A brochure series with accompanying materials on development cooperation
for the UN Decade of Education for Sustainable Development

SUSTAINABILITY HAS MANY FACES

Mountain Gods and Wild Rice

Agrobiodiversity as a Basis for Human Existence

Contributions from China

giz

On behalf of
Federal Ministry
for Economic Cooperation
and Development

EU-CHINA
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Agrobiodiversity as a Basis for Human Existence. Contributions from China.
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Mountain Gods and Wild Rice

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A note on spelling.
In Chinese, the first name always follows the surname. Mao Zedong is, therefore, Mr. Mao.
Beijing is the official Chinese way of writing the name of the capital of the People's Republic of China. Outside of China, the old Western name Peking is occasionally used. In this publication the official Chinese transcription is used throughout.
In China, the term "local communities" is used as a neutral term, with no distinction of ethnic or cultural background, while in the international context the expression "indigenous peoples" is more usual when referring to specific traditional elements.
In this publication we talk of "ethnic" groups and peoples.

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Contents

Foreword of the German Federal Ministry for Economic Cooperation and Development

The major inequalities between rich and poor, the awareness of the finite nature of natural resources, and the increasing threat to the ecological bases of humanity's social and economic development prompted political leaders from 178 countries, in 1992, to develop a new set of solutions. At the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, world leaders signed three international treaties – the United Nations Framework Convention on Climate Change (UNFCCC) (followed by the Kyoto Protocol in 1997), the Convention on Biological Diversity (CBD) and the Convention to Combat Desertification (UNCCD) – which pursue one common goal: sustainable human development. All three conventions are of equal status in terms of their relevance to the preservation of our natural life-support systems, poverty reduction, and achieving more global justice.

In 2000, the United Nations (UN) adopted the Millennium Development Goals, thereby committing to halve global poverty, improve the protection of the environment and achieve equitable development within 15 years. Within the Agenda 2015 framework, Germany too has defined its contribution to supporting the developing countries' efforts to achieve the Millennium Development Goals. Protecting the environment and preserving natural resources are key elements here. We can only achieve sustainable improvements in living conditions for all the world's people if we conserve these resources. Developing countries are particularly hard hit by the impacts of climate change and the growing overexploitation and destruction of natural resources and biodiversity. The German government has, therefore, substantially expanded its climate-related development programmes and its contribution to protecting biodiversity in recent years. At the same time, sustainable development strategies which incorporate environmental and climate elements have steadily moved up the policy agenda. The German Federal Ministry for Economic Cooperation and Development (Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung, BMZ) is scaling up its activities to protect the climate, the environment and natural resources as key sectors of development policy. Thereby, development cooperation is becoming less about searching for straightforward technical solutions and more about providing support and guidance for people and organisations and empowering them to manage challenging economic and social transformation processes.

Young people often have a strong sense of justice and are keen to understand how our actions here in Germany relate to what is happening elsewhere in the world. They actively seek fundamental, long-term solutions. The United Nations has emphasised the great importance of education for peaceful and equitable global development and has proclaimed the years from 2005 to 2014 the United Nations "Decade of Education for Sustainable Development". The "Sustainability has many faces" brochure series is a contribution to this Decade and is, therefore, primarily aimed at teachers and multipliers working in non-school environmental and development education. It shows how people in countries with which we are, perhaps, less familiar, are finding ways of improving their conditions of life while developing a more sustainable approach to their natural environment. The "faces" of sustainability portrayed are as diverse and creative as the people behind them. They encourage us to change our perspectives and take new approaches. As part of a global learning process, we can respond to their ideas and initiatives by looking at ourselves and our actions in a fresh light, and sharpening our focus on future challenges. In this way, sustainability becomes a learning experience.

Sino-German technical cooperation has changed. After 25 years of cooperation, Sino-German cooperation today focuses on a dialogue which supports processes of reform, particularly in the spheres of law, economy and climate and environmental protection including renewable energy. The classic form of Financial Cooperation was brought to an end in 2008 in favour of this dialogue process. German Development Minister Dirk Niebel announced in October 2009 that Technical Cooperation would now also gradually be phased out. In July 2010, the German and the Chinese government agreed to continue cooperating as strategic development partners.

Dr. Stefan Schmitz

Head of Division 314, Rural development; global food security
German Federal Ministry for Economic Cooperation and Development (BMZ)

Foreword of GIZ

Agrobiodiversity refers to the variety of crops and livestock on which our lives depend. Farmers all over the world have been constantly improving it since agriculture began more than 10,000 years ago. This diversity of crops and livestock adapted to local conditions has made it possible for millions of people in rural areas to survive under some extremely difficult ecological conditions. Traditional agrarian landscapes managed in accordance with site conditions also provide a multiplicity of services for society as a whole, such as plant pollination and stable water catchment areas, and are thus critical to human life on earth.
But this diversity is under threat. Like biological diversity, agricultural diversity is disappearing at an alarming rate. Often it is the unsustainable production methods of these very same farmers which are responsible for the massive losses of species we are seeing today. This not only compromises the productivity of agriculture, but also its potential to adapt to changing conditions. In times of climate change in particular, the genetic diversity of plants and animals has a crucial role to play. For instance, it gives people the ability to cope with rising temperatures and drought.
The conservation of agrobiodiversity, therefore, plays a key role in providing insurance against future threats to the world's food supply. In 1996, in recognition of this role, the conference of the parties to the Convention on Biological Diversity (CBD) established a programme of work on agricultural biodiversity.
The issue also has an important place in the work of GIZ. In numerous projects geared towards rural development, natural resource management, agricultural research and the promotion of trade and industry, we are advancing the conservation and sustainable use of agrobiodiversity worldwide. A Sino-German development cooperation project scheduled for completion by the end of 2011 exemplifies the prerequisites and success factors of such an approach.
For centuries, farmers in China have carefully selected and nurtured many different animal breeds and plant varieties adapted to their local environments and needs. Intensive, industrialised farming, particularly over the past 30 years, has indeed increased yields to such an extent that China's growing population has adequate supplies of food. At the same time, however, the persistent concentration on high-yielding varieties has led to a steady decline in diversity.
The main objective of GIZ's efforts in the project "Sustainable Agro-biodiversity Management in the Mountain Areas of Southern China" is, therefore, to promote the awareness and skills needed to conserve resources and engage in sustainable farming methods. Target groups are smallholders, farming groups, authorities and institutions. The lessons learned and results achieved at village and district administration level constitute a valuable basis for consultancy in other regions of the country. They will also be incorporated in China's national policy on agrobiodiversity.
The project will finish at the end of 2011 after a term of six and a half years. By that time the public agencies and private enterprises concerned will possess the skills and experience they need to ensure the conservation of agrobiodiversity on their own account. The loss of diversity is a form of impoverishment – a challenge to us all.
This brochure is an account of the experiences of the Sino-German project.

Joachim Prey

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Part 1
Introduction, Overview, Structure

Agrobiodiversity in times of change

The number of different food plant varieties is shrinking daily while, at the same time, more and more people have to be fed. Conditions throughout the world are changing, not least because of the globalisation of markets and changing climatic conditions. The question has to be answered once again – how, in the future, can sufficient food be guaranteed for a world population growing day by day? If this remains unaddressed, humankind will find itself at a dead end.

Biodiversity in agriculture is necessary for mankind's survival.

In the summer of 1845, in a small country in Europe, there began one of the greatest catastrophes in that country's history. In this and the following two years, more than a million people died in a famine which, without any warning, swept through the country. Another two million – roughly a quarter of the population – left their homeland and emigrated to America. To this day, the country has never recovered its population levels of 1845. What happened?
People had lived mainly off subsistence farming and the potato was by a wide margin the country's most important staple food. But only two varieties with high yields were under cultivation. A potato disease, caused by a parasitic fungus (*Phytophtora infestans*), broke out. Because it happened that both varieties of potato were susceptible to this disease, it was able to spread unhindered, wiping out large parts of the crop.

The country described is Ireland, and the story provides a glimpse into European history which speaks to how dangerous relying on too few varieties is.
Nevertheless, agricultural land everywhere in the world is producing ever fewer species and varieties of plants. Furthermore, the world population has continuously increased over the last few decades. Plants grown for food also have to be highly productive in order to be economically competitive. Growers, therefore, prioritize high yield plants. Other characteristics, such as resistance to diseases and pests, also play a role in the selection of plants - but not such a dominant one. This frequently results in the cultivation of delicate species which are heavily reliant on chemical inputs in the form of fertilizers or pesticides – not, in other words, robust plants, able to resist pests and disease, withstand bad weather such as drought, cold or heat, and climate change.

There is still a big diversity of plantlife in China – in the wild and on the fields.

There are plants, however, which have developed characteristics through evolution which could be vital for survival under different biotic and abiotic stresses. Over the centuries, many of them have adapted to various environmental conditions. They have survived in areas and odd corners of the world which have so far not been greatly affected by industrialised forms of agriculture. Some are found in nature, others have been cultivated. They are the result of small-scale growing and are found in regions, where extensive farming methods still dominate. These plants carry genes which may provide characteristics key to the future survival and performance of crops under changing conditions.
If man succeeds in unlocking this potential and grasping how the strategies of nature and of small-scale farming can be understood and applied, then he perhaps has a chance, in a changing world, of producing sufficient food for everybody. In this context, agrobiodiversity acquires a new significance as a kind of risk insurance for the future. Central to this are also wild relatives of crops, the mostly not directly used original forms of today's cultivated plants. Wild relatives of crops often possess qualities which as of yet have had no agricultural relevance and have not yet been of focus in breeding.

The mountain regions in Southern China are amongst those areas in which a large number of such agriculturally valuable plants grow. In the project "Sustainable Agro-biodiversity Management in the Mountain Areas of Southern China", which will be finalized at the end of 2011, Chinese and German specialists in agriculture are working together to develop plant resources and motivate farmers to begin cultivating once again those species which have, in part, been lost. The aim is to restore diversity to cultivated land. This brand of diversity is termed "agrobiodiversity". The first priority is to strengthen the capacity and the awareness of farmers on the ground, as well as the capacity for action on the part of authorities or institutions. The project is a joint effort between the Ministry of Agriculture of the People's Republic of China (MoA) and German Development Cooperation. China has long been very active in the field of agrobiodiversity conservation. However, traditional varieties have been threatened by the promotion of intensive forms of agriculture and the increasing concentration on high-yielding varieties, and most traditional varieties have thus already been lost. Experts are seeking to open the door for agrarian diversity to play a more important role in China's future by encouraging farmers to exploit traditional varieties sustainably.

Cultural landscape in Southern China: the goal of a number of internationally and nationally supported projects is to conserve or restore agrobiodiversity – the diversity on cultivated land.

The Ministry of Agriculture of the People's Republic of China in Beijing also implements a cooperative project sponsored by the Global Environment Facility (GEF), executed by the United Nations Development Programme (UNDP), entitled "Conservation and Sustainable Utilization of Wild Relatives of Crops in China". Its focus is on the wild relatives of three of the most important crops worldwide: rice, wheat and soybean. They are to be conserved for future generations and knowledge about them captured for use in food production in the future.

Agricultural diversity is closely related to cultural diversity. Knowledge about plant varieties and animal breeds is often tied to agricultural methods and medical knowledge which have been passed on from generation to generation. This is also mirrored in a diversity of language, clothing, cuisine and festivities which are also in danger of being lost.

With the help of experience and knowledge generated during the projects presented in this brochure, strategies are suggested and discussed which allow sustainable forms of production and offer a greater security of food provision for people in China and in other regions of the world. In industrialised countries, the decline of the original diversity of crops and animals took place mainly in the 20th century, the age of mechanisation and increased efficiency. Whereas this trend has faded somewhat in Europe, the trend now in developing countries is, as before, relentless.

But in Germany, too, farmers and experts are looking for new paths towards more diversity, higher quality, more integration of local ecosystems and consequently more robustness of plants in the fields. Varied cultivated landscapes with their diverse forms of agriculture, pastoral farming, small woodland areas, hedges, pools and ponds – all created by man over the course of several centuries – can serve as models here. One example of this is the UNESCO Biosphere Reserve in the Rhön region introduced in the brochure.

Whereas in Europe the major part of the wild relatives of cultivated plants have already died out, many wild species are still to be found in rural areas in China. Through their project, the UNDP and the Ministry of Agriculture of the People's Republic of China seek to ensure the survival of these treasures of nature, since they can provide humankind with materials of great genetic value and potential with which to counter the effects of imminent climatic changes.

Plant diversity may be used in so many ways – everything from medicines to dyes.

Structure of the brochure

Following the introduction (**Part 1**), **Part 2** explores the various facets of agrobiodiversity and its worldwide significance. After an explanation of the term agrobiodiversity, the chapter explores how people in various parts of the world have, over the centuries, produced the great diversity of crops we have today. It traces the development of agriculture and takes a look at the past few decades in which, *inter alia* due to the interlinked nature of world trade, there has been a dramatic loss of this diversity. Diversity is still to be found, particularly amongst those local population groups who still have much traditional knowledge at their disposal. Even today in remote regions, one can still find many wild relatives of cultivated plants. These will have an important role to play in securing the world's food supply in the future. Finally, the focus switches to ideas for preserving, sustainably using and enhancing this diversity.

Part 3 of the brochure takes us on a journey into the Chinese provinces of Hainan, Hunan, Henan, Ningxia, Yunnan and to the capital city Beijing. The maps at the beginning of a reportage, a portrait, or an interview help to orientate the reader.

Part 3 is the result of two research trips to the Chinese project areas in the spring and summer of 2009. The introduction explains the theme of agrobiodiversity in China. The next five sub-chapters follow the same structure. The background text serves as introduction to the particular theme at hand, the reportage depicts the situation in the villages, each portrait uses an individual to illustrate the theme and, in the interviews, people involved in the project and experts explore further prospects in agrobiodiversity conservation. Maps in the margin serve to provide more perspective to the reader. The five sub-chapters deal with five independent topics, one building upon another (food security, the importance of rice, wheat, soybean and their wild relatives, traditional knowledge, protected areas and other strategies to protect wild relatives of crops). **Part 4** is a descriptive summary and attempts a preview of the brochure topic.
In **Part 5**, the reader will find an extensive glossary, a list of links and literature, as well as commentary on the multi-media materials on the accompanying DVD. They contain *inter alia* an audio-reportage (mp3-data file) which provides a stimulating introduction to the topic and takes the audience on an audiophonic journey into the mountain regions of Southern China, the location of the agrobiodiversity project. Teachers may utilize these materials, particularly at the beginning of a lesson, to arouse their pupils' interest.
The present brochure is aimed at all those involved in out-of-classroom pedagogy in the field of environmental and developmental studies, as well as at those teaching at senior high school level. The materials are equally suitable for interdisciplinary and university level teaching, for classical school subjects (geography, social studies, politics, ethics, and biology), the emerging subject "global studies", as well as for teaching English and Chinese.
The brochure was conceived primarily for German students. Nevertheless, it should also be valuable to non-German speakers interested in agrobiodiversity and its relevance to poverty alleviation, international relations, sustainable development and human well-being. As the suggestions for further work (each marked with a frame in the corresponding chapter colours) and the infoboxes (each framed in grey colour) are developed for the German context, not all of them appear in the English version, and none in the Chinese version as requested by our Chinese partners.

Part 2
Agrobiodiversity and cultural variety: the keys to food security

If humankind does not change its behaviour, it will destroy the great diversity of life in the world's various climate zones and habitats. Biotic and abiotic resources are an expression of the history of the Earth and testament to the development of its inhabitants. Diversity in agriculture is a product of over ten thousand years of farming practices. In rural regions, cultivated landscapes and small-scale farming serve to secure livelihoods and often survival, and may become the key to coping with life-threatening challenges such as climate change by offering, through their diversity, more potential ways of adaptation.

Introduction and explanation of terminology

Many centuries ago, a much greater variety of wild animals was found in Germany. Amongst them were large mammals such as aurochs, brown bear, wisent, and wild horses. Now, they are all extinct. So what? – you might think. These days we have got our Mercedes Benz limousines, playstations and microwaves. None of those existed at the time of the aurochs. It would have been much better however, had the progress of humankind been more in step with nature and had kept the diversity of species. Then we would have the best of both worlds.

Amongst the causes of extinction for many species, their populations and races in Germany are the construction of buildings and roads, the destruction and fragmentation of the habitat for wild animals and plants, the channelling of rivers and streams, and also the partly intensive agriculture and forestry, the pollution of air and water, and the drainage of wetland areas. Scientific research shows that many species in Germany are on the brink of extinction. At present, only every second animal race in Germany is considered to be out of such danger, and the other half is threatened, to a greater or lesser degree, to become extinct. The same holds true for plants: 49 per cent of native plant species are thought to be extinct, or threatened, with only 51 per cent deemed for the time being to be safe. In other words: despite the various and most strenuous conservation efforts in recent decades, Germany is in danger of losing half of its natural riches.

You can read all about this on the "Red List" of endangered species drawn up by the International Union for Conservation of Nature (IUCN). It presents a picture of the situation worldwide of endangered plants and animals. The World Watch List for Domestic Animal Diversity issued by the Food and Agriculture Organization (FAO) and the United Nations Environment Programme (UNEP) sends out the same unequivocal message. It estimates that of the 5,639 breeds for which population data exist, some 3,143, or 55.7 per cent are at risk of extinction. In other words, every second domestic breed is in severe danger. A multiplicity not only of species but also of breeds and varieties within one species is absolutely vital for the sustainable conservation of agrobiodiversity.

Every second domestic breed is threatened with extinction. For the sustainable conservation of agrobiodiversity, however, a multiplicity of species, breeds and varieties is vital.

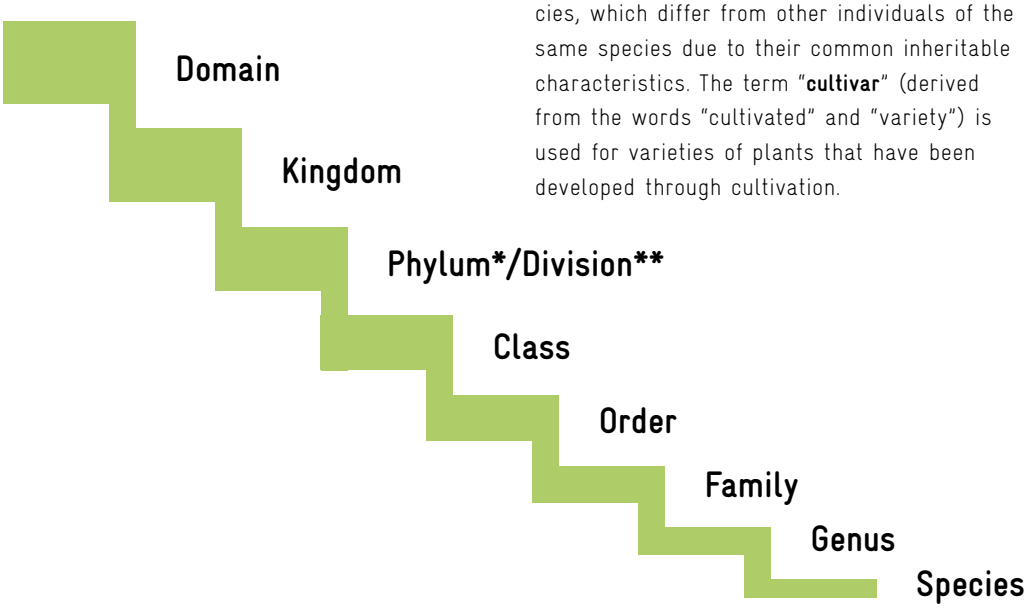
Infobox: classification systems for living organisms

Until today scientists are disputing how to classify the seemingly endless variety of living organisms in a reasonable and systematic manner. The basic principles of modern systematics were established by the Swedish scientist Carl von Linné in the 1730s. Living organisms were classified by him according to their graduate similarities and were given scientific names made up of two parts. By the use of this "binomial nomenclature", they can be clearly assigned: the genus is indicated by the first part of the name, the species by the second part.

Species, sub-species, breeds, varieties

The basic unit of all biological systematics is the **species**. There is no universally accepted definition – in biology different species concepts do exist. The biological (population-genetic) species concept, for instance, defines a species as a population or a group of populations whose members can mate under natural circumstances and produce viable and fertile descendants.

Within the systematic classification, the **sub-species** as well as the **breed** for animals and **variety** for plants come below the **species**. They comprise groups of individuals within a species, which differ from other individuals of the same species due to their common inheritable characteristics. The term "**cultivar**" (derived from the words "cultivated" and "variety") is used for varieties of plants that have been developed through cultivation.



Biological classification of the honey bee and wheat:

Domain	**Eukaryotes**	
Kingdom	*Animalia* (animals)	*Plantae* (plants)
Phylum*/division**	*Arthropoda* (arthopods)	*Spermatophyta* (flowering plants)
Class	*Insecta* (insects)	*Liliopsida* (monocotyledons)
Order	*Hymenoptera*	*Cyperales*
Family	*Apidea* (family of bees)	*Poaceae* (grass family)
Genus	*Apis* (honeybee)	*Triticum* (wheat)
Species	*Apis mellifera* (European honeybee)	*Triticum aestivum* (bread wheat)
Sub-species	*Apis mellifera ligustica* (Italian bee)	*Triticum aestivum ssp.*
Breed*/variety**	Many	Many

* in animals, ** in plants

Suggestions for further work: apples and oranges

What are species? Just to get things clear: what happens when one crosses an apple tree with an orange tree? What fruit do we get – an oranpple? No, we get nothing, because they are two different species which, furthermore, belong to different families and, therefore, cannot be crossed (or their descendants – should there be any – are unable for their part to reproduce, like mules who are a cross between a horse and a donkey). The apple is, therefore, by definition one species and the orange another. There are many different apples. Some apple trees yield only green, sour fruit; some red, floury ones; others large or small apples. These are not of a different genus and species, but different varieties or populations of the species "apple". And they can be crossed with each other.
What further examples can you think of? Are you familiar with "old varieties" which are now being grown and marketed more widely again? Or old animal breeds which are being reused?

Today, it is possible to conserve the genetic material of plants and animals, in gene banks for instance. As a result of agrogenetic diversity, there are some plants and animals which are capable of coping much better with increasing heat or drought. This process of adaptation is a dynamic one in the course of which the organism actively engages with its environment. It is not enough, for instance, that a drought-tolerant variety of millet should only be stored for decades in a gene bank (*ex situ* conservation). It must also be grown out in the open under the most diverse ecological conditions and cultivated further (*in situ* conservation) so that it can adapt to changing environmental circumstances.
Once an animal breed or a plant variety has disappeared, it is difficult to restore or re-establish it. Its disappearance, moreover, tears a hole in the ecosystem of which it was once a part – sometimes with far-reaching consequences for the interplay of plants, animals and ecological cycles, as, for instance, in the processes of soil formation and the part played in them by fungi, bacteria and other living organisms. If key elements in the ecosystem disappear – for example, fodder for animals or bees as pollinators of plant flowers – this can have dramatic repercussions for other organisms which exist in delicate balance with each other.

Sources & further information:
- www.iucn.org
- IUCN: Red List of threatened species
- www.bfn.de/index+M52087573ab0.html
- Commission on Genetic Resources for Food and Agriculture (2007)

If animal breeds or plant varieties die out, this often has widespread consequences: bees, for example, play an important role in the pollination of plants.

Infobox: gene banks

It is a collection of superlatives. In the centre of Beijing is the world's second largest (after the USA) plant seed gene bank – the National Gene Bank of China. 350,000 plant seeds are stored here at -18°C. For safety reasons, there is a duplicate in Qinghai Province. In the adjoining laboratories, staff not only collect the valuable resources, but also identify and examine the seeds for their traits and characteristics.

At present, near Spitzbergen in Norway, a new international plant gene bank is being set up. Its construction in the polar region was agreed on in 2004 as part of the International Treaty on Plant Genetic Resources for Food and Agriculture. This was considered an urgent necessity following the civil war in Rwanda, but also in peacetime in the Philippines, when it was discovered that the freezers in both places had not been functioning properly. The internationally supported gene bank – the Svalbard Global Seed Vault – is considered secure, being situated at the end of a 120-meter-long tunnel in sandstone rock and under permafrost conditions.

Biodiversity

Biodiversity is the name given to the total richness of living organisms on our planet – which make up so many millions of different species with their diversity of subspecies and populations (plant varieties, animal breeds and microorganism strains), and the ecosystems that these species form through their interactions with each other and with their physical environment.

Man benefits from this great richness in many ways:

- we derive many renewable resources such as edible plants, timber, fuel-wood, fodder, fish and game meat, fungi and medicines from nature.
- man has domesticated many species for improvement and perpetuation under controlled conditions in the form of crops, vegetables, fruits and domesticated animals. We continue to improve our domestic varieties through growing and cross breeding with ancestral wild forms and near related species.
- humankind has developed a vast pharmacopeia of drugs derived from or synthesized as copies of potent biological compounds found in nature.

Infobox: definition of "biodiversity"

The "Convention on Biological Diversity" (see p. 20) defines the term as "the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems."

The "Institute for Biodiversity" defines biodiversity as follows: "The earth's biosphere consists of a functional structure of diverse ecosystems, composed by complex partnerships. Each organism from this partnership has individual genetic information. Biodiversity covers the diversity of life on all these levels, the diversity within species (genetic level), between species (species diversity level) and the variability of habitats (ecosystems level)."

Sources: www.cbd.int/convention/convention.shtml; www.biodiv.de/index.php?id=13&L=1

"Biodiversity" was the topic of the GTZ publication "Akzente special" in 1/2008, also available as a PDF file on the accompanying DVD.

If a plant or animal has died out in a certain location, it is most difficult to re-establish them, whether through breeding or relocation programmes.

Sources & further information:
- www.cbd.int
- www.giz.de/agrobiodiversity
- Brochures "Development needs Diversity", Vol. 1 in the present series, and "Biodiversity in German Development Cooperation" 2010 (both available as PDF files on the accompanying DVD)

- we benefit enormously from the ecological services provided by ecosystems in the form of soil formation, nutrient recycling, water storage and purification, carbon fixation, pollination of crops and natural control of crop pests.
- we derive many indirect benefits in the form of beautiful scenic and recreation areas, living field laboratories, culturally sacred sites and inspirational heritage.

The diversity of ecosystems includes areas such as beech woods, orchard meadows or tropical cloud forests, the species diversity determines whether it is an apple or a pear tree in one of these orchard meadows, the diversity within a species whether, for instance, it is an early or a late ripening Elstar apple.

The term "biodiversity" gained international recognition in 1992 when participating countries at the pioneering United Nations (UN) Summit in Rio de Janeiro signed the UN Convention on Biological Diversity (CBD). This was a global, political measure, agreed on by most nations of the world, to regulate the conservation of biodiversity. By 2010, 192 countries and the European Union (EU) have become signing parties to the CBD. The CBD has three equally important objectives: 1) the conservation of biodiversity, 2) the sustainable use of its components, and 3) the fair and equitable sharing of benefits arising from the use of genetic resources (the so-called "Access and Benefit Sharing", ABS, see also infobox on p. 80). The sharing of benefits can mean, for instance, that business enterprises, when they develop and market new products from natural resources, for instance a medical plant, share their profits with local communities who take care of cultivation and conservation of this plant. It also means that industrial countries support developing countries in implementing the aims of the convention. This is frequently carried out within the framework of development cooperation.

Mankind benefits from biodiversity – the total richness of living organisms on our planet – in many different ways, such as in the development of medicines.

Over time mankind has domesticated many wild animals.

Agrobiodiversity

The term "agrobiodiversity" can be taken to be one very important sub-sector of overall biodiversity and includes the biological richness found within agricultural systems and on farmland. Agrobiodiversity has three dimensions:

Firstly, it includes all the different plant and animal species that are cultivated or bred on farmlands, their varieties (plants), breeds (animals) and their cultivars and populations in the various farming systems.

Secondly, it includes the wealth of non cultivated species that are found on farmlands and even in neighboring wilderness areas that are essential for the health and productivity of those crops and herds. For instance, the insects that we rely on for pollinating many of our crops; the birds and spiders that help control insect pests; the micro-organisms that have an impact on soil structure and quality; the plants we need as wind breaks; near relatives of crop species that we need to maintain for future cross breeding purposes and even the weeds that cover the fallow fields but protect and deliver green manure to be ploughed back into our fields.

Thirdly, agrobiodiversity represents the diversity of agro-ecosystems as a whole – including their functional diversity, that is the interaction between various components of the system.

Both biodiversity and agrobiodiversity are facing severe threats in China – no less than in other parts of the world. Loss of species and agricultural varieties is weakening humankind's capacity to adapt to and cope with changing climate and ever growing demands of increasing human populations. This brochure tells the story of some efforts to conserve agrobiodiversity in China – not only the world's most populous nation but also the original home of rice and soybean, and so many other valuable agricultural crops.

One example for the dramatic decline of the number of cultivated plant and livestock species can be cited from India. Once, up to 30,000 different rice cultivars or local varieties were grown there. Now virtually half of them have disappeared, only 16,000 remain. Only very few of these varieties retain any economic or cultural significance: 75 per cent of Indian rice production is met by a mere ten varieties. It is very probable that in the years to come a further large part of the present

"Agrobiodiversity" encompasses the biological diversity found in agriculture. This includes all livestock such as this water buffalo on China's Hainan Island.

Infobox: the International Seed Treaty and Farmers' Rights

In 2004, the member countries of the Food and Agriculture Organization of the United Nations (FAO) established the internationally binding "International Treaty on Plant Genetic Resources for Food and Agriculture" (ITPGRFA), also called "International Seed Treaty". It regulates the conservation and sustainable use of all plant genetic resources for agriculture and food supply, as well as farmers' rights. As of February 2010, there were 132 Parties to the ITPGRFA. At the heart of the treaty is the so-called "Multilateral System" which guarantees the free exchange of genetic material for 35 food crops and 29 forage plants between the states, which have signed the treaty. These crops represent 80 per cent of the global calorie intake.

In view of the dramatic losses and the accompanying risk to the world food supply, the treaty also obliges the member countries – in accordance with the Convention on Biological Diversity (CBD) – to conserve their plant genetic resources for food and agriculture. In 1996, the CBD set up a working programme on the theme of agrobiodiversity which was extended in 2000.

Sources & further information: www.giz.de/agrobiodiversity; www.planttreaty.org; *GIZ Issue Papers on the International Treaty on Plant Genetic Resources and on Farmers' Rights*

Agrobiodiversity includes crops (pictured here is a Chinese family harvesting long beans). They have been bred from wild plants over thousands of years of human history.

Under www.seedmap.org you can order the "Seed Map" which raises the topic of "Food, Farmers and Climate Chaos" in a clear and didactic way.

Sources & further information:

- GIZ Issue Paper: Agrobiodiversity – The key to food security.
- Indian Country Report (1995)

wealth of Indian rice cultivars will disappear. In China in 1949, 10,000 local varieties of wheat were under cultivation. Today there are less than 1,000 which are grown in any great amount. In other words, in the course of half a century, 90 per cent of the local wheat varieties have disappeared.

According to the Food and Agriculture Organization of the United Nations (FAO) at least one indigenous livestock breed becomes extinct every month. Since the worldwide demand for eggs, meat and milk has risen constantly over recent years, many farmers are concentrating on animals, which promise the highest yields and best meet the demands of the market. Because consumers in the high-purchasing industrial nations prefer low-fat food, those animal breeds producing much fat are rapidly disappearing.

According to an FAO investigation, a mere 14 mammal and bird species provide 90 per cent of the human food supply from animals. An example from Uganda demonstrates the risks of this reduction. For a long while farmers there kept the very productive Holstein cattle. These dairy cattle found throughout the world proved, however, to be a bad investment in times of drought. Whereas local breeds were able to withstand the drought, almost all of the Holsteins died of disease or heat.

Where do our crops come from?

Crops are those plants which farmers have bred from wild plants and, over thousands of years, have been passed on from generation to generation. Together with the various animal species and breeds, as well as fungi, they constitute the agricultural diversity we have today. About 12,000 years ago, at the end of the last ice age, man began cultivating crops for food. Scientists estimate that this happened at around the same time in America, China and the Middle East. The Earth's warmer climate and the accompanying increase in population triggered the change from an economy of hunters and gatherers to one of farmers and pastoralists. In the course of the centuries, man learned to appreciate the various qualities of plants, and began to breed varieties with specific characteristics according to criteria such as taste, yield, and resistance to drought.

Every month, one indigenous livestock breed dies out – also in China, the diversity of domestic animals is seriously endangered.

