



# Annual report 2010

INSTITUT DE RECHERCHE POUR LE DÉVELOPPEMENT



Institut de recherche  
pour le développement

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Volcano / Réunion.



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# The IRD around the world



Staff at 31/12/10  
Source: Personnel department

# Editorial

2010 was a pivotal year for the IRD, as the government published the decree altering its statutes and changing its governance structure. The decree created the post of executive chairman at the head of the Institute and reorganised its management under three major divisions and a Geostrategy and Partnership department. It also gave the agency AIRD<sup>1</sup> an official status within the IRD.

During the year the IRD confirmed the excellence of its scientific output, often making our assessments jointly with Southern partners. The results of external assessments such as those conducted by AERES<sup>2</sup> were also excellent: 85% of the joint research units assessed were given A or A+ grades. Clearly, “science in the South” can be of very high quality.

With this high performance record highlighting the quality of the research conducted by the IRD as operator, we were able to set time aside for thinking about the future of the Institute. The strategic plan for *The IRD Tomorrow* was approved and our representatives will now be implementing it with our partners in their respective areas.

2010 was a year of intense activity for the IRD. Numerous missions consolidated the links with Southern partners that our representatives build and maintain day by day. Some important agreements and conventions were signed, establishing long-term relationships with partners, for example in international joint laboratories and units.

It was also a very fruitful year for scientific advances and prospects. Results are giving rise to ever more publications, especially co-publications with the South. In another important development, we recently learned that under the national “Investments for the Future” call for projects, the IRD is a partner in numerous national excellence structures: 15 Labex, four Equipex, one Institut Hospitalo-Universitaire and one Institut Carnot. These collective results highlight the excellence of our teams and will enable them to devote even more to their work with the South.

As you know, the start of 2011 was a time of great upheaval in North Africa, which is one of the IRD’s priority regions. In the short term, these events remind us that, as in the Sahelian-Sudanian zone, the safety of IRD staff is never definitively assured and is a factor we must all be constantly aware of. In the long term, the upheavals give grounds for hope and it falls within the mission of the IRD and its partners to cultivate this hope and help transform it into practical reality.

<sup>1</sup> Agence inter-établissements de recherche pour le développement: Inter-establishment agency for research and development.

<sup>2</sup> Agence d'évaluation de la recherche et de l'enseignement supérieur, a government agency.



Michel LAURENT > Chairman



# The IRD in a nutshell

The IRD is a French research institute which, working with Southern partners, addresses international development issues. The aims underpinning all its work are to improve health and public health, understand how societies are changing and protect the environment and natural resources, with a view to achieving the global Millennium Development Goals.

It is a public sector research establishment reporting to the French ministries responsible for research and for foreign affairs. Its work is international in scope,

the head office in Marseille and two mainland France research centres in Montpellier and Bondy acting as hubs.

Through partnership-based research, training and innovation it is present in more than fifty countries in Africa, the Mediterranean basin, Latin America and the French overseas territories. Its projects are jointly run with partners and are based on an interdisciplinary approach. They address questions vital for Southern countries, such as tropical diseases and diseases of

civilisation, the links between health and environment, climate change, water resources, food security, natural hazards, poverty, vulnerability and social inequality, migration and labour market trends.

AIRD, the French inter-establishment research agency for overseas development, is now an integral part of the IRD and is a powerful resource for mobilising research capacities. Its goal is to unite French research bodies and universities to act in partnership with the South.

## HIGHLIGHTS OF 2010



Natura Maxima exhibition.



Chile.



Fortaleza / Brazil.

**JANUARY** ●● Collaboration with countries in the Mediterranean basin is strengthened with the signing of agreements in Egypt, Jordan, Lebanon and Syria ●● For International Biodiversity Year the IRD initiates some thirty conferences and several exhibitions including *Natura Maxima*, presented more than twenty times in France and Latin America ●● **FEBRUARY** ●● IRD/AIRD mandated by the French higher education and research ministry to revive Haiti's higher education and research system ●● IRD joins AIIEnvi, the national alliance for environmental research ●● Haïti-Obs seismic survey: seafloor seismic stations deployed following the earthquake of 12 January ●● The Institute's strategic orientation committee submits its report ●● **MARCH-APRIL** ●● French post-earthquake mission to Chile: operation coordinated by the French-Chilean Montessus de Ballore seismology laboratory ●● Results of the expert panel review on energy and development in New Caledonia delivered in Nouméa ●● **MAY-JUNE** ●● Decree issued on the organisation and functioning of the IRD: Michel Laurent appointed Chairman and three new senior management divisions created ●● Framework agreements signed with the

# Key figures 2010

**€237.32 M** budget ●● **€26.3 M** revenue from contracts and spin-out products ●●

**2,220** staff including **843** researchers, **1,048** non-research staff and **329** local staff ●●

Almost **39%** of staff were working outside Metropolitan France, some **50%** of these in Africa and the Mediterranean basin ●●

**58** research units ●●

**1,640** scientific publications, i.e. about **2** articles signed per researcher per year ●●

**44%** signed jointly with Southern partners ●●

**172** fellowships awarded to Southern scientists, including **120** for theses ●●

**17** emerging IRD partner teams supported ●●

**96** patents held ●●



Inauguration of the CPRBI / Polynesia.



Lengguru expedition.



IRD award.

Vietnam Academy of Agricultural Science and Can Tho University ●● EU-Pacific Region science and technology cooperation strengthened with the PACE-Net project ●●  
 Pôle Eau, competitiveness cluster with a global remit, formed in Montpellier ●● **JULY-AUGUST** ●● Two CNRS silver medals awarded to researchers working at the IRD for their research on climate and infectious diseases ●● International conference on climate, sustainability and sustainable development in the semi-arid regions held in Fortaleza, Brazil ●● **SEPTEMBER** ●● Centre for research on island biodiversity (Centre polynésien de recherche et de valorisation de la biodiversité insulaire, CPRBI) opens in Tahiti ●● IRD assessment by AERES, the agency responsible for assessing research and higher education in France ●● First IRD awards: six prizes awarded for research innovation and commitment to Southern countries ●● Opening of the new plant sciences building at the IRD centre in Montpellier ●● **OCTOBER-NOVEMBER** ●● Lengguru-Kaimana expedition: exploration of biodiversity in West Papua ●● IRD and Cirad become partners in a new international rice research programme ●●



# AERES: positive assessment

●● The IRD was assessed by an international committee set up by AERES, the French evaluation agency for research and higher education. One of the main issues in this assessment was to identify channels for improvement to make the IRD, and research for development more broadly, more efficient. ●●

AERES is an independent administrative authority whose main task is to assess research institutes and units and validate their internal staff assessment procedures. Chaired by Gilles Bœuf, university professor and chairman of the Muséum national d'histoire naturelle, the committee was made up of experts recognised for their competence in areas of the IRD's work.

The report identifies as the Institute's chief strong point its *"original and indispensable position in the research world"*, combining basic and applied research in the service of development. It highlights the Institute's *"wealth of experienced human potential with a strong institutional identity"*. The committee stressed the scientific achievements that have earned the Institute *"undeniable international recognition"* and the vigour with which it works, with a steadily growing number of publications. Among the other strong points it notes *"openness to broad partnerships in France and abroad by creating open facilities and joint research structures"* and a *"growing interest in generating spin-off and introducing advanced tools and effective external communications"*. Its recommendations for improvement include the following: clearly define research goals and partners in the South, assess the impact of the Institute's work on development, monitor multidisciplinary, address the decline in expatriate numbers

and improve communication and dialogue between head office and the research units. On this point, the reorganisation of head office functions as from 1 January 2011 should allow the research departments to play a greater part in this task of facilitation, monitoring and consolidation.

As a preliminary phase to the renewal of the performance agreement with the government, this assessment will stimulate strategic thinking within the IRD. The Institute's ambition is to achieve effective coexistence between its research operator and inter-establishment agency components to serve one and the same mission: research for the development of countries in the South.

## ●● AERES' recommendations ●●

- Clarify the IRD's practical goals from the standpoint of the research capabilities and economic development of the partner countries;
- Define different collaboration strategies for the different types of "South": research capacity building in the less advanced countries, collaboration on topics of common interest with emerging countries, and specific strategies with Overseas France authorities;
- Fully mobilise information, collaboration and monitoring mechanisms, at all levels of the Institute and particularly in the research departments, particularly when elaborating, updating and implementing scientific strategy;
- Establish better linkages between the focus on priority research themes and the application of financial resources, and organise financial monitoring more effectively; in the joint research units, involve all the partners in this task;
- Strengthen IRD presence in the South with the help of suitable partner structures, particularly the international joint laboratories; continue the experiment with international joint units and other structures that could be tried out;
- Foster multidisciplinary approaches and inter-sector cooperation, particularly through pilot research programmes, involving the human and social sciences more at the project design phase;
- Define more precisely the position of AIRD, its medium- and long-term missions and its structure; seek out specific resources for its work and operating budget so that they are not a burden on IRD resources.



Soil study / South Africa.



# Ethics and quality: two principles for action

## Ethics at the heart of partnership

The consultative committee on professional conduct and ethics (CCDE) works to establish, implement and adjust the ethical and professional conduct rules for research work conducted by the IRD and its partners. Its purpose is to provide support on such issues for all staff working in research and research support.

In 2010 the CCDE conducted ethical and regulatory examinations of six research projects on health issues (e.g. malaria and mining hazards) and agriculture (e.g. GMOs). It also examined three business formation projects in climatology, agriculture and aquaculture. It was asked for advice on a number of subjects including scientific excellence awards and expatriation awards, employment of contract staff, participation in joint administrative commissions, conflicts of interest and researcher recruitment procedures. As allowed under Article 7 of the committee's founding decree, it examined on its own account the question of promoting traditional knowledge.

The committee continued working to develop an awareness raising module on the ethics of research for development. During a Science Week in the Provence-Alpes-Côte-d'Azur

region it talked to students preparing their entry to the *grandes écoles*. It also launched discussions about the notion of partnership and the sharing of risks and benefits.

## Advances in quality management

Research quality management began at the IRD in 2001 and since 2008 has advanced by leaps and bounds. It is applied to scientific work and support functions alike.

In France and abroad, laboratories and administrative entities starting the process receive training, awareness raising support and conceptual and practical assistance for setting up quality management and conducting audits. There is also a collaborative platform to facilitate networking, funding, certification etc.

At present, the IRD structures implementing quality management around the world include 15 laboratories (9 already ISO 9001 certified) and 17 administrative structures (4 already certified). In 2010 the Montpellier centre finalised certification of all its administrative and research support structures, while the Dakar centre had its certificate for human and financial resources management renewed. Four ISO 9001 certified laboratories in Senegal<sup>1</sup> improved the

planning and traceability of their work, introducing procedures for measurement and analysis of samples, demographic data monitoring and knowledge transfer to students.

As part of the reorganisation of the Institute's central services, quality control acquired an added dimension by incorporating the notions of environmental and social responsibility. The Quality and Sustainable Development mission was introduced in response to demand from the Institute's parent ministries and partners but also to meet its own in-house needs. In addition to the quality and traceability of its work, the IRD now explicitly takes an environmentally and socially responsible approach to its work.

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<sup>1</sup> Analytical resources laboratory (LAMA), joint microbiology laboratory (LCM), laboratory for microbial ecology of tropical soils and agrosystems (LEMSAT), laboratory of the emerging tropical and infectious diseases research unit (URMITE) in Dakar.

