EDIBLE INSECTS

The contribution of edible forest insects to human nutrition

Wherever forest insects are part of the human diet, they have generally been collected from the wild. In most cases, minimal management of forest vegetation has been practised in association with the exploitation of forest insects, and actual domestication of insects thus far has been limited to only a few species such as silkworms and bees. The most commonly eaten insect forms are larvae and pupae, usually with little or no processing of the insects before they are consumed.

As an academic discipline, entomophagy (the human consumption of insects) is necessarily interdisciplinary, with relationships to several different recognized fields of scientific study. While entomology is the core related discipline, edible forest insects are also closely linked to the fields of forestry, human nutrition (including famine food and ritual food), traditional medicine, anthropology, agriculture and livestock raising. Contributions from these allied disciplines are exceptionally important to understanding the past and present roles, as well as to the future potential of food insects.

The lack of any one institution in the world with a strong research focus on edible insects is an impediment to conducting research on the subject. Relevant information is scattered far and wide among a variety of books and articles from different university departments and research facilities.

Worldwide, nearly 1 700 insect species are reported to be used as human food. Four insect orders predominate, in rank sequence: Coleoptera, Hymenoptera, Orthoptera and Lepidoptera, accounting for 80 percent of the species eaten.

Edible forest insects represent rich sources of protein for improvement of the human diet, especially for individuals suffering from poor nutrition because of a protein deficit. Gram for gram, insects often contain more protein and minerals than meat. In fact, nutritionists represent the leading group of researchers in food insects, motivated by a desire to remedy the problems associated with protein-deficient diets. (*Source*: D.V. Johnson. 2010. The contribution of edible forest insects to human nutrition and to forest management. In *Edible forest insects. Humans bite back!* 2010. Rome, FAO.)

Number of edible insect species reported in the world

Order	Common English name	Number of species
Coleoptera	Beetles	468
Hymenoptera	Ants, bees, wasps	351
Orthoptera	Grasshoppers, cockroaches, crickets	267
Lepidoptera	Butterflies, moths (silkworms)	253
Hemiptera	True bugs	102
Homoptera	Cicadas, leafhoppers, mealybugs	78
Isoptera	Termites	61
Diptera	Flies, mosquitoes	34
Odonata	Dragonflies	29
Ephemeroptera	Mayflies	19
Trichoptera	Caddis flies	10
Neuroptera	Dobson flies	5
Anoplura	Lice	3
Thysanura	Silverfish	1
Total		**1 681**

Number of edible insects per continent and number of consumer countries

Continent	Number of species recorded	Percentage of total	Number of consuming countries
Asia	349	20	29
Australia	152	9	14
Africa	524	30	36
Americas	679	39	23
Europe	41	2	11
Total	**1 745 ***	**100**	**113**

* The world total is actually 1 681; some species occur in more than one continent, hence the higher total.

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Nigerian researchers explore nutritional value of local insects

Nigerian researchers have confirmed that insects are indeed a good source of protein and other nutrients. They have found that edible insects constitute an important part of the daily diet of a large proportion of the population in southwestern Nigeria.

According to a study published in the *African Journal of Biotechnology*, these insects provide a high quality of proteins and supplements (minerals and vitamins) even when dried. A.D. Banjo, O.A. Lawal and E.A. Songonuga of the Department of Biological Sciences, Olabisi Onabanjo University, Ago-Iwoye, Ogun State (Nigeria) have written that "the consumption of non-toxic insects, therefore, should be encouraged. Insects are traditional foods in most cultures, playing an important role in human nutrition and have many nutrients to offer. They can be reared for their high nutritional qualities and sold to the populace that regards them as delicacies. Some of the most sought-after species, especially those with high nutritional content, ought to be cultivated with modern techniques to increase their commercial values and availability."

The study is entitled: *The nutritional value of 14 species of edible insects in southwestern Nigeria*. According to the study, commonly eaten insects in Nigeria are termites (winged adults, queen), *Macrotermes bellicosus/Macrotermes notalensis*, *esusu* in Yoruba and *aku* in Ibo; adult crickets (*Brachytrypes* spp.), *ire* in Yoruba; grasshoppers (*Zonocerus variegates*), *tata* in Yoruba and *abuzu* in Ibo; adult short-horned grasshoppers (*Cytacanthacris naeruginosus* unicolor), *tata* in Yoruba and *ukpana* in Ibo; rhinoceros beetle larvae (*Analeptes trifasciata*), *ipe* in Yoruba and *ebe* in Ibo;

scarab beetle larvae (*Oryctes boas*), *ogongo* in Yoruba; snout beetle larvae (*Rhynchophorus phoenicis*), *munimuni* in Yoruba; eggs, larvae and pupae of honey bees (*Apis mellifera*), *oyin* in Yoruba and *anwu* in Ibo; and larvae of caterpillars (*Anaphe* spp.), *ekuku* in Yoruba.

The researchers analysed 17 species of edible insects representing nine families from southwestern Nigeria for nutrient composition. They include the orders of Orthoptera, Lepidoptera, Coleoptera, Hymenoptera and Isoptera. *Analeptes trifasciata*, *Rhynchophorus phoenicis* and *Zonocerus variegates* have the highest crude protein content (29.62, 28.42 and 26.8 percent, respectively).

Hundreds of insect species have been used as human food; some of the more important groups include grasshoppers, caterpillars, beetle grubs and sometimes adults, winged termites (some of which are very large in the tropics), bees, wasps and ant broods (larvae and pupae), as well as winged ants, cicadas and a variety of aquatic insects. Insects are not normally used as emergency food during shortages, but are included as a planned part of the diet throughout the year, or when seasonally available.

The researchers concluded that "this study revealed that some of the insects which are pests also have high nutritional qualities". (*Source*: www.ngrguardiannews.com [Nigeria], 14 April 2010.)

Insects proving food for thought

An insect summit is aiming to revolutionize the way we think about bugs as a sustainable source of food. It is estimated that 80 percent of the world's population include some sort of insect in their diets. Yet, in the West, the idea is confined to reality TV shows.