Infobox: plants to feed the world population

There are presently an estimated 500,000 species of plants in the world, of which not quite 400,000 have been classified. Many plants are used by men but only some, an estimated 500 species, are cultivated and encompass all plants grown by man, while a range of other, non-cultivated but nonetheless useful plants, are wild plants and collected. Examples are wild strawberries and medicinal herbs. Both, cultivated and collected plants can be considered as crops. Thirdly, there are the wild relatives of cultivated plants such as wild rice. Of the roughly 400,000 plants known to man, some 20,000 are – according to the German Federal Research Centre for Cultivated Plants (Julius Kühn-Institute, JKI) – used for food, medicine or spices, as well as for technical purposes. "Of these, however, very few are grown on a large scale. In Central Europe there are, of course, even fewer varieties." Barely a dozen plants and eight animal species produce 90 per cent of our food worldwide – maize, wheat, and rice alone cover roughly half of global food requirements. The three most important crops in terms of production in 2008 were, according to FAO data, maize, rice, and wheat and, in monetary terms, rice, wheat, and soybeans.

Sources & further information: www.jki.bund.de/en/startseite/home.html; www.fao.org

All GIZ Issue Papers and Factsheets referred to in this brochure are available as PDF files on the accompanying DVD.

Vavilov's centres of origin of cultivated plants

According to the theory of the Russian botanist Nikolai Ivanovich Vavilov, all cultivated plants originate from eight centres of diversity, i.e. regions with a high diversity of plants. From here they spread throughout the world:

1 **Chinese** Centre: soybean, broomcorn millet, buckwheat, many vegetables and fruits
2 **Indian** Centre: rice, african millet, cucumber, eggplant and other vegetables
   a **Indo-Malayan** Centre: sugar cane, yam and a large number of tropical fruits, vegetables and spices
3 **Central Asiatic** Centre: mung bean, pea, chickpea, lentil, hemp, almond
4 **Middle East** Centre: a large part of endemic wheat subspecies, rye, barley
5 **Mediterranean** Centre: durum wheat, olive, rape, countless vegetables and forage plants such as clover
6 **Abyssinian** (now **Ethiopian**) Centre: teff, tetraploid wheat, sorghum, pearl millet, sesame, indigo, coffee, and the ensete banana
7 **South Mexican** and **Central American** Centre: maize, several subspecies of cotton, various species of beans, gourds, cocoa, sisal, sweet potatoes, cherry tomato, bell pepper and many fruits
8 **South American** Centre: potatoes, the quinine tree, coca, particular maize varieties, tomato (mountain region), cassava, peanut, pineapple, rubber (lowlands)

Sources & further information:
- Vavilov, N.I. (1928)
- Hawkes, J.G. (1991), (2008)
- International Development Research Centre (1992)

One of the most important, if not the most important of humankind's natural treasures lies in these eight centres of diversity: the gene pool of most plants which is crucial to the nutrition and health of man and animals.
Just as without oxygen and water there would be no human life without biodiversity; human survival depends on various plants. A great number of them grow in the open countryside. Man makes use of them by collecting them or harvesting their fruits – but he does not cultivate them. In these wild and useful plants an enormous genetic pool lies dormant.
Nevertheless, man produces the vast majority of the food supply by growing crops himself. Amongst these plants are resistant species which, over many thousands of years of breeding, have developed the ability to withstand adverse conditions such as rising temperatures, droughts or diseases. Therefore, it is vital to maintain the diversity of plants still found today in fields throughout the world in order to conserve the special characteristics which are stored in the genes of these plants. If the conservation and utilisation of this gene pool is successful, then humankind will be in a better position to tackle one of its greatest challenges – the consequences of climate change. Accordingly, biodiversity conservation – be it in fields or open landscape – is one of the most important goals for the future of mankind.

Suggestion for further work: plants and their type of use

Very bewildering all these classifications and different terms just for plants, don't you think? Assign each plant in the following table to its correct type of use. (Note that they sometimes can be slotted into several different types of use – justify your choice).

Plant	Type of use
Oak	Crop
Sugar beet	Ornamental plant
Blueberry	Cultivated plant
Wheat	Food plant
Arnica	Medicinal plant
Rose	Plant used for technical purposes
Pasture grass	
Cactus	
Deadly nightshade	
Weeping willow	
Peppermint	

Suggestion for further work: everyday food plants

Just think about what plant foodstuffs you consume on any particular day. Make a list and then find out where each item was originally cultivated. It might also be interesting to find out where what you have consumed was actually grown. Have there, over time, been regional shifts? To what reason are they perhaps attributable? There are tips on this on the Web site: www.mpiz-koeln.mpg.de/oeffentlichkeitsarbeit/kulturpflanzen/index.html
In addition to the disadvantages and negative aspects of globalisation, there are also some positive ones. Without worldwide trade relations we would have no chocolate here.

The wild relatives of crops

Through cultivation, farmers have domesticated wild plants in order to encourage characteristics such as higher yields, better taste, or greater ease of handling. The term "wild relative" of a cultivated plant denotes a wild plant which has a close relationship with a domesticated plant. It can either be the direct ancestor of a domesticated plant or have ancestors in common with it.
Since the 19th century, scientists have recognised that the diversity of cultivated plants and their wild relatives is not everywhere the same. Locally grown varieties of a plant are in greater abundance in those regions in which their wild relatives are also frequently common. After many decades of field research in more than 60 countries, the scientist Vavilov summed things up as follows:

"The original focus of the origin of plants [lays] in mountainous regions." From this, Vavilov developed his theory about the centres of origin of cultivated plants. According to this, plants were not cultivated in certain areas by chance, but there were certain regions in which the domestication of wild plants was initiated. To this day, Vavilov's centres indicate where a great diversity of wild relatives are to be found (see also map on p. 23).

The wild forms of cultivated plants – the farmer pictured here proudly shows a wild soybean plant – have enormous potential, and their genetic material often forms the basis for new developments in plant breeding.

The importance of wild relatives of cultivated plants

Through the course of evolution, the wild forms of cultivated plants have built up enormous adaptive potential. Some have developed resistance to pests and diseases, some can withstand extreme temperatures, have adapted to saline soil conditions, or can tolerate drought conditions.
Many of these characteristics demonstrate how useful wild varieties are in improving today's cultivated plants. Peanuts are a classic example. The root-knot nematode *Meloidogyne arenaria* race 1 had destroyed large parts of harvests worldwide. By hybridization it has proven possible to transfer the pest resistance of wild relatives into the cultivated variety *Arachis hypogaea*.
Accordingly, wild relatives are useful and important for scientific and technological progress in plant breeding. A diversity of genetic material is often the decisive factor in moving the process of plant breeding forward, and thereby often also achieving higher profits for farmers. Wild relatives of crops are equally vital for industrial agricultural production as they are for subsistence-oriented small-scale farming.
Improvements in molecular technology make it possible today to identify more simply and quickly the useful characteristics of wild relatives, and to develop new and improved varieties. Wild relatives have increased worldwide the productivity of important plants such as barley, maize, oats, potatoes, rice and wheat. Take just one of many examples which document their value: one wild relative of tomato has made it possible to reduce the water content in tomatoes and to increase the dry matter content by 2.4 per cent. This is worth USD 250 million a year in the state of California alone.
Breeders also use wild relatives to improve the health-related constituents in food. One example is the "anti-cancer" substance discovered in some of the wild varieties of Sicilian broccoli. By crossing cultivated broccoli with the Sicilian one, the proportion of the anti-cancer compound sulforaphane, an anti-oxidant that destroys compounds that can manipulate DNA (Deoxyribonucleic acid), was increased a hundred-fold.
Another example concerns important nutritional elements and micronutrients that are often short in diets largely depending on grains such as protein, iron, zinc, or Vitamin A. A wild variety of wheat from the Eastern Mediterranean, *Triticum turgidum* var. *dicoccoides*, has contributed to raising the protein content of durum wheat and, therefore, of bread. The International Maize and Wheat Improvement Center (CIMMYT) has discovered that the grains of another wild relative of wheat contain 1.8 times the amount of zinc, and 1.5 times the amount of iron, in cultivated wheat.
In the 1970s, the Grassy Stunt Virus devastated the rice yields of millions of farmers in South and Southeast Asia. This virus, which is carried by the brown plant hopper, prevents rice plants from producing flowers and grain. Asia was on the brink of catastrophe. What would have happened if the virus could not be stopped?
Scientists from the International Rice Research Institute (IRRI) screened more than 17,000 cultivated and wild rice samples for resistance to the disease. A wild relative of rice, *Oryza nivara*, growing in the wild in Uttar Pradesh was found to have one single gene for resistance to the grassy

Source:
UNEP/IPGRI (2004)

stunt virus. This gene is now routinely incorporated into all new varieties of rice grown across more than 100,000 km^2 of Asian rice fields. By crossing the wild relative with rice varieties, rice cultivation in Asia could be saved.

Suggestions for further work: genes and risks

- Are there such things as "gene-free" tomatoes? Don't answer "yes, I know a shop that sells them", but think a moment what that could mean.
- A biological question: how does the hybridization of genes function without genetic engineering, how do plant breeders identify the genes and then get them into the new plant? What differences are there in the various methods (speed in the development of new varieties, costs which arise in the process, marketing opportunities), and what advantages and disadvantages arise from this for production and marketing? What health risks might be involved?

(To get an idea of the topic, have also a look on the text about transgenic plants on pp. 32)

Agricultural diversity and traditional knowledge

The regions in which agrobiodiversity has been best conserved up to the present day are very remote. Far away from the cities and highly developed countrysides, surprising diversity can be found in mountainous regions, hostile arid regions, on marshy fields or in tiny cultivated areas in the midst of thick forests – in other words in isolated, thinly populated areas and places. The few people there have lived their lives cut off from the outside world, some surviving as independent ethnic groups. They have adapted to the particular ecological conditions in which they live, know the local challenges, and have developed strategies for ensuring that they survive in extreme situations. The inhabitants of areas with great plant and animal diversity almost invariably have close links with nature. Traditionally, they divide up the year according to patterns of planting and harvesting, and their daily life is governed by seasonal fishing or hunting. They know what plants can cure diseases or heal wounds. They know many plants which can affect the health of the human body. Nature plays an important role in their rituals and customs, as well as in their dances and poems, and the motifs which decorate their traditional

Infobox: the International Rice Research Institute (IRRI)

is based in Los Baños, Philippines, but has research partners and stations in most rice producing countries including China.
IRRI is active in agrobiodiversity research focusing in two areas. First, the institute collects and maintains a diverse rice variety gene bank and does research work on identifying useful genes. Second, it focuses attention on maintaining biodiversity in the rice landscape, especially on restoring the diversity of predators and parasitoids to enhance ecosystem services related to pest invasions and control.
Rice is a short-term crop and thus the herbivores that do well in these habitats are usually species that have short life cycles, small size, move a lot and lay a lot of eggs. As a result, invading females when they come into a new rice field will lay a lot of eggs, and without predator and parasitoid biodiversity, the survival of the eggs may be 90 to 100 per cent and eventually lead to great damage. But if the rice field has rich biodiversity, most of the eggs of the invading pests don't survive (usually less than five per cent), and thus damage is low. The factors that destroy the biodiversity are pesticides and extreme mono-cropping.
The IRRI Rice Plant Hopper Project restores local biodiversity by encouraging farmers to increase floral diversity to bring about an increase in resources for pest predators, such as nectar and shelter. Check out the project blog for other details and examples: http://ricehoppers.net.

Source & further information: www.irri.org

Those who live in areas with higher plant and animal diversity often have the closest relationship to nature. They and their knowledge must be included for the effective protection of agrobiodiversity.

clothing. In questions of the supernatural or religious they often placate the world of the gods with prayers and offerings of food, and sometimes of alcohol and cigarettes.
Agrobiodiversity can only be conserved by sustainable use. People on the ground must, therefore, be included. Not only because they possess so much knowledge about local agro-ecosystems, but also because they live within these ecosystems, serving as the creators and custodians of agrobiodiversity. The interplay between nature ("bio") and man ("culture") produces a harmony in complex systems, resulting in what is termed "biocultural diversity". Biocultural diversity, like agrobiodiversity, is a key resource whose conservation and restoration is vitally important.

"Biocultural diversity" is the harmonious interaction between nature ("bio") and mankind ("culture").

Why agrobiodiversity concerns us all

Anyone today who drives a car, who gets on an aeroplane, or who is involved in some way or other in the burning of fossil fuels, is contributing to climate change. Together with other gases, the release of carbon dioxide triggers the greenhouse effect and contributes to climate change. The greenhouse effect, for which man is responsible, causes a continuous rise in temperature, thereby disturbing the delicate balance of the Earth's highly complex ecosystems.
It is the speed at which climate change is advancing which makes it such an urgent problem, and leaves the complex ecological systems limited time – within the context of evolutionary processes – to react. In the past 100 years, and particularly in the last 30, the Earth's median temperature has risen, on average, by 0.6 +/- 0.2 degrees Celsius. At the same time the sea level has risen by ten to

Sources & further information:

- Brochure "Nature and Mankind facing Climate Change", Vol. 8 in the present series
- GIZ Issue Paper: Agrobiodiversity and climate change – a complex relationship
- www.ipcc.ch

25 centimetres. Should these trends continue, the temperature by 2100 – according to the fourth report of the Intergovernmental Panel on Climate Change (IPCC) – will have risen by up to 6.4 degrees, and the sea level by up to 0.59 metres. Other scenarios forecast even more dramatic and devastating impacts. Coastal countries such as Bangladesh will to a large extent probably disappear from the map, but even North Germany or the Netherlands are threatened.

Climate change is not a future event. It is ongoing and with accelerating speed. We can already see its dramatic consequences. In Middle and South America, the number and strength of hurricanes damaging vast areas are increasing, and heat and drought are on the rise. As a consequence many people – particularly in developing countries – are forced to migrate. This mainly affects the countries in the interior of the continents, for instance in the Sahel region in Africa, but also Ethiopia has been repeatedly overwhelmed by food shortages. Even rainforests such as those in the Amazon basin in South America have been subject to dry periods. Other examples of countries which have suffered from climate-induced drought are India, China, Afghanistan and Pakistan. The Northern hemisphere is also seriously affected and Europe and the USA as well have been forced to address the implications of drastic changes in climate.

Many people will have to look for a new home, in regions that are perhaps already being stretched to the limits of their ecological capacity. Climate change will have serious implications on ecosystem conditions, and on the world's systems of agricultural production. There is increasing evidence that if the global average temperature rises this will have significant adverse effects on crop yields in many regions. In order to combat the consequences of climate change tomorrow, thought must be given today as to how the world can secure its food supply in the future. To do this, a great variety of animal races and plant varieties with the widest diversity of characteristics are needed in order to adapt better to heat, periods of cold, drought, and floods.

Suggestions for further work: agriculture and climate change

Spin this thread of thought further and consider how the repercussions of a climatic "catastrophe" might affect farming and food production in China or Germany, and worldwide. Try to bring as many factors as possible into your deliberations. It might help you to download climate change scenarios from the internet – those from the Intergovernmental Panel on Climate Change (IPCC), for instance.

What can humankind, individual countries, and you yourself do, as individual or in a group, with respect to mitigation of climate change? What is currently being done? See also the brochure on "Nature and Mankind facing Climate Change", Vol. 8 in the present series.

Film: Hope in a Changing Climate

The film "Hope in a Changing Climate" was shown on BBC World on 27 November 2009, and at the climate conference in Copenhagen in December 2009.

The documentary presents possibilities for large-scale ecosystem rehabilitation. The restoration of ecosystemic functions can bring about fundamental improvements in the living conditions of local populations and can also offer natural ways to sequester CO_2. Such initiative was implemented on the Chinese Loess Plateau, a mountain landscape of 640,000 km² in the Northern part of Central China. Today, more than 35,000 km² of previously degenerated landscape has sprung back to life, serving as the basis for a sustainable economy and for the social and agricultural activities of the local population. The documentary film was produced by the Environmental Education Media Project (EEMP), under the direction of Jeremy Bristow. In addition to the example from China, experiences in Ethiopia and Rwanda are presented.

Length: 22:24 min, language: English, can be viewed online at http://hopeinachangingclimate.org

Infobox: national and international commitment on (agro-)biodiversity

Each year, on May 22 the world community is celebrating the International Day for Biological Diversity. Its aim is to draw attention to the importance of safeguarding the global diversity of animals, plants, microorganisms and the ecosystems they are living in. In 2008, the so-called "B-Day" was dedicated to the topic of "biodiversity and agriculture" to raise awareness in the wider public of the importance of agrobiodiversity. This was supported by a comprehensive documentary published by the Secretariat of the Convention on Biological Diversity: "CBD: Biodiversity and Agriculture. Safeguarding Biodiversity and Securing Food for the World" (available as a PDF file on the accompanying DVD).

At an international level, numerous organisations, including the FAO (Food and Agriculture Organization), UNESCO, the International Union for Conservation of Nature (IUCN) and the World Wide Fund for Nature (WWF), are involved in biodiversity conservation. In the Federal Republic of Germany, there are initiatives and institutions specifically committed to biodiversity and agrobiodiversity. For instance, the Federal Ministry of Food, Agriculture and Consumer Protection, the Federal Agency for Nature Conservation (Bundesamt für Naturschutz, BfN) and also the Bavarian Forest National Park. At Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), agrobiodiversity activities are coordinated by the supraregional sector programme, "Sustainable natural resources management in agriculture (NAREN)" which is part of the GIZ "Agriculture, Fisheries and Food" division.

Thus, the conservation of agricultural diversity has become increasingly important. Crops and animal races are the result of breeding by selecting or crossing of various populations in order to develop desired traits: a maize plant that can withstand periods of drought, a rice plant which remains unaffected by variations in temperature, or a variety of millet which can even grow on saline soil. The capacity and information for breeding are in the plant genes. The gene pool of all plants and animals – cultivated ones and their wild relatives – contains much of this information. The 16,000 varieties of rice presently in existence in India constitute a very varied gene pool which will be vital to rice breeders in the future. The same holds true for the potato, which Germans think of as something typically German, but which in fact has its origins in the Andes in South America. The conservation of these so-called "Plant Genetic Resources for Food and Agriculture" (PGRFA) is getting increasing importance in scientific discussion.

The interactions between agrobiodiversity and climate change are illustrated in a CBD banner: www.cbd.int/doc/bioday/2009/banners/cbd-ibd-banners-8-en.pdf

Climate change makes agricultural diversity all the more important. A record-holder in the area of diversity is maize: worldwide people make use of 50,000 varieties.

What is threatening agricultural biodiversity?

The last hundred years witnessed a leap in agricultural production which accompanied a rapid increase in the world population. A German farmer, at the beginning of the 20th century, could produce food for just four other people. By 1950, he could feed ten, and by 2004 as many as 143 people – within a century, the farmer's labour productivity increased 35-fold. Similar trends could be observed in German milk production. 40 years ago a cow gave 2,500 litres of milk a year, today it gives on average 6,700 litres and production per cow almost tripled. At global level, in the period between 1950 and 2000, cereal production almost tripled as well. All this was made possible by advances in plant breeding, intensive use of nitrogen fertilizers and the use of herbicides to eradicate weeds. This growth in agricultural production has been achieved for the most part on fertile soils and under optimal production conditions, meaning that only a small number of farmers could profit from it.

According to recent estimates, 85 per cent of all farms worldwide are still small-scale. Because the aforementioned intensification strategies are not suitable for their holdings, most of these farmers are operating on small fields without the use of fertilizers or pesticides. In the 1980s, roughly 60 per cent of agricultural land globally was farmed in this way. Todays percentage is unknown, but smallholder agriculture with limited or no external input remains indispensable for ensuring the world's food supply.

It is predicted that by 2050 the world population will have reached nine billion. There is only a limited possibility of extending cultivated land in order to feed a population of that size. Agriculture, therefore, faces an enormous challenge of feeding several billion more people while maintaining ecosystems and their functions and conserving biodiversity. Climate change will have to be addressed, and nutrients, water, energy, and soil fertility will have to be used much more efficiently.

In the past, an increase in agricultural productivity led to losses in diversity. In many developing countries, the "green revolution" of the 1960s reduced the number of plant varieties and animal races to the most productive ones. These were then supposed to feed a constantly growing population. Today, in large parts of the world, the landscape is dominated by monoculture production systems. The agricultural industry is producing more and more food, but with an ever decreasing diversity. In future it will be necessary to do both: increase productivity further and enhance diversity.

About 85 per cent of all farms worldwide are smallholdings. Classic intensification strategies that have led to higher productivity at the cost of agrobiodiversity are largely not in use by small farmers.

Infobox: green revolution

From the 1960s onwards, the World Bank has promoted the increase in food production in the developing countries in what is known as the "green revolution" with considerable success. As a result, global agricultural production has doubled since the 1970s. In terms of biodiversity, however, the green revolution was a catastrophe due to its encouragement of monocultures and the use of fertilizers and pesticides. It also had serious social consequences as many farming families became indebted due to their investment in inputs, irrigation and machinery.

Agriculture today has become part and parcel of the process of globalisation. With a few exceptions, such as oranges or bananas, the shelves of German food shops were, until a few decades ago, filled with seasonal, regional – or some European – vegetables and fruits. But now, green beans from Senegal, fresh flowers from Columbia, ecologically produced kiwi fruits from New Zealand, pangasius fish filet from Vietnam, and North Sea crabs which have been hand-peeled in Morocco are an everyday sight in delicatessen and discount stores – whether in China or in Germany. These fresh agricultural products arrive by ship, lorry, rail and even by plane. Transport and refrigeration have been refined and tuned to perfection. Flowers cut yesterday at daybreak in Bogota are on the table a day later in Hannover, Germany – this is now the rule rather than the exception.
Market logic dictates that business is concentrated increasingly around ever fewer players. There are fewer (but bigger) transport firms, fewer (but stronger, market-dominant) distributors, fewer (but all the more powerful) seed producers, and ever fewer cultivated varieties. There are also fewer farmers managing larger acreages of land and producing greater yields for the world's growing population. Because farmers are producing for fewer distributors, their market, despite globalisation, is getting smaller. Or, put another way, profit margins are narrowing and competition is increasing. Because of global market networks, farmers all over the world are in competition with each other. In addition, the rapid rise in population is one of the most important reasons for the loss of agrobiodiversity. Wherever more has to be produced, diversity gives way to uniformity. Wherever more people have to be fed, there is growing pressure on agricultural land, because more people inevitably means that more room, more living space, more industrial districts, more roads are required.

Subtropical fruits have long been on German supermarket shelves. Agriculture is a part of globalisation and farmers have been turned into global competitors.

A further factor is that the demand for energy intensifies competition for the world's arable land. Wherever oil palms grow for bio-fuel, no rice can flourish. Wheat, soybean or maize cultivated for bio-fuel contributes nothing in terms of food consumption. It fills car tanks, not stomachs.
But agrobiodiversity is also increasingly threatened by the advent of genetic engineering. Its aim is to produce particular characteristics in a plant by artificially implanting single genes of other organisms into its DNA. The two most important features of transgenic crops, which are being cultivated on a huge scale, are their resistance to herbicides (herbicide tolerance) and pest toxicity

Infobox: biotechnology and transgenic plants

With the aid of biotechnology, new methods of plant breeding have been developed. The DNA of one organism can be incorporated into the DNA of another one. In doing so, a certain trait or quality can be transferred. This is possible not only within, but also beyond species boundaries, since all organisms use the same genetic code. Several methods exist for the introduction of DNA sequences into the cell nucleus – by mechanical means or by transformation through the introduction of DNA altering bacteria (as if by courier service). Two genetically modified induced traits have been widely applied: herbicide tolerance and insect toxicity of plants. Herbicide tolerant plants allow the spraying of the herbicide Glyphosate without damaging the crop, whereas most other plants (weeds) are destroyed by this herbicide. Insect toxicity is created by a gene from the bacterium *Bacillus thuringiensis* (Bt). Transgenic plants containing this Bt-gene produce a poison in the plant cell which can kill a specific pest. The Bt-technology helps to decrease the use of chemical pesticides, for instance to control the bollworm in cotton cultivation.

Sources & further information: www.biotechnologie.de/BIO/Navigation/EN/root.html; www.greenpeace.org

The hunger for energy has increased the competition over our planet's use of farmland (pictured here an oil palm plantation in Indonesia).

("Bt-technology") (see infobox on p. 32). Further features such as salt resistance, signal colours, or the ability to withstand heat are being researched, with some being grown as genetically modified plants but not yet on a large scale.

Whether and how genetically modified plants can have a negative impact on the natural diversity of plants is unclear and requires further research. For many years there has been heated discussion between supporters and opponents of genetic engineering. It is proven that genetically modified plants can pollinate unmodified plants and thus contaminate local varieties and their wild relatives. Genetically modified plants are used for cultivation on a huge, agroindustrial scale. They represent an increasingly grave setback for agrobiodiversity. Soybean cultivation in Argentina is a typical example. Since the mid 1990s, soybean has been grown in monoculture on a vast scale for human consumption as well as for the German cattle fodder market. Within ten years, the area under soybean production has more than doubled from six to 14 million hectares.

During this period, non-genetically modified organism (non-GMO) seeds have almost disappeared. In the period from 1994 to 2004, the share of land cultivated with non-GMO soybeans fell from 100 to one per cent in Argentina. At the same time, food production and other forms of cultivation decreased drastically. Rice and potato growing declined by 40 and 38 per cent respectively, the production of milk, eggs and meat dropped at similar rates, and the cultivation of vegetables decreased even more sharply. In other words, there has been a dramatic decline in the variety of food produced in the South American nation.

With the emergence of genetically modified plants, the concentration process in the seed market has accelerated and is increasingly dominated by a few transnational companies. One firm, Monsanto in the US, collects licencing fees from 90 per cent of all genetically modified seed. The conservation of agrobiodiversity finds itself, therefore, confronted with an emerging issue. Agrobiodiversity expert Johannes Kotschi writes that "concentration in the seed sector is today probably the greatest threat to the diversity of agricultural plants." Genetic engineering can also constitute a threat to the existence of the individual farmer, since it is illegal to save any seed from the harvest of genetically manipulated crops. Every year farmers have to buy fresh supplies from seed firms, thereby sinking into an existence-threatening dependency. This may apply less to farmers in Germany but has become a severe problem in other places. In India for example, cotton farmers are buying expensive GMO seeds and no longer have the alternative of using non-GMO varieties. There are hundreds of cases where farmers are no longer able to pay back the credit borrowed for seed because of poor harvests.

Should the use of genetically modified seeds expand to food crops, the world food supply may become dominated by just a handful of companies.

Infobox:
the Cartagena Protocol on Biological Safety

The biosafety protocol, named after the Columbian City of Cartagena where it was approved, regulates the import and use of genetically modified organisms (GMOs). Its objective is the protection of human health and biodiversity, termed biosafety. It follows the principle of precaution and allows CBD member states to decree import restrictions or ban imports of GMOs, even if the possible risks are not fully known. Transboundary movements of GMOs are regulated by the Biosafety Clearing House (BCH), an internet-based information system.

Sources & further information:
GIZ Factsheet on Biosafety; www.cbd.int/biosafety; www.biosafety-info.net

Further listening: Wild Talk

"Food crisis is here to stay" – so the title of an interview with Jeff Sayer, a scientific advisor for the IUCN. He explains the challenges to the world's food supply in the future as a balancing act between adequate production for all and the safeguarding of the natural resources on which we all depend.

Listen to the following: www.iucn.org/knowledge/news/focus/2009_food/all/index.cfm?3552/Food-crisis-here-to-stay

Source & further information:
GIZ Issue Paper: Genetic engineering in agriculture: how does it impact on biodiversity?

Infobox: the human right to food

The right to adequate nutrition legally became an international human right in 1966 (Article 11 of the UN Social Covenant, the International Covenant on Economic, Social and Cultural Rights). It is an integral part of the right to an adequate standard of living (Paragraph 1), as well as "the fundamental right of everyone to be free from hunger" (Paragraph 2). It is also included in the UN Universal Declaration of Human Rights (Article 25), as well as in national constitutions of several countries. A violation of this right is considered when one's dignity is affected by the lack of or denial of acces to food. Given FAO estimates that 925 million people are suffering from hunger, and 24,000 are dying of hunger every day, this has surely been for many decades one of the most massive violations of all human rights.

The Agreement on Agriculture (AoA) and International Trade Regulations

With the Agreement on Agriculture of the World Trade Organization (WTO) (1995), which defines the framework for agricultural policy and the worldwide trade of agricultural products, the agricultural sector was subject for the first time to international trade rules. The agreement defines the agricultural sphere, establishes rules for the protection of trade (reduction of tariffs or minimum market access), regulates "internal price support", or the elimination of domestic subsidies (for instance, direct payments), as well as export subsidies, and calls for the dismantling of customs duties, or the conversion of non-tariff barriers into custom duties. The preamble to the agreement makes provision *inter alia* for "a fair and market-oriented agricultural trading system". The classification of the domestic support of agricultural production (subsidies) is divided into three categories, or so-called "boxes":

- The **Amber Box** prohibits subsidies which have a direct effect on production and, therefore, have a distorting effect on trade.
- The **Blue Box** measures regulate direct payments under programmes aimed at limiting agricultural production. These are allowed only if made on fixed areas and yields or a fixed number of livestock.
- The **Green Box** deals with agricultural subsidies which have little or no distorting effect on trade, on which there are no set limits.

Many non-governmental organisations (NGOs) regard the WTO Agreement on Agriculture as very dangerous, particularly for developing countries, since farming there is in a very different situation from that of large industrial nations for whom the agreement was largely conceived. Often, for instance, they are dependent on imports, have no surplus production, and small-scale farming is invariably one of the most important sectors of the economy – not least because of its employment function. This is why it is necessary for most developing countries to give stronger support to the agricultural sector and small-scale farmers in particular than is provided for in the agreement. Minimum price fixing is also forbidden, even though it is often an absolute necessity for protecting the internal market from subsidised imports.

This has created a demand that the agreement should have an additional **Food Security Box** which would:

- allow the developing countries to grant comprehensive support to small farmers and staple foods production, and give incentives to increase productivity, also by guaranteed prices,
- permit the developing countries to take comprehensive protective measures against dumping and subsidised imports and, in addition, create further safety mechanisms against a serious collapse in prices, especially of staple foods,
- secure a firm commitment from the industrial countries to support those developing countries which are net importers of food in improving the conditions of their agriculture.

Sources & further information: GIZ Issue Papers: The human right to food and agricultural trade, The International Treaty on Plant Genetic Resources – status of implementation; www.bpb.de/wissen/5K80XI,0,0,WTO.html*; epd-Entwicklungspolitik 1/1999; Weltladen Dachverband (2000)*

Film: Hijacked Future. Who controls the seeds, controls the food.

"Our food production is dependent on oil, our food security is threatened by climate change, and we are losing control of it. Multinational concerns control the oil, agricultural trade, the food industry, and patent species and monopolize their breeding. The film contrasts industrial agriculture in Canada with small-scale farming in Ethiopia. In Canada, farmers have lost control of their seed and are dependent on seed companies, in Ethiopia diversity is being conserved and new ways explored of safeguarding food security. One has the impression that we can learn a lot for the future there. 'Hijacked Future' describes the dangers facing the world's food supply. The role of farmers worldwide in this is of enormous significance. Can they maintain control over their seed? What dangers are we exposing ourselves to by relying on ever fewer varieties? Why is a gene bank being built in the Norwegian permafrost in order to safeguard the whole of the world's agricultural diversity? How can we get back control over the food on our plates? At the end of the film, we look with renewed awe at the tiny seeds in a packet. This, because everything begins with a grain of seed!" (translated citation from the Web site of German Agrar Koordination)

"Hijacked Future" is a documentary for political educational work in the field of development and environment by David Springbett, produced by Asterisk Productions; Duration: 45 minutes (English with German subtitles)

Source, further information and order of the film: www.agrarkoordination.de/laendernavigation/about-us.html; www.hijackedfuture.com

How can agrobiodiversity be restored?

One initiative which has led to more diversity in the fields in recent years is organic farming which takes account of natural local conditions. It practises well tested crop rotation techniques, fights pests with their natural enemies, and mostly does not use agro-chemicals.