## ●● CCDE members ●●

**Chairman: Ali BENMAKHOULF**, doctor of philosophy, professor, University of Nice Sophia-Antipolis  
**Ahmadou Lamine NDIAYE**, veterinarian, honorary rector, Gaston Berger University, Senegal  
**Jean-Claude ANDRÉ**, director, Centre Européen pour la Recherche et la Formation Avancée en Calcul Scientifique, Toulouse  
**Roger GUEDJ**, professor, co-director of the organic chemistry laboratory, CNRS – University of Nice-Sophia Antipolis  
**Vladimir de SEMIR**, associate professor of scientific journalism, director of the Master's in scientific communication, Pompeu Fabra University, Barcelona  
**Sandrine CHIFFLET**, research manager, CAMELIA unit  
**Marie-Danielle DEMÉLAS**, historian, university professor, IRD representative in Bolivia  
**Bernard TAVERNE**, anthropologist, HIV/AIDS and associated diseases unit



TOXBOL survey / Bolivia.





INSTITUT DE RECHERCHE POUR LE DÉVELOPPEMENT

**€136.45** MILLION FOR RESEARCH,  
INCLUDING

**€111.55** MILLION  
FOR STAFF PAY





# Excellence in research

Science in the service of development

## Six research programmes

- ① Natural hazards and climate
- ② Sustainable management of Southern ecosystems
- ③ Water resources and access to water
- ④ Food security in the South
- ⑤ Public health and health policy
- ⑥ Development and globalisation



# Science in the service of development

●● For more than 65 years the IRD has been working to improve the living conditions of vulnerable populations and to foster self-reliance in Southern countries' scientific communities. Today, research for development is pursued through close North-South partnerships.

Societies, health, environment and resources are the three fields of study through which the IRD sets out to address the world's great development challenges. ●●

## Exploring and understanding the terrains of the South

From Sahelian desert, volcanic regions and seafloors to tropical rainforests, Andean glaciers and mega-cities, IRD researchers explore a host of physical environments and societies.

There are teams studying ongoing change in socio-ecological systems, the emergence of new pathologies and nutritional problems in different parts of the world. Others are investigating population movements and urban dynamics, for example changes in infrastructure, governance and spatial organisation of the great metropolises' outskirts. Cities, heritage recognition, identity issues and the fight against infectious diseases are among the development aspects crucial to the health and social sciences agenda. Across the world's oceans, every year IRD surveys monitor ecosystems and measure the physical-chemical parameters of the environment, pushing back the frontiers of knowledge a little further each time. A real-time ocean weather monitoring network has been set up with stations at a dozen key points of the tropical Atlantic. A programme tagging large fish in the high seas is part of the European MADE<sup>1</sup> project whose aim is to reduce the negative impact of fishery on marine ecosystems. On land, areas still unexplored are arousing huge interest among scientists.

## Cooperating for the South

In 2010 the Institute's research structures continued to develop, forging closer, fruitful links with universities and other research bodies. Now 95% of the Institute's research units are joint units (UMRs). As of 1 May 2011, the IRD had 58 units including three international units. The joint service unit FOF<sup>2</sup> was formed in 2010, in partnership with the CNRS, Ifremer and the French polar institute IPEV to implement the program plan and investment policy of the French oceanographic fleet.

As well as its involvement in joint research units, the IRD played a full part in the development of the French research landscape. It became a member of several research and higher education clusters. Already a partner in two research alliances – AVIESAN on life sciences and health and ANCRE on energy research – it took part in setting up the AllEnvi environmental research alliance. AllEnvi's mission is to improve synergy among research teams working on scientific issues connected with food, water, climate, ecology and land use planning. The IRD also takes part in the work of the ATHENA human and social sciences alliance.

<sup>1</sup> MADE: Mitigating ADverse Ecological impacts of open ocean fisheries.

<sup>2</sup> Flotte océanographique française.

## ●● Lengguru-Kaimana expedition 2010 ●●

The Lengguru-Kaimana expedition, involving some fifty French and Indonesian scientists, was co-organised by the IRD. In the north of Western Papua, this is one of the least-known parts of the world in terms of its biology, archaeology and geography. Five sites around the Lengguru range were studied to trace the geological history of the area, explain the diversification of its habitats and make a preliminary assessment of surface and underground biodiversity. From the preliminary inventory drawn up by the expedition's biologists, new species of fish including one cave-dwelling fish, insects, bats, crustaceans and gastropods were identified. The archaeologists and palaeontologists also discovered vast scope for research into the trade and migration routes of the ancient inhabitants. The 2010 Lengguru-Kaimana mission marks the start of a close collaboration between France and Indonesia to study karst environments. The scientific network now established intends to conduct major programmes focusing, for example, on the mechanisms that structure and regulate biodiversity in inter-tropical karst mountains.



Hydroecology / Morocco.

Under the 'future investments' programme run by the national research agency ANR, the IRD was involved in several joint project applications and is now a partner in three facilities (*équipements d'excellence*), 15 laboratories (*laboratoires d'excellence*) and one *institut hospitalo-universitaire* funded by the programme.

Partnerships launched in Metropolitan France on food security issues met with an international response. Montpellier hosted the first World Conference on agricultural research for development, and has now been chosen as home for the CGIAR<sup>3</sup>. The success of the French candidacy to house the CGIAR is the result of vigorous efforts by scientific bodies, the Montpellier agglomeration, the Languedoc-Roussillon regional authorities and the ministries concerned. The Fondation Agropolis International, of which the IRD is a founding member, was mandated to coordinate and promote Montpellier's candidacy.

One important collaboration was the IRD's decisive participation in setting up the Pôle Eau, a competitiveness cluster with global ambitions, working for better management of water resources and use in response to climate change. Contributing to the cluster will be the ILEE water and environment research institute in Montpellier, with nearly 750 scientists from twelve partner institutions including the IRD.

## Advancing knowledge through publications

The ever-growing number of publications is a reflection of the research teams' drive and energy. Articles published by IRD researchers rose by some 7% to 1,640, including 1,320 cited on *Web of Science* and nearly 320 other articles included in the *Horizon* human and social sciences database. Taking UMR members into account, output amounted to 3,000 articles. In human and social sciences, the number is rising constantly: over 400 articles, nearly 400 book chapters, 67 books written and 75 books edited.

At 44%, the proportion of co-publication with Southern institutions was slightly up on the previous year. The partner countries mainly concerned were Cameroon, Senegal, Brazil, Burkina Faso, South Africa, Thailand and Benin. The increase is particularly notable in West Africa, North Africa and Asia-Pacific.

Publication visibility was high: 62% of articles appeared in journals with a high impact in their field and more than 10% in top journals. Twelve articles were published in *Emerging Infectious Diseases*, 9 in *Clinical Infectious Diseases*, 8 in *Remote Sensing of Environment*, 6 in *Journal of Hydrology*, 5 in *PNAS*, 5 in *Plos Pathogens*, 4 in *Nature*, 4 in *The Lancet* and 3 in *Science*.

Joint and international research units accounted for 84% of publications, up from 70% in 2009 and 58% in 2008. On average, each researcher contributes to 2 publications a year and of the 771 researchers and non-research staff who published, nearly 14% signed more than 5 articles.

These are the ways in which the IRD works with the Souths to perform high-quality research centred on humankind and our relationship with the environment.

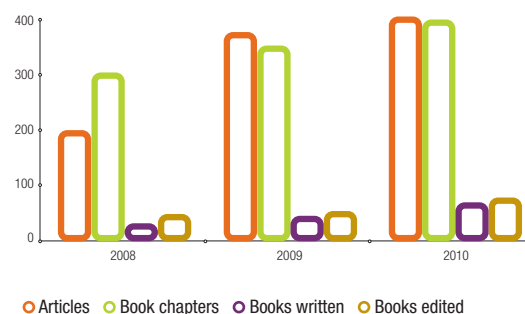
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[dic@ird.fr](mailto:dic@ird.fr)

Lengguru expedition / Papua New Guinea.

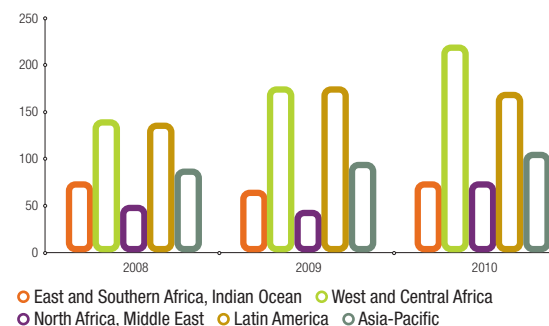
### PUBLICATIONS WITH AN IRD AUTHOR (WEB OF SCIENCE)



### HUMAN AND SOCIAL SCIENCES PUBLICATIONS (HORIZON DATABASE)



### CO-PUBLICATIONS BY MAJOR SOUTHERN REGION



<sup>3</sup> Consultative Group on International Agricultural Research.

# Natural hazards and climate

●● Extreme natural events such as earthquakes, tsunamis, volcanic eruptions and landslides happen in North and South alike. But in Southern countries, people and infrastructure are even more vulnerable to the often disastrous consequences. The study of these hazards and the attendant risks is therefore a priority issue for the IRD and its partners. By describing the phenomena, analysing the physical processes involved, monitoring and modelling, we improve capabilities for prediction, early warning and prevention. The work includes studying people's perceptions of risk, understanding societal vulnerability and analysing public policy on civil defence and crisis management.

Climate variability and the impact of climate change occupy a central place in scientific and political agendas. In order to describe and model these phenomena, remotely-sensed and *in situ* observation systems monitor atmospheric, oceanic and continental dynamics and their interactions in tropical regions. These approaches further our understanding of the processes at work and improve our ability to predict regional climatic variability, refine climate change scenarios and make clear the consequences at different scales ●●



Landslide / Bolivia.

<b>40</b> RESEARCHERS	<b>€5.4</b> MILLION	<b>97</b> ARTICLES
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# Seismic activity in the Andes

●● Earthquakes and volcanic eruptions regularly occur in the Andes, causing many victims and enormous damage. After the Pisco earthquake in Peru in 2007, a severe seismic event struck Chile in February 2010. Researchers from the IRD and its partners have for some years been studying the dynamics of this subduction zone where the Nazca oceanic plate is pushed beneath the South American continental plate, in order to more accurately estimate the likelihood of these earthquakes recurring, their location and magnitude. ●●

Earthquakes are complex phenomena that it is still impossible to predict. In the Pisco region, a French-Peruvian-US team<sup>1</sup> installed a network of GPS stations and characterised the entire seismic cycle, throwing new light on the dynamics of the faults and the physical mechanisms at work. Although the timing of earthquakes cannot be predicted, this progress makes it possible to say where future major events will occur and what their magnitude will be. On the social science side, an in-depth survey was carried out with Peruvian colleagues and an Italian NGO in one of the most affected areas. This research showed the great vulnerability of disadvantaged communities, who are hit hardest by the destruction of their homes and also find it most difficult to get involved in the rebuilding work.

In Chile, IRD researchers and their Chilean and German colleagues carried out a series of observations for a month following the earthquake and reconstituted a map of ground level uplift and subsidence along the coast, revealing a fracture zone some 500 kilometres long. This research suggests that the earthquake released a major part of the energy stored in the South American western plate for nearly 170 years. Build-up and release of stress are the characteristics of the seismic cycle, whose timing is provided by historical observations. As the stress was released, the plate was pushed up at the side, lifting the coastal zone by up to 2.5 metres and causing the coastline to advance up to 500 metres in places. Inland, the plate subsided, lowering the ground level by nearly a metre. This catastrophic earthquake appears to have released a major part of the energy built up in this segment of the Chilean subduction zone. This may explain why there have not to date been any strong aftershocks, which is rare for events of this magnitude.