The Royal Entomology Society Conference taking place at Swansea University (United Kingdom) from 26 to 28 July will hear that insect protein may be key to alleviating famine.

One man is on a mission to give us a taste for creepy-crawlies. Professor Arnold van Huis from Wageningen University in Belgium said: "Producing a kilogram of meat from a cow requires 13 kg of vegetable matter as feed. Yet 1 kg of meat from a cricket, locust or beetle needs just 1.5 to 2 kg of fodder and produces a fraction of the CO_2 emissions. The maths are quite simple. On average, in the West, we eat 120 kg of meat per person. China is currently at 80 kg per head and catching us up fast."

"If five billion people eat 100 kg of beef or pork, then we'll need to grow an average of 6.5 trillion kg of fodder per year. There just isn't enough space or nutrients in the earth to support that and the poorest people will simply starve to death," he said.

"The good news is that, not only do insects require less food to farm, you also don't have to eat as much to survive, as they are an extremely good source of protein and vitamins," added van Huis.

Thailand has 15 000 household cricket farms bred for human consumption. In southern Africa, the Mopane worm industry is worth USD85 million and is an important source of protein for the indigenous population. The insects are harvested from the Mopane trees that they use as their habitat.

In the Netherlands, insect-rearing companies are already in business; typically, they tend to breed large beetles, crickets and locusts. Locusts have to be farmed at 30 degrees, so this may be the main reason why insects are not eaten in the Western world to the same extent.

However, Professor van Huis said that the most common misconception is that insects are not tasty. "Because of the mild climate, we're just not culturally used to eating insects but, if they're cooked correctly, they can be delicious. Really, there's no credible reason against eating them, taste-wise and nutritionally, there's no difference between insect meat and that from birds, fish or mammals," he said. "But in an attempt to combat the developed world's squeamishness, we're looking at ways of grinding the meat into some sort of patty, which would be more recognizable to Western palates. It's also possible, although not yet commercially viable, to extract the protein, and produce a kind of meat substitute, similar to the Quorn products we're already used to."

On health grounds, Professor van Huis warns against going down The Good Life route, and harvesting your own bugs in the back garden.

Swansea University was chosen to host the summit in recognition of its ground-breaking work in the field. (*Source*: BBC News Online, 27 July 2010.)

Scientists "grow" edible insects in Costa Rica

The day when restaurants will serve garlic grasshoppers or beetle larva skewers is getting closer in Costa Rica, where scientists are "growing" insects for human consumption. Entomologist Manuel Zumbado's research into this alternative food source is inspired by practices in Africa, where insects have long been part of people's diet.

With its rain forests playing host to countless insect species, including thousands that have yet to be identified, Costa Rica is a perfect breeding ground for the work. From leaf-cutting ants to rhinoceros beetles and a dizzying flurry of butterflies, the Central American nation is also a haven of ecotourism. But is it the next hotbed of mouth-watering bugs? The food diversification programme at the National Biodiversity Institute in Santo Domingo de Heredia, a small city close to the capital San José, looks into indigenous insect species. But it also examines mushrooms, inspired by their importance in diets in the Himalayan kingdom of Bhutan. At the institute, Costa Rican scientists mingle with Bhutan mycology expert Ugyen Yangchen and Elisabeth Zannou, an entomologist from Benin.

"Benin knows a lot about insect consumption and Bhutan about eating mushrooms, while Costa Rica is bringing its experience in managing biodiversity," Marianella Feoli, who manages the foundation coordinating the research programme, told AFP.

In Benin, termites, grasshoppers and crickets, as well as butterfly and moth larvae, are a common part of people's diet, explained Zumbado, who travelled with his colleagues to explore the phenomenon in the coastal country. "In other countries, gourmet restaurants serve insects," he noted. "In the beginning, people thought we were a bit crazy, but I think this is an alternative, not only as a survival food, but also as a cultural concept."

Esperanzas, a large grasshopper species with long antennae that abounds in Costa Rica's forests and rural areas is "far more savoury than shrimp" when seasoned with garlic, according to the researcher.

Zumbado should know – he has consumed scores of insects during his travels in Costa Rica and Benin.

As part of his efforts to convince a sceptical public not particularly enthused at the thought of munching on crunchy creepy-crawlies, the entomologist suggested first adding insect delicacies to the menus of the best restaurants in town. (*Source*: AFP, 3 February 2010.)

Author holds "insect-tasting sessions" across Japan

Green ants, hornet larvae and silkworm pupae were on the menu at Shoichi Uchiyama's most recent insect-tasting event, held at a café in the Asagaya district of Tokyo on 8 June. And the events are becoming so popular, he said, that he has a waiting list for future insect buffets.

"I first tried this four years ago, but I have had to increase the frequency to less than one a month now because so many people want to take part," he said. "Everyone who came already knew that we would be tasting insects and even though some were a little nervous at first, they soon got their courage up and tried the dishes," he said. "I think they really enjoyed them."

Around 1 000 species of insects from around the world are considered to be edible and Mr Uchiyama has sampled most of them. He released a book of insect recipes in 2008 and traces his interest in insect cuisine to his boyhood in the northern prefecture of Nagano, where corner stores would sell bags of grasshoppers that had been cooked in sake, soy sauce and sugar.

Mr Uchiyama, 59, believes that insects can be the healthy and nutritious answer to the world's growing food shortages. To raise beef cattle, he points out, takes vast areas of land and large amounts of fodder, while insects consume the things that humans will not touch and can be raised in much smaller spaces. It helps that they are very nutritionally balanced and have little fat, he added.

Insects have been eaten for centuries, he points out, with the Chinese fond of scorpions, huge spiders considered a delicacy in parts of South America and water bugs popular in Thailand. (*Source*: *The Daily Telegraph* [United Kingdom], 14 June 2010.)

