Contents

Perspective in Practice

The genetic diversity represented by crop varieties and their wild relatives is a treasure to be shared justly across borders. But human error, neglect, and misfortune have gravely endangered both that biological resource and the very land on which it grows. These are not isolated annoyances, amenable to local containment. They are global threats.

If the diversity of Latin America's beans, for example, were to be suddenly dealt a crippling blow, it would not be long before small farmers in Eastern and Central Africa began feeling the loss. And each of us, regardless of postal code, will have to face the consequences of faster global warming if pastures in the African and South American savannas store less carbon because they have become degraded.

The constructive counterpoint here is local innovation. Like any form of creativity, this endowment cannot be minted like so many identical pennies. But it can be stimulated, documented, and emulated.

This issue of *CIAT in Perspective*, the 2003-2004 annual report of the International Center for Tropical Agriculture (CIAT, the acronym in Spanish), is more prospective than usual. It considers collaborative strategies for addressing three global issues: conserving and using agrobiodiversity, fighting land degradation, and promoting rural innovation.

Cardinal Points—Charting the Direction of CIAT's Work

Director General's Message

Like any team of explorers, researchers and the institutions they work for need reliable navigational aids to keep them on track. Typical aids are mission statements, strategic plans, project log frames, external reviews, and impact assessments.

The *CIAT Strategic Plan for 2001-2010* describes three broad avenues for helping rural people improve their livelihoods: make small-scale agriculture more competitive, protect agroecosystem health, and stimulate rural innovation. Early in 2003, CIAT's scientific staff went on a 2-day retreat to reflect on how to put this people-centered strategy into practice over the next 7 years. In the end we agreed to pursue three major goals that closely parallel our strategy.

Let me extend the metaphor of exploration and navigation for a moment. Imagine that one of the four cardinal points of a compass, say south, represents CIAT's scientific capital. This is the Center's current standing on the rural development map. It reflects many assets: the expertise and innovations of individual scientists, the Center's collective knowledge

acquired over more than three decades, its many contacts and partnerships, its laboratories, and its reputation for good science.

From that position of strength, we can, so to speak, move east, west, and north, in each case tackling a major constraint to sustainable development. Although these three cardinal points— distilled from many good ideas aired at the 2003 retreat—are now our research priorities, we will continue to pay attention to other intermediate targets on the R&D map.

Biodiversity, land degradation, and rural innovation

The three cardinal points on which we chose to focus are agricultural biodiversity, land degradation, and rural innovation. Each is a topic encompassing global challenges and opportunities for improving rural livelihoods, and each is an area in which CIAT can deliver international public goods.

The world's agrobiodiversity is under threat from population growth, natural habitat destruction, climate change, and shifts in agrarian economies and international trade. Two landmark agreements, the 1992 Convention on Biodiversity and the 2001 International Treaty on Plant Genetic Resources for Food and Agriculture, recognize these dangers. They also propose mechanisms and actions for conserving and harnessing agrobiodiversity and for sharing the resulting benefits equitably.

One of the three CIAT priorities, then, is to assist developing countries in implementing these treaties—through joint research, information and technology sharing, and capacity building. Our aim here is to make agriculture more productive and competitive through creative use of plant genes, thereby benefiting the traditional guardians of that genetic diversity, farmers. Protein-rich cassava, stress-tolerant beans, and iron-rich rice are three examples of the pro-poor benefits that can come from improved conservation and use of biodiversity. The last-mentioned example also illustrates that, through our co-leadership of the HarvestPlus Challenge Program of the Consultative Group on International Agricultural Research (CGIAR), CIAT is working to add value to agrobiodiversity. The benefits in this case are in improving the health of the poor and the survival and cognitive capacity of their children.

Our second cardinal point is the prevention, reduction, and reversal of land degradation in the tropics. The objective is to restore the potential economic, social, and environmental benefits and services of such land. This widespread and growing problem afflicts one-third to three-quarters of the developing world's farmland, depending on the region. It is of particular concern in areas with fragile soils or steep slopes, typically tilled by poor farmers.

Despite many organizations' efforts over the years to introduce better land management practices, the impact has been disappointing. CIAT and its partners hope to improve the success rate by taking into account not only the biophysical aspects of land degradation but also the social, economic, and policy influences at work. We will look, too, for possible synergies across traditionally distinct disciplines, such as soil science and plant breeding. For example, introducing stress-adapted germplasm at the same time as soil fertility enhancement and erosion control should make land restoration more attractive to farmers, because the payoff period is shorter. Combining these biophysical interventions with the scenario-building and decision-making tools developed by our Land Use Project allows farmers and policy makers to assess where investments in land restoration are most likely to pay off and how best to carry out the interventions.

During a recent visit to Nicaragua, where the long dry season is hard on both livestock and pastures, I was impressed by the performance of a CIAT hybrid *Brachiaria* grass marketed under the varietal name Mulato. Plots of this grass were green and lush—tiny oases amid the surrounding brown and burnt unimproved pastures. The immediate benefits for farmers are healthy, more productive animals, milk for children, and lower bills for feed supplements. In the longer term, the environment will also benefit from Mulato's ability to fix large amounts of carbon in the soil through its deep root system. And in drought-prone areas with infertile acid soils, this robust grass can provide a thick protective cover, reducing nutrient loss and erosion.

The final cardinal point on CIAT's institutional compass is the promotion of rural innovation through learning alliances—groups of institutions and individuals who deliberately set out to learn from their experiences as they implement jointly agreed activities. This initiative recognizes the need to empower individual farmers and communities, so they can design their own solutions and exchange knowledge and technology among themselves. The use of information and communication technologies, both new and traditional, is central to this work. We will capitalize on our recent experiences in promoting community telecenters, designing and disseminating participatory research methods, and developing rural agroenterprises. The goal is to enrich agricultural knowledge and information systems with new tools, methods, and approaches, so that these genuinely improve the lives of the rural poor.

Kindling enthusiasm, capturing the imagination

The choice of these three cardinal points for CIAT's research program furnishes the principal objectives around which our research activities can coalesce. The selected topics are major items on the international agenda, the most cogent and agreed-on expression of which is the United Nations' eight Millennium Goals and 18 targets for the coming decade. Our work on the three issues will contribute especially to the stated UN targets for reducing hunger and extreme poverty and protecting the environment. We believe these initiatives will kindle enthusiasm among our partners and capture the imagination of donors and beneficiaries.

While we at CIAT agree on the importance and relevance of using our research capacity to tackle these three major development challenges, we also recognize how vital it is to maintain space for other creative ideas and to seize new opportunities. Likewise, we are engaged in several areas of research that contribute to one or more of these challenges, but whose principal objective is to resolve another problem or seize a different opportunity. We must recognize the merits of such responsiveness to our partners' needs but at the same time avoid becoming excessively scattered. What we are aiming for is a healthy balance of focus, responsiveness, and new experimentation.

This issue of *CIAT in Perspective*, our annual report for 2003-2004, carries three articles about the cardinal points we have selected to anchor our research program. Fund raising to support implementation of these R&D initiatives is under way. We invite our donors to lend their support to CIAT and its partners as we together tackle a trio of problems that affect the livelihoods of millions of rural people.

Joachim Voss
Director General, CIAT

Sharing the Benefits of Agriculture's Green Gold

An initiative to help Latin America apply international biodiversity agreements

Imagine you've accumulated a small family fortune during a working career that spans several decades. You hope and expect it's enough not just to fund your retirement but eventually to provide your children with an inheritance. But unexpectedly, over a period of just 6 months, the value of your hard-earned capital collapses to just a quarter of its previous level, leaving you and your family vulnerable to an uncertain future.

The world agricultural community is currently in much the same predicament, its threatened nest egg being plant genetic diversity. The speed and scale of the decline are frightening. Over the past 150 years, the diversity of crop varieties—the biological capital amassed by farmer breeders during 10 millennia of observation and selective saving of seed and other reproductive materials—has fallen by an estimated 75 percent. The loss is closely tied to human behavior and demands: changes in land use, population growth, the uniformity required by high-input commercial agriculture, and shifting patterns of trade in food commodities due to globalization.

At the same time, the wild relatives of food crops, so vital to future plant breeding and therefore to food security, are also under threat. Habitat destruction, which includes, ironically, forest clearing for crops and livestock, is the central cause. And now climate change poses fresh dangers to certain populations of both wild and domesticated plants. For example, without direct human intervention, many of South America's wild peanut species will be extinct within 50 years.

Following up on global agreements

The Convention on Biological Diversity was adopted at the United Nations Conference on Environment and Development, the so-called Earth Summit, in Rio de Janeiro in June 1992. Together with Agenda 21, a much broader blueprint for environmental protection, the Convention was a global call-to-arms against burgeoning threats to biodiversity—not just the diversity of agricultural plants but of all life forms.

Since then, two other international instruments, closely linked to the goals and spirit of Agenda 21 and the Convention, have been adopted. The Cartagena Biosafety Protocol, which stems from Article 19 of the Convention, was adopted in 2000 and is now in force. The International Treaty on Plant Genetic Resources for Food and Agriculture, separate from the Convention but in harmony with it, was adopted in 2001 by member states of the UN's Food and Agriculture Organization (FAO). It entered into force on 29 June 2004.

