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cirad
AGRICULTURAL RESEARCH FOR DEVELOPMENT

40 1984-2024 years in an ever-changing world

cirad
AGRICULTURAL RESEARCH
FOR DEVELOPMENT
1984-2024

Shared research to grow the world of tomorrow

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40 years in an ever-changing world

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Élisabeth Claverie de Saint Martin
CIRAD President and CEO

What a long way we have come since our first business plan in 1991, centring on how to "Renew cooperation in a changing world"! More than ever before, our world is constantly shifting. From climate change to the collapse in biodiversity, rural societies face a range of challenges. One of the cruellest ironies is that the people most affected by today's many crises are vulnerable groups, particularly in rural areas, in the countries of the global South; the very ones whose research and innovation systems are least well equipped to come up with the solutions needed and to put results into practice. Within this context, and thanks to its long history, CIRAD is pursuing research in partnership that is capable of adapting, making use of collaborative approaches and paying particular attention to impact.

One constant: adaptation

The CIRAD of today is the result of the merger, in 1984, of nine tropical agricultural research institutes set up by the French State between 1920 and 1960 to improve knowledge and economic exploitation of tropical resources. Over the decades, tasked with contributing to rural development in hot regions and with a double remit for scientific research and international cooperation, the establishment has adapted to global change, to respond more effectively to the expectations of both society and its partners. The 1990s and 2000s, a time of growing awareness of the major environmental issues, saw CIRAD broaden the scope of its research. The introduction of internal research units and joint research units in January 2005, followed by the creation in 2006 of three departments, formed what is still the backbone of our organization today. From its original three main fields of research (agronomy, forestry, and livestock and veterinary science), CIRAD now has more than 40.

Impact and partnership are not just words

In 40 years, CIRAD has forged many partnerships, a unique treasure chest of relations, knowledge and expertise. We now work within a broad network of partners in more than 100 countries across five continents. The platforms in partnership for research and training created in 2007 have structured our operations and fostered exemplary South-South cooperation. From Madagascar to Brazil through Vietnam and Zimbabwe, the past two years have seen a host of anniversaries in which I, as CIRAD CEO, have been lucky enough to take part. In every case, the wealth of historic yet constantly updated collaborations in favour of agricultural innovation and progress has been celebrated. As long ago as 2010, CIRAD built a methodology to design and assess the impact of its projects. It now has a dedicated team that has trained 600 CIRAD scientists and 400 partners. The targeted, contextualized and participatory research we do with our partners has helped to make farming and food systems more sustainable and resilient, to prevent or eradicate diseases, to preserve biodiversity and adapt to climate change, to strengthen the links between science and policy-making and to train thousands of researchers. However, a number of challenges remain.

What does the future hold?

We have opted to tackle the main challenges of tomorrow – climate change and biodiversity loss – by means of agroecology, the One Health approach and sustainable food systems and by rolling out collaborative approaches. More than ever, we believe that equal, strong partnerships are the only possible solution. More than ever, we are also conscious of the need for research to be accountable. The relationships

between science and society must be made healthier and built on a single watchword: trust. Participatory research will really come into its own in working with players in the public, private, academic and associative sectors to foster the emergence of knowledge and explore collective solutions. The world is constantly changing, and not just for the worse, thank goodness. As in many other fields, women, be they scientists, producers or policymakers, were invisible in the world of research for a long time, but they are now taking control. This is a game changer, and offers fresh hope. And although many people are scared of artificial intelligence, it is also a vast window of opportunity for research, provided we use it appropriately. Our historic relations with our line ministries and donors, such as the European Union, are a sign of our strong partnerships and a guarantee for the future.

Impact, partnerships and future prospects are the three pillars on which we have built this brochure, an eclectic and inquisitive journey through time. From interviews to photographic reports, I invite you to discover this sensitive portrait of a research organization that is conscious both of its strengths and of the extent of current challenges. ■

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Chrysoula Zacharopoulou
Secretary of State
for Development and
International Partnerships,
French Ministry of Europe
and Foreign Affairs

The fact that the French Agricultural Research Centre for International Development (CIRAD) is celebrating its 40th anniversary is a source of pride for the Ministry of Europe and Foreign Affairs. CIRAD is living proof of both the scientific excellence that underlies our best cooperation activities and the diplomatic commitment that allows our greatest coalitions to shine.

CIRAD is central to the "France team" and always ready to act within the "Europe team". It plays a crucial role, making decisive contributions to addressing major issues for our country's overseas policy: fighting food insecurity, which affects many of our partners; protecting biodiversity, as the collapse of the living world gathers pace; mitigating the disastrous effects of climate disruption and adapting our economic models, particularly in the agricultural and agrifood sectors, to its consequences. In short, CIRAD is a key exponent of "French-style" ecology on the global stage.

Its contribution takes the form of a method fully in keeping with the policy of partnership that drives the French government: research *with* the South and *for* the South rather than on the South without the South. Along the lines of the Paris Pact for people and the planet, CIRAD applies two of the founding principles of our overseas action: on the one hand, systematically reconciling ecological imperatives and poverty alleviation; on the other, acting in response to our partners' priorities.

CIRAD is playing a major role in the emergence of sustainable value chains shaped in line with 21st-century issues. I am proud to observe that its research is collaborative, founded on robust networks of experts, and geared towards a clear ambition: agroecology.

On this anniversary, on behalf of the Ministry of Europe and Foreign Affairs, I should therefore like to send my sincere thanks to CIRAD's staff members and all of their partners throughout the world who have worked for 40 years to sustain this model of scientific cooperation for sustainable development! ■

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Sylvie Retailleau
Minister of Higher Education
and Research

In this special year, we are proud to be celebrating the 40th anniversary of the French Agricultural Research Centre for International Development. Four decades of commitment, innovation and cooperation in favour of sustainable development and agricultural research worldwide.

Since its founding, CIRAD has embodied scientific excellence and international cooperation. Its research has helped to tackle some of the major challenges of our time: food security, biodiversity preservation, adaptation to climate change, and the development of rural territories in particular. Its action is a tangible illustration of the importance of science and research for building a more sustainable, fairer future.

CIRAD has also played a crucial role in building capacity in the global South. Its collaborative approach has allowed it to forge strong partnerships with local players, universities, research centres and international organizations. Those collaborations have made it possible to share knowledge, train local experts and develop bespoke solutions for the specific contexts in each region.

Through its projects, CIRAD shows how powerful a lever for economic and social development agricultural research can be. By building more resilient farming systems, promoting agroecological practices and supporting local agricultural value chains, it contributes not just to food security, but to creating jobs and improving living conditions for rural people.

I would like to pay tribute to the commitment and devotion of all CIRAD's teams, and those of its partners, which have contributed to its successes. Their work is a source of both inspiration and pride for France. At a time when global challenges call for concerted responses, CIRAD is living proof that international cooperation is crucial for finding sustainable, inclusive solutions.

Now more than ever, we are continuing to build the future, and CIRAD is playing a determining role. To respond to environmental and health crises, agricultural research must continue to innovate and adapt. With its expertise and global network, CIRAD is ideally placed to tackle those challenges with both ambition and determination.

In celebrating this anniversary, we are reiterating our support of CIRAD and our commitment to promoting research and higher education in favour of sustainable development. Together, we can continue to move towards a future in which science and international cooperation will pave the way for a fairer, more prosperous world. ■

CIRAD

1984
CIRAD founded

1986
Agritrop, the CIRAD publications database, created

1991
First business plan "Renew cooperation in a changing world"

1992
Start of the CIRAD internal reform, switching from 11 departments (inherited from its constituent institutes) to seven: annual crops; tree crops; fruit and citrus; animal production and veterinary medicine; forests; agrifood and rural systems; and GERDAT (management, research, documentation and technical support)

1995
Last stage of transfers of scientific teams from Paris to Montpellier

1995
First "assigned national experts" sent to the European Union

2001
2001-2010 strategy plan

2005
First accreditation for CIRAD as observer of the Montreal Conference of the Parties to the United Nations Framework Convention on Climate Change (COP11)

CIRAD organized into internal research units (UPRs) and joint research units (UMRs)

Directors General 1984: Hervé Bichat • 1990: Henri Carsalade • 1993: Michel de Nucé de Lamothe • 1996: Bernard Bachelier • 2002: Benoit Lesaffre • 2006: Gérard Matheron

1984
IMF and World Bank introduce structural adjustment plans

1986
Agropolis International founded

1987
West and Central African Council for Agricultural Research and Development (CORAF/WECARD) founded, with ORSTOM (which became IRD in 1998) and INRA (which became INRAE in 2020)

1988
Intergovernmental Panel on Climate Change (IPCC) created

CIRAD is co-founder of Agrinatura, the European Alliance on Agricultural Knowledge for Development

1992
United Nations Conference on Environment and Development: Rio Earth Summit

1995
World Trade Organization (WTO) founded

1996
World Food Summit

2002
World Summit on Sustainable Development, Johannesburg (South Africa): Johannesburg Earth Summit

2005
Entry into force of the Kyoto Protocol

2008
Global food crisis

2009
High Level Panel of Experts (HLPE) on food security and nutrition created, in which CIRAD plays a major role

2010
Organization in Montpellier of the first Global Conference on Agricultural Research for Development (GCARD)

2006
Three departments created: Biological Systems (BIOS), Performance of Tropical Production and processing Systems (PERSYST) and Environments and Societies (ES)

Éditions Quae joint publishing house with IFREMER and INRAE created

2007
Platforms in partnership for research and training (dPs) launched

2008
CIRAD-INRA Joint Ethics Committee created, broadened to include IFREMER in 2016 and IRD in 2019

2012
2012-2022 strategic vision: making research a true development tool

2014
ImpresS impact assessment approach launched

2015
Agritrop becomes the CIRAD open publications archive

2021
CIRAD coordinates 13 EU DeSIRA projects and contributes to 16

2022
A CIRAD veterinarian specializing in One Health is appointed to the French Committee for Monitoring and Anticipation of Health Risks (COVARS), which replaced the Covid-19 Scientific Council

2022
60 years of CIRAD in Réunion

TSARA – Transforming Food and Agricultural Systems through Research in Partnership with Africa – initiative launched in partnership with INRAE and more than 15 African national and regional organizations

2023
30 years of CIRAD in Vietnam and Zimbabwe

2024
2023-2026 Scientific and Partnership Strategy Objectives drafted

President and Chief Executive Officer 2010 : Gérard Matheron • 2013 : Michel Eddi • 2021 : Élisabeth Claverie de Saint Martin

2011
G20 Conference on Agricultural Research for Development in Montpellier

LabEx Agro, a global agricultural research spearhead, launched

French agricultural innovation and transfer networks (RITAs) launched in its overseas regions

2012
Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), a group of international biodiversity experts, launched

2014
EU-Africa Summit; EU-Africa Partnership on Food and Nutrition Security and Sustainable Agriculture (FNSSA) founded

CGIAR System Management Office established in Montpellier

2015
United Nations organization adopts the Sustainable Development Goals (SDGs) as part of the 2030 Sustainable Development Agenda

COP21 or Paris Conference, resulting in the Paris Climate Agreement aimed at limiting global warming to 1.5-2°C above preindustrial levels, in line with IPCC recommendations

2017
European Commission Development-Smart Innovation through Research in Agriculture (DeSIRA) initiative launched

First One Plant Summit

Scientific community in Montpellier designated MUSE (Montpellier University of Excellence) I-SITE (Initiatives-Science-Innovation-Territories). The project, led by the University of Montpellier, associates 19 partners, including CIRAD

2019
Start of the Covid-19 pandemic in Wuhan (China)

2022
French State confirms Montpellier University of Excellence (MUSE I-SITE), in which CIRAD is a partner

Results and impacts

From human and social science to genomics,
CIRAD's research involves a wide range of disciplines.
However, from Latin America, through Africa and the Indian Ocean to Asia, not forgetting the French overseas regions,
all its operations have something in common: they generate useful science, geared towards results and impact.

We look at some examples…

Agroecological transitions, from food security to health security: one transition, many issues

We often talk about "the agroecological transition", but it would be more accurate to refer to "agroecological transitions" (AETs) in the plural. Depending on whether we are looking at bananas in the West Indies or local cereals in West Africa, there are many factors that may vary. However, the overall process, which aims to allow farmers to grow and produce differently while respecting the environment and people, is similar. From West Africa to the French West Indies, two researchers retrace the path followed by CIRAD as regards AETs.

Jean-Michel Risède

is a plant pathologist and nematode expert specializing in agroecological management of soil parasites within banana cropping systems.

Eric Scopel

is an agronomist and agroecologist specializing in multi-criteria assessments and co-design of agroecological systems for the family farming sector.

What prompted CIRAD to begin supporting agroecological transition?