Critter cuisine could feed a nation

Vientiane, Lao People's Democratic Republic. After a hard day's work, Bounpheng Wattana and his friends like nothing better with a cold beer than a mouthful of creepy-crawlies. In his opinion, insects are the ultimate organic food. "These are local and natural foods from our country," said Bounpheng "so Lao people like this kind of food because there are no chemicals".

While tasty critters may be a popular city snack, investing in sustainable insect farming and promoting the benefits of bug-gobbling could form part of the answer to alleviating chronic malnutrition in the Lao People's Democratic Republic, said Vonglokham Phouvanh from FAO. "Insects can provide a good source of protein, fats, carbohydrates, calcium, vitamins and other minerals – this is an essential part of human nutrition," he said.

A 2007 World Food Programme report estimated that about 40 percent of children were malnourished or stunted, one of the worst rates in Southeast Asia, while the *UNDP Human Development Report 2009* indicates that 40 percent of Lao children under five are underweight.

Promoting insects could help alleviate the problem, and the potential is there – a recent FAO survey found that more than 95 percent of Lao people snack on critters. There are about 1 700 edible insect species worldwide but their nutritional benefits are a relatively recent discovery. To capitalize on this and ensure sustainability, FAO has a programme focused on the whole chain – from bug breeding to commercialization and consumption.

A video on FAO's work with edible insects in the Lao People's Democratic Republic can be found at www.youtube.com/watch?v=n6jfcHwT5_w

Vankham Duangbutby started breeding crickets from her home in the suburbs of Vientiane five years ago and soon realized how profitable it could be. "At first I did a little farming, just tried with two cylinders of crickets. After we found it worked we continued to farm until we had 56 cylinders. When we sell, on average, we can earn one million kip [USD115] a month," Vankham said.

She now receives advice and equipment from FAO to help with her cricket farming.

One of the attractions of insect farming is its simplicity, Bounthavy Sisouphanthong, Vice-Minister of Planning and Investment, told Integrated Regional Information Networks (IRIN). "You don't need to have lots of land, you don't need lots of equipment and you don't need that much knowledge, and then you can make a business," he said.

Insect farming can be a lucrative venture. Neighbouring Thailand cannot satisfy its growing demand for insects and already imports from countries including Cambodia and Myanmar.

Serge Verniau, FAO's representative in the Lao People's Democratic Republic, thinks insects could play a part in tackling world poverty. "The vision of FAO is not just to reduce chronic malnutrition in the country, which is of course the core objective, but also to feed the grand metropolises in the future, from Calcutta to Shanghai and even New York to Rome. This great food source is also environmentally friendly to produce and needs much less energy and space than conventional meats," Verniau said. (*Source*: IRIN, 14 June 2010.)

Combining traditional knowledge and approaches with modern science and understanding

In this fast-paced modern world, it is sometimes easy to lose sight of valuable traditional knowledge and practices. There is a tendency to think of traditional habits and customs as outdated or primitive. Yet, experience across numerous fields has highlighted the value and benefits to be gained from combining customary knowledge and approaches with modern science and understanding.

Such is the case with edible forest insects. The practice of eating insects goes back thousands of years and has been documented in nearly every part of the world. In modern times, however, consumption of insects has declined in many societies and is sometimes ridiculed as old-fashioned and unhealthy. Yet, it would be prudent to consider carefully the value of customary knowledge before discarding it too readily. Scientific analysis confirms, for example, the exceptional nutritional benefits of many forest insects, and studies point to the potential to produce insects for food with far fewer negative environmental impacts than for many mainstream foods consumed today.

Aside from their nutritional and environmental benefits, experts see considerable opportunity for edible insects to provide incomes and jobs for rural people who capture, rear, process, transport and market insects as food. These prospects can be enhanced through promotion and adoption of modern food technology standards to ensure that the insects are safe and attractive for human consumption.

Traditionally, most edible insects have been harvested from natural forests, but surprisingly little is known about the life cycles, population dynamics, commercial and management potential of most edible forest insects. Among forest managers, knowledge and appreciation of how to manage and harvest insects sustainably are limited. However, traditional forest dwellers and forest-dependent people often possess remarkable knowledge of the insects and their management, offering excellent opportunities for modern science and traditional knowledge to work together.

In an effort to explore more fully the various facets of edible forest insects, the FAO Regional Office for Asia and the Pacific organized an international workshop, entitled "Forest Insects as Food: Humans Bite Back" in Chiang Mai, Thailand, in February 2008. The workshop brought together many of the world's foremost experts on entomophagy – the practice of eating insects. Specialists in the three-day workshop focused specifically on the science management, collection, harvest, processing, marketing and consumption of edible forest insects, as well as their potential to be reared commercially by local farmers. The edited proceedings of the Chiang Mai workshop have just been published. It is hoped that the publication will help to raise awareness of the potential of edible forest insects as a food source, document the contribution of edible insects to rural livelihoods and highlight linkages to sustainable forest management and conservation. (*Source*: foreword to *Edible forest insects. Humans bite back!* Rome, FAO, 2010.)

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(*Please see page 73 for more information.*)

Edible insect taste test: from ant candy to bacon and cheese cricket

Many cultures across the globe incorporate insects into their diets, both as a protein source and a means of enhancing taste.

While many Americans question the practice, entomophagy (the practice of eating insects) remains a legitimate part of food culture and an ancient human tradition. Insect candy, ant candy and "crispy crickets" are now readily available even here in the United States of America through mail order.

Those looking for a fresher taste are encouraged to visit the Audubon Insectarium in New Orleans. Every day, the museum's Bug Appetit Café serves a slew of treats, such as chocolate chip cookies and garden herb dip – insect-infused, of course. Jayme Necaise, the Insectarium's Director of animal and visitor programmes, says: "We offer a virtual bug buffet. It's really a nice spread".

Last year, the Insectarium celebrated National Chocolate-Covered Insects Day with a chocolate fountain and roasted crickets. "The crickets are roasted off-site," says Necaise, "but we always hand-dip them right here".

Visitors can sample dips such as wax worm mango chutney and mealworm salsa.

