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ICT Update

a current awareness bulletin for ACP agriculture

CTA

http://ictupdate.cta.int

Farmers in **Burkina Faso** use multimedia tools to teach fellow producers

A multimedia database records the biodiversity of the **Cook Islands**

GIS helps preserve livelihoods and conserve wildlife in **Tanzania**

Biodiversity

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ICT Update

ICT Update issue 52, December 2009.

ICT Update is a bimonthly printed bulletin with an accompanying web magazine (http://ictupdate.cta.int) and email newsletter.
Each issue of ICT Update focuses on a specific theme relevant to ICTs for agricultural and rural development in African, Caribbean and Pacific (ACP) countries, and includes feature articles and annotated links to related web resources and projects. The next issue will be available in January 2010.

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Editorial

Survival of the most adaptable

2009 is the 150th anniversary of the publication of The Origin of Species, in which Charles Darwin outlined his theory of evolution. In the first chapter, on variation under domestication, he says, 'Variability is the source of all the choicest productions of the garden'. This statement holds true today, as the variation in domesticated crops is still used by plant breeders to emphasize desirable characteristics such as drought tolerance or pest resistance. Breeding for these traits helps farmers to maintain a productive agricultural system and provide food security. And, to ensure that crops can continue to survive the ever-changing environment, ICTs are now increasingly used to record, monitor, promote and preserve biodiversity.

Throughout history, food production has steadily risen to meet the needs of the world's growing population. Until quite recently, that increase in production came mostly from the expansion of farmland. Then, in the mid 1980s, more than 50% of the increase came from intensified agricultural production; using crop varieties that provided a higher yield to get more from the existing land.

In the Sissili region of Burkina Faso, the Federation of Farmer Organisations of Sissili (FEPPASI) worked with scientists at the Environmental and Agricultural Research Institute in Ouagadougou to test fertilization and seed multiplication techniques for a number of crop varieties. The research identified the varieties that would be specifically suited to the environment around Sissili.

FEPPASI then trained a group of farmers to use video and digital cameras to produce agricultural training materials. The group of trainers now use the videos and photographic images to advise fellow farmers on improved growing techniques for the new crop varieties.

Relative loss

All of these new, domesticated crop varieties originally came from wild plants. And these crop wild relatives, as they are called, are still a source of the genetic material that will allow for the development of crop varieties that can withstand future environmental changes. However, many of these wild relatives face extinction. Scientists have to quickly find and collect samples – usually seeds – before these species disappear forever.

The International Centre for Tropical Agriculture (CIAT) is now using geographic information systems (GIS) to identify locations where these vulnerable species might be found. CIAT then enters the data into GPS devices so that collectors out in the field can locate the plants and gather the seeds for storage.

It is not only plants that suffer from the increased pressures on the land. In the Elerai region of Tanzania, the Maasai communities felt their pastoralist livelihood was becoming increasingly constrained. One option was to give up their traditional lifestyle and turn their land over to agriculture. The community was reluctant to do this and instead sought a way to make use of the variety of life around them. They collaborated with the African Wildlife Foundation (AWF) and used GPS receivers to record important land features, such as the location of households, grazing lands, water points and wildlife numbers.

With an accurate picture of their land resources, the Elerai Maasai were able to work with AWF experts to develop a plan for the region. They decided to lease part of the land for the construction of an ecolodge, where tourists can stay to view the wide array of animals that roam the area. The extra income ensures that the Elerai community can continue their traditional way of life and, by making the area a nature conservancy, they have helped to protect the movement of wildlife between a number of other connecting parks and farmland areas that run across the border between Tanzania and Kenya.

Conserving biodiversity helps to protect livelihoods and can ensure that our agricultural systems can adapt and remain productive in the future. After all, as Darwin explained all those years ago, 'It is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is the most adaptable to change'. And, without the rich source of diversity for farmers and plant breeders to draw on, our future food security is uncertain. ■

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Food security through diversity

When people think of biodiversity, they usually think of the diversity of species, the range of animals and plants inhabiting the world. In agriculture, we usually talk of crop biodiversity, which is slightly different. Farmers deal in domesticated crops, and the raw material for plant evolution is the diversity within any given crop.

There are, for example, more than 200,000 different varieties of wheat, and each of them has a unique set of characteristics. Some varieties have the potential to produce higher yields others may be resistant to certain pests and diseases or be able to adapt to changes in the climate. This diversity within a species, which at its most basic level is genetic diversity, contains the richness of traits and characteristics that the crop has to offer. It contains the 'options' that the crop has for future development.

Svalbard Global Seed Vault

REX FEATURES / MARI TEFRE / GLOBAL CROP DIVERSITY TRUST / REX FEATURES

Crop yields have increased tremendously in the last few decades and that is largely due to plant breeders using this diversity to create new varieties. And while I believe that the world needs a highly productive agricultural system, it also needs one that is resilient and sustainable. The variety of crops grown in the field has an impact on the long-term future of agriculture, especially if that variety needs a lot of water, pesticides or fertilizer.