Éric Scopel: In West Africa, CIRAD has always worked on agricultural production, in a fragile food security context given the region's fast-growing population and irregular production, which depends on rainfall levels and climate variations. Some zones face substantial degradation of both soils and their fertility, and productivity is low. Since the 1970s-1980s, conventional intensive value chains have emerged, such as cotton, with practices relying on external inputs (genetic improvement, fertilizers, mechanization). Such chains are now reaching their limitations, and cotton yields, for instance, have been falling steadily since the 1990s. As a result, it is vital that we intensify production: growers need to produce more, and better.

Jean-Michel Risède: As far as banana is concerned, the first agroecological transition was completed in the French West Indies. The situation at the time was marked by soils exhausted by parasites and intensive pesticide use that had caused a series of health and environmental crises since the 1970s-1980s. Research played a central role in helping producers, by offering alternatives to conventional farming practices. However, the transition to agroecological practices was not really made until there was a combination of favourable circumstances, including growing demand from society for production systems less dependent on pesticides, and a proactive approach on the part of policymakers (*Grenelle de l'Environnement*, 2007, Écophyto Plan, 2008).

What role has research played?

E.S.: For a long time, research worked to intensify production in a very conventional way, before adopting a vision aimed at making better use of the ecological processes that exist within agrosystems, and of local resources and knowledge. Practices were developed that caused less erosion and served to capture rainfall. To boost carbon resources within agro-ecosystems, attempts focused on striking a balance between synthetic fertilizers and organic compost. While there was some controversy over whether to use chemical fertilizers, work published in 2020 showed that they were essential, particularly in degraded zones. At the same time, CIRAD was also working to rebuild legume-based systems, using soybean or cowpea, for instance, which benefit soils (nitrogen), livestock production (fodder)

and food security, and to maintain wooded parks, which foster fertility transfer via animals and pest control. Furthermore, it built organizational innovations, particularly support for the creation of discussion arenas on a territorial level, to reach beyond the individual level. Lastly, CIRAD has worked to build producers' capacity to negotiate with economic players and policymakers.

J.-M. R.: Research was a central player in the ***Plan banane durable*** (sustainable banana plan), supporting public policy aimed at cutting pesticide use. This involved setting up two technological innovation platforms. However, CIRAD did not only set out to develop technology packages: it was also keen to make those packages a part of innovative farming systems, co-designed with local players. Ecological intensification served to leverage changes in pest and disease dynamics and more sustainable natural resource use. Preventive plot decontamination techniques for use between two cropping rounds and biological control through trapping were developed, and service crops were introduced to foster biotic regulation, limit erosion and provide ecosystem services. The results have proved conclusive: while modest on a global scale, the banana sector in the French West Indies has shown that it is possible to cut pesticide use substantially and change how bananas are produced.

What challenges do agroecological transitions pose for research?

E.S.: Ecological knowledge is a tricky field: while we are still discovering interesting organisms such as mycorrhizae, there are many complex processes that we have not yet mastered and a lot of room for progress in terms of fostering interactions between crops. Integrating processes on a territory scale is also a challenge, from a biophysical and organizational point of view: how can we encourage all the players in complex territorial dynamics to work together? Access to modern technologies for AET is another big issue. Training local players to make full use of new technologies and promoting organizational change to facilitate the transition to more sustainable farming systems is yet another. In short, we need to continue our research on ecological interactions and the integration of agroecological processes on a territory scale. A multidisciplinary, collaborative approach is the only way of tackling the challenges posed by AET and fostering sustainable rural development in West Africa.

J.-M. R.: Genetic diversification in banana plots remains a major issue, and one of the fundamentals of the agroecological transition. Despite the use of service plants as intercrops, banana growing systems are still generally monocrop, monospecies and monovariety. In time and across large areas, this genetic monotony results in increased parasitism. For instance, while today's hugely dominant variety, Cavendish, performs well, it is highly susceptible to several pests and diseases (black Sigatoka, nematodes, weevils). It is now under attack from a soil fungus that is spreading across the world: Fusarium TR4, which first appeared in Asia. In its time, Cavendish was developed to replace the Gros-Michel variety, which was killed off by another type of Fusarium (race 1) in the late 1960s. History is therefore repeating itself. Responding to climate change is another challenge, with a need to promote carbon-neutral banana production systems that also use less water, with varieties better suited to local constraints, while succeeding in integrating such systems into the circular economy in the territories concerned. ■

In vitro plantlets, a major innovation for sustainable banana growing systems (Martinique)
© J.-M. Risède, CIRAD

A farmer from Koussanar testing millet-sesame intercropping as part of the FAIR Sahel project, Senegal © R. Belmin, CIRAD

Water and society

Water is an issue of universal concern, which is why CIRAD is working with societies to understand and support territory-based change. With their feet alternately in the water or on dry land, its dedicated teams conduct grassroots research wherever societies come into contact with water, covering all their requirements and usage habits.

In India, where groundwater is now often the main source of water for both irrigation and domestic use, there are 25 million wells and boreholes, each supplying between six and 15 irrigators. In many semi-arid countries, new forms of governance are being tested to reduce over-exploitation of groundwater © F. Molle, IRD, 2013

The Tunisian government is rolling out the Programme of adaptation to climate change in vulnerable territories in Tunisia (PACTE) over six years (2018-2024), at a total cost of 56 million euros.

CIRAD and its partners supported the rollout of a concerted planning process involving citizens in six Tunisian regions, to shape territory-based governance of water and agricultural value chains © E. Hassenforder, CIRAD, 2021

New irrigation equipment being tested in field conditions, in this case in Morocco. Coupling such equipment with agroecology projects is the only sure way of guaranteeing water savings © M. Benouniche, 2011

On 10 April 2000, following a vast social movement and violent repression, the Bolivian government announced the departure from the city of Cochabamba of the US giant Bechtel, which had arrived the previous year to manage drinking water services. This now legendary "Water War" is commemorated each year, in this case in 2008 © P.-L. Mayaux, 2008

"Living with drought" in Nordeste, Brazil. In the absence of a water system in the community, drinking water is transported by tanker trucks and stored in drums. Raquel is glad to have this water in her house, even if it is only used for domestic purposes and for animals © H. Gasmi, 2022

From wood to biodiversity… a history of forest monitoring mechanisms

For over 50 years now, and despite constant market growth. natural tropical forests have provided most of the tropical timber used worldwide. It is therefore vital that we understand their capacity to reconstitute the wood stock that is harvested, while retaining their functions and main ecological characteristics. This can only be achieved through long-term monitoring of forest dynamics. CIRAD has been working on this ever since it was founded.

> “However, in recent decades, the concept of sustainable forest management has shifted to a more wide-ranging view of conservation.

Conserving forests, whether tropical or temperate, means exploiting their resources in a sustainable way. In using them, humans are taking care of them for both current and future generations. Forest dynamics monitoring mechanisms were originally intended to come up with silvicultural practices aimed at stimulating timber productivity, with little concern for the other functions of natural forests. However, in recent decades, the concept of sustainable forest management has shifted to a more wide-ranging view of conservation. The aim is no longer merely to produce wood, but to strike compromises between producing wood and conserving both biodiversity and carbon stocks. Since the early 2000s, in the light of climate change, the role of forests in storing carbon and preserving biodiversity has been recognized as crucial. There is therefore an urgent need to understand the effect of silviculture on the time it takes for selectively logged forests to reconstitute their initial carbon stocks and preserve plant and animal biodiversity. The existing monitoring mechanisms, initially planned to monitor the reconstitution of timber stocks, have proved essential, since they allow regular forest dynamics monitoring, tree by tree, and provide detailed, accurate knowledge of logging practices and their immediate impact.

An increasingly global history of sustainability

Since “modern” tropical forestry took off in the mid-20th century, tropical foresters have been testing silvicultural practices and setting up forest dynamics monitoring mechanisms, in partnership with research organizations in the countries concerned. The aim is to understand the effects of those practices on tropical forest stands. The Centre technique forestier tropical (CTFT), which became part of CIRAD in 1985, established monitoring mechanisms as long ago as the 1970s. Some are still active, such as those in the Téné forest, Ivory Coast, which date back to 1976, Mbaïki in the Central African Republic (1982), Paracou in French Guiana (1984), STREK in Indonesia (1989), and Malinau (1999) and Ecosilva (2004) in Brazil. In addition to the mechanisms initiated by CIRAD, others have been rolled out across the world, by EMBRAPA in Brazil or the Forest Research Institute Malaysia (FRIM). In 2012, CIRAD took the initiative of federating the mechanisms tasked with monitoring post-logging forest dynamics, by creating the Tropical managed Forests Observatory (TmFO). The TmFO is now a collective of around 50 scientists from 25 research institutions and universities, working at 30 experimental sites in the Amazon, central and West Africa and South-east Asia. Its specificity lies in the fact that its members monitor forests used for timber production. The central

Measuring the girth of trees in tropical forests is not always as easy as it looks. In this case, a tree with buttress roots in a plot overseen by the Ecosilva platform © P. Sist, CIRAD

Long-term observations

Jean-Guy Bertault was behind several tropical forest study facilities in Africa and southeast Asia, particularly in Ivory Coast and Indonesia. He retired in 2011, but remains an active member of the Association des forestiers tropicaux et d'Afrique du Nord. He looks back at his experience of setting up those experimental facilities, the oldest of which date back almost 50 years and are members of the TmFO.

DR

"After the wave of Independence for many countries in the global South, those countries launched ambitious forest inventory programmes aimed at rational logging to ensure the future of the ecosystems concerned. However, they encountered a series of obstacles. To overcome those difficulties, FAO and the Centre technique forestier tropical proposed a new methodology in 1974 to develop simple silvicultural intervention techniques and observe how species react to them, with a view to more long-term modelling of the comparative evolution of stands subjected to different regimes. That methodology, tailored to the specific context in each country, was rolled out in Ivory Coast, the pioneer, in 1976, and in New Caledonia in 1993. It revealed variable reactions in terms of the productivity of species and stands subjected to different types of interventions, although those reactions were positive overall, compared to non-intervention. Modelling operations, which have become increasingly accurate and have benefited from long-term observations, have served to estimate expected production levels, which are much higher in thinned, logged zones, albeit well below the levels that would allow second logging cycles, which are generally scheduled after between 35 and 50 years. This necessary revision of logging cycles is one of the main contributions such studies have made to guaranteeing sustainable tropical forest management. The studies have also allowed numerous observations that will contribute to our understanding of how tropical forest ecosystems function and thus ensure greater sustainability." ■

> Most of the management rules set out in forestry legislation in tropical countries do not permit sustainable timber production.

aim of the TmFO is to build a regional and global vision of the long-term impact of silvicultural and logging practices. This monitoring is all the more crucial in that managed forests, used to produce timber, play a major role in the economy of many tropical countries, since they create both income and jobs, along with revenue for those countries.

Logging less and better

The data gathered by these mechanisms over the past five decades have enabled a precise assessment of the capacity of the forests concerned to reconstitute timber volumes and biomass stocks and, to a lesser extent, the impact on biodiversity. They have also served to build dynamics simulation models that are particularly reliable since they use data gathered over a long period. The resulting models have shown that most of the management rules set out in forestry legislation in tropical countries do not permit sustainable timber production. There is an urgent need to revise those rules, notably to extend rotation cycles and significantly reduce logging intensity. These results have also shown that natural forests alone will not be able to satisfy the growing market demand for timber and that we urgently need to find other means of producing it, by promoting more diverse tropical silviculture operations. It is vital that managed forest dynamics monitoring mechanisms be maintained, if we are to understand the resilience of such forests. This will mean funding measurement campaigns and investing in instruments to measure environmental and climate conditions (for instance weather stations), which are still lacking in tropical regions. ■

The TmFO network's Ecosilva platform in Para state, Brazilian Amazon, set up by CIRAD and EMBRAPA in 2024
© P. Sist, CIRAD

tmfo.org

Characterization, processing and development… spotlight on biomass

At a time when resources are becoming increasingly scarce, CIRAD is working to promote the use of forest and agricultural waste to produce biosourced products and bioenergy in the countries of the global South. Its work in this field centres on three types of activities: characterizing resources and products, processing biomass, and developing sustainable value chains.

Characterization

The CIRAD xylotheque, a unique scientific heritage

The CIRAD xylotheque is a crucial research, appraisal and teaching tool and a unique scientific heritage whose oldest samples date back to 1937. With 34 000 samples, including more than 85% from tropical countries, the collection has been partially accessible since 2021 via NumBA, the CIRAD tropical agronomy digital library.

Wood samples sorted by family, genus, species and country of origin © S. Paradis, CIRAD

Labelled cubes cut along the customary three planes for wood observations, for comparison with samples of unknown woods © S. Paradis, CIRAD

Processing

Concrete solutions built with and for partners in the global South

CIRAD has been working doggedly for more than 20 years to understand and optimize roasting, pyrolysis, gasification and combustion processes, in the hope of resolving energy supply issues in the global South. Its dedicated facilities enable it to work on several scales to develop biomass use for energy generation, from the laboratory to semi-industrial pilot units.

