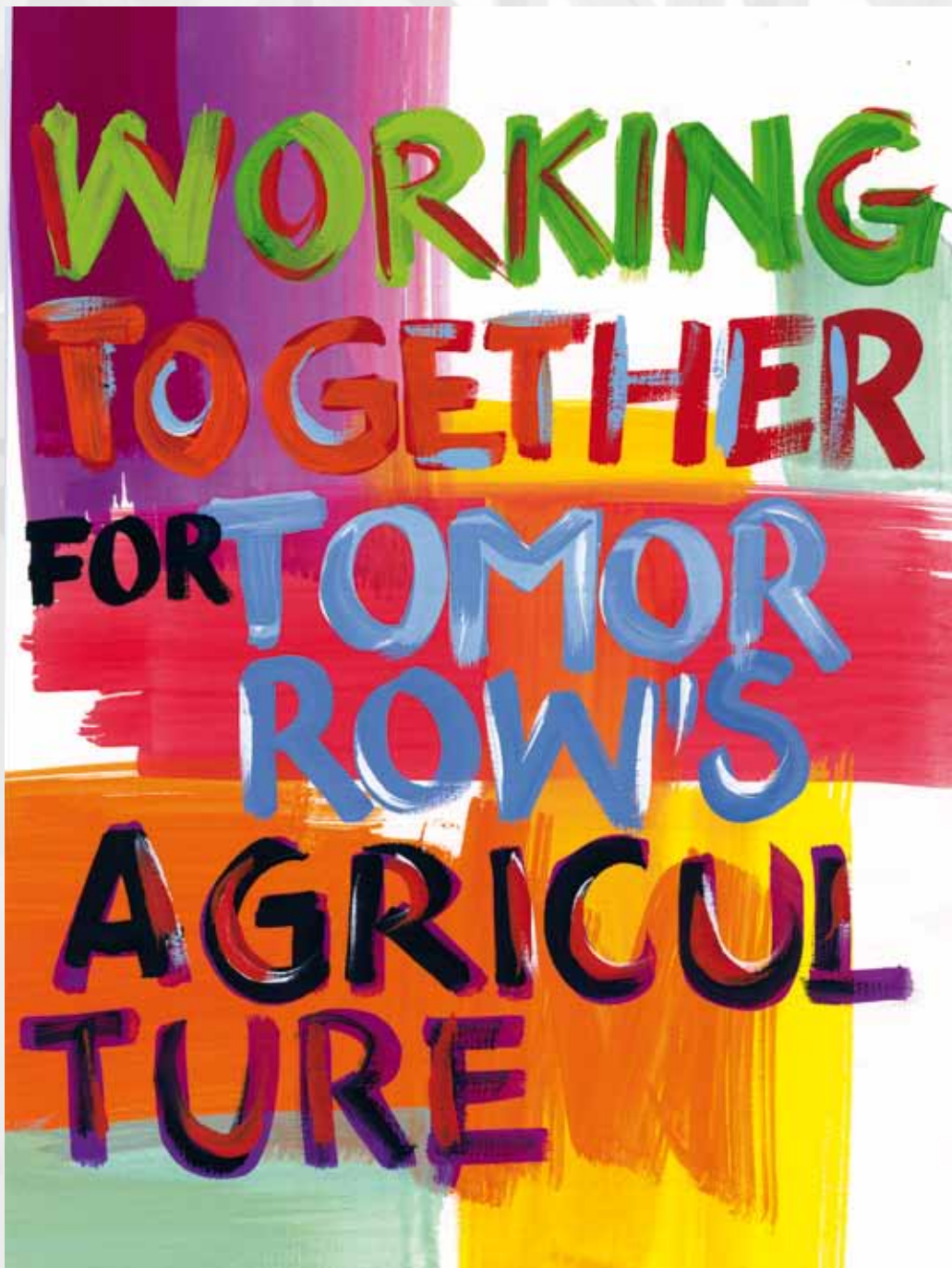


CIRAD 2011



Rural advisory mechanisms

After years of State withdrawal and the implementation of privatisation policies, there is renewed interest in agricultural advisory services. A special edition of Cahiers Agricultures was published to take stock of the debates underway in this field. CIRAD contributed to its coordination. It compiles research by several institutions from the North and the South.

AGRICULTURAL ADVISORY SERVICES are back on the agenda. Their organisation at the regional level is the outcome of political choices and social relations between stakeholders, which have evolved over the course of time. These services swing constantly between a rationale of supervising farmers and one of supporting them; these are often led by different operators and may be contradictory. The growth in the number of stakeholders interacting within the agricultural and rural sphere, and the high increase in the risks and uncertainties surrounding agricultural production prompt questions about the role of advisory services, particularly within

innovation systems. A special edition of Cahiers Agricultures provides an overview of research in this field and brings together a number of studies conducted by CIRAD researchers.

After a literature review of scientific productions in the field of advisory services over the last 10 years, several contributions describe the public policies implemented for these services and examine their impact on farmers' access to advice in Europe and America. These policies materialise in the specific establishment of farm support schemes. But these are deployed in a social arena in which other potentially competing mechanisms are already present.

Further articles explain the schemes and strategies of the organisations that implement advisory services in African countries. Private firms are setting up original mechanisms aimed at providing advice associated with the sale of their products, as is the case in France. Finally, several articles focus on the activities of advisors, how they conduct them, the resources available to them and the way they interact among themselves and with farmers. ■

Faure G., Compagnone C. (coord.), 2011. Transformations et diversification du conseil pour des agricultures en mouvement. Cahiers agricultures, 20, n° 5. <http://www.cahiers-agricultures.fr/>



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AGREEMENTS, PARTNERSHIPS

The **World Agriculture Watch** (WAW) was launched in October at the FAO headquarters in Rome. Its aim is to characterise production structures and to analyse their impacts using environmental, social and economic indicators. The systemic approach and the involvement of stakeholders in its governance are what make the initiative original. The WAW involves FAO, the French Ministries of Agriculture and Foreign Affairs, IFAD, CIRAD and numerous experts.

The **Alliance nationale de recherche pour l'environnement**, AllEnvi, created in February 2010, has published its first progress report. Its goal is to plan and coordinate environmental research at the national level, focusing on food, water, climate and regional issues.

The **Centre d'Etude de la Biodiversité Amazonienne (CEBA - French West Indies and Guiana)** has been designated a **laboratory of excellence (LABEX)** as part of the French investments for the future programme. Through CEBA, the whole biodiversity community has been strengthened in French Guiana, but also in the Amazon-Caribbean area, within the scope of the multi-regional University of the French West Indies and Guiana.

The aim of the **Géosud EQUIPEX** project coordinated by IRSTEA is to develop a national **satellite data infrastructure** for use in regional management, environmental monitoring and the prevention of natural risks (floods, fires), etc. It involves 14 institutions, including CIRAD.

Snake gourd flowers, Réunion.
© Michel Roux-Cuvelier / CIRAD



COMMUNICATION, CONFERENCES

CIRAD hosted the annual conference of the **Plant Virus Ecology Network** (PVEN) in Montpellier in May. The aim of these annual conferences is to bring together two communities, ecologists and virologists, in order to lay the groundwork for a new discipline: plant virus ecology.

The **Réseau des irrigants méditerranéens (RIM)**, led by CIRAD, ENAM, ENSA, Farm Foundation and Montpellier SupAgro, organised a seminar in October in Montpellier on saving water in irrigated systems.

The first summer school of the European **Imagine 2020 - Art and Climate Change** Network, in connection with the International Year of Forests, brought together scientists and artists around the theme of trees and forests for three days in Montpellier in August.

Rare species, endangered plants. Photographs from the CIRAD, CNRS and IRD archives on the theme of biodiversity were exhibited in June at the Collège de France, Paris. The exhibition was organised by the magazine *La Recherche* with *LVHM Recherche*, within the framework of the *Science, Recherche et Société* forum.

The managers of the **French tropical biological resource centres** (BRCs) met in Réunion in March, at the Plant Protection Platform (3P). The five French BRCs, based in Réunion, the French West Indies, French Guiana and Montpellier, joined forces through a project, Inter-Trop, to pool their efforts in terms of plant collection management and protection, and to make up one of the world's leading tropical plant reserves.

PUBLICATIONS

Savoirs et développement rural : le dialogue au cœur de l'innovation. Coord. D. Clavel. Ed. Quae. To what kind of rural development do we need to return? The author describes several innovative African initiatives, which respect the identity of rural populations.