But productivity and sustainability are currently under threat, and agriculture is facing probably the greatest challenge of its history, a history that dates back to Neolithic times. Twenty years from now, as our climate changes, it is very likely that we will need new varieties of crops, varieties that we don't have right now. There is going to have to be a massive effort to locate the genetic diversity in our agricultural crops, the traits for extreme heat resistance or extreme drought tolerance, and to move those into the plant breeding pipeline so that farmers have them when they need them.

Global solutions

This, however, is one world problem, perhaps the only one, that we can solve. The enormous amount of diversity that exists in most agricultural crops is like a gigantic toolkit of options for the future development of agriculture. We know how to conserve that diversity and we have the institutions in place to do it. There are now a number of important seed banks throughout the world that preserve samples of hundred of thousands of varieties, and they are backed up by the Svalbard Global Seed Vault in the Arctic.

There are a small number of scientists around the world who specialize in breeding crop varieties, crossing one variety with another to try to combine them in a way that would make the crop good for farmers to grow. This is because the modern varieties of most of our agricultural crops have a limited life-span. After a while they fall prey to pest or diseases, or they don't do so well in the environment, or a new, higher yielding variety comes along.

Technology also plays an important role in the preservation of crop biodiversity. At the Global Crop Diversity Trust we are now using a combination of technologies to create predictive computer models. If we know where a particular variety of crop originally came from we can then predict some of the characteristics of that variety. For example, if the variety comes from an arid area then we could test that for drought tolerance rather than a sample that came from a very wet or tropical country.

Computer modelling also helps us to make climate change and development projections, which can help to pinpoint varieties that are endangered through rising water levels or expanding urban environments. The models would tell us that we have to quickly collect samples from that area.

These are early days for putting ICTs to use for preserving biodiversity, we are only now starting to take advantage of the technology. In the near future, we will be able to use mobile phones and other communication networks to offer crop varieties to farmers in a much more targeted way. We can use the technology to provide information on the best varieties for very specific conditions, and locations to give the best yield and protection from pests, diseases and the changing environment.

I cannot imagine how society is going to adapt to climate change if crops don't also adapt. I cannot imagine how we are going to save the tropical rainforests if we have an unproductive agricultural system. I cannot imagine how we can deal with water shortages in the future if we don't have a productive agricultural system, since irrigated agriculture already uses 70% of the world's freshwater supplies.

It is not a solution to every problem, but I think preserving crop diversity can solve and certainly contribute some answers to many issues affecting the planet today. We have the tools and raw materials for an agricultural system that will guarantee future food security, the question is: are we going to be smart enough to conserve it? ■

Feature

When FEPPASI, the Federation of Farmer Organisations of Sissili, started its activities in 1998, the organization wanted to find out which crop varieties and production techniques were most suitable for the specific soil and climate conditions of Sissili province, in south-central Burkina Faso. Until then, farmers depended on knowledge and techniques passed on orally from generation to generation, without having access to new developments and innovations in the sector, and without having the opportunity to experiment.

Assistance from government extension workers was not suited to the specific conditions of the area, and their information was often outdated.

Farmers teaching farmers

After researchers in Burkina Faso identified the best crop varieties for the Sissili region, a local organization, FEPPASI, introduced ICTs to inform farmers and explain new growing techniques. As a result, production is up to nine times greater than before.

In order to provide farmers with more relevant information, FEPPASI started a research programme in collaboration with the Environmental and Agricultural Research Institute (INERA) to test different varieties of crops, fertilization techniques and seed multiplication techniques.

In one research project, for example, FEPPASI tested 25 different varieties of corn, of which seven proved particularly suitable to the soil and climatic conditions of the province. They started to promote these seven varieties to farmers and teach them accompanying production techniques.

Since 2005, FEPPASI has been testing the potential of ICTs to train farmers and to help professionalize their businesses. In that time, the organization has managed to gradually integrate ICTs into its day-to-day working processes. They regularly use multimedia tools, such as digital photos and video cameras, to document the tests of crops varieties in the field and to create training materials.

Spreading local practices

FEPPASI initially trained a group of 20 farmers as advisors, who could then go on to train and advise other farmers in their respective districts. Since the advisors are farmers from the same area, the trust and acceptance levels are very high compared to an advisor from the capital city. This group of advisors were subsequently trained in basic ICT skills and how to use these to create training materials.

'Previously, people fell asleep during our training sessions,' says Korotimi Barry, a former evaluation officer at FEPPASI. 'With the digital camera, we can show images of the development in the agricultural test fields. In our meetings with producers, these images allow us to make visual comparisons. We beam the images and discuss the causes of the successes and failures of the different fields. We also make videos of the farming techniques and show them during the training sessions.'