Design and development of an energy production reactor using agrifood waste, in the Biomass Energy Facility (CIRAD Montpellier) © D. Josserond, CIRAD

Installation to produce energy from cashew nut shells, to dry mangoes in Burkina Faso
© L. Van de Steene, J. Blin, CIRAD

Development
The example of the rubber value chain

Did you know? Planes could not land without natural rubber. The biological origin of natural rubber gives it exceptional properties, including the fact that it does not overheat, unlike its synthetic rivals. However, its characteristics are more variable. CIRAD's main scientific objective is therefore to understand rubber variability better and identify new criteria for predicting those characteristics. The establishment offers bespoke analyses, services, technical appraisals and training, as well as collaborative research projects.

Natural rubber cup lumps obtained by tapping rubber trees and leaving the latex to coagulate naturally in the cup for three days. The lumps will be sent for initial processing, to produce TSR (technically specified rubber). Ivory Coast
© J. Sainte-Beuve, CIRAD

Following latex dilution and controlled coagulation by adding formic acid, the cup lumps are rolled. The resulting natural rubber sheets are hung over bamboo poles to dry in the open air. Kasetsart University Research Station, Thailand
© C. Bottier, CIRAD

Health: from research to policymaking

We can no longer ignore the impact of human activity on the environment and wellbeing. Health as a whole should not be seen as collateral damage, but as a compass to guide policy and economic decisions. From "integrated health" to the "One Health" concept, CIRAD has always supported these developments.

> Integrated health approaches have been used ever since the establishment's first research and development projects in the mid-1980s.

In 2020, the scientific community, which had been working for more than 15 years on emerging infectious diseases, was forced to face the truth: scientific issues were not reaching policy circles. The devastating Covid-19 pandemic at least prompted scientists to make themselves heard. The One Health concept now has the attention of policymakers and greater financial support. With some 40 years of integrated health projects under its belt, CIRAD is keen to pursue its role in converting research results into policy.

The One Health approach has always held sway at CIRAD

One Health, Eco Health and Planetary Health are all so-called "integrated health" concepts. Those approaches address the links on which the living world rests. Human health and animal, plant and ecosystem health are interlinked, and are constantly pushing each other towards a new, not necessarily desirable, equilibrium. Farming and food systems, which are priority topics for CIRAD, lie at the crossroads between them.

Integrated health approaches have been used ever since the establishment's first research and development projects in the mid-1980s. In sub-Saharan Africa, for instance, entomologists noticed that over-using pesticides to protect crops fostered the development of resistance in certain insects that transmit animal and human diseases. The same thing happens everywhere: unsuitable or unsustainable farming practices inevitably result in degraded soils and more fragile ecosystems, with long-term impacts on production systems and thus on food security.

CIRAD's history has been marked by similar field observations, thanks to our contacts with local partners and bridges between scientific disciplines. Considering the impact of human activity means adopting a global viewpoint and acknowledging that the world is a complex place. The key challenge is to determine what type of equilibrium will guarantee good long-term health for people in all four corners of the world.

Scientific networks close ranks to tackle avian influenza

CIRAD's One Health operations gained pace as of 2003, with the fight against avian influenza, which was sweeping across the world. The first cases in humans and the spread of the disease among wildlife triggered fears of a pandemic. At CIRAD, research began with the epidemiology of the disease and an assessment of surveillance systems and on-farm vaccination strategies in Africa and also in Southeast Asia, where avian influenza was endemic. The aim for scientists was to contain the economic consequences for farmers and to protect people by minimizing the number of cases among animals, thus limiting the risk of spillover between species.

As long ago as 2006, there was a clear need to combine a range of disciplines. Veterinarians brought their knowledge of vaccines, while epidemiologists were in a position to predict how the virus might circulate. Economists did a cost-benefit analysis of vaccination systems, while anthropologists were studying information networks and looking at solidarity mechanisms on a local level. 2006 also saw the birth of research programmes funded by France, on the ecology and epidemiology of avian influenza (GRIPAVI), and on avian influenza surveillance in Southeast Asia (REVASIA). Those programmes served as catalysts for new interdisciplinary projects at CIRAD and for new partnerships with the international scientific community, which also firmly believed in the One Health concept. They in turn gave rise to international research initiatives such as the ComAcross project focusing on improving the health and wellbeing of vulnerable populations in Southeast Asia.

The first networks centred on monitoring animal diseases, but CIRAD also played a part in eradicating rinderpest in 2011. It has repeatedly been confirmed as a

reference laboratory for peste des petits ruminants, firstly by the OIE in 2008, then by FAO in 2010, and lastly by the European Union in 2017. This requires CIRAD to provide assistance in terms of preventing, diagnosing and treating the disease. 2017 also saw it set up a multidisciplinary research unit: "Animals, Health, Territories, Risks, Ecosystems" (ASTRE), in which human and social science rubs shoulders with epidemiology, entomology and virology. From genetics to how society is organized, the unit addresses health from many different angles, and now has FAO recognition as a reference centre for coronaviruses.

Covid-19: research becomes more proactive in terms of policymaking

The pandemic that began in December 2019 did not come as a surprise to the international community involved in One Health networks. What that community did not expect was that politicians would turn a blind eye to the previous 15 years of scientific discoveries. The work done on avian influenza, which like Covid-19 spreads via airborne droplets, should have alerted governments and societies to the emergence of a new infectious disease. At CIRAD and elsewhere, scientists had to put their hands up and admit that they should have done a better job of passing on their results to non-specialist audiences. One Health is not a scientific method but a tool for observing the links between human, animal, plant and ecosystem health. It serves to see beyond the frontiers between disciplines and sectors, and is therefore not restricted to purely scientific networks: it is clearly a matter for civil society and politicians too.

In 2020, in the midst of the pandemic, French public research organizations called on the government, pointing out that as far as infectious diseases were concerned, there was an urgent need to switch from cure to prevention. French policymakers were won over, and supported the idea of a global initiative aimed at preventing disease emergence, involving networks from a local to a global level. Within a fortnight, CIRAD helped to organize several workshops attended by more than 200 people worldwide. The scientific networks that already existed at last joined forces with policymakers. In January 2021, at the One Planet Summit, the French President announced the founding of PREZODE, an international initiative aiming to prevent the emergence of zoonoses by building resilient, sustainable socio-ecosystems.

PREZODE is a major One Health programme of unprecedented scope. It was launched by CIRAD, INRAE and IRD, involves more than a thousand contributors from 130 countries, and associates governments, scientific establishments and NGOs. For the first time, the One Health approach has ringfenced funding. The World Bank, the Global Fund, the European Union, the Agence française de développement, and private foundations are all aware of the importance of working together to address two traditionally distinct topics: agriculture and health.

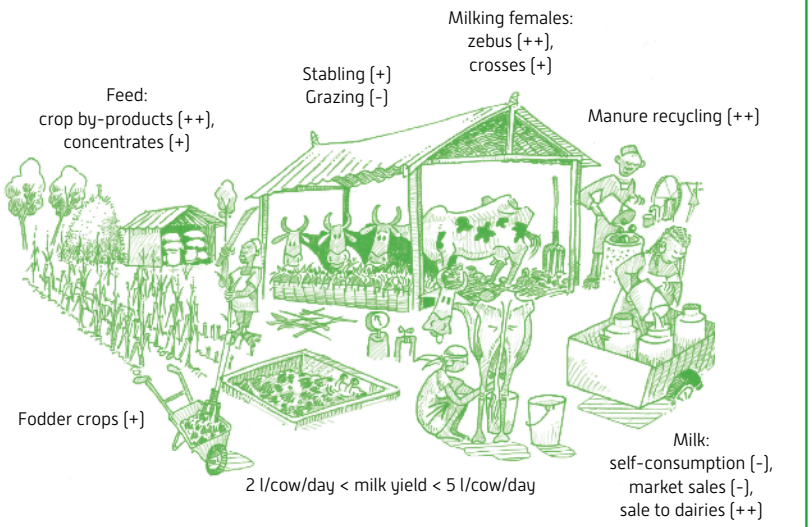
Within this new institutional landscape, CIRAD is shouldering its share of the responsibility for translating scientific results into political action. Pandemics are avoidable. We need to reduce the negative environmental impacts of our economic activities, guided by One Health, a compass to help navigate human, animal, plant and ecosystem health issues. ■

Non-invasive sampling of a colony of *Rhinolophus hipposoderos* (lesser horseshoe) bats in the Magweto Caverns, Zimbabwe

West Africa: a bright future for local milk

CIRAD has been working for all of its 40 years to support dairy value chain stakeholders in Africa. Its research has contributed to a better understanding of the dynamics involved in transforming milk production, processing operations and marketing circuits.

CIRAD's teams have built on their initial zootechnical expertise and developed multidisciplinary skills covering the entire dairy value chain, from production to consumption. From the geography of dairy basins to value chain economics, CIRAD's researchers and those of its partner organizations have in-depth knowledge of this complex, ever-changing world.



Milk production systems: a family-run mini-farm © E. Vall, CIRAD

Milk collection has a central role in food supplies and sustainable development in the agropastoral territories of West Africa. Less than 5% of milk is currently collected by local dairies in the region, leaving huge room for developing collection operations.

Milk collection by tricycle, Richard-Toll, Senegal
© E. Vall, CIRAD

Milk collection by bicycle, Bobo Dioulasso, Burkina Faso
© E. Vall, CIRAD

2005-2010. CIRAD heads the Réseau de recherches et d'échanges sur les politiques laitières (Dairy policy research and discussion network - REPOL)

2004-2014: Co-supervision of seven PhD theses by African researchers, on dairy value chains in West Africa and the Sahel

2013. Coordination of the West African Economic and Monetary Union (UEMOA) regional dairy development strategy

2017. Support for Danone in Africa for the development of a strategy for sustainable milk collection by the *Feed The Cow* project

2018. Coordination of the preparatory study for the drafting of the Economic Community of West African States (ECOWAS) regional dairy offensive

2020. CIRAD participates in establishing a specific tariff code for powdered milk re-enriched with palm oil, at European Union level

2022. Drafting of the Agence française de développement West Africa dairy offensive support project (PAOLAO) action programme

2024. Work on "responsible exports" with the Centre national interprofessionnel de l'économie laitière

Milk and dairy product consumption is growing apace. However, imported powdered milk dominates consumption in West Africa's largest cities. Such powdered products, which are often "fat-filled" blends, are a particular threat to local milk collection now that the zone has embarked upon an open market policy.

Bags of powdered milk
© C. Corniaux, CIRAD

The Laiterie du Berger when it began in 2006, Richard-Toll, Senegal
© C. Corniaux, CIRAD

Through its training operations, CIRAD has also helped build livestock research capacity among national and regional organizations, and supported many local experts providing investment advice.

A CIRAD PhD student measuring milk volumes collected in Senegal
© C. Corniaux, CIRAD

However, some industrialists have decided to gamble on local milk collection, and are contributing to the development of dairy production basins.

Food security: an eventful history

From the Green Revolution to thinking in terms of "food systems", CIRAD has been keeping step with the history of food worldwide since its very beginnings. We look back at 40 years of research in support of food security.

Shepherds and their sheep in the Middle Atlas (Morocco)
P. Dugué © CIRAD

Ever since CIRAD was founded, its research on food security has evolved in line with global political and economic history. It has been shaped by the changes in food security itself, and in the ideas that serve to define and measure it. Over those 40 years, the establishment has nevertheless remained constant in terms of its approach, paying particular attention to people affected by food insecurity and maintaining a holistic vision of food security. This has placed it among the leading European scientific players in the field of food system sustainability.

The Green Revolution of the 1980s: all eyes on production

During the 1980s, which were marked by memories of the severe famines of the 1970s in Asia and Africa, agricultural development efforts and international aid were focused on boosting food production by means of the "Green Revolution". The aim was to develop and disseminate improved varieties, build agricultural infrastructures and use fertilizers and pesticides, within a proactive agricultural and commercial policy framework. With an ever-growing population and the advent of very large cities, States opted to regulate markets and support both producers and consumers. International trade was seen as an opportunity to escape from poverty and food insecurity for export crop (coffee, rubber, cocoa and cotton) producers. As a result, since its inception, CIRAD has always worked hand-in-hand with family farmers in the tropics. It has helped them increase production of food crops (sweet potato, yam, plantain banana, cassava, rice, sorghum, millet, fonio, fruit and vegetables), notably by working on optimizing input use in line with soil characteristics and on varieties, pest control, mechanized cropping and postharvest techniques, etc. It has worked closely with livestock and veterinary services in partner countries to study, describe and analyse tropical livestock operations. With livestock farmers and governments, it has developed and rolled out numerous herd management, feed and health monitoring solutions. Its work has also involved studying, improving and disseminating endogenous and exogenous product processing technologies[1].

> In 1996, the United Nations adopted a new definition of food security, with accessibility as a core factor.