Companion modelling: a participatory approach to support sustainable development. Coord. M. Étienne. Ed. Quae. To implement participatory approaches in the sustainable management of renewable natural resources, companion modelling is a particularly original method.

Le travail en agriculture : son organisation et ses valeurs face à l'innovation. Coord. P. Béguin, B. Dedieu, E. Sabourin. Ed. L'Harmattan. A book on the innovation strategies and organisation of animal and crop farmers, and the values attached to their professions.

Quels nouveaux défis pour les agricultures irriguées ? A special issue of *Cahiers Agricultures* on the new questions surrounding irrigation, the challenges they raise and the main changes underway.

PUBLICATIONS

Fruits et légumes lontans, fruits et légumes d'antan.

M. Roux-Cuvelier, D. Vincenot. Ed. Orphie.
A comprehensive overview of *lontan* fruit and vegetables, which have been grown since the 18th century in Réunion. These fruit and vegetable varieties are now coming back into favour.

Tropix 7.0: technological characteristics of 245 tropical wood species. CIRAD. This new version of the Tropix software presents the technological characteristics of 245 tropical or temperate wood species. Tropix allows multi-criteria searching of species.

Prise en compte de la biodiversité dans les concessions forestières d'Afrique centrale.

A. Billand, J. Fournier, L. Rieu, O. Souvannavong. CIRAD, FAO. A study based on a survey of 26 forestry firms, along with official services, research consultancies and NGOs in the countries of the sub-region.

A paradigm shift in livestock management: from resource sufficiency to functional integrity.

B. Hubert, T. Kammili, J.F. Tourrand. Ed. Cardère.
In the field of sustainable resource management, livestock rearing is the subject of considerable criticism. But is the reality that simple? The authors explore novel approaches to managing livestock systems throughout the world.

Ecosystem services from agriculture and agroforestry measurement and payment.

B. Rapidel, F. DeClerck, J.F. Le Coq, J. Beer. Ed. Earthscan.
The authors analyse the implementation of payments for ecosystem services in central Europe and South America and draw some lessons from these.

Baobabs between sky and earth - When satellites observe *Adansonia grandidieri*.

DVD. This documentary shows how satellite images can be used to find out more about these trees and the biodiversity of Madagascar.

Special reports of the journal *Bois et forêts des tropiques*: n° 305 focuses on carbon storage and planted forests; n° 306, on baobabs; n° 307, on landscape dynamics; and n° 308, on ecological structures and indicators.

Vibrations de poutre : caractérisation acoustique du matériau bois pour son utilisation en structure.

L. Brancheriau. Ed. Universitaires Européennes.
A book analysing the range of non-destructive methods that serve to improve classification of wooden joists for use in construction.

Resilience: a school of thought for adapting and transforming social-ecological systems

The school of thought of resilience offers a specific reading of interdisciplinary concepts to deal with changes in social-ecological systems, especially adaptation and transformation. Researchers that have developed these concepts are gathered within the Resilience Alliance association, of which CIRAD is a member. In 2011, researchers from CIRAD organised several scientific events with their partners.

THE RESILIENCE ALLIANCE ASSOCIATION is the initiative of a group of scientists structured around the concept of social-ecological resilience. The members of the association form a network of some 20 geographical "nodes" throughout the world. Today, this network is one of the global references on the linkages between society and environment. CIRAD is the main operator of the French node, which includes CNRS, INRA and IRSTEA.

The adaptation and transformation of social-ecological systems

Social-ecological resilience, unlike physical resilience, concerns complex systems and describes their ability to absorb disturbance and still retain their basic functions and structure. This school of thought examines changes and trajectories of social-ecological systems through two complementary concepts, adaptation and transformation, both of which are based on learning processes and

collective action. While adaptability is the capacity to strengthen the resilience of a given function and structure of a social-ecological system, transformability is the ability to actively change these in order to move away from undesirable situations.



© Patrick Dugué / CIRAD

PARTNERS

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Resilience, water, aquatic environment and foresight

In January 2011, CIRAD and IRSTEA organised a seminar on "Resilience, water, aquatic environment and foresight" with the support of the French Ministry of Ecology. This seminar brought together more than 80 researchers and practitioners involved in water and regional management. The aim was to foster discussions within the French community on the mobilisation of concepts of resilience, viability and vulnerability of social-ecological systems and adaptive management in connection with regional governance and foresight studies. Several articles were published

further to this seminar to disseminate these theoretical frameworks and tools among the French public.

Comparing the different schools of thought

The disciplinary and thematic development of the school of thought on resilience makes its comparison with other schools increasingly necessary and promising. During the second international conference dedicated to resilience thinking, "Resilience 2011", held in Phoenix, United States, researchers from CIRAD and IRSTEA led a session on participatory modelling approaches involving multiple levels of organisation, including the COMMOD

approach developed by CIRAD. The identification of the specific issues associated with climate change was also addressed. The next international conference, which will be held in 2014 in Montpellier, will be the opportunity to pursue this momentum between the different schools of thought on numerous subjects: development, innovation and learning, ecosystem services, and participatory and foresight approaches.

Botta A., Barreteau O., Bousquet F., Deffuant G., Litrico X. *La résilience de l'eau et des milieux aquatiques comme fil rouge d'une prospective sur l'eau et les territoires*. Chromatiques éditions, collection Le point sur. [forthcoming].



Red locusts, pests under close surveillance in Madagascar

To address the risk of potentially catastrophic plagues of locusts, CIRAD has been using its scientific expertise to help the Madagascan authorities for over ten years, especially at the Centre national antiacridien (CNA), which is responsible for the permanent monitoring and control of two species, red locusts and migratory locusts. Its research on red locusts now helps to better identify risk areas and to detect at a very early stage conditions favourable to the development of outbreaks.



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PARTNERS

Centre national de recherche appliquée au développement rural (Fofifa, Madagascar), University of Tulear (Madagascar), Centre national antiacridien (CNA, Madagascar), French Ministry of Foreign Affairs, African Development Bank.

MADAGASCAR HAS SUFFERED frequent plagues of locusts in the past, and the last one, which occurred in 1997-1999, was primarily due to the migratory locust, *Locusta migratoria*. But from the north to the south of the island, the Madagascan authorities have also had to deal with numerous swarms of red locusts, *Nomadacris septemfasciata*, a major pest for crops and grasslands. Research conducted in the field is aimed at furthering knowledge of the ecology of the red locust and improving monitoring and control strategies. The latest findings, published in 2011, have provided a clearer understanding of what determines outbreaks and a precise definition of the areas most suited to the development of swarms.

Ecology of red locusts

Red locusts produce just one generation per year and make considerable seasonal migrations within

the island. They spend the duration of the dry season in reproductive diapause, and reproduction takes place during the rainy season. Mating and egg-laying occur in November and December, and eggs and larvae develop from December to February. Fledglings appear in March and April. The quantity and regularity of rainfall in December and January is decisive: it can result in very high mortality for eggs and larvae.

Closer monitoring in the rainy season

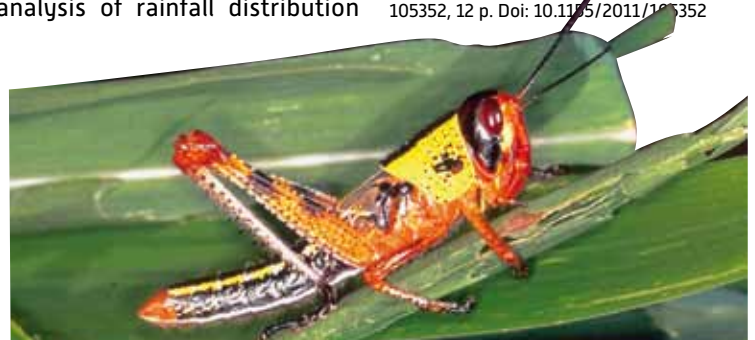
Monitoring must therefore be increased in the main breeding areas at the beginning of the rainy season. One small south-western fringe, which is currently insufficiently monitored by the CNA, has been identified as having the strongest probability of gregarisation and outbreak. Better monitoring of local rainfall levels and distribution in December and January is also recommended. The optimal amount of rainfall for red locusts is between 250 and 300 mm per month. Real time analysis of rainfall distribution

makes it possible to determine this risk, which increases when rainfall is regularly distributed in time and diminishes during dry spells of more than three weeks. Finally, better monitoring of deforestation, which creates new habitats favourable to outbreaks, is also needed.