Barry adds that it was difficult to convince farmers about crop varieties simply by telling them that their neighbours in the other village produced more per hectare. Now, with images, people can visualize the improvements. The images make it possible to overcome the limited understanding of certain topics, a significant problem given the high illiteracy rate among the population (about 80% of producers in this region cannot read or write). For trainer Mahamadou Korogho, the use of digital content has become essential in his work. 'During training sessions, I don't feel at ease anymore without a computer,' he says. 'When I can show pictures of exemplary productions, the participants applaud.'

In four years, FEPPASI's advisors have trained about 2,500 farmers in innovative production, food processing methods, marketing skills, the production of organic fertilizers, and techniques for the sustainable management of natural resources, using videos, photos and digital presentations. For example, one photo stream explains the step-by-step process of turning yams into flour.

According to FEPPASI, the use of these support materials has considerably reduced the length of workshops and enhanced their impact. There are many success stories to tell. Monitoring and evaluation data reveal that the farmers who received training have been able to double and even triple their yields.

In anonymous questionnaires collected in 2006, 2007 and 2008, farmers expressed the numerous ways in which they had benefited. 'I have found contacts online to sell almonds and shea,' said one. 'I manage the production techniques to produce yellow and white corn,' said another. One farmer, who now processes yams into flour, couscous and cake, has increased his income by adopting better business practices: 'The products are better presented through the use of labels and I sell more.' An impact study carried out by INERA revealed that, on average, agricultural production had increased from 0.5 tonnes per hectare in 2003 to 4.5 tonnes in 2007.

Sissili farmers have also used the internet to develop techniques to select and improve seeds from the best of their crop varieties. For example, producer Moumouni Niébié searched online and found an organization in Benin that specializes in production methods for yams. Niébié contacted them and learned how to produce yam seeds from fragmenting yam roots. To further improve the quality of seeds used by its members, FEPPASI took pictures of several crop varieties and

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REUTERS / LUC GNAGO

selected the best. Niébé's corn field was among the fields selected. He said, 'FEPPASI selected a number of producers who applied the new production techniques well, and guided them to produce improved seeds, so the other farmers have access to good quality seeds as well.'

FEPPASI's group of farmer advisors act as intermediaries between the farmer communities and INERA. When disease affects a certain crop, for example, the advisor takes a picture of the plant and sends it by email to the research institute. When similar pictures come from different villages, the institute knows there is an outbreak and can take measures to limit the damage.

Management

The FEPPASI headquarters in Leo, the capital of Sissili province, and the two district offices in Boura and Bieha (at about 50 km west and 30 km east of Leo respectively) are connected to the internet. The three locations function as information centres where members can use the computers.

In the first two years of the project, FEPPASI trained about 150 farmers in basic computer and multimedia skills. However, these courses created expectations regarding equipment and connectivity that FEPPASI was not able to meet at that time, as it had a weak and unstable dial-up internet connection and only two computers per centre.

In 2009, the dial-up internet connection was replaced by a VSAT connection in Leo and Boura. As this connection is expensive, FEPPASI looked to recover the costs by sharing the connection with several other organizations nearby for a fee. This has turned FEPPASI into an internet provider, with positive connectivity results, but at the same time runs the risk of moving the organization away from its core objectives.

FEPPASI also expanded the telecentre in its headquarters, making seven computers available for members. 'Our connection in Leo is now often better than in Ouagadougou,' says Joseph Dagano, president of FEPPASI. According to Dagano, a farmer who is a member of their organization is less likely to be misinformed or taken advantage of.

'With the telecentre in Boura, the district farmer organization is now a member of an online exchange and news group, putting them in touch with other farmer organizations and federations in the country, and with external partners. When necessary,' he adds, 'a farmer in remote Sissili can contact his colleague in other areas to get correct information on cereals and other products in only a few minutes.'

Also, the FEPPASI website and newsletter 'Sissili Vala Kori' (Sissili farmers' voice) have increased the profile of the organization and led to a greater number of contacts within Burkina Faso and beyond.

While FEPPASI initially wanted to create information centres where farmers can access relevant content directly, a different model has evolved. The telecentres, for example, are used by a minority of literate farmers to find market opportunities and communicate with buyers and sellers on national and international levels. Illiterate members – the majority – benefit from the centres indirectly through training courses.