For a more authentic taste, insects can also be ordered online from *Thailand Unique*. The online "specialty gourmet food store" offers insect "variety packs" with bags of cooked and dehydrated grasshoppers, weaver ants and dung beetles, as well as a pouch of mixed bugs, with bamboo worms and silkworm larva. (*Source*: Asylum online, 21 June 2010.)

Governor in the southern Russian Federation hopes to make a delicacy of locusts

The governor of the Astrakhan region in the southern Russian Federation has proposed exporting locusts, killed to protect crops, to Asian countries as a delicacy.

Swarms of locusts have been attacking crops in the region since 25 May. The regional government has declared a state of emergency amid fears the insects may destroy more than 50 000 ha of crops.

"I saw a report yesterday on how many millions we spend annually on the fight against locusts and I thought maybe we can make it a profitable business, because people in dozens of countries around the world eat locusts," Alexander Zhilkin wrote on his Internet blog on Monday.

Zhilkin suggested that locusts could be dried, salted, frozen and exported, or sold to Thai or Chinese restaurants.

The official believes that this may be an ingenious solution to the problem. (*Source*: RIA Novosti News Agency [Russian Federation], 29 June 2010.)

Bugalicious: chefs mix it up for adventurous diners with worms, ants and scorpions

Toronto, Canada. Crickets have hopped back on to the menu at Toronto's Atlantic restaurant.

Chef Nathan Isberg admits the deep-fried critters are a novelty. "Strange though it may seem to the ordinary Canadian palate, there are many people who delight in platters of ants, scorpions, worms and even bullfrogs – if they are cooked just right."

Isberg says some diners may be turned off by the squishy or crunchy delicacies. But for more adventurous types, he is happy to whip up dishes such as chilli-fried crickets with greens, cricket-fried rice or grilled crickets and jellyfish on a skewer.

The insects were briefly swatted off the menu until an insurer recently gave the OK for their return. Isberg uses rosemary or oregano to spice them up but admits that he does not cook them every night since it takes a while to raise them to the right size. "If people are particularly interested in it then I have them available, but they are pretty labour-intensive."

Insects are more often served at special events rather than restaurants in Canada. But such cuisine is catching on at authentic Mexican restaurants in the United States of America, says Jeff Stewart of Creepy Crawly Cooking in Niagara-on-the-Lake, Ontario. Before, only 10 to 25 percent of those attending special events that he catered for would taste insects, Stewart says. Now, it is closer to 75 percent.

At the 5th Annual Bugalicious Insect Food Festival in February, Stewart cooked

up cricket candy and white chocolate crickets, Chinese scorpion soup and fresh ant fettuccine alfredo.

"Is it healthy, is it good for you?" asked Stewart. "Yeah, if you look at the nutritional content, they're very good for you." Still, chefs should check with their sources since wild bugs can be exposed to herbicides, he says. (*Source: Winnipeg Free Press* [Canada], 8 June 2010.)

THE FUTURE USE OF INSECTS AS HUMAN FOOD

Edible insects may be used as space-travel food in the distant future. For long voyages to other planets, their cell culture will provide animal protein in a spacecraft, within which the area for the production of foodstuffs will be limited. If humans ever live in huge airtight domes on other planets, food production will have to be developed within the confines of the domes. Breeding of large livestock will not be practicable because of space limitations. The alternative will be to use insects to provide a source of animal protein. For such purposes, species such as silkworms, termites and flies have been suggested, taking into account the effective recycling of organic substances. (*Source*: Jun Mitsuhashi. 2010. The future use of insects as human food. In *Edible forest insects. Humans bite back!* Rome, FAO. 2010.)

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MEDICINAL PLANTS AND HERBS

Helping African farmers to help themselves

Carole Robert may not fit the stereotype of a humanitarian aid worker, but the Blainville entrepreneur has just won an international award for her programme to help poor African farmers learn to cultivate and market medicinal plants in a sustainable manner.

Until just a few years ago, Robert was a prominent businesswoman running her own construction materials export company. She realized that there was great potential for commerce in some developing countries, but the people needed education and connections.

While doing her MBA, she learned about the flourishing global trade in medicinal, plant-based products that were coming into vogue for use in pharmaceuticals, cosmetics and foods. There was already a USD60-billion global market in these products in 2004, and that market was growing by about 10 percent a year. Yet, sub-Saharan Africa, where 43 percent of the world's medicinal plants grow naturally, was only participating in 0.01 percent of this market.

Robert then launched a foundation called "Biotechnology for Sustainable Development in Africa Foundation" (BDA). BDA's first project is Plant Action, a three-year educational programme in the Democratic Republic of the Congo. This pilot project will train 30 farmers in sustainable planting and harvesting of medicinal plants and trees, and turn them into entrepreneurs.

"I believe developing countries will flourish through commerce, not charity."

In the first year, the "ecopreneurs-in-training", as Robert calls them, learn about sustainable cultivation practices in the industrial production of medicinal plants. The students will learn to grow plants such as *moringa* or neem trees to international standards of quality control. They will have access to a phytochemistry laboratory, built and financed by a local Jesuit group.

The second year consists of practical training in the equatorial forest and savannah of the Luki Man of the Biosphere Reserve, a 30 000-ha conservation area managed by the World Wide Fund for Nature. Students from the Université du Québec's *École de technologie supérieure* helped build a plant-processing centre in the reserve, which will serve as a prototype for other such centres that BDA hopes to build across the country.

In the third year of the programme, the students will return to their land to start their businesses. BDA will create funds for microcredit so the ecopreneurs can hire employees.

BDA has raised and committed USD3 million to the programme to date.

"Africans can exploit their own natural resources," Robert said, "but we wanted to help them embark on international trade in a responsible way, because that is essential. We wanted to show them how to protect these plants from overexploitation so they can protect their resources for the future and make a living at the same time," she said. (*Source: The Gazette* [Canada], 2 March 2010.)

Vets turn to African herbs as animal drugs stop working

The West's veterinary drug drive is not working, say animal disease scientists, who have started researching the effectiveness of plant-based treatments used in Ethiopia.