By applying this strategy for the prevention and management of red locusts, it is now possible to better predict and control outbreaks in Madagascar. However, this pest has a tendency for frequent small and local swarms. The CNA will therefore need to take measures to combat potential plagues as well as to provide locust-control assistance to rural communities.

Lecoq M., Andriamaroahina T.R.Z., Solofonaina H., Gay P.E., 2011. Ecology and population dynamics of solitary Red locusts in Southern Madagascar. *Journal of Orthoptera Research*, 20: 141-158.

Lecoq M., Chamouine A., Luong-Skovmand M.H., 2011. Phase-dependent color polyphenism in field populations of red locust nymphs (*Nomadacris septemfasciata* Serv.) in Madagascar. *Psyche, a Journal of Entomology*, Special issue on Locusts and grasshoppers: behaviour, ecology, and biogeography, ID 105352, 12 p. Doi: 10.1155/2011/105352



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Nematodes, bioindicators of soil quality

In banana agrosystems that are currently being converted to more sustainable cropping methods, the goal is to reduce pesticide use and to adopt cropping practices based on ecological intensification. To determine the biological quality of soil and to assess the impact of cropping practices on soil food webs, a team from CIRAD has used analysis of the structure and functional diversity of soil nematode communities.

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IN AGROSYSTEMS, the study of soil biological functioning provides a clearer understanding of the impact of cropping practices or of any other disturbance (pollution, climate change, etc.). Living organisms in the soil play a key role in the breakdown of organic material, carbon sequestration, the recycling and mineralisation of nutrients and biological regulation.

Nematodes are one of the most abundant taxa among soil invertebrates (several tens of millions of individuals per square metre). They are first-rate bioindicators for monitoring the biological quality of soils. They have a significant impact on soil processes, especially through their influence on biomass and microbial populations. Nematodes also play a role in mineralisation. Their specific trophic and functional diver-

sity, as well as their ecology, make them sensitive to anthropogenic or environmental disturbances. A team from CIRAD monitored soil nematode communities in banana plantations being converted to ecological intensification practices.

Monitoring soil biological quality using nematodes

The study was conducted by coupling the abundance of functional groups of soil nematodes to the use of diversity indicators and ecological indicators, based on these same functional groups and describing the condition of the "soil environment". The team thus showed, using microcosm studies, that soil amendment using certain raw or composted organic materials results in a decrease in the nematode populations in the banana plant roots, the intensity of this regulation depending on the species of plant-parasitic nematode. The mechanisms at work are not yet fully understood, but the organic amendments were marked by a differentiated increase in populations of microbivorous nematodes.

Lignocellulosic materials, which are slow to biodegrade, favour the increase in fungivorous nematode populations, whereas those that biodegrade more rapidly, mostly made up of hemicelluloses and soluble fractions, stimulate



Multispecific association of cover crops to reintroduce biodiversity into banana agrosystems.
© H. Tran Quoc/CIRAD

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Systems



growth in bacterivorous nematode populations. Some organic materials, after having increased fungivorous nematode populations, also cause an increase in predatory nematode populations, even though no causal relationship with the biological regulation observed has yet been demonstrated.

Field tests

Field research has shown that tillage decreases the number of functional groups of nematodes, especially by reducing the omnivores and predators at higher trophic levels. Other studies show that adding a cover crop to a banana agrosystem increases the

abundance and diversity of non-plant-parasitic nematodes, while making the soil food webs more complex through the development of higher levels.

All of this research points the way towards the cautious implementation of ecological intensification strategies. The use of cover crops or of exogenous organic materials could then be dependent on their capacity to improve the biological functioning of soils and to foster certain biological regulation processes.

Cephalic region and oral cavity
of a predatory nematode showing a tooth
(Mylonchulidae). © J.M. Risède/CIRAD

Tabarant P., Villenave C., Risède J.M., Roger-Estrade J., Thuriès L., Dorel M., 2011. Effects of different organic amendments on banana parasitic and soil nematode communities. *Applied Soil Ecology*, 49: 59-67.

Pl@ntWood: a tool for the identification of Amazon trees**PARTNERS**

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WOOD ANATOMICAL CHARACTERISTICS are widely used by specialists to identify trees. In order to make this expertise available to a large number of people, CIRAD designed a software programme for interactive, user-friendly identification, based on the IDAO computer-aided identification system.

In total, 110 species belonging to 34 neotropical families were chosen. The samples and microscopic images of these trees come from CIRAD's tropical wood collection in Montpellier, one of the largest in the world. The 22 anatomical characters selected to describe them, with their 96 states, are based on anatomical descriptions from the literature and from the international InsideWood database.

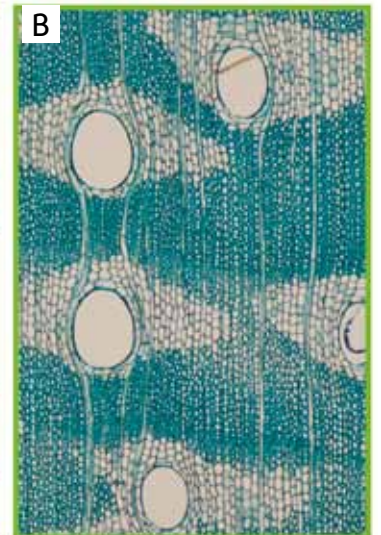
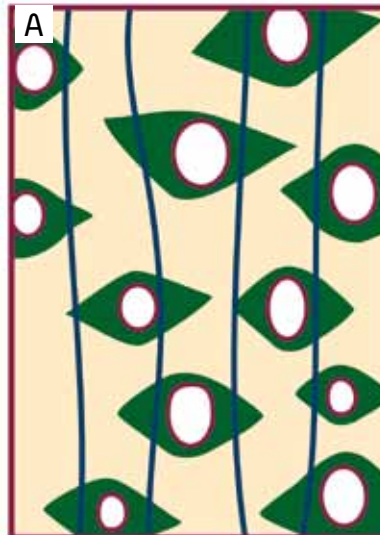
Pl@ntWood will naturally be used in the fields of conservation biology and forest science, but also in that of training. It is a free application available on the site of the Pl@ntNet project.

Sarmiento C., Detienne P., Heinz C., Molino J.F., Grard P., Bonnet P., 2011. Pl@ntWood: A computer-assisted identification tool for 110 species of Amazon trees based on wood anatomical features. *Iawa Journal*, 32: 221-232.

<http://community.plantnetproject.org/pg/file/read/4240/plntwoodexe>

Cross section of wood *Ormosia paraensis* (Fabaceae). Observation of isolated vessel elements, paratracheal axial parenchyma aliform and fibres (support): A) example of vector graphics, B) photograph of thin section.

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Defining indicators to certify sustainable palm oil production

The production of palm oil is often blamed for the degradation of natural resources and for environmental problems. Faced with these accusations, the Roundtable on Sustainable Palm Oil (RSPO) led in 2007 to the adoption of a certification scheme shared by more than 500 operators in the sector. CIRAD, which is strongly committed to the implementation of a policy on the sustainable development of palm oil production, actively supports this process.

PARTNERS

Roundtable on Sustainable Palm Oil (RSPO), Center for International Forestry Research (CIFOR), SMARTRI, New Britain Palm Oil Limited, Centro de Investigación en Palma de Aceite (CENIPALMA, Colombia), Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), Institut national de la recherche agronomique (INRA), Institut de recherche pour le développement (IRD), Zoological Society of London (ZSL, United Kingdom), Cambridge University, Agence nationale de la recherche (ANR), ASEAN-EU, ICOPE Series

THE CERTIFICATION SCHEME adopted in 2007 by the RSPO, recognisable by its logo CSPO (Certified sustainable palm oil), is based on the definition of 39 criteria grouped around eight principles. They take into account all factors for sustainable production in view of global threats. To be effective, these criteria must be accompanied by new tools and quantified indicators of the socio-economic and environmental impacts of the numerous oil palm production systems.

CIRAD is contributing to several projects that will help to increase the scientific credibility of the certification scheme. A web platform, PALMINET, was launched in 2011 by the international network on sustainable palm oil indicators. Coordinated by CIRAD, this platform aims to inform all actors in the sector, to pool research and experience sharing efforts, and to foster the creation of indicators and tools for sustainable development. It also works to encourage new partnerships and to ensure information reaches a wide audience throughout the world. Furthermore, the teams played a part in the development of a greenhouse gas calculator for an RSPO working group. In 2012 and for a period of three years, CIRAD will lead the sustainable palm oil production (SPOP) project. The goal is to characterise the different palm

oil production systems in Indonesia and Cameroon. Their agricultural, ecological and social impacts will be assessed using robust indicators. A multi-agent model will be used to model land use change scenarios.