Both the Convention and the Treaty place great emphasis on equitable sharing of the benefits arising from the use of genetic resources. The Treaty, which is specific to agricultural biodiversity, includes an article on the rights of farmers, the main custodians of edible-plant diversity. It also defines a binding multilateral mechanism for fairly distributing several kinds of benefits: information, technology, capacity building, and profits from product commercialization. The Convention is more general on this point but does mention the rights of "indigenous and local communities" and the need for equitable benefit sharing.

Over the past year, CIAT has worked with five organizations to design an ambitious collaborative project that will help Latin American countries apply the provisions of these seminal international agreements. Latin American members of the project's core planning

group are Colombia's Alexander von Humboldt Institute, Costa Rica's National Biodiversity Institute (INBio), and Mexico's National Commission for Understanding and Use of Biodiversity (Conabio). USA-based members are Cornell University and the Smithsonian Institution's National Museum of Natural History.

In February 2004, after consultations at CIAT headquarters in Colombia, the group submitted a preliminary proposal to the Global Environment Facility (GEF) for a 5-year project on the conservation and use of agrobiodiversity and the sharing of its benefits. The project aims to enable Latin American countries to make wider use of their biodiversity in the context of globalization, to rationalize conservation efforts by supporting policy making with solid technical information, and to uncover "functional diversity" for enriching gene pools. Costs are expected to average about US$5 million per year.

"Biologically rich countries are eating their capital and putting their future options for sustainable development at risk," says Joe Tohme, plant geneticist and manager of the CIAT project Conserving and Using Tropical Genetic Resources. In today's highly interconnected world, he adds, the food security of most countries depends to a large extent on the plant genetic diversity concentrated in just a few countries.

Tapping expertise in tropical America

"We see this new initiative as a regional consortium, not a CIAT project," explains Tohme. "Member institutions in the core group have expertise in specific areas covered by the project, such as conservation, bioprospecting, genomics, and biosafety. They will be called on to participate in their own right but also to identify or recruit professionals in other organizations who can contribute to the consortium's work."

Tohme cites the bioprospecting work of INBio in Costa Rica as an example of the experience and knowledge that need to be tapped for regional agricultural biodiversity work. Although this small Central American country accounts for less than 0.5 percent of the world's land area, scientists estimate it is home to as many as 500,000 species, perhaps 4 or 5 percent of the earth's nonaquatic biodiversity. Cataloging, conserving, and using this "green gold" for national benefit have been INBio's primary tasks since the nonprofit public interest institute was set up in the late 1980s.

In 1991, INBio struck a deal with the US pharmaceutical giant Merck & Co. Under the multimillion dollar pact, Merck was granted screening rights for a limited number of plant, insect, and microbial specimens collected in conservation areas by INBio. Merck agreed to pay a royalty, to be shared by INBio and the Costa Rican government, on profits from the commercialization of any drugs developed as a result of this work. The agreement also obliged Merck to train Costa Rican scientists in techniques to evaluate tropical plants for potential medicinal applications.

As a core member of the new Latin American agrobiodiversity consortium, INBio will extend its research and expertise to species important for agriculture. "I'm very excited about this project," says Ana Lorena Guevara, manager of INBio's Bioprospecting Strategic Action Unit. "People forget that the food we eat is based on genetic resources that are now under intense threat. They tend to focus on wild biodiversity and don't think much about agricultural biodiversity. The consortium project is a real opportunity for us to provide policy makers with the information they need to protect our food supply and security."

For Guevara, an agronomist by training, the project is, ironically, her first opportunity as an INBio scientist to consider Costa Rican biodiversity specifically in terms of its benefits for

food production and rural incomes. “Rice is especially important for food security,” she says. “But Costa Rica also has wild relatives of other crops with good economic potential. Wild papaya, for example, could prove valuable for the genetic improvement of cultivated papaya, allowing the development of new export markets.”

Maize, beans, rice, and more

The project will focus on two major biological corridors that are centers of genetic diversity. The first extends from southern Mexico’s Isthmus of Tehuantepec through Central America to the Panama Canal area. The second lies in the Andes of Colombia and Ecuador, in northwestern South America. To keep the project manageable, it was decided that core activities should initially be restricted to just a few countries. The three national institutions in the group are located in countries well known for their wealth of plant genetic resources—Mexico, Colombia, and Costa Rica.

The project will cover staple food crops important to Latin America and other regions, such as maize, American rice, common beans, and cassava. Also included will be a number of fruit and vegetable crops with significant commercial potential, namely cucurbits (gourd family), papaya, annona (custard apple family), cacao, and avocado, plus a few multipurpose native tree species.

Although Central America harbors a unique store of genetic diversity for maize, rice, and beans, it is no longer self-sufficient in these staples. A major benefit from enhanced conservation should therefore be greater food security in this region. Yet an even bigger payoff will probably be seen in other producing regions, especially Africa, where these crops are much more widely grown. Fortunately, the “multilateral system” envisaged by the International Treaty on Plant Genetic Resources for Food and Agriculture provides for incentives, financial and otherwise, for countries to operate their agrobiodiversity conservation programs as sources of international rather than merely national public goods.

Although a number of countries around the world have made advances in conserving plant genetic resources, Tohme says that much more needs to be done to rationalize those efforts and make them profitable. Ministries of agriculture and the environment, for example, need detailed advice on which species may have special economic importance, which are threatened, and where to designate protected areas. They also need information on how conservation efforts can, with grass roots support, be extended beyond these areas to sites such as farmers’ fields and roadsides.

Biotech and GIS

The swift pace of agrobiodiversity erosion is extremely worrying to genetic resource experts. Fortunately, recent technological advances, especially in biotechnology and geographic information systems (GIS), provide a window of opportunity to reinforce plant genetic conservation and use programs—and perhaps to save some valuable species from extinction.

“A new and helpful aspect of our breeding work is that manipulation is now possible at the genetic level instead of only at the plant level,” says CIAT’s director of research, Douglas Pachico. Improvements in molecular marker techniques and the advent of DNA-chip technology, for example, allow rapid, accurate screening of large numbers of plant specimens, whether from gene banks or natural habitats, for traits of economic value. This information can be fed back into conservation programs to fine-tune or reorient them. Or it can be channelled into breeding programs to develop cultivars with farmer-friendly

traits—such as lower water and soil-nutrient requirements, better pest and disease resistance, and higher concentrations of micronutrients lacking in the diets of poor people.

GIS tools can also make for more effective conservation of plant genetic resources. CIAT's FloraMap, for example, predicts the geographic distribution of wild plants using climate data for the locations (defined by latitude and longitude) where the species have already been collected. By overlaying other georeferenced information, such as road networks, soil patterns, administrative boundaries and population centers, FloraMap can also help identify suitable areas for *in situ* conservation.

Pachico also notes that the intellectual property rights (IPR) scene has changed dramatically in recent years. On the one hand, international agreements explicitly recognize the sovereignty of national governments over the genetic resources within their borders. On the other hand, private firms are increasingly taking advantage of legal means to protect innovations, whether these be patent applications or enforcement of royalty agreements through court action. If international agreements are to foster truly equitable benefit sharing, says Pachico, then CIAT and other centers of the CGIAR (Consultative Group on International Agricultural Research) must be ready to assist their national partners with capacity building related to plant genetic resources.

"Ian Johnson, our CGIAR Chair, has stressed the need to link the work of the international research centers to the whole set of international conventions and agreements. The bottom line is that the CGIAR has got to make its research more relevant to the major issues being discussed in these global fora. A just distribution of the benefits of biodiversity is one of those issues."

A six-step approach to conserving and using agrobiodiversity

A consortium of Latin American and US organizations convened by CIAT has launched a 5-year project to improve the conservation and use of plant genetic resources for agriculture and to promote equitable sharing of the benefits of use. The project is organized around six interconnected activities:

Analyzing threats: What impact do climate change, shifting patterns of land use, urbanization, and economic globalization have on agrobiodiversity? Which species are at risk and what is their economic and social value? Policy makers need answers to these questions before deciding how to respond.

Determining spatial distribution: Where are valuable landraces and wild species located and what are their populations? Some of this information exists, but it is scattered across institutions and countries.

Conservation management: The results of threat analysis and spatial distribution mapping can be used to expand conservation efforts beyond formally protected areas and *ex situ* sites, such as gene banks and herbaria. Communities and local organizations can be mobilized to protect rural habitats and conserve plant species *in situ*—on fallow land, the uncultivated perimeters of crop fields, and along roadsides.

Correlating diversity with key plant traits: Plant specimens need to be mass screened, using molecular markers, for genes that control desirable traits, such as drought resistance or tolerance to acid soils. The results will be useful to both plant breeders and conservation specialists.

Benefit sharing: Better conservation, information dissemination, and access to germplasm will allow researchers to deliver better crop varieties to farmers, including specialty species with commercial potential.