Yields in organic agriculture are often smaller than in conventional agriculture, but economically it is very competitive and sometimes superior. The basic difference, however, is the high quality of food it produces (i.e. it keeps longer, has good flavour, is free of agro-chemicals), and it is also more environmentally friendly. Consumers opting for it are prepared to pay more for this often regionally produced food. This is why regional varieties, not

Organic farming methods have contributed to improved agrobiodiversity. Here in the UNESCO Biosphere Reserve Rhön many traditional apple varieties are being grown once more.

subject to the global rules of high-yield crops, are once again coming into their own.
The rediscovery of old, almost forgotten plant and livestock varieties (such as local potatoes, sweet apples, cabbage, and breeds of pigs and cattle) is a competitive advantage for organic farming. This type of farming can offer goods with which high-performance agriculture cannot compete. Thereby it revitalizes and redevelops the cultivated landscape and allows the ecological cycle to run its course. This allows the building of new production systems and supports a greater development of agrobiodiversity on the fields and pastures.
Most organic farms are, however, far from achieving totally natural systems of production. Cows, for instance, are herd animals which used to roam pasture lands freely. Today, in only very few regions of Germany – the Bavarian Rhön, for instance – have farmers consolidated their agricultural fields so as to allow for more natural forms of grazing and cattle raising (see also pp. 96).
While production and environmental impact objectives are often considered at odds in agriculture, emerging markets for organic and similar specialty products may make ecological and economic goals more compatible. Meanwhile, governments are requested to create incentives to adress the political challenges of conserving and promoting cultivated landscapes, while at the same time protecting nature.

In most regions of Europe, including Germany, agrobiodiversity has largely disappeared, one reason being its high population density. In addition, the often all-year-round availability of exotic fruits or agro-industrially produced

Infobox: how diverse is our planet?

Precisely how many species of animals and plants there are in the world has yet to be ascertained. In the 1990s, the United Nations Environment Programme compiled a list of some 1.75 million species which had been documented worldwide. Scientists, meanwhile, estimate that there are some 15 million species on Earth. "So far, however, there has been only a very rudimentary inventorying of 'biological diversity'. Not even a reliable assessment of its magnitude can be made at present. There is no comprehensive global data bank, and experts are assuming that if every year around 10,000 new species are being recorded worldwide – microorganisms not included – it would take over 500 years to complete even a provisional inventory." (original in German quoted from Dierßen, K. & A. Huckauf 2008).

Source: Dierßen, K. & A. Huckauf (2008); May, R. M. (1997)

Policies should provide incentives to support and maintain local cultural landscapes with the inclusion of nature conservation.

vegetables has pushed local niche products from the market. Untouched landscapes or primary forests in which wild species and varieties can flourish have practically disappeared in Europe. Their revival, through creation of protected areas and other mechanisms, is highly important.

Native varieties at the brink of extinction, for instance, of apples or cherries, are being preserved at institutions such as the Fruit Research Station Jork in the region "Altes Land" near Hamburg in Germany. With a little bit of luck, these old varieties will be cultivated again in organic farms at a later date.

As the public discussion about the potato variety Linda in Germany demonstrates, consumers attribute high value to special varieties. When the owner of the patent for the Linda potato wanted to replace it on the market in favour of new fee-licensed varieties, there was much resistance in Germany to the idea of deciding to allow this old favourite to disappear from the market. The protest of consumers and farmers has born success. "Following the approval last year in Great Britain of the re-registration of Linda, the government's Federal Plant Variety Office in Hannover has now also given the green light for Linda." This quote is from the "Save Linda" campaign in their press release at the beginning of 2010.

Recognise diversity and conserve it

In order to know what one wants to protect – plant, animal, microorganism –, one must first recognise and define the potential of the living organism in that specific region. It is true that, many plant species and their populations have been identified and are being used by people. But we are still far from having a record of the plant world in its entirety.

The *ex situ* method is one way of preserving the genetic make-up of plants. Scientists collect seeds and plant samples, analyse their genetic information, and store them outside their natural habitat (*ex situ*) in gene banks. According to the type of archive, information on origin, history and use of the plant is recorded and made accessible to the public – at least parts of it. In some gene banks, data are available online and seed samples can be ordered.

Scientists use the *in vitro* (Latin: (with) in the glass) method to preserve plant parts which cannot be stored. Parts of the plant are grown separately from the plant itself in glass, and thereby conserved.

The *ex situ* method is very suitable for making an inventory of plant stocks and thus preventing them from being lost forever. However, it has one crucial disadvantage: plants are not conserved in their original habitat; gene banks preserve only

In gene banks seed and plant samples are analysed and stored outside their natural environment *(ex situ)*.

the genetic material of the plants (in form of seeds or plant material). An alternative to this is the *in situ* method in which the plant is maintained in its natural habitat. This method, however, is much more labour-intensive.
Another argument that calls for *in situ* conservation is the necessity of agriculture to adapt to climate change: a plant's, animal's or ecosystem's capacity to be resilient, to overcome constraints, to take advantage of new opportunities and to cope with the consequences of environmental changes such as heat, drought, or salinity, relies fundamentally on genetic diversity. Adaptation is a process. What matters is not so much the drought resistant minor millet landrace, well stored in isolation and deep-frozen in a gene bank. Rather, species must

Infobox: *in situ* conservation measures

To observe and utilise the strategies of the wild relatives of cultivated plants, it is important to conserve them in their natural habitat (*in situ*). There, they are able to develop and adapt to changing environmental and climatic conditions. The following presents some arguments, challenges and questions in connection with *in situ* conservation:

- Natural ecosystems hold the wild relatives of important plant genetic resources for food and agriculture, including endemic and threatened wild crop relatives and wild plants for food production.
- This genetic diversity, because of interactions which generate new biodiversity, is potentially an economically important component of natural ecosystems and cannot be maintained *ex situ*.
- Unique and particularly diverse populations of these genetic resources must be protected *in situ* when they are under threat.
- Most of the world's 8,500 national parks and other protected areas, however, were established with little specific concern for the conservation of wild crop relatives and wild plants for food production.
- Management plans for protected and other areas are not usually broad enough to conserve genetic diversity for these species to complement other conservation approaches.

(Quoted from: Heywood, V.H. & M.E. Dulloo 2005)
This, therefore, gives rise to the following challenges:

- How, specifically, can endemic or endangered species (wild relatives of cultivated plants and wild plants) be conserved *in situ*?
- How can the often not sustainable management of these important plants be improved?

Exhibition: Home gardens worldwide. Treasure troves of food and diversity.

As part of the fair "Garden 2007" in the Botanical Garden of Frankfurt, a photo exhibition was organised by the sector programme "Sustainable natural resources management in agriculture (NAREN)" of GIZ, in collaboration with the University of Erlangen. The exhibition catalogue focuses on the multi-faceted significance of gardens: "Home gardens represent an important basis worldwide for providing people with food, medicinal plants, building material and other raw materials. Farmers harvest from them fresh and nourishing cereals, fruits and vegetables, as well as the raw materials for making traditional remedies. Anyone who grows more than needed can earn extra income by selling some produce at local markets. For many families, this is the first step out of poverty. The encouragement of domestic gardens is of two-fold interest for international cooperation. On the one hand, domestic gardens contribute considerably to subsistence, food security and agricultural income, on the other, they play a vital role in the conservation of plant genetic resources." (cited from the German version).

Sources & further information:
GIZ: Hausgärten weltweit [Home gardens worldwide];
GIZ Exposition module "Hausgärten in Ländern des Südens" [Home gardens in the countries of the south];
GIZ Issue Paper: Home gardens – treasure troves of diversity

With the more labour intensive *in situ* method, plants are allowed to grow in their natural environment.

be exposed to the environment, considering the wide agro-ecological variation of sites. Resistance of plants to environmental stress (e.g. drought tolerance) is mostly a multi-genetic characteristic best developed by *in situ* exposure to it.
Many ecosystems can be protected by setting up protected areas where they can prosper undisturbed by man. But how can local people be motivated to care for plants which are perhaps threatened with extinction, but from which barely any money can be made? They have to be convinced, with sound arguments, and they have to be supported for provision of *in situ* conservation which has to be seen as a service for society as a whole.

Suggestion for further work: conserve diversity

How would you persuade a farmer to take part in an *in situ* project? What incentives might motivate him to participate? Do you think that the incentive structures for farmers in Germany, Europe and developing countries are all different? Why?

Gourmet kitchens, tourist attractions and local seed markets

Individual breeders and consumers may also contribute to maintaining agrobiodiversity. Today, varieties of vegetables from past times are becoming popular again in Germany. Rediscovered and cultivated once more, vegetables such as Teltow beet, parsnips, black salsify or swede, for a long time considered as old-fashioned and almost forgotten, have raised regional food to the heights of European cuisine again. Individual breeders

Many products from the Rhön's traditional apple varieties are produced – one possibility to add value to agrobiodiversity.

Sales of souvenirs made from natural materials can create additional income. This also maintains both agricultural and cultural diversity.

having made a start, the first restaurants are beginning to put dishes using the old varieties on their menus. Some almost forgotten old varieties of vegetable have now, via the gourmet kitchen, also found their way on the plates of an ever larger and more curious clientele.

This recently developing diversity gives the agricultural pioneers who have succeeded in making a "hot tip" of a particular fruit or vegetable the opportunity to bring a very specific product onto the market. This is a good opportunity, of course, to generate some extra income. Farmers and their families are becoming less dependent on the conventional market, they have more control over their work, and sometimes even they can earn more money than with conventional products.

Most of the agrobiodiversity initiatives in development cooperation as well as in European rural development work according to the following principle: it is a matter of showing farming enterprises ways of creating additional sources of income. The aim is to earn more by breeding and conserving animal and plant species threatened with extinction. In this way, families profit and agricultural diversity increases. Thus, sometimes, the protection of agrobiodiversity is at the same time a contribution to the fight against poverty. The agricultural scientist Detlev Virchow: "The most important function of agrobiodiversity today is to provide marginalised and small-scale farmers with sufficient diversity to minimise their production risks and also to enable them to achieve stable yields sustainably under unfavourable to extreme environmental conditions" (original in German quoted from Virchow, 2008).

There are several ways of attaining these goals. In some regions even tourism offers possibilities. If a village or a region can demonstrate what natural riches it has in the way of its fields, gardens and pastures, families can earn extra income doing guided tours, in providing food, accommodation and also perhaps transportation of visitors. They can cook traditional dishes featuring local plants and animals and make traditional products out of natural materials such as bamboo or leaves, as well as modern products like T-shirts and jewellery. In this way new products are created out of combining the maintenance of agricultural diversity with the new business generated by tourism. Value chains are created (see below) which have

agricultural, biotic and cultural diversity as their business basis.

Many regions explicitly promote agrotourism by deploying popular animals to catch the tourist eye. On the Lüneburg Heath near Hamburg, for instance, where the keeping of the "Heidschnucken" (heath sheep) breed for wool and meat has long since ceased to be profitable. Their grazing keeps the forest at bay and also ensures that the heathland remains a tourist attraction and doesn't become overgrown. This Nordic breed of sheep thus enables the inhabitants of the Lüneburg Heath to earn some income from tourism without the animals having to pay their way as sources of meat and wool. The Criollo horses in Costa Rica or the Basutu ponies in South Africa serve a similar function as local attractions.

Seed markets in the highlands of Peru and Bolivia have always played an important role in the everyday lives of farming families in securing their food supply. Families buy and exchange species and varieties among themselves, thereby ensuring the development of their crops. Today, these seed markets are an important attraction for tourists who visit the markets for the variety of products on offer and the traditional, colourful clothing worn by both men and women.

Sources & further information:

- Virchow, D. (2008)
- GIZ Issue Papers on agrotourism and agricultural diversity and on diversity displays and seed fairs

Infobox: value chains

Production – processing – consumption: this sequence of individual steps, each of which produces added value, is known as a "value chain". The value of the initial product increases at each stage of its processing through to the end product. For instance, value I added from the growing of cereal, to the milling of the grain, to the baking of the bread, and through to its sale and consumption.

The value chain "analyses activities, products and services during the individual stages of the process and does the same with regard to those involved, their relationships and power relations, as well as the exchange of information and knowledge that takes place between them. The value chain approach enables one to look beyond individual sectors and national boundaries to all stages in the production process and all actors involved. If support measures are established early on for the marketability of products, sales opportunities later on can be improved.

The marketing potential of a biodiversity product depends both on its characteristics and origin, as well as on its value chain. To achieve a realistic assessment of the role played by the marketing of biodiversity products in the conservation of endangered varieties of useful plants and animals, it is necessary to know the characteristics both of the products and of the value chain."

Source & further information: GIZ Issue Paper on value chains and the conservation of biodiversity

Farmers exchange and buy seeds at seed fairs, thereby further developing their crops.

Sources & further information:
GIZ Issue Papers on agrobiodiversity with various examples of capitalizing on nature's resources: the Schwäbisch-Hall country pig, high-grade cocoa from Ecuador, argan trees in Morocco and various other things.

There are many ideas for marketing products in order to protect and extend agrarian diversity. One example is the Schwäbisch-Hall country pig. This breed of pig resulted from crossbreeding at the beginning of the 19th century between the Chinese saddleback pig and local breeds. By the middle of the 1980s, this extraordinary breed of pig was on the brink of extinction. With just a single boar and seven sows, local farmers managed at the very last minute to safeguard the survival of the breed. Today, the Schwäbisch-Hall country pig is kept on over 300 farms and is marketed locally with great success as a speciality with a natural layer of fat and firmer meat than the conventional domestic pig.

Potatoes are another example of fostering agrobiodiversity by marketing particular varieties and specialities as only a very limited assortment of potatoes is traded globally. In the Peruvian Andes, however, 2,000 of the 4,000 varieties in existence worldwide are still being cultivated – red, blue or black potatoes, long, round, oval, knobbly and spotted ones. In many villages, a typical family enterprise might grow up to 250 different varieties.
In Latin America, in order to protect this diversity, the International Potato Center (Centro Internacional de la Papa, CIP) is developing new marketing channels with potato farmers, facilitating access to the supermarket around the corner, to exclusive speciality shops, and thereby

There is an enormous diversity of potatoes in Latin America. The further lengthening of traditional value chains provides small farmers with new markets.

increasing their turnover. Another method is to extend the traditional value chains – freeze-drying potatoes (Chuño and Tunta), for instance, to make them keep longer and also be sold at reasonable prices. The coloured Jalca Chips, on the other hand, which are made from 30 different varieties of potato, are sold at the airport in Lima as expensive speciality souvenirs. This demonstrates how a marketing concept governed by international criteria has grown around the potato taking into account its value chain. Small farmers are accessing urgently needed new markets, while at the same time maintaining the diversity of potatoes. A further idea has also achieved international fame. Six Peruvian villages joined forces to form the "Parque de la papa". This potato park is a community-based, agrobiodiversity-focused protected area: it is both an agrotourist attraction and a potato-growing area. An agreement was signed with the CIP to reintroduce another 206 traditional varieties of potatoes, which were stored in the CIP gene bank.

With their big assortment of products, China's markets are a feast for the senses – for locals and tourists alike.

Suggestion for further work: regarding potato varieties and gourmet kitchens

- Just imagine you are head chef on a ship. Unfortunately, during a storm just a few days ago, almost all of the provisions were washed overboard! There are no more noodles or rice, but at least there are plenty of potatoes. No one is going to starve – but the crew doesn't fancy eating boiled potatoes every day. It will be 15 days to the next port where fresh supplies can be bought. The captain promises you the moon, if you can come up with a different potato dish every day and keep the crew in good spirits. Can you do it? Of course you can!
- Today, there are several thousand varieties of potato worldwide, some of which are floury when cooked, some of which remain firm – there are softer, harder, bigger, smaller ones … One particular variety is best for making chips. Because chips are becoming ever more popular worldwide, this variety of potato is being grown more and more. This doesn't help other varieties. Is this good, bad, or does it not matter?
- The domestication of animals is not as easy as you might think. Wild animals have a well-developed ability to listen for danger (animals which don't have this are more liable to be preyed on). Penning in a wild animal naturally causes it to become nervous, casting doubt on whether it will be healthy or relaxed enough to breed. … Choose a domesticated animal, find out how man came to tame it, and how long it took. You will be surprised by the results.

Sources & further information:

- GIZ Issue Paper on capitalizing on nature's resources with reference to potatoes in the Andes
- www.cipotato.org

Part 3
Agrobiodiversity in China

In terms of biodiversity, there are quite a number of "hot spots" in China. They represent a gene pool for cultivated and non-cultivated plants of worldwide importance. China, Germany, the EU and the United Nations are working together on joint projects to research, conserve and use these plant resources in a sustainable way.

China has plant genetic resources important for the future of global food security – Wang Tianlai knows of many rare plants in Wuzhishan Nature Park.

According to the United Nations Environment Programme, China, along with countries such as Brazil, the Congo, India, the USA and Papua New Guinea, is one of the world's 18 mega-diverse countries. These 18 countries are home to the majority of all the recorded plants in the world. Also located in China is one of the eight "Vavilov Centres", i.e. one of the original crop regions and a gene pool for the world's most important food plants (see also p. 23). Because so many cultivated plants have their genetic origin in China, the country has important plant genetic resources for future global food security and for adaption of agriculture to climate change.
The most heavily populated country in the world, China, has a long history of agricultural production. China's farmers have been breeding plants and animals for 7,000 years during which a wide diversity of plant species and animal breeds has

Suggestion for further work:
a memory game about nature and culture

On the accompanying DVD and the internet you can find a memory game with pictures of plants and animals which occur in China. See who is quickest at the game!

www.conservation-development.net/rsFiles/Datei/memory.swf

Film: Every seventh person

"Every seventh person in the world is a Chinese farmer, man or woman. [...] For thousands of years they have shaped Chinese history and its cultural landscape". The present challenges are immense. Arable land is diminishing and many people are wandering the land as migrant workers.
"Between 2002 and 2005, the film-makers Elke Groen and Ina Ivanceanu conducted numerous interviews in three Chinese villages and – subject to no censorship – filmed the everyday life there. At the same time, men and women living in the village made short films themselves about their environment, their hopes and dreams, which then became part of 'Every seventh person'. The result is an extraordinary documentary film which gives insights into life in China away from the urban and industrial centres – into a life between socialism and the market economy in which the villages become a testing ground for democracy and self-determination" (original in German quoted from the Web site www.j7m.at).

A documentary film (2006) by Elke Groen and Ina Ivanceanu.

Sources & further information: www.j7m.at;
distributed by: www.amourfou.at

In China over 1.3 billion people must be fed every day, a reason why high yielding crops have come to dominate the agricultural landscape.

emerged. With more than 1,900 breeds, China is a leader in livestock breeding and is home to an unparalleled level of agrobiodiversity. Roughly half of the cultivated plant species which exist in the world today are grown in China. There are 2,200 ornamental, 11,000 medicinal or pharmacological and 4,000 fodder plants found there today.
This richness, however, is under threat. Arable land is increasingly being taken over by production of high-yielding species and varieties, which produce abundant harvests and thus large amounts of food. This is important in a country with more than 1.3 billion mouths to feed.
This drive for high productivity has had costs for China's traditionally diverse agricultural systems. China's intensive use of fertilizers and pesticides puts soil, water supplies and adjacent ecosystems under great pressure. High-performance plants, often grown under intensive monoculture conditions, are displacing China's traditional diversity of agricultural crops. The crops and livestock being displaced were often bred by farmers over centuries and thus specially adapted to local conditions. With the onset of industrialisation, however, the drive towards modernisation inevitably affected agriculture, leading to the abandonment of many well-tried production methods and much traditional knowledge.

Through modernisation, much traditional knowledge and practices – such as in vegetable cultivation shown here – have become lost.

Source: He & Sheng (1997)

A great knowledge of medicinal plants and herbs has existed in China for thousands of years. The first written evidence of how to make medicines from plants goes back over two thousand years. This knowledge has been built on continuously from generation to generation. Even today in many Chinese villages, there are families in which medical know-how is applied and passed on from parents to children.

Today, Traditional Chinese Medicine (TCM, for short) is also popular in the West. Doctors, psychotherapists, chemists and practitioners of alternative medicine throughout the world use centuries-old plant recipes to treat their patients. TCM is regarded as being close to nature, aiming as it does at a holistic approach to illness with the use of plant and herbal remedies, acupuncture and massages. Over ten thousand plant species in China are known for their healing properties and roughly one thousand of these medicinal plants, many of which are exported abroad – to Germany, for instance – are commonly used in Chinese medicinal preparations.

China was one of the first countries to ratify the Convention on Biological Diversity (CBD) adopted in Rio de Janeiro in 1992. The Chinese government began to enact measures for the implementation of the agreement ten years after its coming into force. The first major steps towards conserving species diversity had already been taken in China in the 1950s with initiatives to conserve local crop varieties (for ecample, by setting up gene banks). There then followed other projects, including work on the targeted breeding of local livestock and various types of fish.

Infobox: initiatives to promote the sustainable use of medicinal plants

Nature conservation bodies such as WWF and TRAFFIC are making consumers, politicians and business enterprises throughout the world aware of their responsibilities. In the German-speaking countries, for instance, this is being done through an initiative launched at a symposium at EXPO 2000. More than 100 organisations, firms and individuals have since then signed the "Joint Declaration for the Health of People and Nature". The signatories declared their willingness to participate in a working group to bring about effective and practical measures for the conservation of medicinal plants.

Statistics and facts:

- Importing 45,000 tons annually, Germany is the top importer of medicinal plants in the European league.
- Worldwide, Germany ranks fourth in both imports and exports of medicinal plants.
- Roughly 80 per cent of all plants used worldwide for medicinal purposes come from wild collection.
- In Europe almost 2,000 plant species have medical uses, a good 1,200 of which are native.
- In at least one of their countries of origin, 150 of these European medicinal plant species are under threat.

In 2007, together with the German Federal Agency for Nature Conservation and the IUCN, WWF and TRAFFIC published regulatory guidelines for collecting wild medicinal plants in a sustainable way – the International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP). With these guidelines, collectors of tubers in South Africa, as well as herb collectors in the Ukraine, can evaluate the extent of their natural resources and check how sustainable their picking methods are. Chinese partners such as TRAFFIC China are also involved.

Sources & further information:
www.wwf.de/themen/artenschutz/medizin-aus-der-natur;
www.floraweb.de/proxy/floraweb/map-pro

With the help of the BMZ, the short video "Healing power from nature" has been made. It gives a good introduction to the problems of collecting wild plants and ways of solving them: www.youtube.com/watch?v=FcgFYknzazg
A copy of the English film can be ordered by sending an E-mail to Susanne Honnef at WWF Germany: honnef@wwf.de

Sino-German cooperation on the conservation of agrobiodiversity

Some 30 years ago, the Chinese scientist Yuan Longping made a great discovery. He crossed an existing rice variety with wild rice from Hainan Province, producing hybrid rice with an enomous increase in yield of over 20 per cent. This high-yielding variety gave a tremendous boost to rice production in China and many other countries where it was grown. Chinese hybrid rice became a booming export.

In the genetic heritage of old, locally grown crop varieties, but also in many of their wild forms, lie many dormant but useful characteristics beyond the potential for higher yields, such as low sensitivity to temperature and resistance to drought and pests.

In order to research, conserve and make use of these characteristics, the Chinese and German governments have, since 2005, been implementing the project "Sustainable Agro-biodiversity Management in the Mountain Areas of Southern China" (hereafter also referred to as "agrobiodiversity project"), implemented by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ), jointly with its Chinese partner, the Ministry of Agriculture (MoA), which will end by the end of 2011. It is a pioneer project in the *in situ* conservation and sustainable management of agrobiodiversity in China.

The project supported by GIZ is mainly concerned with increasing the awareness and capacity of different stakeholders to jointly manage and use agrobiodiversity in a sustainable way. In this context, the project introduces innovative strategies and methods to promote agrobiodiversity- and biodiversity-friendly farming practices at the village level in selected mountain areas of Southern China. The conclusions resulting from this work provide a basis for advisory support to national agrobiodiversity policy makers.

The agrobiodiversity project, started in 2005, is designed to take place over a period of six and a half years. Initially, 14 villages in the mountain regions of the Southern provinces of Hainan and Hunan were involved. Technical success and the great interest shown by both partners, allowed that additional financing be secured from the European Union as part of the EU-China Biodiversity Programme (ECBP), implemented through the UNDP and the Ministry of Environmental Protection (MEP). Such additional support has not only enabled the project to be extended to the provinces of Anhui, Chongqing and Hubei, but also clearly shows the recognition and focus now being placed on agrobiodiversity within the wider field of biodiversity conservation. The German share of total costs is roughly EUR 4.5 million, and the Chinese contribution the same. The agrobiodiversity project is led jointly by a member of staff from the Ministry of Agriculture of the People's Republic of China and a GIZ specialist from Germany. The project office is in the Chinese capital, Beijing.

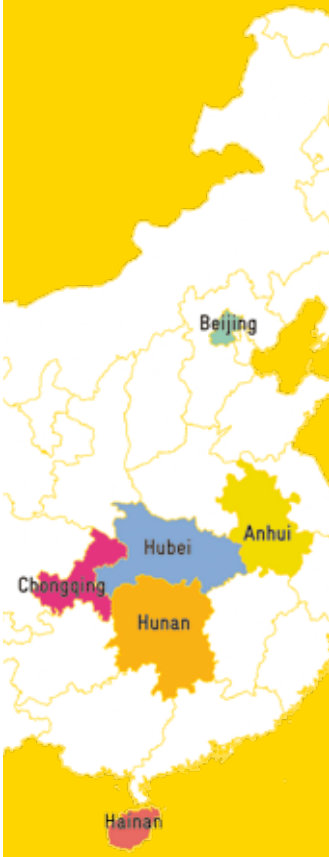
The MoA and the UNDP embarked jointly in 2007 on the project "Conservation and Sustainable Utilization of Wild Relatives of Crops" (hereafter also referred to as the "wild relatives of crops project"). Financing was supplied partly by the Global Environment Facility (GEF), which was established in 1991 to address global environmental protection concerns in developing countries. The project, which is provisionally to be completed in China by 2012 (with the option of being extended), seeks to develop sustainable models for protecting and conserving the wild relatives of crops in eight different provinces in China. Of crucial importance to this project has been convincing the relevant authorities at various political levels of the importance of agrobiodiversity, and that they then move to create supportive legislation. It is vital to build up sufficient competent staff at the various administrative levels, as well as to raise awareness amongst the local population. The project's approach is to set up a monitoring system in order to collect more precise information about the wild relatives of cultivated plants. Building on the experiences made in each province, the next step is to initiate the development of a national system of access to genetic resources, and of the fair sharing of benefits accrued from those resources (Access and Benefit Sharing, ABS). The central project office is also located in Beijing. The total cost is currently estimated at USD 20.9 million, with the Chinese government contributing USD 12.2 million, or over half.

Sources & further information:

- www.agrobiodiversity.cn
- www.giz.de/china › Programmes and projects

In the "Sourcebook on Sustainable Agrobiodiversity Management", a series of papers in Chinese and English, a range of issues on agrobiodiversity are being explored – the publication can be found on the accompanying DVD.

GIZ was formed on 1 January 2011. It brings together the long-standing expertise of DED, GTZ and InWEnt. For further information, go to www.giz.de.












Project documentary film, "When man meets nature"

Together with the China Documentary Film Commission, the GIZ-supported agrobiodiversity project has developed two documentary films. The longer film, "When man meets nature" (35 minutes, in Chinese with English subtitles), was first shown to the public in July 2009 at the Nature Vision Film Festival in Germany, and since then has been broadcasted on several Chinese television stations. In a narrative style, it throws light on specific Sino-German project activities in the conservation and sustainable use of agrobiodiversity in the project areas of Hainan and Hunan. These include seed fairs, training in Farmer Field Schools, support and promotion of traditional knowledge and the culture of the local ethnic groups, and marketing of local agrobiodiversity products. Moreover, the film shares with the audience the daily work routine and the close cooperation between Chinese and German counterparts working hand in hand on agrobiodiversity promotion and protection. The target audience is schools, universities, and the public at large in China.

The shorter film version "Sustainable Agrobiodiversity Management in the Mountain Areas of Southern China" (22 minutes, in English and Chinese) gives an overview of the project's activities. In addition, in interviews, different stakeholders share their view of the project and its impacts. The target audience is professionals participating in workshops and conferences and students at universities. This short version is also well suited for use in educational work. It is available on the accompanying DVD.

Further information:
www.natur-vision.de/en/home/home.html

Summary of the film sequences (short film)

Topic	Start
Introduction to agrobiodiversity, local traditional culture and biodiversity	00:00
Decline in agrobiodiversity, reasons and consequences	02:11
Importance of agrobiodiversity	02:55
Project presentation	03:20
Mr. Fang Fang (Division Deputy Director, Ministry of Agriculture)	04:56
Project regions	05:08
Changes in agrobiodiversity (Origins, today's challenges to farmers)	05:37
Mr. Wang Xuanlai (Project staff of the agricultural authority, Province of Hainan)	07:07
In situ conservation, biodiversity-friendly farming practices, Farmer Field Schools	07:44
Mr. Chen Tingyuan (Project Director, Foreign Economic and Technical Cooperation Centre, Department of Agriculture, Hainan)	08:59
Mr. Huang Yuenan (Project Coordinator of the agricultural authority, Province of Hunan)	09:24
Participatory Village Planning, Capacity Building, training on agrobiodiversity	10:07
Mr. Zhang Xiuying (Division Deputy Director, Ministry of Agriculture)	12:07
Local seed fairs	12:22
Professor Dr. Yang Qingwen (Researcher, Chinese Academy of Agriculture Sciences)	13:52
Farmers' local knowledge	14:23
Different roles of men and women in agricultural production	15:09
Role of team meetings	16:08
Public Private Partnership (HerbaSinica)	16:29
Mr. Zhong Wenjun (Manager, HerbaSinica)	17:21
Awareness raising	17:50
Legislation	18:34
Mr. Fang Fang (Division Deputy Director, Ministry of Agriculture)	19:03
Final credits with statements from various people connected with the project	20:00

Travelling exhibition,
"When man meets nature – Food security, biodiversity and traditional culture"

The agrobiodiversity project also has produced a travelling exhibition with 42 panels in Chinese and English. This exhibition seeks to explain the relation between cultural and biological diversity to a wide Chinese public. It is based on spectacular pictures of the project regions by the Cologne-based photographer Guenay Ulutonçok. In addition, explanatory texts and exhibits on the traditional way of life of a particular ethnic group demonstrate to the viewer the importance of conserving diversity to the identity of the people on the ground. The exhibition was officially opened in the National Library in Beijing in August 2006 and presented to a very interested Chinese public. It was also on view later in Hunan (Hunan Normal University in Changsha and Jishou University), Hainan (Hainan library, Haikou, Hainan University), Anhui (Hefei and Jinzhai) and Wuhan. The exhibition is still making its way through China. By the end of 2010, it has been shown at 19 different places in China and attracted about 100,000 visitors.

Find out more about the exhibition and its highlights at www.agrobiodiversity.cn/index.php?id=197. The exhibition catalogue in English and Chinese is available as a PDF file on the accompanying DVD.

The following five sub-chapters examine various aspects of agrobiodiversity with respect to the agrobiodiversity project in China and the wild relatives of crops project. The **first** sub-chapter deals with a precondition for the conservation of agrobiodiversity: that communities living within agroecosystems see genuine prospects of securing concrete sources of income by conserving agrobiodiversity. The **second** sub-chapter is dedicated to three plants, rice, soybean and wheat and depicts their importance for the world's food supply. Sub-chapter **three** is dedicated to the question of why it is worth treasuring and safeguarding traditional knowledge as a prerequesite for conserving and advancing agrobiodiversity. The **fourth** sub-chapter addresses national and regional development plans, within which the protected landscape and nature reserve areas, with their various utilisation concepts and intensities, might facilitate a constructive partnership between man and nature. A part of this chapter picks up the trail in Germany and, with reference to the UNESCO Biosphere Reserve Rhön, demonstrates what initiatives are being developed for the expansion of agrobiodiversity in Germany. The **fifth** sub-chapter gives a theoretical explanation of how the project "Conservation and Sustainable Utilization of Wild Relatives of Crops" is working and provides some practical examples.

The sub-chapters are all structured in virtually the same way. A background text gives a theoretical presentation and explanation of the topic in question. The reportages give a sensory impression of focus regions, and the challenges facing agrobiodiversity and the wild relatives of cultivated plants. The portraits and interviews give a more in-depth account of individual villages and interviewees. The maps help readers to find their bearings in the regions.

On the accompanying DVD there are some of the original recordings of the interviewees (in Chinese) and an audio-reportage on the research trips (English). The audio-reportage may help teachers to attune their pupils to the topic in hand.

Mountain Gods and Lovage – an audio-reportage from China's Biodiversity Hot Spots

The original recordings for the DVD audio-reportage were made on research trips in February, March and August 2009. Listeners are taken to the various project locations and given a sensory impression of people in the Chinese provinces and of the project's working methods. This enables classes in particular to tune into the topic, and teachers can also make available the corresponding mp3-data file on the DVD, along with the five additional on-the-spot original recordings of interviewees in Chinese. The complete text of the audio-reportage and a document with the English translations of the original recordings are also on the DVD.

