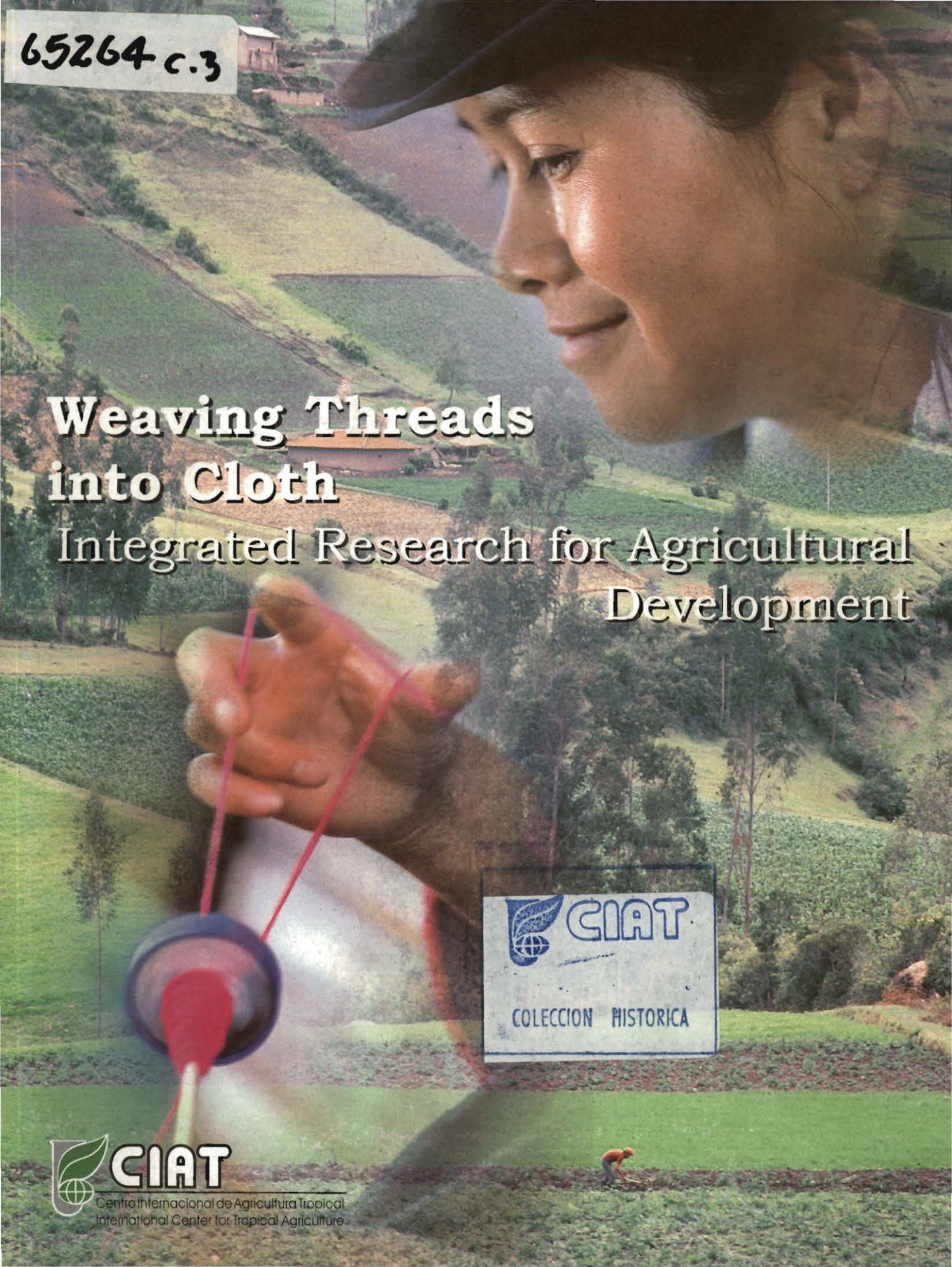


Weaving Threads into Cloth

Integrated Research for Agricultural Development

CIAT
Centro Internacional de Agricultura Tropical
International Center for Tropical Agriculture

Some People You Ought to Meet

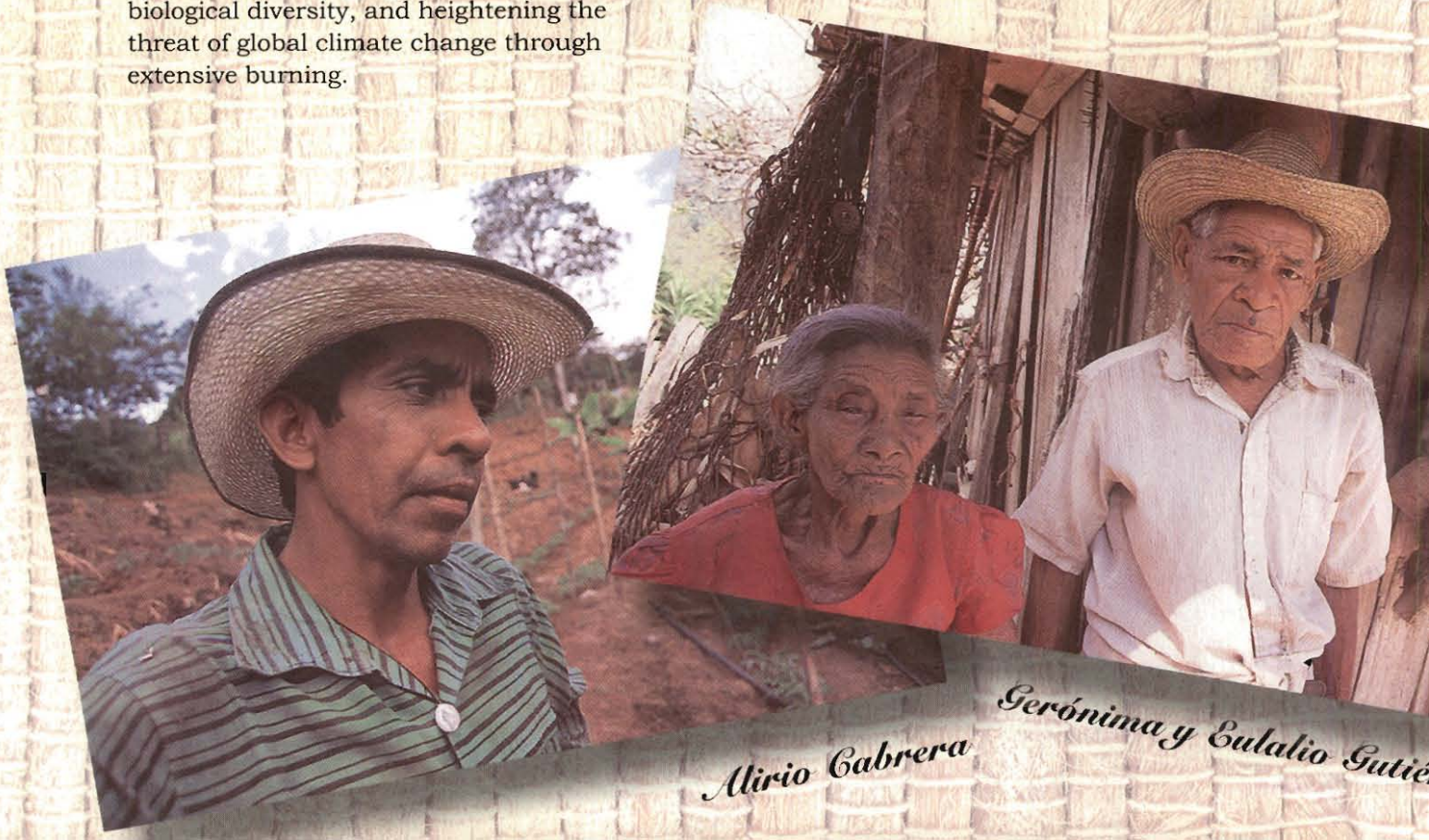
This publication is about some people you ought to meet. They are among the many millions of rural families in the tropical world who lack what many of us take for granted—an adequate diet and livelihood, as well as a glimmer of hope that things will get better.

Though separated by culture and distance, the people you will get to know here lead remarkably similar lives. One common thread is their dependence for food and income on a few, reliable staple crops. Another is their intimate bond with the land that sustains them.

Ironically, these farmers' pursuit of life is one among various forces that now undermine the environments on which they and other people depend. Old patterns of land management have started to collapse under new pressures created by rapid population growth, by the arrival of colonists from other rural areas, and by unrestrained commercial exploitation of tropical forests and other natural resources. More intensive cultivation and its steady expansion onto ecologically fragile land is degrading the soil, diminishing supplies of water, destroying biological diversity, and heightening the threat of global climate change through extensive burning.

The consequent fraying of the land's intricate fabric is leading to social disintegration. As natural systems unravel, agricultural productivity stagnates, and rural people lose hope of finding an exit from poverty. Family members flee to urban shantytowns, and those who remain behind become more vulnerable to the worsening climate of conflict and unrest.

At the International Center for Tropical Agriculture (CIAT), we are convinced that a new design for change can help reverse the disturbing course of events in less favorable agroecosystems of the tropical world. This publication describes one key element of the design—integrated research on agricultural production and land management, aimed at alleviating hunger and poverty, while reversing the destruction of natural resources.