These scientific elements will serve as the basis for the revision of the principles and criteria of RSPO certification, which will begin in 2012. In the long run, they will help to improve the assessment of sustainability in this sector.

Chase L., Bessou C., 2011. Introduction to PalmGHG. The RSPO greenhouse gas calculator for oil palm products. In: *RSPO Roundtable 9*, 22-24 November 2011, Borneo, Malaysia.

Palm oil and palm kernel oil, agreement on an incomparable oil output, but not on nutritional qualities or environmental impacts.

Manure spreading: what are the impacts of the different means of treatment and of organic fertiliser application?

A year-round harvest that employs a large workforce. © C. Bessou / CIRAD



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Performance of Tree
Crop-based Systems

Sustainable Amazon wood extracts

DURING THEIR EVOLUTION, trees have developed defence mechanisms enabling them to protect themselves against attacks from insects and fungi. To do so, they activate secondary metabolic pathways, resulting in the synthesis of protective molecules. Every ligneous species thus produces its own chemical defences, and their biological properties are highly diverse. The French Guianan laboratory of molecules and materials is studying the potential of these molecules, in particular the possibilities for using them to transfer resistance to attacks from durable species to non-durable species.

The research focused on the antifungal properties of extracts from several Amazonian species: *Andira surinamensis*, *A. coriacea*, *A. intermis*; *Manilkara huberi*, *M. bidentata*; *Tabebuia serratifolia*, *T. impetiginosa*; *Bagassa guianensis*, *Qualea rosea*, *Sextonia rubra* and *Vouacapoua americana*. It showed that these extracts can confer resistance to wood species that have none. Produced using waste from sawmills and forest slash in French Guiana, these extracts will generate considerable added value for this waste and will provide active agents for wood treatments. Their production has been patented.

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Extraits de bois durables amazoniens, leur procédé d'obtention et leur utilisation comme agent biocide. Patent n° BIP206417FR00.

Amazonian wood extracts.
© N. Amusant / CIRAD



Predicting the quality of organic matter using rapid analysis techniques

Near infrared spectroscopy (NIRS) is an interesting analytical method for rapidly characterising organic matter. It has many uses in this field. CIRAD uses it in particular in Réunion to analyse the organic status of soils.

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NEAR INFRARED SPECTROSCOPY (NIRS) is an analytical technique widely used to characterise organic matter. Once the calibration equation has been developed to convert a spectrum into a parameter of interest, such as the concentration of a constituent (water, organic compounds), this technique provides an inexpensive and very rapid way to determine this parameter (spectral acquisition and interpretation in just a few minutes).

It is used to characterise organic matter for several purposes. During above-ground transformations, it is used to control or model the processes at work and to monitor the production of organic fertilisers in order to achieve a given quality. It also serves to develop typologies of

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Recycling and Risk

NIRS can be used to qualify the agricultural potential of poultry litter directly in the hen house. © T. Rottatinti/CIRAD



organic matter with a view to assessing strategies for potential uses, whether for energy, through combustion or anaerobic digestion, or for agriculture. During transformations in soil, it is used to predict or model the evolution of organic matter added to the soil, such as the transformation of nitrogen and the mineralisation of carbon. It is also a means to develop indicators of the quality of organic matter, to adapt these to standardisation or to the introduction of new standards, or to define technical recommendations concerning methods and quantities for the spreading of organic products, with the possibility of intervention in the field.

Near infrared spectroscopy may be used on new organic matter from agro-industry and urban areas, or on "traditional" organic matters, whose quantity and quality evolve with the adoption of new production systems. It is currently being used to analyse the organic status of soils in Réunion.

Peltre C., Thuriès L., Barthès B., Brunet D., Morvan T., Nicolardot B., Parnaudeau V., Houot S., 2011. Near infrared reflectance spectroscopy: a tool to characterize the composition of different types of exogenous organic matter and their behaviour in soil. *Soil Biology and Biochemistry*, 43: 197-205. Doi: 10.1016/j.soilbio.2010.09.036

Sabatier D., Dardenne P., Thuriès L., 2011. Near infrared reflectance calibration optimisation to predict lignocellulosic compounds in sugarcane samples with coarse particle size. *Journal of Near Infrared Spectroscopy*, 19: 199-209.

Composting: recycling waste to produce fertilisers

PARTNERS

Agence de l'environnement et de la maîtrise de l'énergie (ADEME), Pôle régional de recherche appliquée au développement des systèmes agricoles d'Afrique centrale (PRASAC, Chad)

IN THE SOUTH, the agricultural value of organic matter from waste is more topical than ever: this matter has often become the main input for production systems and conditions food security. This agricultural use is also a response to the proliferation of household waste in urban areas, which poses a serious problem for the environment and public health. Using the expertise acquired during projects conducted in diverse contexts, CIRAD and its partners have developed

methods for achieving agricultural waste recovery through composting, which can be adapted to local specificities.

To disseminate these methods and to promote a real policy for the agricultural management of this organic matter, CIRAD, ADEME and PRASAC organised a seminar in Douala, Cameroon, in September 2011. This seminar brought together 20 participants

—researchers and managers— from 8 countries, mainly belonging to the Central African Economic and Monetary Community (CEMAC), to discuss challenges and conditions for the use of organic matter from household and organic waste in the South.

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Household waste in the landfill site in Douala. © D. Montange / CIRAD



Visit to the landfill site in Douala. © D. Montange / CIRAD

Towards integrated waste management in Réunion

PARTNERS

Chambre d'agriculture de la Réunion, Fédération régionale des coopératives agricoles de la Réunion (FRCA), Société industrielle des engrais de la Réunion, Etablissement public local d'enseignement et de formation professionnelle agricole de Saint-Paul (Eplefpa), La Créole, Communauté d'agglomération Territoire de la Côte Ouest (TCO)

AGRICULTURE IN RÉUNION depends on imported chemical fertilisers. At the same time, patterns of production and consumption are generating increasing amounts of refuse, which ends up in landfill sites, despite the recognised agricultural potential of some of this waste. In particular, animal manure, droppings and slurry, green waste and sewage sludge can be recycled to produce organic fertilisers locally. This is

a simple idea in theory, but is difficult to put into action at the level of a sub-urban area in Réunion of 200 000 people. The team of the GIROVAR project, which has just begun, has identified three major problems: a lack of technical knowledge; a dearth of social capital between stakeholders; and the predominance of a "waste" rationale, which must be converted into a "product" approach.

The aim of this research, conducted in partnership with professionals in Réunion, is to design, explore and assess scenarios for the integrated management of organic waste on a regional scale. The project's participatory structure is based on a "policy" steering committee, which is separate from the "technical" committee made up of representatives of the different stakeholders. Workshops organised with farmers are the opportunity to disseminate the findings of the project, to foster social learning among participants and, in return, to inform scientific teams about research issues.

www.girovar.com

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Workshops organised with farmers are the opportunity to disseminate the findings of the project and to foster social learning among participants.

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Indicators

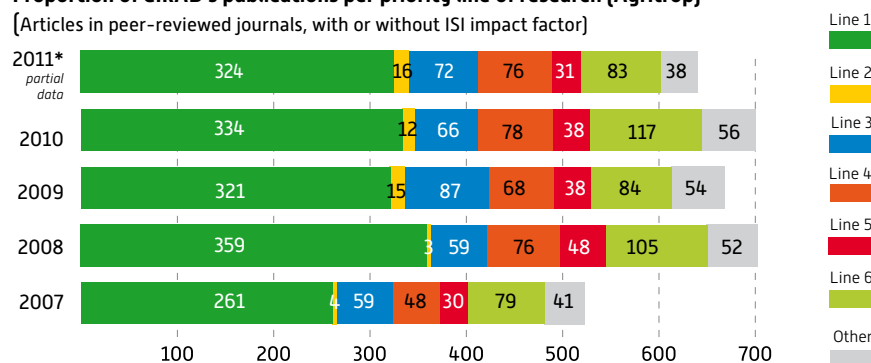
In 2011, CIRAD has continued to apply the *State-CIRAD Agreement on Objectives*, which is nearing completion after the 2008-2011 4-year plan, in accordance with the commitments made to its supervisory ministries. The *Agreement* is based on four main priorities: sharing science to meet the challenges facing southern countries, producing scientific output that is varied and of high quality, opening up national agronomic research to Europe and the rest of the world, adapting the organisation's structure and resources to meet new challenges.