Audio-reportage
Author: Jörn Breiholz
Duration: 14:53 minutes (English)
Original recordings: each recording lasts roughly two minutes (Chinese)

3.1 Diversity as a way of securing both food security and human existence

Background: making use of biodiversity, and thereby conserving it

Conserve old varieties of cultivated plants and open up new and more profitable markets so that, in the middle run, local farmers can earn extra income. That is the objective of the agrobiodiversity project – a worthy beginning, but a hard road ahead.

Just 40 years ago, the kitchens and markets in the Wuzhishan Mountains of Hainan were full of local varieties of cultivated plants. There were many sorts of rice there, upland and lowland rice, sticky and non-sticky rice, and there were local variations on every one of these sub-varieties. The varieties even differed from one another from village to village, region to region. The same was true of peas or beans. There were some that were sweet or particularly aromatic, and they had different shapes and various flavours. They were thinner or rounder, took longer to sprout or blossomed more briefly, they were less sensitive to the cold or had a more intense taste. Hainan was a Garden of Eden on Earth, which the people living there used as such.

In many parts of the markets of Hainan today, only a handful of varieties are on display. For instance, certain sorts of lowland rice – which have a much higher yield than the traditional local varieties and are, therefore, more profitable – have come to predominate. The same is true of other cereals and maize. Where high-yield varieties establish themselves, diversity with all its special qualities disappears. Even though Hainan's markets are still a treat to the European eye, they have nevertheless been stripped of their former diversity.

Agriculture in China has undergone radical changes in the last 40 years. Farming has experienced an invasion of commercially produced seed, pesticides and fertilizers. Acre for acre, they give farmers much higher yields. But this has been accompanied by a drastic decline in the number of local varieties under cultivation. There are several

What's on offer looks good, but Hainan's diversity has also been reduced through the predominance of high yielding crops.

reasons for this. On the one hand, local varieties may produce less, but are generally sufficient for the farmer's own needs. If he is to sell rice, however, then the high-yielding varieties are much more suitable, especially since they are partly subsidised by the state. When agriculture was collectivised, new varieties were introduced from outside, breeding of local varieties did not take place and many of them got lost.

Increased cultivation and improvement of old varieties offers the possibility of broadening plant diversity. Farmers themselves can cultivate these by saving part of the seed of harvested crops, and then using them for the next sowing. In Hainan and Hunan, the old varieties of cultivated plants have (so far) not disappeared entirely, although many of them still have to be rediscovered. In the course of a plant inventory in Hunan in which a dozen scientists working for GIZ systematically catalogued the flora in the eight project villages, the team discovered approximately 1,400 potentially useful varieties from 200 different plant families. In other words, they had stumbled onto a gigantic pool of plants with the most varied range of characteristics. To safeguard and conserve them where they are found, in their natural surroundings, is one of the main objectives of the project.

The local community is mostly made up of farming families who rely on subsistence farming and supplement their incomes through village markets. In many families, at least one parent – sometimes both – work in factories or on construction sites outside their villages to earn money. Without this additional income, annual earnings would seldom exceed a few hundred euros. This means that people are fully occupied with making a living, and not necessarily the fact that they consider themselves as principal players in the conservation of valuable local plant resources.

Therefore, agrobiodiversity conservation can only succeed if local families see some benefit to themselves in it. This is why the staff of the agrobiodiversity project are exploring economically useful plants. They consider, for instance, whether it would be worthwhile cultivating a certain variety of wild raspberry whose fruit could be offered as a speciality in local markets, or if an organic tea which grows wild could be offered on the European market as a high-priced gourmet item. Introducing new products such as this into the market is a lengthy process, particularly since competition can be fierce. Well-established import firms have already recognised the market potential of certain kinds of Chinese tea, and are backed by budgets in the millions USD, detailed market studies, and carefully honed sales strategies. In other words, these firms possess all the tools and advantages of the competitive business world. A comparatively modest development cooperation project cannot afford such an outlay.

Farmer Field Schools are an important awareness raising mechanism for small farmers in the GIZ-supported agrobiodiversity project.

Farmers learn which plants may be grown together for optimal results, thus use of agro-chemicals may be minimised.

Infobox: farmers as breeders

Not all farmers can achieve high yields with the seed produced by commercial seed breeders. Many modern varieties require a lot of water, fertilizers and pesticides in order to achieve their optimal growth. Many farmers are unable to create these ideal conditions, either because there is inadequate rainfall in their regions, or because they have insufficient financial resources to pay for agro-chemicals. This is why also in China, many farmers fall back on seed they have bred themselves. Seed fairs have been organised in order to improve know-how and facilitate the exchange amongst farmers and local seed breeders in order to produce sturdier plants and higher yields. There is often an astonishing diversity on show at these fairs. In the town of Guzhai, for instance, hundreds of local farmers assembled to present 38 plant species with 107 different varieties, amongst which were 31 different kinds of maize and 17 kinds of beans.

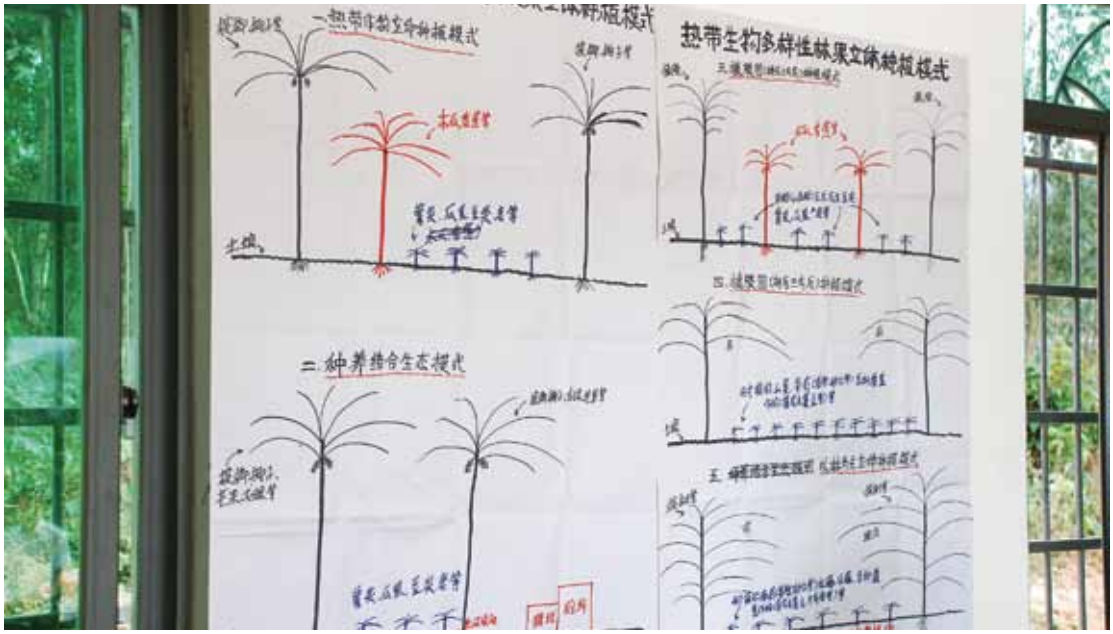
Further information: GIZ Factsheets and Issue Papers on farmers as breeders, and seed fairs

This is why the introduction of new products takes time, particularly when they are aimed at international markets with, for the most part, significantly higher prices than domestic markets. It is vital that project staff on the ground engage the local population early, and develop their understanding of agrobiodiversity, and the opportunities as well as challenges of successfully marketing its products. They must persuade people that the key to both food security and a higher income lies, especially for local people, in product diversity, and that the "simple way" – limiting themselves to a few products or even monoculture – can lead down a dangerous blind alley.

Crucial here are "Farmer Field Schools" (FFS), an important tool in the education of farmers, both men and women. Farmers have had formal schooling and learned to read and write, but they have never undergone classic agricultural training as it is known in Europe. This gap has been filled by the "Farmer Field Schools" of the agrobiodiversity project. These schools are based on an educational concept developed by the Food and Agriculture Organization (FAO), a sub-organisation of the United Nations, and modified by this project.

The farmers (some 15 to 20 men and women) assemble roughly once a month at village meeting points. Here they receive a short introduction to a

With intercropping, available space on normally mono-cropped fields is used for other crops. The result is a more complex ecosystem.



particular training topic, as well as informational materials on, for instance, farming methods or seeds. Afterwards, the group goes out into the fields for practical training and to set up field experiments. Celebrations also take place at these meetings, sometimes giving rise to fresh ideas such as how, for instance, the village might move forward. "An important part of the programme is that families on the ground also learn to develop democratic rules together", says Huang Yuenan, the Project Coordinator for Hunan. "We want families to all participate together in the development of their village."

Farmers at the Farmer Field Schools tackle, on the spot and jointly, problems which they have to deal with day to day. They may focus on, for example, how to protect their citrus plants against insect damage. In other cases, farmers may want to know what animal feed to use to prevent intestinal diseases in Wuzhishan pigs, but veterinarians are rare in these areas and few farmers can afford them. The project then offers solutions or advice, while usually advocating the use of as few chemicals as possible or less pesticides. Increases in productivity are also an important topic. Why should the rubber tree have to be tapped every day when, by using another cutting technique, you could do it every three days and achieve the same, or even higher, yields? In the Farmer Field Schools, farmers benefit from the experiences which specialists have gathered all over the world, in this sense avoiding reinventing the wheel. One example of valuable experience shared through Farmer Field Schools is in the area of "intercropping". On the one hand, this internationally tested concept maximises the use of land in monocultures such as rubber and areca palm ("betel" nut) plantations by growing seedlings of other species there for a time – mango trees or banana plants, for instance, which can then be transplanted to other fields when they are mature enough. This saves farmers having to rent additional land, and reduces the distances they travel between work sites. There are other advantages to intercropping. The cultivation of several different crops in the same spot gives rise to more complex ecosystems than the monocultures they replace. Moreover, farmers who diversify and grow a dozen or more varieties minimise the risk and impact of pest damage and disease. Growing only two or three arable crops runs the risk of losing a large part of one's crop in such cases.

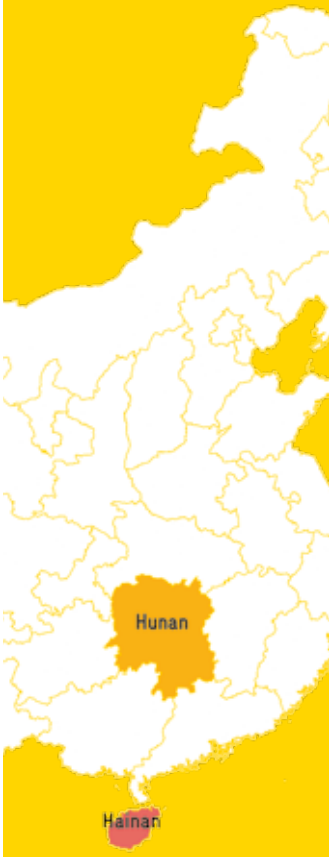
At Farmer Field Schools, farmers learn which plants compliment each other, which can also often lead to minimizing the use of agro-chemicals. This then gives farmers a competitive edge and increases their income: on the one hand, the cost of chemical inputs is saved, and on the other, there is a demand for such reduced input crops generated by a growing awareness of the need to eat healthily.

The following texts deal with the topic in greater depth:

- The **reportage** describes the rich natural plant life of Southern China which the project, in collaboration with farmers, is using to develop new products for the conservation of agrobiodiversity.
- In the **portrait**, the couple Lin Qihui and Li Guixiang describe how the agrobiodiversity project has taught them to eat more healthily and to increase their income.
- In the **interview**, Chinese Project Director Wang Guiling of the Ministry of Agriculture, and German Project Director Luis Waldmüller of GIZ talk about their work under the Sino-German agrobiodiversity project.

Reportage: uncovering hidden treasures

Agrobiodiversity conservation can only succeed if local families see in it some benefit to themselves. People in Hainan and Hunan live in an area of natural abundance. But in order to survive as farmers, they have to develop more products and find new ways of marketing them.



Li Guixiang need not go far to find tasty, wild vegetables for her family's dinner table. In the agrobiodiversity project she's rediscovering these natural treasures and learning to market them.

We go with Tan Weinuan and her older neighbours Li Aihua and Li Guixiang in search of vegetables. They want to show us everything growing in Xialu, their village in Hainan. The three women, all of the Li ethnic group, have strolled only a few steps out of the little village and down to the river before Li Guixiang is already holding a bunch of long Pandan leaves, which they call *ata bokela*, in her hand. Growing right next to them is *nai cai*. *Cai* means vegetable in Chinese. "When times were hard and we had nothing else, we used to eat *nai cai*", Li Guixiang tells us. Today, there is much more diversity in the fields of Xialu once again. On the other side of the river the three women have planted a field with sweet potatoes. "We used to spray the sweet potatoes with pesticides and feed the leaves to the pigs", says Li Aihua. "But since we discovered how delicious they taste and began to eat them ourselves we no longer spray them". "And when we sell them at market", adds Li Guixiang, "we get a good price for them". The holes in the leaves made by pests are not blemishes, but a sign of quality. "Our customers know that the vegetables have been grown naturally, without chemicals", says Tan Weinuan. "This makes them ready to pay a better price for them". The tourist and university town of Sanya is only half an hour away by car, making it easy for the three women from Xialu to sell their vegetables in this urban milieu with its demanding customers and many restaurants.

Since their village has been receiving advice under the agrobiodiversity project, the women now know a lot more about agro-chemicals and their harmful effects. They tell us that, wherever possible, they do without them. "When we spray with pesticides, for instance, this plant here tastes awful", says Li Aihua, pointing to a green plant with yellow flowers. It is called *zip*, a wild vegetable which has spread itself amongst the peppers the women have planted. Just like the next plant Li Guixiang shows us, *zip* tastes sour. "This one here we call *bo dong*. We use it in our sour fish dish", she says.

In barely a quarter of an hour, the three Li women show us more than half a dozen delicious, edible tropical plants which are growing wild. Nature in all its abundance around Xialu is a veritable treasure trove. It safeguards the local community from malnourishment and hunger, but only when they can distinguish what can be eaten, and what is best left alone. "Some of our knowledge about wild plants has been lost over the last few decades", says Li Aihua. The women are now learning from the agrobiodiversity project to rediscover and market nature's long-lost delicacies by, for instance, collecting and bringing to market a wide variety of wild vegetables. Or, they try to cultivate and grow the wild plants themselves. By increasing what they can offer, and earning money in the process, they are helping to conserve Xialu's wild plants.

The island of Hainan is a tropical paradise, with the ideal conditions to act as a storehouse for agrobiodiversity. But those who live inland, where the mountains tower up to almost 2,000 metres, find it difficult to earn hard cash. The town markets are far away, which is why many, including beekepers such as Pan Zhengge, live directly on the main link road. Their customers are typically people who drive by, thus saving Pan Zhengge and his four colleagues from having to carry their honey kilometres from the forest to the markets. The hundred bee hives belonging to Pan Zhengge and his colleagues stand just behind a bend in the road leading from Xialu into the Wuzhishan Mountains. The five of them live well from their hundred queen bees and countless thousands of busy helpers. For the roughly eight kilos of honey which they sell every day they receive about EUR

Beekeeper Pan Zhengge and his colleagues live from the honey they sell at the roadside.

Yun Yongxing's livelihood is based on Shuiman tea sales. He found this valuable wild tea variety in the mountains 20 years ago.

18. The eternally blossoming tropical landscape makes ideal conditions for the bees. "Down in the valley there is a lychee plantation", says Pan Zhengge. "Our bees love their blossoms. But they also pollinate the many other plants which flower here." He explains as he wears a protective net over his face that, of course, he gets stung a lot, "but it's good for blood circulation".

A few kilometres away in the village of Shuiman, the bites of leeches, which tea grower Yun Yongxing gets when he visits his tea fields to collect tea, are less painful than the bee stings. These blood sucking parasites, a few centimetres long, love tea plantations, but they like human blood even better. In Germany, these creatures are widely used in alternative medicine. Early in the morning when Yun Yongxing and his wife Mang Haining drink their first cups of tea, the vegetation is covered in a veil of thick, damp mist. The morning dew of the mountains is ideal for growing tea, the green leaves flourish in it. Twenty years ago, Yun Yongxing, who is now 50 years old, discovered the tea plant, which he now markets as Shuiman tea, growing wild in the mountains. Today, this tea is the basis of his livelihood.

Yun Yongxing tells us that the bulk of the green tea sold by the local rural cooperative (to which ten families now belong) is still today collected wild in the mountains. Only a smaller part of their production is made up of cultivated tea. "Our product is one hundred per cent organic", he says. Even in relatively inexpensive China, this comes at a price: a kilo of Shuiman tea costs CNY 160 – roughly EUR 16, a whole month's wage for many farmers. Even though it is comparatively expensive, the demand is very high and the ten families cannot meet it. "We could sell a lot more

Although this tea is quite expensive, the ten family strong sales cooperative can't keep up with the demand.

Chen Guangbo, one of three leaders of the Farmer Field School in Shimen, shares his knowledge with other farmers.

than we harvest", says Yun Yongxing with some pleasure, taking another sip of Shuiman tea – the costly, yellowly golden coloured beverage with a strong taste.

In Hunan, to the North of the Wuzhishan Mountains and a full three hours by plane, it is still winter. Even though it is bleak outside, families are going out to the fields to work – but also to receive further training. Today, in Shimen, a village of 300 deep in the mountains, some 20 people are standing round Chen Guangbo in a semi-circle. He is one of the leaders of the Farmer Field School, and has been trained by the project in Shimen. Chen Guangbo is now passing on what he has learned to this self-organised group of farmers. Topics close to the hearts of the Shimen farmers are up for discussion, for instance, how they should plant their citrus fruits so that they are well rooted. "You have to make sure that the roots are not too long", says Chen Guangbo. "And you have to cut off the side shoots. Only then will they root firmly, and grow up strong." The farmers nod in agreement, they smoke and laugh a lot. Then they have a go at it themselves.

Li Changquan and his wife Liu Jixiang know how to plant citrus trees so that they grow robustly. Oranges have become a major source of income in Shimen.

The orange trees have become one of the main sources of income in Shimen. Liu Jixiang and her husband Li Changquan, for instance, harvested 12,000 kilos of the citrus fruits last year. This earned them CNY 20,000, or EUR 2,000 – a considerable amount of money. It was, therefore, well worth the family putting into practice what they had learned at the Farmer Field School. "At harvest time, I can carry 50 kilos on my back in the bamboo baskets", relates Liu Jixiang proudly. This means that she and her husband Li Changquan went back and forth from their orange orchard at least 250 times to bring in the harvested fruit.

Li Changquan is convinced that the agrobiodiversity project presents a great opportunity for Shimen. "It is very important for us to learn how

The value of Shimen's plants lies in their being so diverse.

to make use of a variety of plants properly", he says, "because we farmers grow and market local varieties here in Shimen which exist nowhere else. With these old varieties we earn more money than we used to".

Chen Guangbo takes us to the old village school which has now been taken over by the Farmer Field School. On a shelf there are lots of jars and bags – seeds, which he begins to unpack. They are rediscovered treasures, varieties of cereal and vegetable which grow only here in their village, in Shimen. Sometimes, they amount to little more than a few handfuls of seed. But for the families in Shimen they represent new crops to be grown and harvested. There are particular varieties of sunflower seed which are rounder than those found elsewhere, there is red and white maize, and there are local varieties of chestnuts which have a different taste from the introduced varieties, so they are especially marketable.

Chen Guangbo knows that what makes them valuable is the existing diversity. "This here is red rice", he says, allowing it to run through his fingers. "Last year I gave this old variety of rice to some high officials as a present. This year I will make a good profit out of it."

Suggestions for further work: farming in changing times

Over the decades, Chinese farmers have experienced many changes – the transition from traditional farming to a planned economy, then to conventional farming and now once again back to more traditional systems with the introduction of some ecological aspects.

What is agricultural production like where you live? What is being grown there today? What did it use to be like? What new approaches are there? It could be, for instance, that there were orchard meadows nearby, as in many villages in Germany in the past. These have often been abandoned or used for some other purpose. Perhaps there were also agricultural production cooperatives, such as there were in the German Democratic Republic, or common land where the village cattle could graze. Perhaps too, the area had so-called "grazing woods" in which cattle or pigs were herded. Try to find out!

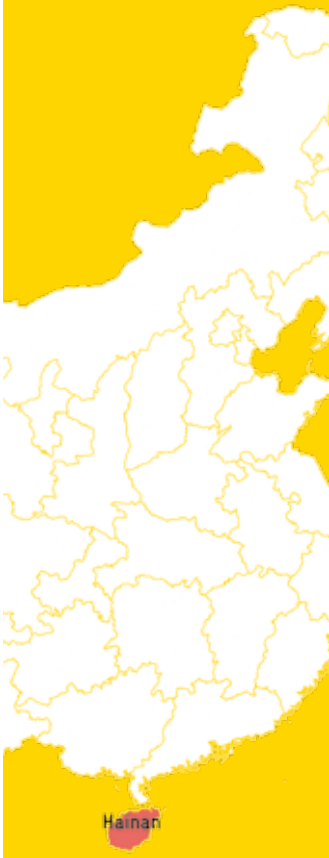
Infobox: a distinct breed

"Actually", says Deng Mingzhong, "we knew nothing about pig breeding. But about three years ago we began breeding them, not just for our own use, but also to sell. We thought this fits in very well with the agrobiodiversity project." The Wuzhishan pig is a local breed which would have been threatened with extinction if Mr. Deng and like-minded farmers from the villages had not taken up raising it. Now one can see the omnivorous creature everywhere in Shuiman, wandering next to or over the road, its snout in the rubbish, four of them by the village pond or dragging their stomachs across the ground between houses. The Wuzhishan pig roams everywhere, just like Indian cows, except the cows in India are sacred, whereas the Wuzhishan pigs are simply treasured for being particularly fat, and thus are ready and welcome candidates for the butcher's knife.
The Wuzhishan pig can be considered a bio-pig, fattened up in Shuiman with the remains of banana and soybean plants and food scraps – all without artificial growth stimulants or hormones. The fact that the Wuzhishan pig is bred and thrives only here has given it special meaning to local people, who take great pride in their regional heritage. This holds true despite the fact that the breed does not command a higher price. "We get the same per kilo as for the normal domestic pig", says Deng Mingzhong. "But I still want to carry on breeding Wuzhishan pigs". After all, he gets a lot more cash for a pig than he does for a few kilos of beans or rice.

The traditional Wuzhishan pig would have died out had the Shuiman small farmers not started to raise it again.

Portrait: wild vegetables instead of agro-chemicals

Lin Qihui and Li Guixiang have learned new methods of cultivation in the last two years. Today, they are producing in a more organic way and at the same time increasing their income.



Like the other 60 families in the village, Lin Qihui and Li Guixiang gratefully accepted money from the government to build a new house for his family of seven. In many Chinese villages, the government subsidises house-building with cheap loans. An altogether fresher wind is blowing in Xialu, Hainan. Three years ago, agricultural experts from the agrobiodiversity project came to the village. They explained how damaging pesticides can be for health and the environment. Instead of cultivating just a few plant varieties and applying vast amounts of agro-chemicals, people should think, they said, of working with a wide pool of plants and using much fewer chemicals. "We then had many discussions in the village about toxic substances. We are now, once again, eating many more wild vegetables", says Lin Qihui.

The 49-year-old is a small man with a narrow face and a head of strong, black hair. His wife, Li Guixiang, is a few centimetres taller than him. She says that they lead a quiet life here, with both men and women on equal footing. "There is no great difference between men and women here. In the morning, I discuss with my husband what there is to do, and then we go out to work together in the fields." She tells us that the women take care of the children, but only in their early years: "When the children get bigger, men look after them too."

These days, Lin Qihui no longer buys seed from a seed merchant for the rice grown to feed his own family. Instead, he grows it from seed he has saved from a part of his own harvest. He opens the door to his little store room at the rear of the unpainted house and points to a broad bamboo bowl holding rice seed. "It is true that this rice does not yield quite so much, because we grow it without pesticides. But we stay healthy", he says. Lin Qihui first grows his rice plants from seed and then transplants them out in the flooded fields.

Rubber trees are one of the family's most important sources of income. "I earned 3,000 yuan from the sap of the trees last year", says Lin Qihui. This is roughly EUR 300 – a lot of money in rural China. The cultivation of rubber has recently become even more lucrative for Lin Qihui. In one of the regular agrobiodiversity trainings in the

Lin Qihui and Li Guixiang pose proudly in front of their new house. They could build it with a government-subsidised loan.

Farmer Field School he has learned a new cutting technique for tapping the rubber sap. Now, instead of cutting trees every day to harvest the milky liquid latex, he only has to do it every three days. "That saves the farmers a lot of work and produces the same, if not higher, yields", says Li Qingsong, the project coordinator on Hainan Island.

Lin Qihui tells that he has learned something else of crucial importance at the Farmer Field School – the method of intercropping. "If I plant the seedlings, small rubber or banana plants for instance, between my Chinese date trees, then I save a lot of space elsewhere. I don't have so far to go to the seedlings, so I'm saving time as well as space". This also brings him extra income. "And the project has come one step closer to achieving its objective of fostering agrobiodiversity", says Zhou Wenzhong of the county's agricultural authority.

He is the project's intercropping specialist. He has drawn up various models on an information sheet which he shows to Li Qingsong. The agrarian engineer is keen to explain the interplay of sun and shade for various plants, as well as the advantages to be derived from growing different plant species in one place, or so-called multi-storey farming. Lin Qihui now knows, for instance, that "one can for instance combine the areca palm ("betel" nut) with papaya, beans and maize". The palms grow 30 metres tall and the mostly unbranched, tree-like papaya grows up to three to ten metres tall, while maize grows only one to three metres. Beans, which are rich in starch and protein, can grow between these trees, and climb up them. This is how, in some of the fields of the Xialu farmers, new plant communities and habitats are being created again. And with a bit of luck with the harvest, Lin Qihui and Li Guixiang will soon have earned enough money for a few pieces of furniture in their new house.

Rubber is an important source of income for the family. By participating in a Farmer Field School workshop Lin Qihui learned a new cutting technique for rubber tapping.

Interview: a question for the world community

Chinese Project Director Wang Guiling of the Ministry of Agriculture of the People's Republic of China and German Project Director Luis Waldmüller of GIZ explain in a joint interview how the GIZ-supported agrobiodiversity project, which will be finalized by the end of 2011, has emerged and talk about their work together.

Mrs. Wang Guiling, Mr. Waldmüller, why did the People's Republic of China and the Federal Republic of Germany start a joint project for the conservation of agrobiodiversity in China's rural mountain regions?

Wang Guiling: Protecting agrobiodiversity is not an issue for a single group, or for a single nation. This is why the conservation of biodiversity in China is not only important for the Chinese, but for the world at large. Only by promoting agrobiodiversity can we conserve the genetic diversity of cultivated plants for the benefit of the whole world. China itself is concerned about conserving a gene pool which is of crucial importance for the development of our rural regions. This gives farmers the opportunity to develop and to create new sources of income.

Luis Waldmüller: China is an important gene pool for many field crops, for rice, for soybean, for kiwi – all originate in China. There are still many local varieties here. In view of food security and climate change, and of adaptation to changing circumstances, conserving these local varieties is also an important goal for Germany. We do not limit ourselves to the agricultural crops which are already known, but we also consider the wild relatives of these crops. In this area, in the future, opportunities can evolve in the medical and agricultural sphere which can also be in Germany's best interests.

How does cooperation of this kind emerge?

Luis Waldmüller: A project arises out of a dialogue between two governments. Various topics of cooperation are discussed and priorities set. The crunch comes when it is decided to implement a project, for instance, on agrobiodiversity. The experts have to exchange views and agree on a planning document for the project. Workshops are held, there are discussions about the objectives and results we want to achieve, and which activities are needed to get there. Representatives from the whole country come together, from the national, provincial, and county levels. Many people are involved, it is real teamwork. My task as project director is steering and monitoring the process. In other words, it is my responsibility to ensure that the project runs smoothly, and that we actually achieve the intended results.

Wang Guiling: The most important thing for us is the dissemination of knowledge. In China, we need to stay abreast of new knowledge, and this includes the scientists in our universities. For us on the Chinese side, the main thing is to get ideas and good examples of agrobiodiversity management from the German side. How it works is that the German experts make a proposal, and I then attempt to coordinate this on the Chinese side. I am, so to speak, the link between the German project proposals and colleagues on the ground.

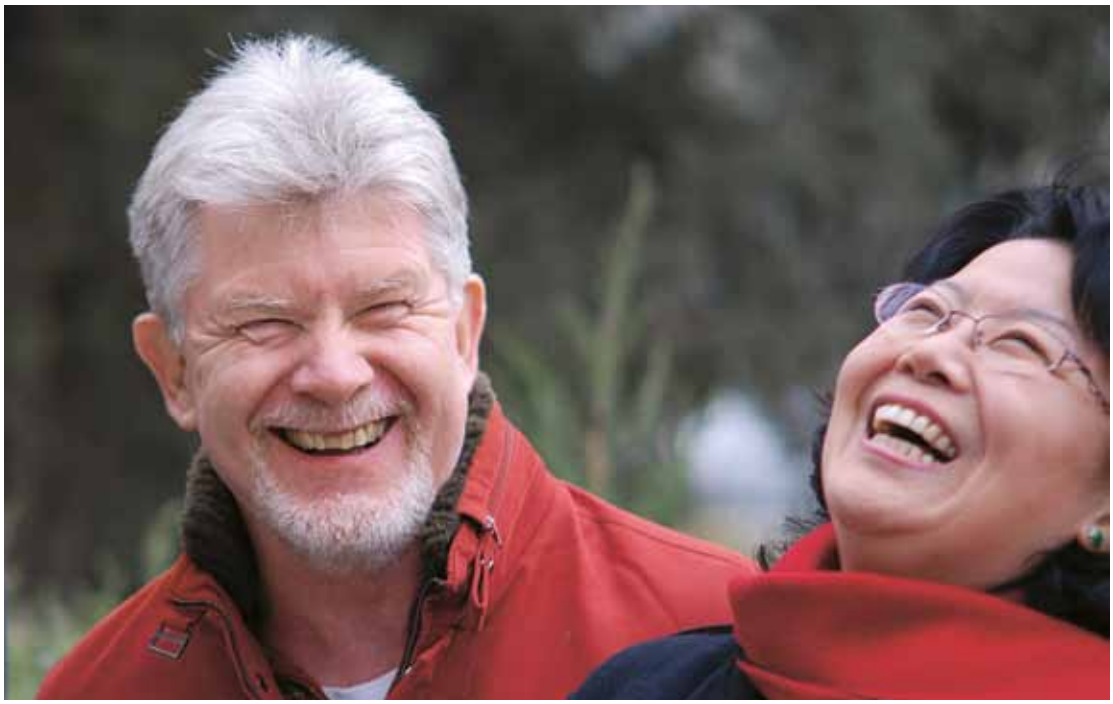
Luis Waldmüller: It is about content, but also about methods and techniques of implementation. This, and the integration of farmers, are where China quite clearly has to catch up. We are thus promoting public participation and discussion with farmers. Germany has decades of experience of development cooperation in Asia, Africa and Latin America, which we want to introduce and apply here.

Where do the difficulties lie?
Luis Waldmüller: There are clear differences between our working methods. For instance, our Chinese partner experts draw up annual plans which tend to be general and sparse in detail. Therefore, it is a learning process for our partners to draft a very detailed plan of operation, and then to implement it with the participation of farmers. The Chinese experts tend to implement the planned measures themselves directly, in order to fulfil the plan. Farmer participation often gets shortchanged in this approach. Most experts are very active and energetically involved in the project work. This is different from other countries where I have worked – for instance, parts of Africa or other Asian countries. You get a very real sense that China has the wind in its sails.
Wang Guiling: There are many examples of good Sino-German cooperation. Our own Ministry's cooperation is one of them. China is, of course, a country which is evolving, a developing country even though the economy is growing rapidly. But we Chinese should not forget biodiversity. I am giving it my full backing and am discussing this with other government departments.