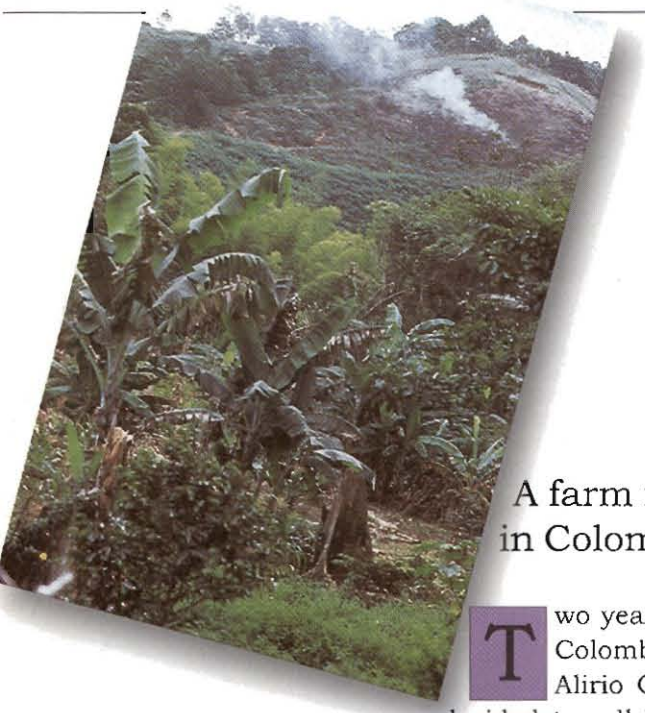
Bui Van Tho

Marcelo Cabrera

Eunice Changirwa

As we explain and illustrate in this publication, such research is needed to provide the combination of technical, economic, social, and policy interventions that can give rural people a larger role in the sustainable development of their countries. In the section that follows, we take you to five places in the tropics where rural communities bear a heavy burden of poverty and have begun to feel the consequences of severe land degradation. Next, we describe an integrated approach to research aimed at solving major problems with crop production and natural resource management in these and other such places. Then, we return to each of the five locations for a summary of progress in solving those problems and thus mending the fabric of the land. In closing we underscore the role of innovative cooperation in making integrated research possible.

The Fraying Fabric of the Land



A farm for sale in Colombia

Two years ago, Colombian farmer Alirio Cabrera decided to sell his hillside farm and move the family to Ibagué, a city about 400 kilometers away from their home in the watershed of the Cabuyal River. He had no friends in Ibagué and no guarantee of finding a steady job there. "But we just couldn't make a living on the farm," he says.

Under better circumstances Alirio would never have tilled this hillside land in the first place. Instead, he would occupy a more profitable corner of the fertile river valley below. But the rapid growth of urban centers has reduced the amount of land available there, and most of what remains is concentrated in the hands of a wealthy few.

With that option closed to them, Alirio and other small-scale farmers have little choice but to cultivate fragile hillside land. Their two most important crops are coffee and cassava, followed by maize, beans, and various fruit and vegetable crops. Since most of the cultivated land is steeply sloping, erosion is a serious problem. Many growers stave off its immediate effects by applying manure. They are also careful to plow across the slopes. Even so, traditional practices are often inadequate to prevent a steady decline in soil quality.

Soil erosion destroys production potential, while deforestation around springs and along riverbanks increases the threat of flash floods downstream and reduces the supply of water available locally and in the valley beyond.

Fire and water in Honduras

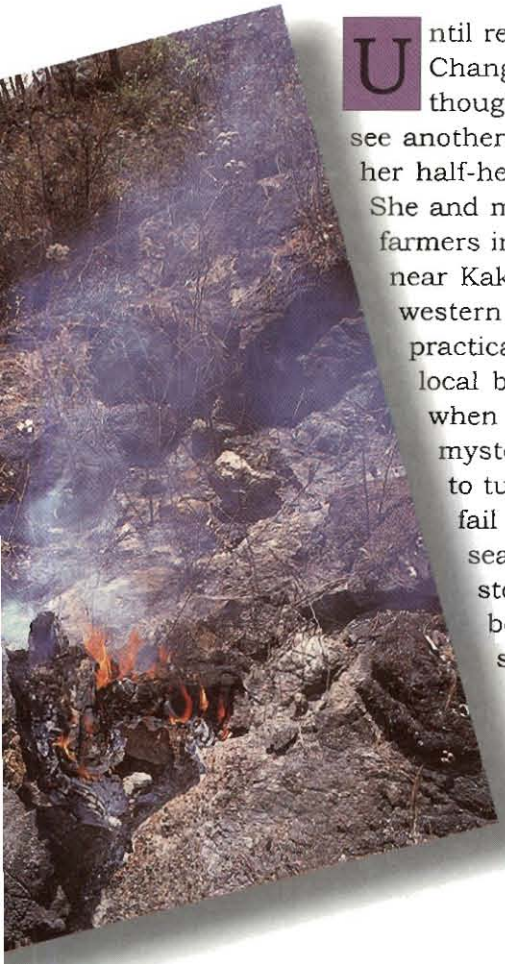
High in the watershed of the Tascalapa River, Eulalio Gutiérrez and his wife Gerónima near the end of life's long and weary journey. With help from their children, they grow coffee, sugarcane, maize, and beans on steep hillsides, in addition to keeping a few pigs and other animals. Their wooden storage shed is full of maize, still in the husk and stacked in neat rows almost to the ceiling.

To sow small plots of annual crops and provide pasture for their cattle, Eulalio and Gerónima have followed the traditional practice of burning and clearing forest. This way of life seemed to do little harm to the land, as long as they, several other *mestizo* families, and a small indigenous community were the only inhabitants of this part of the watershed.

But things have changed, as the community has swelled with the arrival of new settlers. Nowadays, people burn and cut down trees *a la loca* ("like crazy"), Eulalio complains. Eroded slopes and plumes of smoke rising from the forest in almost every direction suggest that what he says is true.

Eulalio and Gerónima are not the only ones worried about the current course of events in this watershed. Just recently, hundreds of people in Yorito, one of two townships in this area of Yoro department, participated in a march to protest the burning. Although the land has shown remarkable resilience under new pressures, these people fear that its productive potential, as well as local water supplies, will be permanently ruined if the remaining forest is destroyed.

Kenya's Kakamega bean crisis



Until recently, Eunice Changirwa never thought she would see another bean crop in her half-hectare field. She and most other farmers in this village near Kakamega in western Kenya practically lost their local bean races when crops mysteriously began to turn yellow and fail season after season. "I had to stop growing beans," she says. "Any seed I planted was just wasted, it didn't produce anything."

After that, beans became a rare treat in her household. "Once in a while, I would buy beans in the market from other parts of the country, but they were expensive," she recalls. In the absence of this vital protein source, the family's diet was reduced to a monotonous dependence on maize and banana, their main starchy staples. It also hurt to lose the income from sales of surplus bean production. Recently, her daughter had to drop out of school, because the family could not come up with the fees.

Kenyan scientists determined that beans had succumbed to a complex of diseases referred to collectively as "root rots." Serious outbreaks occur mainly in areas, like western Kenya, where high population density makes land extremely scarce, forcing farmers to exhaust the soil through ever more intensive cultivation of small plots.

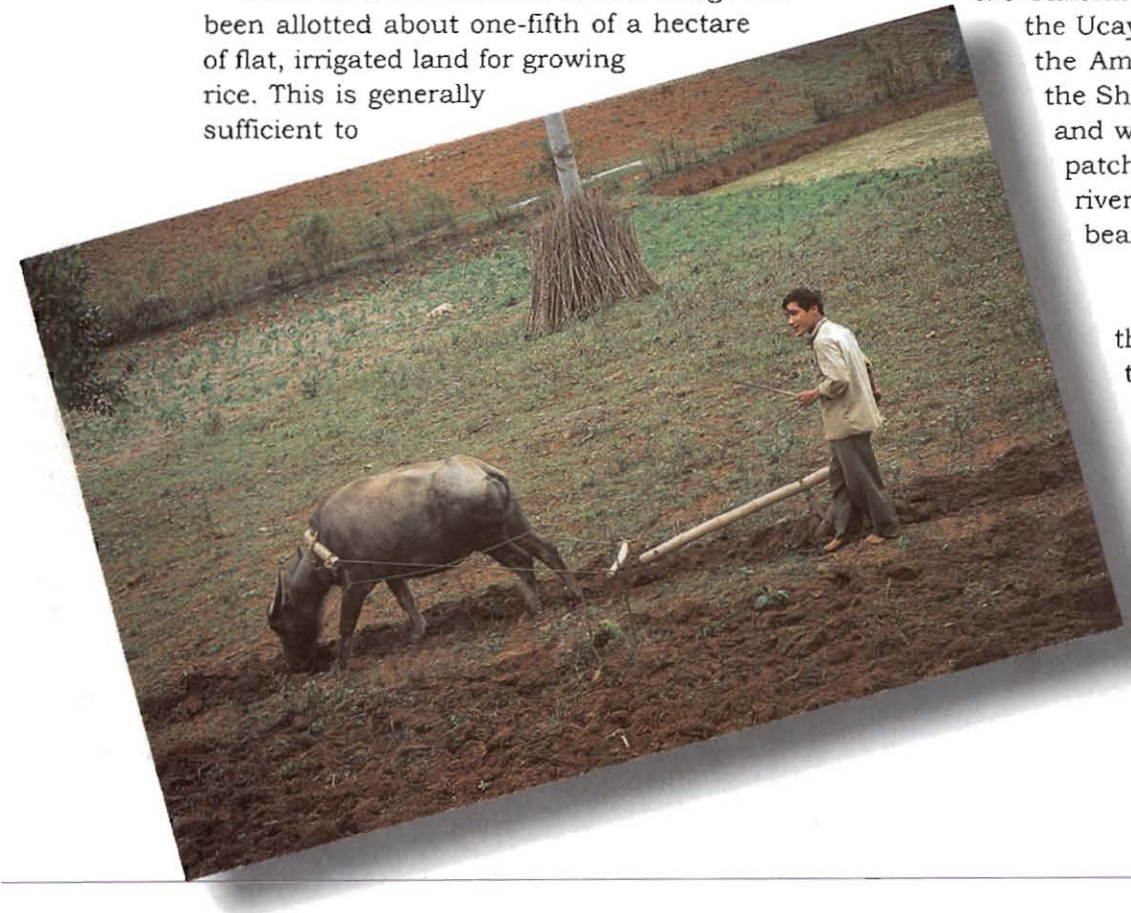
Life in Dong Rang, Vietnam

To support a family of five on a half hectare of good land is difficult enough. But when most of the land lies on an erosion-prone slope, the task becomes almost unimaginable.

Yet, that is precisely what Bui Van Tho and other farmers must do in the village of Dong Rang in Vietnam's northern Hoa Binh province. They belong to an ethnic minority group, the Muong, who live mainly in marginal upland areas.

Each of the 92 families in this village has been allotted about one-fifth of a hectare of flat, irrigated land for growing rice. This is generally sufficient to keep them fed but not always. Whatever else the farmers can provide for their families comes from the production of cassava, taro, peanuts, and sugarcane on steep slopes. Cassava growers sell about half of their production to starch processors in a village about 30 kilometers away. They feed the rest to pigs, which are one of the farmers' best means of earning and saving cash.