Capacity building and information exchange: Farmers and representatives from community organizations, nongovernment organizations, and government agencies will be trained in various aspects of plant genetic resources management. Major benefits at the grass roots level will be the adoption of biodiversity-friendly agricultural practices as well as more land devoted to conservation of landraces and wild species. Knowledge and information will be incorporated into user-friendly information products and services.

Prevent, Reduce, Reverse

An aggressive initiative in the war against land degradation

Over the past year, CIAT and partner organizations have designed a strategy for combating the degradation of agricultural land in the humid and subhumid tropics. Although the extent and intensity of this problem vary widely between regions, it is estimated that one-quarter of the world's agricultural land is now degraded. And the overall situation is getting worse.

Land degradation is the reduction of a terrestrial ecosystem's capacity to perform ecological functions and deliver economic and social benefits, often resulting in diminished system resilience or ability to adapt to change. For example, deforestation may curtail the landscape's capacity to capture and purify water, regulate peak and base stream flows, store carbon, and support suitable habitats for plants and wildlife. The effects depend in part on how the land is used after the trees have been removed. Soil erosion due to poor cropping or grazing practices may undermine local agricultural production, at the same time clogging downstream water reservoirs with silt. Soil nutrient depletion, besides causing a long-term decline in yields, may increase plants' susceptibility to pests and diseases, forcing farmers to stop cultivating certain species or even to abandon land altogether.

Worldwide, the damage from these and other forms of land degradation is so serious that, in October 2002, the Global Environment Facility (GEF), a multilateral financing organization dedicated to improving the global environment, added this theme to its mandated portfolio. Less than a year later, it announced plans to allocate more than US$500 million to fight land degradation between 2003 and 2006.

At present about 35 percent of agricultural land in Asia, 45 percent in South America, and 65 percent in Africa are thought to suffer some form of degradation. Although Central America accounts for only a small fraction of the world's agricultural land, it is considered a degradation "hot spot," with an estimated 74 percent of its land affected. Pastures in hilly areas are the most vulnerable (see box, page 13).

To date, land degradation in the humid and subhumid tropics has received less international attention than that afflicting dryland areas. A United Nations convention that entered into force in 1996, for instance, focuses specifically on desertification, a severe threat to many dry agricultural zones. There is no such international instrument for the humid and subhumid tropics, even though these zones harbor much of the world's biodiversity and serve as a large repository of carbon that might otherwise end up in the atmosphere as carbon dioxide. Addressing land degradation in these environments—especially the destruction of vegetation and soil—is therefore vital, not merely to their 2 billion inhabitants but to all people on earth.

Wealthier farmers, healthier landscapes

Past R&D has concentrated mainly on reducing degradation rather than reversing it, which implies restoring the productivity of the existing systems that support local livelihoods. Many interventions have thus had little to offer farmers in the way of immediate, tangible benefits. Although numerous projects have tried to provide farmers with sustainable land management and crop alternatives, the majority of these alternatives remain unattractive, because the technologies don't fit or work, the initial costs are beyond the means of smallholders, and underlying market assumptions are ill-informed.

For many farmers, then, proposed options have been seen not only as too costly a step forward, but also too big a leap of faith. For promoters and beneficiaries alike, the overall impact of past responses to land degradation has been, in a word, disappointing.

The new CIAT strategy aims to prevent, reduce, or reverse land degradation, depending on the extent of the problem in a given location and the needs expressed by the target community. It will be implemented through a multipartner, 6-year R&D program spanning three regions. By integrating biophysical, socioeconomic, and policy research, the program will ensure that proposed interventions—from the farm level through to the national policy-making level—are both relevant and feasible, thereby increasing the chances of positive and widespread impact.

The bulk of program resources and effort, some 60 percent, will be directed to reversing the degradation of land and restoring its productivity. This specific strategy, which overlaps with the reduction strategy, is the most comprehensive of the three broad types of intervention. It will target the poorest people in the most vulnerable farming systems—in the highly stressed traditional agroecosystems of sub-Saharan Africa, the eroded hillsides of Central America and Asia, and the degraded pastures of South America's Amazon and savanna zones.

The strategy for reducing land degradation, to which about 30 percent of program resources will be allocated, will target moderately degraded crop-livestock systems in certain hillside areas of South America and Asia. The aim here is to maintain or boost farming system profitability by introducing improved crop varieties and management practices.

The remaining 10 percent of resources will be devoted to the prevention of land degradation, particularly in the tropical forests and wetlands of South America. This work will focus on risk analysis and support to policy making. In the past, unsound government policies have often been a driving force behind land degradation. Policy analysis and reform—in areas such as resource pricing, land tenure, settlement schemes, credit, and the creation of protected areas—are central to both the prevention and the reduction strategies.

Placing the emphasis on the reversal and restoration strategy recognizes that the primary stewards of agricultural land in the tropics, small-scale farmers, won't invest in the long-term health of their land unless there is a short-term economic benefit. In fact, poor rural people often view the degradation of their own land as the unavoidable price they pay for their survival as farmers. "Mining" the natural resource base may be the only way to earn enough cash to buy the food they can no longer produce themselves and to pay for other necessities like clothing and medicine.

"One thing that's novel about our approach is the division of farm-level improvements into two steps," says Carlos Lascano, who manages CIAT's Multipurpose Tropical Grasses and Legumes Project and coordinates the Center's collaborative research on land degradation. "First, we need to help farmers get their production back on track so they can make some money in a relatively short period. The second step, over a longer timeframe, is when the real improvements to the land and the more profound shifts in farm structure take place. The rationale is that poor farmers need higher incomes *before* they can afford to turn their attention to environmentally friendly resource management."

Thinking globally, acting locally

The program targets humid and subhumid tropical zones in Africa, Asia, and Latin America. Target countries and subregions are Malawi, Uganda, Indonesia, Vietnam, the Amazon, and

Central America. The first phase comprises the main R&D program, in collaboration with selected pilot communities and partner organizations, mostly universities and national agricultural research institutes.

Researchers will design biophysical, economic, and social indicators of land degradation, as well as impact indicators for later use. These yardsticks will provide a common language for diagnosis, measurement, analysis, and evaluation, allowing problems and solutions in different regions to be compared and contrasted at various geographic scales and administrative levels. Researchers will also match technical problems with potential solutions. Ex ante economic analysis will allow researchers to estimate the probable costs and benefits of different technology options from a farmer's perspective so as to target options more accurately and increase the chances of adoption. The powerful tools of spatial analysis will support this work. Researchers and land-use planners will use geographic information systems (GIS) to identify, for example, those sites whose climate and soil favor the available germplasm-based solutions, and to identify and target areas where extreme poverty and land degradation coincide.

At the community level, major activities in the first phase will be problem diagnosis; selection, adaptation, and testing of promising solutions; and monitoring and evaluation of the outcomes. To help communities carry out this work, researchers will draw on CIAT's substantial experience with community empowerment and participatory research methods. In addition, lessons learned from all aspects of the program and its pilot sites will be used to influence and inform policy making.

The program's second phase will be dedicated to replicating or adapting results in neighboring communities (scaling out) and at higher organizational levels such as national or regional projects (scaling up). Since solutions to the problems of land degradation are site-specific, local stakeholders will again play a central role.

In recent months CIAT managers have been talking to potential donors, including the GEF, about funding for this program. We believe our comprehensive and integrated approach to fighting land degradation merits serious attention and international support. While avoiding the pitfalls of past land rehabilitation efforts, it will directly contribute to the UN Millennium Development goals of eradicating poverty and hunger and ensuring environmental sustainability.

Bridges to a better future in Central America's pastures

CIAT's new program on land degradation envisages a set of projects in various subregions of Africa, Asia, and Latin America, including a major degradation hotspot—Central America.

Three-quarters of the agricultural land in this drought-prone subregion is degraded, and of that, 60 percent, or 9 million hectares, consists of pastures of low and often falling productivity. The alarming dynamics of the problem are clear from two juxtaposed facts: the region's cattle population is growing at less than 1 percent per year, but the area devoted to pastures is expanding at 4 to 9 percent per year.

Reversing degradation and slowing the expansion of pastureland are now R&D priorities for Central American governments. In CIAT's view raising the productivity of forages grown by the subregion's 11 million small- to medium-scale livestock producers is a logical entry point for rapidly improving local livelihoods, while simultaneously protecting the natural resource base.

By adopting improved grasses and legumes that CIAT and national programs have developed over the years, farmers can make better use of existing pastures and avoid expanding their operations into forested areas. Deep-rooting African grasses in particular are highly productive, resist the stresses of Central America's long dry season, and increase soil carbon stocks. They also protect soil from erosion and animal compaction.

Using improved pasture forages to restore and intensify production from existing livestock production systems will serve as a bridge between today's destructive practices and the longer term aim of shifting to fully sustainable, diversified, and market-responsive farming systems. In effect, intensification "prepares the ground," both economically and environmentally, for diversification. In contrast, earlier strategies of trying to "turn the desert into Eden in a single quantum leap," as one CIAT scientist put it, just don't work.