Sharing science to meet the challenges facing southern countries

"The aim of sharing science to meet the challenges facing southern countries" is to adapt existing forms of scientific partnerships in order to address research issues that are pertinent for development in southern countries. Mobilising teams to work on the six priority areas of action set out in CIRAD's strategy, as well as building capacity in southern countries, are central to this challenge.

Proportion of CIRAD's publications per priority line of research (Agritrop)

[Articles in peer-reviewed journals, with or without ISI impact factor]



*The publication indicators reflect the status of the institutional database, Agritrop, at closing on 28th February 2012. The data and indicators shown for 2011 are partial.

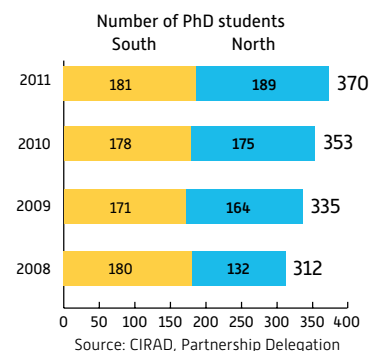
CIRAD has chosen to develop a balanced and sustainable partnership with its scientific partners in southern countries. This is shown by the share of joint publications with southern countries (almost 50 % of all the co-publications in 2011, partial data) and the regular increase in the percentage of co-publications between CIRAD and southern institutions smoothed over a 3-year period, between 2007 and 2010 (from 43.26% to 47.03 %). The increase in the number of PhD students from southern countries, supervised by CIRAD's researchers, slowed down in 2009 but went up in 2010 and 2011.

Co-publications with researchers in developing countries¹

Researchers from southern countries	2005	2006	2007	2008	2009	2010	2011 (partial data)
Number of co-publications	186	194	238	309	329	329	318
Annual average smoothed over 3 years	---	---	206	247	292	322	325
Total number of publications analysed	443	448	522	702	667	701	640
Share [%]	41.99	43.30	45.59	44.02	49.33	46.93	49.69
Share [%] of annual average smoothed over 3 years	---	---	25.62	27.45	27.50	25.41	25.15

1. A country is classified as a developing country if it is on the OECD list of countries that receive public development aid. Source: Agritrop. Data for 2011 is incomplete (as at closing on 28th February 2012)

Supervision of PhD students by CIRAD researchers

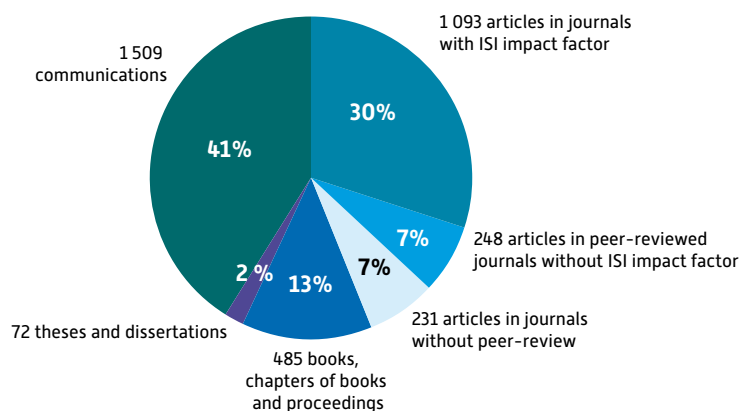


Diversified and high quality scientific output

In order to ensure that science for development attains the highest international scientific level and yet remains relevant to the issues, areas and partnerships specific to southern countries, CIRAD is striving to improve the quality of its scientific publications and the competitiveness of its teams. At the same time, CIRAD is ensuring the diversity of its outputs, which are aimed at different audiences.

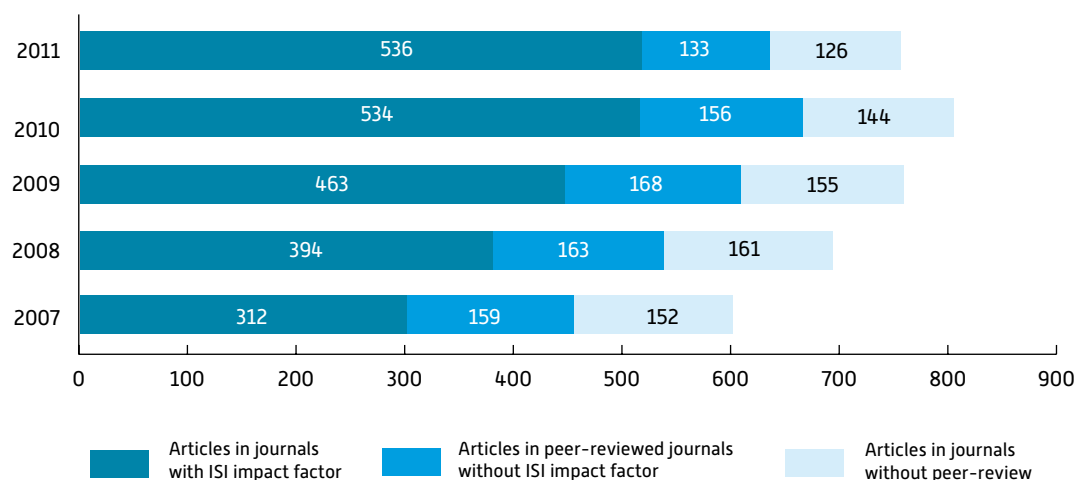
The quality of the scientific output is progressing, with a considerable increase in the number of articles published between 2007 and 2010, particularly in reviews with a high impact factor (ISI). CIRAD researchers are gradually becoming more qualified (number of directors of research). The success rate for calls to tender for projects (ANR) went up again in 2011. CIRAD researchers were more involved in training activities in and through research in 2011 (number of hours of practical work equivalent in Masters courses in southern countries and number of "consultant professors"). Technology transfer and development output has dropped slightly.

Distribution of publications in 2010 and 2011



Source: Agritrop. Data for 2011 is incomplete (as at closing on 28th February 2012)

Change in the number of articles published in journals since 2007 smoothed over 3 years



Source: Agritrop. Data for 2011 is incomplete (as at closing on 28th February 2012)

CIRAD's participation in ANR competitive calls to tender

	2007	2008	2009	2010	2011
Number of projects submitted	75	72	49	65	81
Number of projects funded	23	19	14	12	17*
Success rate (%)	31	26	29	18	22*

Source: CIRAD, European Delegation, ANR Mission.
 *These two figures are incomplete on 15/03/2012 (definite figures available end of June)

CIRAD's involvement in teaching and training development for Masters and PhD courses in developing countries

	2007	2008	2009	2010	2011
Number of hours (practical work equivalent) of teaching and training development for Masters and PhD courses in developing countries	3978	4249	4439	4368	4531

Source: CIRAD, Partnership Delegation.

Training for CIRAD's senior scientific staff

	2007	2008	2009	2010	2011
Number of research directors at CIRAD	82	90	99	102	132
Number of consultant professors at CIRAD	n.c.	36	52	53	61

Source: SIRH (HDR) Partnership Delegation.

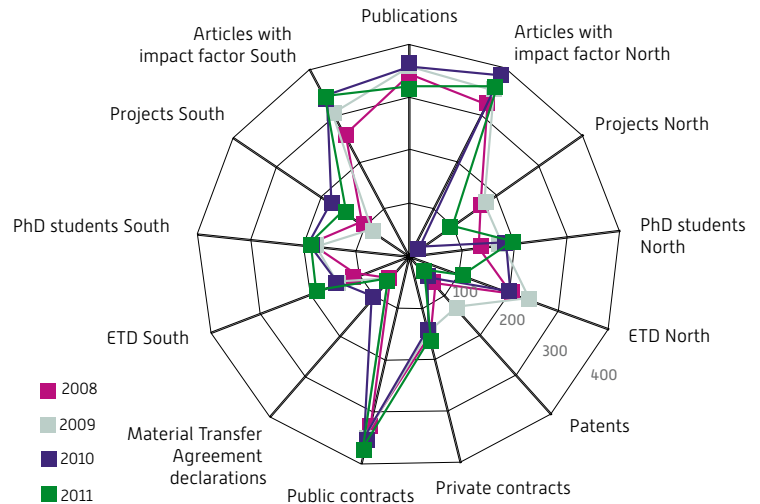
Technology transfer and development: patents, proprietary variety protection certificates and software programmes

	2007	2008	2009	2010	2011
Number of applications for patents, proprietary variety protection certificates and software programmes (in brackets: number of patents attributed)	8 (2)	13 (0)	26 (4)	10 (5)	8 (2)

Source: CIRAD, Delegation for technology transfer and development.

