



Photo: N. Palmer/CIAT

## CIAT in Africa: Science for Impact

The International Center for Tropical Agriculture (CIAT), in collaboration with our national research partners, has been working in Africa for the last 30 years. Our cutting-edge science helps policy makers, private sector, scientists, civil society, and farmers respond to the most pressing challenges of our time.

Our research draws on international expertise in various disciplines. Using the world's largest collections of beans and livestock forages, we work to tackle poverty, food insecurity, gender inequality, malnutrition, climate change, and land and environmental degradation, contributing towards seven of the United Nations' Sustainable Development Goals (SDGs).



## CIAT and the SDGs





Kenyan farmer feeding cattle (photo: G. Smith/CIAT).

## Improving livestock sustainability and profitability

### The challenge

As populations grow and diets shift, demand for milk and meat is on the rise. This represents an enormous opportunity for livestock farmers to improve incomes and diets. Yet the livestock sector is responsible for around 15% of all human-induced greenhouse gas emissions – i.e. about half of the agricultural GHG emissions are associated with livestock production. Around two thirds of the world's total agricultural land is used to feed these animals, much of which has been degraded.

### Our solution: towards reversing current trends

For smallholder farmers, livestock not only prevent hunger, they represent an opportunity to generate better incomes. With the right management, improved grasses can sequester substantial amounts of carbon, boost milk and meat production, and lower greenhouse gas emissions while improving sustainable crop–livestock production.

### What we can do

- ✓ We draw on the **largest collections of tropical forages in the world**, from which we can analyze the impact of improved seeds on milk production and quality.
- ✓ We guide investments by delivering impact studies outlining potential impact of improved forages and management practices in specific areas.

- ✓ Participatory on-farm research can reveal site-specific recommendations for farmers based on which forages grow best, enabling informed investments.



Samples of tropical forages conserved in vitro at CIAT's genebank in Colombia (photo: N. Palmer/CIAT).

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Testing soil health in Western Kenya (photo: G. Smith/CIAT).

## Restoring soil health

### The challenge

Soil degradation can destabilize food production, yet the fundamental role of soils in providing healthy and nutritious food is often overlooked.

### Our solution: Towards reversing current trends

We design and evaluate management practices that improve soil health, boost crop yields, and remove carbon dioxide from the atmosphere. We assess soil health status, map where soils are degraded, and show which areas can be prioritized for investments, including improvement of soil carbon stocks. We also measure how much carbon is stored in soils, and how much more carbon the soils could potentially sequester through improved management practices, contributing to climate change mitigation. We also evaluate different farming practices, their actual and potential tradeoffs in resource uses, as well as their farm-level climate-smart credentials.

### What we can do for you

- ✓ We develop site-specific fertilizer recommendations and decision support systems for smallholder farmers to help them adopt best soil management practices with the right amount of mineral and organic fertilizer.
- ✓ Carry out biophysical simulations of the long-term trend of business-as-usual and improved management practices on soil health, nutrient-use efficiency, and agronomic productivity; and quantify tradeoffs at farm level, balancing costs and benefits.

- ✓ Develop ready-to-finance packages of best-bet soil conservation practices, highlighting appropriate practices to enhance soil health and organic carbon stocks in certain regions.

### Long-term trials in Western Kenya

These trials provide the most comprehensive pictures of tropical soil health we have in Kenya. For more than 10 years, we have monitored crop yield improvements linked to soil health and fertility, showing the impact of soil conservation practices. Soil assessments, economic evaluations, and participatory methods help us make recommendations to farmers and decision makers for long-term sustainability.

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Tana River watershed (photo: G. Smith/CIAT).

## Ecosystem action – Restoring degraded lands

### The challenge

Ecosystem services encompass multiple benefits that people receive from landscapes – from nutritious food and clean water to outdoor recreation. Agriculture provides numerous ecosystem services central to food production while mitigating impacts of climate change. At the same time, agriculture exerts a greater negative impact on these services than any other land use, through for example, nutrient runoff, erosion, and deforestation. Yet, the immediate economic benefits of protecting ecosystems are not always obvious enough to provide incentives for change.

### Our solution: Uniting for impact to protect ecosystems

Our research links the enormous impact that landscape restoration can have on staple crops by looking at the bigger picture. We work with farmers, the private sector, and development partners to protect landscapes and ecosystems – including soils and water systems – to advise which interventions are the most environmentally effective or financially viable in a given area.

### What we can do for you

- ✓ Identify drivers of land-use change at regional, national, and sub-national scales, to recommend management practices to enhance carbon capture and soil moisture utilization.
- ✓ Pilot and monitor sustainable land management practices tailored to specific areas, such as terracing and grass

strips, showcasing benefits and guiding the upscaling of land restoration.

- ✓ Applying hydrological models, such as the Soil and Water Assessment Tool (SWAT), we advise decision makers and investors in land restoration how to avoid potentially harmful scenarios and to maximize the positive impact of investments.