The Núñez family in Yorito, Honduras, illustrates the value of CIAT's progressive approach. For years they grazed their 12 cows on low-quality pasture, including a forested area in the environmentally sensitive uplands above their village. Milk production was just 35 liters per day. With technical support from CIAT, they rehabilitated their entire production system. They planted *Brachiaria* grasses and a high-protein, environmentally friendly forage legume, *Cratylia argentea*. They also introduced a cut-and-carry feeding system for their animals, as well as silage.

Today the Núñez's herd is giving three times the milk output on less than half the land used earlier. Animal weights have improved, as has the herd's reproductive rate. While the family income has gone up, so have the prospects for their local environment—especially since they have been able to free up 47 hectares for reconversion to forest.

Learning to Innovate

An initiative to spread the brushfires of rural discovery

In poor farming communities throughout the tropics, it is *not* business as usual. Mounting economic and environmental pressures on agrarian livelihoods are provoking a rethink of development strategies by all concerned—producers, development workers, researchers, and donors. An adage for the times is "adapt or perish" or, more optimistically, "innovate and survive."

Over the past year, CIAT's Rural Innovation Institute has been devising a novel strategy for helping the rural poor identify problems, design solutions, institutionalize their newfound skills, and share experiences with others. Through our new "Learning to Innovate" (LTI) collaborative initiative, we are pulling together the various strands of our expertise in community outreach and empowerment in order to maximize their potential for impact. These include participatory approaches to plant breeding, land-use planning, monitoring and evaluation, rural agroenterprise design, and—the most recent strand—using new information and communications technologies (ICTs) for rural development. A new LTI model helps us understand what combinations of these elements will work best under different circumstances.

Going a step further, we and our partners have begun to set up what we call "learning alliances" as a way to apply this same innovation therapy to ourselves. A learning alliance is a coalition of R&D organizations, donors, and policy makers. Together, they implement a set of activities in an area of mutual interest, learn from that work, put lessons into practice, and reflect on what has worked and what has not. This learning process is helping not only CIAT but also our partners to become more efficient and innovative in how we ourselves foment rural innovation.

CIAT's first learning alliance was formed in Nicaragua in 2001 with CARE International. Participants were representatives of 12 farmer organizations and seven local NGOs, in addition to CIAT and CARE staff. The learning focused on the promotion of agroenterprises using a territorial approach (as opposed to a product or sectoral approach) designed by CIAT researchers. A wider learning alliance of four Central American countries, including Nicaragua, was launched in late 2003 with CARE, and a similar alliance is taking shape in the Andean Region. In Africa a learning alliance focused on helping farmers build small businesses around new market opportunities is under way in nine countries, in collaboration with Catholic Relief Services (CRS).

Responding to global change

The need for a strong innovation capacity at grass roots level is made particularly urgent by three kinds of global change that are now exposing already vulnerable rural people in the tropics to further threats. The first is economic globalization, especially liberalized trade regimes. While this does open up new opportunities, it also means that traditional crops, such as maize in some South American countries, can in many cases no longer be grown competitively. Options are needed that will enable farmers to diversify their products and markets.

The second kind is climate change, to which crop production is highly sensitive. Here farmers need access to new and improved germplasm and new management practices, both to help them cope with shifts in temperature and rainfall patterns and to reduce the contribution of agriculture to global warming.

The third kind of global change is demographic. While the earth's natural resources, including land, remain finite, population growth continues to push up the demand for food and other commodities. At the same time, rising incomes and urbanization are altering the patterns of that demand. Markets for animal products and convenience foods, for example, are expected to grow rapidly over the next few decades. New options are needed to help smallholder farmers intensify their enterprises and add value to their produce.

The pace of change is so rapid that traditional knowledge systems, which are mostly oral and usually based on personal contact within the local community, are generally unable to cope. Part of the answer is for rural people to gain better and more rapid access to technical information, through the Internet and other means. However, Boru Douthwaite, a technology policy analyst with CIAT's Rural Innovation Institute, believes that won't by itself be enough to persuade them to innovate. "Farmers and processors need support during the learning process, including exposure to the experience others have had in adopting an opportunity or invention."

Modeling the innovation process

In the development context in which CIAT works, innovation can be defined as a process in which key rural stakeholders—individuals and communities who stand to benefit directly—transform inventions or new ideas into practical means of improving their livelihoods. In designing projects under the LTI initiative, Douthwaite and colleagues are attempting to replicate four key functions or ingredients that have been observed in the past to accompany successful rural innovation. These are: (1) opportunity information systems; (2) support to adoption-related decision making; (3) support to incipient innovation processes; and (4) an overview and feedback mechanism—something Douthwaite calls "meta-learning and selection." This model of the innovation process helps outside agencies such as CIAT identify weaknesses in existing innovation systems and "orchestrate" a combination of participatory interventions that will be precisely tailored to the needs of a given community.

The model's first three functions correspond to what training and technology transfer specialists often refer to as the "knowledge, attitudes, and practices" components of learning. The starting point is opportunity information systems. These can be any source of potentially practical ideas or inventions—databases, Web sites, radio programs, magazines, extension brochures, agricultural field days, or farmer exchange visits. Applications of the model have shown that this function often needs improving, especially in more remote rural areas.

Once the opportunities are known and understood, farmers must decide whether to adopt. That is, whether to "embark on the experiential learning process involved in innovation," as Douthwaite puts it. "People need convincing that an invention or new idea is a potential winner *for them*. For example, someone considering growing *lulo* (a small tomato-like fruit native to Colombia and Ecuador) for the first time may need to know whether it will survive at a particular altitude." Support mechanisms for dealing with such issues include farmer field trials, market surveys, discussion groups, and participatory collection and evaluation of site-specific information.

The next step, assuming a decision to adopt has been made, comprises experimentation or adaptation of the new idea—normally a steep learning curve for the innovator. Here things can quickly and easily go wrong. Without timely solutions to the practical difficulties encountered when learning something new, people can become discouraged and decide to give up. Personal contact with other innovators and experts, as well as other less direct technical backstopping, such as on-line question-and-answer services, are essential at this point in the process.

Meta-learning and selection, the fourth function that feeds into the other three, is a way of capturing lessons from past innovation experiences and making them available to current efforts. “A CIAT colleague of mine in Asia recently commented that really good innovations spread like brushfires,” says Douthwaite. “The learning and selection function in our model of innovation is a way of spotting those fires and telling people elsewhere about them. At the same time, it can warn people to avoid technologies or ideas known to be innovation blind alleys.”

Information and communication technologies

Apart from relatively simple options, such as high-yielding crop varieties suitable for uniform growing conditions, rural innovations, whether biophysical or social, can seldom be applied directly off the shelf. Rather, they must be adapted through numerous learning cycles carried out by individuals and groups. The aim of CIAT’s LTI initiative is to speed up the learning process by linking innovators with one another and with past experience. This implies a strong commitment to helping communities find, store, generate, and share information and knowledge, in large part by exploiting new ICTs. While the learning tools now available are powerful and promising, there are caveats.

On the one hand, there exists a huge body of Internet-based rural technical knowledge to support adoption decisions and incipient innovation. And it is growing rapidly, in part thanks to the work of many research institutes, including CIAT, and of specialized NGOs. In addition, most large towns and cities in the developing world now have commercial cybercafes and in some instances publicly funded Internet access points, such as community telecenters. (Telecenters differ from cybercafes in that they are usually operated by local not-for-profit organizations, which typically provide users with personalized training in computer applications, including on-line searches.)

On the other hand, direct personal access to the Internet is still many years away for the vast majority of rural households. In fact, basic telephone voice service is still a luxury in most rural areas of the tropics. And even where people do have limited Internet access through schools and other institutions, a knowledge culture based on ICTs has yet to emerge.

“Better public access to ICTs by no means guarantees rural people will use them to get information that will help introduce technical innovations or improve their livelihoods,” says Nathan Russell, manager of CIAT’s Information and Communications for Rural Communities (InforCom) Project. “For that to happen, local organizations have to make a deliberate effort to build ICTs into pro-poor development efforts.”

For the past 3 years, InforCom has been experimenting with ways of promoting and supporting community telecenters as rural development tools. This work has been done in collaboration with universities and other organizations in southwestern Colombia.

As proof-of-concept, the telecenter pilot work is encouraging. To date, the benefits have been largely institutional in that the community organizations hosting the telecenters have been strengthened by the experience. In one instance, a telecenter in the militarily insecure town of Santander de Quilichao, operated by an indigenous organization representing 75,000 mostly Páez people, succeeded in mobilizing support to denounce a string of human rights violations. These abuses, which were exposed internationally on the Internet, included assassinations of indigenous leaders. The telecenter’s contribution was a good example of how ICTs can support social, as well as technical, innovation—in this case serving to defend basic human rights flouted by both left-wing guerrillas and right-wing paramilitaries.

The "orchestration of CIAT competencies" envisaged by the LTI initiative will expand the value of ICTs as a service to all four innovation-support functions. Telecenters in particular have a critical role to play in building agroenterprises—an increasingly important entry point for scaling up the use of CIAT research results.