What will happen to agrobiodiversity in China when the Sino-German project ends in December 2011?
Wang Guiling: Interest in the topic of agrobiodiversity has grown enormously in China. It is occupying the attention of increasing numbers of scientists. This is a promising sign. Quite apart from the fact that we have learned and achieved a lot in the project sites, it is very important that what we have learned continues to be put into practice in the future. To this end, we have also entered into cooperation agreements with other countries and institutions. For example, with the help of funding from the European Union (EU-China Biodiversity Programme, ECBP), the agrobiodiversity project is being extended to other mountain regions in China. We are also collaborating with the United Nations Development Programme (UNDP) in the sphere of agrobiodiversity, specifically on wild relatives of crops such as rice, wheat and soybeans, which are abundant in China. Our hopes, therefore, are very high.

Find out more about the agrobiodiversity project on the project flyer and description and in an additional interview with Luis Waldmüller – all available as PDF files on the accompanying DVD.

Mrs. Wang: "[…] the conservation of biodiversity in China is not only important for the Chinese, but for the world at large."



3.2 Wild relatives of crops in China: an agricultural treasure chest

Background: important plants for feeding the world

Rice, wheat and soybean are among the world's most important plants. As food and fodder, they provide the daily diet of a great part of the world's population. In China, too, rice, wheat and soybean are the base of the food pyramid. Even today, in the country where a fifth of all humankind has to be fed, wild forms of these three plants are still to be found. They are vital for the survival and continuing evolution of agricultural plants, especially in these times of climate change. But their survival is under threat.

"If you want to be happy all life long – eat rice." This Chinese proverb neatly sums up the importance of the cereal for China. Rice is China's most important cultivated plant. Many scientists believe that rice was grown in the Yangtze delta more than 13,000 years ago, while others estimate that cultivation began between 9,000 and 8,000 years ago based on archaeological evidences. In India, the country with the second largest population in the world, rice has also played a crucial role for many thousands of years: on the Vindhya range in Central India, the remains of cultivated rice have been found which point to it having been grown there between 8,000 and 7,000 years ago. Today, rice is the staple food for more than half of the world's population, making *Oryza sativa* the most important food plant in the world. Rice has a pivotal role to play in food security worldwide.
This species of cereal is grown in more than hundred countries and on every continent except for Antarctica. In 2009, on a total of 161 million hectares worldwide were cultivated and 679 million

Rice is China's most important crop and the main staple for over 50 per cent of the world's population.

tons of rice were produced, the greater part of 612 million tons were in Asia. China and India are by far the biggest producers of rice in the world with 197 and 131 million tons respectively.
Wheat is almost equal in importance. It occupies a total area of 225 million hectares and yields a total of 682 million tons in 2009. Because wheat, in contrast to other species of cereal, has a high gluten content, wheat production over the past few years has risen more sharply than that of rice. Gluten protein has a high degree of elasticity, essential for baking good bread. In Asia, wheat now accounts for more than 19 per cent of total calorie intake. Wheat is also a member of the grasses family, and is said to have been first grown in the Near East 9,800 – 7,200 years ago.
The soybean is a pulse which grows in subtropical and temperate climatic regions. Soybean originates in China and reached Europe the first time in the 18th century. Because of its high oil content, soybean is typically processed into oil. The byproduct of processing oil from soybeans, soybean press cake or oil cake, is due to its high soybean protein contents of 40 per cent and more among the most important feeds in animal production. A further important side product of soybean oil production is lecithin, which is used in the food industry as an emulsifying agent. These agents are used to blend two basically non-mixable liquids such as oil and water into an emulsion. Moreover, because of its high proportion of basic nutritional elements such as Vitamin A and B, and valuable proteins containing all essential amino acids, soybean is now to be found in countless industrially manufactured foods.
There is an increasingly critical attitude of the public that soybeans in the main producing countries, the USA, Brazil and Argentina, are grown with genetically modified seeds. This brings dangers such as the pollution of wild forms and varieties of soybean which have not been genetically modified. In China, the fourth largest producer of soybean in the world, growing GMO soybeans was prohibited. Primarily in Asia, the green husks, or pods of the soybean are eaten fresh as a vegetable. Very popular there as well as with vegetarians worldwide is tofu, which is made by reducing soybean milk and is found in markets throughout Asia in many different forms. Soy sauce is another popular product of the soybean.
Soybean, wheat, and rice are all essential for feeding the world's population and for securing humankind's food supply. All three belong to the world's most cultivated plant species.
The present high yields of these three plants are the result of several thousand years of breeding by man. Many dozens of generations of farmers have set aside a portion of their harvest as seed to be planted for the following season's crop. Women were considered to have a better eye for seed quality and frequently the task of selection was entrusted to them. To achieve better yields, farmers exchanged seed amongst themselves. For some decades now, agricultural companies have been specialising in producing seed that farmers can purchase. Farmers receive quality, high-yielding seed that they no longer have to select and set aside themselves. They do, however, have to pay for it. Breeding plants to improve their taste and make them easier to manage has over the centuries, considerably changed their appearance.
Alongside the cultivated plants man has developed, rice, wheat and soybean have also managed to survive in their original form. They grow wild in nature and are products of a selection process determined by climatic and other site conditions

Tofu – made from soy milk – is available in many variations in Asian markets, as shown here in Hainan.

and influenced by diseases and pests. These "wild" plants naturally developed from the earliest, original form of the crops we have today as a result of being bred by man. They are technically referred to as "wild relatives of crops".
Wild relatives are sometimes substantially different in appearance from cultivated plants. Wild soybean for instance, in contrast to their cultivated relatives which do not need the help of other plants, are climbing plants which require other plants to grow towards sunlight. Their stems are correspondingly narrower and more flexible to enable them to wrap around other plants. Wild soybean grows up to seven metres high, thereby making it several times taller than its domesticated relative. Its flowers and fruits, however, are several times smaller.
By careful breeding throughout history, man has succeeded in increasing the yield of the soybean considerably. Wild soybeans can be found throughout the soybean-growing regions of China.
Wild rice plants also differ considerably from the cultivated ones. They form a much longer stalk which bends under the increasing weight of ears, but produce fewer grains. Wild rice is also becoming increasingly hard to find today in China,

where it originated. Because it needs a lot of moisture, it occurs almost exclusively in low-lying land, such as swamps or on the banks of streams and rivers.
Wild wheat, on the other hand, is much more common. In contrast to the annual crop which farmers grow, wild wheat is a perennial crop that forms new stems and ears every year. Wild wheat is an extremely adaptable plant. Over time, its wild varieties have evolved to withstand temperatures varying from as low as negative 40 degrees Celsius in winter to extreme heat of 50 degrees and more in summer. Even in exhausted soil which can retain very little water, wild wheat is able to form seeds and reproduce itself. Cultivated wheat, which is an annual plant, can produce under such conditions only poor yields, if it can survive at all. It has to be watered regularly, and provided with additional nutrients – something which takes enormous effort in areas where it is very hot in summer and there is little rainfall.
Some wild varieties of wheat have developed abilities which are absent in cultivated wheat. This makes them extremely valuable.
Through the course of evolution, many wild plants have developed special qualities of their own. This has ensured that they survive, even in marginal locations. Some can grow in the desert, some withstand floods, while others remain unaffected by ultraviolet rays which would damage many other plants. They have also evolved their own survival mechanisms against diseases and pests which farmers now fight with pesticides. A high level of resistance is attributed to wild plants in general and scientists discovered these characteristics developed by wild plants several decades ago. But it is only in the last few years that agriculture has begun to focus more clearly on singular qualities. By crossing cultivated varieties or using genetic methods, plant geneticists have, over the last few decades, bred or developed in the laboratory many (high-yielding) plants designed to meet special demands. For more than two decades, breeders have been devoting themselves increasingly to wild plants. This results from the desire to use some of their specific characteristics and qualities in agriculture by transferring selected characteristics of wild plants into cultivated plants through crossing. Characteristics which have developed in nature through evolutionary

Rice, wheat and soybean may still be found in the wild – as so-called "wild relatives of crops". In general, wild wheat is well adapted to difficult environments.

The wild relatives of our crops are often able to survive in marginal locations. Through cross-breeding they can be used to improve food security in times of climate change.

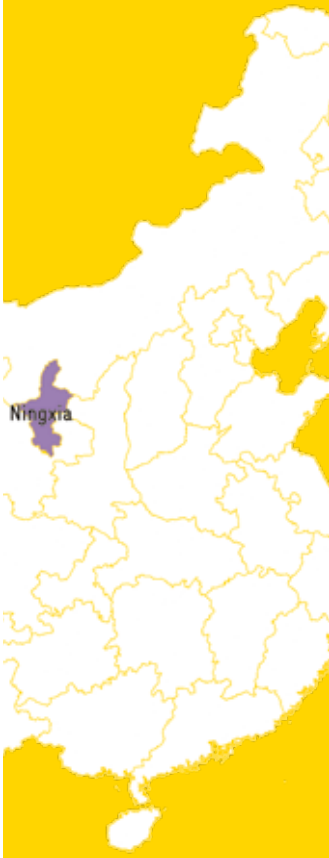
processes can be achieved by breeding only with great difficulty.
Frequently, cross-breeding proves to be less complicated than genetic modification. In the case of rice plants, for instance, plant breeders can create a stable plant within seven to eight generations by cross-breeding. Doing this using genetic engineering usually takes a lot longer. The wild relatives of crops, with their unique adaptive strategies and gene pools, are of particular interest in view of climate change. Breeders and farmers can learn from them how to cope with changing conditions under climate change. They can make use of these characteristics by crossing wild plants with cultivated ones. In doing so, science and breeding are, therefore, copying the evolutionary survival strategies of wild, natural relatives of crops. Predicted global warming resulting from climate change makes these plants ever more valuable. Scientists warn that an increase in temperature of just one degree Celsius will lower global crop yield by ten per cent. A transfer of characteristics that allow survival despite high temperatures from wild relatives to our crops would make a great contribution to food security for humankind.
This is why the project "Conservation and Sustainable Utilization of Wild Relatives of Crops", which is working in close collaboration with the GIZ-supported agrobiodiversity project, has set itself the goal of conserving these three important food plants – rice, wheat and soybean. All three have to be conserved where they grow in nature. Only through such efforts will humankind, in the future, be able to benefit from wild plants which are crucial to food security.

Suggestions for further work: the most important food plants

Find out what the most important food plants are for Germany and China. Do wild relatives of these cultivated plants still exist there? Compare the situation in the two countries: who imports and who exports food – and to where? Of what significance is that for society?
And now a biological task: find out what different species of wheat there are, and how they differ (diploid, tetraploid, hexaploid wheat). Do you know what can be made from them, and to which species Einkorn wheat, spelt, durum wheat can be assigned?

The following texts deal with the topic in greater depth:

- The **reportage** depicts how the project is protecting wild wheat at the edge of the desert, and shows how people on the ground are profiting from this.
- In the **portrait**, the Chinese married couple, Liu Shiling and Wang Zhiqing, relate why they will soon be leaving their farmhouse and why they now no longer look upon the soybean as just animal fodder.
- In the **interview**, rice expert, Professor Lu Yixuan, explains what potential there is in wild rice varieties and why a shortage of water is one of the biggest problems when growing rice.



Reportage: sheep and wild wheat

The province of Ningxia borders on the Ordos Desert in Inner Mongolia. Even though the landscape appears bare and hostile, many plants grow in the desert, among which are many that are valuable as food resources. Wild wheat grows there, for instance, despite the most difficult conditions.

There are moments in China when one asks oneself if the motorway has been built for our car alone. This is one of those moments. We have barely left the Yinchuan Airport and turned onto the motorway in our jeep when we find ourselves about the only souls on the road. Sometimes, we drive for half an hour before seeing another car. "The motorway is an investment for the future of our country", says Song Dongfeng from the Ministry of Agriculture. He is the coordinator of the research trip, and the interpreter. Also in the car is the botanic specialist, Dr. Li Jining, Professor of Biology at the University of Ningxia in Yinchuan. On the left, a legendary piece of China's past appears: the Great Wall. The seemingly endless wall of earth, weathered by the centuries, snakes through boundless expanses, through a grassy steppe, a desert-like landscape. There is not a tree in sight. At certain points, openings for roads have been cut through the Great Wall, and at others you find houses or stables built right next to one of the wonders of the world.

That morning, two of us had set out from Yunnan, two thousand kilometres away in the Southwest part of China, and had flown from bustling, heavily populated Kunming to the edge of the largely uninhabited, hostile Ordos Desert in Ningxia to the Northwest. China reveals itself today to be a country of extremes. Repeatedly during the journey, we get a glimpse of massive

In the bleak landscape of Ningxia Province many plants grow despite tough conditions. Wild wheat may also be found here.

industrial coal and oil facilities. This is where a large part of China's mineral resources, found here in the mountains, are processed. Meanwhile, in the villages we will be visiting, conditions are simple, even impoverished sometimes.
For example, the family of Jia Shume and her husband Hou Shuting. Like all farmers in the region, this family of five makes a living rearing sheep. For many generations, the Yanchi region has been known for its sheep meat. People here say it is the best in China. But Jia Shume and Hou Shuting recently had to sell their hundred sheep. "We are both sick and need money for our medicine", says Jia Shume quietly. The couple has three children, two daughters and a son. In spite of being ill, the family enjoys its weekend together. During the week, all three children go to school. The eldest daughter, 14-year-old Hou Yangin, tells us that school fees and books are paid for by the government. The parents spent half the money they earned from selling the sheep on new medicines. When the wild relatives of crops project – which the Ministry of Agriculture of the People's Republic of China is carrying out here, with co-funding from the Global Environment Facility (GEF) and administered by the United Nations Development Programme (UNDP) – builds new sheep pens, they want to use the other half to buy sheep to start breeding again. "We are hoping to get favourable credit terms, so that we can build up our flock of sheep again", says Hou Shuting.
The county of Yanchi is poor – but also rich, and not just due to coal and oil. For here, in the isolation at the edge of the desert, wild wheat is growing. This is not so unusual. But the wild wheat which survives here can withstand extreme weather conditions. "In this region, the sun shines for almost 3,000 hours a year. But annual rainfall is only about 300 millimetres, with an evaporation rate of 2,000 millimetres", Li Jining, the botanic scientist, tells us. "In other words, six times more water evaporates than rain falls." The wild wheat has to cope not only with severe water shortage. Yanchi is repeatedly subject to sandstorms, and the soil is saline. "Plants which can survive such extreme weather conditions are very well adapted to the climate. They have a valuable genetic make-up", says Li Jining.
Li Jining is very much at home in China's enormous deserts. The scientist shows us the project site, an area of 165 hectares in the unending steppe. Today, Mr. Li's beaming smile rivals the sun.

The living conditions in the Yanchi Region villages are basic: in winter a fire is lit in the oven under the bed on which the whole family keeps warm.

But Yanchi is also "rich" according to desert specialist Dr. Li Jining: "When we consider that climate change will bring even [...] more droughts in some regions, the genetic make-up of wild wheat controlling the drought tolerance is particularly valuable."

"It rained here two days ago. Now, on the very edge of the desert, everything is in bloom", he says, pointing to a caterpillar which will soon emerge from its chrysalis as a butterfly. The rain makes it possible, from one day to the next, for flowers to sprout from the earth and bloom. "Plants are so well adapted that, after months without rain, the tiny amount of water the rain brings is enough for them to flower right away and reproduce themselves", says Li Jining. "The soil here is anything but favourable for plants. It is sour and infertile, and absorbs very little water." The botanical expert is taken with two plants in particular, wild relatives of wheat. One of them is particularly valuable. "The Chinese Ministry of Agriculture lists it as the second most endangered wild plant in the whole of China", says Mr. Li – and here it is growing everywhere. The plant, which can grow for up to eight years, easily withstands temperatures that vary from 50 degrees Celcius in summer, to 40 degrees below zero in winter. "The ears and stalk die off in winter, but the roots survive", says Mr. Li. This ability to tolerate temperature variations of 90 degrees in conditions of extreme drought makes these plants particularly interesting to scientists. "When we consider that climate change will bring even greater swings in temperature, and even more droughts in some regions, their genetic make-up controlling the drought tolerance is particularly valuable", says Mr. Li.

In order to learn how wild wheat relatives survive in nature, it is important to conserve them on the spot, i.e. *in situ*. Li Jining inspects the marker poles with which the scientist and his team have divided up the protected area in order to measure how far the two species have spread. "We are very pleased that we are able to protect them here at once", says the scientist. "Once the desert has buried them, then they are lost for us and for humankind."

Portrait: arable land in short supply – and not just for wild soybean

Liu Shiling and Wang Zhiqing live directly adjacent to a protected zone for wild soybean. Yesterday, this wild form of the soybean was fodder for the farming family's cattle. Today, in their remote village in Tongbai County, the plants are being protected in their original form.

"Look, this is also wild soybean." Liu Shiling carefully picks up the delicate climbing plant with hands roughened by working in the fields, and points to a purple flower: "Wild soybean grows everywhere here", he says. In the last ten minutes, he has repeatedly pointed out the creeper clinging everywhere to other plants along the side of the path. Tongbai is a paradise for wild soybean.
Just a few metres further, across a little ditch and up the hill, the traditional farmhouse appears where Liu Shiling and Wang Zhiqing have spent their lives. It is a fine old farmhouse built out of stone and tiles and plastered with brownish grey clay. The roof is made of traditional wooden tiles, the ridge is decorated with a row of ornamental shingles with mythological figures fixed to the ends of them.
Beneath the roof, golden yellow corn cobs are hanging up to dry, and in the courtyard there is a large wooden bowl full of peanuts for drying. The end of summer has arrived and with it harvest time for farming families. This time of the year is significant, too, for 76-year-old Liu Shiling and his wife Wang Zhiqing, who is one year younger. Their house is about thirty years old. "It is a fine, big house for the two of us", says Liu Shiling. But sometime in the next few years, when Liu Shiling and his wife Wang Zhiqing retire, their house will

Wang Zhiqing and her husband Liu Shiling live in an old house. It will soon be demolished to make way for more agricultural land.

be demolished. “Many of our neighbours have already moved to the town”, says the old farmer, Liu Shiling. “Where our house now stands, there will be new fields.”

Because the population is growing year by year, the most heavily populated country in the world has to produce more food. In order to do this, China needs more agricultural land. This is why hundreds of farming families have already left this region for the town. Many of them commute daily from there to work in their fields. Is Wang Zhiqing not sad at leaving the place where she has spent her whole life? “No, not at all”, she says. “Houses in the town are much better equipped. They are modern, and a lot more comfortable. Here on our farm we have to draw our water from a well. In the town we will have running water and a flush toilet.”

Liu Shiling and Wang Zhiqing live on the edge of Tongbai County in the province of Henan. Located immediately behind their house are the 83 hectares of land recently designated – under the wild relatives of crops project – as a protected zone. To prevent damaging the soybean, farmers are no longer allowed to use the land. The plant has to develop naturally, free of human influence. The protected zone is managed by project staff at the county level. They are supported by scientists who regularly take samples and run checks. This region, not far from the Yellow River, is where the settlement of China began, thousands of years ago. This, too, is where the soybean originates. It is also why, according to the experts from the Ministry of Agriculture in Beijing, wild soybeans found here most closely resemble soybean in its archetype.

Farmers such as Liu Shiling are now no longer able to till their fields in the protected zone, nor are they allowed to use pesticides in the surrounding area. “That could damage the plants”, he says. He knows this from a film about the potential of wild relatives of crops which the project produced to introduce the community to the need to conserve these plants.

Doesn’t it upset him and other farmers that they are no longer allowed to cultivate the fields in the protected zone, which lies directly behind their land? “No”, he says. “We now know that it is important to protect these plants. We used to pull them up and used them to feed the animals. We don’t do that anymore.”

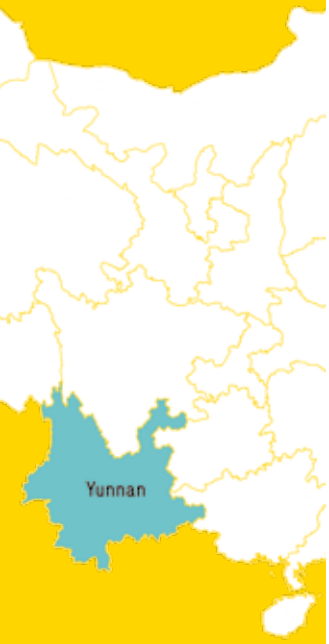
The project helps here by offering the farmers financial support and training to improve their agricultural skills and knowledge. “We are soon going to start building a new road to our fields with the money. We will then be able to harvest more with less work“, says Liu Shiling. Until now, the only way to the fields is on a clay path, which become very slippery when it rains. This makes it difficult to transport tools and crops.

Liu Shiling and Wang Zhiqing want to help build the road, and to stay here until it is finished. “Then we will move to our son in town”, say the two of them.

The protection zone for wild soybeans starts just behind Liu Shiling and Wang Zhiqing’s house. The area was established under the wild relatives of crops project in cooperation between the Ministry of Agriculture of the People’s Republic of China and UNDP.

Interview: rice is not just rice

Professor Lu Yixuan, former director of the Plant Institute in the Faculty of Agriculture at Kunming University in Yunnan, devotes himself entirely to research these days. The Plant Institute employs 160 people, of which 100 are scientists. The 57-year-old is married, with one daughter, and lives in Kunming, the capital of Yunnan Province.



Professor Lu, Yunnan is a good place for a scientist to be studying rice, isn't it?
Certainly. There are only three species of wild rice in China, and all three are to be found here in Yunnan. In China we have roughly 50,000 varieties of cultivated rice, a number found nowhere else in the world. This means that we scientists have a very rich resource to draw on.

What topics are you engaged in at your institute in Kunming?
I have been working for 30 years at the Plant Institute in Kunming. For the first 20 years, I devoted myself to researching rice and its origins, and for ten years I have been working mainly on cross-breeding rice, crossing cultivated with wild rice, for instance. There are many scientists in China who are working on rice. We also exchange our results and experiences with Germany, Russia and the Southeast Asian countries.

What have you and your colleagues achieved so far?
China is very well established in the field of rice research. The breakthrough came in the 1970s when Professor Yuan Longping used crosses with wild rice to achieve male sterility and with it the possibility to develop new varieties. This first successful hybrid variety raised yields considerably – by about 20 per cent. That was the most important step forward in rice breeding.

Does that mean that wild rice is very important in breeding?
For the foreseeable future, there will not be another quantum leap such as Professor Yuan Longpin achieved with the breeding of hybrid rice. But theoretically, we could cross all the wild rice, worldwide, with all the cultivated rice. The exciting thing about wild rice is that, over the centuries, it has – by means of a natural, evolutionary

"The exciting thing about wild rice ist that, [...] it has [...] developed strategies for surviving all weather conditions and establishing itself in nature." – Professor Lu Yixuan is one of the most renowned Chinese scientists researching on rice.

development – developed strategies for surviving all weather conditions and establishing itself in nature. A very powerful and valuable genotype has emerged in the process, one of which we are studying at present.

For example?
One of the three wild rice species is called *Oryza officinalis*. It has developed a genotype which enables it to combat pests and disease very effectively. This, of course, is of enormous interest to research and farming. We are investigating how we can make best use of these strategies. Then we could achieve much higher yields, and farmers would not have to use so many pesticides.

Is it that simple? You cross one plant with another, and already you have a new variety which you can grow?
No. As a rule, it takes seven to eight plant generations before you can produce a stable new variety by crossing wild rice with cultivated rice. Then you still have to duplicate it and introduce it into the market. It is, therefore, a lengthy process, but nevertheless faster than genetic engineering.

Do Chinese farmers produce their own seed?
Not as a rule. Farmers produce seed only from a few local varieties saving a part of the harvest as seed for the following year.

What tasks have to be faced by agriculture and rice research at present?
China's population is growing at a tremendous speed, but the amount of available arable land cannot be extended indefinitely. This means that we have to grow higher-yielding varieties which provide higher yields per unit of cultivated area. But the high-yielding varieties are, as a rule, grown as paddy, requiring a lot of water, and our main worry is that water resources are dwindling.

How much water do you need to grow rice?
In Yunnan, for example, rainfall is comparatively high. Nevertheless, rain accounts for only 20 per cent, on average, of the water needed to grow high-yielding paddy varieties. This means that 80 per cent of the water must be brought to the plant by irrigation. In addition, farmers of poorer regions often cannot afford expensive irrigation.

How can this be solved?
We are working on increasing the yields of upland rice. For many ethnic groups living in remote regions this would be an opportunity for securing their food supply. Our long-term goal is to breed rice which can survive with as little irrigation as possible, or even with none at all. This is a main focus of our work.

There are only three types of wild rice in China. Protected areas as shown here in Yunnan help to conserve these extremely rare plants.

3.3 Traditional knowledge

Background: keeping knowledge active

The products, values and media of the globalised world and its westernised industrial lifestyle are penetrating ever deeper into even the remotest regions, pushing aside centuries of village traditions, and causing local knowledge and culture to be lost, often forever. Of vital importance to the GIZ-supported agrobiodiversity project is the preservation and development of this traditional knowledge.

Further information: GIZ Factsheet on traditional knowledge

Every ethnic group, every village community, every family exists in its own world. They have knowledge relevant to all their needs, knowledge about bringing up children, food, the weather, how to withstand disasters, the health and raising of livestock, nomadic and settled ways of life, clothing and how to make it, and even death and religion.
Ethnic communities often live in regions with abundant biodiversity. Their highly developed knowledge of the environment and its natural resources has been acquired over centuries, and passed on from generation to generation. This knowledge is called "traditional knowledge". It embodies the experiences, innovations and practices with which ethnic communities maintain their traditional way of life.
The circumstances in which these communities live vary considerably according to environmental conditions. The Saami in Russia, for instance, are well adapted to the extreme cold and darkness of the far North. They know the precautions to take against months of temperatures of 40 or more degrees below zero. Because the vegetation period in the Arctic Circle is too short for growing crops, they live almost exclusively on fish and meat. The

Traditional knowledge embodies experiences, innovations and practices with which ethnic communities maintain their traditional ways of living.

Vivid wall paintings, as on this house in Hainan, show how crops – in this case rice – are traditionally processed and used.

Li people in Hainan, China, on the other hand, know nothing about cold of this kind – they live in tropical heat. They need to know how to guard against diseases such as malaria and their pathogens, or what to do if they are bitten by a snake. The Li people eat a lot of wild vegetables which are easily available at the edge of the villages and, moreover, are delicious and nourishing.

In contrast to the hunters in the Arctic regions, people in the tropics are generally farmers. They cultivate vegetables, cereals, spices, as well as coffee or tea. But also in the tropics – in the Amazon, for example – there are numerous ethnic groups who are hunters and gatherers.
Between the two extremes of the tropics and the Polar Regions, there are habitats of the most

Infobox: Li, Miao and Tujia

Li, Miao, and Tujia are three of the 56 officially recognised ethnic groups in the People's Republic of China. They each represent less than one per cent of the country's total population. The Han, who make up almost 92 per cent of China's population, are by far the largest single group.
With about a million people, the **Li** are one of China's smaller ethnic groups. They live mainly in the central and Southern part of the island province of Hainan. For the most part, they occupy the valleys and basins between the mountain ranges. Traditionally they are farmers, but they also hunt, fish and collect plants and fruits. They live in extended families and their houses, made of bamboo and wood, are traditionally shaped like ships. The Li are known for their fine spinning and weaving.
With almost nine million people, the **Miao** are the fourth largest ethnic group in China. They live primarily in the mountainous regions of several Southern China provinces, but are also found in Laos, Vietnam and Thailand, where they are known as the *Hmong*. Traditionally, farming is the main livelihood activity of the Miao. Normally, all the inhabitants of a Miao village – between 20 and 1,000 families – bear the same surname. The traditional Miao dress has more than 130 different patterns. Every pattern has a corresponding piece of silver jewellery, which is rarely found in any other ethnic group in China.
With a population of eight million people, the **Tujia** are also relatively well represented in China. Most of them live in the Wuling Mountains in the provinces of Hunan and Hubei, and are farmers. They have their own language which, however, has only been conserved in a few regions in the Western part of Hunan. The Tujia do not have their own script, but use Mandarin characters. They live mostly in wooden houses which, traditionally, are built on rocky outcrops. Tujia women usually dress in black or blue. Their head scarves and hemlines are decorated with multi-coloured embroidery.

So that traditional knowledge does not get lost, the agrobiodiversity project staff speak with people on the ground – they document, for example, what traditional clothing is still available ...

diverse kind – deserts, for instance, steppes and also mountain regions where there is little oxygen. People living in all these regions have developed their own culture, and with it the knowledge of how to grow and breed crops and livestock. This knowledge is invaluable: many plants have special nutritional qualities for example, others can be used for making medicine, or play a role in ritual activities.

Thus, it is vital to conserve and protect these different natural and cultural environments so that traditional knowledge about plants and animals is not lost. Staff working on the agrobiodiversity project do this in many different ways. They talk to the local inhabitants and document what traditional knowledge still exists in individual villages. Their analysis encompasses traditional clothing and festivities, village architecture, regional religions, songs, dances and, of course, food. What are the favourite staple foods of the Li people, and what, for instance, do the Tujias in Hunan have at their disposal?

The documentations which are being produced by the agrobiodiversity project in cooperation with Chinese universities could become a valuable resource in the near future. If the pace of China's rapid development of the last 30 years continues for the next ten years, many different ways of life in rural China will disappear, and with them a large amount of traditional knowledge. Already today in many villages, there are only a few old people who still know which plants are edible or

have practical uses such as textile dying, while many of the young generation are more interested in their mobile phones and making easy money. The project staff hope that once traditional knowledge about local dances, food preparation, and the use of medicinal plants has been documented, then it can be better conserved and reintroduced to the younger generation.

The traditional knowledge of local communities is also valuable to foreign business enterprises. Pharmaceutical companies, for instance, are interested in the centuries of knowledge about plants and the way they can affect the human body. With the help of this knowledge, they can develop new medicines and remedies. Seed merchants, too, are interested in the plants cultivated or collected by local communities. They can use this knowledge to breed new plants with characteristics such as resistance to cold, higher yield, or specific substance content.

Everyone would agree: if firms or states derive any material benefits from the traditional knowledge of local people, then the profits must be shared with these people. Nevertheless, it is not always like this. Companies have even taken plants from a particular region, analysed them, and, with taking advantage of the system of **property rights** created by the WTO, claimed them as their own intellectual property. Those who have protected these plants for centuries, who have discovered and cultivated their healing properties and who are their true owners, are then left empty-handed, a phenomenon called "**biopiracy**". There have been cases of biopiracy across the world – in India and China, for instance, but also in Africa and Latin America. The research, collection and processing of biological material through genetic screening methods in the laboratory is called "**bioprospecting**". Pharmaceutical companies are particularly anxious to find new active agents or to generate complex ones which cannot yet be manufactured synthetically.

Intellectual property rights and fair and equitable benefit sharing (Access and Benefit Sharing, ABS) were important topics of discussion during the COP 10, the tenth Conference of the CBDs'

... and how the women of Hainan hand dye cloth with natural plant dyes.

Sources & further information:
- GIZ Factsheets on traditional knowledge and genetic resources
- Brochure "Development needs Diversity", Vol. 1 in the present series

Find out more about the conference in Nagoya and its outcomes, the so-called "Aichi targets", which aim to stem the loss of life on Earth, by having a look at www.cbd.int/cop10

parties in Nagoya, Japan, in October 2010. In the end, the parties agreed on the "Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization", also called the Nagoya Protocol (see infobox below). Like many other countries, China has so far drawn up no specific rules for an ABS regime. An exception to this is in Traditional Chinese Medicine, for which there are clear guidelines and patent laws.

Take the *Ganoderma* mushroom in Hainan, for instance. It belongs to the genus *Ganoderma* and grows as a parasite on tree stumps and roots. Coarse and covered with a resin-like layer, it is known as the "Glossy *Ganoderma*" (*Ganoderma lucidum*). The mushroom is reputed to have many curative properties. It has been used for over 4,000 years in Traditional Chinese Medicine (TCM) and is considered to be one of its most important ingredients. It strengthens the immune system, reduces blood pressure, has a calming effect and promotes good sleep. It is sold in the markets of Hainan, and is also available in the form of tea, wine and as a food supplement. In Germany, *Ganoderma* is marketed under the name of *Reishi*, *Ling Zhi* or *Vitalpilz*. Its disadvantage is that it is a tree mushroom and collected, as a rule, in the wild. In Yunnan, some pharmaceutical companies are already cultivating and marketing this kind of mushroom. The wild ones are in much greater demand, however, since their medicinal properties are said to be much more potent than those of the cultivated variety.