In Chile as in Pisco, the main movement zones may correspond to places where the plates are stuck, a phenomenon that seems to recur from one event to the next. This observation suggests that it may be possible to identify zones with high

seismic potential, as opposed to zones where the plates glide smoothly with no risk of earthquakes.



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●● **Publication** : *Science*

## PARTNER

### Department of Geology of the University of Chile

The department works on natural hazards, precious metal resources, geothermics and Andean tectonics. In the last twenty years, close cooperation has developed with the IRD on topics of common interest, and twelve doctoral degrees in geosciences have been awarded.

Geological, geophysical and geomorphological research is carried out under the joint programme *Geodynamics and tectonics of the Andean chain*.

<sup>1</sup> Under an agreement between the Instituto Geofísico del Perú (IGP) and the IRD.



Taking geodesic measurements / Chile.



Subduction / Chile.

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## PARTNER

**CPTEC-INPE - Centre for Weather Forecast and Climate Studies at the National Institute for Space Research** in Brazil, has been in existence for ten years. Its mission is to make and broadcast weather forecasts and to model atmospheric phenomena by analysing the satellite data it produces. Its research covers numerous topics including surface hydrology, soil science and vegetation-atmosphere interactions. Its work with the IRD concerns climate change, its consequences for the environment and human health, and adaptation strategies for agriculture, rural development, hydroelectric power production, river transport and management of water resources and wetlands. Some of this research is conducted under European projects: CLARIS, CLARIS-LPB and more recently DEEPER. For the latter, CPTEC-INPE is coordinating Brazil's participation.

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# Climate and public health: dengue fever

●● Because of its impact on vector insect populations, climate plays an important role in the spread of diseases like dengue fever. Every year, dengue affects 100 million people and causes 25,000 deaths, mainly in tropical and subtropical regions. So gaining a more thorough knowledge of the climate factors that affect the arbovirus<sup>1</sup> is important for many Southern countries. To achieve this the IRD and its partners in Brazil<sup>2</sup> and the South Pacific<sup>3</sup> launched a multidisciplinary programme. ●●

The four dengue viruses have spread in the past decade and are now found in over 100 tropical and subtropical countries. They are among the viruses most frequently transmitted to humans by arthropods. The geographical distribution of the disease reflects that of its main vector, the *Aedes aegypti* mosquito. In the absence of a vaccine, vector control is the only real way to combat dengue. To understand how climate acts on the spread of the disease, the IRD and a number of partners joined forces to produce an index of climate risk that can be used operationally by the countries concerned.

Starting from observation, the researchers collected and assessed entomological data and homogenised country data on dengue epidemics over time, to establish a usable scorecard. By epidemiological modelling based on the laws governing the insect's growth and the development of the virus inside it in relation to surface temperature, relative humidity and precipitation, it proved possible to estimate the density of infectious female mosquitoes, i.e. those capable of transmitting the disease. Then, taking relations between humans and the vector into account with an index commonly used in epidemiology, the epidemic risk was mapped using current and estimated future climate data. The results show that the conditions with a large number of days early in the year when temperatures are above 32°C and relative humidity is over 95% favour the development of the disease.

By 2100, areas with these conditions could spread northward and southward beyond the currently identified geographical range. In countries already affected by dengue the risk could increase, as the model indicates a more rapid circulation of the virus.

While the results open the way to a better overall knowledge of the impact of climate, it remains to be shown whether this kind of model can also be used to analyse the seasonal and interannual dynamics of the disease at a regional level. In the long run, with a better understanding of the influences of phenomena like El Niño and the Southern Oscillation on countries of the Southwest Pacific, it should be possible to introduce effective preventive measures.

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●● **Publication** : *Climatic Change*

<sup>1</sup> Arbovirus: viral disease transmitted by an arthropod.  
<sup>2</sup> Federal University of Rio Grande do Norte (Natal-RN), Federal University of Campina Grande and Paraíba State University (Campina Grande-PB), National Meteorology Institute (São Paulo), National Space Research Institute (Cachoeira Paulista-SP).  
<sup>3</sup> CNRS, Météo France, Institut Louis Malardé, Institut Pasteur in New Caledonia, University of New Caledonia, New Caledonia Department of Health and Social Welfare.



Dengue risk areas.



Harvesting mosquitoes / Bolivia.

# Sustainable management of Southern ecosystems

●● Southern populations and societies rely on tropical aquatic and land ecosystems for most of their resources and subsistence. But these richly diverse ecosystems, some of which have yet to be described, are under severe pressure from human activity. This, combined with climate change, is causing environmental degradation.

Studying biodiversity, agrosystems and marine, coastal and continental aquatic ecosystems in the tropical zone, IRD scientists and their partners are developing approaches to maintain the viability of biotopes and their uses. In doing so they provide answers to major global challenges in emblematic fields ranging from coral reefs and aquaculture to tropical rainforests, desertification, land use and drought resistance in plants. They also add to scientific knowledge by taking part in biodiversity inventories and encourage sustainable ecosystem management – for example by recommending changes in behaviour or practice and the use of protected areas as a conservation measure ●●



<b>122</b> RESEARCHERS	<b>€22.4</b> MILLION	<b>261</b> ARTICLES
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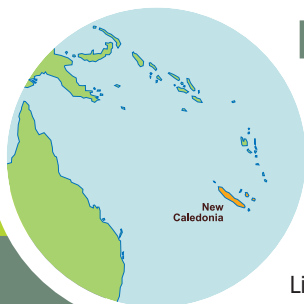


# Protecting New Caledonia's lagoons

## PARTNER

The missions of New Caledonia's **Direction de l'environnement, Province Sud** include acquiring knowledge about coastal, reef and lagoon environments, protecting these ecosystems, managing the Unesco World Heritage Site dossier and publicising the Province's work towards protecting the marine environment. Since 2006, the Sea department, in charge of these activities, has used the expertise of the IRD scientists to introduce a responsible management system for these ecosystems. The researchers also play a part in actions to raise user awareness of the ecological value of the mangroves, coral reef biodiversity, etc.

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●● New Caledonia possesses the world's second largest coral reef lagoon, which Unesco added to its World Heritage List in 2008. The island itself possesses a unique and diverse ecosystem but also one of the world's largest reserves of nickel. Nickel mining during the 20th century tripled the rate of sedimentation on the lagoon floors in some places. To understand the functioning of the lagoons and protect them, scientists from the IRD and its partners<sup>1</sup> ran an ambitious ten-year multidisciplinary research programme under the National Coastal Environment Programme (PNEC). ●●

As with most island environments, cultural and economic ties to the sea are strong in New Caledonia. The richness of its marine ecosystems is of great interest to scientists, who have been amassing knowledge of its coral reefs for fifty years now. The Caledonian strand of PNEC ran from 1999 to 2007, taking an innovative multidisciplinary approach. The aim of the research was to improve knowledge of the structure and functioning of New Caledonia's lagoons and assess the impact of human activities. The topics covered included the physical-chemical composition of the water and marine

sediments, the currents responsible for dispersing input from the land, ciguatera, marine habitats, fauna and flora, and the effects of metal contaminants on living things. For example, scientists tracked the sedimentary history of the lagoon by a series of measurements on the particles that accumulate on the lagoon floor. Apart from the influence of extreme weather such as cyclones and tropical downpours, this research has shown the important role played by the hydrodynamic system – i.e. all the mechanisms involved in the movement of water masses including currents, swell, tides and turbulence – in the distribution and fate of soil particles and metals washed from the land. An atlas of currents and maps of residence time in the lagoon waters were produced, tools that can be used in developing integrated management of the zone. Other results define avenues for further research, under GOPS<sup>2</sup> particularly, on the effects of atmospheric phenomena on ocean circulation in the open sea offshore.

These findings will be of use to specialists on other lagoon areas of the world's oceans as well as researchers and students doing further work on New Caledonia's lagoons. Beyond the scientific prospects, these investigations have kindled an awareness among political decision-makers and

mine operators. The industry is now setting up a number of measures to limit soil erosion and pollution of the lagoon, such as less destructive mining methods, retention basins to hold effluents and revegetation of degraded areas. The big challenge for local stakeholders is to reconcile development goals based on mining, which is the island's leading economic activity, with protection of this unique place, a gem of marine biodiversity.

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<sup>1</sup> This work was conducted mainly by teams from the IRD, CNRS, Ifremer, the EPHE (École pratique des hautes études, Perpignan), and universities in New Caledonia, Metropolitan and overseas France and elsewhere, under the National Coastal Environment Programme (PNEC). It also enjoyed the support of the New Caledonian ZoNéCo Programme.

<sup>2</sup> Leading monitoring centre for land and marine environment and biodiversity in the South Pacific.



Lagoon / New Caledonia.



Marine biodiversity / New Caledonia.

# Agrarian transition in Indonesia

●● The rubber agroforests on the island of Sumatra, Indonesia, are exceptionally biodiverse ecosystems. These domesticated forests rich in commercially useful species are a source of diversified income for farmers and usually combine subsistence resources and cash crops. Since the 1990s, rubber and oil palm monocropping have been replacing the agroforests at an unprecedented rate. IRD researchers and their partners studied the functioning and evolution of the agroforests. ●●

Until the late 19th century, the island of Sumatra was almost entirely forested. The first use of the forest was for hunting and gathering, later combined with swidden farming and upland rice. With the industrial revolution in Europe and North America came high demand for natural rubber. Sumatra's farmers responded to the opportunity by planting rubber seedlings among the rice in their swiddens; the rubber agroforest came into being.

The agroforests continued to expand until the 1990s, when they began to decline as single-species rubber and palm oil plantations took their place. To encourage sustainable management of these new 'landscape mosaics', IRD researchers

and their partners joined forces under a project financed by the Swiss Agency for Development and Cooperation and conducted jointly with CIFOR<sup>1</sup> and ICRAF<sup>2</sup> in five Asian and African countries. The aim was to make a socio-economic and biophysical assessment of the agroforests and study possible ways to pay for the environmental services they provide. During four years of work the researchers compared the landscape combinations and designed an online tool for studying complex landscapes.

In Indonesia, the researchers found that there is no social pressure to maintain the agroforests. Farmers, government and industry, all the players in the Indonesian farm sector want to expand single-species plantations, of oil palm especially. The reason is that plantations provide much higher incomes than rice farming or agroforests. In addition, oil palm requires little labour and has a shorter production cycle than rubber. Sentimental or cultural attachment to the less profitable agroforestry systems is a luxury that local people cannot afford. And yet the agroforests have many advantages. They not only bring security against economic crises by diversifying farm incomes, they can also act as a buffer zone around the national parks. To promote a sustainable agrarian transition

that will benefit Indonesia's people, the researchers have been exploring systems of payment for environmental services and other ways to make biodiversity profitable.



## PARTNER

### CIFOR, Centre for International Forest Research

Formed in 1993, CIFOR is an international research body based in Bogor, Indonesia. Its aim is to work for the conservation of tropical forests and the improvement of local living conditions. It is one of the fifteen institutes that make up the CGIAR, a global consortium of centres working in agricultural research for development. Its research and expertise aid decision making in tropical forest management in Asia, Africa and Latin America. IRD researchers have been working at CIFOR for the past fifteen years, on topics of common interest. An IRD researcher directed one of CIFOR's three major programmes between 2009 and 2011.