Local communicators straddle the digital divide

In 2003, InforCom staff began investigating the potential role of information intermediaries. The idea here was to bridge the digital divide between ICT services (including those in telecenters) and farmers, using young local communicators to promote a culture of knowledge acquisition. "Our impact data showed that many farmers don't have easy access to the telecenter or don't feel inclined to use it," explains Russell. "Or, if they do visit, they won't necessarily have a concrete idea of their information needs."

Nearly 15 years of CIAT experience with local agricultural research committees (the Spanish acronym is CIALs) have demonstrated how successful farmers can be at conducting practical adaptive research and developing successful agroenterprises on behalf of their local communities. CIAT expects that small communications teams, each consisting of 6 to 10 rural youths with a strong interest in ICTs, can likewise serve as catalysts to rural innovation. Such teams, duly trained in a variety of communications media, are currently being set up within community organizations in Colombia's Cauca Department.

"If successful," says Russell, "these teams could provide a useful support service to local research and agroenterprise development." Producers of crude sugar (panela), silk, and coffee are among the innovators expected to benefit in the pilot area.

A strategy for creating learning spaces of rural innovation

Global change is putting enormous pressure on small-scale farmers in the tropics to switch or diversify crops and adopt new methods of cultivation and resource management. If rural people are to not merely survive but also improve their livelihoods, they must become more adept at social and technical innovation. That process in turn depends heavily on the presence of strong agricultural knowledge and information systems.

What can R&D organizations like CIAT do to help rural people build their traditional knowledge bases and streamline innovation processes? Our strategy is to identify critical components that are currently missing from knowledge and information systems but which are needed to help the rural poor make informed decisions for improving their incomes. In short, our strategy is to help create practical learning spaces and networks for rural innovation by filling in gaps that other organizations are unlikely to deal with. The work plan of the LTI initiative envisages four types of outputs, each of which is linked in different ways to one or more of the four functions in the LTI model explained above.

Strategies for strengthening rural innovation systems: Through the learning alliances described earlier, for example, we foster collaboration and strengthen linkages between international research centers, major development organizations, and local partners in the innovation process.

Institutional and business models for local provision of rural information services: In Latin America and eastern Africa, for example, we are developing such models for the provision of marketing information via the Internet and radio.

Tools and knowledge for systemizing scientific and local knowledge: In Latin America and eastern Africa, for example, we are developing and testing an approach for documenting and learning from “life histories” of technical and social innovation.

Interactive software that allows rural entrepreneurs to find answers to questions and share experience: CIAT is developing several computer-based programs, for example, that will facilitate local decisions about what to grow, where, and for what markets. and services.

Research and Development Highlights

Bouncing back after tragedy: The Cassava Biotechnology Network

The past year has been a busy and productive one for the Cassava Biotechnology Network (CBN), which supported 11 new projects under its small-grants scheme, approved seven fellowships for Master's students, and gave guidance to pilot projects in Colombia, Brazil, Cuba, and Ecuador. CBN's grand finale for 2003-2004 was a week-long event, its Sixth International Scientific Meeting, held at CIAT headquarters in March.

CIAT staff and collaborators know that heavy workloads and hectic schedules like these are nothing out of the ordinary. What makes CBN's recent accomplishments noteworthy is that they emerged from what was, throughout 2002, a gaping professional vacuum and period of mourning by CIAT employees and cassava specialists around the world. In January 2002, two CIAT staff—CBN coordinator Chusa Ginés and CBN social scientist Verónica Mera—lost their lives when the plane they were on, flying in foggy weather, crashed into the Cumbal volcano. The two women had been en route from their base in Quito, Ecuador, to meetings at CIAT headquarters.

After the tragedy Canada's International Development Research Centre (IDRC) announced it would provide US$450,000 over 5 years to launch the Ginés-Mera Memorial Fellowship Fund for Postgraduate Studies in Biodiversity. The first round of fellowships was approved in 2003. The funds support seven students, carrying out their research projects in Colombia and Peru.

IDRC, along with The Netherlands' Directorate General for International Cooperation (DGIS), also supported CBN operations in 2001 and 2002. DGIS funding continues through 2004.

In February 2003, Brazilian plant physiologist Alfredo Alves was appointed CBN coordinator. And in May, Elizabeth Caicedo, from Colombia, was recruited to the position of social scientist. With these key positions filled, CBN is once again able to fulfill its mission: mobilizing biotechnology to enhance cassava's contribution to food security and economic development in poor areas of Latin America and the Caribbean.

Grown mainly by small farmers, cassava is vital to the food security and livelihoods of about 500 million people across the tropics. However, compared with other major food crops like rice, wheat, and potatoes, this versatile industrial and food crop has received remarkably scant scientific attention since the advent of modern biotechnology some 25 years ago. As research by CIAT and CBN members has shown, biotechnology offers many useful tools for cassava improvement. Applications range from farmer-operated tissue culture laboratories for producing healthy planting material, through the use of molecular markers for selecting superior plants in breeding programs, to genetic transformation for higher vitamin A content.

For more information, including documents from the Sixth International Meeting, visit CBN's Web site: www.ciat.cgiar.org/biotechnology/cbn/index.htm

Industrial drying opens up a lucrative market for cassava

New technology for high-volume drying of cassava roots and leaves is poised to slash Latin America's heavy reliance on imported animal feed, especially maize. In Colombia the rapidly

expanding poultry industry, 90 percent of whose raw materials for feed still come from foreign sources, has taken serious note of this low-cost innovation and begun to invest.

The drying system was designed and tested by the Latin American and Caribbean Consortium to Support Cassava Research and Development (CLAYUCA) and CIAT. Colombia, whose agriculture ministry provided project funding, is the test ground.

Three factories—which clean, peel, chip, and then dry cassava with hot-air blowers, all in one operation—went into service in 2003. As of March 2004, another eight were under construction. Throughput capacity varies between half a ton and 5 tons of fresh cassava roots per hour.

Significantly, one-quarter of the US$1.6 million invested so far in the new technology comes from Colombian farmers. The rest is from a mix of government and commercial sources, including members of the National Poultry Federation of Colombia (FENAVI), which recently joined CLAYUCA.

Strong interest among farmers is to be expected, since the new technology not only expands their market but also brings the animal feed industry right to their doorstep, creating rural jobs in the process. Because freshly harvested cassava is highly perishable, the drying factories must be located close to their source of raw material if they are to be competitive. The artificial drying plants also allow cassava to be grown at different times of the year, giving farmers a welcome measure of flexibility in their cropping systems. In many regions farmers are normally restricted to growing cassava at certain times, because they have to ensure that harvest coincides with the dry period.

“We brought the poultry industry to the discussion table,” says CLAYUCA executive director Bernardo Ospina. “Cassava, and therefore CLAYUCA, were really good bets for the poultry producers.” Hernán Ceballos, manager of CIAT’s Cassava Improvement Project, adds that enthusiastic private-sector participation has so far helped whittle down construction costs of the CIAT artificial drying plants to about one-fifth of the price in 2000. At the same time, high-yielding cassava varieties and good cultural practices have allowed yields of fresh roots to rise well above the threshold of 20 tons per hectare for product competitiveness.

Tropical farmers, especially grain producers, are being hit hard by new trade regimes. To survive the tidal wave of globalization, say Ospina and Ceballos, they must adapt quickly by exploiting comparative advantages and new markets. Cassava, a tropical crop, is an obvious entry point, and the livestock industry represents a ready-made and largely untapped market for it.

“With the help of this drying plant, we think it’s possible to eliminate at least 500,000 tons of maize feed imports per year in Colombia alone,” says Ospina. This would represent an annual foreign currency saving of US$50 million.

High-tannin legumes help suppress methane from livestock

Recent CIAT studies show that including high-tannin legumes in dietary supplements for livestock can help strike a balance between better nutrient-use efficiency in animals and lower emissions of methane. Cattle, sheep, and other ruminants, along with rice paddies, are major agricultural sources of methane, a powerful greenhouse gas.

In the tropics livestock are often fed low-quality forage consisting mostly of grass, resulting in low productivity. Much research has gone into helping farmers improve animal

nutrition through the addition of protein-rich legumes, such as *Cratylia argentea*, a tropical shrub. But the leaves of low-tannin legumes, while improving key aspects of ruminant digestion (nutrient degradation and nitrogen turnover), also dramatically increase methane production.

CIAT's Multipurpose Tropical Grasses and Legumes Project, in collaboration with the Swiss Federal Institute of Technology Zurich (ETH) and funded by the Swiss Agency for Development and Cooperation (SDC), examined two legumes, *Calliandra calothyrsus* and *Flemingia macrophylla*. While these plants have similar chemical composition and high tannin content, *F. macrophylla* was found to be the more nutritious of the two when it was combined with the low-tannin legume, *Cratylia*, as the feed supplement. But it wasn't nearly as good as *C. calothyrsus* at suppressing methane production.

In related experiments the researchers looked at the nutritional effects of adding sugarcane molasses to different livestock diets. (Experiments were done *in vitro*, that is, in an artificial fermenter that simulates digestion, rather than with actual livestock.) When molasses was added to the grass-only diet and to the grass-plus-Cratylia diet, there was no effect. Then came the surprise: Molasses dramatically boosted nitrogen degradability for the diet composed of grass supplemented by *C. calothyrsus*.