In order to create an additional source of income for farmers without decimating natural resources, the agrobiodiversity project has started a cooperation with the college of Qiongzhou on Hainan. The aim is to find a way of cultivating the tree mushroom so that as many of its active agents as possible are retained. "If we don't do this, the danger is that people will pick so many of them that the *Ganoderma* will soon disappear as a resource for improving incomes", says Li Qingsong, GIZ Technical Advisor for the project in Hainan. Professor Lin Yingyao in Wuzhishan is getting his students to grow the mushrooms, first in nutrient solution in a test tube, then in top soil, and finally in a greenhouse. The first mushrooms, albeit still rather small, are growing well. There is a lively exchange between the farmers engaged in the

Infobox: traditional knowledge, intellectual property rights and fair and equitable benefit sharing – important themes of the Biodiversity Convention and the Nagoya Protocol

One of the three objectives of the CBD (see p. 20) is the fair and equitable sharing of the benefits resulting from the use of genetic resources (Access and Benefit Sharing, ABS). Article 8 (j) of the convention regulates the recognition and protection of the traditional knowledge of local communities which contributes to the conservation and the sustainable use of biodiversity, while Article 15 regulates ABS. The last point has still not been jointly regulated between developed and developing countries.

The adoption of the "Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization" during the COP 10 in 2010 was a remarkable breakthrough towards the international regulation of ABS. After governments having discussed the topic for many years, the new protocol now provides basic rules on how nations should cooperate in accessing and sharing the benefits of genetic resources. Governments from now on must consider ways to provide compensation for genetic material and traditional medical knowledge that is being used, patented and sold. Before using traditional knowledge, the approval of the respective state has to be obtained. However, the protocol left several aspects open and unclear. With the support of GIZ, various groups of experts are working at present to find viable solutions. Some developing countries argue that the protocol inadequately safeguards the rights and benefits of developing nations. Nonetheless, the Nagoya Protocol was an extremely important step towards the establishment of international binding regulations for ABS. Based on the protocol, those signatory parties (China included) who have not yet specific policies for an ABS regime will have to establish one.

The *Ganoderma* mushroom has been used in Traditional Chinese Medicine (TCM) for over 4,000 years and is considered one of its most important ingredients.

project and the college. "This can develop into a very good business", says Professor Lin Yingyao. He believes that in Hainan alone the demand for the *Ganoderma* is at about 100 tons, of which only half is deliverable at present.

Another plant cultivated only recently by farmers in the project area is *Cheng Xiang* (*Aquilaria sinensis*), a medicinal plant endemic to China (i.e. occurring only in China). This delicate tree comes from the daphne family (*Thymelaeaceae*) and has similarities with the weeping fig (*Ficus benjamini*) often found in German living rooms. Its strongly aromatic wood and distilled oils are much sought after in Hong Kong of China as well as in Arab countries. As a result of fungal infections or injuries, it forms from the tree's heartwood. The so-called "*Gaharu*" is used for making incense, perfume and medicine.

"I only know that it is supposed to be good for stomach aches", says Li Zhiming, a 40-year-old farmer. He is the first one in his village of Xialu in Hainan Province to grow these small trees. Agricultural advisor Zhou Wenzhong from the agrobiodiversity project, who is training the local farmers at the Farmer Field School, is helping the pioneer farmer. He shows him how much distance should be between individual plants, and how to get rid of the weeds in a way as environmentally friendly as possible. "The liquid you can get from the plant is more precious than gold", says Li Zhiming. "You can get a lot of money for it in Hong Kong."

Suggestions for further work: traditions

Other people's exotic traditions are often interesting, but what about our own? What sort of roots and traditions do you have? Are there songs, clothes, festivities and customs which you consider part of your traditions? Think, too, about your own childhood, and about your grandparents – what did they pass on to you? What things of importance would you, one day, like to pass on to your children and grandchildren?

The demand for wild *Ganoderma* mushroom is so high that it is becoming scarce. The goal of cooperation between the agrobiodiversity project and the college of Qiongzhou on Hainan is to cultivate *Ganoderma*, so that as many of its active agents as possible are retained.

Suggestions for further work: Access and Benefit Sharing

Everyone agrees with the principle that when I benefit from using your resources, I should give you something in return. Suppose a local community possesses knowledge about certain plants and I come along and would like to make this knowledge more widely available (and also, of course, find personal gain in the process). To whom does this "knowledge" belong? Can it be limited as a commodity to a small number of people who can afford it, when it might cure many who are sick? Is it fair for local people's knowledge to generate a fortune for others, when the same local people gain nothing in return, and often continue to struggle to meet their own basic livelihood needs? Imagine I am a pharmaceutical company and intend to share my profits: who should I pay? The village head, all villagers? And how far does my responsibility to compensate extend? How much should I hand over – after all, I have costs which have to be covered? Who is going to check whether I have a valid permit? Who, in fact, is responsible for issuing that permit? Does that person (or institution) have a sufficient grasp of the issue and context? These are all complicated questions which have no easy answers. That is why the signatories to the Convention on Biological Diversity (CBD) have been working intensively on them and as a result adopted the Nagoya Protocol in 2010. Unfortunately, not all of these questions have been answered yet. Do you have any ideas for implementing more equitably shared benefits?

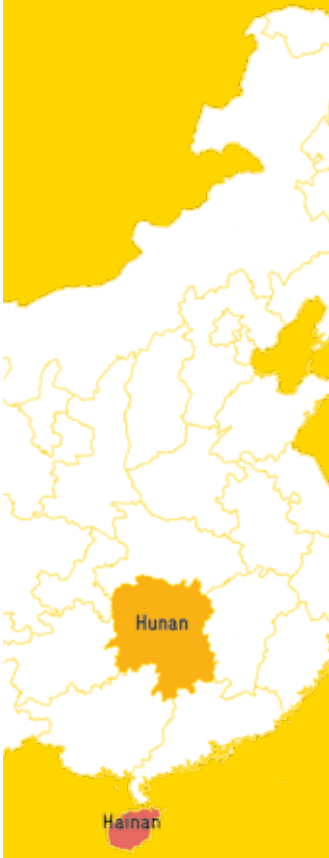
The following texts address the topic in more detail:

- The **reportage** presents the rich traditional knowledge found in the various regions of Southern China, and describes the cooperation between the agrobiodiversity project and the German medicinal plant importer, HerbaSinica.
- In the **portrait,** Fu Yanv talks about the 300 plants she uses to heal people.

Reportage: hundred-year-old pipes and good business with Germany

To this day, many villages in South China have been able to maintain their own independent culture and traditional knowledge. Their conservation is vital to the conservation of plant richness and agrarian diversity at the local level. This knowledge is also of great value to German companies and the rest of the world.

The motor has just been switched off when the car is suddenly surrounded by four dancing musicians with brass bells, hand drum and flute. It is cold today in Longmudong, with the damp penetrating every jacket. Unpleasant, nevertheless, nothing is going to prevent these musicians from the little village in the Wuling Mountains in the Chinese province of Hunan from accompanying the guests with traditional music to the village square. Already there is the large red drum on which an elderly man is beating out the rhythm for the dragon with big drumsticks. Half a dozen men are carrying the brightly coloured dragon's head with its five-meter-long yellow and red body.
All at once, Peng Guofu appears. The 69-year-old is keen to show us his wooden pipe, which is a good meter in length, intricately carved, and which has a brass bowl and mouthpiece. "My grandfather used to smoke this a hundred years ago", he announces proudly, "and now I am



When guests arrive the inhabitants of Longmudong in the Wuling Mountains of Hunan Province like to greet them with music and a dragon dance.

Peng Guofu from Longmudong uses an over 100 year old pipe to smoke his homegrown tobacco.

smoking it, too, with tobacco we grow ourselves. I shall pass it on to my grandson." He then starts to sing an old melody. Soon, he is joined by a second elderly man, Shu Sheng aged 63, and they sing a duet together.

Today, in the village of Longmudong with its 96 families, much of what has always been there has been conserved: music and dances, pipes and home-grown tobacco and, of course, the typical large, dark-brown, slate-roofed houses which, from afar, look as if they were nestling up to each other. Inside them now for winter, with its unpleasantly cold and damp climate and temperatures below zero, one can see the glimmering charcoal fires around which families invariably gather since this is the only warm spot in the whole house – the other rooms remain unheated.

The winter drags on for a good four months here before the warm weather returns and the drafty construction of the houses comes into its own. For here, in the sub-tropical Wuling Mountains, it gets extremely hot in summer. At the end of the harvest, the large houses overflow with oranges and lemons, with various varieties of rice and maize, with peanuts and dried peas and lentils.

Shu Sheng's hands are shaking, perhaps he is agitated, perhaps he is also feeling the cold. His medical advice is much sought-after in Longmudong. He says he can cure shingles, and bends down to pick a piece of greenery growing by the fence. "You take this plant here, squeeze out the oil, and rub it on the affected part of the body. The shingles will rapidly disappear. It's that simple. But sometimes you have to search long and it's hard to find the right plant".

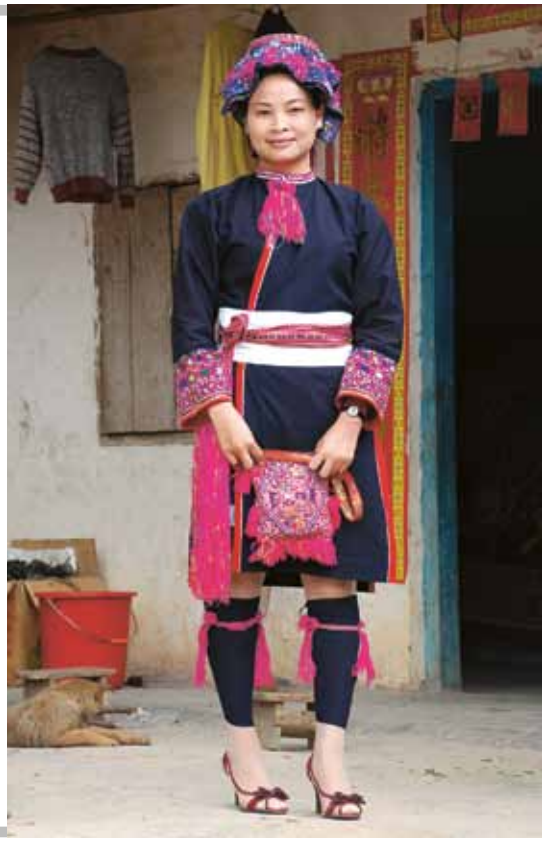
He hasn't got a name for the plant. But if his method for treating shingles really does work that well, then people in other parts of the world could profit from it if, for instance, a pharmaceutical company were to develop a medicine from it.

Shu Sheng shows us even more medicinal plants which grow in Longmudong. The "chicken tail", *Xian Ji Wei*, for instance. "The herb *Xian Ji Wei* stops bleeding", says Shu Sheng, whose knowledge comes from his family which has always been interested in herbal medicine. Shu Sheng continues to educate himself further by reading books on Traditional Chinese Medicine. The knowledge of this at first sight unassuming farmer, who is able to cure his neighbours with herbal remedies, is, therefore, extremely valuable.

A few houses further on, Peng Yunjiang is sitting round the fire in the village hall with a few neighbours. The village head is a committed supporter of the agrobiodiversity project, and is keen to explain the various display boards just behind him. For a few months, the farmers have been using them to log, very precisely, the vegetation dates in Longmudong: "We enter data for rainfall and temperature here, as well as for crop growth.

Infobox: traditional clothes

In small communities in South China, particularly in remote mountain regions, many forms of traditional knowledge have been maintained. In Shuiman, three hours by plane South of Longmudong, in the middle of the tropical island of Hainan, the Miao women still know which plants to boil up in order to dye the traditional clothes of the Miao the right blue-black colour. Peng Guili is 53 years old and wears the traditional, richly decorated headdress. These days, only the older women wear the traditional materials and colours every day. The young prefer jeans and T-shirts. But like Xiao Lin, they all have their wedding dress, usually made by their mothers, hanging in the wardrobe long before they even have a husband-to-be. "Admittedly, I'm already over 20", says the pretty young woman, "but I don't want to get married yet." Nevertheless, she insists on putting on her wedding dress, to show her guests from Europe how lovely she looks in it.



The young Miao woman Xiao Lin normally wears jeans and a T-shirt. She wants to wear her traditional, plant dyed costume for her wedding.

Here, for instance, you can see how the peaches developed last year." A wide variety of crops are grown in Longmudong: plums, pears and Chinese dates, walnuts or kaki fruit, which is also known as sharon fruit or persimmon.
For some months of the year, there is hardly anyone in Longmudong aside from old people looking after the children. This development is threatening the village's existence, and with it, knowledge about the cultivation of traditional crops such as maize, rice or fruit trees. And, of course, the valuable experiences of practitioners of herbal medicine such as Shu Sheng. But there are ways of using, and thereby conserving, this ancient knowledge. For example, by cooperating with German companies.

The knowledge of medicinal plants growing in the village has been handed down to Shu Sheng by his ancestors.

Change of location. In Rednitzhembach in Germany, not far from Nuremberg, Eberhard Hilsdorf points to a pile of boxes. "Goods fresh in from China, via the port of Hamburg", says the trained chemist. "The goods now have to be tested in the laboratory and passed as fit for use." 15 years ago, Hilsdorf founded the company HerbaSinica with his Chinese partner Wenjun Zhong. Today, the

Over the past few months farmers have been recording the details of Longmudong's vegetation data on pin boards in the community centre.

company is one of the European market leaders in the import of Chinese medicinal plants and herbs to Germany. Thousands of chemists in Germany, countless clinics and pharmaceutical manufacturers throughout Europe, are supplied by this company based in a small Bavarian village. "Chinese medicine has really taken off in the past few years", says Wenjun Zhong with some satisfaction. The 46-year-old came to Germany 23 years ago, studied geoecology, did a PhD in plant physiology, and has long been settled in Rednitzhembach with wife and family. Some of his family work in China in the agricultural production area of Hunan Province, growing, cleaning, drying, and processing until ready for distribution, herbs specifically for him. The production unit is located in Shenyang, some 600 kilometres to the Northeast of Beijing. The medicinal plants are cut, pre-processed and packed according to European standards of quality control. HerbaSinica has created 80 jobs in this plant. In addition to this, there are countless farmers who provide the company with plants they have bred, cultivated or collected themselves.

220 different plants lie packed close together on the metal shelves. One of them is called in Chinese *Chuanxiong* (*Ligusticum chuanxiong* Hort), sounding not quite so exotic in translation: Szechuan Lovage. "Szechuan" is the old transcription for "Sichuan", a province in Southwest China. The plant belongs to the family of *Umbelliflorae* and is good for blood circulation, menstrual cramps and abdominal pains, or swellings resulting from a blow or fall.

A good ten thousand kilometres away in the Wuling Mountains in the Chinese province of Hunan, the farmer Hu Hongchun and his wife Qin Qiuying have high hopes for *Chuanxiong* and the possibilities offered by HerbaSinica. Hu Hongchun grows many different kinds of fruit – apples, plums, melons and grapes, but also leafy vegetables, cabbage and garlic. Hu Hongchun belongs to the Tujia ethnic group and is hoping that the few centimetres thick, wrinkled *Chuanxiong* tuber will prove a product with which he can stabilise his income. Commissioned by HerbaSinica, he has just planted a field with *Chuanxiong*. "They pay me 30 per cent more than I can get at the markets round here", declares the Chinese farmer. He has committed himself to growing the plant without agro-chemicals, i.e. purely organically. Yang Chunhua, one of the agrobiodiversity project staff from the county town of Yongding, has shown him how to do this.

Many families earn their livelihoods in factories or on construction sites outside the village. Thus, their knowledge of cultivating traditional crops is threatened. The cooperation with the German company HerbaSinica (founders Eberhard Hilsdorf and Zhong Wenjun are pictured here) makes use of traditional knowledge and thereby not only preserves it, but also helps to increase local incomes.

Hu Hongchun plants *Chuanxiong* organically and sells the harvest to HerbaSinica. He earns 30 per cent more from the company than from the local market.

The cooperation between Hunan and Bavaria, between Hu Hongchun and HerbaSinica, was initiated by the agrobiodiversity project. Feng Yingli, the project coordinator for Hunan, knows how difficult this cooperation is. "The European and American markets expect high and consistent quality." That is why Hu Hongchun is giving up pesticides in favour of weeding by hand. He knows that it "can become a very good deal for us if the harvest is good and the price high."

Suggestions for further work: business counts

This work is very complex business, so getting an overview might be helpful. Compare of the gains made by the firm in Germany (and other countries), to what they offer in return. What is a Public Private Partnership? What is important to the farmer in China, and what can he give in return? Think about the advantages and disadvantages, as well as the risks (as opposed to working without this cooperation). How would you as project coordinator approach the task of setting up a cooperative venture? What measures would you take?

Portrait: a wise woman

Fu Yanv is a very special woman. She knows over 350 plants and medicinal herbs with which she can cure illnesses. She knows what songs to sing to ensure that the mountain gods remain favourably disposed towards the Li. And she is one of the few who can still make the traditional clothing – invaluable knowledge which the young Li women on the tropical island of Hainan are beginning to forget.

Fu Yanv is 60 years old, but bounds through the undergrowth like a young woman. "This plant here is called *Ben Bu Dui* and is good for a sore throat". Looking serious, she lifts up the leaf and stalk of the plant in her right hand, and is soon hurrying off again. "And this here is called *Daling Sen*. It's mainly for older people. You have to boil it up with other herbs. In the right combination, it is very good for rheumatism and joint problems." She bends down again, pulls another green herb out of the ground, and holds it up triumphantly: "This here is good for women's period pains." Fu Yanv is a wise woman. She is someone with a good knowledge of the plants and herbs which flourish round her home village of Xialu, and also beyond, in the less accessible mountains. "Many things do not grow down here, only up there in the mountains. I sometimes go there to collect plants, which I dry so that they keep." She stores her plant treasures in large sacks in a cool, dark room. Looking at this little woman, one sees a wrinkled face, but incredibly watchful, large brown eyes. Fu Yanv's life is written in her face. In Xialu, there is no doctor in the western sense. The roads which connect the villages in the region with the town of Sanya are only a few months old.

Fu Yanv knows the medicinal effects of over 350 plants. With this knowledge she helps to treat her family, friends and neighbours.

Mrs. Fu stores her plant treasures in large sacks. She specialises in treating bruises, sprains, wounds and joint pains. Her knowledge has not been documented in writing to date.

Formerly, tropical downpours frequently turned the paths here into impassable skid pads. The little motorbikes, one of which almost every family owns, are also a sign that the wealth here is very recent. So for decades, Fu Yanv was often the only one for miles around who could offer help when one farmer dislocated his leg, or another had slashed his arm with a bush knife. "I have specialised in bruises, sprains, wounds and joint pains", she says. "Those are the most frequent complaints and injuries that we get here".
She has spent her whole life extending and improving her knowledge, so that she is able to help her family, her friends, her neighbours and the inhabitants of the surrounding villages even more effectively. Her son Lin Yu interprets for her, since she doesn't know Mandarin – the official Chinese language – but speaks the Li dialect, which only the locals can understand. In his mid-twenties, he gives the impression that he would like to be her manager. He is wearing an ironed, bright blue brand-name shirt, an expensive-looking watch, and enjoys showing off his new mobile phone. Not only altruistic motives made Fu Yanv become an expert on herbal medicine. Yanv has earned money and a decent living from it. On her land there are two stone houses. A room in each of them is reserved solely for prayer and practising her faith, a local nature religion. There are altars in the rooms, one is painted gold and open to the public, the other is inconspicuous and next door. This is where Fu Yanv prays to the gods and for her ancestors. She doesn't believe in any of the great world religions, but practises the traditional faith of the Li. She speaks of the mountain gods, to whom sacrifice must be made: schnapps, cigarettes, food, scented candles – and bank notes, too. "The gods live in the mountains", says Fu Yanv. The mountains which are visible from the village, and where she collects her plants.
She says she now knows the healing and toxic properties of over 350 plants. Even though she is very attentive to visitors, and they immediately feel welcome when met with the warm, open gaze of her brown eyes, Fu Yanv lives in another world. Different values count here – ancestors have to be worshipped, songs and dances which exist only here amongst the Li have to be sung and danced, and Fu Yanv knows what patterns have to be embroidered on the traditional dress.
So far, the old healer has committed none of her medical secrets to paper. She has explained to the staff of the agrobiodiversity project the medicinal effects of some plants. "My knowledge has not been written down", she says with conviction. Neither has she, as yet, passed everything on to her son Lin Yu who one day will inherit it, and who is prone to behave towards foreigners as if he were already a healer.

This wise woman believes in the traditional, mountain-dwelling gods of the Li. She has built them an altar where she prays every day.

3.4 Different landscapes – abundant biodiversity

Background: no forest – no food

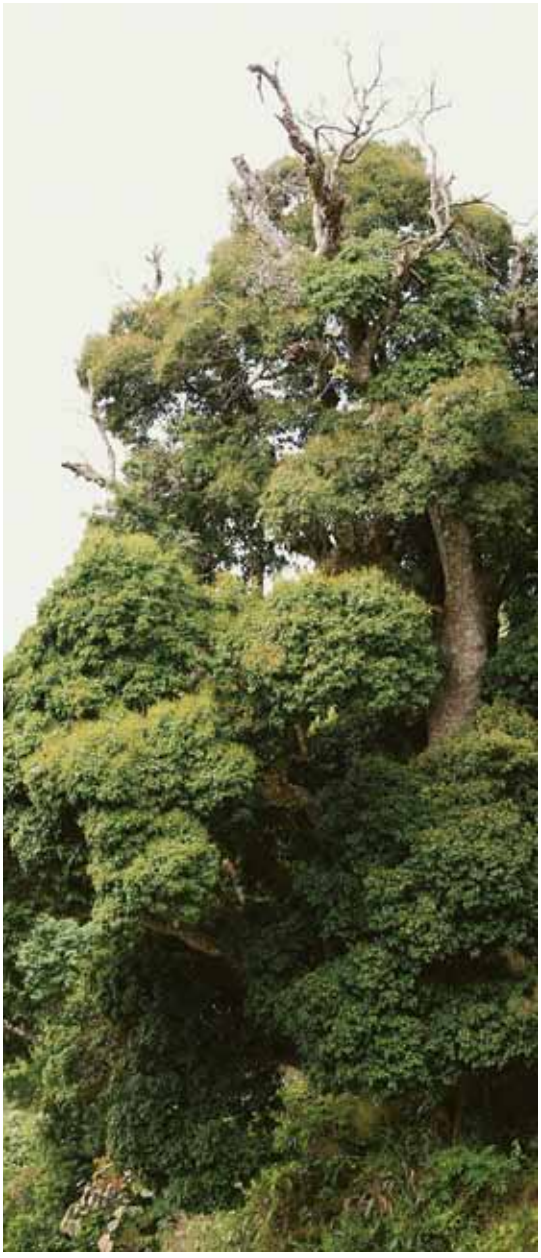
In the protected natural sites of national parks, floral and faunal or other nature reserves, plants and animals can evolve and develop new genetic diversity relatively undisturbed. In some of the globally recognised UNESCO Biosphere Reserves, projects on agrobiodiversity are being piloted.

In conservation areas many wild relatives of plants and animals may be left to evolve undisturbed by people.

At present, there are more than 100,000 protected area sites worldwide, covering nearly twelve per cent of the world's land surface. An enormous area considering that it is barely 140 years since Yellowstone National Park in the Rocky Mountains of the USA was created as the world's first national park – a pioneering project for the concept of national parks today.

Concepts of nature conservation, however, have been in existence much longer. We have documented evidence in India, as well as Indonesia, more than 2,000 years ago, of reserves set up for religious reasons or as a ruler's exclusive hunting ground. For the Dai, an ethnic group in the province of Yunnan in Southwest China, the protection of their sacred forests has for many generations been a matter of survival: "No forest, no water. No water, no rice paddy. No rice paddy, no food. No food – we cannot live." This saying explains the rationale for the strict regulation by the Dai of access to, and use of, resources in the sacred forests. Plant collecting, for instance, and felling of trees and hunting are prohibited. For many ethnic peoples, not only the material, but also the spiritual world are closely bound to nature. In the Dai faith the forests are also believed to be inhabited by gods, and all the species of plants and animals living there to be sacred beings.

Since long, the people of Southern China have developed effective and sustainable concepts for the conservation of diversity in nature reserves. There, wild relatives of agricultural crops and animals could develop undisturbed by men. Some of the plants can perhaps develop new characteristics which are able to adapt to a changing environment, to



Infobox: what is a protected area?

The International Union for Conservation of Nature (IUCN) defines the term as follows: an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means (EUROPARC/IUCN 2000).

The reasons for the designation of a protected area vary enormously. They stretch from religious motives (for instance, sacred groves or waterholes which are "taboo"), to protection against natural catastrophes (such as, for instance, the forests planted in the Alps to protect village dwellers against avalanches, and which cannot be cut down), and a variety of other reasons cited in the legal arrangements of many protected areas including the following:

- the conservation of specific elements of biodiversity (animal or plant species threatened with extinction, areas of outstanding natural beauty, or biodiversity as a whole),
- the protection of ecosystem services (i.e. drinking water catchment areas, erosion prevention),
- the conservation of areas and ecosystems for future generations ("option value"),
- research purposes, education, recreation,
- and finally the sustainable resource use or the conservation of distinctive traditional and cultural features interconnected with natural elements.

In order to do justice to the varying goals and functions of protected areas, the IUCN has drawn up internationally recognised management categories. Their scope extends from landscape and marine reserves with sustainable use, to nature reserves for species protection and natural monuments, to national parks and wilderness areas (strictly supervised nature reserves for the conservation of largely untouched areas of wilderness). In addition to the natural lay-out of the protected area in question, its impact on humans is also of central importance.

new pathogens or changed climate conditions, for instance.

The United Nations Educational, Scientific and Cultural Organization (UNESCO) has two different instruments at its disposal for recognising nature conservation initiatives: Biosphere Reserves and Natural World Heritage Sites. Since both of them feature in the brochure, we will examine them a little closer in what follows.

The UNESCO **Biosphere Reserves** (established under the Man and Biosphere Programme, MAB) are intended as models for sustainable development. Sustainable because their emphasis is not only on nature conservation, but also rests on a viable interplay of man, flora and fauna. Biosphere Reserves are expressly designed to include the economic development of people living there. The programme focuses less on untouched natural landscapes than of cultivated landscapes which have been shaped in the course of history by agricultural use, and which are, therefore, considered particularly worth conserving.

The conservation of agrobiodiversity is of central concern in the Biosphere Reserves. Very often, local farmers bred animal and plant species which were best adapted to the ecological conditions,

Biosphere Reserves (pictured: Rhön) and Natural World Heritage Sites are two instruments UNESCO uses to give recognition to nature conservation efforts.

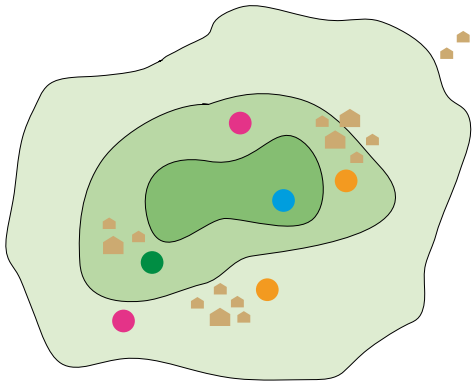
and which were not, or are no longer, to be found in this form in other regions. But because of economic and social changes, their descendants have already often lost the knowledge or the appreciation of agricultural diversity. This is why scientists or staff working in the MAB Biosphere Reserves are in some regions, together with farmers and producer organisations, developing methods of cultivation and marketing which will firmly re-establish traditional breeds and old varieties as part of local culture.

40 years ago (1970), the first Biosphere Reserves were recognised by the United Nations. By the end of 2010, there were already 564 of them, in 109 states. They often include sites which have already been designated nationally as protected areas – the core zone in Germany, for instance, is frequently a nature reserve, and the transition zone a landscape protection site.

UNESCO Biosphere Reserves are network-linked and exchange research results amongst themselves. They also foster cooperation between agricultural enterprises and other companies across different countries and continents.

Luis Waldmüller, GIZ Project Director in China, sees in this as a great opportunity for one of the regions in which the agrobiodiversity project is operating: "It would be a great idea to set up a

UNESCO Biosphere Reserve: zoning and economic utilization



Adapted from: Deutsches Nationalkomitee für das UNESCO-Programm MAB 1996,
www.bfn.de/0308_zonen+M52087573ab0.html

Biosphere Reserves singled out by UNESCO are to serve as model locations for researching and demonstrating conservation and sustainable development at the local level. To this end, Biosphere Reserves are divided into three zones:

- **Core zones** dedicated to long-term conservation and which are in harmony with the ecological goals of the Biosphere Reserve. They should be of adequate size and, as a rule, are excluded from any form of utilisation. Since animals and plants are living and evolving under natural conditions in these zones, scientist are able to draw valuable conclusions about how plants develop in nature under different conditions, and how they react to changes, for instance, to climate change.
- **Buffer zones** which surround the core zones, or are adjacent to them. The only activities here are those which are compatible with conservation goals – i.e. considerate, natural utilisation of land. This is the optimal place for initiatives which foster agrobiodiversity. They create – in the least harmful and most natural way – a broad diversity on the land put to agricultural use, ensure that older animal breeds are bred and local crops are grown and made ready for market, promote the cause of regional independence by making diversity competitive (once again), and secure a decent income for local people. Non-aggressive tourism (for instance, agrotourism) has a contribution to make here.
- **Transition or development zones** in which procedures for the sustainable management of resources are encouraged and developed. In principle, all forms of use and economic activity are permitted here. By encouraging targeted model projects for sustainable forms of economic activity, these resource-saving concepts are to be made known and familiar to a wide public audience. The intention, also, is to win over farmers operating with conventional methods to these new, ecological concepts.

In China, 26 Biosphere Reserves have been recognised by UNESCO so far.

Source: Chinese National Committee for Man and Biosphere Programme of UNESCO

kind of Biosphere Reserve in the Wuling Mountains – that is, to promote an overall concept on sustainable development which brings together the cultural and natural landscapes".

Regions of "outstanding universal value" are recognised as **World Heritage Sites** by the United Nations under the UNESCO Programme. This applies to cultural as well as natural property. At the end of 2010, a total of 911 sites in 151 countries worldwide received the accolade, the great majority of which (over 700) were for their cultural uniqueness. In Germany, there are 33 World Heritage Sites. The Messel Pit Fossil Site and the Wadden Sea are Natural World Heritage Sites, the other 31 are Cultural World Heritage Sites – Cologne Cathedral, for instance, or the Museum Island in Berlin. Since 1992, important cultivated landscapes have also received recognition: the Middle Rhine Valley is one example. They are distinguished by a close relationship between the landscape and its cultural treasures. Mixed World Heritage sites, like the Angkor Wat temple complex in Cambodia or the legendary Historic Sanctuary of Machu Picchu in Peru, are inconceivable when divorced from their grandiose natural surroundings.

The connection between nature and economically active people is particularly clear in cultivated landscapes – as, for instance, in the Rice Terraces of the Philippine Cordilleras, also a World

Suggestions for further work: Biosphere Reserves

Were you already familiar with the concept of the Biosphere Reserve? Which is the closest Biosphere Reserve to where you live, and have you ever been there? Is it also divided up into three zones? What is permitted or prohibited in the different zones? What is the main emphasis of what they want to achieve in each zone? What does the reserve offer for the tourist? Are there any special agricultural products on sale? What particular plant and animal species, plant varieties and animal breeds occur there?

The 16 Biosphere Reserves recognised by the UNESCO in Germany.

Source: Bundesamt für Naturschutz (BfN) (2010) according to data provided by the German federal states and the administration agencies of the Biosphere Reserves

Heritage Site. The use of traditional farming practices and thus the conservation of agricultural diversity means that many cultivated landscapes are of great importance for agrobiodiversity. In contrast to many cultivated landscapes formed by man, the Natural World Heritage Sites offer a protected site in which plants and animals can evolve undisturbed – a vital prerequisite for the long-term conservation of the diversity of genetic resources and their potential use.

Recognition as a World Heritage Site means that you can be quite sure that the area possesses some especially precious attriubutes. Since 1992 UNESCO also declared the Wuling Mountains in Hunan a Natural World Heritage Site. This area includes the Zhangjiajie National Forest Park. With their spectacular sandstone pillar formations, they form an unusually beautiful natural

landscape, rich in history. In 2004, the area was also designated by UNESCO as a **Geopark** – a site of outstanding geological interest where one can experience Earth's history first-hand. At sites such as these, visitors learn how landscapes emerge, how rocks and other raw materials are distributed underground, and how geology influences land use in a particular region. Information on these topics is offered by the worldwide network of geoparks in the form of guided walks, display boards and much more.