1990s-2000s: making way for markets

In the 1990s, the structural adjustment policies imposed by the World Bank and the International Monetary Fund forced the world's poorest countries to slash their budgets, at the expense of agricultural support funding. Moreover, the inclusion of agriculture in free trade talks pushed most countries to revise their agricultural support policies and switch to a more market-oriented system. This put producers and consumers at the mercy of highly variable market prices. CIRAD consequently decided to focus its work on supporting marketing operations, notably on food product markets, often serving booming urban areas. The aim was to organize such markets, both physically and financially, and to

1.To find out more: CIRAD's Agritrop open access database contains tens of thousands of documents that bear witness to its activities.


Ecuador

Senegal


Thailand

encourage producers to sell their "surplus" food production. It also extended to global markets. In 1996, the United Nations adopted a new definition of food security, with accessibility as a core factor. Much of CIRAD's work was therefore geared towards studying global markets (for instance coffee, cocoa and cotton) and their link with poverty alleviation. The aim now was to build producers' capacity to trade their products for other goods via markets, and thus ensure their food security. CIRAD worked on conceptual models linking political action and poverty alleviation. Its research aimed to boost incomes among producers, processors and traders (many of them women) and thus reduce food insecurity. CIRAD acquired substantial expertise in terms of both techniques (on farms and in the processing industry) and quality certification (geographical indications and sustainability indicators along the lines of organic farming or fair trade systems).

Since 2008, a time of crisis: thinking in terms of "food systems"

The international commodity price crisis of 2008 saw the start of the return to the world stage of a productivist vision. Strong global price rises cast doubt on the capacity of markets to drive agricultural and food production, and to reduce food insecurity worldwide. Agricultural production and specific policies to frame it were back in the limelight. The effects of climate change were increasingly making themselves felt, while the Covid-19 pandemic, the Russian invasion of Ukraine and the resulting price rises forced the world to acknowledge both the links between human activities and nature (increased climate risks, risks of zoonoses, etc) and the risks of basing the global food system solely on the principle of competitive advantage. After a long period of decline, armed conflict and climate disruption triggered a rise in hunger worldwide.

> Since its inception, CIRAD has always worked hand-in-hand with family farmers in the tropics.

To tackle these crises, which were largely linked to the 20th-century agricultural development model, CIRAD opted to broaden its research to cover all the different dimensions of farming and food systems, particularly environmental and human aspects. It drew on its knowledge and experience to build a "socio-ecosystem"-based vision. Its researchers are now working to analyse the links between agricultural biodiversity and food and assess the impacts of various production and processing systems on greenhouse gas emissions. Nutrition is no longer seen in terms of just calories, but of micronutrient content, and the links between production and consumption are being studied on a range of levels. Likewise, while families used to be seen as single entities, CIRAD's food security research now looks at households and analyses the relations between men and women. CIRAD is working to build its capacity for scientific analyses of how food security stakeholders interact across territories: food security is also (and above all) a question of power relations between players, and of governance. ■

Compulsive botany

"With the Pl@ntNet app, identify one plant from a picture, and be part of a citizen science project on plant biodiversity."

This is the clear, simple message on the Pl@ntNet website home page. However, the history is not as simple and the project is more complex than they seem…

One plant, one photo, one species: the Pl@ntNet app at work
© N. Kaden, CIRAD

Botany enthusiasts cannot fail to have heard of Pl@ntNet, the citizen science platform that uses artificial intelligence to help identify and inventory plant species. With its 60 million users in more than 200 countries, it is one of the world's leading biodiversity observatories. For CIRAD, one of the research organizations behind it, Pl@ntNet is all that and more. The platform straddles many of the organization's research priorities, such as food security (it is being used in the fight against desert locusts in West Africa) and agroecology (it can serve to observe plants in innovative and agroforestry-based systems).

A long, rich history

Pl@ntNet is the fruit of cooperation between several organizations, from CIRAD to INRIA through IRD and INRAE, under the aegis of Agropolis Fondation, taking an interdisciplinary, participatory approach. However, while it is often dated to 2009 (when the eponymous project began), this overlooks an important detail: the determination of a group of passionate tropical botanists to compile and share a set of visual data gathered in the tropics well before the 2000s. The target set for Pl@ntNet in 2009 was to use the data and knowledge acquired previously, while also generating new botanical observations, by means of an initiative that can now boast 15 years of experience and is continuing to evolve. While Pl@ntNet is a digital platform, it is first and foremost a field dataset, comprising a myriad of data from a wide range of territories, environments and plants (trees, creepers, orchids, etc): a dataset that would require a multitude of players – amateur and professional naturalists – to compile.

However, Pl@ntNet is more than just a dataset. The platform is based on a triptych of "tools" (methods, algorithms and software) – "data" (employed and co-produced) – and player "networks". While Pl@ntNet is useful to people out for a stroll who want to identify the flowers they see along the way, that is not its only purpose… the application can also be used to characterize plant biodiversity in many research fields, whether in temperate or tropical forests, the Andean highlands, the grasslands of Africa or cultivated plots. It will also be applicable to plant and environmental health in the near future, with evolutions due that will allow users to detect and identify plant diseases based on leaf symptoms.

Testing the acquisition of plant samples and visual data to characterize the diversity of a tropical rainforest, as part of the XPRIZE Rainforest international challenge. March 2022. Cananéia, São Paulo, Brazil
© P. Bonnet, CIRAD

A history of partnerships

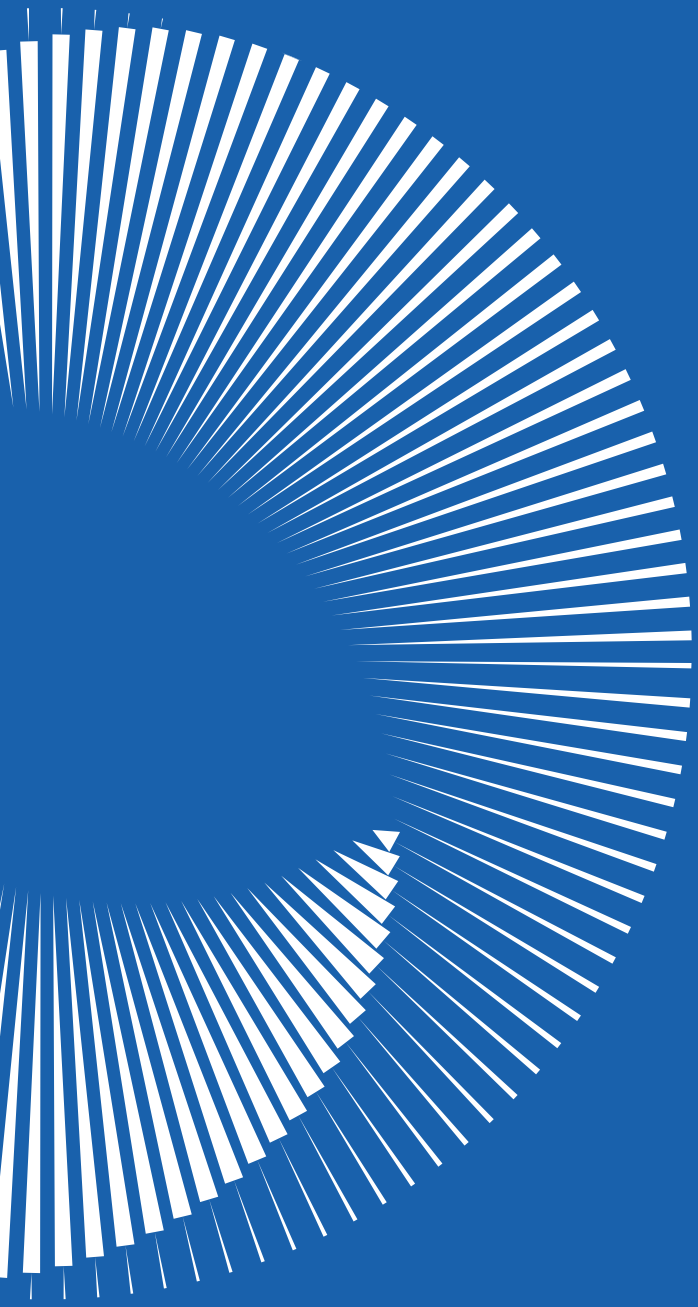
From the start, Pl@ntNet has been the fruit of a partnership between four French research organizations: CIRAD, INRIA, INRAE and IRD. The challenge in IT terms of scaling up solutions to encompass concrete, local issues without overlooking macro-ecological aspects has required unprecedented forms of collaboration, of which the life sciences, data science and citizen science are now reaping the benefits. The platform's history of partnerships has also involved countries in the global South, for instance via the national forest inventory in Costa Rica, the work done on plant biodiversity in Madagascar and that on plant health with a university in Malaysia. There have also been many partnerships with the private sector: Pl@ntNet's services have been contracted out to a range of players from small businesses to start-ups, major groups, natural parks and local authorities. From biodiversity to digital agriculture, on-board visual sensors, which are both cheap and easy to use, can now be used to take advantage of the automatic analysis services offered by Pl@ntNet. The quality, robustness and generic nature of the approaches tested using Pl@ntNet have frequently been recognized: it was awarded the *Prix de l'Académie des sciences INRIA-Dassaul*t and the topic of the article of the year in the journal *Computers and Electronics in Agriculture*. Since 2022, a series of changes have been made as a result of several major projects (notably the EU GUARDEN and MAMBO projects) that have benefited massively from Pl@ntNet. One of the aims now is to characterize more complex images of plant communities, or enable explorations of large-scale spatial biodiversity indicators. This work has given rise to new floras for every world region, and a new identification model that uses artificial intelligence. Since 2023, Pl@ntNet has also been included in the French "Agroecology and IT" Priority Research Programme and Equipment (PEPR) scheme, aimed at supporting new practices within the world of agriculture.

© P. Bonnet, CIRAD

A history of continuity

Since 2019, Pl@ntNet has been headed by a consortium of the four research organizations that founded it, plus Agropolis Fondation as an invited member. The consortium is an open one, and several French and overseas research and training organizations have already expressed a desire to join. Pl@ntNet has constant, growing support from its user network, has succeeded – by answering several major calls for projects – in broadening its network of partners worldwide, and has now adopted a diversified business model that the consortium is continuing to test. Like any software, Pl@ntNet will not last unless its maintenance costs are supported. However, although nothing can ever be taken for granted, experience would seem to suggest that a combination of scientific, citizen and institutional objectives can help to guarantee the future of such projects. Who would have thought, 15 years ago, that Pl@ntNet would come this far? And how much further will it take CIRAD and its partners? We should be savouring the success of this minor revolution, and looking forward together to the new opportunities it offers! ■

Leading a field workshop as part of the One Forest Vision programme. March 2024, Republic of the Congo © M. Simo-Droissart, IRD



Partnerships

While the word “partnership” is somewhat over-used, it holds true meaning for CIRAD, which conducts its research hand-in-hand with its partners in tropical and Mediterranean countries. That meaning has changed in time, and the establishment has broadened its scope, but kept the same values, the first of which is equity. So who are those partners? They include research organizations, universities, NGOs, private players, etc.

Focus on a selection of partnerships, from Brazil to Vietnam…

MALICA, building linkages to help feed people

The oldest platform in partnership for research and training (dP) of which CIRAD is a member is MALICA (Market and Agriculture Linkages for Cities in Asia). The partnership, which dates back over 25 years, is now called "MALICA, Sustainable Food Systems in Asia", and is primarily working in Southeast Asia. Interview with MALICA Chair Dao The Anh and member Nguyen Thi Mai Huong.

Dao The Anh,
Chair of MALICA, is Deputy Director of the Vietnam Academy of Agricultural Sciences (VAAS)

Nguyen Thi Mai Huong,
member of MALICA, is Deputy Director of the Rural Development Center (RUDEC) at the Institute for Policy and Strategy for Agriculture and Rural Development (IPSARD)

Interviewing a street seller, Hanoi
© M. Bruckert, CIRAD

What is the history behind the creation of dP MALICA, and how has it changed since?

Dao The Anh: The history of this dP in Vietnam dates back to the late 1990s, with collaborations on periurban agriculture between CIRAD and Vietnamese research organizations. That cooperation was consolidated by the creation in April 2002 of a "platform in partnership for research and training" (dP). MALICA's research topics have evolved since then, but began with the question of food systems in Vietnam. In the 1990s, the focus in the country was on food self-sufficiency. Since the 2000s, it has shifted to diversification, calling for new ways of assessing value chains, with a strong need to build capacity among junior scientists. I finished my studies in Montpellier in 2003, working alternately in France and Vietnam, and was able to help build the platform, guided by the need to set up a research team to work on food supplies to cities, centring on socio-economic issues and taking a multidisciplinary approach. In the early 2000s, there was very little research of this type in Vietnam, where work centred on agricultural exports. A highlight for MALICA was the publication, in 2007, of "The Participation of the Poor in Supermarket-driven Chains in Vietnam", on the linkages between small-scale producers and supermarkets, which had a substantial impact. Collective action appeared to be required to improve producers' access to markets and boost their incomes. It was also clear that product quality had to be improved. Other regional organiza-

tions (such as the National University of Laos) and international bodies (such as CIAT) working on the value chains concerned have joined us since 2010.