This finding, the researchers note, points to the potential of molasses for reducing the negative nutritional effects of high-tannin legumes, while allowing their methane-suppressing trait to be exploited. The research complements earlier CIAT work that clearly demonstrated the methane-suppressing properties of tropical fruits rich in chemical compounds known as saponins.

In the meantime, CIAT scientists are continuing their efforts to balance livestock production and environmental goals by identifying optimal mixes of high- and low-tannin legumes for use as feed supplements.

Weapons against whiteflies

Whiteflies are one of the most destructive groups of insect pests known to farmers. Most species damage crops by feeding directly on leaves; some also transmit deadly viral diseases to plants. The Tropical Whitefly IPM Project (TWFP), coordinated by CIAT, is a three-phase global R&D campaign launched by the CGIAR's Systemwide Integrated Pest Management Programme to combat this grave threat to rural livelihoods in the tropics.

During its second 3-year phase, the project began to translate earlier results of basic research into IPM practices and validate them under farmer conditions.

In the Andean highlands, research has concentrated on whiteflies as direct pests of crops, particularly dry and snap beans. This is because at elevations higher than about 1,000 meters, the most important disease-carrying whitefly species, *Bemisia tabaci*, is generally absent. The main pest is a direct feeder, *Trialeurodes vaporariorum*, certain populations of which are showing pesticide resistance.

The recommended IPM strategy has two key components. The first is to get farmers to abandon their practice of frequent spraying of plants with broad-spectrum pesticides. Instead, they are advised to use more target-specific chemicals, at smaller doses and only under certain conditions and at specified times. Foliar spraying, for example, is done only when an "action threshold" is reached, that is, when the whitefly population reaches a known level at which economic damage occurs.

Researchers are also working with farmers to test the effectiveness of the whitefly's natural enemies as biological control agents. Two of the more promising candidates are a parasitic wasp, *Amitus fuscipennis*, and a fungus, *Verticillium lecanii*.

However, the action threshold approach does not work when the target whiteflies are vectors of plant viruses. In this case, susceptible crops have to be protected from the moment plants emerge from the soil. This is because it takes just a few virus-bearing whiteflies to start a devastating epidemic.

Currently, most farmers use pesticide "cocktails" regularly, sometimes daily, to control viral diseases transmitted by whiteflies. TWFP promotes the use of physical barriers—antiwhitefly screens known as "microtunnels"—to protect vegetable crops from whitefly-borne viruses during the first month of their highly susceptible vegetative period. This strategy also eliminates the need for regular pesticide applications—a practice that contaminates the environment and which may account for as much as 60 percent of crop production costs.

Microtunnels are being rapidly adopted by vegetable growers in El Salvador, Honduras, Guatemala, and southern Mexico as a way to boost income from their small farms. TWFP also continues to distribute cassava and common bean germplasm resistant to whitefly-transmitted viruses in Africa and Latin America, respectively, to help improve food security.

TWFP funding has come mainly from the UK's Department for International Development (DFID). Other donor agencies are Danish International Development Assistance (Danida), New Zealand's Ministry of Foreign Affairs and Trade, the U.S. Agency for International Development (USAID), the U.S. Department of Agriculture (USDA), and the Australian Centre for International Agricultural Research (ACIAR).

The Project's 2004 brochure contains more details of recent IPM advances around the world. It can be downloaded from www.tropicalwhiteflyipmproject.cgiar.org

Trade fairly in Spanish

A new CIAT information service links Latin American farmers and rural development groups with organizations around the world that buy and sell "Fair Trade" products in industrialized countries or provide services to developing country entrepreneurs. The Spanish language Information Service on Fair Trade was launched in June 2004 by CIAT's Rural Agroenterprise Development Project as a subsite of the main CIAT Web site. Its centerpiece is an annotated directory of about 150 organizations whose corporate profiles can be downloaded in PDF format. These organizations include Southern exporters, Northern importers, wholesalers and retailers, organic farming groups, advocates of Fair Trade practices (including certification agencies), and suppliers of credit and other business support services.

Fair Trade is both an international movement for social progress and an alternative system of South-North commerce. The body that sets its international standards is Fairtrade Labelling Organizations (FLO) International, based in Germany. Under those standards some 800,000 producers, workers, and their dependants in more than 45 countries benefit from the value added by labelled Fair Trade products. In exchange for a better price, producers guarantee an agreed level of product quality and the use of environmentally sustainable and socially responsible production methods.

On hearing the term Fair Trade, many consumers still glance automatically at their mug of coffee, tea, or cocoa or perhaps their sugar bowl. But the range of products available is now much wider and includes bananas, flowers, juices, honey, and wine. Footballs are the first manufactured item to become available as Fair Trade goods. Other products under consideration are avocados, dried fruit and nuts, spices, and a traditional Andean grain, *quinoa*.

Carlos Ostertag, a marketing specialist with CIAT's Rural Agroenterprise Development Project, says the volume of Fair Trade is still only a tiny fraction of total international agricultural trade and still much smaller than trade in organic farm produce, which has now gone mainstream. But he also points out that the Fair Trade system represents a rapidly growing market that could open up excellent opportunities for Latin Americans—not just the largest beneficiaries to date, coffee growers, but also the region's small-scale growers of fruit and other tropical specialties. As an example of what can be achieved, U.S. sales of Fair Trade coffee rose nearly 56 percent between 2000 and 2001, from around 2,000 tons to just over 3,000.

CIAT's Spanish language Information Service on Fair Trade was designed with the help of a survey of 40 potential user organizations in the Andean region. Besides profiling relevant organizations, the Service provides background documents on organic farming and Fair Trade certification, a glossary, and links to other CIAT tools for agroenterprise development. For more information, visit www.ciat.cgiar.org/agroempresas/sistema_cj/inicio.htm

Empowering rural people through participatory monitoring and evaluation

For the past 2 years, CIAT has been using participatory monitoring and evaluation (PME) to strengthen community involvement in rural innovation. The aim is to empower grass roots client groups by enhancing their role in research and development decision making.

Under the PME system promoted by CIAT's Participatory Research Approaches Project, providers of R&D services work with local beneficiaries to measure the short-, medium-, and long-term results of activities using agreed-on yardsticks (indicators). These results are then compared with the original objectives as a measure of progress. As a formal feedback loop, PME systems help keep research and other activities on track and allow both service providers and clients to learn lessons, thereby increasing the chances of success for future projects.

CIAT's introduction and testing of PME systems has focused on 22 local agricultural research committees (or CIALs, as they are known in Spanish) in Colombia's Cauca Department. A CIAL usually consists of 6 to 12 farmers, elected by their peers to conduct research on behalf of the whole community. In 2003, Center staff also began testing PME at a higher organizational level, namely an umbrella organization representing 39 CIALs, the Corporation for the Promotion of CIALs (CORFOCIAL).

Institutionalizing PME has proven quite challenging. CIAT researchers have found that communication and collaboration between CIAL members and the community are often poor; record keeping of research outputs and impacts is weak; and PME is often viewed as extra work with no immediate payoff. Social unrest and the sheer workload of farmers, particularly during planting season and harvest, also interfere with the introduction of PME.

In response to these obstacles, CIAT has worked with CORFOCIAL to better coordinate PME tasks and to strengthen the team of facilitators that provide technical support to the

CIALs. The researchers have found that, despite the problems, it is possible to establish PME in just about any CIAL, regardless of the group's level of maturity.

During 2003, CIAT researchers also began promoting PME among R&D service providers in Bolivia through a project funded by the UK's Department for International Development (DFID). This collaboration is timely, since the government recently reorganized its national system for delivering R&D services to make it more responsive to rural demands.

Under the new arrangement, called the Bolivian System for Agricultural and Livestock Technology (SIBTA), four foundations serve as brokers between rural communities and various providers of research and other services. CIAT is currently working with two of the foundations to institutionalize PME and other aspects of participatory research. In a series of training workshops, which began in 2003, the service providers formulate action plans for the introduction of PME in their community projects. CIAT hopes this on-going effort in Bolivia will help rural groups articulate their needs better and become more discriminating in their choice of services and technologies.

Distance learning for sustainable rural development

Tools don't make rural development decisions. People do. Although CIAT's indicators of rural sustainability can help government ministers and advisers to formulate good policies, there is a gap between access to such tools and their application. The necessary skills for producing and using indicators are generally lacking, not only among policy makers but also among the technical staff who support them.

In November 2002, CIAT and two institutional partners organized a 4-day tele-course on sustainability indicators. The course was transmitted from Washington, D.C., to participating organizations throughout Central America. Such distance learning is proving an effective way to bridge the gap between theory and practice, by building human capacity within key ministries and other policy-oriented bodies in Central America.

Each day the course provided 2 hours of video conferencing and 2 hours of applied exercises. In this instance the training targeted mostly technical staff—in ministries of the environment, agriculture, and planning, in census bureaus, in regional and international organizations, and in NGOs and universities.