A few years ago, Tho and his neighbor saw signs of trouble on their hillside plots. "We realized that production was going down, but we weren't sure why and didn't know what to do," he says. But now, as a result of participatory experiments, these farmers can see that the culprit is soil erosion.

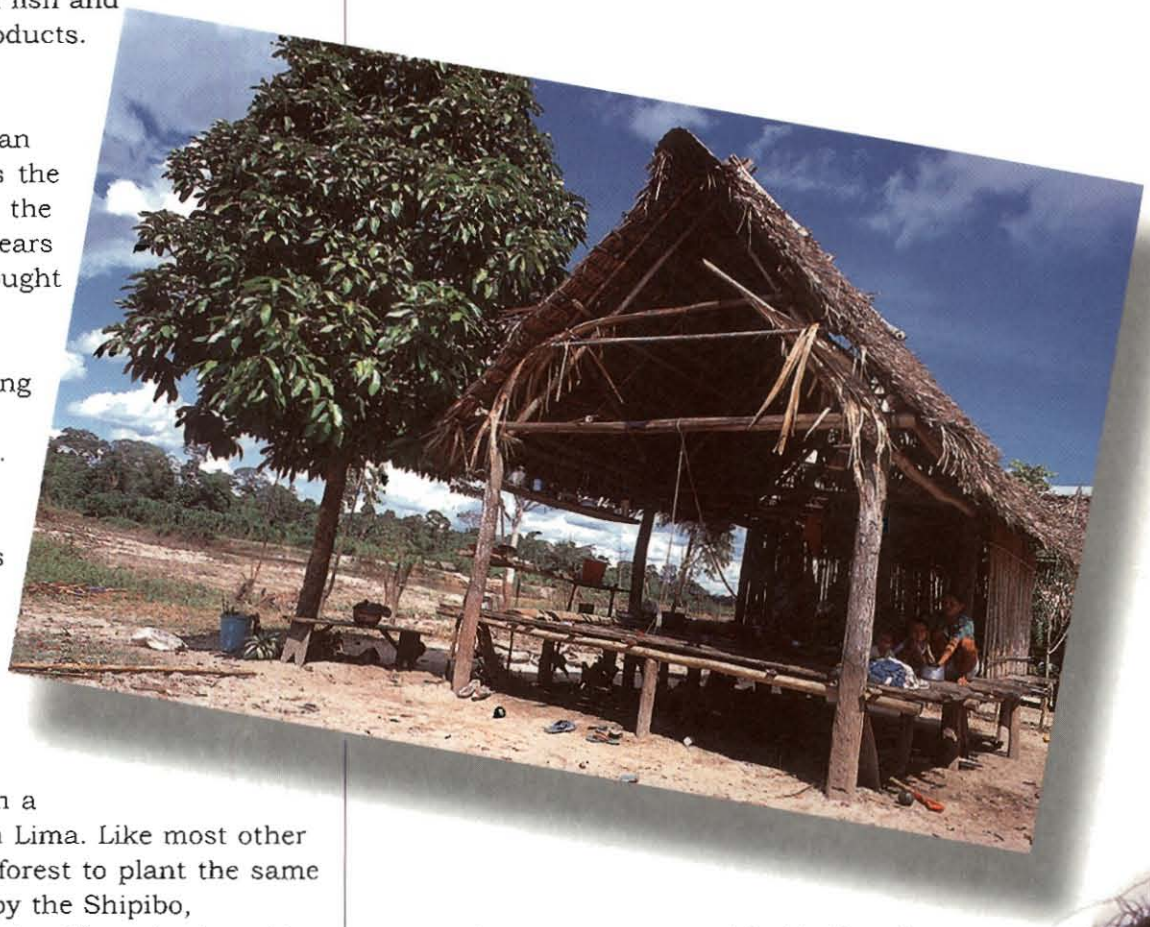


A river and a road in Peru

The village of Calleria, home to 513 of the Shipibo people in Peru's tropical rainforest, is aptly named after the winding river that shapes every aspect of community life. The seasonal rise and fall of the Calleria's waters—which flow into the Ucayali River, a tributary of the Amazon—determine when the Shipibo can fish or hunt and when they can clear small patches of forest along the river to plant cassava, rice, beans, and maize.

The Calleria also ties the destiny of the Shipibo to that of Pucallpa, a rapidly growing city about 100 kilometers up the Ucayali. In recent years logging companies there have paid this and other indigenous

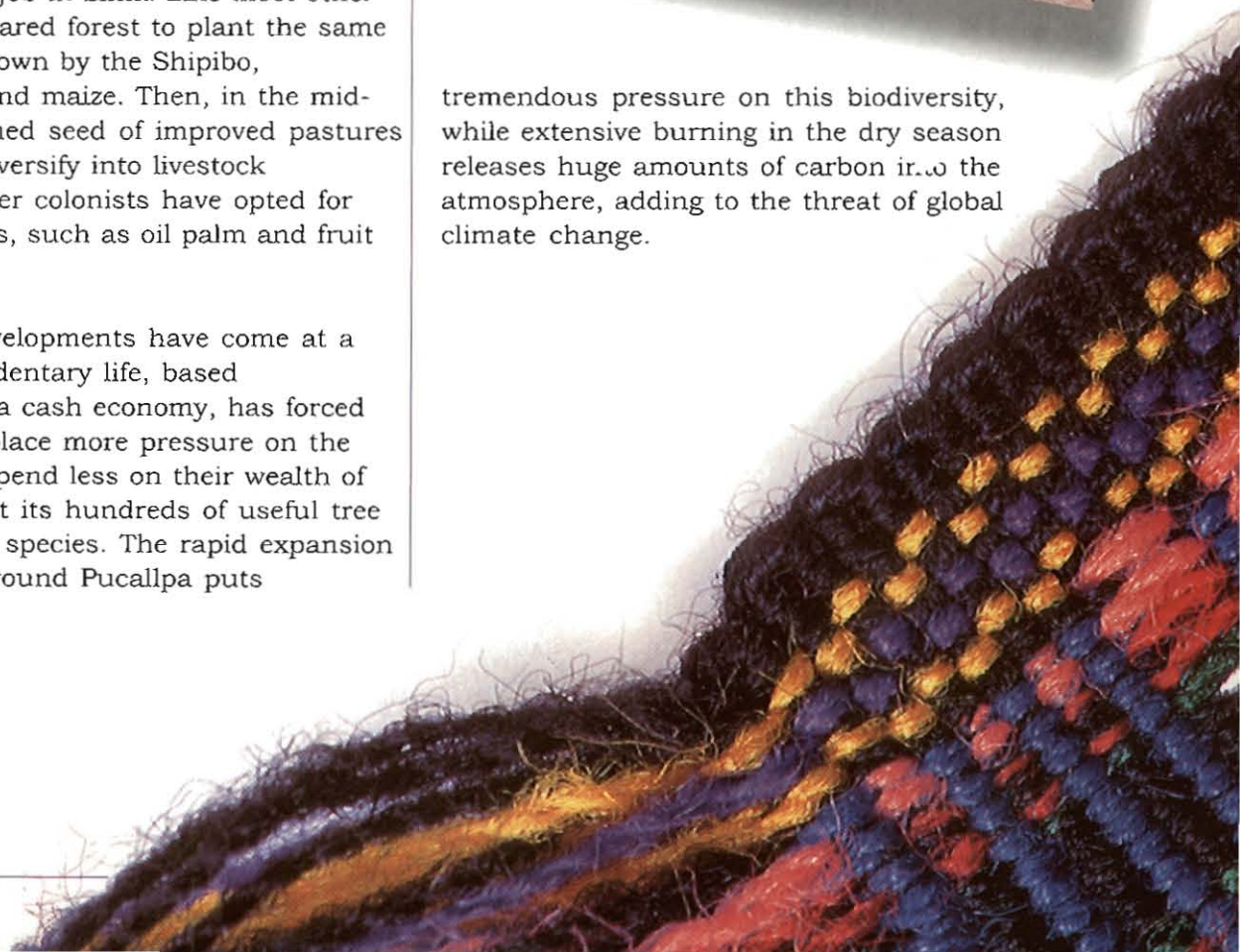
communities for the right to cut timber on their land. The city also provides an expanding market for Shipibo crafts and for their small surplus of fish and other agricultural products.



A road that links Pucallpa to the Andean highlands determines the pattern of life around the city. Built about 50 years ago, the road has brought a steady stream of colonists, who have cleared the forest along dirt roads branching out from the highway.

One man who travelled that route is Marcelo Cabrera. Originally from Cajamarca in northern Peru, he came to Pucallpa in 1968 in search of something better than a minimum wage job in Lima. Like most other colonists, he cleared forest to plant the same annual crops grown by the Shipibo, especially rice and maize. Then, in the mid-1980s he obtained seed of improved pastures and began to diversify into livestock production. Other colonists have opted for permanent crops, such as oil palm and fruit trees.

All these developments have come at a cost. A more sedentary life, based increasingly on a cash economy, has forced the Shipibo to place more pressure on the forest and to depend less on their wealth of knowledge about its hundreds of useful tree and other plant species. The rapid expansion of agriculture around Pucallpa puts tremendous pressure on this biodiversity, while extensive burning in the dry season releases huge amounts of carbon into the atmosphere, adding to the threat of global climate change.



A New Design for Change

The people you have just met and the land they manage may seem remote from the concerns of those who lead easier lives in more hospitable environments. Yet, the poverty of these people and the degradation of their land have numerous consequences that lessen the distance between them and everyone else.

Even earth's most privileged inhabitants will eventually feel the effects of diminishing water supplies, the loss of biodiversity, and changes in the global climate. Many already suffer from the social fallout of this destruction and of the poverty that feeds it, whether through the pressures created by massive emigration of rural people to urban centers and to wealthier countries or through rural violence fueled by conflicts over land.