Researchers from the Scottish Agricultural College (SAC), United Kingdom, will visit the East African country and select 30 plants used by native herders to control parasites in their animals. These will then be taken to laboratories in Ethiopia and Scotland to test for their effectiveness.

"Like farmers across the world, they often do things because their fathers and grandfathers did. Our idea is to find out if and how they work and to feed that information back to the farmers," said project leader Dr Jos Houdijk.

Dr Houdijk said the project was recognition that it was time to look for alternatives to the veterinary drugs on which farmers in industrialized countries had become reliant to control animal diseases. "When these drugs were introduced in the West in the 1960s we thought they would solve all our problems but we couldn't have been more wrong. Nowadays, the parasites are becoming resistant and the consumer is becoming more aware about having products that have a minimum use of drugs. Alternative medicines are coming into fashion again."

The project is one of 16 others given funding by SAC to look into helping sub-Saharan and South Asian farmers tackle the spread of livestock diseases. (*Source*: *The Ecologist*, 19 February 2010.)

MANAGING AFRICA'S MEDICINAL PLANTS

Research into Use's (RIU) pocket guide and policy brief series has produced a brief that outlines the need to find ways to manage Africa's medicinal plants in a sustainable way.

The brief, *Future health: sustainable management of Africa's medicinal plants*, highlights that 80 percent of Africans use traditional treatments made from wild native plant species and one-third depends on them entirely. As populations increase, so too does use; overexploitation is rampant. Control is imperative to sustain forest resources before they are lost, potentially denying access to medicines for millions of people.

There is demand for better management of resources, and a firm belief that this can be achieved. The Trees for Health Forever resolution was signed by foresters, traders, herbalists and ministry officials from countries across southern Africa in 2005. It committed to cross-border collaboration on forest management and to get the message of sustainable harvesting issues through the medicinal plant supply chain.

Scientists are already producing tools that can make sustainable management a reality. Policy-makers are encouraged to support groups, such as the Indigenous Resources Working Group in southern Africa, and take advantage of new management approaches and tools as they become available.

Policy must ensure that all stakeholders, from traders and wholesalers to local collectors gathering forest products, are included in initiatives to preserve forests and their medicines. As a result, policies must be inclusive of all countries, and push for all trade to be monitored and recorded. This may involve new joint policies among countries in the region to protect these valuable resources. (*Source*: www.worldpress.com, 30 March 2010.)

Application of ISSC-MAP for Cambodian plants

A two-year project being piloted in Cambodia by TRAFFIC Southeast Asia on the sustainable management of medicinal and aromatic plants has come to a successful close this year. The pilot was part of the "Saving Plants that Save Lives and Livelihoods" project, designed to test a recently developed International Standard for the Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP) for species important to local health and economies around the world. Cambodia's particular success offers insights into the feasibility of a global standard for sustainable medicinal and aromatic plant (MAP) management and provides direction for future courses of action.

In Cambodia, the reliance of many people on traditional medicines highlighted the need for the application of a standard such as ISSC-MAP to conserve resources and improve livelihoods. Nearly 40 percent of plants in Cambodia are medicinal and aromatic plant species used in health care, subsistent livelihoods and commercial trade. Generally, the highly valued species in local and international markets face exhaustive collection, resulting in population scarcity, which impacts local livelihoods, traditional knowledge and biodiversity. Like plant species in many countries around the world, many MAP species in Cambodia are now threatened, mainly because of overharvesting, unsustainable collection and poor management of natural resource areas.

To apply the ISSC-MAP standard in Cambodia, a suitable location and MAP species with high potential market value were first selected. During the first project workshop, stakeholders from local communities, traders, research organizations, NGOs, government, universities and others discussed and selected a location and MAP species based on data from field observations and local interviews. The Prek Tnoat Community Protected Area (CPA) was chosen as the site for ISSC-MAP implementation for two MAP species: *krakao*, *Amomum ovoideum*, a plant whose fruits are medicinally used for respiratory and digestive health, and *tepirou*, *Cinnamomum cambodianum*, a rare tree whose bark is also used for digestive health.

A detailed resource assessment was conducted by biologists and members of the Prek Tnoat CPA to measure vegetation type and structure, species ecology, population density and yield production. In addition, a market chain survey was conducted in Phnom Penh to determine the market viability of *krakao* and *tepirou*. Results of these studies found that the *tepirou* tree was not a good candidate for the management programme: bark collection of this species can only happen on a five-year rotation and the current population size is too small to provide enough potential income for the Prek Tnoat community, and incorrect harvesting would threaten the species with extirpation. However, the management plan put in place a methodology for sustainable harvesting so that, while income generation is small, overexploitation can be avoided. The resource assessment also provided the basic information necessary to create a community-based MAP management plan covering three main areas: (i) managerial structure, role and responsibility; (ii) regulation of collection; and (iii) benefit-sharing. This MAP management plan was drafted by a team of various stakeholders and integrated into the annual CPA management plan.

- "Saving Plants that Save Lives and Livelihoods" is a global project that aims to conserve MAPs and their habitats and to establish sustainable use schemes, including benefit-sharing within local communities. It is funded by the German Federal Ministry for Economic Cooperation and Development (BMZ), and implemented by TRAFFIC, the World Wide Fund for Nature and the International Union for Conservation of Nature (IUCN) Medicinal Plants Specialist Group in India, Nepal, Brazil (*please see page 43 for more information*), South Africa/Lesotho and Cambodia.
- The ISSC-MAP standard was developed between 2004 and 2007 by WWF, IUCN, TRAFFIC and the German Federal Agency for Nature Conservation (BfN) to provide a tool to achieve this conservation target. The rationale for developing the project was to put the ISSC-MAP into practice in selected regions worldwide to develop efficient conservation mechanisms for selected MAP resources and their habitats, which are under threat or likely to become threatened.