The course sponsors—CIAT, the World Bank Institute, and the World Bank—chose distance learning as the delivery vehicle because it is easy to replicate and costs less than face-to-face meetings. However, a face-to-face course was later organized by the Economic Commission for Latin America and the Caribbean (ECLAC) and the World Bank Institute to fine-tune the six-module CD-ROM and other materials for future training and capacity building. The course took place in Santiago, Chile, in early June 2003.

The first rural development and sustainability indicators designed by CIAT were released on CD-ROM in late 1998 under the title *Atlas of Environmental and Sustainability Indicators for Latin America and the Caribbean*. Building on that joint effort with the United Nations Environment Programme (UNEP), CIAT then worked with UNEP, the World Bank, and more than 50 regional and national partner institutions to design a set of sustainability indicators specific to Central America. This is a subregion of significant environmental degradation, closely linked to poverty. Published in a bilingual Spanish/English format, *Developing Indicators: Experience from Central America* was the basis for the recent distance learning course. For more information, visit www.ciat.cgiar.org/indicators/toolkit.htm

Mapping Ecuador's vulnerability to El Niño

Governments can't prevent calamities like earthquakes, floods, and droughts. But if they can determine which citizens are most vulnerable, they can better target emergency services and prepare people for future threats. With this in mind, researchers within CIAT's Land Use Project are mapping the vulnerability of Ecuador's population to El Niño.

Over the past two decades, Ecuador has twice suffered major losses of human life, property damage, and economic hardship due to severe flooding and landslides following heavy rains. The El Niño-related disaster of 1997-98 killed at least 286 people and left 30,000 homeless. Lost farm production and the destruction of infrastructure such as bridges and roads accounted for most of the economic loss.

Three-quarters of Ecuador's 12 million people currently live in poverty, and nearly one-fifth are undernourished. Combined with lack of awareness about how to protect themselves, this poverty and food insecurity make many Ecuadorians, particularly those in isolated rural areas, extremely vulnerable to the negative effects of future El Niños.

The mapping exercise is part of a larger international project on poverty and food insecurity, funded by Norway's Ministry of Foreign Relations and carried out jointly by the UN Food and Agriculture Organization (FAO), CIAT and UNEP/GRID-Arendal (an environmental information center in Norway, linked to the UN Environment Programme). CIAT coordinates the seven country case studies now being carried out by CGIAR centers.

CIAT researchers hope to shed light on the nature of vulnerability by looking at factors such as employment, housing, education, land ownership, and family links. Their aim is to see which combinations of these "assets" contribute to a household's ability to minimize damage or recover quickly from disaster, and which assets may themselves be vulnerable. The research team surveyed 218 households in about 20 communities that form a rural-to-urban continuum in the coastal area.

"We now have an idea of who didn't have enough food to eat in the wake of the last El Niño and why," says Andy Farrow, the CIAT specialist in geographic information systems (GIS) who leads the 3-year study. "Our results will help government officials and agencies plan preventive measures."

An Overview of CIAT

The International Center for Tropical Agriculture (CIAT) is a not-for-profit organization that conducts socially and environmentally progressive research aimed at reducing hunger and poverty and preserving natural resources in developing countries. CIAT is one of the 15 centers funded mainly by the 58 countries, private foundations, and international organizations that make up the Consultative Group on International Agricultural Research (CGIAR).

CIAT's donors

CIAT currently receives funds through the CGIAR or under specific projects from the countries and organizations listed below. We gratefully acknowledge their commitment and contributions. CIAT also receives funds for research and development services provided under contract to a growing number of institutional clients.

Andean Development Corporation (CAF)
Asian Development Bank (ADB)

Australia
  Australian Agency for International Development (AusAID)
  Australian Centre for International Agricultural Research (ACIAR)
Austria
  Austrian Federal Ministry of Finance (BMF)
Belgium
  General Administration for Cooperation in Development (AGCD)
Bill and Melinda Gates Foundation
Brazil
  Brazilian Agricultural Research Enterprise (Embrapa)
Canada
  Canadian International Development Agency (CIDA)
  International Development Research Centre (IDRC)
Colombia
  CHEMONICS Foundation
  CONGELAGRO
  Ministry of Agriculture and Rural Development (MADR)
Common Fund for Commodities (CFC)
European Commission (EC)
Food and Agriculture Organization (FAO) of the United Nations
France
  Center for International Cooperation in Agricultural Research for Development (CIRAD)
  Ministry of Foreign Affairs
Fund for Agricultural Development (FONDEAGRO)
Germany
  Federal Ministry of Cooperation and Economic Development (BMZ)
International Fund for Agricultural Development (IFAD)
International Fund for Agricultural Research (IFAR)
Italy
  Ministry of Foreign Affairs
Japan
  Ministry of Foreign Affairs
  The Nippon Foundation
Latin American and Caribbean Consortium to Support Cassava Research and Development (CLAYUCA)
Latin American Fund for Irrigated Rice (FLAR)
Mexico
  Grupo Papalotla
  Secretariat of Agriculture, Livestock, and Rural Development
Netherlands
  Catholic University of Leuven
  Directorate General for International Cooperation (DGIS)
  Ministry of Foreign Afffairs
New Zealand
  New Zealand's International Aid & Development Agency (NZAID)
Norway
  Norwegian Agency for Development Cooperation (NORAD)
  Royal Ministry of Foreign Affairs
The OPEC Fund for International Development
Peru
  National Institute of Agricultural Research (INIA)
South Africa
  Ministry of Agriculture and Land Affairs
Spain
  Ministry of Agriculture
Sweden
  International Programme in the Chemical Sciences (IPICS) of Uppsala University
  Stockholm Environment Institute (SEI)
  Swedish International Development Cooperation Agency (SIDA)

Switzerland
  Swiss Agency for Development and Cooperation (SDC)
  Swiss Federal Institute of Technology Zurich (ETH)
Technical Centre for Agricultural and Rural Cooperation (CTA)
Thailand
  Department of Agriculture
United Kingdom
  Department for International Development (DFID)
  Natural Resources Institute (NRI)
United Nations Development Programme (UNDP)
United Nations Environment Programme (UNEP)
United States
  National Starch and Chemical Company (NSCC)
  The Rockefeller Foundation
  United States Agency for International Development (USAID)
  United States Department of Agriculture (USDA)
  W.K. Kellogg Foundation
  World Vision
The World Bank

Our mission

To reduce hunger and poverty in the tropics through collaborative research that improves agricultural productivity and natural resource management

Our project portfolio

CIAT's research is conducted through the projects listed below and grouped according to the three "compass points" on which the Center is focusing its efforts to address global development challenges.

Agricultural biodiversity
Conserving and Using Tropical Genetic Resources
Bean Improvement for the Tropics
Cassava Improvement for the Developing World
Rice Improvement for Latin America and the Caribbean
Multipurpose Tropical Grasses and Legumes
Tropical Fruits
Integrated Pest and Disease Management

Land degradation
Tropical Soil Biology and Fertility Institute
Communities and Watersheds
Land Use in Latin America

Rural innovation
Rural Agroenterprise Development
Participatory Research
Information and Communications for Rural Communities
Impact Assessment

Crop and agroecosystem focus

Within the CGIAR, CIAT has a mandate to conduct international research on four commodities that are vital for the poor: beans, cassava, tropical forages, and rice. Our work on the first three has a global reach, while that on rice targets Latin America and the Caribbean region. Increasingly, the Center also helps national programs and farmer groups find solutions to production problems encountered with other crops, such as tropical fruits, by applying research capacities developed through work on the mandate commodities.

In Latin America our integrated research on crops and natural resource management is organized largely on the basis of three agroecosystems: hillsides, forest margins, and savannas. CIAT scientists also work to improve crops and natural resource management in midaltitude areas of eastern, central, and southern Africa and in upland areas of Southeast Asia.

Institutional links

CIAT builds ties with other institutions through research partnerships based on projects. Our expanding circle of partners includes other international centers, national research institutes, universities, NGOs, and the private sector. We work with them under a variety of innovative arrangements, such as consortia and networks, at the local, regional, and global levels. As a service to its partners, the Center provides varied offerings in training and conferences and specialized services in information, communications, and information systems.