Assessing the diversity of CIRAD's scientific outputs

The set of outputs presented below illustrates the diversity of CIRAD's missions and activities. The diversity indicator for CIRAD's output was developed in 2010. The star-shaped diagram was designed on a pilot basis for the years 2007, 2008 and 2009 at the behest of the scientific committee. In 2012, the diversity indicator for the establishment's output was recalculated for the years 2007-2011. It is based on a selection of outputs that are weighted: firstly, publications (articles in peer-reviewed journals, with and without an impact factor: IF articles), PhDs supervised (PhD students), hours of Masters and PhD teaching (HPWE), participation in ANR and EU FP7 competitive projects ("projects"). For these indicators, the activities directly associated with researchers in developing countries are shown on the left opposite those that are directly associated with researchers from industrialised countries, shown on the right. Output that cannot be divided North/South is then added: books published, patents, PVPCs and software programmes, Material Transfer Agreement declarations (MTA), and contracts funded by the private and public sectors. 2011 was marked by an improvement in the weight attributed to outputs oriented towards developing countries (projects, teaching, supervision of PhD students).



National agricultural research

open to Europe and the rest of the world

Between 2008 and 2011, CIRAD has been operating on different levels: regionally, within research and training organisations, (PRES in Languedoc Roussillon and the French overseas departments and territories; the sustainable development campus in Nogent); nationally, in France as part of its alliance with INRA, which expanded in 2009 to become Agreenium, the national consortium, and with other research organisations involved in Programme 187, particularly IRD, and more recently with research alliances, such as AllEnvi; then, in Europe, with partnerships that have been reinforced; and lastly, internationally, with the renewal of its partnerships in southern countries via the research platforms in partnership and the strengthening of its links with the Consultative Group on International Agricultural Research (CGIAR). In particular, the evolution in co-publications illustrates the priority in developing countries, Europe and internationally. In 2011, the overseas assignments carried out by CIRAD

researchers progressed (particularly in Asia, Latin America and French overseas departments and territories), with greater concentration on fewer platforms in partnership (21 PRPs, including 14 internationally and 7 in French overseas departments and territories). Moreover, there were fewer overseas missions in Asia, though more in Latin America.

Co-publications with French, European or international researchers

In order to eliminate annual fluctuations and identify trends more easily, it is common practice to consider certain indicators for publications by smoothing data, or proportions, over 3 years. The calculations indicate presence (non-additive values because, for example, the same article could be signed by a French researcher, as well as by an international researcher).

Co-publications with French, European or international researchers - annual average smoothed over 3 years	2006	2007	2008	2009	2010	2011 <i>partial data</i>
French researchers (including INRA) (*)	---	210	256	289	306	299
European researchers (EU27 excluding France) (*)	---	51	72	82	100	101
International researchers (excluding EU27) (*)	---	234	284	336	372	370
Southern researchers (*)[**]	---	<206	247	292	322	325
Researchers from P187 (*)[***]	---	121	153	173	175	168
INRA (*)	---	78	105	116	119	110
Total number of publications analysed	---	471	557	630	690	669

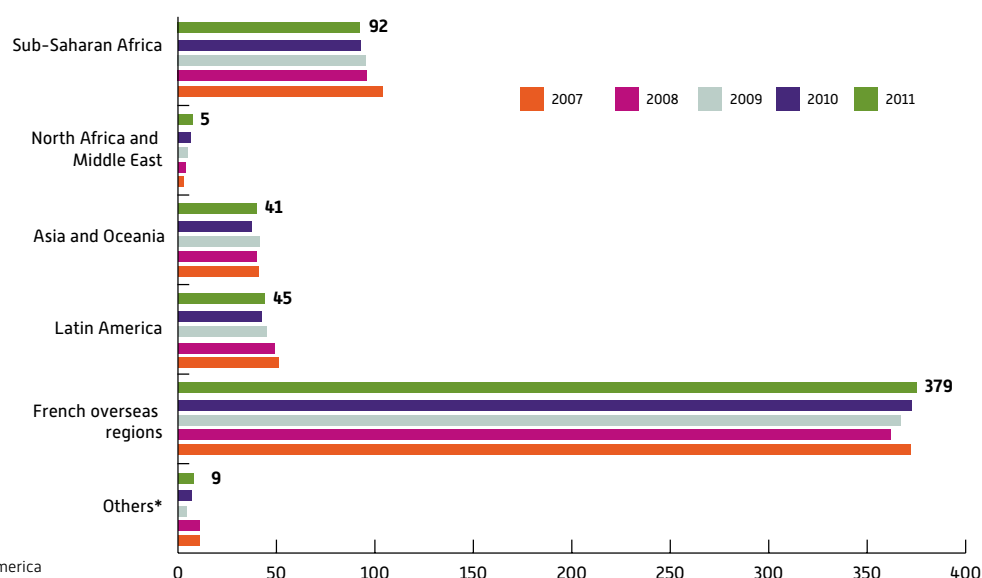
Source: Agritrop.

CIRAD co-publications with each organisation in the LOLF Programme 187

Number of co-publications, data smoothed over 3 years	2005	2006	2007	2008	2009	2010	2011
BRGM	0	0	0	0	0	0	1
CEMAGREF	4	3	5	16	14	12	7
IFREMER	0	0	2	0	1	1	0
INRA	59	74	101	139	108	109	112
IRD	34	41	63	51	61	54	57
Total number of publications	443	448	522	702	667	701	640

Source: Agritrop.

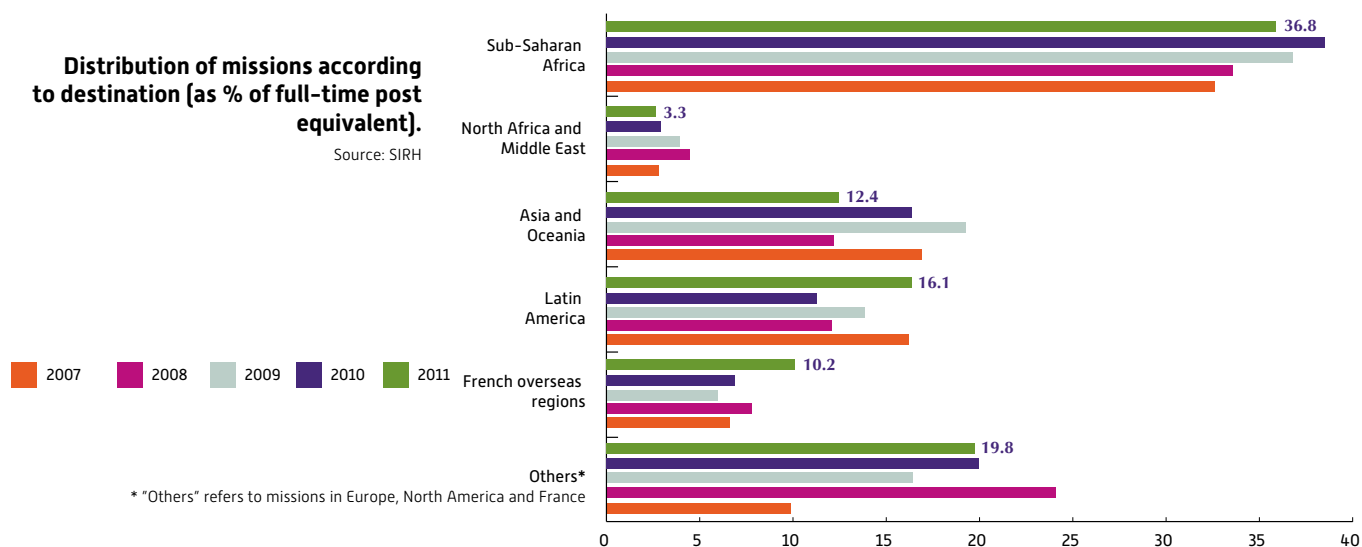
Distribution of overseas assignments (in full-time post equivalent). Source: SIRH



**Others* refers to assignments in Europe and North America

Distribution of missions according to destination (as % of full-time post equivalent).