In protected areas of any category, the balance between conservation and people's need to cultivate has to be constantly readjusted. Conflicts and challenges abound, with China being no exception. With about 3.5 million tourists a year, visitor numbers at the Wuling Mountains World Heritage Site are enormously high. In the past, many residents were moved out of the core zone. How should the authorities tackle the various claims made on a site?

Planners responsible for protected areas are increasingly of the opinion that there is little point in resettling ethnic groups and other local people. It makes more sense to develop joint strategies with them to tie their survival as an independent community in the development and management of the protected area. They are, after all, important sources of knowledge about flora and fauna in the region.

An important initiative in the creation of alternative incomes is high-end, nature-compatible tourism, income from which both the inhabitants and the protected area benefit. More and more visitors have come to appreciate excursions to agricultural areas where knowledgeable inhabitants can explain to them the particular characteristics of local animal breeds and cultivated or collected plants. Many residents living within or near protected areas also boost their income from farming by offering tourists accommodation in their own homes.

China's Wuling Mountains in Hunan Province were declared a UNESCO Natural World Heritage Site in 1992. This souvenir seller can count on 3.5 million visitors to the site annually.

Sources & further information:

- World Heritage Convention: http://whc.unesco.org
- UNESCO, German Commission: www.unesco.de/?L=1
- UNESCO: State of Conservation of the World Heritage Properties in the Asia-Pacific Region, China, Wulingyuan
- See a video of the Wuling Mountains under http://whc.unesco.org/en/list/640/video

Suggestions for further work: protected area – conflict area

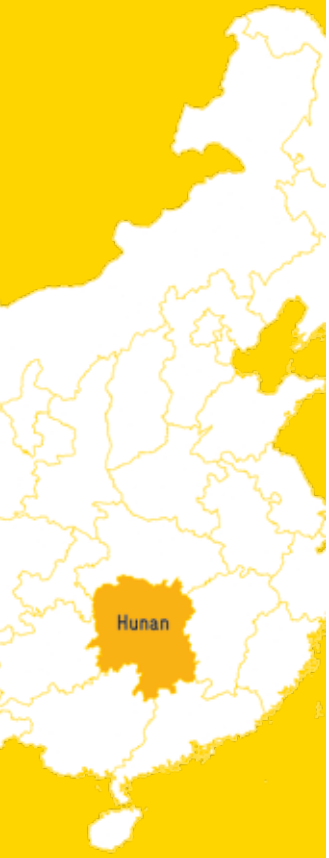
What initiatives occur to you which might help people with their concerns and hopes, but which, at the same time, do not subject animals, plants and the countryside to damage and excessive use? On the accompanying DVD you will find the data file "protected area – conflict area". It gives a description of five typical situations where the conservation and utilisation of an area are in conflict. Each of you adopt a role and try to find a solution. Drum up a few people and try your hand at conflict resolution!

One example: protected area near to a large city

Every weekend tourists visit the protected area located close to the city. They concentrate at certain points which, in part, are already overused: the paths have been worn away, tramping feet have created fresh ones, rubbish lies all over the place. Income from the sale of souvenirs goes mainly into the pockets of the inhabitants of this section of the park – there is no benefit to those living further away in the border zones of the protected area.

But now, a tour operator whose main customers come from the city is seeking permission to offer trips to the remote part of the protected area. In return he is offering to contribute to the costs of improving the local infrastructure. This would enable the children in the district to get to school more easily – at present the path they have to take is very tricky, particularly in the rainy season when parts of the clay road are regularly swept away. A local nature conservation group, however, is of the opinion that there are far more species of animals and plants in these remote areas than in the part already used by tourists.

Should the tour operator be given this permission or not?



The following texts deal with the topic in greater depth:

- The **reportage** describes two very different concepts of protected areas: the UNESCO Biosphere Reserve in the Rhön area in Germany and the UNESCO World Heritage Site in the Wuling Mountains of China.
- In the **interview**, the landscape ecologist Doris Pokorny explains the Biosphere Reserve concept and approach used at the Rhön UNESCO Biosphere Reserve.

Reportage: snakes, sheep and Franconian cattle

The long-term conservation of nature is very high on the agenda in both the Rhön UNESCO Biosphere Reserve and the Chinese World Heritage Site in the Wuling Mountains. The management concepts, however, as well as the significance of local development and tourism activities, vary considerably in both.

Countless bees are buzzing amongst the white blossoms. Like mini-helicopters, they rise and fall above the many blossoms of the Boskop apple tree. There are different sorts of bees: some have a proboscis which is only 6.5 millimetres long. If a plant has a longer flower tube, these bees are unable to pollinate it. Therefore, also bumble-bees are important for pollination, because they have a longer proboscis. It is at least eight millimetres long, in some species up to 16 millimetres.

Adam Zentgraf lives in the Rhön village, Hausen, at the heart of the UNESCO Biosphere Reserve. He knows what is good for the apple trees. Trained as a stonemason, his main job is as an industrial worker. His private passion, however, are the orchard meadows in the Rhön UNESCO Biosphere Reserve in Southern Germany. His apples earn him a good supplementary income. "A large tree can produce up to 750 kilos of fruit every two years", says the family head.

Biosphere Reserve Rhön: Adam Zentgraf takes care of the "Apple Initiative" to conserve traditional apple varieties that grow on meadow orchards ...

... around the clustered Franconian villages.

The 57-year-old is deputy chairman and driving force behind the Rhön Apple Initiative, a project which has evolved out of the Rhön Biosphere Reserve, and which, since 1995, has brought a good deal of progress to the agrobiodiversity of the Rhön region. In the mid 1990s, due to a drop in demand, traditional methods of growing fruit in orchard meadows were increasingly in danger of being forgotten. In the 1970s, the European Union was even paying a grubbing premium.
All this despite fruit having, for almost 300 years, always played an important role in the Rhön in terms of domestic consumption, sale as a dessert fruit, and for juicing and drying. After the Second World War and the ensuing chronic lack of vitamins in most peoples' diets, the orchard meadows, which surrounded the clustered Franconian villages like strings of pearls, proved to be a lifeline. Later, due to increasing trade and provision of non-seasonal fruit grown intensively in warm, climatically favourable regions, fruit produced in orchard meadows dwindled in importance – even in the Rhön. Zentgraf recalls, however, how from the middle of the 1990s, with a handful of apple growers and a fruit pressing plant, things gradually began to look up. "It took us some time to find a pressing plant willing to process organic fruit." Today, 2,500 private individuals and apple farmers press 2,500 tons of apples a year in the Elm plant, to produce organic apple juice. "By not only selling apples, but also extending farmers' role in the value chain (see infobox, p. 41) by developing lucrative products, we have managed to revive the role played by the apple in the Rhön", says Mr. Zentgraf.
Many developments have contributed to this success story: the annual apple market, refining of the range of products produced with the introduction of fruit brandies, apple sherry, apple beer and apple crisps, and establishment of the orchard meadow education trail and the garden that serves as a local gene bank for local varieties. In this garden, traditional varieties and also those particularly worth conserving are grown under the sponsorship of private individuals and companies. Apple growers as well as consumers are contributing jointly to widening, *in situ*, the variety of apples available in the Rhön. At apple blossom time in May, the magnificently blooming trees cover the green and gently rolling hills of the Rhön with enchanting dabs of white. The Apple Initiative also promotes the replanting of trees in the orchard meadows. "500 apple trees of different varieties have already been planted in the Rhön", says Mr. Zentgraf contentedly.
The Apple Initiative received powerful backing from the administration agency of the UNESCO Biosphere Reserve. Their goal is to generate economic, ecological and social benefits in the most efficient way. This will promote agrobiodiversity in the Rhön and generate more income from agriculture. The success of the concept is also visible

Zhangjiajie National Forest Park is in the middle of the Natural World Heritage Site in the Wuling Mountains. Tujia families that used to live in the park's core zone have been moved to its edges.

in other agricultural projects in the Biosphere Reserve, such as the reintroduction of the Rhön sheep or the Rhön grazing ox. UNESCO staff and landscape ecologist Doris Pokorny explains the procedure: "The farmers produce organic and sustainable products and we work out utilisation chains and marketing strategies with butchers and traders." Step by step, the criteria for the "Rhön seal of quality" as a certificate of ecological and social standards were also developed for other products and industries. Farming enterprises which have received this accolade promote smallholder agriculture in the Rhön and help to build up producer networks. New sustainable forms of production have been introduced. At the same time, habitats for plants and animals are conserved without man and nature coming into competitive conflict with each other.

Change of location. The Chinese Zhangjiajie National Forest Park in Hunan is one of the world's most beautiful landscapes. It is located in the Wuling Mountains in Hunan, which UNESCO recognised in 1992 as a World Nature Heritage Site, or in other words, as a place of outstanding value.
In the Wuling Mountains, more than 3,000 sandstone pillars soar into the sky, with their spectacular growths of conifers and broadleaf trees. Crystal-clear water flows in the rivers and streams, many animals live there, amongst which are rhesus monkeys and poisonous snakes. "Anyone bitten by the five-steps snake, is dead after five steps", says Xiang Fumeng, head of resources management. But this is a very rare occurrence, and a man who had his finger bitten by a snake in 2007 managed to survive: "He cut off the finger, and then afterwards even succeeded in rescuing two tourists who had got lost."
But there is no way that the snake is regarded as a real threat. Otherwise, up to 3.5 million tourists would hardly come to visit the world heritage site every year. A protected area with 3.5 million people on barely 4,810 hectares – isn't that impossible? "No", says Xiang Fumeng. "It's a symbiosis. The tourists bring the money which enables us to conserve the region's unique natural landscape." It is a fact that many protected areas worldwide fail because of a lack of financial resources. In total, with various extensions over the past few decades, the all-embracing Zhangjiajie Sandstone Peak Forest National Geopark, which was recognised in 2004 as a UNESCO Global Geopark, is 360,000 hectares in size.
The park administration of the World Heritage Site has demolished 20,000 square metres of

formerly human-inhabited area in the core zone. The families belonging to the Tujia ethnic group who once lived there have been resettled. "They now live on the edge of the park, many of them have found work with us. Inside the protected area, hunting, fishing and the felling of trees are now forbidden", says Xiang Fumeng.
The park is a medium-sized enterprise. 1,500 persons are employed here, 1,300 looking after tourists and 200 in nature conservation. "A main focus of our work is the centre for salamanders threatened with extinction. Also important is the conservation of particular plants, and scientific cooperation with universities", says Mr. Xiang.
Today, the spectacular sandstone mountain pillars are vanishing into the low-hanging clouds. Very few tourists are wandering the paths, one of them is being carried on a litter through the park, while a young tour guide is explaining the flora and fauna to a group of women visitors.
The management approach focuses on the uniqueness of the landscape and differs from that of the Rhön Biosphere Reserve, which emphasises sustainable use. There is barely a quiet corner in Zhangjiajie. During tourist season, buses unload tourists by the minute, leaving the park overwhelmed by noise and bustling activity. On average over the year, there are around 10,000 tourists per day. "But we have a buffer and core zone", says

In the Rhön Biosphere Reserve the emphasis is on nature conservation by local people. The Manger family practices ecologically sound farming.

Mr. Xiang. "The core zone is closed to tourists" – an important retreat where flora and fauna can continue to evolve undisturbed.
Things are different in the Rhön. Tourists there can visit all the zones, though must stay on certain paths in the core zone. In the Rhön Biosphere Reserve management model, the emphasis is on the conservation of nature by people on the

The buffer zone of Zhangjiajie National Forestry Park has hardly a quiet spot as it is such a hotspot for tourists. The park's core zone is, however, out of bounds to tourists.

ground, on sustainable organic farming practices, and on the promotion of local varieties and breeds.

Take the example of the Manger family in the village of Oberelsbach-Ginolfs. At the beginning of the 1980s, when the father, Gerd, first moved to his wife Christine onto the farm, iron chains and narrow cow stalls were soon consigned to history. "You didn't like conventional animal husbandry, but right from the beginning you wanted species-appropriate husbandry of the cows", says Christine to her husband Gerd whose primary job is as a lorry driver. While farmers were building new cow barns which the cattle never left, even in summer, the Mangers drove their cattle out on to the common grazing land in spring and converted to strictly organic farming practices. Today, their roughly 50 head of cattle are outside almost year round, even in winter, in an open-air barn with a cattle run.

A good five years ago, Klaus, the son, got the family thinking about yellow Franconian cattle. "Why should we keep French Charolais cattle when the local breed is almost extinct?", asks the 24-year-old butcher, rhetorically. A good 40 of the 50 of the family's head of cattle today are of the Franconian breed. Because other farmers are now beginning to breed Franconian cattle once again, there are now almost 300 head of them in the district.

These committed farmers are getting support from agricultural experts such as Karl-Heinz Kolb of the Bavarian Farmers Association. A crucial factor in the breed's revival was a research project in the Rhön Biosphere Reserve on the compatibility of grazing and nature conservation. By keeping cattle on large-scale, extensively-managed pastures, habitats for wild plant and animal species of the original cultivated landscape could be conserved. Overall, this makes less work for farmers than is required by intensive grazing.

Technical extention and financial subsidies are provided through a practical project on large-scale grazing in which 13 farms and nine livestock grazing cooperatives from various federal states participate. Marketing strategies which place farmers' own products in selected restaurants, such as a beef salami shaped like a walking stick (the "Rhönstegge"), helps to gradually re-establish the use of Franconian cattle in its area of origin. Even though it will not make the Mangers rich, "treating the animal with dignity gives us a good feeling", says Christine Manger.

The traditional yellow Franconian cattle was almost totally driven out of the Rhön by hybrid cattle breeds. Nowadays the Franconian is again a much appreciated specialty breed.

Interview: conservation through conscious consumption

The landscape ecologist Dr. Doris Pokorny has worked since 1991 at the Rhön UNESCO Biosphere Reserve in the federal states of Bavaria, Thuringia and Hesse, and is presently deputy director of the Bavarian administration agency. In addition, she is research coordinator and project manager, and is active in international cooperation within the worldwide network of UNESCO Biosphere Reserves with, for example, South Africa. The Rhön is planned to extend its international cooperation to include a partner project in China.

Doris Pokorny, landscape ecologist, works in the Rhön Biosphere Reserve. She says that a key to preserving agrobiodiversity is market demand for more varied agricultural products.

Dr. Pokorny, how do people in the Rhön feel about their UNESCO Biosphere Reserve?
Two years ago, there was a scientific assessment of the views and attitudes of the local population towards the project. It found that three quarters of the people welcomed the Biosphere Reserve, while only 19 per cent declared that they felt it limited them. 89 per cent approve that farmers are being paid for keeping the landscape open and cultivating and conserving it in a sustainable way. And 69 per cent consciously choose to buy local Rhön produce. These statistics are a pleasing affirmation of our work.

One of the most important goals is the conservation of agrobiodiversity. You have built up a lot of experience over the last 18 years. What is the key to *in situ* conservation of agrobiodiversity in protected areas?
The indicator of success is primarily the economy. Without a functioning market for farmers' regional products, without success in marketing the Rhön for ecologically oriented, "gentle" tourism, agrobiodiversity cannot be conserved in the long run. The conservation and extension of agrobiodiversity not only depends on convincing farmers to cooperate – this is merely one of many factors. Above all, consumers must be prepared to pay a little extra for the positive effects connected with the product – namely, species diversity, clean groundwater, a contribution to climate protection, a really wonderful cultivated landscape, and the certainty that these qualities – and their accompanying high quality of life – will remain to be enjoyed in the future. Our experiences may be summed up very briefly: conservation by means of thoughtful consumption. The entire regional value chain is important here: producer, processor,

retailer and consumer. The more stable this chain is, the more sustainable production will be. Without a shadow of doubt, organic farming practices make the biggest contribution.

What is not yet functioning at its best?
Demographic change, which is also happening in the Rhön, is being aggravated by the outmigration of mostly young people. It is not just us who are looking anxiously at the future but, above all, the local communities. In the Rhön, too, as in many rural areas worldwide, it is difficult to persuade young people that they could have a future here. There is a lack of jobs for highly qualified young people, most of whom have to migrate to the cities to find work. It is also hard to arouse in young people any enthusiasm for farming as a demanding and fulfilling independent profession – and as one so completely different from that of an employed technician in industry. It is quite wrong, in my opinion, when the latter is often used as standard by which to compare incomes. The same worries about who will take over the business apply to the food processing sphere, to butchers and bakers, for instance. For various reasons, society regards these manual professions as unattractive. But they are indispensable if the consumer does not want to depend on industrially produced food only. This is where good nutrition begins.

What can be done about this?
In the Hessian part of the Rhön Biosphere Reserve, an exemplary training association has been founded which draws those activities situated at either end of a value chain closer together. A butcher today should know how the animals whose meat he is processing have been reared. The same should apply to a cook or, a farmer, who should know how his produce is going to be processed. The idea is that knowledge and education should be wider and more encompassing. This is the prerequisite for greater sustainability.

New products which have developed over the last few years in the Rhön Biosphere Reserve as a result of the reintroduction of the Rhön sheep, of orchard meadows and, more recently, Franconian cattle, have become known beyond federal state borders. What new plans do you have at present?

The very successful soft drink "Bionade" is being produced organically in the Rhön. Like beer, it is fermented. The company has had resounding success in Germany and is increasingly putting its faith in the marketability of local production for its ingredients. The drinks manufacturer is also now sourcing basic ingredients such as malting barley and, increasingly, elderberries from organic farmers in the Rhön. The company guarantees that it will purchase a set amount of a farmer's produce. This has contributed significantly to the development of more ecologically sound agricultural methods in the region. This strong push forward compliments the concept of the UNESCO Biosphere Reserve. We are also cooperating with Bionade on other projects, for instance, with our partner, UNESCO Biosphere Reserve "Kruger to Canyons" (K2C, for short) in South Africa. This is a partnership arranged through GIZ as part of a project in South Africa on development-oriented nature conservation. Following land reforms, black families and tribal associations are getting back their expropriated land and cultivating it, in part, as cooperatives. The long-term goal is that Bionade should initiate sustainable, organic agriculture in K2C, and purchase its produce. They are thinking of herbs to begin with, and, perhaps at a later point, lychees.

This sounds like social commitment.
Yes, it is not just about trade in raw materials, but with Bionade it is also about social engagement. The aim of organic farming practices is also to secure healthy nutrition as a way of stabilising the state of health of a population battered by HIV/AIDS. The company has insisted on sourcing its products from organic smallholdings, and not from intensive plantation agriculture. This is conservation of agrobiodiversity, and it also suits Bionade's image.

Are there any other areas where the two UNESCO Biosphere Reserves, K2C and Rhön, work together?
There is a series of initiatives where we believe it is important that cooperation be directly between the persons involved, and that the function of the respective administrations of the protected areas is merely to provide organisational and logistical support. Take the example of two

The two Biosphere Reserves, Rhön and Kruger to Canyons in South Africa, cooperate in the context of several projects.

hotels working together and exchanging personnel for a training visit. In summer 2009, a young cook from South Africa came to the Rhön for a few weeks. To do one's apprenticeship in a dual education system such as we have it in Germany is unknown in most countries in the world. So it was a new experience for her to get to know not only various enterprises, but also the apprentices here, as well as the vocational school and the system of education.

Another project is concerned with the use of renewable energy. The former director of the Rhön energy agency, in conjunction with players in South Africa, set the project rolling. The idea came from a former mill in the Rhön which is equipped with a small turbine. K2C, meanwhile, has with our support and as part of the International Climate Initiative of the Federal Ministry for the Environment, applied for the construction of a small turbine which can be used to harness the water power of a dam to create energy. We very much hope that this project will be approved. This would not only be a way of reducing carbon emissions by environmentally-friendly electricity production, but the earnings from feed-in tariffs could be invested in K2C in sustainability projects. This would be an outstanding model project on the theme of "energy from the region for the region". A further form of cooperation involves universities who work together in the field of nutritional science and home economics. Finally, a small, joint music project has emerged, initiated by a specialist in environmental education of the registered association "Nature Park and Bavarian Rhön Biosphere Reserve". New media has opened up many possibilities for virtual contact, and will certainly be put to great creative use by students. We hope, however, that this contact will one day become quite real, and that students and teachers will get to know each other personally. We are, at any rate, working on it.

Suggestions for further work: conservation through consumption

Conservation through conscious consumption – what is your view on this? What do you consume in a conscious way? What criteria do you have when buying something, why and what do you buy? Is it a matter of taste, habit, price, attractive packaging, or of what your friends are buying? Are there products which you would never buy under any circumstances (why not?), which you deliberately boycott by not buying them? We consumers are well able to influence the market: what a lot of people buy is supplied, what a lot of people don't buy disappears from the market – that is the general principle. What does your ideal market look like? And do you think that we are necessarily forced to spend more and more money if we buy in a conscious way?

3.5 Treasures for future generations

Background: preserving wild plants for the world

The United Nations Development Programme (UNDP) and the Ministry of Agriculture of the People's Republic of China want to save China's wild relatives of crops from extinction. With the programme on the conservation of wild relatives of rice, soybean and wheat, methods are being developed – initially in selected project villages at local level – to conserve these valuable natural resources. The goal is to anchor the conservation of these plants in national laws and the public conscience. In this way valuable plant resources will be preserved for future generations.

China's Agricultural Agenda 21 (1999) identified 20 important *in situ* – that is, in their original place – conservation sites for wild relatives of rice, soybean and wheat, located across China, and representing a wide range of climatic, topographic, and socio-economic conditions. Many of the activities listed in the Agenda were literally last-minute rescue operations to save the plants from disappearing. Often, however, these measures aren't sustainable.

Among them are fenced-off areas created where wild relatives of crops are growing, and which are guarded round the clock by security guards. The conditions here are, however, no longer natural as animals are prevented from entering these fenced-off areas. Another disadvantage of enclosure is that the local inhabitants are prohibited from entering and using it. This makes people on the ground mistrustful, and is hardly likely to convince them that these plants are vital to man's future food needs.

Source: Global Environment Facility (2005)

Two staff of the wild relatives of crops project at the gate to a field where wild wheat is protected. The project no longer hires guards; rather, it creates awareness among local people to care for these valuable plants.

This is precisely the objective of the wild relatives of crops project, initiated in 2007 by the UNDP and the Ministry of Agriculture of the People's Republic of China (MoA): to engage the interest of the people of China, and convince them to respect and protect wild relatives of crops by mainstreaming their conservation into agricultural production. To this end, suggestions for regulations and laws governing the conservation of wild relatives of crops were to be worked out jointly by Chinese governmental and administrative authorities at various levels.

The open countryside is subject to increasing pressure, particularly in China, from industrial and infrastructural projects, road building, new housing estates, or the constantly rising need for agricultural land to secure the food supply of a growing population. Farmers expect to earn more from growing cash crops such as bananas or pineapples than they can from staple foods such as rice or wheat. This is a threat, particularly to the rarely occurring wild rice, which grows in regions which are very fertile. But also wild soybean is increasingly pushed into marginal areas by fruit plantations, and the cultivation of peanuts, sesame and other cash crops. Especially in economically weak regions where annual per capita earnings are often only between EUR 200 and 300, the prime concern for families in the villages is their own survival. Environmental protection or the conservation of wild plants are secondary or tertiary priorities.

There are also threats from nature itself. Invasive or so-called "alien species" such as common ragweed (*Ambrosia artemisiifolia*) and Crofton weed (*Eupatorium adenophorum*) are spreading and jeopardising the existence of the wild relatives of crops. These are also threatened by climate change. An investigation of the Consultative Group on International Agricultural Research (CGIAR) found that more than half of the 51 wild forms of peanuts will disappear over the next 50 years if climate change advances at the rate predicted over the next 50 years.

Added to these threats and pressures is pollution from agro-chemicals. While pesticides and artificial fertilizers increase the yields of cultivated plants, they can be very harmful to their wild relatives because they severely disturb the natural environment.

Whereas in favourable climatic locations, wild rice suffers greatly from strong competition from various cultivated plants, this barely holds true for wild wheat since it grows primarily in arid barren lands and pasture regions where, because of poor

The pressure on China's land resources is continuously growing to ensure food security for its growing population.

Wild wheat grows especially in arid barren lands and pasture regions where, because of poor soils and drought, hardly any food crops can be grown. Cooperative solutions to conserve wild wheat are sought in the project villages.

soils and drought, hardly any crops are grown. In the wheat regions, the threat to these valuable plants and their natural environment comes principally from livestock rearing.
To protect these important resources, the UNDP and the MoA have set five objectives for the project, which ends in 2012:

- sustainable systems and models are to be developed which create financial and other incentives for the conservation of wild forms of rice, wheat and soybean in eight Chinese provinces. To achieve this, solutions are to be sought in the project villages, together with the local inhabitants.
- politics and the executive authorities at various administrative levels are to be enabled to promote the spread of the wild relatives of rice, wheat and soybean, and also to implement the necessary protective measures.
- all participants at the central and local level are to receive training, equipping them with the knowledge necessary to conserve the three wild relatives of crops efficiently.
- a monitoring and supervision system is to be established by the end of 2011 with the aim of collecting reliable information about the status of wild plants in China.
- based on the experiences from the eight provinces, an Access and Benefit Sharing system will be established at the national level before the end of the project.

In all these activities, the main objective is to collect experiences in the project areas which can later be applied in other villages and regions. The results acquired have to be replicable and shall serve as a contribution towards "mainstreaming" the conservation of the wild relatives of important crops.

Suggestions for further work: working together

Think along the lines of climate change. What do you think the repercussions for German/Chinese agriculture and our food supply would be if the temperature went up by two degrees? What difficulties do you foresee, and what new opportunities could arise? If you were the German/Chinese Minister of Agriculture, what course would you set for the future?
The wild relatives of crops project in China will cost roughly EUR 15 million. The People's Republic of China will contribute nine million; the rest will come from the international community. Discuss the use of these funds, and argue the pros and cons of this commitment of the international community to a country which is on the brink of becoming one of the world's most powerful economies.

The following texts deal with the topic in greater depth:

- The **reportage** underlines the importance of the soybean in China and describes how project staff are seeking joint solutions with local inhabitants, how they can protect the plant, and how local people can benefit from this.
- In the **portrait**, Wang Xingsheng relates how he discovered the precious wild rice, and what this means for his village.
- In the **interview**, Hu Liancun reports how the Yanchi region stopped the desert from spreading by prohibiting the grazing of sheep, and why the project has brought hope for the future.

Reportage: a deal

There are wild soybeans in many regions of China, but the variety growing in the province of Henan in the county of Tongbai has evolved its own strategies for withstanding disease and extremely varied climatic conditions. This is what makes it so valuable.

It is sweaty work the married couple, Chen Faliang and Lu Zhouyu, is engaged in. They soak about 100 kilogrammes of soybeans overnight. Next day, they grind the beans into soy milk, bring it to a boil, then stir in a coagulator to thicken the fluid. After this, they must move very quickly. Mrs. Lu ladles the liquid mass from a large wok and plops it into a mould on a wooden stand. Her husband then presses the substance evenly into the mould, and squeezes out any excess liquid before finally covering every batch with a cloth. Mrs. Lu is already there with the next ladleful to slap into the wooden stand. "We both have to be very quick about it", she says with a laugh. "But we have had plenty of practice."

Tofu has to be produced quickly: Lu Zhouyu and her husband form a smoothly working team. The couple sells homemade tofu at the market – fresh, smoked, firm or soft.

Not only is Henan ideal for soybean cultivation, in Tongbai a particularly valuable wild soybean also grows. The beans are much smaller than of their domestic cousin, but the protein content is higher.

When they have finished, the fresh tofu is ready for sale. If they sell their bean curd in the market, their day's work will have earned them just about four euros – a lot of work for little reward. But they can feed the pigs they keep in the yard on the residue from grinding the beans. Its high protein content makes soybean a very nutritious animal feed.

Tongbai in Henan Province, which with 96 million inhabitants is the most populous province in China, is soybean land. With its continental climate, dry winters, and hot, damp summers, Henan is ideal for growing soybeans. There are lots of couples like Chen Faliang and Lu Zhouyu selling tofu on the market – fresh or smoked, hard or soft, and sometimes just the tofu skin, a special delicacy. Here in Tongbai – just a few kilometres from the village – the wild relatives of crops project has made a discovery. On an area of land of some 83 hectares in size, and surrounded by three rivers, wild soybean is growing. In itself, this is nothing unusual in China, but this soybean is something special. Because it has to withstand the effects of both tropical and temperate climatic conditions, it is of particular scientific value. Plants which have evolved through natural selection have even more to offer than others. "They flourish here in the project area, despite the inhospitable saline and alkaline soils", says Dr. Li Xianghua, a soybean specialist researching at the Chinese Academy of Agricultural Sciences (CAAS). "They are by nature very resistant and have developed genes which offer defence against diseases and pests. We can make good use of this variety to breed more resistant plants for agricultural production".

She tells us that soybeans can grow up to seven metres tall. She bends down over the shrubs around which the wild soybean is entwined and points to the beans. "Admittedly, the beans of the wild soybean are a lot smaller than those of the domesticated variety. But their protein content of 50 per cent is ten per cent higher than the domesticated ones. If we cross the two, we are able to breed agricultural plants which produce a lot more protein for the food industry. In our institute we have already produced plants with a protein content as high as 55 per cent", says Li Xianghua. Worldwide, there is just a single species of wild soybean. It has the scientific name *Glycine soja*. But the one growing here in Tongbai is especially resistant to external influences. It is growing in a region, enclosed by three rivers, which has largely remained ecologically intact, since – due to the

relatively low population density – the land has so far been used for low intensity agriculture only. Wang Guiling, the Chinese director of the wild relatives of crops project, says that in order to protect the wild soybean, it is not sufficient to simply tell farmers that they are not allowed to turn uncultivated areas into agricultural land: "If we are to conserve the valuable soybean variety in the long term, we have to compensate farmers for the loss of land. Otherwise, they would cultivate the land over the coming years, and the wild soybean would disappear." This is why she has come to Tongbai with a delegation from Beijing to discuss the issue with the farmers. "Another important objective for us is that the farmers recognise the value of the wild soybean, and want to conserve it for their own interest."

In the afternoon the project director meets the farmers in the village to discuss possible compensation. Already that morning she had met with the relevant authorities at the provincial and county level to discuss the project, and had quickly agreed that both the province and county should contribute financially.

About two dozen villagers have come to the community centre to participate in the discussion. The farmers have come with a long list: they would like a motor-driven water pump to install a new irrigation system, a communal pig sty and a new road to the fields. But because of project funding limitations, Wang Guiling and her project colleague, Professor Yang Qingwen, cannot agree with all proposals made by the farmers. They have lots of experience in negotiations with farmers. They insist that the project can only support farmers in performing some public and urgently needed activities.

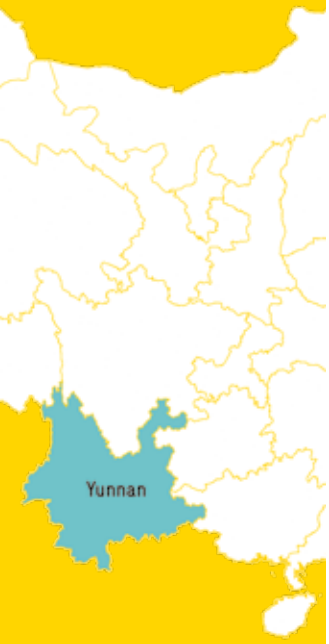
Finally, they all gather together at the edge of the village fields. An agreement has been reached: "We will give you the materials with which to build a road yourselves", says Wang Guiling. The farmers nod. "We will also help you with the irrigation system, and negotiate loans for you to build greenhouses."

It has grown late but by the end, everyone is happy: the villagers, because they can now build a new road, the project management because they are a step closer to conserving the wild soybean.

The Ministry of Agriculture's project leadership would like local people to protect the wild soybean. In return, the farmers would like a motorised water pump, a better road or a modern pig sty.

Portrait: the find of the century

Wang Xingsheng leads a normal life. He lives with his family in the little hamlet in Jinghong County in the province of Yunnan. He is a farmer. But he has recently made an important discovery. The 44-year-old discovered in Jinghong a very rare form of wild rice: *Oryza officinalis*.



Wang Xingsheng is an agile man who doesn't look his 40 years. Seven mouths have to be fed in his home every day. But despite the family's annual income being equivalent to EUR 900, he says this is not a problem. "We produce most of what we need ourselves." To the right of the huge oven are two dozen ceramic pots containing preserved vegetables, pigs are grunting just outside, and the farmers grow a lot of fruit and vegetables for their own use in their gardens – rice, soybean, tea, raisins and maize are a modest source of income when sold at market.
Mr. Wang is not just a farmer and family man. For a year now, he has been leader of the Communist Party in his village. He says that the Party here has nine members in all. "My most important task is to create, with the village head, new sources of income." Mr. Wang tells us that they have just recently put together a general plan – one which has a lot to do with his own personal discovery. Last year, Mr. Wang had telephoned his friend at the University to inform him that he thought he had discovered something of great importance. His scientist friend had asked him to look for wild rice – and he had now found some.