What are dP MALICA's aims and activities these days?

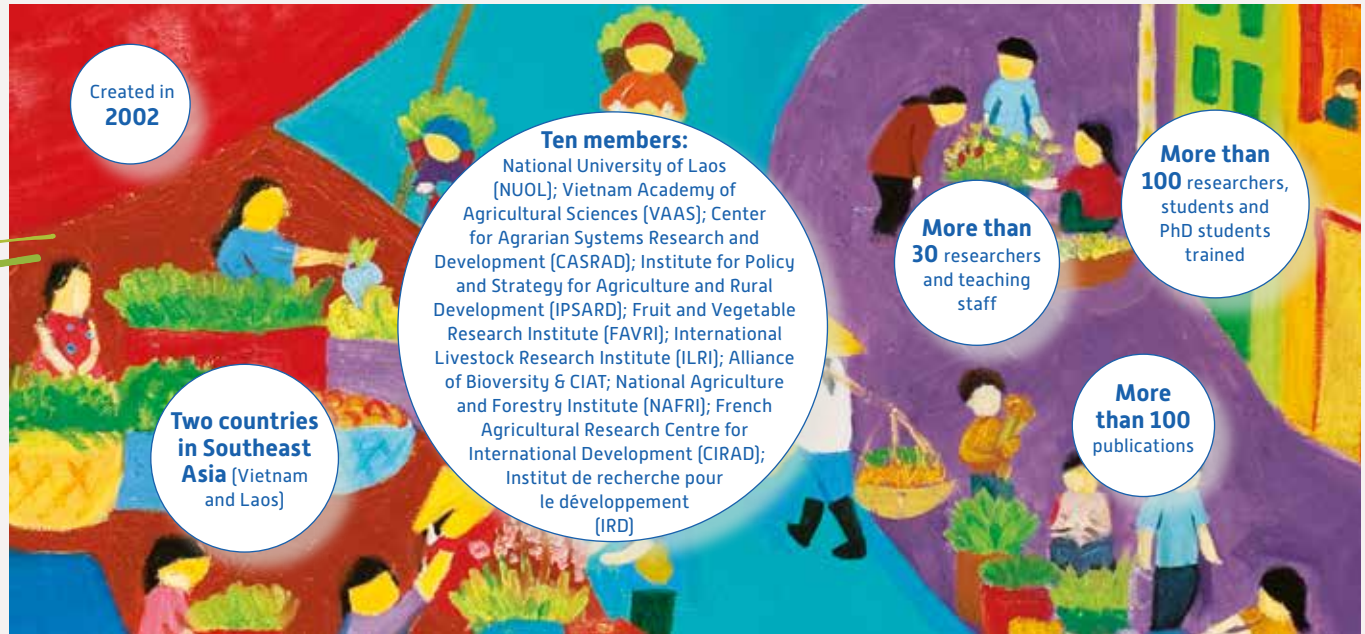
Nguyen Thi Mai Huong: MALICA's main aim nowadays is to make food systems in Southeast Asia more sustainable. Our collaborative platform is working to build food system research, analysis and decision-making capacity. The dP's activities centre on three main fields: scientific research, training and capacity building, and policy dialogue. The plan is to identify, analyse, assess and support innovation and changes in agricultural production, distribution and consumption models. The partners are working on joint research, development projects, training and scientific seminars, in addition to supervising Masters and PhD students and disseminating scientific outputs.

What are the main prospects for MALICA?

N.T.M.H.: Today's world is changing very rapidly. MALICA's strategic aim is to address emerging issues relating to food system sustainability in Southeast Asia. Firstly, we will be pursuing our broad-scale research programme. This encompasses food security and nutrition, the resilience of food value chains to climate change and epidemics, and greater well-being for players in food value chains. Secondly, we are building a vision of innovative research on a national and international level, tailored to local conditions, to support policymakers. Lastly, we are keen to build capacity among our partners in Laos and Vietnam and open the platform to other countries. In particular, this means boosting MALICA's role in policy dialogue on a national and regional level, with the Association of Southeast Asian Nations (ASEAN), to foster the agroecological transition to sustainable food systems.

D.T.A.: Since the 2010s, Vietnam has been food self-sufficient; it even exports many goods. However, this comes at an environmental cost, a so-called "hidden cost", and this is currently an important topic for MALICA. While our scientists in Vietnam have been working for a long time on agroecology on a local level, it is now time to scale up and begin lobbying in Laos and Vietnam for agroecology to be included in policy. The dP is increasingly open to non-research partnerships with policymakers and NGOs. MALICA is now being asked to contribute to policymaking within structures such as the UN Food Systems Summit. We have robust research results that could support policymaking: it is up to research to stay ahead of policy. ■

dP MALICA in a nutshell



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malica.org

CIRAD and EMBRAPA, working to build a desirable shared future

After a post-doc at CIRAD and IRD in 2021-2023, as a guest researcher in France and then working with the Açai'action project, Ana Euler knows more than anyone about the ins-and-outs of Franco-Brazilian agricultural research cooperation. EMBRAPA's Executive Director of Business looks back at a historic collaboration, following the signing by EMBRAPA President Silvia Massruhá and CIRAD CEO Élisabeth Claverie de Saint Martin of a memorandum of understanding strengthening the partnership between the two organizations.

Ana Euler,

a researcher specializing in agroforestry, is Executive Director of Business at EMBRAPA. She has a PhD from the Yokohama National University (YNU) Graduate School of Environment and Information Sciences (Japan) and a Masters in plant ecology.

What is the history of the partnership between EMBRAPA and CIRAD, and what have the highlights been so far?

Franco-Brazilian agricultural research cooperation is strategically important for EMBRAPA, which celebrated its 50th anniversary in 2023, and it dates back a long time. For more than 20 years now, we have had a great facility in the form of the Montpellier LabEx, as a result of which Agropolis International, CIRAD and INRAE have received Brazilian researchers. Our long shared history has produced many remarkable results, for instance on cropping techniques suited to the degraded soils of the Amazon, or on emerging topics such as the bioeconomy. The latter is just one of many crucial examples, and is particularly relevant at a time when the Brazilian Ministry of Agriculture has just announced a programme to restore 40 million hectares of degraded grazing land, and is leading the G20 Bioeconomy Initiative. CIRAD's research topics fit perfectly with our research, whether on conservation agriculture for polyculture-livestock systems, family farming or the role of the forestry sector, among many others. The TmFO network initiated by CIRAD plays a crucial role in plot monitoring across the Amazon, while the TerrAmaz project, which is working with local players to restore forest as part of a territorial dynamic, is a major, concrete achievement and proof of our dynamic cooperation. We also have important partnerships in other parts of Brazil, such as Nordeste, where we are working together on the question of territories and food, and EMBRAPA recently set up a Food and Territories research unit, inspired by French public policy on the issues surrounding geographical indications. In addition to projects, EMBRAPA and CIRAD can boast many joint scientific studies, for example resulting in more than 1000 joint publications between 2002 and 2022. France is EMBRAPA's second biggest partner in terms of scientific publications after the US, and 30% of EMBRAPA's publications with EU organizations have been with France, including over 50% with CIRAD.

Training provided by CIRAD and EMBRAPA for technicians from Banco da Amazônia, with a view to the rollout of the "green husbandry" loan © J. Ripardo

What does the future hold for the CIRAD-EMBRAPA partnership?

In addition to publications and projects, there are frequent exchanges of scientists and students between EMBRAPA and CIRAD or other French organizations. This is very important, and not just in terms of scientific exchanges. We work with local players: government institutions, community organizations, and universities. The fact that we are a member of Agropolis brings us into contact with the rest of the world, particularly with the global South. On a personal level, studying in France allowed me to forge links with many colleagues in Africa and Latin America, and also in Asia, even if it is further away. In future, Africa in particular could be a theatre for building many other links. Brazilians are the descendants of Africans, which is why President Lula sees cooperation with Africa as very important. We think this could be a great chance to pool our shared, complementary knowledge. In terms of fighting hunger, to which Brazil is deeply committed, Africa faces the same challenge as Brazil: we need to bring production chains together and market their products more effectively, among other things. We have learned a lot about the solutions we could share as regards technology transfer, and we have things we can bring to CIRAD in this respect. Like CIRAD, we are working to adapt food systems using new cultivars and production processes, in response to the uncertainty caused by extreme climate events. One Health is a priority for EMBRAPA as well as for CIRAD, and offers many opportunities for collaboration, notably on preventing new pandemic cycles affecting not just humans but animals too. And climate change and agro-ecological transition, which are central research topics for CIRAD, are equally vital for EMBRAPA.

What are your ambitions for the global South?

In the current world, with its many ongoing conflicts, science diplomacy has a role to play. Our institutions must provide policymakers with sound arguments. In this context, Brazil is pursuing three main objectives: (1) generating and analysing data for use in eradicating hunger and fighting inequality worldwide; (2) achieving its ecological transition by treating the bioeconomy as an economy of knowledge and of biodiversity, not just of natural resources. The aim is to produce more using less, and respect land and indigenous people, which is part of our ethical commitment; and (3) building a new type of global governance. This makes EMBRAPA a valuable tool for the Brazilian government, with its almost 3000 researchers worldwide in a position to exchange and share knowledge. Our reputation also allows us to receive researchers and other people from all over the world. We intend to help build capacity in the global South and expand technology transfers. Our shared experience with CIRAD in the Amazon could serve as a model to build a strategy for joint scientific cooperation in Africa. However, to be able to implement such an ambitious agenda, we need a new vision for cooperation, fixing shared priorities and designing appropriate funding mechanisms. This is a huge challenge for both CIRAD and EMBRAPA, with economies worldwide still recovering from pandemics and significantly impacted by war, while they would be better used on the ecological transition. We need to be creative, if we are to truly cooperate without falling out! More than ever, EMBRAPA is open to scientific and technical cooperation. We were recently in Colombia, with Presidents Lula and Petro, and accompanied our president on his visit to Addis Ababa, in Ethiopia. Moreover, we will shortly be opening an office in Africa dedicated to South-South cooperation, a clear demonstration that agricultural research and cooperation are both on the agenda. ■

Strategic partnerships for greater impact: CIRAD and producer organizations in West Africa

Since its founding, CIRAD has constantly adapted its objectives, practices and partnership methods to suit development players and their needs in terms of new knowledge and skill building. The changes in the partnerships between CIRAD and producer organizations (POs) are a prime example of this organizational agility, which has served to promote research as a crucial support for transitions to sustainable farming systems.

Advice for family cotton farmers belonging to the national cotton producers' union in Burkina Faso (UNPCB), 2013 © A. Toillier, CIRAD

During the 1980s, producer organizations (POs) were recognized as drivers of sustainable development in sub-Saharan Africa in their own right. They participated in a number of research-support-training projects, to help their members adapt production systems to environmental and economic constraints. CIRAD and its research partners worked alongside those POs to design, test and roll out new types of agricultural advice, seed management, product certification and credit services. By improving PO services, such research projects in partnership aimed to build farmers' decision-making capacity and make them more independent. The use of farmer know-how and learning through experimentation was driving a renewal of the support and advice services promoted by State players in previous decades. CIRAD's scientists were working on a range of fronts, from gaining a better understanding of the technical and organizational challenges farmers faced in order to co-design technical innovations to translating farmers' support requirements into services. This was how the organization and its research partners came to roll out advice services for family farmers based on the use of participatory methods, to allow farmers themselves to analyse their practices (production, processing, marketing) and their technical and economic results in order to innovate. On management advice, derived from management science, the support provided was broken down into several phases: analysis, planning, monitoring, adjustment and assessment. A range of analysis and decision support tools were tested in partnership with agricultural advisors in 30 or so POs in West Africa, involving approximately 100 000 producers. They were subsequently adapted to new contexts, including Burma (Southeast Asia) and Malawi (East Africa), in the 2010s.

Find out more:

DyTAES

FAIR Sahel project

AMINATA project

AcceSS project

Participatory assessment of the network of organizations working on innovations to foster the rollout of organic farming in Burkina Faso (CNABio network), led by an innovation facilitator. CDAIS project, Ouagadougou, Burkina Faso, 2017 © A. Toillier, CIRAD

Supporting organizational innovation

In view of the growing complexity of the challenges facing producer organizations, CIRAD became increasingly involved in building the capacity of POs to adapt their service offering and embark upon the environmental transition with other players in value chains and territories. The aim was to give POs ways of encouraging their members to switch to agroecological or organic production systems and adopt approaches to co-build those new production systems with their members. It was also to support advocacy activities to boost funding for POs, which were recognized as key players in adapting production systems locally for greater sustainability. To this end, CIRAD built new partnerships with communication agencies, financial institutions, NGOs, or agencies working to develop digital solutions. The establishment adapted its partnership and contractualization tools to become one of many players helping to roll out organizational innovations, such as the BioSPG participatory systems guarantee label. Support structures such as innovation platforms and facilitated networks were increasingly being used to trigger and organize such collaborative innovation dynamics. They called for coordination mechanisms and protocols for interaction between the different players, a shared vision, and resources, with the help of external facilitators specializing in this type of support. The efficacy of multi-player innovation approaches, involving the private sector, public sector, civil society organizations and national and international research, was particularly sensitive to the quality of the collaboration from third parties. There were many challenges: it was vital to steer individuals' practices towards collaborative ways of working and catalyse the relations between many organizations that were not always convinced of the merits of working together to innovate. CIRAD embarked upon new types of research, in the fields of social science, management science and more broadly action science and science of participation, not to design technical innovations but to build and oversee actual multi-player collaborative innovation structures such as innovation platforms.