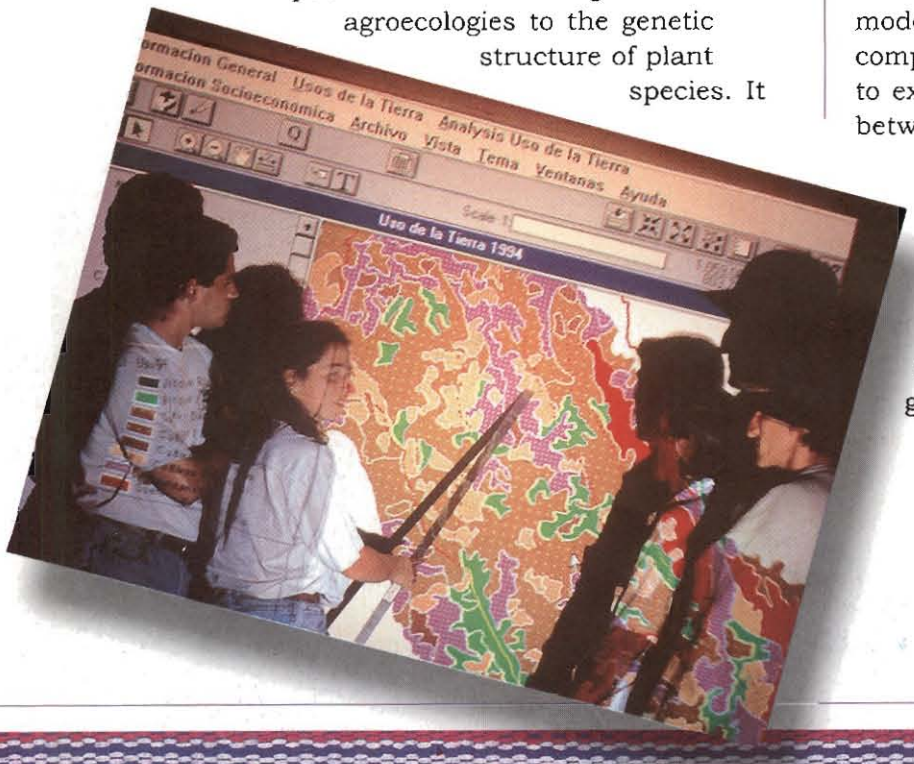
Self-interest and humanitarian concerns thus leave no doubt that something must be done about rural poverty and the degradation of natural resources in less favorable tropical environments. The critical question is what to do.

CIAT's answer is an integrated approach to research that weaves together the diverse elements and actors in unraveling natural and social systems. This research stretches across different levels in those systems—from patterns of land management in whole agroecologies to the genetic structure of plant species. It also brings together a variety of experts—including geneticists, soil scientists, anthropologists, and ecologists—who work hand-in-hand with agriculture's key players—from farmers to policy makers.

Projects are the Center's chief mechanism for conducting integrated research and for organizing cooperation with partners. Currently, CIAT has 16 projects, each dealing with a different aspect of the research themes described below (brief profiles of the projects are available upon request). Our work feeds into an emerging global system, which includes national research institutes, universities, nongovernment organizations, the private sector, and other international centers. CIAT is one of 16 such centers supported by the Consultative Group on International Agricultural Research (CGIAR), a consortium of donor countries and organizations committed to sustainable agriculture in the developing world.

Land management

To design effective programs for improving land management, community leaders, development specialists, researchers, and government officials desperately need more reliable information. Fortunately, the information revolution that is sweeping the modern world has provided the means to compile large amounts of complex data and to examine and visualize the relationships between them.



CIAT has embarked on a major initiative that is helping bring this revolution to people in the tropics who need it most. Our scientists are developing powerful but relatively simple computer tools that make geographic and other information readily

available to decision makers at the local and national levels. With our databases on rural poverty in Latin America, for example, government and nongovernment organizations will be better equipped to plan and target programs for combating poverty and then measure their impact.

In conjunction with our work on geographic information systems, we are conducting research that helps us understand the biophysical, social, economic, and policy factors behind particular land uses and gauge their ecological consequences. The information, methods, and other products resulting from this work better enable decision makers to explore the probable long-term effects on natural resources of current and alternative land uses.

Often, changing the status quo is beyond the capacity of individual farmers. For that reason our scientists are devising widely applicable methods for community management of natural resources that promote collective efforts to increase productivity while protecting the environment. These innovative methods bring local, national, and international organizations into a process of negotiation, whereby rural people obtain services that help them strengthen food security and raise incomes in exchange for a commitment to specific conservation initiatives.

Soils and systems

Once communities gain access to information and get better organized, they are more truly the owners of their development and of the natural resources they manage. This new power may do them little good, however, unless they also have improved production systems and soil management practices that make it technically feasible for them to intensify agricultural production without undermining the environment.

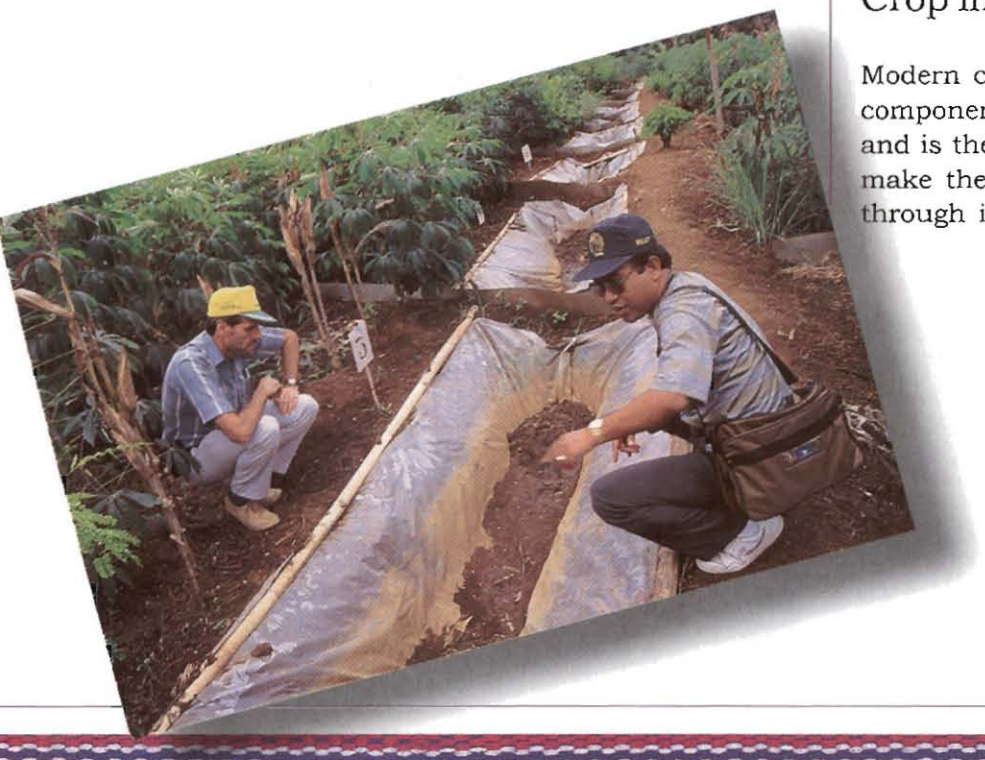
Ultimately, the development of such systems is a local challenge, requiring that researchers work closely with farmers to adapt improved practices to varying circumstances. CIAT and other international institutions facilitate this process by evaluating cropping system components for their potential to raise productivity and use resources more efficiently (through their effects on nutrient cycling or soil organic matter dynamics, for example). Among other findings, this research has shown that rotations with perennial legumes are particularly effective in holding and recycling nutrients.

To aid local adaptation of system components, our scientists pursue three lines of research. First, they determine basic principles and guidelines for selecting efficient combinations of crops and forages; for better managing nutrients, crop residues, and green manures; and for controlling erosion and improving soil structure. Second, they develop simple diagnostic tools that help farmers and technicians assess soil health (in terms of such factors as rates of water infiltration and aggregate size and distribution) and make decisions about resource management. And third, they develop effective approaches for involving farmers and their communities in shaping research priorities, developing improved practices, and evaluating their impact.

Crop-pasture combinations and other improved systems must generate enough income to improve the well-being of rural families and provide them with strong cash incentives to conserve natural resources. A further means to that end is to link communities with profitable domestic and even international markets through value-added processing of tropical products. Based on many years of experience with seed production and cassava processing, CIAT scientists are generating widely applicable methods and information that aid the development of viable agroenterprises in rural areas.

Crop improvement

Modern crop research provides the key components of improved production systems and is therefore at the heart of our effort to make these systems more sustainable through integrated research.



Often, new varieties give farmers both the incentives and the means to manage natural resources better. For example, increased income from improved annual crops (the result of higher yields or desirable quality traits) helps cover the costs of controlling erosion or engaging in a community initiative to conserve biodiversity, in addition to satisfying the immediate needs of farm families. Likewise, forage grasses and legumes can maintain soil fertility and control weeds, besides raising income from the production of livestock for meat and milk.

Plant breeders at CIAT and many other institutions have compiled an impressive record of success in generating new varieties that produce food and raw material more efficiently, offer traits that markets demand, tolerate poor soils and drought, and reduce the need for pesticides. In its own crop research, the Center focuses on beans, cassava, tropical forages, and rice. Within the CGIAR system, we have a global mandate for the first three, and we have successfully introduced improved germplasm of these crops from Latin America to Africa and Asia.

One lesson we have learned from this experience is the importance of farmers having a say in germplasm selection and testing to ensure that new varieties meet their requirements. In recent years we have also demonstrated the promise of upstream biotechnology research (particularly on molecular markers, genetic maps, and tissue culture) for increasing the efficiency of variety development.

Pest and disease management

Pest and disease damage imposes a sizable tax on the profits from crop production. For fear of that hazard, some farmers (especially those growing higher value vegetable crops for the market) fall into a pattern of indiscriminate pesticide use. This robs a growing share of their income and poses a dire threat to human health and the environment.

To avoid those dangers, farmers need integrated pest management (IPM) strategies. They rely on combinations of environmentally friendly control measures, such as genetic resistance and biological control, which reduce or even eliminate the need for pesticide application. International institutions help increase the efficiency of local IPM research by developing or identifying resistant germplasm, biological control agents, and new methods and by moving these technologies across political boundaries.