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<sup>1</sup> Centre for International Forestry Research.

<sup>2</sup> World Agroforestry Centre.



Oil palms / Indonesia.



Harvesting rubber / Indonesia.

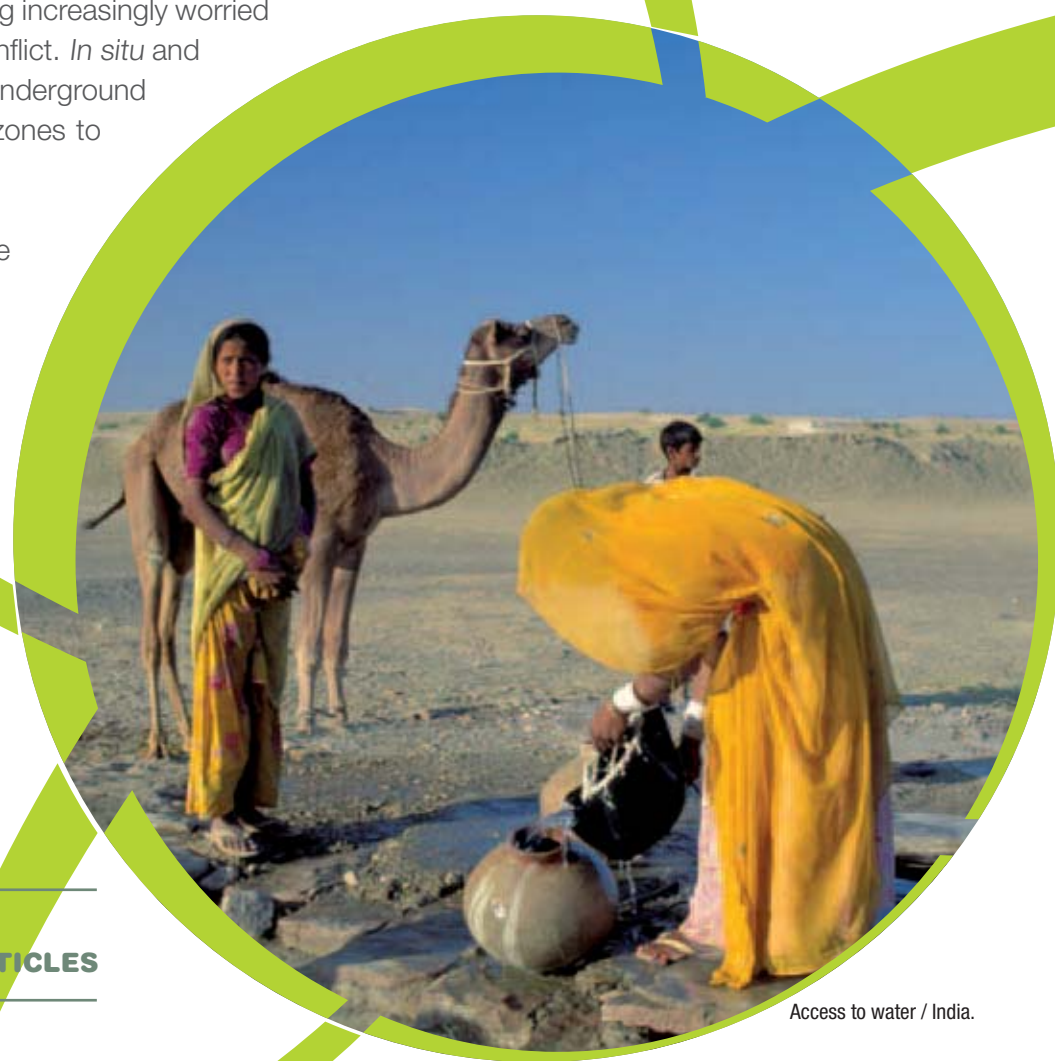
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# Water resources and access to water

●● Access to and the sharing of water resources are fundamental issues in Southern countries. Around the world, 2.6 billion people have no access to clean water. Climate change is creating increasing scarcity and competition for water for domestic and agricultural use. Societies are becoming increasingly worried about the future of these resources and their accessibility; this can lead to conflict. *In situ* and space-based observation systems are being used to monitor surface and underground hydrologic dynamics in a number of areas ranging from Sahelian-Sudanian zones to tropical glaciers.

Armed with quantitative and qualitative resource assessments, adequate modelling and a better understanding of the processes and mechanisms at work it becomes possible to propose water resource management systems at catchment and hydrosystem level. Incorporated in public policy these proposals lead to management methods that are more sustainable, more equitable and therefore more socially acceptable ●●



Access to water / India.

<b>141</b> RESEARCHERS	<b>€26.3</b> MILLION	<b>247</b> ARTICLES
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# Snow and water management in Morocco

●● Snow is a major water resource for the mountainous countries around the Mediterranean. The High Atlas in Morocco receives most of the country's precipitation, much of it as snow, and acts as a reservoir for the flat farmlands below. As precipitation has dwindled, this resource is now under threat from higher consumption. Monitoring snow cover with the use of satellite imagery is now of crucial importance in providing decision-making tools for local water managers. ●●

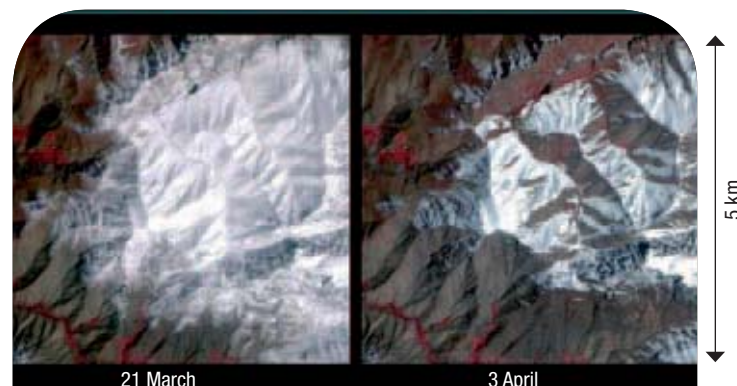
In the Tensift region, west of the High Atlas mountains, pressure from agricultural and socio-economic development requires rational water use rules and better seasonal forecasting. To that end, since 2002 a major cooperative project has involved research and higher education bodies<sup>1</sup>, the Tensift basin agency (ABHT) and the Haouz Regional Agricultural Development Office. The partners run the SudMed programme for integrated agricultural water management. Using imagery from the Spot-Vegetation satellite, the scientists mapped the snow-covered areas of the mountain range. They analysed spatial and temporal variations in snow cover in the High Atlas

from 1998 to 2005, discovering wide fluctuations from year to year<sup>2</sup> in snow cover area and duration and the number of snowfall and snowmelt episodes during winter. These variations directly impact streamflow in the wadis and the availability of water in the dry season. To supplement these general observations, the research team also uses higher-resolution (10 m) images. These new data appear to offer encouraging scientific prospects for refining the monitoring of snow cover dynamics. The challenges facing water managers are all the greater since climate change threatens a reduction in total precipitation, especially snow, which is a reserve stored during the winter and available during low streamflow periods in summer.

The Tensift plain is typical of water management problems in the arid and semi-arid zones around the Mediterranean. Researchers are currently extending their work to the north and east of the Mediterranean in order to use satellite remote sensing to monitor variations in snowmelt and their connections with river basin dynamics.



Atlas mountains / Morocco.



Snow melt in the Atlas mountains/ Morocco.



## PARTNER

**Georesources laboratory,  
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The laboratory carries out research intended to contribute to the sustainable, integrated management of natural resources in arid and semi-arid environments. It aims in particular to set up multidisciplinary research into water resources in the Tensift/Al Haouz region and to transfer the results for use in management tools and decision-making aids. Together with the CESBIO unit in Toulouse it formed CREMAS, an emerging IRD partner team, with a major research area in mountain hydrology and snowcover monitoring: rainfall/flow modelling, erosion measurement, characterisation of aquifers. This partnership also involves joint supervision of doctoral students on these topics.

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<sup>1</sup> Cadi Ayyad University Marrakesh (UCAM) and the French CESBIO joint research unit (CNES-CNRS-IRD-UPS).

<sup>2</sup> The work was done as part of Abdelghani Boudhar's doctoral thesis "Remote sensing of snow cover areas and modelling the contribution of snowmelt to streamflow in the wadis of the High Atlas in Morocco" - Cadi Ayyad University Marrakesh, faculty of science and technology.

# Water, agriculture and poverty in West Africa



## PARTNER

**The Volta Basin Authority<sup>1</sup>** covers six countries: Benin, Burkina Faso, Côte d'Ivoire, Ghana, Mali and Togo. This coordinating structure was set up in 2007 after being gradually developed since 2004 to manage water at river basin level. The VBA meets regularly to consult about the planning of resource use, and a monitoring system manages and connects hydrological databases. The multidisciplinary work and the literature produced by the basin project are providing useful knowledge to improve people's living conditions.

<sup>1</sup> A similar structure exists for the Niger river basin, the Niger Basin Authority.

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•• Crop water is poorly productive in the Sahel: one cubic metre of water produces only one-tenth as much grain as in France's prime wheat region, the Beauce. As part of the Challenge Programme on Water and Food, international research has been launched in the major river basins. ••

Multidisciplinary analysis of the relationship between water, farm production and poverty has been carried out for each river basin. The surveys on the Volta and Niger basins were coordinated by IRD researchers. The two basins have similar climatic conditions and food crops are basically rainfed: in the northernmost areas grain can only be grown during the rainy season. The rest of the year, farmers are forced to seek seasonal work elsewhere and the land is left unfarmed. An initial factor for improvement is accurate forecasting of rainfall at the start of the season in order to plant the crops. Mapping of the agro-climatic zones reveals considerable spatial variability in rainfall, with a clear aridity gradient from south to north. In

the Volta basin, rainfall variation depends on the seasonal shift of the Intertropical Convergence Zone between the warm, wet south-westerly monsoon and the harmattan, the extremely dry Saharan wind from the north-east. The researchers made several recommendations including rainwater collection systems that reduce evaporation loss in areas where nearly 90% of the precipitation returns to the atmosphere. Small dams can be used to develop local irrigation, share the water resource more fairly and introduce off-season crops. Analysis of the volumes and uses of water (draw-off for direct consumption, hydro-electric generation, etc.) contributes to a comprehensive understanding of the operation of these river basins. In addition to technical solutions, it is also essential that the water resource should be managed by proactive policies and regional consultation between countries.

The efficiency of public policies depends heavily on socio-economic factors, and consequently the region's position on the development gradient from predominantly farming to transitional to predominantly industry. For the Volta and Niger

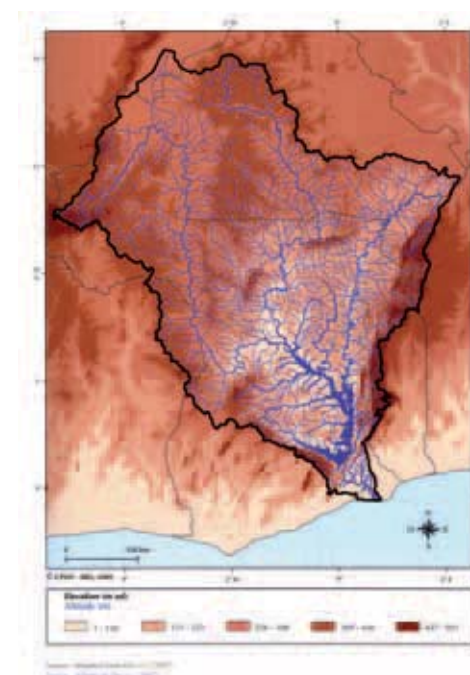
basins, which are mainly at the farming stage, the role of local authorities outweighs that of national or river basin authorities. At the transition and industrial stages, the authorities cover wider areas and may play a major role in preventing the emergence of pockets of poverty, correcting inequalities between social groups and preserving the environment.

