

# Population and biodiversity

**N**OBODY KNOWS how many species there are in the world – or how fast they are disappearing. Fewer than 2 million have been cataloged and estimates of the total vary wildly, ranging from 7 million to as many as 80 million. The currently accepted working estimate is 13.6 million.

A quarter of the total number of species may be beetles, whose diversity is especially rich high in the rainforest canopy of the Amazon. Many more could be nematodes on the floors of the oceans. As many again could exist among single-cell microbes, whose diversity is beginning to be assessed for the first time using gene-typing<sup>1</sup>.

Biodiversity is a term applied to describe the complexity of life. It is generally measured at three levels: the variety of species; the genetic diversity found within members of the same species (what makes you different from your neighbor); and the diversity of the ecosystems within which species live. These three levels are intimately connected. Genetic diversity is essential to the prosperity of the species, giving it the resources to adapt. And the number of species within an ecosystem is closely tied to the health and size of the ecosystem itself<sup>2</sup>.

However it is defined, biodiversity is the stuff of life. However far we may be removed from "wild" biodiversity in our daily lives, it remains the source of our food and most of our medicines. In addition, 15 percent of our energy is derived from burning plant materials. Even in the United States, wild species contribute around 4.5 percent of GDP<sup>3</sup>.

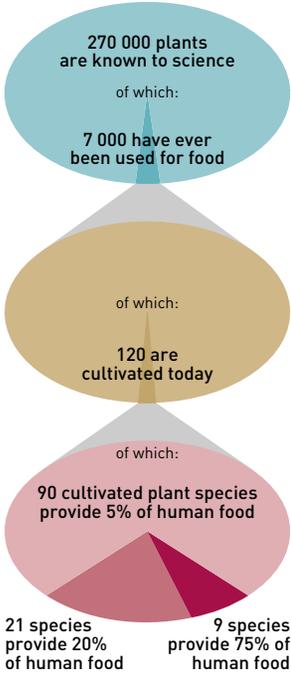
Some of our uses are direct. Billions of people still harvest wild or "bush" food around the world. Between a fifth and a half of all food consumed by the poor in the developing world is gathered rather than cultivated, while at global level we gain 16 percent of our animal protein from sea fish caught in the wild. The World Health Organization (WHO) estimates that more than 60 percent of the world's population relies on traditional plant medicines for day-to-day primary health care<sup>4</sup>, and 3 000 plant species are used in birth control alone<sup>5</sup>.

In the Uxpanapa region in Mexico peasant farmers use 435 wild plants and animals, eating 229 of them<sup>6</sup>. One Thai village was found to eat 295 different local plants and use 119 in medicines. Europe's prime treatment for prostate disorders comes directly from the bark of the African cherry tree, now severely depleted in its homeland in the Central African highlands.

But biodiversity's role extends far beyond these direct uses. We may today only eat a small proportion of the 70 000 plants known to have edible parts<sup>7</sup>, but most food crops constantly require an infusion of "wild" genes to maintain their resistance to ever-evolving pests. These raids on nature's "genetic library" enable increases in crop productivity of about 1 percent a year, worth in excess of a billion dollars<sup>8</sup>.

Approximately 118 out of the top 150 prescription drugs sold in the United States are laboratory versions of chemicals found by "bioprospectors" in the wild – mostly synthesized from plants but also from fungi, bacteria and extracts from vertebrate animals such as snakes<sup>9</sup>. Aspirin, for instance, derives from an acid first taken from the bark of willow trees. The promising anti-

### BIODIVERSITY FOR FOOD



### GERMPLASM OF NUTRITIONALLY IMPORTANT CROPS HELD BY CGIAR\* CENTERS

	Number of samples held, 2000	% of wild species not yet collected*
Barley	24 218	0-10
Cassava	7 886	80
Chickpea	26 077	50
Common bean	27 595	id
Cowpea	15 001	70
Forages	52 456	id
Groundnut	14 357	30
Maize	19 548	85
Millet	30 300	90-98
Potato	5 057	60
Rice	122 632	70
Sorghum	35 780	90
Soybean	1 909	70
Wheat	110 182	40
Yam	2 878	id

\* Consultative Group on International Agricultural Research  
\* Global estimate

Source: CGIAR; UNEP-WCMC; FAO.

