hunger. She is also the official spokeswoman for the World Hunger Relief campaign run by fast-food corporation Yum! Brands that benefits the WFP. So far, her efforts in this role have helped raise tens of millions of dollars.

Established in 1963, the WFP is the world's largest humanitarian hunger-relief organization, annually feeding around 100 million people in some 70 countries affected by war, famine, drought and political upheaval. Besides providing emergency rations, the WFP also provides school dinners to help young children stay in education, offers food in exchange for work, and feeds people living with HIV and AIDS. To improve food security in impoverished countries, it purchases produce from local farmers to help establish them in a more secure market, allowing them to innovate and strengthen their businesses.

Aguilera spreads the word about World Hunger Relief on television, and has appeared in a promotional video singing

her international hit ballad *Beautiful* to a rapt audience on a Los Angeles street corner. She also visits communities that receive food aid, such as Haiti and Guatemala, to see how hunger affects lives, and how food assistance helps communities rebuild. 'I was so moved by the devastation in Haiti but also by the spirit of its people,' said Aguilera after a visit to Port-au-Prince, where she served rice and beans to children at local schools shortly after the 2010 magnitude 7.0 earthquake. She also toured refugee camps where she was moved by the plight of mothers and children. 'I urge everyone to go to [www.wfp.org/christina](http://www.wfp.org/christina) and make a donation, so we can bring food to these mothers and children and help them rebuild their lives,' she said.

A mother herself to four-year-old Max, Aguilera is particularly concerned to highlight the need to provide food to growing children. 'If a child under two doesn't get the nutrients they need, we can never fix the damage later on,' she said during a trip to visit villages in the Guatemalan highlands, where 80 per cent of the indigenous children are malnourished. 'I want to raise awareness and open people's eyes so that WFP can get the funds it needs to keep on working.'