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Regional Coordination
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Eliaineny Minja, Entomologist (Senior Research Fellow)
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Rafael Posada, Agricultural Economist
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Costa Rica
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Honduras
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Italy
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Louise Sperling, Social Scientist

Kenya
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Malawi
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Michel Valés, Rice Pathologist, CIRAD*

Louise Willemen, Agronomist, IPGRI
David Williams, Genetic Diversity Scientist, IPGRI*

CIAT around the world

Headquarters
Apartado Aéreo 6713
Km 17, Recta Cali-Palmira
Cali, Colombia
Phone: +57 (2) 4450000 (direct) or +1 (650) 8336625 (via USA)
Fax: +57 (2) 4450073 (direct) or +1 (650) 8336626 (via USA)
E-mail: ciat@cgiar.org
Internet: www.ciat.cgiar.org

Bolivia
Hubert Mazurek
Institut de Recherche pour le Développement (IRD)
Consejo de Población para el Desarrollo Sostenible (CODEPO)
La Paz, Bolivia
Phone: +591 (2) 2419326
Fax: +591 (2) 2782944
E-mail: h.mazurek@cgiar.org

Costa Rica
Pedro Argel
IICA-CIAT
Apartado 55-2200 Coronado
San José, Costa Rica
Phone: +506 2160271 (direct) or 2160222, ext. 0756
Fax: +506 2160269
E-mail: p.argel@cgiar.org

Ecuador
Daniel Danial
MAG/INIAP/CIAT
Avn. Eloy Alfaro y Amazonas
Edificio MAG, Piso 4
Quito, Ecuador
Phone: +593 (2) 500316
Fax: +593 (2) 500316
E-mail: ddanial@ciatfza.org.ec / angela@ciatfza.org.ec

Ethiopia
Tilahun Amede and Ralph Roothaert
c/o ILRI
P.O. Box 5689
Addis Ababa, Ethiopia
Phone: +251 (1) 463215
Fax: +251 (1) 464645 or 461252
E-mail: t.amede@cgiar.org / r.roothaert@cgiar.org

France
Manuel Winograd
CIRAD
Département TERA
Avenue Jean-François Breton
TA 60/15
34398 Montpellier CX5, France
Phone: +33 (4) 67593841
Fax: +33 (4) 67593838
E-mail: m.winograd@cgiar.org

Honduras
Miguel Ayarza and Guillermo Giraldo
CIAT-Honduras
Apartado Postal 15159
Edificio de DICTA en la Secretaría de Agricultura y Ganadería
Segundo piso
Boulevar Miraflores, cerca edificio Hondutel, subiendo a INJUPEM
Tegucigalpa, Honduras
Phone: +504 2326352 (direct)
Fax: +504 2322451, ext. 733
E-mail: ciathill@cablecolor.hn

Italy
Rupert Best
GFAR Secretariat
c/o FAO, SDR
Viale delle Terme di Caracalla
00100 Rome, Italy
E-mail: r.best@cgiar.org

Louise Sperling
Le Ginestre
Lucio Volumnio 37
00178 Rome, Italy
Phone: +39 (6) 7185454
Fax: +39 (6) 6197661
E-mail: l.sperling@cgiar.org

Kenya
Paul Kimani
Department of Crop Science
University of Nairobi
College of Agriculture and Veterinary Science
Kabete Campus
P.O. Box 29053
Nairobi, Kenya
Phone: +254 (20) 630705, 631956, or 632211
Fax: +254 (20) 630705 or 631956
E-mail: kimanipm@nbnet.co.ke / p.m.kimani@cgiar.org

Jemimah Njuki
CIAT
National Agricultural Research Laboratories
Kenya Agricultural Research Institute
P.O. 759-00606
Nairobi, Kenya
Phone: +254 (20) 4444253
E-mail: j.njuki@cgiar.org

Nteranya Sanginga, André Bationo, Jeroen Huising, Peter Okoth, Joshua Ramisch, and Bernard Vanlauwe
TSBF Institute of CIAT (TSBF-CIAT)
ICRAF Campus
UN Avenue, Gigiri
P.O. Box 30677-00100
Nairobi, Kenya
Phone: +254 (20) 524766 or 524755
Fax: +254 (20) 524764 or 524763
E-mail: tsbfinfo@cgiar.org

Lao PDR

Peter Horne and John Connell
P.O. Box 6766
Vientiane, Lao PDR
Phone: +856 (21) 222796 or 222797
Fax: +856 (21) 222797
E-mail: p.horne@cgiar.org / j.connell@cgiar.org

Rod Lefroy, Keith Fahrney, and Yukiyo Yamamoto
CIAT-Asia
P.O. Box 783
Vientiane, Lao PDR
Phone: +856 (21) 770090
Fax: +856 (21) 770091
E-mail: r.lefroy@cgiar.org / k.fahrney@cgiar.org / y.yamamoto@cgiar.org

Malawi

Rowland Chirwa and Jean-Claude Rubyogo
SABRN Network
Chitedze Research Station
P.O. Box 158
Lilongwe, Malawi
Phone: +265 8822851, 1707146, or 1707278
Fax: +265 1707278
E-mail: rchirwa@malawi.net / r.chirwa@cgiar.org / j.c.rubyogo@cgiar.org

Nicaragua

Jorge Alonso Beltrán, Axel Schmidt, and Gilles Trouche
Apdo. Postal Lm 172
Del Restaurante Marseillaise 2c abajo
Managua, Nicaragua
Phone: +505 (2) 709965
Fax: +505 (2) 709963
E-mail: ciatnica@cablenet.com.ni / j.beltran@cgiar.org / a.schmidt@cgiar.org / g.trouche@cgiar.org

Philippines

Werner Stür
CIAT/Livelihood and Livestock Systems Project (LLSP)
c/o International Rice Research Institute
Domestic Airport P.O. Box 7777
Metro Manila, Philippines
Phone: +63 (2) 8450563, ext. 2406
Fax: +63 (2) 8450606
E-mail: d.bonilla@cgiar.org / w.stur@cgiar.org

Rwanda
Kwasi Ampofo
ISAR/CIAT/USAID
Agricultural Technology Development and Transfer (ATDT) Project
ISAR-Rubona
B.P. 255
Butare, Rwanda
Phone: +250 530560
Fax: +250 513090
E-mail: k.ampofo@cgiar.org

Senegal
Nathalie Beaulieu
BP 24680
Ouakam, Senegal
Phone: +221 8203652
E-mail: n.beaulieu@cgiar.org

Tanzania
Mukishi Pyndji and Eliaineny Minja
SADC/CIAT
Selian Agricultural Research Institute
P.O. Box 2704
Arusha, Tanzania
Phone: +255 (27) 2502268 or 2508557
Fax: +255 (27) 2508557
E-mail: m.pyndji@cgiar.org / e.minja@cgiar.org / ciattz@habari.co.tz

Thailand
Reinhardt Howeler
CIAT-Bangkok Office
c/o FCRI, Dept. of Agriculture
Chatuchak, Bangkok 10900, Thailand
Phone: +66 (2) 5797551
Fax: +66 (2) 9405541
E-mail: CIAT-Bangkok@cgiar.org

Uganda
Roger Kirkby, Robin Buruchara, Robert Delve, Shaun Ferris, Susan Kaaria, Rachel Muthoni Mbogo, and Pascal Sanginga
CIAT Africa Coordination
Kawanda Agricultural Research Institute
P.O. Box 6247
Kampala, Uganda
Phone: +256 (41) 566089, 567670, 368104, 567804, or 566721
Fax: +256 (41) 567635
E-mail: r.kirkby@cgiar.org / s.ferris@cgiar.org / ciatuga@imul.com / ciat-uganda@cgiar.org

USA
Douglas Horton
5118 Creekside Trail
Sarasota, FL 34243, USA
Phone: +1 (941) 3511562
E-mail: d.horton@cgiar.org

Fernando Posada
CIAT Miami
1380 N.W. 78th Ave.
Doral, FL 33126, USA
Phone: +1 (305) 5929661
Fax: +1 (305) 5929757
E-mail: f.posada@cgiar.org

Vietnam
Dai Peters
36A/48 Tay Ho
Tay Ho
Ha Noi, Vietnam
Phone: +84 (4) 7182845
Fax: +84 (4) 7182811
E-mail: d.peters@cgiar.org

Zimbabwe
Herbert Murwira
CIAT/TSBF
Faculty of Agriculture
University of Zimbabwe
P.O. MP167
Mount Pleasant
Harari, Zimbabwe
Phone: +263 (4) 333243 or 333244
Fax: +263 (4) 333244
E-mail: h.murwira@cgiar.org

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The Power of Perspective

Juanita Zaldívar has been excited about what's happening in her native Yorito, Honduras, ever since a Community Knowledge and Communications Center was set up there early in 2004 through a government program. She administers the center on behalf of CLODEST, a local NGO dedicated to fomenting local efforts to combat poverty and protect natural resources.

One of Juanita's main tasks is to motivate members of her community to learn to use the new information and communications technologies (ICTs), such as the Internet, now available to them for individual and collective development. Fortunately, she's not alone in this task but is accompanied by representatives of the various local, national, and international organizations, including CIAT, that are working in the community.

"We've started building our Web site," says Juanita, with an air of confidence. "And we've started making valuable contacts by e-mail." Like her, other inhabitants of Yorito see the telecenter as a bridge that helps them overcome their community's isolation, build useful knowledge on diverse topics, and find new pathways out of poverty.

CIAT. 2004.
CIAT in Perspective, 2003-2004
Cali, Colombia.

ISSN 1692-0503
Press run: 2,000
Printed in Colombia
September 2004

Report coordination: Nathan Russell

Text: Gerry Toomey, Green Ink Publishing Services Ltd.
(www.greenink.co.uk)

Design and layout: Julio C. Martínez G.

Printing: Imágenes Gráficas S.A.

The International Center for Tropical Agriculture (CIAT) is a not-for-profit organization that conducts socially and environmentally progressive research aimed at reducing hunger and poverty and preserving natural resources in developing countries.

CIAT is one of the 15 centers funded mainly by the 58 countries, private foundations, and international organizations that make up the Consultative Group on International Agricultural Research (CGIAR).

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