He takes us with him to a small rivulet a good kilometre behind the village, to where he discovered *Oryza officinalis*. Very carefully, he takes the more than a metre and a half long stalk in his hand, and points to the ears. "This is where I discovered the wild rice, last year. It is extremely rare." Mr. Wang is a little embarrassed when talking about his find, since he knows how important his discovery is for the Ministry of Agriculture of the People's Republic of China, which had been looking for this extremely rare wild rice. It is important, too, for his village. "We have now reached an agreement with the Ministry. We will conserve the wild rice here where it grows, and we will plant no more rubber or tea shrubs. This will allow the wild rice to grow in its natural environment, and it will not get polluted by herbicides."
In return – and this is the general plan which he has devised with the village head – the wild relatives of crops project will assist the villagers, financially and through knowledge and capacity building, to build a pig farm. "We want to construct a large, common pig sty in which every family can keep 50 pigs", says Wang Xingsheng.

Wang Xingheng discovered the extremely rare wild rice *Oryza officinalis* near his village.

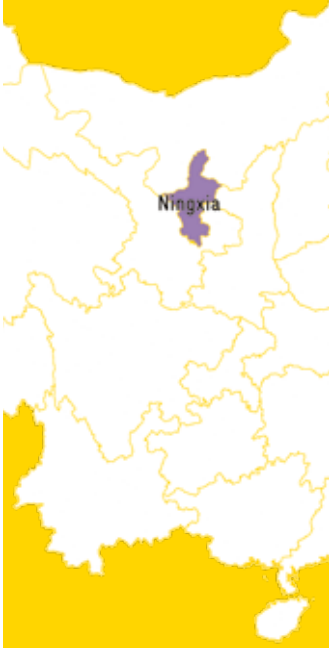
Interview: "The desert can be stopped"

Hu Liancun grew up as the son of sheep farmers in a little village in Yanchi County in the province of Ningxia in Northwest China. Today, the graduate in animal breeding works as deputy director of the Department of Agriculture in Yanchi. He is 44 years old and lives in the town with his wife and daughter.

Mr. Hu, Yanchi lies in the shadow of three great deserts, the Taklamakan Desert, the Gobi Desert, and the Ordos Desert. What does that mean for the region in which you live?
We suffer a great deal from the storms which sweep over us and make life then very difficult. Yanchi has, for many years, been under threat of losing the last bit of vegetation which makes life at all possible. The deserts are forever increasing. The main source of income in our community is sheep rearing; but it is at the same time one of the principal causes of desertification. The sheep eat the very few grasses and plants which grow at all in our region with its low rainfall. This is a big problem.

You have faced up to the challenge.
Yes. In 2000, we were the first county in China to impose a complete ban on grazing. Three years later, the provincial government followed our example and prohibited all sheep farmers in Ningxia from grazing their animals. We are now beginning to see the first signs of success.

For many hundreds of years, sheep have been the main source of income for people here. This can't have been an easy step to take.
No, we turned things completely upside down. In general, however, one can say that things are running well. We are experiencing a time of change in which we have to find new ways of sheep rearing,



"If we hadn't stopped desertification, we would have been soon forced to leave our homes" says Hu Liancun, son of sheep farmers, and deputy director of the Yanchi Department of Agriculture.

Hu Liancun was successful in getting local sheep farmers to allow their sheep only to graze in exceptional cases. In the way, in the area of the wild relatives of crops project wild wheat is also protected.

jointly with the sheep farmers. We also have to develop other sources of income.

What help are you offering?
We assist farmers with the construction of sheep pens and help them to feed the animals in the villages. We provide them with irrigation and seed for fodder plants. We help them to improve their knowledge base. And we are also considering, meanwhile – after having imposed a complete ban on grazing – lifting it temporarily.

Why?
The vegetation is recovering again. In the past few years, jointly with the governments at the provincial and national level, we have invested a lot of money in reforestation programmes. We have planted hundreds of thousands of grasses and shrubs. Now, ten years after the grazing ban, the vegetation is flourishing once more, and there has also been an increase in rainfall. It seems that nature is rewarding us for our efforts.

When speaking to sheep farmers one gets the impression that it is merely the time when grazing takes place which has changed. They no longer let their sheep out onto the fields by day, but by night, when no one can see them. Farmers now work at night and sleep during the day. Is that true?
We can't avoid saying that there are farmers who let their sheep graze at night. But it is strictly forbidden, and they are at risk of being punished. But what are they supposed to do? You cannot change, from one day to another, a system that has grown up over centuries – you have to take it slowly. It is still permitted, however, to cut grass and feed it to the animals. This protects nature

because it means the roots are not damaged. But it takes a lot more effort, of course.

Are there alternatives to sheep farming?
Our main problem is the inadequate supply of water for growing plants. We can only solve this with new, better designed, smarter irrigation systems.

How important for the region is the wild relatives of crops project?
We did not know that wild wheat is such a valuable resource. The project has completely changed public awareness about this. And in our battle against desertification, we are receiving concrete support from the project in the form of financial help and technical skills in the construction of irrigation systems. We are protecting wild wheat by prohibiting grazing in the project areas and we receive support in return.

Untill now, people have regarded wild plants merely as fodder for their sheep. Do people now look at them in a different light?
Certainly not all of them, but some do. We live in a region where people do not earn a lot of money. We now understand that what grows here is of value. We now want to consider, for instance, whether it is possible to create new sources of income from wild plants. Perhaps there are certain herbs which grow particularly well in our region, and which would, for instance, enhance the meat of our sheep before sale.

What would have happened if you had not faced up to the desert and nothing had changed?
For us, today, that is unimaginable. It would have been a tragedy. We would have had a lot more desert storms and much less rainfall. The desert would have expanded even further, and perhaps in some regions in Yanchi it would not even have been possible to survive.

Desertification is also a consequence of climate change, and threatens man's very existence. What can the world learn from Yanchi?
You sometimes have to take uncomfortable measures if you wish to let nature recover. We prohibited sheep grazing in order to achieve this goal. If we really want to, we human beings can stop the desert.

In the meantime, Yanchi's vegetation is recovering. Mr. Hu is now thinking of allowing sheep to graze again, if only temporarily.

Part 4
Outlook

One goal of the German government supported agrobiodiversity project is to support local people to regain a measure of economic independence.

Over the past decades, agriculture in almost every part of the world has had to play by the rules of a globalised market increasingly dominated by large companies. Individual farmers, the weakest link in the production chain, find themselves under ever more pressure from these global forces. If, however, people reconsider the importance of their unique local strengths, and develop new regional products and their own methods of production and marketing, then they will be able to regain a measure of independence. This is one of the objectives of the agrobiodiversity project which is supported by the German government until the end of 2011.

Low biodiversity of intensive farming systems such as monocultures may help to produce high yields in the short term. But considering long term aspects such as sustainability in production and agricultural adaptation to climate change, there is an evident need to diversify agriculture and increase biodiversity.

Anyone seeking to conserve or to re-introduce agrobiodiversity will only be successful, if reasonable yields can be achieved. This, however, requires additional time and effort. New methods and concepts of plant breeding have to be applied, which result in varities with high genetic diversity and well adapted to environmental stress. Secondly, present cropping systems as well as animal husbandry systems have to be re-designed towards higher biological and functional diversity. No doubt, the potential for sustainable intensification does exist and biodiversity plays a key role in it.

When, in July 2005, experts from GIZ moved into their office in Beijing, this project was the first of its kind in China. The activities in the sphere of *in situ* conservation of agrobiodiversity obtained considerable interest amongst specialist circles, both nationally and internationally. The project also gave rise to the idea for the wild relatives of crops project which has also been described in this brochure.

But what will remain with the villagers in Southern China and GIZ's partners in the Ministry of

The motto spread by the Farmer Field Schools: Diversity pays!

Agriculture at the conclusion of the agrobiodiversity project at the end of 2011? A lot. In many villages, the Farmer Field Schools have given farmers their own meeting places for the first time – somewhere they can discuss the future development of their villages. They can learn together there, analyse, develop techniques and work out marketing strategies. They have recognised that diversity pays and that, out of the richness of crops with numerous varieties and animals with many different breeds found in their villages, they can develop agricultural products which differ from those of competing farmers in other villages. They know that they can earn more money by doing this, instead of just competing with other farmers in terms of price for the exact same products.

In the German Rhön, too, farmers are developing a competitive advantage by growing unique old varieties of apple, as opposed to the usual mass-produced "plantation" apples. This makes them attractive to the customer. When the farmers in Hunan bring rare varieties of buckwheat or special varieties of rice such as black sticky rice to market, this gives them an edge over their competitors. They enjoy a market advantage in providing these unusual products, and not just in regards to their higher price. People eventually hear about these advantages, and other farmers soon follow suit. Of equal importance is the fact that farmers in the villages have learned, through the different projects, how precious their environment is and how valuable biological and cultural diversity are.

They will benefit from the new diversity in the fields: children of Hainan.

Many people have come – from the Department of Agriculture in the provincial capital, from the Minsitry of Agriculture in Beijing, and even from distant places in Europe – to visit them and their villages and to work jointly with them on projects. Their houses and village communities are no longer just a symbol of the old, rural agrarian China, which young people are increasingly leaving for the new China of burgeoning industrial growth. These villages can also demonstrate potential for development. In the future, many will be organically producing medicinal herbs which can be sold to Europe, others mushrooms which will generate extra income in the markets of Southern China. Still others may focus on organically produced food, local chestnuts, red rice, or wild raspberries for regional markets.

The agrobiodiversity project is engaged at the moment in incorporating considerations of biodiversity and agricultural diversity into the strategies and policies of the relevant authorities. A precondition for this was a comprehensive public relations campaign for awareness raising, as well as the extensive capacity building of political decision-makers in the Ministry of Agriculture and various agricultural authorities in the project provinces and counties.

It is now vital to disseminate the knowledge generated to other rural regions of China. To this end, further capacity building and awareness raising will have to be done. Moreover, additional sources of income must be found for the farmers, for instance by sharing the proceeds from plants which are used by pharmaceutical or cosmetic companies for developing new products. Farmers are the intellectual custodians and proprietors of traditional knowledge about these plants, including their effectiveness, methods of cultivation and of collection, as well as breeding. New mechanisms have to be developed for adequately remunerating the farmers. This aspect of "Access and Benefit Sharing" is still woefully lacking in detail – not only in China, but also in the international negotiations between the developing and the

Every individual plant can contribute to combatting climate change and other challenges ...

... and thereby ensure our world's food security.

industrialised countries, as well as multi-national companies. The recently adopted Nagoya Protocol, which is particularly relevant to this issue, has yet to be put into practice by its signatories.
The project on the "Conservation and Sustainable Utilization of Wild Relatives of Crops" has only recently begun. It has ambitious goals and has been generously funded. By 2012, a good EUR 15 million – of which nine million euros were contributed by China – will have been poured into the conservation of the wild relatives of rice, wheat and soybeans. Eight provinces – almost one in every three Chinese provinces – are taking part with their own local project. This demonstrates how serious the Ministry of Agriculture of the People's Republic of China and the United Nations Development Programme are in driving the conservation of the wild forms of these globally important food plants. Countless plant species and varieties have vanished worldwide from the Earth over the past 50 years and with each, a precious plant which could perhaps have helped man to support adaptation to climate change and other challenges, or have contributed to food security for the world's constantly growing population. The biological wealth still present in China's mountain regions will – with the help of the project – also benefit the next generation. In view of the constant wave of new challenges we face, our children and grandchildren will certainly appreciate the benefits derived from the conservation of agrobiodiversity.
And what is the world learning from the project's experiences in the mountain regions of China? That it pays, for instance, to scrutinise very precisely the riches which nature has to offer. This diversity which has evolved over millions of years is one of the most important treasures produced by the Earth. People can use it in a multiplicity of ways only if they conserve and cease to endanger, degrade or destroy it. In the expansive landscapes of China, an extraordinary richness of plants and animals is still to be found, but there is also diversity elsewhere in Europe. In Germany, too, many people are working on the topic of plant diversity in the fields, and are thinking about ways in which locally bred animals and plants could be used for the benefit of future generations.
The projects in China are also an example of how the combined experience, knowledge and commitment of people across cultural and geographical borders can produce answers to questions which cannot be responded to by one country, or even one company, alone. For example, how – in view of the multiple challenges facing us – are we to ensure that we can feed the world in the future?

Part 5
Appendix

Glossary

Access and Benefit Sharing (ABS)
Access to genetic resources and the fair and equitable sharing of the benefits arising from them.
www.cbd.int/abs

Agrobiodiversity
All components of **biodiversity** of relevance to food and agriculture. This includes all organisms that contribute to sustaining the key functions of agro-ecosystems.

Agro-chemicals
Chemical products used in the agricultural sector such as herbicides (weed killers), insecticides, molluscicides (for killing gastropods, particularly snails and slugs), seed and plant protective agents, fungicides (for killing fungi and spores) and synthetic fertilisers.

Biodiversity
Variety of life on Earth. This encompasses genetic diversity, species diversity and ecosystem diversity.

Bio-fuel
Liquid, solid, or gaseous fuel produced by conversion of biomass. Examples include bioethanol from sugarcane or corn, charcoal or woodchips, and biogas from the anaerobic decomposition of wastes.

Biosphere Reserve
A site established by countries and recognized under UNESCO's "Man and the Biosphere (MAB) Programme". The concept is aimed explicitly at harmonising man's use of resources with nature conservation.
www.unesco.org/mab

Capacity Building
A process whereby information and knowledge about a specific problem are made accessible and disseminated, a differentiated awareness of the problem is created, and the skills necessary for tackling and solving it acquired.

Convention on Biological Diversity (CBD)
Adopted in Rio de Janeiro in 1992, the CBD combines the conservation of **biological diversity** with the sustainable use of its components and the fair and equitable sharing of the benefits arising from the use of genetic resources. By 2010, 192 countries and the European Union had become members of the Convention.
www.cbd.int

Crops
Plants harvested for food, animal fodder or for raw material purposes. A differentiation can be made between cultivated and wild-collected crops.

Cultivated plants
Plants that have undergone a process of domestication by selection and breeding from wild populations.

Cultural Landscape
A landscape which has been shaped by man. Specifically, the character of the natural location and the way man has influenced, utilised and interacted with it.

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
The GIZ was formed on 1 January 2011. It brings together under one roof the long-standing expertise of the Deutscher Entwicklungsdienst (DED) gGmbH (German Development Service), the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH (German Technical Cooperation) and InWEnt – Capacity Building International, Germany. As a federally owned enterprise, it supports the German Government in achieving its objectives in the field of international cooperation for sustainable development.
www.giz.de/en

Development Cooperation (DC)
The joint effort between industrialised and developing countries to dismantle global differences in socio-economic development and general living conditions in a permanent and sustainable way. Since the 1990s, the term "development cooperation" has replaced the term "development aid" in the vocabulary of development policy. Development aid pursued largely the same goals as DC, but by contrast was not characterised by equality on the basis of partnership, and rather by the dominating role of expert knowledge and the wealth of the industrialised countries.

Endemic
Plants or animals are endemic to an area if they occur mainly there, in a clearly demarcated environment. This can apply to species, genera or families of organisms which are exclusively native, for instance, to particular islands or groups of islands, mountain regions, individual valleys or water systems.

Ethnic group
A group of people or a population which defines itself by having either a past or a future perspective in common. This common ground is reflected in tradition, language, religion, clothing or eating habits. Having this common history and culture, as well as being rooted in a specific territory, gives ethnic groups an often powerful sense of solidarity and affiliation.

EU-China Biodiversity Programme (ECBP)
A joint initiative of the European Union, the Ministry of Commerce of the People's Republic of China, the United Nations Development Programme and the Ministry of Environmental Protection of the People's Republic of China. The programme aims to conserve specific ecosystems in China by strengthening biodiversity management, enhance the capacity of the relevant organisations to implement the **Convention on Biological Diversity**, establish effective systems of monitoring and feedback, and seek to strengthen the effectiveness of the Steering Committee itself.
www.ecbp.cn

***Ex situ* conservation**
(Latin for "outside the (original) place")
The conservation of components of **biodiversity** outside their natural habitat, for instance in gene banks or botanical or zoological gardens.
www.cbd.int/convention

Farmer Field School (FFS)
Group-based training and learning processes for farmers which combine concepts and methods from the sphere of agricultural ecology, learning by experience, and community development. The concept of the FFS was developed by the FAO and first used in Indonesia in the 1980s when it was recognised that farmers found it hard to put theoretical concepts about the ecology of rice paddies and agricultural management systems into practice.

Gene pool
The total amount of genetic material within a freely interbreeding population at a given time. A larger gene pool with many different variants of individual genes leads to the increasing possibility that the descendants of a population will be better adapted to changed environmental conditions. Unwelcome genes can be bred out of the gene pool. The size of the gene pool can be increased by the hybridisation of

individuals who do not belong to the population.
www.ecbp.cn/en/knows.jsp?cid=19

German Federal Ministry for Economic Cooperation and Development (BMZ)
BMZ develops the guidelines and the fundamental concepts on which German development policy is based. It commissions various independent organisations to implement concrete projects and programmes in German **Development Cooperation**, or provides financial contributions to enable these measures to be carried out.
www.bmz.de/en

Herbicide tolerance
The ability of a cultivated plant species to survive the application of a particular herbicide and to reproduce itself.

Hybrid variety
The result of a specific method of plant breeding, which ends with the crossing of two inbreeding lines. Contrary to open pollinating varieties, for hybrid varieties new seeds have to be used every year.

***In situ* conservation**
(Latin for "in the (original) place")
The conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties.
www.cbd.int/convention

Intercropping
The agricultural practice of growing two or more crops on the same piece of land. This kind of mixed cultivation (the opposite of **monoculture**) makes optimum use of the arable land available and at the same time can contribute to **agro-biodiversity**. In most cases it is a matter of growing a main crop supplemented by other plants; intercropping is designed in a way that competition for space, nutrients or sunlight is minimised. Further advantages are: natural pest control and soil improvement by fixation of nitrogen, improved erosion control and better use of water.

IUCN protected area management categories
These categories classify **protected areas** according to their management objectives. They are recognised by international bodies such as the United Nations and by many national governments as the global standard for defining and recording **protected areas** and as such are increasingly being incorporated into government legislation.
www.iucn.org/about/work/programmes/pa/pa_products/wcpa_categories

Mandarin
The official language of China. Its Chinese term literally means "usual or normal language". It is based on the Northern Chinese dialect spoken in the Beijing region.

Medicinal/pharmacological plants
Plants that can be used for medicinal purposes and the treatment or cure of disease due to their healing properties. It is assumed that early *Homo sapiens* possessed basic knowledge about the healing properties of plants. It has been proven that even animals use particular plants to prevent or fight sickness.

Megadiverse
Applies to regions distinguished by an unusually high degree of **biodiversity**. Megadiverse countries have a wealth of species of more than 5,000 higher plants to an area of 10,000 km² and are located mostly in the tropics and subtropics (Brazil, China, Colombia, Costa Rica, Ecuador, India, Indonesia, Kenya, Mexico, Peru, Venezuela, South Africa, Madagascar, Bolivia, Malaysia, the Philippines, the Democratic Republic of the Congo).

Monoculture
(Greek *monos* for "alone", "only" and Latin *cultura* for "agriculture")
A form of agriculture and forestry where just one particular variety of plant is grown and harvested on one field or woodlot and season after season. The opposite of this is intercropping, mixed cultivation, or the widely used agricultural term, crop rotation.

Non-Governmental Organisation (NGO)
Non-profit-making institution which is neither organised by, nor dependent on, the state. Numbered amongst them are: every non-profit-making organisation, associations with or without recognised charitable status, employers' organisations, trade unions, and administrative bodies. International NGOs are active worldwide (for instance, WWF, Greenpeace, and Conservation International).

Protected area
An area of land and/or sea especially dedicated to the protection and maintenance of **biodiversity**, and of natural and associated cultural resources, and managed through legal and other effective means.
www.iucn.org

Public Private Partnership (PPP)
PPP brings together the private sector, on the one hand, and development cooperation organisations such as GIZ, on the other hand. Each partner brings its own particular expertise to a project – costs, risks and the success of the partnership project are shared equally by both partners.

Resistance
The ability of an organism to withstand negative external influences.

Resources
Collective term for everything humans needs to live. A distinction is made between natural resources and man-made resources (infrastructure, buildings, machines, knowledge). Natural resources are divided into those that are renewable (plants, animals, water as part of the natural water cycle) and non-renewable (mineral deposits, coal, oil and soil). In everyday linguistic use, natural resources are often meant to be only those which are renewable. Non-renewable resources are finite, and, therefore, exhaustible. The sun's energy occupies a special position since it is practically inexhaustible.

Subsistence farming
Usually operating in local and regional units, a subsistence economy is geared to self-sufficiency and earning enough to live. Subsistence agricultural and livestock farming is primarily for self-provision. Therefore, the more appropriate term is "subsistence-oriented farming".

Taxonomy
(Greek *táxis* for "order", *nómos* for "law")
The practice and science of classification of living organisms, for instance. Taxonomy uses taxonomic units know as taxa.

Technical Cooperation (TC)
Transfer of technical, economic and organisational knowledge and skills in order to strengthen the performance capacity of people and organisations in partner countries.

Transgenic organism
Organism whose genome has received additional genes from other species, thus making it a genetically modified organism (GMO).

Acronyms and abbreviations

ABS	Access and Benefit Sharing
AoA	Agreement on Agriculture (of the World Trade Organisation)
BCH	Biosafety Clearing House
BfN	Bundesamt für Naturschutz (Federal Agency for Nature Conservation, Germany)
BLE	Bundesanstalt für Landwirtschaft und Ernährung (Federal Office for Agriculture and Food, Germany)
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (Federal Ministry for Economic Cooperation and Development, Germany)
bpb	Bundesanstalt für politische Bildung (Federal Agency for Civic Education, Germany)
Bt	*Bacillus thuringiensis*
CAAS	Chinese Academy of Agricultural Sciences
CBD	(United Nations) Convention on Biological Diversity
CGIAR	Consultative Group on International Agricultural Research
CIMMYT	International Maize and Wheat Improvement Center
CIP	Centro Internacional de la Papa, Peru (International Potato Center)
CNY	Chinese Yuan
DC	Development Cooperation
DED	Deutscher Entwicklungsdienst (German Development Service)
DNA	Deoxyribonucleic acid
ECBP	EU-China Biodiversity Programme
EEMP	Environmental Education Media Project
EU	European Union
EUR	Euro
FAO	Food and Agriculture Organization of the United Nations
FFS	Farmer Field School
GEF	Global Environment Facility
GENRES	Informationssystem Genetische Ressourcen (Information System Genetic Resources)
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH, Germany
GMO	Genetically Modified Organism
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit GmbH
IDRC	International Development Research Centre
IIED	International Institute for Environment and Development
IMF	International Monetary Fund
InWEnt	Internationale Weiterbildung und Entwicklung GmbH (Capacity Building International, Germany)
IPCC	Intergovernmental Panel on Climate Change
IPK	Leibniz-Institut für Pflanzengenetik und Kulturpflanzenforschung (Leibniz Institute of Plant Genetics and Crop Plant Research, Germany)
IRRI	International Rice Research Institute
ISSC-MAP	International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
IUCN	International Union for Conservation of Nature
JKI	Julius Kühn Institute (Federal Research Centre for Cultivated Plants, Germany)
K2C	Kruger to Canyons Biosphere Reserve, South Africa
KfW	Entwicklungsbank, Germany
MAB	UNESCO Man and Biosphere Programme
MDGs	Millenium Development Goals
MEP	Ministry of Environmental Protection, China
MoA	Ministry of Agriculture, China
NGO	Non-Governmental Organisation
OECD	Organisation for Economic Co-operation and Development
PPP	Public Private Partnership
TC	Technical Cooperation
TCM	Traditional Chinese Medicine
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNFCCC	United Nations Framework Convention on Climate Change
UNFPA	United Nations Population Fund
USD	US Dollar
WCPA	World Commission on Protected Areas
WDPA	World Database on Protected Areas
WRI	World Resources Institute
WTO	World Trade Organization
WWF	World Wide Fund for Nature

Links & Literature

available as a PDF file on the accompanying DVD "Agrobiodiversity in China" in this brochure

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Web site with a wide variety of well researched articles on various aspects of sustainability and global environmental issues, with a special focus on China
www.chinadialogue.net

CIA World Factbook
www.cia.gov/library/publications/the-world-factbook/index.html

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
www.giz.de/en
- GIZ in the People's Republic of China, including information about priority areas, programmes and projects
  www.giz.de/china

European Commission External Cooperation Programmes
http://ec.europa.eu/europeaid/index_en.htm
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  http://ec.europa.eu/europeaid/where/asia/country-cooperation/china/china_en.htm
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http://eeas.europa.eu/index_en.htm
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www.auswaertiges-amt.de/diplo/en/Laenderinformationen/01-Laender/China.html

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Transparency International
Corruption Perception Index
www.transparency.org/surveys/#cpi

United Nations (UN)
in the People's Republic of China
www.un.org.cn

United Nations Development Programme (UNDP)
www.undp.org
- Millennium Development Goals
  www.undp.org/mdg
- UNDP in the People's Republic of China
  www.undp.org.cn
- Various publications by the UNDP in China: China Human Development Report 2009/2010, UNDP China Annual Report 2007/2008, MDGs Report 2010, Download:
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United Nations Environment Programme (UNEP)
www.unep.org
- Country Profile People's Republic of China
  http://ekh.unep.org/?q=taxonomy_menu/9/28/17/82&cprofile=1&lev=top&contf=9/28/17/82
- Global Environmental Outlook 4
  www.unep.org/geo
- Information on biodiversity
  http://ekh.unep.org/?q=taxonomy_menu/8/8&type=flexinode-1
- World Conservation Monitoring Centre: United Nations List of Protected Areas
  www.unep-wcmc.org/protected_areas/UN_list/index.htm

United Nations Framework Convention on Climate Change (UNFCC)
www.unfccc.int

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Statistical data and comparisons by country
www.unfpa.org

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www.worldbank.org
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  www.worldbank.org/environmentaleconomics

Agrobiodiversity & Biodiversity

Agrar Koordination
Forum for international agrarian policy
www.agrarkoordination.de/laendernavigation/about-us.html

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Biosafety Information Centre
A Web site set up and managed by Third World Network
www.biosafety-info.net

Biotechnologie.de
An online information portal about biotechnology
www.biotechnologie.de/BIO/Navigation/EN/root.html

Bioversity International
Organization dedicated to researching agricultural biodiversity to improve people's lives, formerly known as IPGRI
www.bioversityinternational.org

Chinese Academy of Agricultural Sciences (CAAS)
www.caas.net.cn/engforcaas/index.htm

Chinese Crop Germplasm Information System (CGRIS)
Plant-genetic Institute at the Chinese Academy of Agricultural Sciences, a central repository for all types of plant genetic resource information in China
http://icgr.caas.net.cn/cgris_english.html

Conservation & Development
Publications, educational material and campaigns on the topic of nature conservation and development
www.conservation-development.net/index.php?L=2&ds=176

- Series "Sustainability has many faces"
  www.conservation-development.net/index.php?L=2&ds=247
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DVD contents “Mountain Gods and Wild Rice”

Mountain Gods and Lovage (English/14:53 minutes)

An audio-reportage from China’s Biodiversity Hot Spots, produced by Jörn Breiholz on behalf of GIZ. The text of the recording can be found with the additional materials and on the Web site.

Five original recordings (Chinese/approx. 2 minutes each)

from the authors’ research trips, produced by Jörn Breiholz on behalf of GIZ. The texts of the recordings can be found with the additional materials and on the Web site.

Sustainable Agro-biodiversity Management in the Mountain Areas of Southern China (English, Chinese/22 minutes)

Short version of the film on the GIZ-supported project on agrobiodiversity in China, produced by this project.

Additional materials

see next page

Additional materials

The Brochure (PDF file, English)

Background information on the presented exhibitions

- Catalogue for the travelling exhibition on Agricultural Biological Diversity in China: "When man meets nature. Food security, bio-diversity and traditional culture" (English, Chinese).
- Accompanying brochure on the exhibition *Nachhaltiges Management der Agrobiodiversität in China* [Sustainable management of agrobiodiversity in China] in the Palmengarten, Frankfurt/Main, Germany (German, Chinese).
- Accompanying brochures on the exhibition module *Hausgärten in Ländern des Südens* [Home gardens in the countries of the south] in the Palmengarten, Frankfurt/Main, Germany (German):
  - *Hausgärten in den Ländern des Südens – Schatzkammern der Vielfalt*
  - *Hausgärten weltweit – Schatzkammern für Ernährung und Vielfalt*

Material for educational use

- Text of the audio-reportage "Mountain Gods and Lovage" (English)
- Texts of the five original recordings (English)
- Suggestions for further work on the subject, "Protected area, conflict area?" (English)
- Memory game with pictures of plants and animals which occur in China (German)
- Banner of the CBD Secretariat on the topic "Agrobiodiversity and Climate Change" (English)

Factsheets and Issue Papers on the subjects, "biodiversity" and "agrobiodiversity" (English)

- Factsheets on the subject of shaping frameworks for the conservation and sustainable use of biodiversity
- Factsheets on the subject of communicating biodiversity
- Issue Papers on the subjects of feeding the world and agrobiodiversity (four pages each, including GIZ order list):
  - Managing agrobiodiversity
  - Fundamentals of agrobiodiversity
  - Generating economic value from agrobiodiversity
  - Agrobiodiversity in Crisis Situations
  - Right to Food
- Sourcebook on Sustainable Agrobiodiversity Management (English, Chinese): Issue Papers on agrobiodiversity have been compiled in one volume in order to provide background information, interesting case studies and specific recommendations for action.

Photo gallery

Links, literature and selected PDF files on the subject

Additional materials for all the brochures which appear in the series "Sustainability has many faces" are also available on the Web site www.conservation-development.net/?L=2&ds=248

Where can I find the additional materials?

All materials are stored on an off-line Web site on the accompanying DVD.
To get there, just open the file "index.html" in the folder "Daten" on the DVD.

Exclusion of liability

With its ruling of 12 May 1998 - 312 O 85/98 - "liability for links" Hamburg Regional Court held that anyone including a link may also share liability for the content of the linked page. This can only be avoided by explicitly disclaiming responsibility for the content in question. We hereby disclaim responsibility for the content of all the Web sites mentioned or linked in the present text, and of any further links included there, which we do not adopt as our own.

Development Needs Diversity
People, natural resources and international cooperation

Nature Conservation Is Fun
Protected area management and environmental communication

Use it or Lose it
Hunter tourism and game breeding for conservation and development

Land Rights Are Human Rights
Win-win strategies for sustainable nature conservation

Innovative cooking stoves and ancient spirits
Conserving nature at the interface between energy efficiency and traditional customs

User Rights for Pastoralists and Fishermen
Agreements based on traditional and modern law

Who Protects What for Whom?
Participation and governance for nature conservation and development

Nature and Mankind facing Climate Change
One planet with many people – what's the future?

Energy is Life
Sustainable development and poverty alleviation need energy

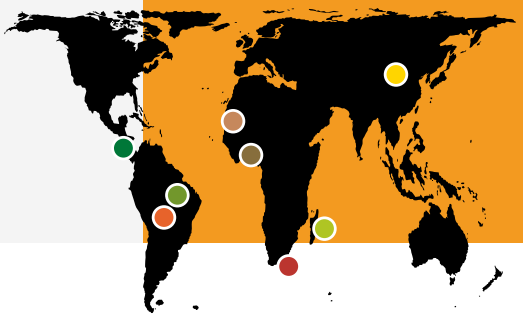
A Big Foot on a Small Planet?
Accounting with the Ecological Footprint

Mountain Gods and Wild Rice
Agrobiodiversity as a Basis for Human Existence

SUSTAINABILITY HAS MANY FACES

A brochure series with accompanying materials on development cooperation for the UN Decade of Education for Sustainable Development

Conserving biological and cultural diversity prepares the ground for human development. The examples included in this series present various "faces" of sustainability, offering ideas, contributions and suggestions on education for sustainable development both in and out of school (UN Decade 2005-2014). They show how people in countries with which we are less familiar find ways of improving their living conditions, while at the same time learning to protect their environment. In these settings, development cooperation means helping facilitate difficult economic and social change processes.



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