### CENTERS OF PLANT DIVERSITY, GENE BANKS AND GENETIC ORIGINS OF CROPS AND LIVESTOCK

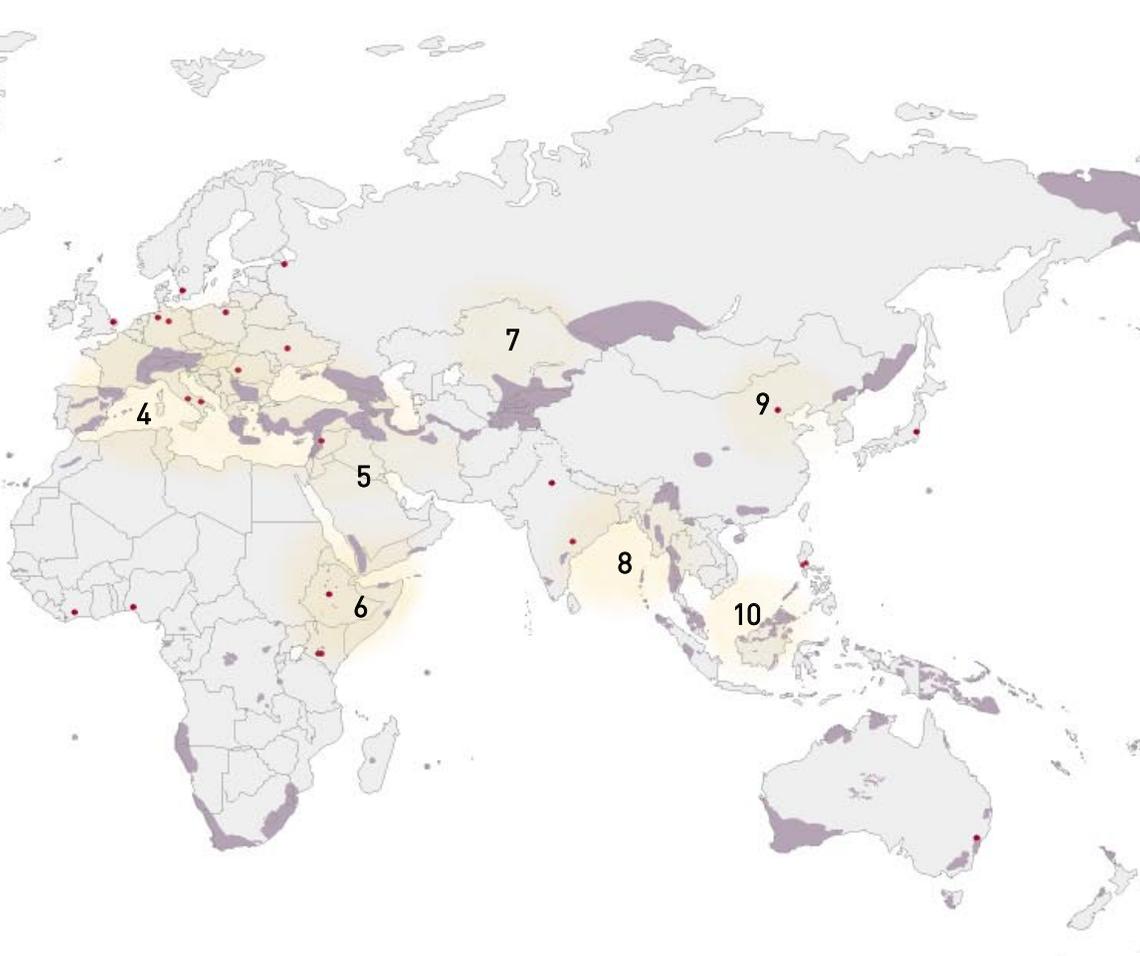
- Centers of high plant diversity**  
Sites and areas identified as important centers of plant diversity at regional and global level
- Major gene banks**  
International centers belonging to the Consultative Group on International Agricultural Research (CGIAR) plus major national plant gene banks
- Genetic origins of crops and livestock** (see below)



The majority of the world's gene banks are situated in or near the richest regions of biodiversity, from which most of our staple foods originated. These repositories are gaining in importance as wild biodiversity comes under increasing pressure from population growth and landuse change.

### GENETIC ORIGINS OF CROPS AND LIVESTOCK

<b>1. North America</b>	Sweet potato	Pumpkin	Rape	Hazelnut
Cranberry	Tabasco pepper	Quinine	Sugar beet	Leek
Jerusalem artichoke	Tomato	Rubber		Lentil
Muscadine grape	Vanilla	Upland cotton	<i>Belgium</i>	Pea
Sunflower			Brussel sprout	Pig
Turkey	<b>3. Andes/South America</b>	<b>4. Mediterranean</b>		Plum
	Avocado	Asparagus	<i>North Africa</i>	Rye
	Common bean	Broad bean	Cattle	Shallot
	Grapefruit	Cabbage	Marjoram	Sheep
	Hemp/sisal	Cauliflower		Spelt wheat
	Maize/corn	Celery	<b>5. Near East</b>	Sugar beet
	Papaya	Common grape	Alfalfa	Sweet cherry
	Pecan	Globe artichoke	Barley	
		Lavender	Cabbage	
		Mint	Einkorn wheat	<b>6. Horn of Africa</b>
		Oat	Fig	Black-eye pea
		Parsnip	Goat	Bread wheat
				Castor bean



Source: UNEP-WCMC; FAO.