By 2050, the major challenge will be to supply quality domestic water and develop farming practices that can meet the needs of a population which may have doubled or tripled by then. Prevention of water-borne diseases is also a development issue.

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•• **Publication :** Water International



Market gardening / Burkina Faso.





# Food security in the South

●● Food security is still a major obstacle to development over huge areas, in Africa particularly, while world prospects for agricultural and fishery resources seem to be deteriorating. Tensions over prices, competition from energy crops, purchase of land in poorer countries and overfishing are especially problematic as they are coupled with sustained population growth.

To address these challenges, research focuses on improving yields while maintaining soil fertility. To this end, better scientific knowledge of plant biology and physiology can speed up plant breeding and identify those plants best suited to particular soils and climates. Innovative pest control projects complement this approach.

Eliminating hunger and malnutrition in its various forms will require integrated management of natural resources and fisheries; the sciences involved here are the environmental and social sciences. In Sahelian regions, vulnerability to food shortage is still a major problem. Researchers work to identify the most vulnerable populations, identify the policies and social mechanisms underpinning this vulnerability and assist players such as NGOs and policy makers. Only this way can government food security policies match real needs and be properly sustainable ●●



Granaries / Burkina Faso.

<b>147</b> RESEARCHERS	<b>€26</b> MILLION	<b>238</b> ARTICLES
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## PARTNER

**CIAT, Centro Internacional de Agricultura Tropical**, is one of the fifteen international institutes that make up the CGIAR. It is based in Cali, Colombia, where it works on a large number of tropical plants of value for Latin America and Africa. Since 1995, its cooperation with the IRD has involved the permanent presence of IRD researchers at CIAT, working on fields such as cassava bacteriosis, fertility of tropical soils and the genetics and functional genomics of rice. The rice research now comes under the GRISP programme, which aims to harmonise research globally, bringing together international research institutes (IRRI<sup>3</sup>, AfricaRice, CIAT) with a large number of institutions in the global South and some in the North (IRD and Cirad in France, JIRCAS<sup>4</sup> in Japan).

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# Improving rice-farming in Africa

●● Food security in the global South depends largely on growing varieties that are adapted to their environment against a backdrop of climate change. Cross-breeding with wild species or traditional varieties can produce plants that stand up better to drought, salty soil, disease and insect pests. To help improve rice varieties in Africa, IRD researchers thought of building genetic bridges between two species of cultivated rice. The project is an international cooperation effort supported by the Generation Challenge Programme of the Consultative Group on International Agricultural Research (CGIAR). ●●

The Africa rice species *Oryza glaberrima* is particularly resistant to water stress and pathogens. It was crossed with *O. sativa*, the Asian-origin rice species most widely grown in the world, to create the New Rice for Africa (NERICA) cultivars. NERICA cultivars have been distributed by AfricaRice<sup>1</sup> since the early 2000s after years of selection to overcome the sterility caused by interbreeding. To address this problem the

iBridges (interspecific Bridges) project was launched with CGIAR support. Research by the IRD targeted the *S<sup>1</sup>* gene, previously identified as a key determining factor in this sterility, and it was mapped in detail in partnership with CIAT. Using the work done in sequencing the genomes of all rice species (OMAP project, Tucson, Arizona), the researchers decrypted a chromosomal fragment of some million bases around the *S<sup>1</sup>* gene in *O. glaberrima*. All these results have led to the design of a genetic model that explains the sterility of interbred descendants and opens the way to research into the genes involved. From analysis of these genomic sequences, markers have been developed and will be used to facilitate genetic selection. Being able to identify the rare fertile individuals eliminates the many stages previously required for interspecific breeding. These advances mark the way towards varietal creation making greater use of African rice cultivars' natural biodiversity. They are the fruit of close cooperation since 2005 between CIAT, AfricaRice and African national agronomic research bodies such as the Institut d'économie rurale in Mali and the Institut de l'environnement et des recherches agricoles in Burkina Faso. The iBridges project is continuing as part of GRISP<sup>2</sup>, a

new CGIAR programme launched in Hanoi in November 2010, in which the IRD will be supervising certain research fields such as interspecific breeding.

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<sup>1</sup> Africa Rice Center (<http://www.africaricecenter.org>).

<sup>2</sup> Global Rice Science Partnership.

<sup>3</sup> International Rice Research Institute.

<sup>4</sup> Japan International Research Center for Agricultural Sciences.



Planting rice / Mali.



Rice genetics.

# Impact of Peru's anchovy industry

●● Anchovy fishing in Peru uses the largest national industrial fleet in the world that targets a single species of fish. It harvests an average of six million tonnes a year. These anchovies are used almost exclusively for fishmeal and oil. Although there is a small-scale fleet able to supply local markets, only one per cent of total catch goes to direct human consumption. In a country where malnutrition affects a quarter of the population, this is a paradox that has been studied by IRD researchers and their Peruvian partners. ●●

Fishmeal and fish oil are used mainly in animal feed. In energy terms, this long processing chain, which also requires major goods transport, is less efficient than direct fish consumption in providing proteins and fatty acids. Because its catch rate is extremely high, however, Peru's anchovy industry is remarkably efficient in energy use and low environmental impact (greenhouse gas emissions, acidification, etc.). The question remains of how far this advantage compensates for the length of the production process.

A new research programme into the environmental and socio-economic impacts of the anchovy industry in Peru was launched in 2009 by the IRD and IMARPE, along with a large number of other partners from universities, companies and voluntary associations. The aim of the programme is to quantify and compare long and short industrial processes from one end of the chain to the other. Initial economic analysis reveals the greater profit available from the fishmeal-oil process, stimulated by growing demand from the fish farm sector. This trend is supported by current overcapacity in the processing factories. Concerning the environment, a comparative study of the industrial processes, using life-cycle analysis, shows that the consumption of fossil energy is by far the greatest impact, followed by the use of antifouling paint and metal in equipment construction. These initial results have already led the scientists to encourage the use of more environment-friendly practices: replacement of heavy diesel oil in processing factories by natural gas, use of low-copper and low-tin paint, reduction of liquid and solid discharge at sea, etc.

Forthcoming studies will examine the two ends of the chains: energy flows in the ecosystem for various exploitation scenarios and the impact of fish farms. Ultimately, all the production chains will be modelled in order to propose public policy choices for sustainable development. The methodology developed could be transferred to other sea- or land-based products.



## PARTNER

**IMARPE - Instituto del mar del Perú** - has the mission of studying the marine environment and its biodiversity, assessing its resources and providing information and recommendations for decisions concerning fisheries, fish farming and the protection of the marine environment in order to actively contribute to Peru's development.

The institute reports to the fisheries sector of the Ministry of Production and has for many years been working intensively with the IRD to assess and manage the stocks harvested on the basis of ecological and physical oceanographic studies. Data representation and analysis tools and models have been jointly developed. An international conference was jointly organised in 2006 and a Master's in sea sciences was launched in 2010 with support from the International Joint Laboratory (LMI) Dynamics of the Humboldt Current System (DISCOH).

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Fishery / Peru.



Anchovy / Peru.

# Public health and health policy

●● Improving the health of mothers and children and combating the world's main infectious diseases are three of the eight Millennium Development Goals. They are also the core of the IRD's health research work.

AIDS, malaria and tuberculosis and particularly their perinatal transmission have major repercussions for the development of Southern countries. Poverty also favours neglected diseases such as leishmaniasis, Chagas disease, trypanosomiasis and onchocerciasis. 'Diseases of civilisation' such as cancer, heart disease and diabetes, predominant in Northern countries, now also account for an increasing proportion of illness in developing countries. The risk of emerging pandemics, viral pandemics especially, in the intertropical zone has created a need for epidemiological monitoring and diagnostic resources.

Against this background IRD researchers work in partnership with their Southern counterparts, taking a multidisciplinary approach and monitoring disease, developing suitable, effective diagnostic tools and treatments and seeking ways to combat or indeed eradicate some diseases. The success of these projects depends on close collaboration with the human sciences and also an ecosystem approach to health, proposing viable approaches that are properly applicable in local situations ●●



AIDS prevention / Togo.

<b>151</b> RESEARCHERS	<b>€28.7</b> MILLION	<b>465</b> ARTICLES
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# Nutritional deficiency in Vietnam

●● Vietnam is an emerging country facing a double burden of malnutrition: overweight is a growing problem, while micronutrient deficiencies and delayed growth still persist. Prevention in this area is the responsibility of the National Institute of Nutrition (NIN) in Hanoi, with which the IRD has been working for over ten years. ●●

Most of the joint research is in assessing the impact of measures taken with high-risk population groups, i.e. women of reproductive age, unweaned infants and young children. Most of these measures involve providing food supplements and micronutrient-enriched foods. The main aim of the work is to define appropriate long-term strategies for a situation where most people have very limited resources.

One of the most recent research findings is that in some cases the food supplement dosages recommended by international organisations are too high and can cause undesirable side effects. In a study among young women, the researchers showed that intermittent preventive supplementation for a few months before and during pregnancy, with smaller amounts of iron and folic acid, has a better impact on mother and

infant health than the current practice of high doses during pregnancy. This research contributed to the recent WHO recommendation on preventive treatments for women of reproductive age.

Other studies assessed the impact of micronutrient enrichment of foods intended for the population as a whole (*nuoc mam*) or for specific groups such as small children and schoolchildren. These operations have significantly improved the nutritional status of the target populations and have shown that in Vietnam, several micronutrients other than iron are involved in anaemia. These results suggest that nutrition operations should be re-thought. Another study assessed the efficacy of breast milk supplements produced in Vietnam under the Fasevie project involving the National Institute of Nutrition, Hanoi medical school, the IRD and GRET<sup>1</sup>; it showed that regularly consuming these supplements protects infants from iron deficiency and reduces the prevalence of delayed growth.

The research has led to new international funding for district- and province-wide operations. Ongoing work in Vietnam and Cambodia is examining unresolved questions such as

the ineffectiveness of vitamin A supplementation in breast-feeding women, the role of vitamin A in the absorption of iron, and micronutrient enrichment of rice. The question of the interaction between micronutrient deficiency and chronic, non-transmissible diseases such as obesity is an important research topic for the future.

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<sup>1</sup> Groupe de recherche et d'échanges technologiques, a professional solidarity and international cooperation association.



## PARTNER

**The National Institute of Nutrition in Hanoi** is a Vietnamese public body reporting to the Ministry of Health. Its missions are nutrition monitoring and research. It is responsible for ensuring public health and it evaluates the nutritional and functional properties of foods. The Institute also runs public awareness campaigns to combat mother-and-infant malnutrition and micronutrient deficiency. The partnership with the IRD began in 1995 and has strengthened over the years. It involves joint research and joint supervision of French and Vietnamese doctoral and Master's students.

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Making noodles / Vietnam.



Feeding Infants / Vietnam.