The group of farmer trainers use the centres to create and store specific audiovisual content adapted to the local conditions and based on local

Related links

Federation of Farmer Organisations of Sissili
FEPPASI provides information and training to develop the skills of farmers, promote technological innovations in agricultural production, and assist farmers in the marketing of agricultural products.
➜ www.feppasi.org

Environmental and Agricultural Research Institute
INERA specializes in the development, implementation and coordination of environmental and agricultural research in Burkina Faso.
➜ www.inera.bf

International Institute for Communication and Development
IICD is an international organization specializing in enabling people in developing countries to make use of ICTs to improve their livelihoods and their quality of life. IICD works in the sectors of agriculture, health, education, governance and citizen participation.
➜ www.iicd.org


FEPPASI

research. At the moment, however, there is no central storage system for all the training materials produced. Trainers are reluctant to share their own materials with colleagues or online. FEPPASI will need to develop an institutional policy on knowledge management that encourages, as well as guides, trainers and extension workers to process and share their content.

Although the farmers are now growing the new crop varieties, their increased production does not automatically lead to increased incomes. For that, FEPPASI also uses ICTs to improve marketing and sales. In the last few years, they have assisted farmers to collect data on their production, their costs, and revenues.

Having worked with ICTs for four years, the next step is to create a database that can aggregate the data collected in that time to make projections and calculations of crops and productivity throughout the province. Based on these data, FEPPASI will be able to access credit for its members through gathering and selling their products in larger quantities.

Leadership

There are several lessons that can be drawn from FEPPASI's work in the past four years. Joseph Dagano understood the importance of ICTs long before many others in the sector. When they started to work with ICTs in 2005, farmers, as well as donors, did not immediately see the advantages. An old anecdote that is often repeated in the organization concerns a donor who once said: 'Farmers need food, not computers!' Dagano knew where he wanted his organization to go, and initial resistance did not stop him.

FEPPASI was able to integrate ICTs at its own pace, gradually exploring the possibilities and learning how to exploit them for maximum advantage. The project objectives set at the beginning evolved over time as increased confidence gave way to new ambitions. This would not have been possible from the start; the organization needed time to incorporate the technology, build skills, and discover how ICT tools can best suit their interests.

Networking with local ICT training partners and other organizations has also been crucial for FEPPASI, enabling them to get technical advice, and share challenges and ideas. For example, they recently started organizing nightly events in villages to provide more information on their work, using a beamer and a generator, a concept taken from network partner Sahel Solidarité.

Agricultural advisors from government agencies in the capital city did not know the specific conditions of the area. FEPPASI decided to invest in its own research and ICT training, and create its own training materials. The organization's advisors look the same as the farmers, speak the same language, with the same accent, and tell their own stories. Farmers are more inclined to adopt new production techniques from someone they feel is like them. Through improved research and training courses facilitated by fellow farmers, Sissili producers are improving the quality of their seeds and growing new crop varieties that best suit their province's climatic and soil conditions.

These lessons show that the successes the farmers of Sissili have enjoyed through FEPPASI's work were not purely a result of technology. It was about having a clear vision of what the organization wanted to accomplish and how ICTs could facilitate this, taking into account the importance of local trainers, locally developed content, local support, and the freedom to gradually change objectives according to new insights. ■

Eco-efficient agriculture

Our food system is built on the traits contained in crop wild relatives. Researchers are now using geographic information systems to help protect this valuable genetic resource.

Opinion

All the domesticated crops grown in farms around the world today have evolved from wild plant species. But very few people give much thought to these crop wild relatives, even though they are critical to our global food security.

The peanut (*Arachis hypogaea*), for example, was domesticated somewhere in the border region of Paraguay, Argentina and Bolivia by local indigenous groups around 3,000 years ago. The new crop arose from the fortuitous crossing of three wild species, each providing traits that were favourable for cultivation and human consumption. Almost every crop we cultivate across the world has a similar story.

Crop wild relatives are the foundation of our agricultural system. And we still need them. They grow in the fields and the natural ecosystems that we see every day, but often go unnoticed. More recently, however, some people have started to take notice.

Crop breeders use wild relatives when crossing plant varieties to bring in novel traits that might, for example, introduce greater resistance to pests and diseases, or provide resistance to extreme climate conditions. The breeders use seeds from species samples that have been collected in the wild. But the sad truth is that many species have not been collected, or are facing extinction in the wild due to the loss of natural habitats. We therefore need to make a concerted effort to ensure that we do not lose these vitally important traits, which can help humanity produce more and better crop harvests.

REUTERS / LOUAFI LARBI

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Efficiency

At the International Centre for Tropical Agriculture (CIAT), we are now using geographic information systems (GIS) to predict where important species might be found. Collectors can then use global positioning systems (GPS), loaded with the data, to locate the vulnerable species and collect their seed. The CIAT analyses have helped to raise the profile of crop wild relatives and ensure that greater attention is paid to their conservation.

There are, for example, a total of 69 species of crop wild relatives that are in some way related to the cultivated peanut. Of these, 17 species are under significant threat of extinction from the expansion of agriculture in Brazil, Paraguay, Argentina and Bolivia. Our analyses have demonstrated that a further 15 species are significantly threatened with extinction from climate change.