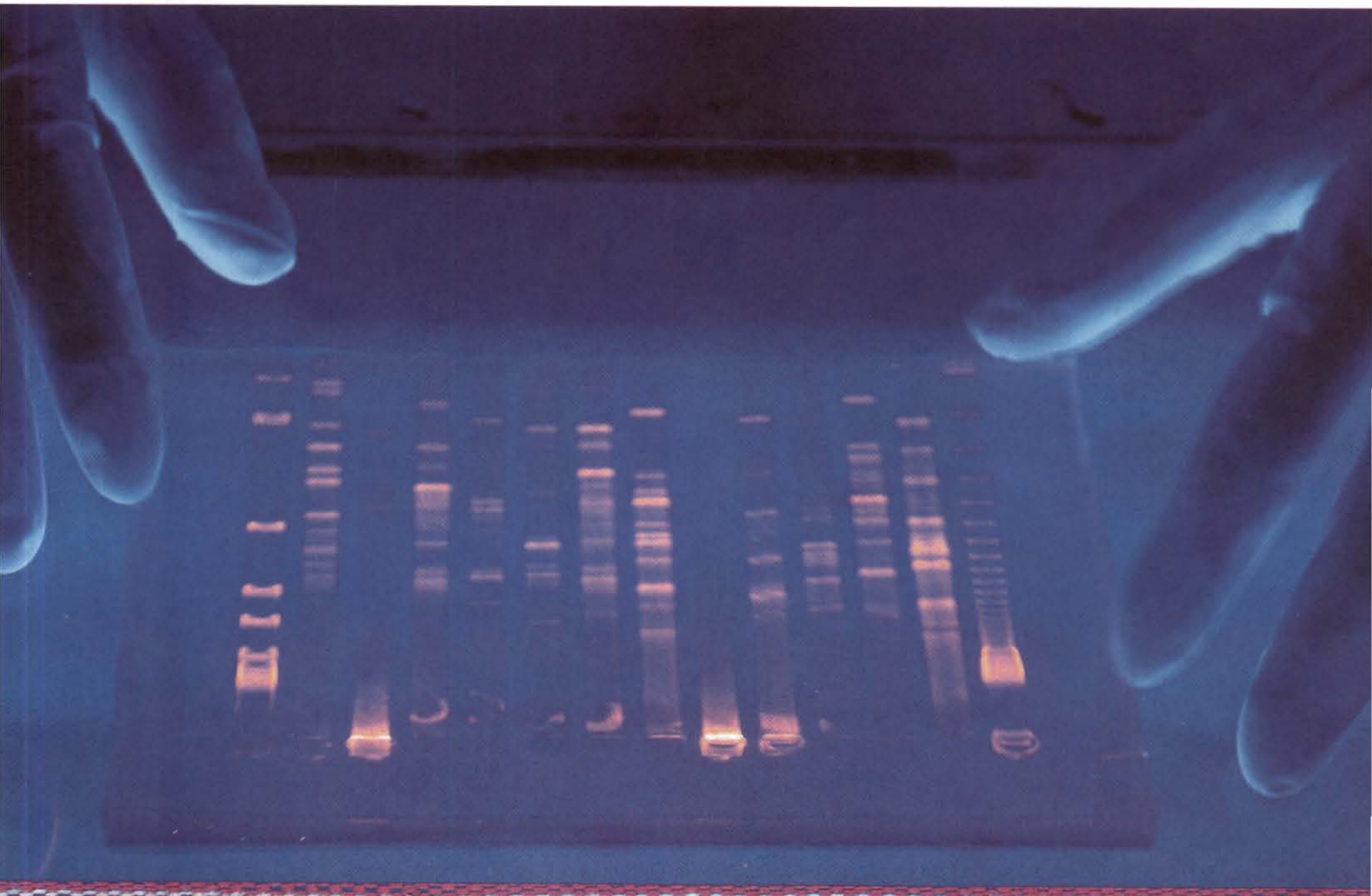
Agrobiodiversity

Current patterns of land management are diminishing biological diversity (including many species important for agriculture) at an alarming rate. The permanent loss of this natural resource steadily limits our options for using genetic diversity to alleviate the rural poverty that accounts in part for its destruction.

Because biodiversity is so central to agriculture, it provides an important focal point for integrated research. In addition to conserving the genetic diversity of beans, cassava, and tropical forages, CIAT promotes better management of agrobiodiversity in several ways. First, we provide more effective tools (such as molecular marker techniques and geographic information systems) for locating, preserving, assessing, and using this resource. Second, we demonstrate the immense value of agrobiodiversity by generating a wealth of improved germplasm, by helping to develop diversified crop and livestock systems, and by

promoting enterprises that add value to tropical species through processing. Third, we devise farmer participatory approaches that improve local management of biodiversity and other natural resources.

In the section that follows, we return to the five locations you have already visited. There we describe how the various elements of our integrated research approach are helping reduce the threat to agrobiodiversity and other natural resources and improve the livelihoods of the people you have met.

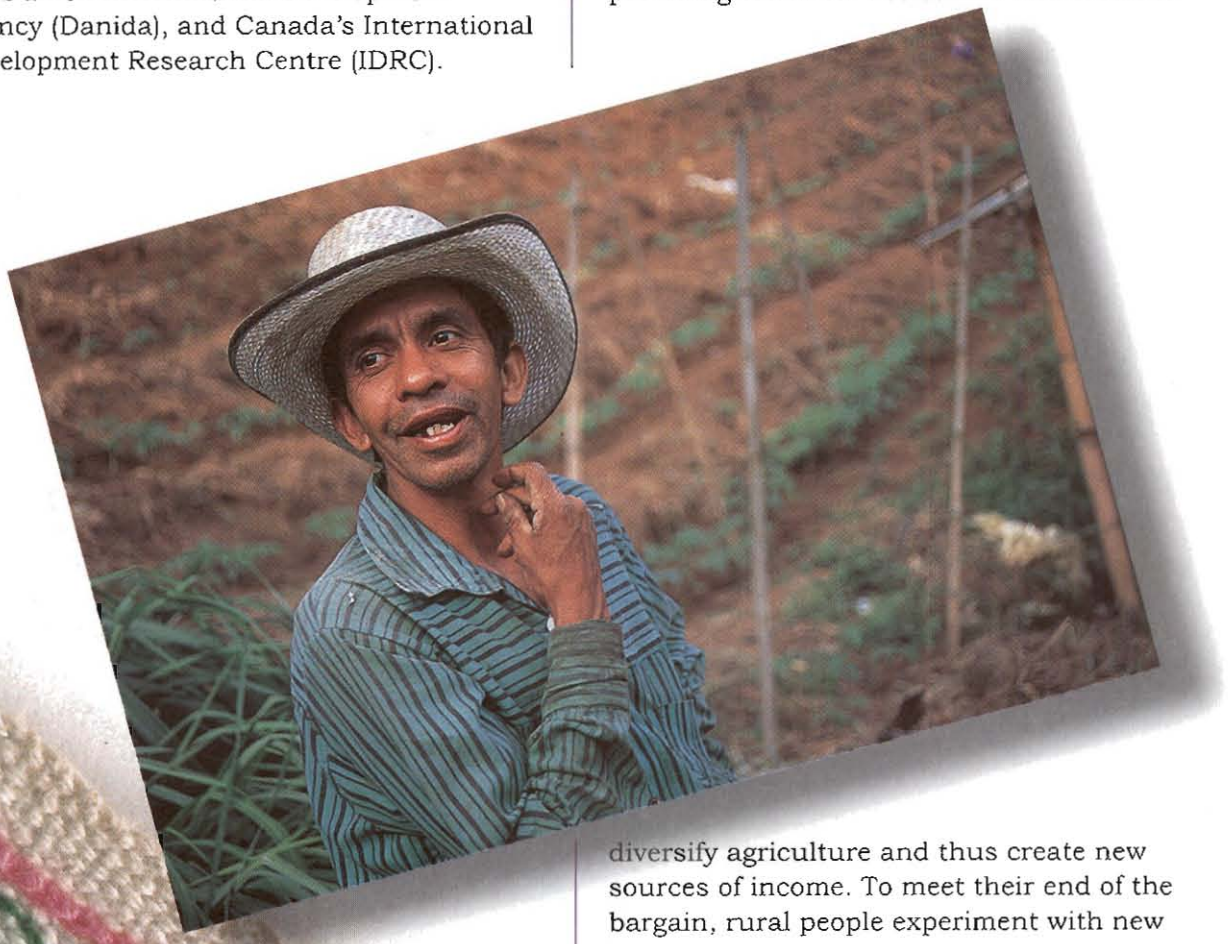


Mending the Fabric of the Land

Not for sale at any price

Colombian farmer Alirio Cabrera has found a way out of his predicament, and it was much closer to home than an unfamiliar city. Help came through the Interinstitutional Consortium for Sustainable Agriculture in Hillsides (CIPASLA), an alliance of 16 organizations that includes CIAT and is supported by the Colombian government, the Danish International Development Agency (Danida), and Canada's International Development Research Centre (IDRC).

Members of the consortium used to work separately, but now they are united in a common cause with the inhabitants of the Cabuyal watershed. Through a combination of improved technology and collective action, CIPASLA is enabling the community to raise its standards of living and safeguard its natural resources. Each organization contributes to these ends in a different way, conducting research and training or providing technical assistance and credit to



diversify agriculture and thus create new sources of income. To meet their end of the bargain, rural people experiment with new technologies and join in collective action to protect forests and springs.