## PARTNER

### Institut de recherches médicales et d'études des plantes médicinales du Cameroun (IMPM)

The virology laboratory at the IMPM, fruit of a partnership with the IRD and CREMER (Cameroon's centre for research into emerging and re-emerging diseases), coordinates all work connected with research on primates and the risk of emergence of new infectious disease in Cameroon. The laboratory, located at the Ministry of Research, is accredited by the WHO for monitoring resistance to anti-viral drugs. Since 1994 the research teams have been conducting collaborative projects in clinical research, assessing the first generic AIDS treatments, and on anthroponosis risk. The discovery of an HIV-1 reservoir in apes was a result of this work.

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## Malaria came from gorillas

●● Malaria is the most widespread parasite disease on Earth. It affects 250 to 500 million people each year and kills more than a million, usually young children and 90% of them in Africa. Although much progress in treatment and prevention has been made in recent decades, an international consortium of researchers<sup>1</sup> including a team from the IRD and the University of Montpellier, has just shown for the first time that the gorilla, greatest of the great apes, is an animal reservoir for the disease transmitted to humans by *Anopheles* mosquitoes. ●●

The gorilla was the original source of human infection by *Plasmodium falciparum*, the parasite responsible for the most common form of malaria. This discovery refutes the findings of earlier studies which also suggested a simian origin but in the chimpanzee or the bonobo. Researchers from the CNRS and IRD<sup>2</sup> had recently detected *P. falciparum* in gorillas, but the origin of the infection remained to be clarified. The scientists have just shown the almost perfect genetic match between the parasites found in gorillas and those that infect humans. Using

the single genome amplification technique they identified and characterised DNA sequences of the parasite found in faecal samples from wild animals. This extremely precise method also allowed them to prove that the parasite jumped species from gorillas to humans and not the reverse.

Another discovery with important implications for public health is that gorillas are still an animal reservoir for the disease. The research team analysed over 2,700 faecal samples from wild chimpanzees and gorillas collected at 57 sites in sub-Saharan Central Africa, from Cameroon through the Central African Republic to the Democratic Republic of Congo. Using this non-invasive method developed ten years ago by the IRD team and their partners at the University of Alabama, the researchers were able to bring together large amounts of genetic material without disturbing this protected species. The analysis results were unexpected: infection with *Plasmodium* is widespread among Western gorillas (*Gorilla gorilla*), with prevalence rates of 32 to 48% and in some communities over half of individuals being carriers. These results do not tell us whether the parasite causes an illness in gorillas, like malaria in humans, but carrier animals could constitute a pool of infection for contaminating

humans. The work poses a new challenge for the fight against malaria. Given that contacts between humans and gorillas are increasingly common in Central Africa owing to large-scale deforestation and the resulting population movements, the existence of a *Plasmodium falciparum* reservoir among gorillas suggests that it will be even more difficult to eradicate the disease.

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●● **Publication :** *Nature*

<sup>1</sup> This work was conducted in collaboration with research teams from the University of Alabama in the United States, the Sanger Institute Malaria Programme in the UK and the Cameroon AIDS prevention project.

<sup>2</sup> Prugnolle *et al.* 2010 African great apes are natural hosts of multiple related malaria species, including *Plasmodium falciparum* of the *National Academy of Sciences of the United States of America*, 2010, 107 (4), *Proceedings*: 1458-1463.



*Anopheles* mosquito.



Gorilla / Cameroon.

# Development and globalisation

●● Much of the IRD's human and social sciences research focuses on the many facets of urban and rural development in the South against the background of globalisation and climate change. Several teams are examining current and future changes in socio-ecological systems in North Africa, sub-Saharan Africa and Asia; others are looking at population movements, focusing for example on changes on the outskirts of major metropolises in terms of infrastructure, governance and spatial configuration. Other studies concern the determinants and consequences of migration for societies and their environments, and the resulting reshaping of territories and identities.

Based on regional-scale comparative studies, this research is arousing increasing interest because it fosters communication between different actors in society. The great priority issues addressed are development and governance; vulnerability, inequality and growth; poverty reduction; borders and social and spatial dynamics. These broad themes are well illustrated by the work on decentralisation, migration, public policy, religiosity and generating income and employment from local heritage ●●

<b>176</b> RESEARCHERS	<b>€27.6</b> MILLION	<b>570</b> ARTICLES AND BOOKS
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Primary school / Vietnam.





## Biodiversity and cultural heritage in Brazil

### PARTNER

**IPHAN, Instituto do Patrimônio Histórico e Artístico Nacional**, is an institute under the Brazilian Ministry of Culture. In 2009, which was the Year of France in Brazil, it signed a cooperation agreement with the IRD to develop joint actions to preserve traditional farming systems and strengthen the ties between research and its development applications. France and Brazil possess complementary experience in promoting locally produced goods. While France has focused more on protected geographical indications, Brazil has more experience on the cultural heritage side and has laws on access to biodiversity and the associated traditional knowledge. One output of this collaboration was a jointly organised French-Brazilian seminar on cultural heritage and farming systems, held in Brasília in 2009.

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●● The protection of plant genetic resources was long thought of in terms of conservation, mainly in off-site seed banks. Only recently has more attention been paid to the traditional farming systems that maintain a considerable proportion of the world's agricultural biodiversity. With climate change and globalisation under way, a better understanding of the ecological and sociological underpinnings of these systems is now essential. Ways are needed to ensure that the processes of innovation and experiment through which man-made biodiversity is constructed can continue. Finding such ways was the goal of research by the IRD and its partners in the Rio Negro region of Brazil. ●●

Brazil has broken new ground in this regard. It has set up a national register of intangible heritage which opens avenues for generating income and employment from the biological resources and significant knowledge connected with traditional farming systems. In November 2010 IPHAN, Brazil's national institute of artistic and historic heritage, added the traditional farming system of the Rio Negro in central Amazonia to its list.

Since 2000, 21 cultural goods have been listed but this was the first such registration to specifically refer to the notion of a system, and the first to concern a good that is both biological and cultural.

This registration is the result of synergy between scientific research, public policy and local communities. The work was part of the Pacta programme<sup>1</sup> in which the IRD is a partner along with Unicamp<sup>2</sup>, environmental NGO Instituto Socioambiental (ISA), IPHAN and three Amerindian associations, the Association of Indigenous Communities of the Mid Rio Negro, the Federation of Indigenous Organisations of the Rio Negro and the Indigenous Association of Barcelos. The findings on the farming system concern local knowledge and practices relating to spatial management, crop diversity (especially the many varieties of bitter cassava), dietary heritage and the material culture (mainly wicker and basketwork) that is inseparably tied to the production and use of the crops. The research helped to achieve recognition of this collective good. While registration on this list does not provide legal protection, it does entail the application of conservation and valorisation measures defined by common agreement between IPHAN and

the local communities as represented by their associations. The issue at stake is to keep alive a heritage shared by twenty ethnic groups living along the Rio Negro and its tributaries. The instrument is in line with agreements drawn up by Unesco in 2003 and 2005. It provides a way to preserve agricultural biodiversity taking into account the interdependence and dynamics of biological, ecological, sociocultural and economic factors.

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●● **Publication** : *Symposium Innovation and sustainable development in agriculture and food*

<sup>1</sup> *Populations, agrobiodiversité et connaissances traditionnelles associées* (populations, biodiversity and associated traditional knowledge).

<sup>2</sup> Universidade estadual de Campinas.



Rio Negro / Brazil.



Preparing cassava / Brazil.

# Urban fringes: coveted territories

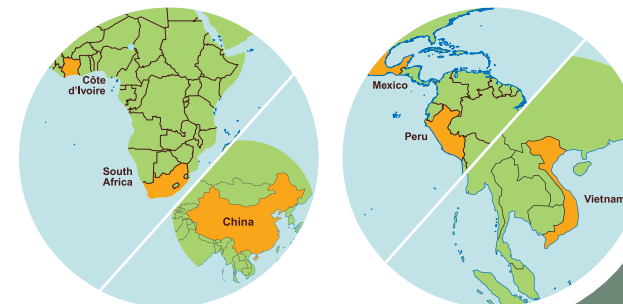
●● In the South, the urban fringes where the two worlds of city and countryside meet have undergone profound changes in recent decades. With the explosive growth of the big cities and their changing role within globalisation there has been acute competition for land on city outskirts. By comparing the dynamics of this process in major agglomerations in Africa, Asia and Latin America, researchers have achieved a better understanding of these singular places and shed light on the vital role of public policy in their planning and management. ●●

Scientific approaches to change in these areas have themselves greatly changed. In the 1960s and '70s city outskirts were often viewed as simple extensions of the city or rural areas in process of being absorbed, with no identity of their own. This changed during the 1980s: the idea of an either-or division between town and country gave way to a conception of these marginal areas as singular, dynamic spaces in their own right. As large cities became metropolises and their role in globalisation developed, researchers began to consider the concepts of fragmentation and increasing segregation.

The Perisud<sup>1</sup> research programme concerns Abidjan, Cape Town, Hanoi, Lima, Mexico City and Shanghai – six

agglomerations very different from each other in terms of geography, economics and politics. Analysis of recent dynamics in their urban fringes shows that even where urban growth has slowed, they are still growing fast owing to redistribution of the population within the agglomeration, while the city centre populations are growing more slowly or shrinking. The urban fringes are used and partly recreated by mixed populations: alongside the lower socio-economic classes are the middle-class and rich, in neighbouring areas but with better infrastructure. In some cases surviving rural activities receive a fresh boost from the urban market nearby and improved transport facilities. Competition for space is ever more acute in these urban fringes and can give rise to conflict between different groups – as in Abidjan, for example, between property developers or individual purchasers and the traditional authorities.

In this situation the role played by national and local government policy can be crucial. The Cape Town authorities, for example, have opted for property development and are conserving green spaces and improving the living environment. In China and Vietnam, the State is very much present and still imposes zoning and strict land use regulations. In Abidjan, Lima and Mexico City, policy makers do little to control the extent and



pattern of urban expansion. There is one point in common however: inadequate governance fosters political and administrative centralisation and the emergence of conflicts of competence between the different decision bodies concerned.

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 ●● **Publications :** *Atlas de Mexico*, Paris, Éditions  
 Autrement / *Les métropoles des Suds vues de leurs*  
*périphéries*, Grafigéo

<sup>1</sup> Several institutions are involved in the project: Facultad Latinoamericana de Ciencias Sociales (Mexico); Universidad Nacional Mayor de San Marcos in Lima (Peru); Vietnam Academy of Agricultural Sciences in Hanoi (Vietnam); East China Normal University, Shanghai (China); University of Fort Hare (South Africa); University of Abidjan-Cocody (Côte d'Ivoire).



Urbanisation / Shanghai.



Bogotá / Colombia.

## PARTNER

**Universidad Nacional Mayor de San Marcos, Lima,** founded in the 16th century, is a public university with over 30,000 students. It holds an important place in Peru's university system. The geography school at San Marcos University has been working in partnership with the IRD for many years. Between 2005 and 2008, a joint research programme was conducted on land reform and territorial dynamics. The collaboration has been extended, with a master's course in geography and regional development partly funded by PREFALC, the regional cooperation programme currently financed by the French Ministry of Higher Education and Research and the IRD. Six students on the master's course are taking part in the Perisud work, which gives them the benefit of hands-on research training.