A key objective of the project was to ensure the continued success of ISSC-MAP implementation following completion of the pilot project. At each step in the process, efforts were made to empower and build capacity among the various stakeholders in order to retain long-term sustainable MAP management in Prek Tnoat. Members of the local community were trained to conduct their own resource assessments, monitor MAP harvest and survival, properly collect and process the MAP species, and participate in access and benefit-sharing. Leaders of the project also produced and distributed a leaflet in Khmer on sustainable harvest and processing techniques of *krakao* to produce quality fruits with high market value.

One challenge to the implementation of ISSC-MAP in Prek Tnoat was that only a select few MAPs are valued in national and/or international markets. A potential solution was to add value to the raw *krakao* material by processing and packaging it on-site into traditional medicine that commands a higher price. To this end, the stakeholders have initiated a community-based Traditional Medicine Producer Group charged with producing medicines from sustainably harvested resources. Another obstacle was that Prek Tnoat does not have a direct market link to Phnom Penh. MAP sellers were forced to transport *krakao* to Phnom Penh and often complained of being stopped and taxed by authorities along the way.

The seasonal availability of *krakao* means that Prek Tnoat will need to expand its MAP management to include other species such as *Smilax glabra*. The best strategy for increasing income for the community without overharvesting *krakao* will be to harvest multiple MAP species throughout the year. In order to meet market demand for popular MAP species and avoid local extirpation, collectors will have to expand collection to other communes and sites. Future management will also need to establish technical standards on issues such as names of MAPs (*krakao* is just one of many common names), processing techniques and community benefit-sharing. (*Source*: *TRAFFIC Bulletin*, 22: 3, 2010).

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Recognition of traditional medicine by governments

Politics have a large influence over herbal medicine, as can be demonstrated historically. East Africa and parts of the Himalayas were subject to colonial rule until the 1940s to 1960s, during which time traditional medicine tended to be neglected or even denigrated by the authorities. Since independence, traditional medicine has gradually gained increasing recognition in East Africa, especially recently with the declaration by the African Union of 2001–2010 as "The Decade of Traditional African Medicine". A "Traditional Healer Policy" was established for the United Republic of Tanzania in 2002 and similar policies are at an advanced state of preparation in Kenya and Uganda. An East African Network on Traditional Medicine and Medicinal Plants has been established with its hosting since 2007 in the Lake Victoria Basin Commission of the East African Community.

Among the Himalayan countries, Bhutan has accorded an equal status to Tibetan and Western medicine, influenced by Buddhism and regard for environmental stewardship. The Government in China has provided strong encouragement to traditional Chinese medicine, and recognized several other medical traditions, such as those associated with the Dai, Mongolian, Tibetan, Uigur and Yi peoples. In India, several indigenous systems of medicine have been legally recognized (for instance, Ayurveda, Siddha

HERBALISTS SCORE MAJOR VICTORY

Herbalists have scored a major victory in their quest for official recognition after scientists have provided evidence that some herbal medicines can cure many diseases.

Scientists from the University of Nairobi and Jomo Kenyatta University of Agriculture and Technology analysed 12 medicinal plants used by traditional healers in the Machakos and Kitui districts in Nairobi and found most to contain healing properties against common bacterial infections, including tuberculosis. They also confirmed the widely held belief that the *mchicha* plant (*Amaranthus*) has properties that protect people with HIV from various opportunistic infections.

The study carried out by nine researchers from the two universities was published in the *Phytotherapy Research Journal*. "In the past few decades, there have been intense pharmacological studies brought about by the recognition of the value of medicinal plants as potential sources of new compounds for managing diseases," says the study.

The researchers say plants such as *Aloe*, *Croton*, catch thorn (*Ziziphus abyssinica*) and several others of the analysed 12 are promising candidates in the search for new cures.

However, they warn that their findings do not authorize herbalists to use the plants indiscriminately because they have to understand the correct dosage and the part of the plant to use for the best and safest results.

Amaranthus spinosus

Citing an earlier study on the antibacterial properties of the *Croton* tree which found the plant had little medicinal value, the researchers in the current study found the tree to be quite effective, a contrast they attributed to the locality of plant species, parts used, and time of collection, storage and methods of analysis. This in essence means that a neem tree (*Azardirachta indica*), for example, found at the coast may not have similar medicinal properties to its counterpart growing elsewhere in the country. This should serve as a warning for many herbalists who are increasingly domesticating plants away from their indigenous habitats. (*Source*: Daily Nation [Kenya], 5 January 2010.)

and Unani, but not Tibetan) and the Government has established a National Medicinal Plants Board to develop and regulate the medicinal plants sector. In Nepal, recognition has been accorded to Ayurveda, but not Tibetan medicine, and development of the medicinal plants sector has been accorded a priority in government planning. A high-level Herbs and Non Timber Forest Products Coordination Committee has been formed with 12 medicinal and aromatic species selected for the development of agronomic technologies. (*Source*: A.C. Hamilton (ed). 2008. *Medicinal plants in conservation and development: case studies and lessons learnt* [Salisbury, United Kingdom], Plantlife International.)

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Ginseng: a highly valued herb

Like the rich mountain forests where ginseng grows naturally, its use dates back to antiquity. Ginseng is a perennial herb belonging to the genus *Panax*, which is derived from the Greek word *Panakos*, or panacea in English, meaning an all-healing remedy.

Both the Asian and American varieties are employed medicinally, sharing the same growth habits and virtually the same appearance, with the only difference being that the Asian variety is larger.

American ginseng (*Panax quinquefolius*) is found throughout the deciduous mountain forests of central and eastern North America. The first specimens of American ginseng were transported to Europe in 1704. It should come as no surprise that the North American Indians also knew of and utilized ginseng root for its medicinal qualities. They called it *garantoquen*, which translates as "like a man", in reference to its forked root structure, which closely resembles the shape of a man.

American Indians have a particular method of harvesting the root, whereby it is only harvested after the red fruit of the plant has reached maturity. They then bend the stem down to the ground before proceeding to dig the root. This method reportedly increases the germination rate and provides for a greater future yield. The Sioux Indian women had especially well-developed ways of cleaning and processing ginseng, and were said to collect the finest root of all the tribes.