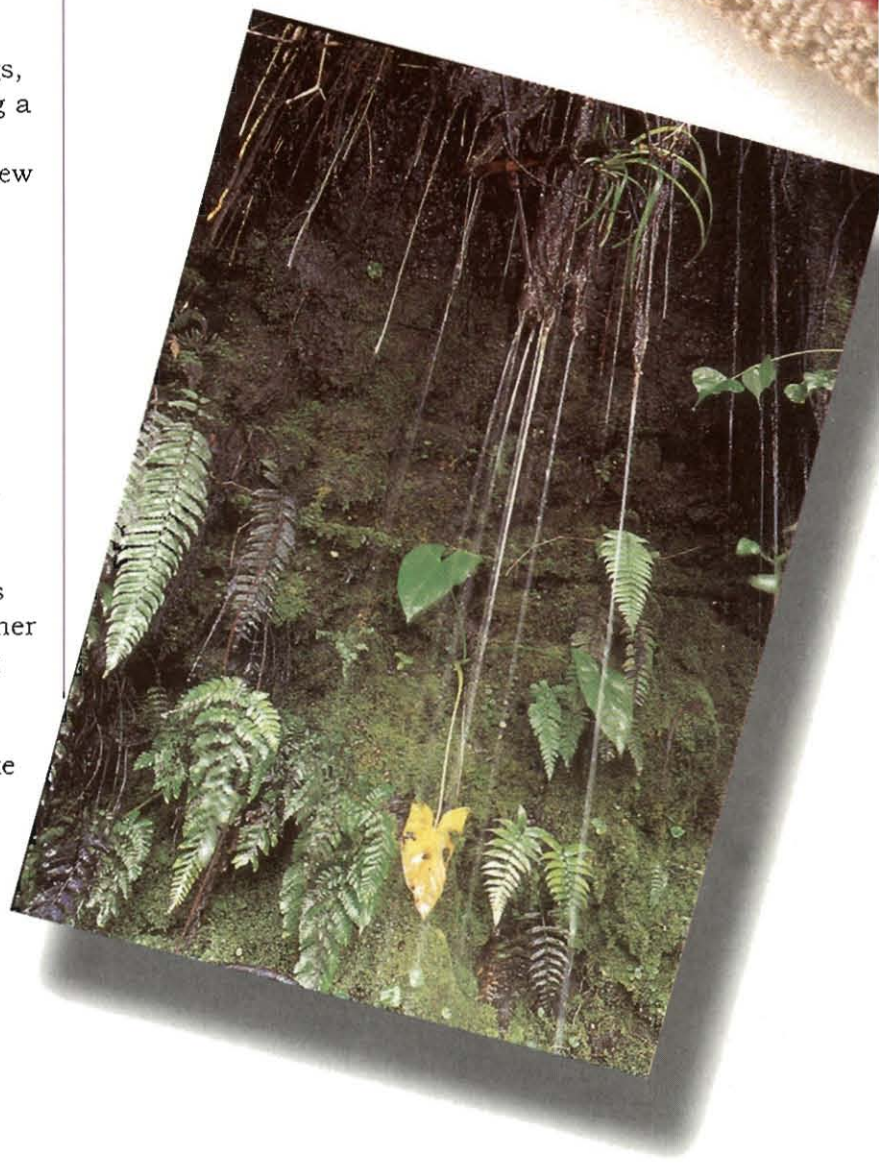
Under these terms Cabrera and other farmers have decided to give farm life another chance. Some inhabitants of the higher, more ecologically fragile part of the watershed have increased their incomes by adopting

high-yielding, disease-resistant climbing beans. At the same time, they have entered into negotiated agreements aimed at reducing the negative effects of land clearing by burning. Other farmers have adopted improved pastures to intensify milk production in response to the demand created by new local agroenterprises that process milk into cheese and other products. Still others have created a niche for themselves in local markets for tropical fruits, vegetables, and aromatic herbs.

With help from the Corporation for Interdisciplinary Studies and Technical Assistance (CETEC), a nongovernment organization, Cabrera and his family now supplement their income from cassava, maize, and bean production by raising pigs, fish, chickens, and rabbits and by keeping a vegetable garden. They also sell eggs, homemade ices, and fruit drinks. In the new spirit of social responsibility, they have fenced off a portion of their property with barbed wire to protect native vegetation around a spring that supplies water to neighbors downstream.

Not long ago someone offered to buy Cabrera's farm. "But we're not selling," he says. "We want to make a decent living on our own land."

To derive strategies and tools from this experience that can be extrapolated to other hillside environments, CIAT is conducting research on the CIPASLA model with support from Danida. Through this work we have identified key functions that make watershed management associations effective, and we have tested and refined various methods that enable such groups to perform those functions better.



New tools for development in Yorito

Several years ago CIAT expanded its research in hillsides, with funding from the Swiss Agency for Development and Cooperation (SDC), the European Union (EU), and IDRC, to include several watersheds that form a continuum from northern Honduras south into Nicaragua. One of these is the watershed of the Tascalapa River.

Inhabitants of the area who marched in Yorito recently made a compelling case against land clearing by burning. But their arguments will have little force as long as poverty reigns in the community and most farmers simply cannot afford the luxury of conservation. That is why the same group that staged the march—the Local Committee for Sustainable Development in the Watershed of the Tascalapa River (CLODEST)—has also begun to explore new options for raising agricultural productivity and improving land management. The committee includes about 20 local government and nongovernment organizations, and receives technical and institutional support from CIAT and from the Inter-American Institute for Cooperation in Agriculture (IICA).

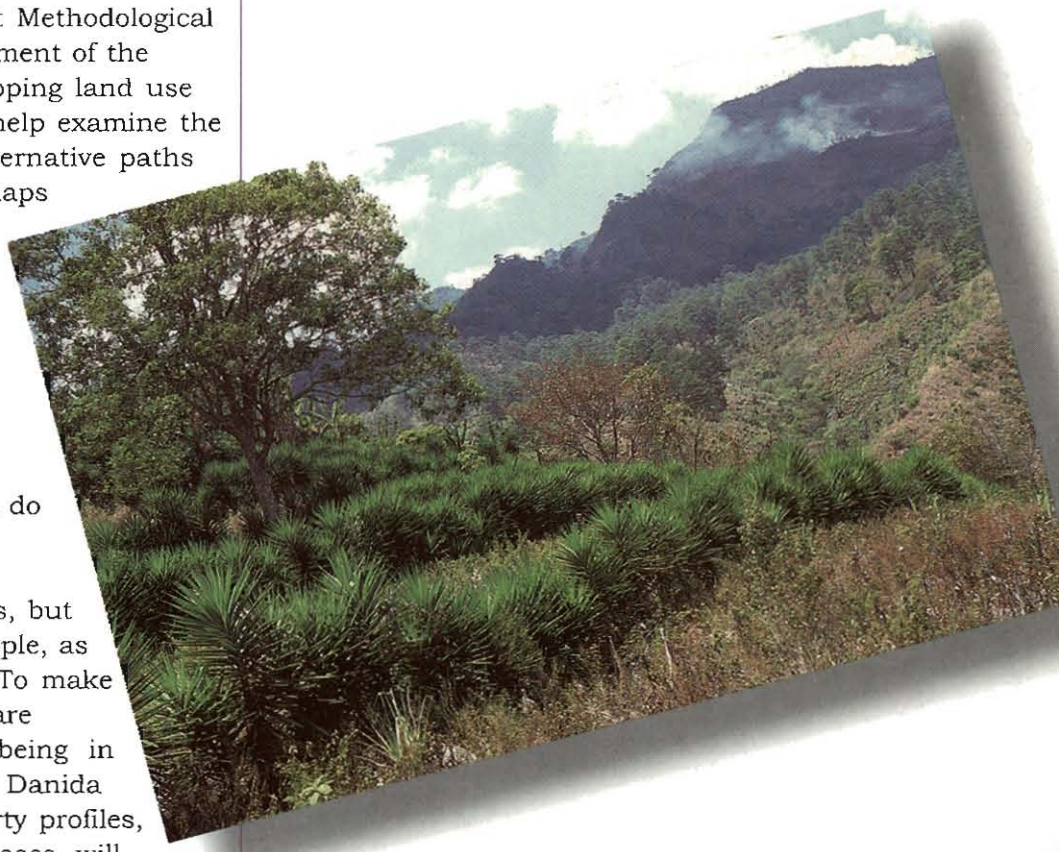
Within this stronger institutional framework, efforts are now under way to evaluate and introduce improved pastures and to identify opportunities for establishing new agroenterprises. Farmers here and elsewhere also have access to bean varieties made available through the longstanding Regional Bean Program for Central America, Mexico, and the Caribbean (PROFRIJOL), which is supported by SDC.

One important step toward sustainable agriculture in the community is to integrate forage and other legumes, such as *Mucuna*, into current systems. A valuable complement to improved seed of beans, maize, grass pastures, and other crops, legumes can help intensify crop and livestock production, while maintaining soil fertility and reducing erosion. CIAT scientists are assembling genetic diversity, together with agronomic and agroclimatic data, that will enable local organizations here and elsewhere in the region to better target the introduction of leguminous species.

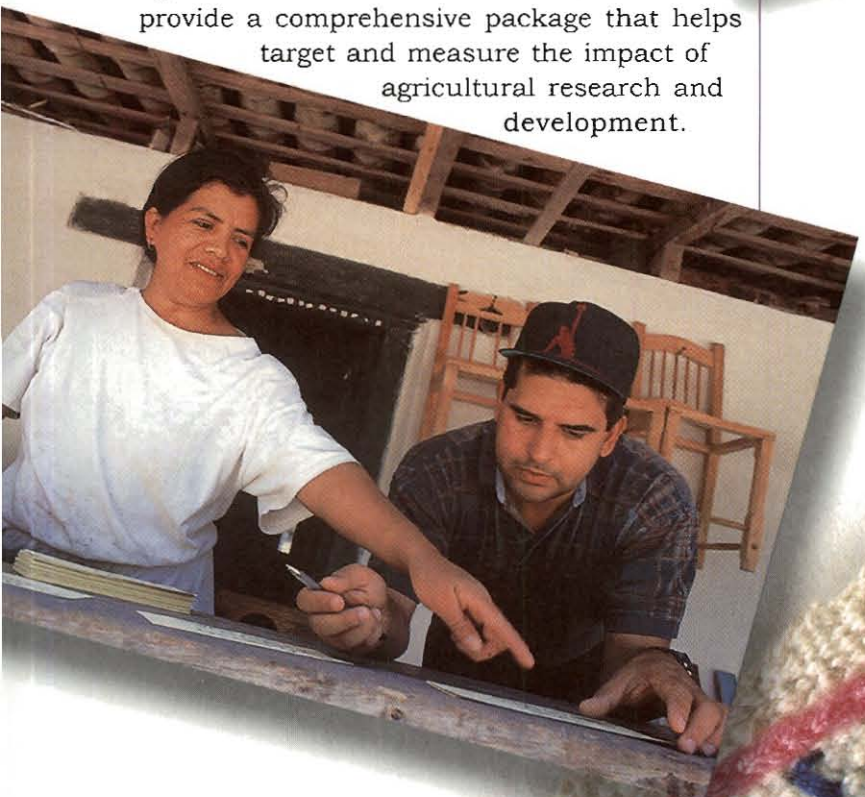
To create lasting institutional arrangements for farmer participation in this and other research, the Center is also helping establish Committees for Local Agricultural Research (CIALs) in Yoro and other departments of the country with support from the Kellogg Foundation.