## Contact ●●

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# AIRD: Inter-establishment agency for research for development

AIRD: mobilising research energies  
Capacity-building support for Southern  
scientific communities  
Innovating with the South  
Sharing knowledge



# AIRD: mobilising research energies

●● After four years in operation, research development agency AIRD (Agence inter-établissements de recherche pour le développement)<sup>1</sup> was officially created by decree as a component of the IRD. Its new status puts it in a stronger position for its mission of coordinating French scientific research in the South, with the South and for the South. It now constitutes a senior management division within the IRD. Its North/South steering committee includes its founding members and the IRD's parent ministries. ●●

## Supporting the Haitian university system

Following the Haitian earthquake on 12 January 2010, AIRD was mandated by its parent ministries MESR<sup>2</sup> and MAEE<sup>3</sup> to coordinate the work of the French scientific establishments to help relaunch the country's higher education and research system. French-Haitian academic encounters concluded with the Paris Declaration, fixing a framework for the reconstruction of the Haitian university system. Three steps were taken:

nearly 450 Haitian students were accommodated in French universities, an online distance learning plan was set up with AUF<sup>4</sup>, and research topics matching Haiti's priority needs were identified. To manage the various actions, AIRD relied on a team of four people and the logistic and administrative resources of the IRD, which also granted a starting loan of €300,000, in addition to the MAEE funding, to support the launch phase. The aim is to expand priority Master's courses, joint diplomas, hosting of fellowship students in France and strengthening of emerging research teams. In the long run a website should function as a monitoring post featuring all the work achieved in Haiti. AIRD was also involved in the steering committee for the Flash Haiti call for proposals launched by national research agency ANR<sup>5</sup>, under which eight projects were selected.

<sup>1</sup> Founder members: Cirad, CNRS, CPU, Inserm, Institut Pasteur, IRD.

<sup>2</sup> Ministry of Higher Education and Research.

<sup>3</sup> Ministry of Foreign and European Affairs.

<sup>4</sup> Agence Universitaire de la Francophonie.

<sup>5</sup> Agence Nationale de la Recherche.



SUD EXPERT PLANTES programme / Madagascar.



Earthquake / Haiti.



Students / Haiti.



## Piloting programmes on priority research issues

AIRD plays a steering role in research, training and innovation programmes in the South on issues of climate change, resource management, environmental protection, health and the human and social sciences, always with a view to sustainable development.

AIRD is the managing agency for six programmes under the MAEE's Priority Solidarity Fund (FSP) for 2007-2011, for a total of €15.8 million.

For example, since 2007 RIPIECSA, with an additional €400,000 from the IRD, has been supporting 25 multidisciplinary projects on climate change and its consequences for West Africa. The MAEE's assessment highlighted the progress made in terms of knowledge acquisition and capacity building in the South. A call for articles was issued in partnership with the IDRC<sup>6</sup> and the AMMA programme, to improve the visibility

of the climate research conducted by African scientists. In the field of tropical plant biodiversity the SUD EXPERT PLANTES programme achieved remarkable results in terms of training, consultancy and biodiversity conservation in Africa, Asia and the Indian Ocean. There was greater participation by Southern countries in major international events including the Nagoya biodiversity summit in October. The agency is also supporting 32 research teams in the Priority Solidarity Zone through the AIRES-SUD programme, and 50 South-North research and capacity-building projects under CORUS2. The agency is also funding a Master's in Water and Development and a Centre of Excellence in water science and technology in Ethiopia under FSP support for the University of Addis-Ababa. The FSP MALI CONTEMPORAIN programme is helping to fund six human and social sciences programmes in Mali on subjects including heritage recognition and religious memory strategies, and local governance.

AIRD and the ANR have jointly provided €2 million for the 2008-2011 period to fund projects involving Southern teams

under the programmes SYSTERRA (agricultural research), MIE (emerging infectious diseases) and Les Suds Aujourd'hui (social science).

In partnership with the Hewlett Foundation and the AFD<sup>7</sup>, AIRD is piloting the DEMENTREND programme for the study of population trends in Sub-Saharan Africa and their consequences for health and the economy. The Memorandum of Understanding between the three partners released €2.4 million including €650,000 from the IRD.

As the MESR's appointed managing agency, AIRD also currently funds health research and training in liaison with the CRVOI centre for emerging diseases research and monitoring in the Indian Ocean<sup>8</sup>.

<sup>6</sup> International Development Research Centre, a Canadian Crown corporation.

<sup>7</sup> Agence française de développement.

<sup>8</sup> Centre de Recherche et de Veille sanitaire sur les maladies émergentes dans l'Océan Indien.

<sup>9</sup> GBIF: [www.gbif.org](http://www.gbif.org)



Large family / Guinea Conakry.

## ●● SUD EXPERT PLANTES: enhancing knowledge of plant biodiversity in the South ●●

In 2007 the French Ministry of Foreign and European Affairs launched the FSP Sud Expert Plantes programme, to support the efforts of many developing countries to explore, protect and sustainably utilise their plant biodiversity. This five-year North-South joint development programme produced some fifty projects in 22 countries of Africa, Asia and the Indian Ocean.

Examples of progress in research and networking activity in this field were the launch of the Global Biodiversity Information Facility<sup>9</sup>, the creation of an international Master's in plant biodiversity (BEVT-BVT) and the holding of an international conference on flora in Indochina.

To effectively transfer research results and consolidate the procedures, IRD and its partners have started discussions on the programme's future – a new stage that would be an integral part of the United Nations' Global Strategy for plant conservation.

[www.sud-expert-plantes.ird.fr](http://www.sud-expert-plantes.ird.fr)



Endemic plant / Australia.



## Galvanising partners for the South

The first call for proposals issued under the partnership with the Conférence des Présidents d'Université (CPU) led to 44 project proposals by 31 universities. Sixteen were selected and now have the benefit of AIRD's cooperation instruments: hosting facilities, fellowships, Emerging IRD Partner Teams, long-term missions, etc. A second call for proposals was issued with a view to intensifying synergy between research and training in North and South, particularly by hosting researcher-lecturers being posted outside Metropolitan France.

The agency has harnessed the energies of Cirad and the IRD to initiate and mediate thinking towards new programmes in agroforestry and protected areas.

One high point of AIRD's year was the launch of a call for proposals with the Egyptian Science and Technology Development Fund, designed to support collaboration between French and Egyptian research teams working on environment, technology for water, agriculture and food, health and life sciences, space-based technologies, and human and social sciences.

A joint fund of €5.4 million will be used to provide five years' funding for research work, high-level skill-based professorships and scientific exchange fellowships for researchers of both countries.

Its energies renewed by confirmation of its status, AIRD is now an operational instrument for bringing energies together and promoting research, consultancy and capacity building. It is closely focused on making an impact in the South through value-added output and the transfer to society of its programmes' research results.

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Irrigation / Egypt.



Mosque / Mali.



# Training, innovating, sharing

**172** FELLOWSHIPS TO SCIENTISTS  
FROM SOUTHERN COUNTRIES

**96** PATENTS  
HELD

**OVER 100** EXHIBITION PRESENTATIONS IN  
FRANCE AND ABROAD

# Capacity-building support for Southern scientific communities

●● Scientific capacity building is vital for development and is one of the IRD's priority missions. This means supporting doctoral students' training and in-service training for partners, assisting recently-formed research teams and helping to structure research and teaching systems in the Souths. ●●

## Commitment to hands-on research training

Doctoral thesis supervision and teaching provision for Master's courses contribute to the gradual establishment of recognised, self-reliant scientific communities. Several training streams in health and environment resulted in active North-South collaboration. In Benin, a Master's in physical oceanography and another in medical and veterinarian entomology<sup>1</sup> have been embedded for several years now in the training offering at Abomey Calavi University. IRD social science teams also teach in partner universities such as San Marcos University in Lima and the Pontificia Universidad Católica del Ecuador in Quito. As a result of collaboration with the universities of Yaoundé in Cameroon, and Montpellier 1 in France, an inter-university diploma on care of persons living with HIV is now available to health professionals. In Vietnam, under a broad French-Vietnamese partnership, the IRD took part in setting up the University of Science and Technology of Hanoi.

## Supporting teams and individual projects

Individual training fellowships were granted to 172 research workers from Southern countries, including 120 for thesis projects. The assessment of the doctoral fellowships programme revealed its excellent results in terms of professional integration and publications in reference journals: over 90% of former grantees were working in research, teaching and/or consultancy, mostly in Southern countries. Among the year's new collaborations was a project for scientific exchanges among volcanologists, which drew partial funding from the Chilean National Commission for Science and Technology.

Under the *Emerging IRD Partner Teams* programme, the Institute has for several years now been supporting emerging researchers to help structure the teams and their scientific output and help them achieve international recognition. Twelve new teams were selected in 2010, bringing the current

<sup>1</sup> MIE, international medical and veterinary entomology Master's, included in the offerings of Abomey-Calavi and Montpellier 2 universities.

## ●● Ten years of support for Southern doctoral students ●●

Every year the IRD grants some forty thesis fellowships for Southern doctoral students. Proposals are called for and projects are selected on the basis of their scientific quality, partnership dynamics and likely impact in terms of research capacity building for the South. The past ten years of this individual empowerment programme were assessed in 2010. Of over 450 fellows, 79% had submitted their theses. An analysis of the subsequent careers of 155 of them showed that more than three-quarters were still working in research or higher education. The programme's success is due to the rigorous selection of projects, the principle of students working alternately in their home country and in France and/or another Southern country, and the supervision skills of the IRD teams in the field.

The quality of the scientific output generated by the programme was assessed in terms of citation of former fellows on *Web of Science*. Over the five years following the end of the funding, each new PhD had published an average of 3 articles. At 10 per publication, the average citation index shows that these researchers' work is having an impact. Another encouraging finding was that more than half the emerging researchers were publishing independently, with Southern institutions.



Entomology training / Burkina Faso.



total to 17. The network so created organises theme-based workshops: one of these, on human and social sciences and health, brought together 11 teams from Africa, Latin America and Asia in Bamako. As well as discussing research themes and qualitative survey techniques, the workshop proposed methods and tools for fund-raising, scientific and technical information and team management.

The programme of *Joint professorships* was set up to encourage initiatives by confirmed scientists. It provides support for projects involving one North-based and one South-based researcher for combined research and teaching at Master's and doctoral level or income-generating actions. In 2010 the IRD was supporting six joint professorships, including two new ones in Vietnam and Peru.

### Nurturing the development of teaching streams

Another lever for capacity building is to support teaching streams and help to structure the research space. Strengthening the IRD's close established links with partners, the *Structuring theme-based actions* programme helps to

fund short-term training in the South: eleven theme-based schools were run, including one on methodological and theoretical approaches to racism and another on gemmology in Kenya. In partnership with eight West African institutions, the IRD coordinates Gval, a European initiative designed to boost management capabilities for research programs on food security. A Gval workshop for trainers, on project design and fund-raising, was held in Niger. Support was also provided for distance learning projects such as the regional Master's in plant biotechnology involving seven universities in West Africa, two in the South of France and the Bondy digital campus. A training course in analytical methodology for the social sciences, set up with the Agence française de développement, was delivered in Vietnam. Assistance for the PREFALC networking programme to set up Master's degrees in the Latin America/Caribbean region was renewed, as was the agreement with the International Foundation for Science for organising joint workshops on scientific project design.

Theme-based workshops were also jointly organised with several institutions in West and East Africa and the Mediterranean under the French programmes *CORUS*

(research cooperation) and *AIRES-Sud* (empowering Southern research teams). These encounters actively nourished regional exchanges in many fields including post-harvest systems; technology applications and quality of African food resources; restoration, conservation and optimum use of plant biodiversity in Africa; and territorial diversity and policy decentralisation.

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Emerging partner teams workshop / Mali.