> “This was how the organization and its research partners came to roll out advice services for family farmers based on the use of participatory methods, to allow farmers themselves to analyse their practices.

Becoming a transformative partner within multi-player coalitions

By virtue of a joint learning process and journey with POs in Latin America, Africa and Asia over the past 30 years, CIRAD shares with a lot of those organizations the belief that it is vital that we transform agrifood systems. That transformation will also undeniably call for a combination of technical, social and organizational innovations primarily driven by the agricultural world and civil society. In particular, the aim is to support the ecological, energy and digital transitions of agriculture, with so-called systemic innovations, in other words those that enable fundamental change within societies and agricultural and food systems. CIRAD and its research partners have evolved towards an increasingly strategic position as an integral part of many national, regional and international networks, with a view to deploying research-support-training on different levels within national innovation systems, from local to political. To quote just one example, on a national level, CIRAD has been working since 2019 alongside several farmers' organizations, as well as government and civil society players, within the “movement for an agroecological transition in Senegal” (DyTAES). The network associates POs, consumer and rural women's organizations, NGOs, research institutions, civil society networks, a local elected officials' network and businesses, with the aim of promoting the agroecological transition in Senegal through advocacy, awareness raising, sharing of experiences and support of territories involved in transition. ■

CIRAD, spearheading dynamic regional cooperation in the French overseas regions

For almost 40 years, CIRAD has been helping to set up research networks in the French overseas regions.

It has contributed to Réunion's visibility across the southwestern Indian Ocean sub-region, and to that of the French West Indies-French Guiana region across the Caribbean and the Amazon.

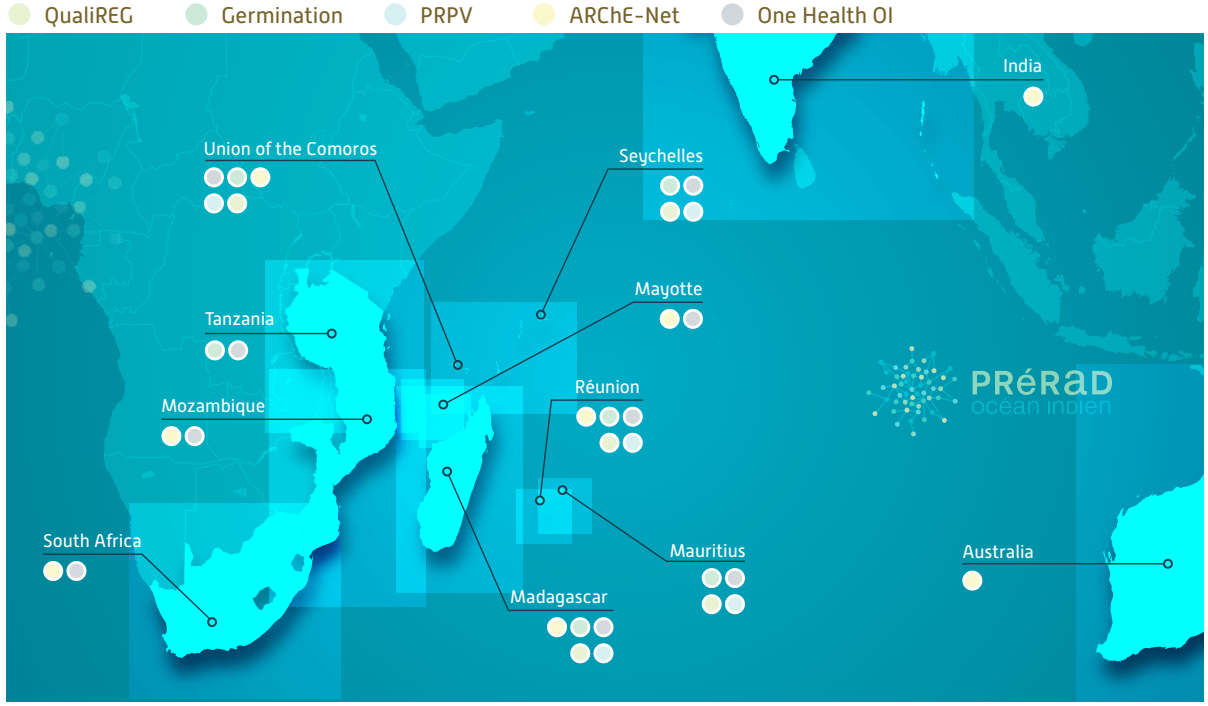
Réunion

Starting point for regional cooperation in the southwestern Indian Ocean

The late 1990s and early 2000s saw a desire on the part of CIRAD and its partners to work across the southwestern Indian Ocean sub-region from a base in Réunion. CIRAD is now involved in six regional thematic cooperation networks, two of which are platforms in partnership for research and training (dPs): One Health OI and BIOCONTRÔLE-OI.

From regional cooperation projects to structured networks in the Indian Ocean

Firstly, several regional scientific and technical cooperation projects were launched. In time, those projects became major networks for R&D cooperation with neighbouring countries belonging to the Indian Ocean Commission. The first, founded in 1988, took the form of the "regional fruit fly control programme", before extending its operations and becoming the "regional crop protection programme (PRPV)". 2007 saw the creation of the Animal Risk network, which joined the SEGA ONE HEALTH network in 2015, to tackle the issues surrounding zoonoses by means of a One Health approach. That network proved very useful and relevant in response to the Covid-19 crisis, thanks to its experience of regional health questions. This structuring into networks continued in the 2010s, around new issues such as agrobiodiversity conservation and preservation (Germination network), the development of healthy, sustainable food systems (Qualireg network), and lastly the adaptation of livestock systems to climate change (ARChE_Net network). In 2014, the Regional Platform for Agricultural Research for Development in the Indian Ocean Region (PRéRAD-OI) was founded. It has support from the French State, the Réunion Regional Council, the Réunion Depart-



State of regional scientific cooperation in the Indian Ocean © Stratégies & Territoires

mental Council and Indian Ocean Commission, and federates the above six player and skills networks. CIRAD was tasked with its coordination from the start. The platform now associates 26 public and private institutions in the zone from the research sector, technical institutes, higher education and professional education, as well as the private sector and civil society (NGOs and associations).

Results in a wide range of fields

As far as One Health is concerned, the case of Rift Valley fever is an excellent example of successful research. The zoonosis is transmitted by a wide range of vectors, but can now be detected very quickly, thanks to a rapid diagnostic test developed and validated by CIRAD with support from research laboratories in South Africa, Spain, Madagascar and Mayotte. The VATEL Biological Resource Centre (CRB) in Réunion conserves and preserves a broad diversity of traditional food crops, and is proving extremely useful in response to climate change and the arrival of new pests and diseases, while the Biocontrôle OI (Biocontrol and plant epidemiosurveillance in the Indian Ocean) platform in partnership for research and training was set up in 2022 to help develop innovative alternatives to chemical pest control, to support successful agroecological transition. Local cattle, goat and sheep races have been assessed according to different criteria, to identify those that could best resist or adapt to climate change. In view of their rusticity, those races could prove invaluable for the food sovereignty and security policies currently being rolled out. Lastly, an observatory of farming systems in the Indian Ocean has been set up. It is a true decision support tool, capable of describing and analysing the diversity of farms in a given territory with a view to targeting action and investments in favour of inclusive, resilient, sustainable production systems tailored to the realities of island territories. ■

Livestock farmer in Mayotte L. Balberini © CIRAD

West Indies

Active agricultural research cooperation in the Caribbean

CIRAD's regional cooperation activities are tailored to the main challenges facing farming systems in the Caribbean. The regional networks and projects it coordinates cover health issues, via a One Health approach, and make use of agroecology, as an environmental component of One Health. The aim is to prevent and tackle diseases that threaten crop and livestock value chains, and develop territorial surveillance tools and "eco-friendly", sustainable production methods that promote and preserve the Caribbean's natural and cultivated biodiversity. This scientific and technical cooperation on a Caribbean-wide scale is organized from the French overseas departments in the region, in association with networks in neighbouring countries (Brazil, Costa Rica, Mexico, etc) and teams in Montpellier. CIRAD's cooperation activities are supported by the European Interreg programme, the French State Regional Cooperation Fund, and the AFD. They are intended to consolidate the scientific knowledge available on various agriculture-related topics (biodiversity, health, environment, public policy), and multiply the potential for partnerships, capacity building, training, innovation and transfers in the zone, and for disseminating information. One example of this is the CaribVET platform in partnership for research and training, founded in 2006 and now a legally-approved association, which has 48 partners in 35 member countries including CariCOM member states. CaribVET is working closely with national surveillance networks and international organizations to limit the impact of animal diseases and help reduce vulnerability and boost the resilience of territories in the Caribbean. ■

Training: from one generation to the next, times change but the spirit stays the same

Q: How many people have spent time at CIRAD during their agricultural research training? A: Several thousand. Whatever path they have taken, their profile or their geographical origin, they have all had their own unique experience that has marked them, both personally and professionally speaking. A community without borders, in all four corners of the world, committed to building resilient farming systems in a more sustainable world. Focus on Madagascar.

Jacqueline Rakotoarisoa, who from 2012 to 2023 was Scientific Director of the Madagascar National Centre for Applied Research and Rural Development (FOFIFA), the main agricultural research organization in the country's National Agricultural Research System, trained at CIRAD. At FOFIFA's 50th anniversary celebrations in 2024, she received France's médaille du mérite agricole from CIRAD CEO Élisabeth Claverie de Saint Martin.

Salohy Rafanomezantsoa Since 2021, Salohy Rafanomezantsoa has been preparing her thesis at CIRAD (UMRs TETIS and MOISA), on women's access to land and land tenure security in Madagascar, and has benefited from the organization's recognized expertise in land tenure issues. After an initial encounter with CIRAD during her studies, her career led her to the country's land observatory and then to the Madagascan government's agricultural growth and secure land tenure project (CASEF), although she maintained close ties with CIRAD. Then she finally took the plunge and decided to become a researcher...

What was your experience of training with CIRAD?

Jacqueline Rakotoarisoa: I did two types of training with CIRAD: professional, then academic. As far as professional training goes, when I graduated from Antananarivo University in 1978 with an agronomy degree, I began working at FOFIFA. I then worked in partnership, supervised by CIRAD researchers in the field. I was soon appointed Head of FOFIFA Scientific Management's Monitoring and Assessment Service and trained in research management in Marseille, France. For my "DEA" (note: the equivalent of a Masters), I chose a research topic that was of interest to researchers at both FOFIFA and CIRAD, and had been since the early 1980's, with the advent of the first droughts coinciding with a critical stage in the rice reproduction phase: "Test of the agro-meteorological approach for cropping systems in midwestern Madagascar". In 2005, I began a PhD at CIRAD, on the sustainability of high-altitude upland rice growing, again taking account of climate constraints. To be more precise, the topic of my thesis was "Comparison of the efficacy of nitrogen nutrition in tilled upland and DMC rice systems", a research topic covered by the Sustainable Cropping and Rice Growing Systems research unit in partnership, created in 2001 to promote upland rice growing and new agroecological techniques in the highlands of Madagascar.

Salohy Rafanomezantsoa: I came across CIRAD when I was at university, during a six-month internship in 2011, before I qualified as an agronomist from the École supérieure de sciences agronomiques in Antananarivo, one of CIRAD's partners. It was a great experience! A few years later, I went to France to continue my studies. When I returned, I worked for an IFAD project, then at the land observatory, which was working closely with CIRAD. From 2016 to 2020, I was capitalization and research officer, strongly supported by a CIRAD researcher, before I had to leave the observatory for administrative reasons. In 2020, I was taken on by the

Madagascan government's agricultural growth and secure land tenure project (CASEF), supported by the World Bank, as Head of land operations. This allowed me to work with CIRAD again, on research aimed at securing rural areas. CIRAD was doing most of the studies at the time, and although I liked the operational aspects of my work, I felt a need to concentrate more on reflection and research. I decided to quit my job and sit the entrance exam for a PhD in land tenure. Since 2021, I have been a PhD student at AgroParisTech, jointly funded by AgroParisTech and CIRAD.