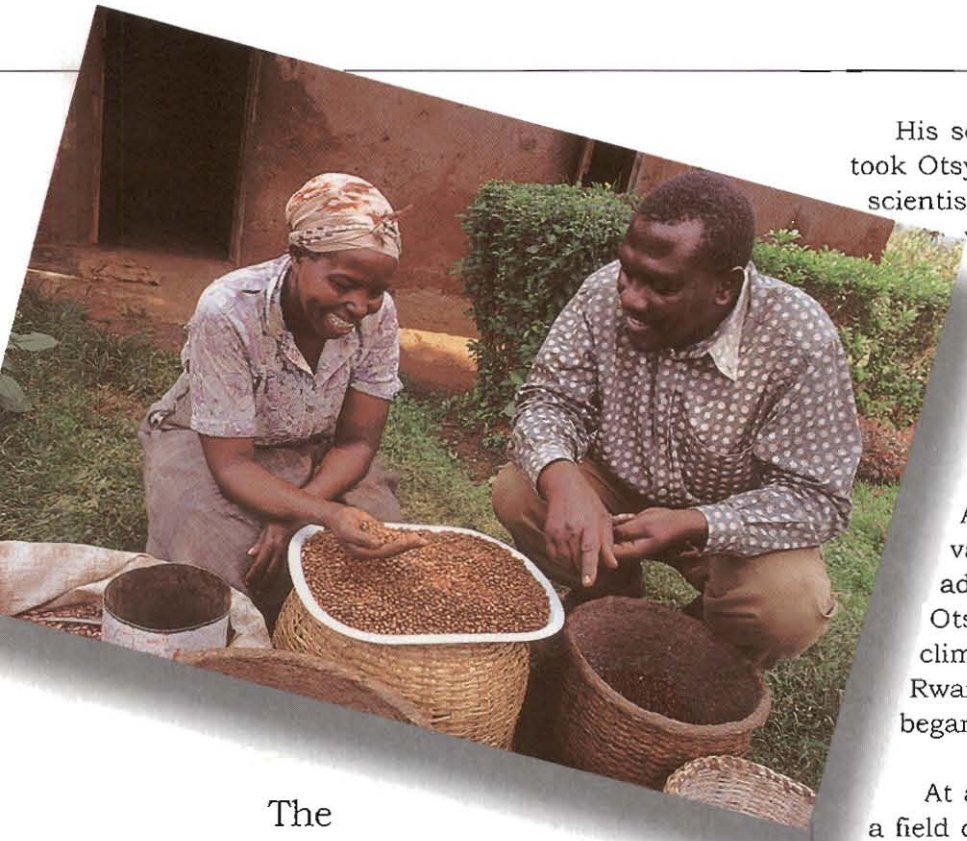
How can we tell if the significant collective effort being brought to bear on this and other rural communities in Honduras will be effective in reducing poverty and environmental degradation? CIAT specialists in geographic information systems are convinced that new information tools can greatly increase the chances of success by improving the design and targeting of a whole range of development interventions—from agricultural technology to government policy.

In a project financed by SDC, the Inter-American Development Bank (IDB), and the Ecoregional Fund to Support Methodological Initiatives (set up the government of the Netherlands), they are developing land use databases and models that help examine the possible consequences of alternative paths in land management. With maps and other information generated with these tools, national and local organizations in Honduras will have the means of making more informed decisions.



Whether life and the land do improve in Yorito should be reflected, not just in official statistics and expert opinions, but in the well-being of rural people, as they themselves perceive it. To make this possible, our scientists are identifying indicators of well-being in Honduras with support from Danida and IDB. The resulting poverty profiles, together with land use databases, will provide a comprehensive package that helps target and measure the impact of agricultural research and development.





The Kakamega bean revival

Scientists refused to accept the apparent victory of root rots over bean production in western Kenya. One of them, Reuben Otsyula, a plant breeder with the Kenyan Agricultural Research Institute (KARI), obtained a grant for research on the disease through a regional bean network supported by CIAT and financed by the governments of Canada, Switzerland, and the USA.

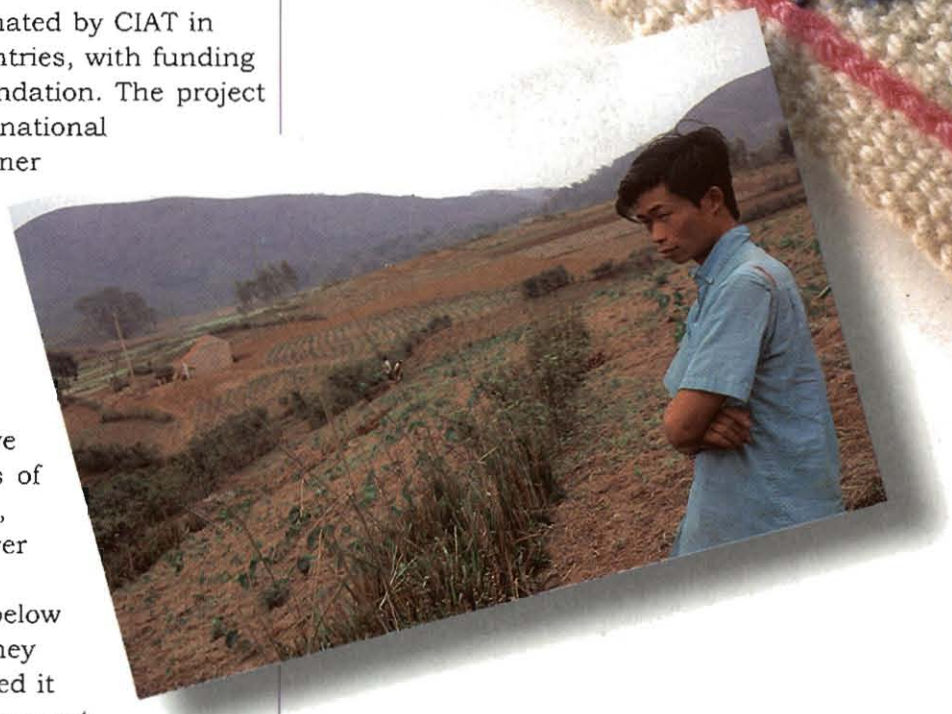
His search for a genetic remedy eventually took Otsyula to Rwanda, where he joined scientists from other countries for a traveling workshop organized by the network in 1993. "I was really impressed with farmers' widespread adoption of high-yielding, root-rot-resistant climbing beans in highland areas similar to ours in western Kenya," Otsyula says. Introduced in Rwanda from Latin America during the 1980s, the new varieties showed marked advantages over local climbers. Otsyula arranged to import the best climbing and bush varieties from Rwanda into Kenya, where he soon began testing them with farmers.

At about that time, Otsyula attended a field day organized by Patrick Nekesa of the Association for Better Land Husbandry (ABLH). A nongovernment organization supported by the British government, ABLH seeks solutions to the problem of declining soil fertility in Kakamega through better management of green manures and other sources of organic material. By enabling farmers to derive more income from the land they already occupy, the organization hopes to relieve pressure on the area's remaining tropical forest.

KARI and CIAT scientists worked with Nekesa to develop and promote an integrated method of root-rot control that includes resistant varieties, planting on raised beds, and incorporation of organic material into the soil. "Without new opportunities to produce, farmers have no motive to adopt better soil management practices," Nekesa says. "That's why high-yielding climbing beans were the right technology at the right place and at the right time." By 1997 more than a thousand farmers around Kakamega were growing the new varieties.

Imagining a future in Dong Rang

Bui Van Tho and nine other farmers in this upland village are developing solutions to their erosion problem with technical help from Vietnam's National Institute for Soils and Fertilizers. Their work is part of a project coordinated by CIAT in four Southeast Asian countries, with funding from Japan's Nippon Foundation. The project is improving the ability of national institutions to employ farmer participatory methods in adapting new production and resource management technology to diverse situations.



At Dong Rang the farmer experimenters have established different types of barriers across the slopes, using plants such as vetiver grass and *Tephrosia*, a leguminous shrub. Just below each experimental plot, they have dug a trench and lined it with plastic to gauge the amount of sediment washed away by rain. The farmers have also tested high-yielding, high-starch cassava varieties, which CIAT and Thai scientists developed (with funding from the Japanese government) through hybridization of Latin American and local germplasm. The new varieties are now being further developed and promoted in northern Vietnam by the Bac Thai Agroforestry College.

Based on trial results, Tho has decided to extend the vetiver grass or *Tephrosia* barriers next season. Over time terraces will form behind them, providing further protection against erosion. Though the barriers occupy land that could be devoted to crop production, Tho and other farmers expect that the increased yields of the new varieties, which boost their income from pig production and the sale of cassava for starch processing, will more than compensate for the loss.

Toward new paths of development in Pucallpa

What happens to the forests here ultimately depends on the value that people assign to this immense natural resource. One CIAT study in the Pucallpa area has suggested that, contrary to conventional wisdom, small farmers practicing slash-and-burn at the forest margins do appreciate the need to preserve its biodiversity. But, as shown by another of our studies, clearing and pasture establishment increase land values, giving these same farmers a powerful financial incentive to clear more forest.

The problem is a lack of production alternatives and policy incentives that enable farmers to put their appreciation of biodiversity into practice. In a wide-ranging search for options, CIAT is working closely with various local and international organizations that belong to the Consortium for the Sustainable Development of Ucayali (CODESU). For example, we are engaged in a study with the International Centre for Research in Agroforestry (ICRAF)—coordinator of the global Alternatives to Slash and Burn project—that documents indigenous knowledge about hundreds of useful forest species. In addition to preserving part of the Shipibo people's cultural heritage, this research will generate information that should help integrate valuable species into improved cropping systems.