Asian ginseng (*Panax ginseng*) is found primarily in the Northern Hemisphere and mainly in China, Tibet, Mongolia and the Republic of Korea. The Korean and Manchurian species are traditionally considered the most highly prized. Wealthy Chinese will pay up to USD200 000 for the vitality-enhancing properties of a premium-grade ginseng root.

These highly prized roots are found growing wild in the mountainous regions of the Republic of Korea and the Changbai and Xiaoxinganling Mountains in China's northeast. They grow on steep slopes at heights between 500 to 1 100 m above sea level.

Wild ginseng growing in ancient forests with deep loamy soil and moisture-laden air is found to have a much greater potency than ginseng grown commercially out of its natural environment. (*Source*: *The Epoch Times* [United States of America], 23 February 2010.)

***Picrorhiza kurrooa*, an endangered medicinal plant offering high commercial potential in the Himalayas**

Himalayan medicinal plants have been a source of curiosity for their use in ethnomedicine by numerous community healers and native people and, most important, for their historical use in one of the most accepted Indian medicine systems, Ayurveda.

The Indian Himalaya records over 1 750 species. Many Himalayan medicinal species offer a very high market value, viz.

Taraxacum officinale

Aconitum heterophyllum, Acorus calamus, Angelica glauca, Bergenia ciliata, Cinnamomum tamala, Dactylorhiza hatagirea, Heracleum candicans, Picrorhiza kurrooa, Podophyllum hexandrum, Panax pseudoginseng, Swertia chirayita and *Taraxacum officinale*. In recent times, *Picrorhiza kurrooa* Royle ex Benth (Scrophulariaceae), a perennial herb, has drawn tremendous attention from pharmaceuticals as well as conservationists. The species has an immense trade value on national and global markets and is an important high altitude herb of the Himalayas, having flexible habitat niches, mostly on open slopes (temperate to alpine). It has several local names, *kutki* (in Sikkim), *karu* (in Himachal Pradesh) and *katuka, kuru, katvi, katurhini* and *katki*.

Underground stolons of *P. kurrooa* producing erected inflorescence stalks, embedded with numerous pinkish flowers, allure visitors to alpine habitats in summer. It is distributed in Pakistan, India, Nepal, Bhutan and southern China, along an altitude of 2 700–5 000 m. In India, it is distributed from Kashmir to Sikkim; in Sikkim, it is found at an altitude ranging from 2 800 to 4 500 m. The snow melts of early summer reveal the emergence of the shoots. In the alpine meadows, the plant reaches a height of 20 cm during its flowering stage.

In Ayurveda, the whole plant is considered medicinally useful and is one of the most bitter plant drugs. The dried roots are considered a tonic, cathartic, stomachic, cholagogue and purgative, and are used in fever and dyspepsia and

against scorpion stings. The species is one of the most potent liver conditioning and protective drugs. The chief bioactive photochemical of the root is glycosides, especially picroside and kutkoside. The roots sampled from the trade market showed 0.5–3.5 percent kutkin (bitter principles). The roots/rhizomes produce non-bitter product kurrin (D-mannitol), vanillic acid and kutukol.

Over the decades, because of the prevalent trade demand by pharmaceuticals, *P. kurrooa* has been severely harvested in its natural habitats. In recent times, as a result of this depleting natural population and resulting unavailability of the raw material to meet the expanding demand from pharmaceuticals, *P. kurrooa* has become the focus of conservationists. Using International Union for Conservation of Nature (IUCN) criteria, the species was assessed as endangered and in 1997 was also incorporated in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Among 29 plants, *P. kurrooa* is banned for the export and re-export in raw form through EXIM (Export and Import Policy) 1998, under the Foreign Trade (Development and Regulation) Act, 1992, excluding manufactured parts or derivatives.

During a brainstorming exercise of international experts (Workshop on Endangered Medicinal Plants), convened by the author in 2002, *P. kurrooa* was prioritized and identified as one of the top taxa for immediate conservation through *ex situ* cultivation. In addition, *P. kurrooa* is one of the proposed taxa for overall development by the Indian Medicinal Plants Board, Government of India.

Few scientific studies have appeared so far on the cultivation of *P. kurrooa*. Wild populations at different altitudes may exhibit variations in active compounds. Studies indicated that there may be the potential to obtain a high amount of the plant's active contents even at a lower elevation, within the flexible limit of species adaptation, if densely grown. One of the cultivation efforts by my group indicated that altitudes above 2 200 m are very suitable agroclimates for *P. kurrooa* in the Himalayas, using stolon cuts. The below-ground dry weight production in *P. kurrooa* cultivation may reach 0.7 to 3.8 quintal/acre (0.4 ha) if careful and appropriate agropractices are adopted and depending upon the manure in practice in one year. The use of vegetative propagule may provide about 2.6 to 7 times greater productivity over seeds. Phenological observations, which may fluctuate over the years and altitude zones, are crucial for standardized cultivation practices at different agroclimatic zones and can be taken as important indicators of climate change and global warming.

I have tested this cultivation protocol. However, it would be beneficial if more scientific studies covering different Himalayan zones are targeted, especially on *population studies, demonstration trials* and *marketing status exploration*. Very important, location-specific knowledge on the *technical feasibility, economic viability* and *farmers' acceptability* as basic criteria for launching cultivation trials would add value to baseline guidelines for strengthening commercial ventures for poor farmers in the Himalayas.

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93 PERCENT OF INDIA'S WILD MEDICINAL PLANTS ARE ENDANGERED

The Botanical Survey of India found 93 percent of wild medicinal plants in India are endangered, many of which are used in traditional Ayurvedic medicine. The research was carried out on 359 of the most widely used wild medicinal plants species. Of these, 335 species have been assigned the Red List status. The threatened species include *Utleria salicolia* and *Hydnocarpus pentandra* in the Western Ghats and *Gymnocladus assamicus* and *Agapetes smithiana* in Sikkim. All of the surveyed plants are under threat because of overexploitation to meet the demand from herbal industries. (*Source*: Terragreen (May 2010) in *MFP News*, XX: 2, 2010.)