What is special about training with CIRAD?

J.R.: The training I received was valuable in that it allowed me to make academic progress while also working. I alternated between field trips to Madagascar and stays in the laboratory in Montpellier, travelling back and forth for three years. My training also allowed me to network, particularly since I had a management job at FOFIFA at the same time. Thanks to CIRAD, I was able to specialize and improve my research skills in my field, while encountering other research organizations such as IRD or AgroParisTech, and people from CGIAR organizations, for instance AfricaRice Director General Dr Harold Roy-Macauley, who also trained with CIRAD.

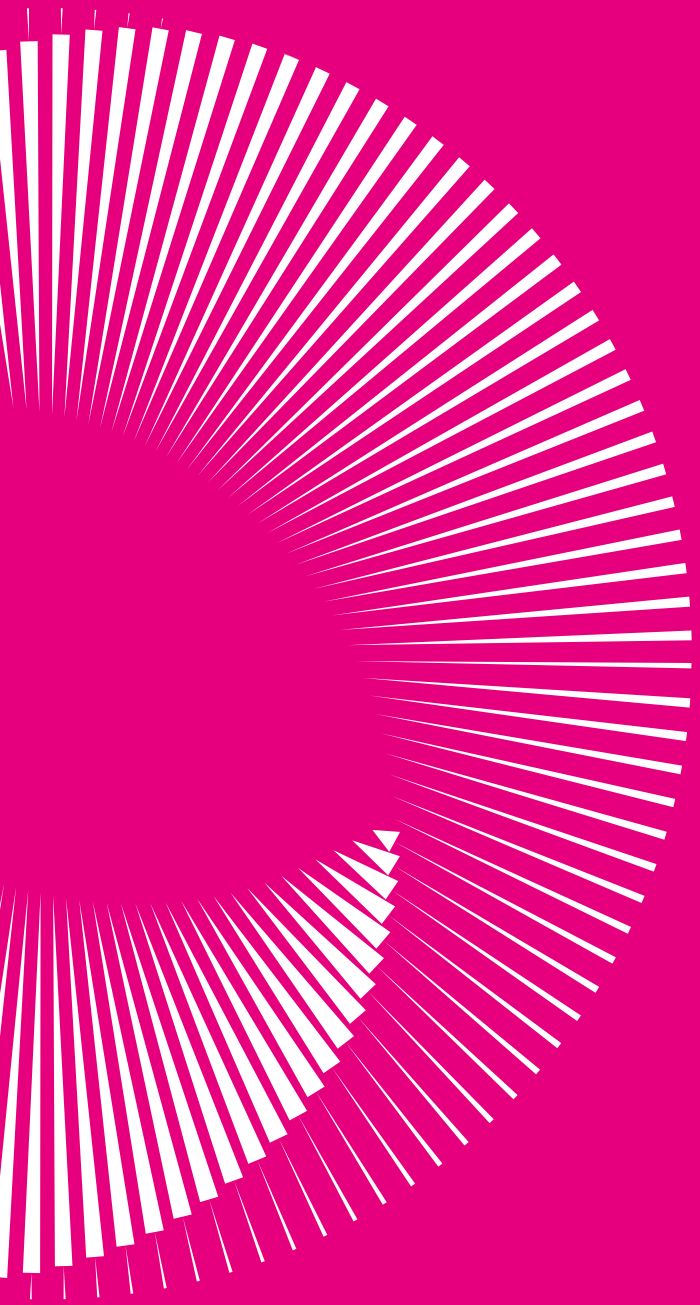
S.R.: The training I have had at CIRAD, notably as part of projects linked to my thesis and my career, has been very useful. It has not only boosted my career prospects; it has had a significant impact on a personal level. It has allowed me to strengthen my interpersonal relationships and to network. I have met a lot of people at CIRAD, and have been able to join the land tenure platform in Montpellier, which is not limited to CIRAD: it also includes researchers from IRD, GRET, etc. This interdisciplinary experience has proved invaluable. There are frequent, fruitful discussions within the network, allowing me to extend my horizons. Moreover, my thesis has enabled me to broaden the scope of my reflections to take in other fields such as law and economics. I am also planning to branch out into geography and sociology.

Assessing upland rice varieties with producers at the FOFIFA experimental station in Andranomanelatra, Madagascar © S. Castro Pacheco, CIRAD

What are your favourite memories? How has your training determined your career choices?

J.R.: My training at CIRAD has boosted my recognition on a professional level. I was lucky enough to be taught in conservation agriculture very early on, by Lucien Séguy, the "Father" of DMC, and I am still an advocate of agroecology in Madagascar. I also made a lot of friends at CIRAD, and when I fell seriously ill while writing up my thesis, CIRAD agreed to extend my insurance. This meant I could be operated on in Montpellier. I was a long way from my family at that time, but my friends at CIRAD were always by my side. One of them, to whom I am still very close, agreed to act as my next-of-kin to contact if my health deteriorated, and another was at my bedside. My family and I are very grateful to them, and I will always remember them and treasure their friendship.

S.R.: I have fond memories of the day I got the message saying that my thesis project had been accepted. I was working at CASEF, and the e-mail arrived in the middle of a meeting with the Ministry and the World Bank. I was overcome. Luckily, it was a videoconference because it was during the Covid-19 pandemic, but my reaction took everyone by surprise. I knew that having my thesis project accepted would mean putting my career on hold. Had I made the right choice? When I got the e-mail, I was sure I had. After my PhD, I am going to try to combine research and appraisal services, or teaching. There is still a lot left to do in terms of land tenure in Madagascar, but progress is being made. However, I am open to other opportunities. I am keen to work in France or elsewhere on the topic of development, in the hope of having a practical, useful impact. I would also be interested in comparing what I know about Madagascar with other countries: what have they been doing? My heart is here, but I am open to exploring other horizons. ■



What about the future?

Nobody knows what the future holds.

So scientists invented foresight, a discipline that sets out to envisage desirable futures.

CIRAD is working on this. To look to the future, we have also chosen to look at the inescapable subject of artificial intelligence – a source of both concern and optimism – and at a question that concerns CIRAD's ever-changing identity, a term at the heart of its name: development…

Artificial intelligence and what it can do for agriculture

The abundance of data available to scientists in an ultra-digital world has brought new challenges. This mass of open-access data is a mine of information that can be processed automatically using artificial intelligence (AI) tools. What are the uses, issues and limitations of using AI for agricultural research to benefit countries in the global South?

Databases, texts, images and videos relating to agriculture contain often crucial information that AI methods are capable of processing and analysing automatically. For instance, over the past decade, CIRAD and the #DigitAg Institute have used that variety of data to design tools and algorithms to predict production in agricultural value chains, address food security issues more effectively, set up automatic animal and plant epidemiological monitoring systems, tackle land use planning questions, etc. This has meant using AI methods (machine learning, deep learning, language models, semantic web, etc) to automatically "train" models based on datasets (databases, satellite images, text data, etc.). Such AI approaches have now been integrated into numerous operational tools and platforms (Pl@ntNet[1], PADI-web[2], PixFruit[3], KEOPS[4], Agritrop5[2], etc) produced or co-produced by CIRAD through a number of ambitious research projects.

Using AI to identify, model and explore

In concrete terms, CIRAD is currently developing AI approaches to (1) identify emerging disease outbreaks or explain and analyse food security issues using texts such as multilingual press articles, (2) model farming systems or produce land use maps based on satellite images, and (3) explore scientific publications using data from the CIRAD open archive, Agritrop. The processes used generally comprise several stages: data collection, data processing, and knowledge extraction. While AI methods essentially focus on data processing, they can also be used at other stages, for instance for reasoning and extracting new knowledge by means of so-called "symbolic" AI methods. Such methods complement the "statistical" methods that are currently predominant. CIRAD also uses other AI approaches based on multi-agent systems to model and simulate systems, focusing on simple and individual behaviours to reveal complex behaviours. Such approaches have given rise to apps that serve to control crop pests or simulate management scenarios for territorial foresight exercises, and to the CORMAS[6] platform for modelling relations between societies and their environment.

Data and methods: new challenges for artificial intelligence

When applying AI to agriculture, data are a valuable resource that can be used to train or adjust AI models. The data used and produced in this way must respect the criteria – usually associated with open science – of Findability, Accessibility, Interoperability and Usability (FAIR), which is a major challenge CIRAD needs to address in relation to AI and also, more broadly, in order to manage its digital heritage efficiently. There is another challenge: handling datasets that may be very small, highly specific or particularly heterogeneous in terms of structure and content. This can prove very complex for conventional AI approaches, which are generally very demanding as regards resources (data quantity and quality, computing power, etc). AI approaches can automatically generate very high quality results (indicators, maps, forecasts, etc) without the user really being able to explain or understand how they were obtained. This is known as the "black box" effect. The results that generative AI, for instance ChatGPT, can produce automatically are a perfect example. Ensuring the explainability of the AI approaches used should make it easier for innovative methods to be taken on board. Those methods can also be combined with model-based techniques. Conventional ways of modelling the living world, such as agroforestry systems or crop models, consist in proposing and parameterizing mathematical equations using expert knowledge. There are now promising extensions that will consist in combining data-driven approaches (for instance using remote sensing or web crawling) and methods driven by math-

1. plantnet.org/en/
2. padi-web-one-health.org
3. cirad.fr/en/worldwide/cirad-worldwide/projects/pixfruit-project
4. keops.cirad.fr/
5. agritrop.cirad.fr/
6. cormas.cirad.fr/indexeng.htm

ematical models. This could offer interesting prospects for combining AI methods with an explainability component and expert knowledge.

Guaranteeing responsible use of artificial intelligence

As we have seen, in addition to the methodological contributions AI approaches can make to mathematics and informatics, CIRAD still needs to tackle the challenge of analysing requirements and applications in the field of agriculture. The proposal and rollout of these new approaches, in partnership with countries in the global South, has prompted various debates about the advantages and limitations of using digital technology in the agricultural sector (platforms, decision support tools for producers, agricultural advisors, leaders of producer organizations, the public authorities, etc). Lastly, the legal and ethical aspects of AI should not be overlooked, since it is those aspects that will guarantee enlightened, responsible use of digital technology both in the agricultural sector and for the tools developed by CIRAD. ■

> The explainability of the AI approaches used should make it easier for innovative methods to be taken on board.

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What does “development” mean?

CIRAD has changed considerably since it was founded in 1984. The very term “development”, the last word in the establishment’s name, is now in question, as shown at the 28th France-Africa Summit in Montpellier in 2021, when young West Africans tackled French President Emmanuel Macron. Is there still a future for “development”? Catia Grisa and Kako Nubukpo give some clues…

Catia Grisa,

Brazilian sociologist, tutor and researcher at the Federal University of Rio Grande do Sul (Brazil). Co-coordinator of the Public policy and rural development in Latin America platform in partnership for research and training (dP PP-AL). Former Vice-President of the Brazilian Society of Economics, Sociology and Rural Administration (2019-2023).

Kako Nubukpo,

Togolese macroeconomist; CIRAD researcher; Commissioner for Agriculture, Water Resources and Environment, West African Economic and Monetary Union (WAEMU/UEMOA), since 2021; former Minister for Foresight and Public Policy Evaluation in Togo; former Dean of the Faculty of Economic Sciences and Management, University of Lomé.

Now that the word “development” is up for debate, do you think we should be talking in terms of “partnership and co-construction” rather than “aid and development”?

Catia Grisa: It is important to understand why the word “development” or “development aid” has come in for criticism. The concept was invented in the 1940s by the countries of the global North, based on the prevailing notions of ethnocentric, “economistic” modernization, and did not take account of inequalities. We undoubtedly need to break with such concepts, particularly as they might have helped boost agricultural production and intensify commercial activity over the decades, but at a cost: certain ways of life have come under threat. Farmers and traditional communities have become more vulnerable, as their relations with nature, their cosmogonies, their traditional know-how etc, have not been taken into account, whether in Latin America or in Africa. Development must be bespoke, tailored to local people and their world vision. However, I get the impression that CIRAD is already working towards this, by trying to conduct science with and for society and promoting partnerships with the countries and territories concerned.

Kako Nubukpo: I agree with Catia. As regards development theory in Africa, there have been three periods since the wave of Independence in the 1960s: from the 1960s-1980s, a time of voluntarism; then in the 1980s-2020s, a time of management, with World Bank and IMF structural adjustment programmes; and now, a time of pragmatism. In terms of agronomy, the second period resulted in marginalized Ministries of Agriculture, a reduction in State capacity to support agricultural prices and incomes, and all-powerful Finance Ministries. Nowadays, when the watchword is pragmatism, the aim is to strike a happy medium between liberal and neo-structuralist thinking: what should the State be doing? what could markets be doing?, and so on. As regards CIRAD’s activities, the first period meant grassroots cooperation, with large numbers of expatriate researchers working for the French value chain-oriented research institutes. Structural adjustment was a challenging period for cooperation organizations, for want of interlocutors. Nowa-

days, it is publishing that is the Holy Grail. The "field" in general, and sub-Saharan Africa in particular, is less important to academic scientific careers, and researchers have turned away from it. However, a new generation of Africanist researchers, including many Africans themselves, is now emerging and showing much more interest in the rural world. Young people in urban zones are also more radical these days, with often very high expectations, a greater degree of anti-French feeling and one main question: "What are these people doing for us?".