Scientists from CIAT and the Veterinary Institute for Research in the Tropics and Highlands (IVITA) are already seeking to incorporate agroforestry species into improved grass-legume pastures. Through the Tropileche project, these organizations are demonstrating the ability of such systems to intensify the production of livestock for meat and milk, while preserving important tree species. The project receives funds from IDB and through the CGIAR's Systemwide Livestock Program, which is coordinated by the International Livestock Research Institute (ILRI).

Marcelo Cabrera is one of the most active participants in Tropileche at Pucallpa. Although he suffered setbacks during the Shining Path guerrilla's reign of terror, his livestock operation is thriving now, and the new grass-legume combinations are increasing his production of meat and milk.

Local organizations are pursuing other paths of development as well, including the production of permanent crops, such as oil palm and a native fruit referred to locally as *camu-camu*. IDRC's Food Links Initiative is exploring further opportunities for small farmers to break into national and export markets. In support of this effort, scientists from CIAT and CODESU are gathering inventories of crops that farmers can grow, particularly species that are native to the Amazon and show strong market potential. CIAT's contribution is financed in part by the UK's Department for International Development (DFID).

The adoption of new livestock production and agroforestry systems and the promotion of permanent crops are vital steps for enabling farm families around Pucallpa to fulfill the hopes that brought them to the forest margins. Because these systems are relatively stable, durable, and intensive, they also have potential for reducing pressure on the forest. But to accomplish this purpose, rather than create yet another incentive to clear more forest, new production systems must form part of an integrated research program that explicitly addresses the conservation imperatives of the Ucayali region. A new initiative that will help us do this involves the development of an integrated conceptual framework for research on tropical agroecosystems. The project is being funded by the Canadian International Development Agency (CIDA) and carried out by the University of Guelph and CIAT.

A key concern of our land management research around Pucallpa is government policy, since it directly affects the pace of

deforestation and the viability of alternatives to slash and burn. To provide information that helps policy makers examine the issues and options, Center scientists are using participatory methods to determine the forces that account for current patterns of land use, and they are measuring the impact of land use on biodiversity and carbon emissions. With that information government officials, like the farmers around Pucallpa, will have a menu of options for putting their perceptions of the value of natural resources into practice.

Patterns of Partnership

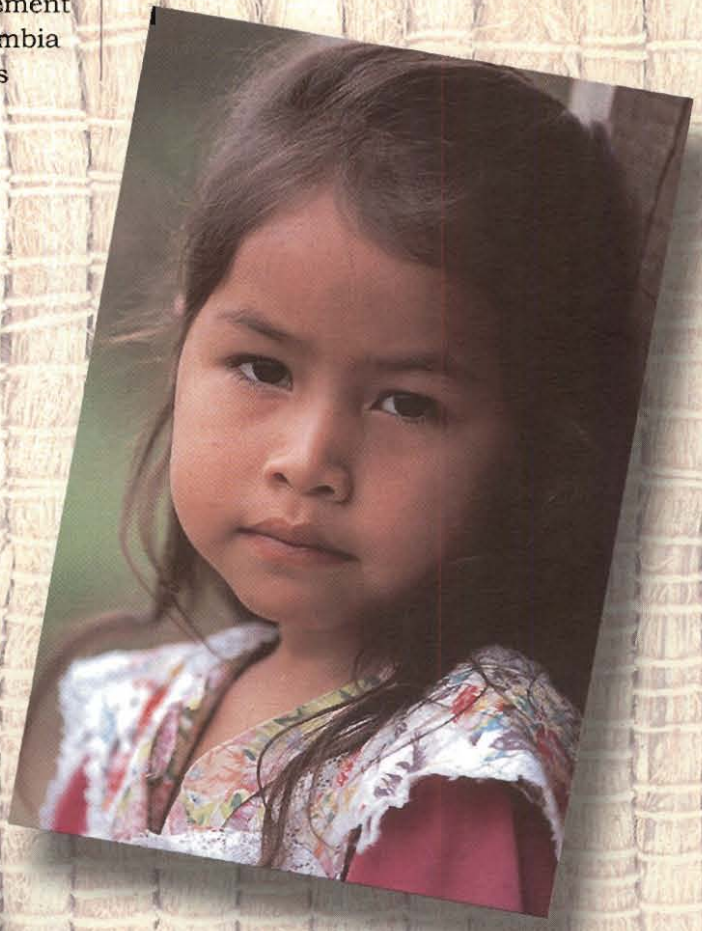
At all the locations you have just visited with us, CIAT acts in concert with numerous other organizations. For no single institution can supply all the resources and expertise that are needed to confront the complex problems faced by farmers in less favorable environments of the tropics.

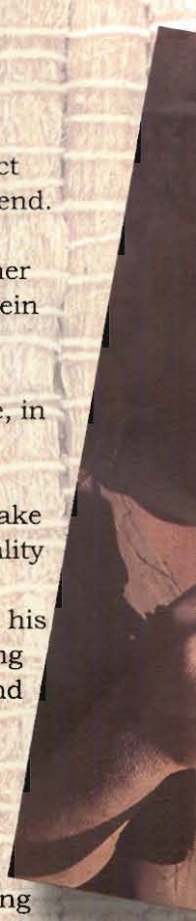
Instead, we and others weave patterns of partnership that include international centers, national research and development institutes, universities, nongovernment organizations, private companies, and community groups. With generous support from donor countries and institutions in the developing and industrialized worlds, we pursue an integrated approach to agricultural research and development. As a result of this work, the people you have just come to know are improving their lives and mending the worn fabric of their land.

With help from a watershed management consortium, the Cabrera family in Colombia has entered into a fair deal that enables them to make a decent living and protect the water on which their neighbors depend.

Eunice Changirwa and hundreds of her neighbors have regained a source of protein and income, because a Kenyan scientist brought solutions from afar through a regional network of bean researchers. He, in turn, formed an alliance with a nongovernment organization whose local connections and focus on soils helped make integrated management of root rots a reality in farmers' fields. Through a similar combination of talents, Bui Van Tho and his neighbors in northern Vietnam are finding ways to safeguard the soils of their upland fields.

Around Pucallpa, Peru, and Yorito, Honduras, consortia of local and international institutions have better organized themselves and are assembling information, methods, and technologies that

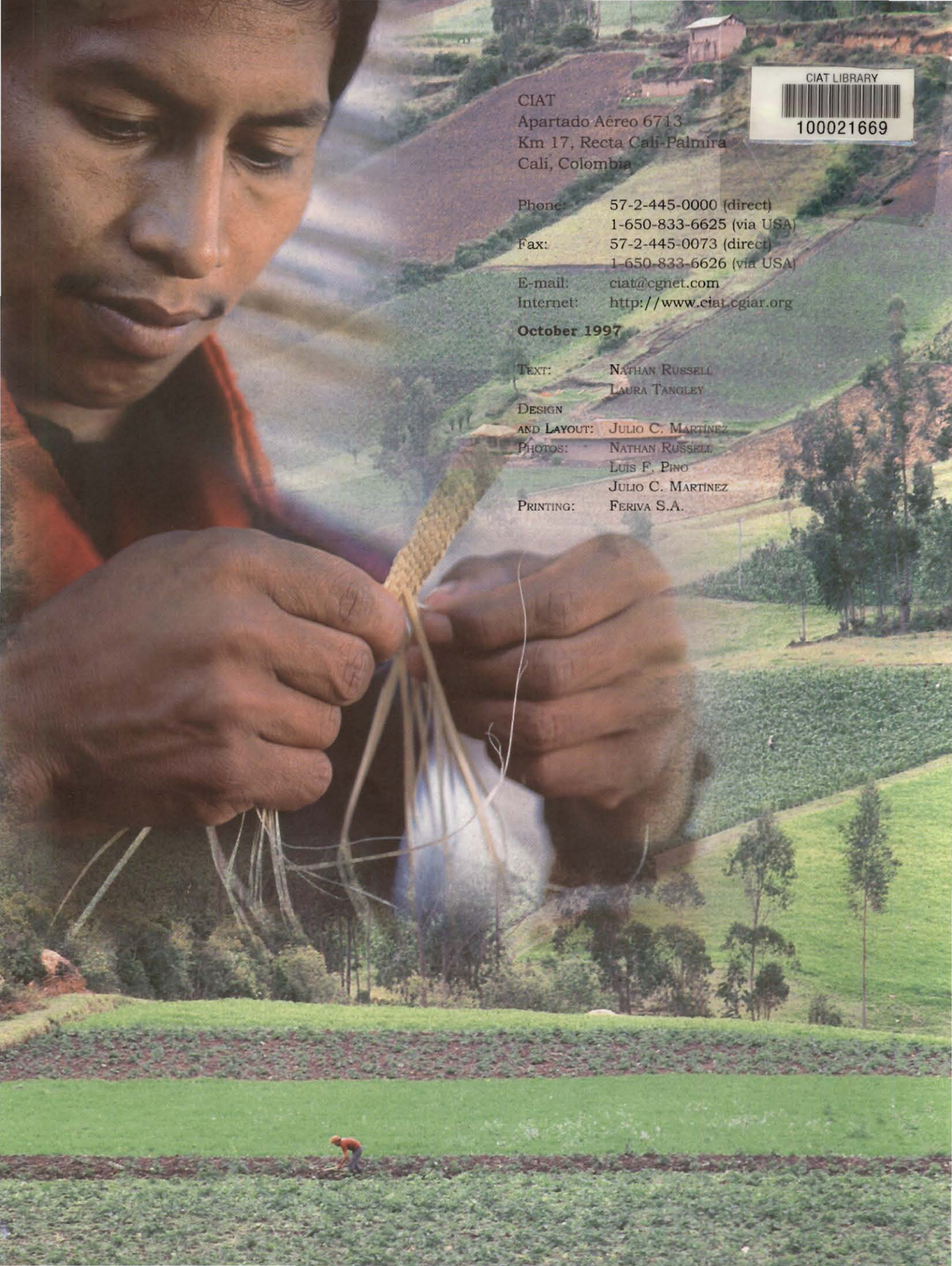




will enable rural communities to find their way out of the vicious circle of poverty and environmental degradation.

The kinds of solutions that are proving effective in those places can work just as well for people in similar predicaments at other locations. If you want to benefit those people, then maybe you should get to know CIAT. And if you like us, no doubt you will like our partners, too.

Let us introduce you.



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