### Nairobi Water Fund

Our research is guiding decision makers and the private sector within the framework of the Nairobi Water Fund to generate up to US\$21.5 million in long-term benefits to Kenyans, including farmers and business members of the Fund. The Nature Conservancy (TNC) and partners, including CIAT, the Kenyan Water Resources Management Authority (WRMA), and the Green Belt Movement, launched the public-private initiative to support farmers and businesses to protect the Tana River watershed. CIAT scientists provide soil erosion data from farmers' fields, while monitoring water quality changes and presenting improved management options to big business downstream, so they can support farmers financially to improve water quantity and quality, cutting costs for water users.

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Improved bush beans perform better than local varieties (photo: S. Malyon/CIAT).

## Tackling malnutrition and iron deficiency through improved markets for better beans

### The challenge

Beans can contribute importantly to end hunger and achieve food security and improved nutrition. They are affordable, and an important source of protein, fiber, carbohydrates, folic acid, iron, and zinc, tackling malnutrition, especially among pregnant women and growing children. Yet, one of the challenges is putting more beans – and more nutritious beans – on the table of rural and urban consumers.

### Our solution: Capacity building and improving beans for Kenya

Through the **Pan-Africa Bean Research Alliance (PABRA)**, CIAT and local partners in Kenya are developing beans adapted to different agro-ecological conditions, tolerant to pests and diseases and impacts of climate change, while responding to market demand for seed size, color and taste.

### What we can do for you

- ✓ We strengthen capacity in national research programs, supporting cutting-edge bean research to tackle iron deficiency, drought, flooding, and pests and diseases.
- ✓ We can fast-track more resilient and nutritionally improved beans in national feeding programs, working with private sector companies to improve value-addition and market-driven varieties for farmers to grow.

### Quick-cook beans hit the shelves

Dried grains, the most available and affordable bean product, take up to three hours to cook. That uses up time, energy, and money in sourcing electricity or paraffin – especially for women, who usually do the food preparation. In Kenya, researchers at CIAT, PABRA, and the Kenya Agriculture and Livestock Research Organization (KALRO) are working with the private company Lasting Solutions Ltd., to develop bean products that can be prepared in less than 15 minutes, with positive impacts on the environment, finances, and fuel consumption.



Pan-Africa Bean Research Alliance  
Transforming agriculture since 1996

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Bean diversity helps farmers tackle climate change (photo: G. Smith/CIAT).

## Climate change and extreme weather

### The challenge

Climate change will affect particular crops and regions in Africa differently, and farmers must respond urgently to combat climate change, extreme weather and its impacts. We work with partners, including governments, development partners and the private sector, to help farmers manage agricultural risks related to climate, through investments targeted at specific vulnerabilities, for example, through climate information services.

### Our solution: Climate proofing investments

CIAT is developing Climate-Smart Agriculture (CSA) and Climate Risk Profiles at the national and county levels throughout Africa. The Climate Profiles initiative assesses risks, interventions, policies, institutions, and finance related to climate, specifically identifying enabling environments and barriers to mainstream adoption of CSA, as well as ongoing and potential CSA activities. At national level, these profiles provide the context for agricultural investment planning and program development. At the subnational and local scale, these profiles provide clear direction for implementation of programs, policies, and projects, such as the on-the-ground project design and implementation of the World Bank US\$250 million Kenya CSA Project.

CIAT is working with national government partners in Rwanda to develop climate services for agriculture with the goal of providing over a million farmers across Rwanda

with decision-relevant, operational climate information and advisory services, and helping farmers be better trained to manage risks.

### What we can do for you

- ✓ CIAT leads the CGIAR Global Integrating Program on Climate Change, Agriculture and Food Security (CCAFS), a collaboration among all 15 CGIAR Research Centers and multiple partners, to address the increasing challenge of global warming and declining food security on agricultural practices, policies, and measures.
- ✓ We consult with a wide range of partners to help design CSA interventions that address vulnerability for farmers in specific areas.
- ✓ With limited investment, CIAT is helping public, NGO, and private partners identify where investment can be channeled for the best economic and environmental returns, taking county and community priorities into account.



RESEARCH PROGRAM ON  
**Climate Change,  
Agriculture and  
Food Security**



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Weather station collecting rainfall data in Western Kenya (photo: G. Smith/CIAT).

## Making big data intelligent data

### The challenge

Data is much more than simply information: in expert hands, it is intelligence. Analysts are finding ways to harness big data into an invaluable resource for planning and decision-making, helping refine policies and improve lives.

### Our solution

Through the **CGIAR Platform for Big Data in Agriculture**, led by CIAT and IFPRI, we have a unique opportunity to transform the way that farmers access and use information, empowering them with more options for making the best possible decisions on what to grow, when to plant, and how to manage their crops.



Platform for  
Big Data  
in Agriculture

Harnessing the power of big data for  
agricultural research

### What we can do for you

- ✓ By integrating multiple datasets, we can identify potential hubs for specific commodities. For example, where rare commercial-quality forage seed production can be located.
- ✓ Using big data analytics to reveal how climate variation impacts crop yields, we can identify optimal varieties and planting times for specific sites.

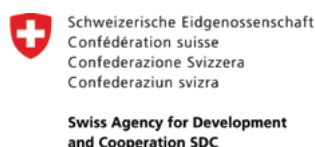


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