C.G.: There have also been three historic development phases in some Latin American countries since the 1940s-1950s: developmentalism, neo-liberalism and neo-developmentalism. Although the ideas held by countries in the global North have been ever-present in the academic and research fields and even in political debate (particularly during the neo-liberal period), Latin America has also come up with its own development theories (such as the structuralist theory put forward by the Economic Commission for Latin America and the Caribbean - ECLAC) and even critical development studies (such as the post-development debate). I think we need to include the criticisms resulting from alternative development approaches or critical development studies in our interpretations, practices and public policies. Some colleagues prefer to talk about "post-development", but for my part, since I am working on public policy and believe in the role of the State, I still use the development concept, although I now include critical aspects.

> "Development must be bespoke, tailored to local people and their world vision
> C. Grisa

What are the priorities for change in terms of the relations between research and training organizations in the global South and CIRAD?

K.N.: West Africa is now facing a specific risk, with an increase in insecurity. It has become nigh-on impossible to do development work in rural areas of regions seized by jihadist groups that see whites and urban Africans as potential hostages. The global situation will therefore probably force us to change how we work on both cooperation and development. As a result, we urgently need to support African researchers and make it easier for them to travel to northern countries. Young Africans are becoming increasingly politically active, unlike their counterparts in France. Let's not forget that the protagonists in West Africa are very young: the President of Burkina Faso is just 34! Sub-Saharan Africa is reaching the stage that Latin American countries reached a long time ago, but there are differences of scale compared to the history of Latin America, notably as regards the construction of the State. Moreover, African leaders regularly talk in neo-mercantilist terms, prompted by a desire to imitate the type of development seen in Asia, based on the competitiveness of its products on the export market. However, it is demand that will drive development in Africa, not supply: the continent's population is currently doubling every 25 years. There will be two billion Africans by 2050, a quarter of the global population, and half of them will be under 20 years old! Hence the importance of building Keynesian-type policies combined with ecological protectionism.

C.G.: While histories differ from one continent to another, with less violent conflicts in certain respects in Latin America, we have also seen political crises, conservative governments, and big challenges. What with climate change, food and nutrition insecurity, poverty and threats to biodiversity, we are all facing significant systemic crises. CIRAD's six priority research topics are addressing those crises and could help to resolve them. In Latin America, CIRAD and its partners are working more horizontally and collectively. For instance, this is how the Public policy and rural development in Latin America platform in partnership for research and training (dP PP-AL) operates. I am its co-coordinator, along with a researcher from CIRAD.

Looking ahead to 2030, how do you imagine more settled relations between France and the global South in terms of research?

K.N.: The loaded relationship resulting from French colonialism in Africa has masked its comparative advantages. We are now seeing a return to blocs on a global level, with northern countries turning away from those in the global South. As a CIRAD staff member, I have always regretted that geopolitical debate is not one of our core commitments. We also need to build real dialogue with peer organizations (INRAE and IRD), under the aegis of the French Ministry of Europe and Foreign Affairs. And we should be banking on young people, while building more horizontal relations, using platforms for exchanges between geographical zones to sustain our collectives. Southern Africa is a valuable partner in this respect, and the interactions between countries in the global South set a good example.

C.G.: I agree with the idea of strengthening South-South interactions and cooperation. In fact, we organized a seminar on family farming in Porto Alegre in May 2024, to welcome colleagues from Africa working with CIRAD. One of the results we were hoping for was greater cooperation between those colleagues and others from Latin America. While the links between Latin American researchers and CIRAD place everyone on an equal footing, there are still some inequalities. For instance, in those research and cooperation projects that encourage student exchanges and mobility between Brazil and France, we have problems finding French Masters and PhD students interested in studying in Brazil.

K.N.: Some things are moving in the right direction, such as the recruitment of Africans for management positions at CIRAD, which would have been unimaginable even a short time ago but which has been

welcomed locally. Recent recruitments, which have brought down the average age at CIRAD, give reason for hope, and much greater attention is being paid to gender issues. However, apart from in Senegal, African research centres still have a long way to go. The question of human rights should also be centre-stage, since what is happening in Africa today – systemic political instability, young people demanding their rights and democracy – is the result of France's decision to favour dogma and stability rather than promoting democracy and recognition of human rights. It would be foolish to believe that an agricultural growth corridor could work without the right social conditions. CIRAD is one of the few institutes with such in-depth knowledge of Africa; that knowledge is one of its strengths, and it should be a tool for advocacy on the part of CIRAD General Management.

C.G.: It is vital that we work with young people, and boost gender equality. Cooperation and dialogue between partners are also central to any plans for a viable future that will address the vast global challenges we currently face. ■

> We should be banking on young people, while building more horizontal relations, using platforms for exchanges between geographical zones to sustain our collectives.
> K. Nubukpo

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Looking before we leap, a brief history of foresight

Foresight, an eminently adaptable discipline, has always held a key position at CIRAD, from drafting a "business plan" to making it easier to explore alternative futures for the countries of the global South. Two of the establishment's researchers, Marie de Lattre Gasquet and Fatma Zahra Rostom, give us their thoughts on this forward-thinking approach that investigates possible futures.

Fatma Zahra Rostom,
transdisciplinary researcher with a PhD in Economic Science, joined CIRAD in 2022 as a "futurist" with UMR ART-DEV.

Marie de Lattre Gasquet,
CIRAD researcher since 1988, started with its agricultural foresight and policy unit (URPA) before becoming a task officer with the External Relations Office, Scientific Management, General Management, DGD-RS, and finally a researcher with UMR ART-DEV.

What is foresight?

Fatma Zahra Rostom : There are several types of foresight, including institutional foresight studies for management or research programming purposes. However, foresight and forward planning are also research topics in their own right, within action research approaches. Territorial foresight, with its clearly framed methodological approaches, is original to CIRAD and globally recognized. It is important to remember that foresight does not set out to predict, but to anticipate: how does the way in which food system players see the future influence the current situation in those systems? Foresight has an obvious, intuitive role as regards future issues that are already having impacts today, such as climate change or biodiversity loss. However, its role doesn't stop there: it also encompasses social inequality, relating to exploitation of workers or to gender or racial issues, etc. It is also important to take account of our relationship with our colonial past, insofar as it influences current and future perceptions. All these issues are central to agroecology. Foresight provides a discussion forum and serves to galvanize groups. It can also help us decolonize futures, by questioning the role of expertise and considering skills and knowledge that are not just academic or technical. It requires intellectual rigour and reflexivity if it is not to be used merely for communication, much less manipulation.

Marie de Lattre Gasquet: As soon as CIRAD was founded, its agricultural foresight and policy unit (URPA) began looking at how to ensure that structural adjustment policies did not penalize agricultural development. Two complementary approaches – foresight and modelling – were developed. In 1989, in response to a request from the French Ministry of Research to draft a strategy plan, CIRAD General Management opted to produce a "business plan". A participatory debate was organized between 1989 and 1991 to build a "CIRAD culture" based on the identities of the different technical institutes, forge a new, shared vision of "cooperation", and make the institution easier to read. This resulted in a plan to "Renew cooperation in a changing world". In 1993, a foresight and strategy group was set up to address the rapid changes in the organization's environment and pinpoint CIRAD's strengths and

A culture of the future, to reshape the present

Foresight is not just a matter of technique: above all, it is a mindset. CIRAD researcher Robin Bourgeois is convinced of this, and having observed that foresight was often reduced to using tools to build scenarios, he decided to make anticipation his speciality, in terms of both research and practice. Since 2019, this former foresight advisor to the Global Forum on Agricultural Research, who has worked in Indonesia, Costa Rica, South Africa and the Netherlands, has launched a training course at CIRAD on "the discipline of anticipation: concept, tools and methods".

In 30-odd years of research on how to use the future in many countries worldwide, the discipline of anticipation has clearly been shown to be much more than just a process aimed at building scenarios or imagining possible futures in order to make those futures desirable ones. The training on offer at CIRAD comprises two modules: one on the concept of using the future and different possible postures (anticipating in order to adapt, planning in order to influence, exploring in order to rethink the present); the other on co-drafting scenarios, notably in terms of territorial development, one of CIRAD's specialities.

After five sessions and the opening up of the course to partners, there is now a critical mass of researchers. A community of practice is up and running. CIRAD sees anticipation as a discipline in its own right, and the establishment's expertise in this fundamental element of research for development is recognized. ■

weaknesses, to come up with strategy options. The aim was also to develop an in-house foresight reflex, in response to a changing world. As long ago as the 1990s, foresight analyses were under way, particularly on the rubber and cocoa value chains, and even now, we can see how they facilitated interdisciplinary operations, structured research programming and helped to transform the departments of the time, by opening up CIRAD's research to other partners and networks. They played a significant role in the evolution of CIRAD's work in those fields, with the birth of a vision centring on value chains.

How has the role of foresight for research changed over the years, and why?

M.L.G.: Alongside the foresight exercises launched to support CIRAD's strategy and research programming, URPA was also conducting exercises focusing on viable development, including participating in an international scientific body set up by the Consultative Group on International Agricultural Research (CGIAR) and tasked with proposing a forward-looking vision with a timeline of 2025. Then in the late 1990s, the French Ministry of Research asked the organizations concerned to promote French agricultural research on a global scale, with a focus on "how to feed the world sustainably". Between 2006 and 2011, CIRAD and INRA (which became INRAE in 2020) worked together on Agrimonde, a set of scenarios intended to feed the world in 2050. Several objectives were set for the exercise, to find alternatives to the "green revolution", which had reached its limitations. This was the start of a debate on agroecology dubbed the "doubly green revolution". A few years later, CIRAD and INRA launched a second foresight study – Agrimonde-Terra – involving 80 international experts and centring on land use and food security. The resulting five scenarios pinpointed several major challenges, notably the need for determined, coordinated national and regional policies. This work boosted CIRAD's role in supporting public policymaking and its global expertise. Combined with the work being done on a territorial scale, it helped identify new research topics (such as agroecology) and priorities (decision support, lobbying). Whatever changes have been seen across the years, the common thread for CIRAD has been that foresight means anticipation to fuel action and internal and external strategy, by ensuring that as many people as possible have access to its work.

What is the current role of foresight and anticipation at CIRAD and beyond?

F.Z.R.: Foresight and anticipation are in the forefront at CIRAD at the moment. There is a community of practice, built by means of a series of anticipation training sessions. In our research, which now primarily takes the form of projects, the issues for foresight are the same as those for action research and participation. There is a vast amount of literature on

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participation, which has come in for substantial criticism: there is a degree of "professionalization of participation", with an almost ridiculous phenomenon: "professional participants". How can projects ensure that action research and foresight do not just organize workshops, involving Mr or Ms Foresight, as proof of their good practice? Action research is necessarily a long-term undertaking, or else it does not produce either momentum or hope. Like foresight, it is a sensitive, fragile process governed by the territories and players involved, and it is important not to ask too much of it.

M.L.G.: Fatma has clearly shown that foresight is an integral part of CIRAD's research. This makes us very different from other institutions, which have set up specific foresight units. Foresight at CIRAD has other specificities too: the way in which it combines qualitative anticipation methods and quantitative methods; participatory approaches; debate on

a territory, national and global level; and decision support. We are also working with other organizations via networks such as Prosper (http://www.reseau-prosper.org/point-of-view/indexc82f.html?set_language=en) and AllEnvi. On a global level, in addition to institutions in the global South, we also work with the WRI, FAO, CGIAR, etc.

F.Z.R.: There is increasing demand on an institutional level and from projects, since future issues and demands for transdisciplinarity call for foresight. However, we are running up against two obstacles: a lack of resources and the fact that individual grassroots knowledge and aspirations are not easy to incorporate into the organization's strategy. How can we fuel strategy? This is a crucial issue, which raises other questions about the nature of foresight and how to conduct foresight that results in action and is not just "for show". ■

CIRAD is the French agricultural research and international cooperation organization working for the sustainable development of tropical and Mediterranean regions.

t works with its partners to build knowledge and solutions for resilient farming systems in a more sustainable, inclusive world. It mobilizes science, innovation and training in order to achieve the Sustainable Development Goals. Its expertise supports the entire range of stakeholders, from producers to public policymakers, to foster biodiversity protection, agroecological transitions, food system sustainability, health (of plants, animals and ecosystems), sustainable development of rural territories, and their resilience to climate change. CIRAD works in some fifty countries on every continent, thanks to the expertise of its 1800 staff members, including 1240 scientists, backed by a global network of some 200 partners. It also supports French scientific diplomacy operations.

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