Source: SIRH



* "Others" refers to missions in Europe, North America and France

Number of senior scientific staff assigned to platforms in partnership/number of senior scientific staff on overseas assignments (full-time post equivalent)

2008: 111 senior scientific staff at 18 platforms in partnership out of 291 expatriate scientific staff.

2009: 137 senior scientific staff at 23 platforms in partnership (20 international PRPs + 3 PRPs in French overseas departments and territories) out of 267 expatriate scientific staff.

2010: 149 senior scientific staff at 27 platforms in partnership (20 international PRPs + 7 PRPs in French overseas departments and territories) out of 273 expatriate scientific staff (5 more PRPs including 4 in French overseas departments and territories; 1 PRP less).

2011: 175 senior scientific staff at 21 platforms in partnership (14 international PRPs + 7 PRPs in French overseas departments and territories) out of 276 expatriate senior scientific staff (6 international PRPs less, following changes in the rules governing certification).

Region	National platforms in partnership (PRPs)	Regional PRPs	French overseas regions	PRPs in French overseas regions
Africa				
	URP PPZS, Senegal, Lines 1, 5, 6	ASAP, West Africa, Line 1	Réunion	3P, Line 1
	PRP-PCP, Zimbabwe, Lines 1, 4, 6	DPFAC Congo Basin forests, Central Africa, Lines 1, 2, 4, 6		Reagir, Line 6
	CR2PI, Congo, Lines 1, 6			Kappa, Line 3
	URP SCRID, Madagascar, Line 1			
	Forest biodiversity, Madagascar, Lines 2, 6			
Asia				
	HRPP PCP, Thailand, Line 1	RCP CANSEA (RACASE), South-East Asia, Line 1		
		GREASE Animal health and emerging diseases, Line 4		
Latin America				
	PCP-AFS-PC Agroforestry Systems with Perennial Crops, Central America, Lines 1, 2, 5, 6	Amazonia, Amazonian Basin, Line 6	Caribbean Guiana	Forests
	CIBA, Brazil, Line 1			Agro-ecology and multi-species cropping systems
				Biodiversity and genetics
				Animal health and emerging diseases, Line 4
Mediterranean				
	SIRMA, Maghreb, Lines 1, 3, 5, 6			

Source: CIRAD, Partnership Delegation

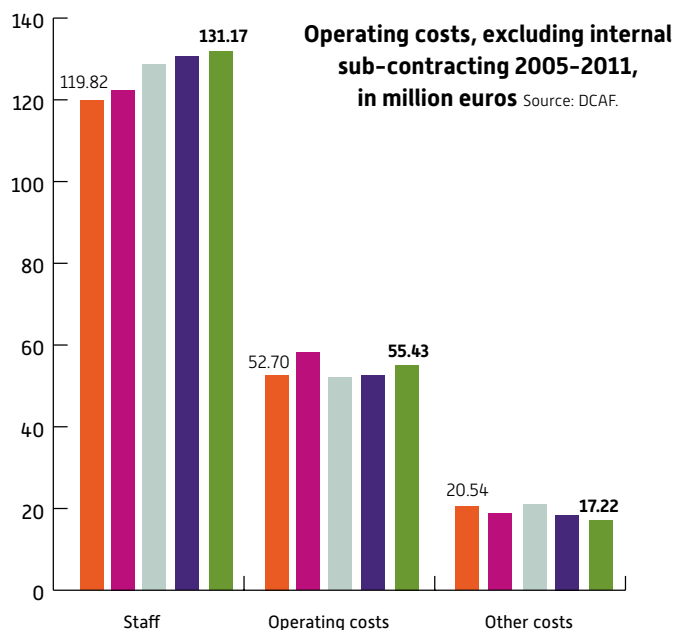
CIRAD's EU research and development projects (FP7) between 2007 and 2011

Source: CIRAD, European Delegation.

	2007	2008	2009	2010	2011
Number of projects submitted	36	23	23	18	21
Number of projects funded	10	7	11	7	5
Success rate (%)	28	30	48	39	24
Number of projects coordinated by CIRAD	0	4	3	2	3

A structure and resources adapted to meet new challenges

In addition to simplifying and modernising its management methods so that they are more effectively driven by its scientific objectives, CIRAD is making the most of its human and financial resources by ensuring a degree of stability.



CIRAD is still working on the stabilisation of its operating costs as a result of the stagnation in public subsidies, which has an impact on the change in the number of agents (full-time staff and grant-funded students). The increase in contracted resources linked to the European structural funds has facilitated an internal redistribution (incentives). The quality approach, which aims to simplify and improve efficiency, assigned even more scientific and administrative staff in 2011.

Total number of CIRAD staff (full-time post equivalent)

FTPEs at CIRAD	2007	2008	2009	2010	2011
Number of "classified paid" permanent contracts	1770	1755	1764	1752	1739
Number of grant-funded PhD students	24	48	71	83	81

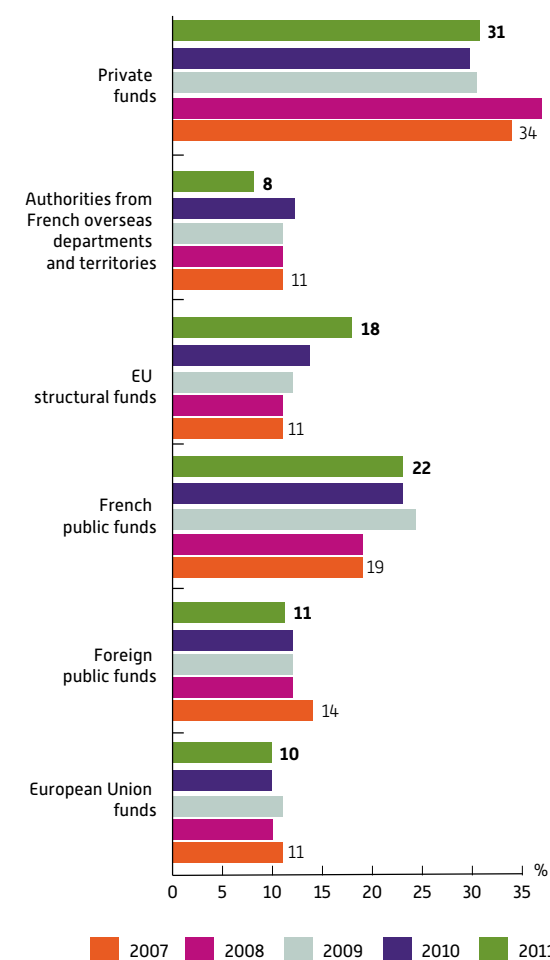
Source: CIRAD, SIRH.

Number of units (in number of staff) applying a quality approach

	2007	2008	2009	2010	2011
No. of units (in no. of staff) applying a quality approach					
Levels 1/2 to 5	375	445	853	929	1279
Levels 3 to 5	115	265	353	439	546

Source: CIRAD, Quality Delegation.

Resources generated by CIRAD: amount and annual breakdown as a percentage (excluding joint contracts)



Annual breakdown of "classified paid" jobs per category (including grant-funded research students with CIRAD contracts), as a percentage

	2007	2008	2009	2010	2011
Senior staff	59	58.8	59.2	59.6	60.6
Grant-funded PhD students	1.3	2.7	3.9	4.6	4.5
White-collar staff	31.6	31.8	31.4	31.5	31.6
Ancillary staff	8	6.7	5.5	4.4	3.4

Source: SIRH.