Gymnocladus assamicus

***Heliotropium foertherianum*: is the octopus bush a solution to fish poisoning?**

Cebu, Philippines. Scientists are improving a Pacific folk remedy used to treat a form of food poisoning that prevents millions of people in the region from consuming fish.

The octopus bush (*Heliotropium foertherianum*) is the traditional medicine of choice in the Pacific islands for ciguatera fish poisoning, which is caused by powerful ciguatoxins produced by microscopic *Gambierdiscus* algae.

Ingested by fish and clams, the toxins accumulate in the food chain, causing diarrhoea, vomiting and neurological symptoms. At least 100 000 people, mostly in the Pacific, are poisoned each year.

Scientists from the Institute of Research for Development (IRD), collaborating with colleagues from the Louis Malarde Institute in French Polynesia and Pasteur Institute in New Caledonia, Melanesia, screened around 100 medicinal plants for their activity against ciguatoxins.

Octopus bush extracts were found to be the most promising, containing a molecule similar to rosmarinic acid – a compound known for its antiviral, antibacterial, antioxidant and anti-inflammatory properties. The researchers think rosmarinic acid may remove the ciguatoxins from their sites of action, as well as being anti-inflammatory.

They are now seeking to patent rosmarinic acid and its derivatives, and are developing octopus bush extracts with an even stronger detoxifying effect.

Lead researcher Dominique Laurent of IRD in French Polynesia said that Japanese research has suggested that octopus bush may contain alkaloids, naturally occurring chemicals that can be toxic. Fear of poisoning from the remedy may be deterring people from using it and a detoxified version might be more acceptable to local people, he said. "We

prefer to improve the folk remedy because it could be difficult to explain to local populations to buy a drug rather than use a plant growing on the beach," he said.

But the researchers have yet to consider how they would commercialize such a drug, said Laurent.

The poisoning is rarely fatal but the neurological symptoms can last several years. Fear of poisoning has reduced fish consumption, and the resulting dietary shift could lead to higher rates of cardiovascular disease, obesity and diabetes.

Paul Bienfang, a specialist in diagnosing algal toxins in fish, at the University of Hawaii, said the development of an effective antidote would be a significant accomplishment. (*Source*: SciDev.Net, 9 June 2010.)

Cinnamomum cassia

Unlocking keys to herbal medicines

A team of researchers at the University of Maryland, Baltimore (UMB), United States of America, writing in the science journal *PLoS ONE*, has developed a biological method to tease out which compounds from herbal medicines and medicinal herbal mixtures produce their reputed medicinal benefits.

"This provides the first step to find, from all of the hundreds of compounds in herbs, which ones have potential for medicinal purposes. And you can do this very quickly and efficiently," says co-author Laura Dosanjh, graduate student with the School of Pharmacy at UMB.

Science has not been very helpful in determining the efficacy of herbal medicines in the United States of America. The US Food and Drug Administration (FDA), for example, has so far sided with science only once to approve a herb-based treatment with multiple active ingredients – an ointment for genital warts made from green tea leaves.

Now, using tiny worms that live only 20 days, the team sorted out which compounds found in two common Chinese herbal formulations showed the most potential for their stated purpose: extending life expectancy.

Cinnamon and ginseng won, showing the most promise.

A team led by Yuan Luo, Ph.D., M.Sc., Associate Professor at the School, conducted a first-of-its-kind, "systematic evaluation" of a mixture of ten herbs called Shi Quan Da Bu Tang (SQDB), reportedly effective for fatigue and energy; and an 11-herb formula called Huo Luo Xiao Ling Dan (HLXL) used as a treatment for arthritic joint pain. Both mixtures are reputed to have benefits for healthy living and longevity in humans.

The researchers tested the mixtures, as well as each separate herb in them, on the laboratory worm model *C. elegans*. This particular worm – which biochemists often use as their "lab rat" – shares genes for ageing and other traits with humans and other organisms.

Cinnamon bark (*Cinnamomum cassia*) from HLXL extended the life span of the worms by 14.5 percent and cinnamon bark from SQDB extended life by 10.8 percent. Ginseng root (*Panax ginseng*) from SQDB extended the life span by 7.7 percent.

Significantly, cinnamon, ginseng and SQDB also thinned out levels of hydrogen peroxide, which can destroy cells. They each also enhanced expression of small heat shock proteins, an indicator for cellular response to stress that plays an important role in the maintenance of cell functions.

Herbal medicines are usually mixtures of herbs. That presents a severe challenge for the FDA to understand which compounds or combinations of compounds in the herbs are effective or not effective.

"Because it's very difficult to sort out so many herbs with so many constituents together, we needed to find a model," says Dosanjh. *C. elegans* is valuable to science because its very short life cycle is suitable for conducting rapid experiments and between 60 to 80 percent of the 20 000 genes in the *C. elegans* genome have similar origins to human genes. The genes are found consistently along the evolutionary paths including worms and humans. (*Source*: University of Maryland, 26 March 2010.)

Institutes complete first gene map of Chinese medicinal plant

Two traditional Chinese medicine institutes announced the completion of a gene map of the plant *Salvia miltiorrhiza*, the first of its kind, on 20 June in Beijing. The Institute of Medicinal Plants of the Chinese Academy of Medical Sciences launched a programme to create a gene map of *S. miltiorrhiza* in conjunction with Hutchison Whampoa Guangzhou Baiyunshan Chinese Medicine Co., Ltd. They used the second generation of high-flux sequencing techniques to check *S. miltiorrhiza*'s DNA order and finally finished its gene map.

The success of the gene map is seen as a step forward in the research of medicinal plants and the merger of front-line life science and traditional Chinese medicine. It promises new breakthroughs in the research of Chinese medicine. (*Source*: People's Daily Online [China], 21 June 2010.) ♣

Salvia miltiorrhiza