These alarming figures have brought attention to the problem and encouraged a number of national and international initiatives. The urgent need to conserve species has led to the establishment of a number of projects to collect seeds from species under threat, and to include these species in conservation plans for national parks and other protected areas.

Crop wild relatives provide a unique opportunity to show the great value of conserving biodiversity. Our entire food system is built on the unique traits that they contain. For other plant and animal species, our analyses are showing similar threats. We are losing natural ecosystems at a rapid rate, and many important wild species are being lost.

These species include insect species that provide a service to agriculture by pollinating crops and increasing our harvests. They include natural enemies to agricultural pests and diseases, which reduce crop losses. They include wild berries and fruits that can provide communities with nutrition in difficult times. Yet we are losing a great number of important species at a rapid rate.

CIAT have also been using GIS to look at how climate change might cause increased rates of extinction of these species, and the results are grim. We predict that over the next 40 years, climate change alone could mean that we will lose as much as 20% of all species – one in five wild species.

So what can we do about it? CIAT is working to develop eco-efficient agriculture. This is a vision for agriculture where it continues to be productive and provide food and nutritional security to all, including the world's poorest, but at the same time is efficient in the use of inputs (less fertilizer, fewer pesticides) and provides environmental sustainability.

We need a productive agricultural system to provide enough food and nutrition, and we need to conserve the wild species upon which continued productivity depends. It isn't easy, but we need to learn to value biodiversity. In doing so, we will ensure that our domesticated crops will have the resources to adapt and survive future environmental changes. ■

Related resources

Gap Analysis of Agricultural Biodiversity
The Gap Analysis project is developing a system that will allow people collecting information on species diversity to know which areas around the world, traits and taxa are still unrepresented among target CGIAR genebank collections.
➜ http://gisweb.ciat.cgiar.org/gapanalysis/

Pastoralists picture land use

A team of researchers combine maps, satellite images and participatory mapping techniques to develop an accurate picture of land use among pastoralists in southern Ethiopia

Case study

The amount of land given over to growing crops has dramatically increased in the last few decades, leading to a reduction of available grazing land in many places. Pastoralists are restricted to grazing their livestock in smaller pastures, which results in overgrazing and added pressure on the land. Inevitably, some plants and animals can no longer survive in these areas. And, as the species disappear, valuable knowledge of the local fauna and flora is also lost.

In an effort to better understand changing land patterns and preserve indigenous knowledge, researchers are using participatory mapping techniques. Spatial visualization tools, such as three-dimensional modelling, rural appraisal community maps, printed maps and even screen-based computer planning exercises with communities, can help to give an overview of natural available resources and how they are shared among the various land users.

Although these community maps were often little more than lines drawn in the sand, or sketches on paper, they played a key role in giving communities the chance to express their needs and understand the delicate balances on which their livelihoods are based.

Drawing a sketch map to show the resources of an indigenous community became an important contact point between local knowledge systems and the scientific world. This is particularly important because traditional relationships with the environment have been so poorly understood and neglected in recent times. When working with pastoralists, for example, the outlines gave researchers a better understanding of local perceptions about the status and quality of pastures, rangelands, water sources, livestock types, the movement of people and their relative pressures on the local ecosystems.

But subjectivity and inconsistency in spatial representation, especially when considering a large area of land, meant that these maps were only of limited use when they were used outside the original village or read by non-pastoralists. The question, therefore, was how to translate symbols on a piece of paper in a way that could be understood by everyone. One solution was to involve the communities in the interpretation of high resolution satellite images.

Recognition

The Lay Volunteer International Association (LVIA) tested this methodology for the first time in Moyale and Miyo *woredas* (districts) of southern Ethiopia at the beginning of April 2009. The project used the same idea as community maps, but substituted a piece of paper with geo-referenced maps and remotely-sensed imagery.

LVIA identified four *woredas*, spread over more than 2,300 km², and used 1:25,000 scale maps to carry out a series of participatory exercises with 15 different groups of pastoralists. In combination with high resolution satellite images, the community members were asked to identify a variety of features on the maps.

The team discovered that after only a few minutes of explanation, the pastoralists could consistently and accurately interpret features on the maps and satellite images. Women in particular showed a great ability and accuracy for locating features such as cultivated land and private enclosures. Men were more reliable in pointing out administrative boundaries, while the young livestock scouts could quickly recognize migration routes.

By combining the input of the different groups, the team was able to gather complete and accurate information on infrastructure, the locations of wet and dry grazing areas, livestock migration routes, water sources and administrative boundaries, as well as detailed information on the sharing of natural resources across multiple territorial units.

The team manually entered all the data they had collected into a GIS (geographic information system) program. They then produced a number of posters and maps which they took back to the communities to verify the details.