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Pests and Diseases: Risk Analysis and Control (UPR), Christian Cilas

Biology and Genetics of Plant-Pathogen Interactions (UMR BGPI: INRA, Montpellier SupAgro), Philippe Rott

Botany and Computational Plant Architecture (UMR AMAP: CNRS, University of Montpellier II, INRA, IRD), Pierre Couteron (IRD)

Centre of Evolutionary and Functional Ecology (UMR CEFE: CNRS, Universities of Montpellier I, II and III, Montpellier SupAgro, EPHE), Philippe Jarne (CNRS)

Centre for Biology and Management of Populations (UMR CBGP: INRA, IRD, Montpellier SupAgro), Flavie Vanlerberghe (INRA)

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Tropical and Mediterranean Cropping System Functioning and Management (UMR SYSTEM: INRA, Montpellier SupAgro), Christian Gary (INRA)

Agropolymer Engineering and Emerging Technologies (UMR IATE: University of Montpellier II, INRA, Montpellier SupAgro), Hugo de Vries (INRA)

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Mediterranean and Tropical Livestock Systems (UMR SELMET: Montpellier SupAgro, INRA), Philippe Lecomte

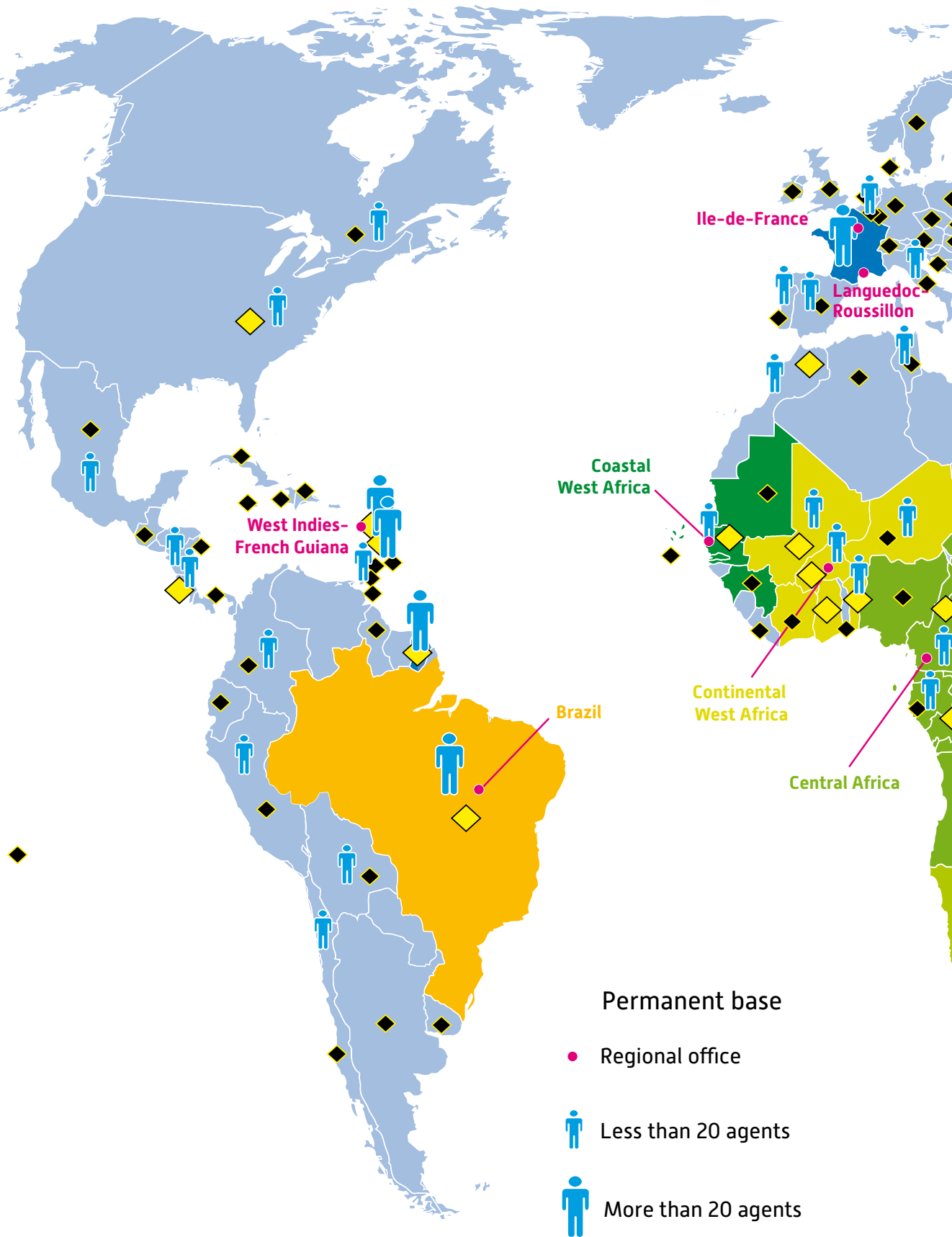
Spatial Information and Analysis for Territories and Ecosystems (UMR TETIS: IRSTEA, AgroParisTech), Jean-Philippe Tonneau

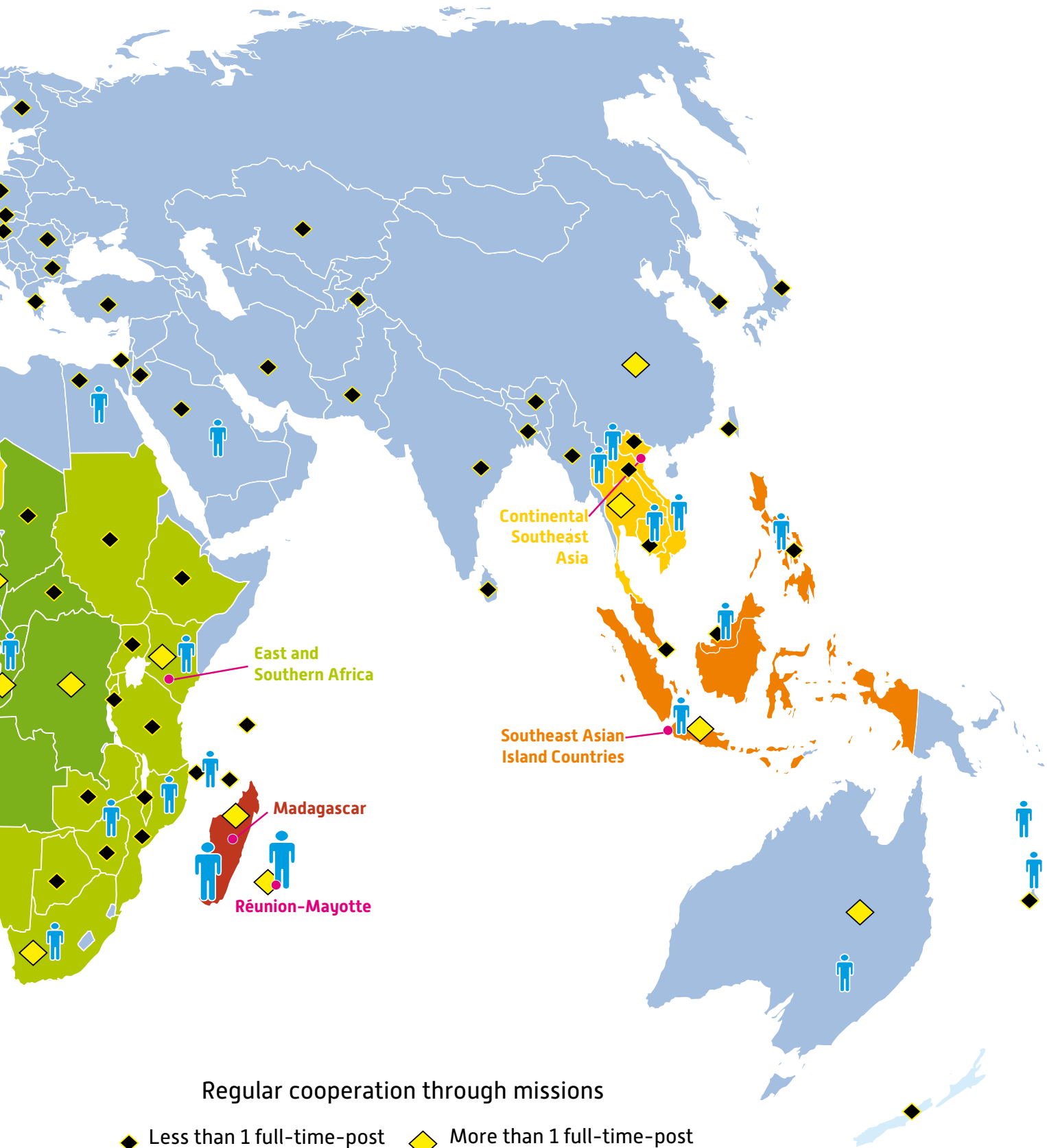
* UMR: Joint Research Unit.

UPR: Internal Research Unit.

US: Service Unit.

CIRAD Worldwide





Regular cooperation through missions

- ◆ Less than 1 full-time-post equivalent
- ◆ More than 1 full-time-post equivalent

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