### ESTIMATED VALUE OF WILD RESOURCES IN DEVELOPING COUNTRIES, 1990s

- Pre-ban ivory exports, Africa:** US\$35-45 million per year
- Tropical non-coniferous forest product exports:** US\$11 billion per year
- Fruit/latex forest harvesting, Peru:** US\$6 330 per hectare
- Sustainable timber harvesting, Peru:** US\$490 per hectare
- Buffalo range ranching, Zimbabwe:** US\$3.5-4.5 per hectare
- Wetlands fish and fuelwood, Nigeria:** US\$38-59 per hectare
- Viewing value of elephants, Kenya:** US\$25 million per year
- Ecotourism, Costa Rica:** US\$1 250 per hectare
- Tourism, Thailand:** US\$385 000-860 000 per year
- Research/education, Thailand:** US\$38 000-77 000 per year
- Tourism, Cameroon:** US\$19 per hectare
- Genetic value, Cameroon:** US\$7 per hectare
- Pharmaceutical prospecting, Costa Rica:** US\$4.81 million per product

Source: UNEP.

### MAJOR DRUGS DERIVED FROM PLANTS

Plant	Application
Amazonian liana	Muscle relaxant
Annual mugwort	Antimalarial
Autumn crocus	Antitumor agent
Belladonna	Anticholinergic
Coca	Local anesthetic
Common thyme	Antifungal
Ergot fungus	Hemorrhage control in childbirth
Foxglove	Cardiotonic
Indian snakeroot	Antihypertensive
Meadowsweet	Analgesic
Mexican yam	Birth-control pill
Nux vomica	CNS stimulant
Opium poppy	Analgesic, antitussive
Pacific yew	Antitumor agent
Recurd thornapple	Sedative
Rosy periwinkle	Antileukemia
Velvet bean	Antiparkinsonian
White willow	Analgesic
Yellow cinchona	Antimalarial, antipyretic

Source: WWF.

Coffee	Common grape	Pear	<b>9. East Asia</b>	<b>10. Southeast Asia</b>
Cowpea	Cucumber	Watercress	Buckwheat	Apricot
Date palm	Flax/linseed		Camphor tree	Banana
Egyptian cotton	Garlic	<b>8. India/ Indo-Malaya</b>	Chive	Cinnamon and cassia
Finger millet	Onion	Black pepper	Foxtail millet	Clove
Mustard	Rhubarb	Breadfruit	Ginseng	Coconut palm
Okra	Spinach	Cardamom	Lychee	Eggplant
Pearl millet		Chick pea	Mulberry	Indian almond
Short staple cotton	<i>European</i>	Chicken	Peach	Lemon
Sorghum	<i>Siberian Region</i>	Dwarf wheat	Radish	Mung bean
Yam	Cattle	Lime	Soybean	Sugar cane
	Chicory	Mango	Sweet orange	Tangerine
<b>7. Central Asia</b>	Gooseberry	Moth bean	Tea	
Almond	Kale	Rice	Turnip	
Apple	Lettuce	Safflower	Water chestnut	
Carrot	Licorice	Sesame		

Source: WWF.

cancer drug taxol was first extracted from the wild Pacific yew tree. Globally, it has been estimated that the pharmaceuticals industry gains US\$32 billion in profits a year from products derived from traditional remedies<sup>10</sup>.

The emerging science of biotechnology offers new potential for using the world's genetic resources, but it is an area of some controversy, yet to be fully developed. Moreover, many of these resources are under threat from human activity. Species are being lost at a rate probably unprecedented outside times of mass extinction millions of years ago. One estimate puts the loss at 27 000 species a year<sup>11</sup>. The United Nations Environment Programme's *Global Biodiversity Assessment* estimates current extinction rates at 50 to 100 times "normal", and anticipates a ten-fold or even 100-fold increase over the next quarter century, when between 2 and 25 percent of species could be lost<sup>12</sup>.

The primary cause of this loss is not hunting or overexploitation, though these play a part, but loss of natural habitat. Habitat loss is generally greatest where population density is highest. A study of biodiversity data from 102 countries found that in the most densely populated 51 countries (averaging 168 people per square kilometer), 5.1 percent of bird species and 3.7 percent of plant species were threatened. In the 51 less densely populated countries (averaging 22 people per square kilometer), the proportions of threatened species were only half as high at 2.7 percent and 1.8 percent respectively<sup>13</sup>.

### **MASS EXTINCTIONS IN HISTORY**

Looked at on a geological timescale, the planet's biodiversity has always been faced with threats of one form or another. Mass extinctions have a history almost as long as biodiversity. There are five known cataclysmic extinctions in the Earth's history. The biggest, at the end of the Permian era 250 million years ago, eliminated between 75 and 95 percent of all species, while the best known, 65 million years ago, saw off the dinosaurs and much else. The extinctions appear to have been caused by massive climatic disruptions, some at least arising from meteor impacts.

Extinction, moreover, is an essential engine for evolutionary progress. Even mass extinctions, by killing large numbers of creatures, open up ecological "niches" to which surviving organisms swiftly adapt. Thus the demise of dinosaurs allowed the rapid evolution, within 10 million years, of bats, whales, horses and numerous other species of mammals and birds. Nonetheless, whatever such benefits to life on Earth may be in the long term, our own immediate future on the planet is jeopardized by the current human-induced mass extinctions.