The study area still has a wide variety of animal and plant species. Because of this, the government has designated a large part of the study region as a protected area, and it could soon be established as a reserve. While the main focus of the research was to preserve indigenous knowledge and the pastoralists' way of life, the results will also improve understanding of the needs of all land users and help to maintain a rich diversity of life. ■

Related resources

Enhanced Livelihoods in the Mandera Triangle
The ELMT programme supports the people living in arid and semi-arid areas of southern Ethiopia to move away from a dependency on emergency relief to long-term economic development.
➜ **www.elmt-relpa.org**

WAYNE HUTCHINSON / ALAMY

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A balance of life and livelihoods

Faced with difficult choices, a Maasai community in Tanzania was able to get an accurate picture of their land resources with the help of conservationists and GPS receivers.

Case study

Situated at the foot of Mount Kilimanjaro in Tanzania, and just 10 km south of Kenya's Amboseli National Park, Elerai has a lot to offer tourists. The region's woodlands and savannah are home to lions, cheetahs, leopards, antelope, buffalo and giraffe, plus a wealth of birdlife. The land is owned by the Elerai Maasai community, who live and tend their livestock throughout the 5,000 acres.

But with less access to open, undeveloped lands for grazing, the Elerai community face a difficult problem: do they continue with their traditional pastoralist livelihood, which is increasingly constrained, or, like many Maasai, do they reluctantly turn the land over to agriculture? Fortunately for the Elerai community, there was an alternative: create a way to benefit from the wildlife they live alongside.

The people of Elerai worked with the African Wildlife Foundation (AWF) to develop an ecotourism model for their land, and turn Elerai into a conservancy. This included an improved land management strategy that has allowed the community to keep their land open for both livestock and wildlife.


REUTERS / ANTONY NJUGUNA

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The project began in 2004, and an initial priority was to find out exactly what resources were available on the land, how they were being used, and to identify possible areas of conflict between the wildlife and the local population. To achieve this, AWF worked with the community and technicians from local NGOs and government authorities to conduct a resource mapping survey. This involved collecting data on the existing infrastructure and assessing community land use needs.

AWF trained community members to use handheld GPS (global positioning system) receivers to record the exact location of households, water points, grazing lands, wildlife sightings and other significant features. By combining their local knowledge with advanced mapping tools, the resource mapping teams efficiently collected a wealth of data in a relatively short space of time. In fact, more than 95% of the mapping was conducted in about six days.

At the end of each mapping day, AWF staff downloaded the data onto laptop computers and compiled the results with GIS (geographic information system) software. Using A3 printers, they printed large maps for the resource mapping teams to review the next day. Community members helped to annotate GPS observations and identify gaps for further mapping.

Choices

Following the completion of the survey, AWF collated and analyzed the data to present to the community. The community used the information to develop a land use plan, featuring management zones that will meet their future land needs while also securing valuable habitats for conservation. The plan contained guidelines for the effective management of the zones, which included wildlife and tourism, cultivation and settlements, and livestock grazing areas.

Armed with a detailed overview of their land, the Elerai community chose to work with a safari operator to develop an ecolodge in the Elerai Conservancy, in an effort to provide sustainable income from tourism. The ecolodge also gave the community an interest in protecting the wildlife and the habitat. The lodge operators pay an annual rent to the community, plus conservation and overnight fees for every visitor. Under the lease agreement, all unskilled labour will be sourced from the Elerai community, and if there are any skilled positions, they will get first consideration.

With the creation of the Elerai Conservancy, the growing communities avoided a future of farming dwindling plots of marginal land. Instead, they are keeping most of their land open for wildlife tourism and their traditional pastoralist way of life.

Corridor

By itself, Elerai could not sustain large wildlife populations; the site is not big enough to be a viable conservation area on its own. But the region's high density and diversity of wildlife depends on the ability of the animals to move between a network of adjoining land units. Although relatively small, Elerai has added an important piece to a matrix of public and private conservation lands that span the border between Kenya and Tanzania.

Elerai now forms part of AWF's Kilimanjaro Heartland, which links neighbouring national parks, privately-owned land and community-owned land into a conservation network of more than 7,600 km². This larger-scale conservation area, one of nine AWF Heartlands, secures critical wildlife habitats and movement routes, and introduces opportunities for a more sustainable tourism sector that respects regional cultural heritage.

Perhaps more importantly, Elerai served as a conservation model that AWF has since replicated elsewhere. The success in Elerai has proved that this approach, of combining wildlife conservation with the preservation of community livelihoods, is a viable alternative to the subdivision, fencing and expanding cultivation of lands seen in similar settings. ■

GERALD MCCORMACK / COOK ISLANDS NATURAL HERITAGE TRUST

A base for biodiversity data

For the last 20 years, the Cook Islands Natural Heritage Trust has been collecting the details of the country's fauna and flora in one multimedia database.

Case study

The Cook Islands, a small island developing state (SIDS), has an online database designed to record details of its biodiversity: marine and terrestrial species, indigenous and introduced species, mammals and plants, fungi and bacteria.

The country consists of fifteen small islands covering only 240 km², but it is spread over an area of about 2 million km² in the central South Pacific. Agriculture, mainly horticulture, brings in approximately US$ 15 million a year, around 5% of its GDP.

No other small developing country is known to be creating a comprehensive biodiversity database, probably because there has been little international support for making such information available in SIDS. But in 1990, the Cook Islands government supported a proposal to develop an electronic, multimedia-focused database to make information on local plants and animals available, including related traditional and community knowledge.

Since then, the government has invested more than NZ$ 1 million into the Natural Heritage Trust to run the project. The Trust has one professional staff member responsible for collecting and collating information on local plants and animals.

Recognition

It took many years of fieldwork, but the database, which is hosted at the Bishop Museum in Honolulu, USA, finally went online in 2003 and regularly receives 1,000 visitors a week, mainly from people in developed countries. The Trust also published the database on interactive CDs for schools in the Cook Islands, which have limited or expensive web access.

The database presently records 4,500 species out of an estimated total of around 7,000 socially or biologically significant species in the country. About 2,500 species (55%) on the database have one or more images to aid recognition. The main challenge is to identify and photograph species in the field, which is where the public will encounter and hopefully recognise them.

The Trust's primary goal was to tabulate data on the social and biological significance of a species and then list key identification features along with a detailed image. This data is reasonably comprehensive for the

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larger or otherwise conspicuous terrestrial species, but the lack of available biologists to input data has meant that the detailed information is often inadequate for many groups. There is still an immense amount of basic fieldwork required on Cook Islands biodiversity.

Although it is not the purpose of this database to record the location of all collected specimens, it increasingly refers to a few specimens or photographs for each island to vouch for the claimed presence of a particular species. In the future, collection points will be georeferenced and displayed on active maps.

The database entry for each species includes an image to aid identification and, where possible, supporting secondary images, videos and audio files. The image files are as small as possible so that they load rapidly in a web browser, but can still be viewed well on a screen and when printed to show the main species features. Database videos are also small, under 20 seconds in duration, to make it possible for users to download them on a dial-up or slow broadband internet connection.

More input

The database had the advantage of growing slowly, which provided time to experiment with many data options and to develop the search menus for different user groups, from taxonomists to biosecurity staff to home gardeners. Over the last 20 years, the Cook Islands Natural Heritage Trust has learned some valuable lessons and discovered some important strengths and weakness in their biodiversity database.

Strengths:

- all biological groups are available within a single database
- searches are available for Latin, English and Māori names, and names of higher taxa
- users can search for more than one species or taxa by name in one search
- users can search across taxa for socially and biologically significant groups, such as medicinal use
- default results are displayed as thumbnail images, which presently cover about 60% of the species
- the thumbnail zoom enlarges images to allow more detailed comparison on the results page
- primary images are of live specimens to assist with field identification.

Weaknesses:

- users cannot find species by listing or selecting their features
- voucher data is not georeferenced to enable active GIS displays
- users cannot currently contribute images and other information.

From the lessons learned in developing the database, the Trust will launch a new, improved version in 2010. Registered editors will be able to edit data online and general users will be able to add information at the bottom of each species page, with the possibility to upload images and other data directly into the database, although these will be moderated before appearing online.

The new database will be a major advance in the management, retrieval, display and editing of data. It is based on open source software and the application supports editing via compatible web browsers on a variety of devices, including desktop computers, laptops, PDAs and smartphones. The system can also be delivered as a stand-alone application from a computer hard disk, USB thumb drive or CD/DVD.

The main work in the future, as in the past, will be finding, identifying, photographing and uploading information on unrecorded species. But with more people able to contribute, thanks to the new database developments, the load should become much lighter. ■

GERALD MCCORMACK / COOK ISLANDS NATURAL HERITAGE TRUST

TechTip

Searching the Cook Islands Biodiversity Database

The search page on the database allows the user to find a species by typing the first part of one of its names in Latin, English or Māori. The species are arranged in a hierarchical system of taxonomy and higher taxon names are also searchable. Users can input multiple names with semi-colon separators to find multiple species or higher taxa, or allow for spelling uncertainties. And, although Cook Islands Māori is often written with standard letters only, there is a character input function on the site to enable searches using orthographically correct Māori.

Searching for the taxonomic group – butterfly or mammal, for example – works well for most users trying to identify an unknown animal. In contrast, many large groups, such as the 1,200 local flowering plants, are not easily divided into subgroups by the public. In the future, the Trust will develop a system so that users can find the species by easily observable features, such as leaf shape and flower colour.

Currently, however, it is the advanced search criteria that are perhaps most useful for the general public. These menus enable the user to search for habitat, distribution, threatened status, medicinal usefulness or biosecurity significance. For example, a student on the island of Atiu can find the birds that are native and endangered in the Cook Islands and that exist on Atiu.

Since most of the islands are a long way from each other, the names for many plants and animals evolved independently. The database records and maintains these differences, and gives users the opportunity to select species names according to region. For example, on Rarotonga, the White-tailed Tropicbird is the *Rākoa*, while on other islands it is the *Tara*, *Pirake*, *Pirake* or *Tavake Mokomoko*.

An alternate results page consists of one line of text per species to provide a concise list. The list includes the scientific, English and national Māori names, along with the family name and a concise English descriptor, such as wasp, fern, seaweed. The group descriptor is particularly useful for interpreting the diverse taxa found using the advanced search criteria menus.

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The richest natural resource

Why is agricultural biodiversity important?
➜ Agricultural biodiversity is a key natural resource in the provision of food, fuel, fibre, pharmaceuticals and much more. Agricultural biodiversity also regulates environmental variability, supports important ecological functions, such as soil formation and water cycling, and is an essential component of cultural identity and diversity.
All crop and livestock improvement, both through breeding and biotechnology and also through the age-old processes of selection by local farmers, is based on agricultural biodiversity.

What are the biggest threats to biodiversity? And why is it important that we do something to conserve biodiversity now?
➜ It is very difficult to give a single ranking for 'threats to agricultural biodiversity' because so much depends on the specific circumstances. In some places habitat destruction and conversion threatens crops and the wild relatives of existing crops. Drainage, for example, or irrigation, can displace the biodiversity that used to thrive in those places. In other places, the spread of new varieties, often the product of advanced breeding programmes, displaces traditional and more reliable landrace varieties that farmers have depended on. By the time the farmers discover that the old varieties may have been more reliable and resilient, they're gone, unless they've been conserved somewhere. Development and growing urbanization can also be major threats to biodiversity.

JOCHEM WIJNANDS / HOLLANDSE HOOGTE

Why is it important to conserve the biodiversity of crops in ACP countries?
➜ Some crop species are simply unknown elsewhere. Fonio (*Digitaria exilis*) is peculiar to the drier parts of the Sahel. In the Caribbean, there are hot peppers (Capsicum species) that are adapted to the conditions there, and often you find more different varieties in a single home garden in many ACP countries than in a whole country elsewhere in the world. These regions are particularly rich in agricultural biodiversity.

Should small-scale farmers in ACP countries be concerned about biodiversity?
➜ In the simplest case, a farmer may grow two varieties of sorghum; one in the bottom lands where it gets adequate water, one at the top of the valley where it gets less water. Maybe sometimes it rains too much, and the lower one is washed away. The upper one thrives. Or there may be a drought, and the upper one fails. Replace those with a single variety that is supposed to be grown in both places, and the crop is at risk from both floods and droughts. Having several varieties, and several crops, is a form of insurance policy.

Can those farmers help to conserve biodiversity? Is the preservation of biodiversity purely for scientists and international institutions, like Bioversity International?
➜ Farmers, especially small farmers, are crucial to conserving biodiversity. We already know that small farmers conserve more biodiversity than was previously believed. What they need is a good reason to do so, one that can counter the promises made by big seed companies and government 'experts'.
The efforts of farmers in conserving biodiversity need to be supported and complemented by national agriculture research programmes and gene banks, and also by organizations such as Bioversity International.

There is often conflict in many countries between conservation and agriculture. Is it possible, through promoting biodiversity, that the two could exist side-by-side?
➜ Conservationists have tended to see farmers as the enemy, with a 'fence everyone out' attitude. But the fact is that farmers, pastoralists, forest dwellers and others manage a sizable portion of the Earth's surface, and it would be much more constructive to work together so that farmers can conserve biodiversity. In this way, farmers will help to conserve other life forms and ecosystems too. I've heard it said that intensive agriculture with fertilizers and other high tech solutions would leave more 'wilderness' for conservation. But what will the effect of intensive agriculture be on the wilderness and on the environment in general?

Could genetically modified crop varieties solve the problems of productivity and climate change we might face in the future?
➜ I do not believe that genetically modified organisms have the capacity to solve the problems of productivity and climate change on their own. Our genetic resources provide the basis for how we adapt to the effects of climate change and other global challenges. Therefore, we need to ensure that these resources are being used appropriately today, and also conserved for tomorrow. Where will the raw materials for modifying varieties come from if not from conserved agricultural biodiversity? If just a little bit of the money and commitment that currently goes into genetic modification went into research into the better use of agricultural biodiversity, I believe that we would be well on the way now to truly sustainable food security. ■