### ●●RISA: an energetic new team working on insecticide resistance, health and agriculture ●●

Following a thesis funded by the IRD, the emerging research team RISA (Résistance Insecticide Santé Agriculture) was formed in 2009. It unites regional efforts to assess the impact of pesticide use in Africa on insecticide resistance in the malaria vector *Anopheles gambiae* and the plant pests *Bemisia tabaci* and *Plutella xylostella*. Research is conducted in Benin, Burkina Faso and Togo. The aim, at a time when food resources are strained, is to introduce crop protection programme management strategies that will limit the ecotoxicological risks connected with large-scale pesticide use.

On the strength of its own energies and some support from the Mivegec unit (Infectious diseases and vectors: ecology, genetics, evolution and control), the team, now with five members, is working towards full self-reliance.

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Plant biology / Montpellier.

# Innovating with the South

●● The IRD aims to ensure that its research teams' skills, knowledge and research results are put to practical use in the service of development. In 2010 its consultancy missions and many collaborations with the socio-economic world generated over €3.776 million in revenues. ●●

## Expertise and consulting

The findings of the expert panel review on energy and development in New Caledonia were delivered in Nouméa before the two commissioning authorities, the government of New Caledonia and ADEME<sup>1</sup>. The panel's recommendations were presented to the various government departments concerned, the three Province authorities, public and private operators and non-profit associations. This was the eleventh expert panel review the IRD has coordinated.

Ten institutional consultancy contracts were signed with governmental organizations, public authorities and development agencies for work of interest to Southern countries.

The IRD signed the national Charter on scientific and technical consultancy.

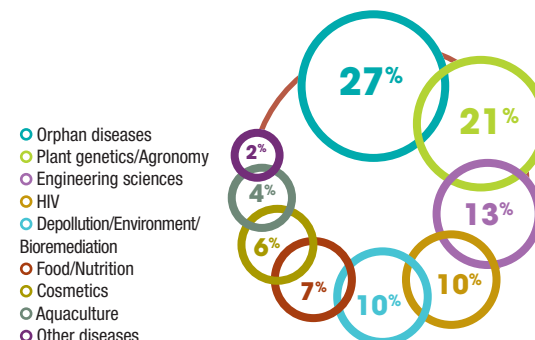
## Intellectual property and technology transfer

The efforts made in recent years to give greater protection to research findings and to increase innovative technology transfer, systematically involving Southern partners and stakeholders, has begun to bear fruit.

Fifteen priority patent applications were filed for in 2010. The IRD now has some hundred active patents. Special attention is now paid to Southern partners' contributions: over 40% of applications were filed jointly, bringing the percentage of co-owned patents in the IRD's total portfolio to 25%.

<sup>1</sup> Agence de l'environnement et de la maîtrise de l'énergie.

## PATENTS BY RESEARCH FIELD



## ●● Expert panel review on energy in New Caledonia ●●

An expert panel review was conducted on energy-related issues in the New Caledonia territories. The New Caledonian government had commissioned the review as it was preparing to finalise its strategic development plan for the period to 2025. The panel of experts examined the many aspects of the energy question, analysing them from the standpoint of climate-related issues and the need to reduce greenhouse gas emissions. Among the recommendations made were the creation of a permanent, autonomous structure for training, research, technology watch and consulting services in New Caledonia. The main purpose of this structure would be to capitalise on the experiments conducted in the region in underground CO<sub>2</sub> storage and adaption to climate change. It was suggested that the GOPS monitoring unit on South Pacific marine and land environments and biodiversity might play a supporting role.



Plumpy'nut® / Burkina Faso.

Transfer of technology, software and technical knowledge was consolidated, with 34 active patent license agreements bringing in €463,000 of income. Among the new license agreements signed in 2010 was one to develop an underwater video camera. The IRD and the company Nutriset decided to open the patents protecting Plumpy'Nut, the flagship product now widely used to treat severe malnutrition around the world, to as wide a use as possible. Henceforth, any company established in a Southern country covered by the patent can produce and market similar products. To date, more than 4.5 million children have been treated with Plumpy'Nut.

To stimulate the technology transfer process the IRD initiated meetings with business professionals and took part in a dozen international events including one-day French-Vietnamese technology conferences, the first technology forum in Cameroon and Pollutech in Morocco. IRD inventions now feature in more than 40 technology offerings and commercial brochures as well as the websites of OSEO-Techno and France Transfert Technologie.



Jean-Loup Lemesre receives the Innovation Sud award.

## Bringing projects to maturity

Twenty-three projects received funding to consolidate technology and validate market potential of ideas, products, processes or know-how developed by IRD research teams or researchers with a view to income generation. Nearly €250,000 were granted for additional research and the human and material resources needed to bring the projects to maturity.

## Business start-ups

The IRD continued its practical encouragement for the creation of innovative enterprises to make use of technologies and technical knowledge for Southern markets. There are now 7 companies in business that emerged from IRD laboratories and more than ten projects in the pipeline. AEL in New Caledonia, for example, is a company performing physical-chemical analyses to monitor the environmental impacts of mining, to meet growing demand from local authorities.

## Business partnerships

The IRD fosters responsible partnership with industries working in or with the South. Income from business contracts totalled more than €3 million in 2010. More than fifty concern scientific service provision, research collaboration, consortium agreements and framework agreements, covering all the Institute's research fields. The IRD is involved in nine "French competitive clusters" and in several collaborative R&D projects funded by the national research agency ANR and the Fonds unique interministériel.

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<sup>2</sup> Grand Observatoire de l'environnement et de la biodiversité terrestre et marine du Pacifique sud.



Aquaculture / Indonesia.

## ●● PACEIM: supporting innovation in the Mediterranean ●●

PACEIM, a programme to support innovative company creation in the Mediterranean, aims to mobilise the French-trained, French-based scientific and technological diasporas of South Mediterranean countries. It was set up in collaboration with Marseille Innovation business incubator and North African public institutions concerned with innovation. PACEIM's goal is to assist the creation of over 100 companies. In 2010, 28 project promoters selected from among some 50 candidates took part in the first PACEIM event, in Montpellier, before senior officials from the research and industry ministries of the North African countries. Six of the 28 entrepreneurs were granted business trips to their country of origin and personalised assistance to bring their projects to fruition.





# Sharing knowledge

●● Disseminating knowledge and delivering research results to stakeholders in Southern countries constitute a major strand of the IRD's work. The task here is to stimulate dialogue between science and society at large and encourage the sharing of constantly enhanced scientific information. ●●

The IRD also promotes scientific culture in France and in the South through a wide range of activities. As 2010 was International Biodiversity Year, the Institute produced several exhibitions on the theme: *Natura Maxima* (a photographic exhibition presented more than twenty times in France and Latin America), *Biodiversité Mon Trésor* in partnership with natural history museums in the southeast of France and *Biodiversity is life. Biodiversity is our life* with Unesco. More than thirty conferences on the theme were held. Other itinerant exhibitions were highly successful, with more than 100 presentations in France and abroad. Over 300 other events, science festivals, lectures and science cafés gave IRD researchers opportunities to share their knowledge.

With fewer and fewer young people opting for science studies, several youth-focused awareness-raising events were held. Thanks to *S@ntéjeunes*, financed by the Fonds Francophone des Inforoutes, 25 science clubs were set up in Mali, Burkina Faso, Cameroon, Senegal, Tunisia, Morocco and France on the topics of health and the new technologies. The clubs brought in 400 young people, mentored by 20 teachers and researchers. The IRD, Ifremer and CNES set up the programme *De l'Espace pour la Mer* (Space for the Sea) for 30 youth groups in

southeast France, with lectures attended by a total of over 1,200 high school students. The IRD was awarded a Diderot trophy from AMCSTI, the French association of museums and centres for scientific, technological and industrial culture.

The IRD facilitates delivery and sharing of scientific knowledge through a system of systematic collection and monitoring of publications<sup>1</sup> spun off from the Institute's research work. The resulting document base, with over 72,000 documents, can be accessed online at *Horizon / Pleins textes* (<http://www.documentation.ird.fr/>). In 2010, hits on this service increased from 4,500 a day to 7,500, more than half of these coming from Southern web surfers. Some 10,000 e-documents were downloaded daily.

<sup>1</sup> For more information see the annual report on bibliometric indicators.



Youth science club / Cameroon.



*Natura Maxima* at the Muséum d'Histoire Naturelle / Paris.



On the training side, new actions were undertaken to help new researchers, particularly Southern researchers, publish in high-quality scientific journals. At the FAO's request, the IRD is planning to adapt for French-speakers fifteen distance training modules. Examples concern e-libraries, open archives and information access rights.

The IRD's mapping work serves three purposes: researcher support (FAUNAFRI<sup>2</sup>, the IRD's reference geographical data server); map products such as the atlas of tropical tuna fishery resources in the Indian Ocean; and geomatics training provision (94 people trained). The *Sphaera* map library, with more than 18,000 references, can be accessed online; it received some 3,500 hits a month in 2010.

Three thousand photographs were added to the IRD's image collection, taking the total in the *Indigo* image base to 46,000.

At the Bondy centre, with support from the Ile-de-France Regional Council, a major project, *NUMERISUD*, is under way to digitise the IRD's audiovisual, cartographic and documentary heritage and make the data as widely available as possible.

The IRD supported over sixty symposiums in 2010. Subjects included climate (in Fortaleza, Brazil), water (in Fez, Morocco), malaria (in Cotonou, Benin) and the French oceanographic fleet (in Marseille).

Film-making and book publication are also effective ways to disseminate research results. Several documentary films were produced in 2010 including *La Tentation de Potosi*. Among the films broadcast on television were the series *La Science, c'est l'Aventure* on TV channel France 2. Several films won awards and the shooting of *Lengguru*, about the expedition in Western Papua, looks particularly promising.

Two of the books published, *Natura Maxima* by Olivier Dangles and François Nowicki and *Des sols et des hommes* by Alain Ruellan are intended for general readers. Five others were summaries of scientific programmes, including *La Grande Muraille verte*, *Parcours de recherche à Madagascar* and *Gestion durable des eaux et des sols au Maroc*. To improve distribution through bookshops, an agreement was signed with the Eyrolles/Géodif distribution group.

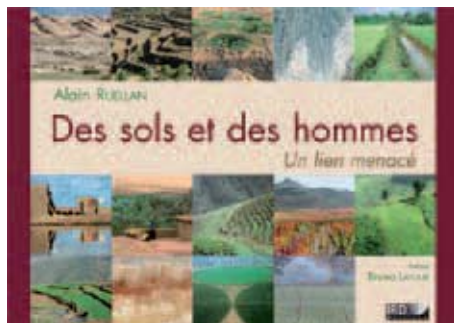
The IRD enjoyed a high profile in the media, with some 2,000 articles in the press including some forty in the leading daily *Le Monde*. Twenty-nine press releases and 27 scientific news sheets about major research advances were issued. Other means of outreach to the general public are the IRD newspaper *Sciences au Sud*, with a print run of 75,000 and summaries in English and Spanish, and the Institute's website, which received 4.6 million hits in 2010. The redesigning of IRD local structures' websites continued with those of Benin, Tunisia and the Montpellier centre.

To reward research for development in the Souths, the IRD launched a first round of IRD awards. *Recherche-Sud*, *Innovation-Sud* and *Laurence Vergne* prizes were awarded to six researchers working in medicine, ecology and microbiology applied to agriculture. With this first prize-giving the IRD highlights the importance of innovation and knowledge transmission for countries that have made science and technology an essential lever for their development.

•• Contact : [dic@ird.fr](mailto:dic@ird.fr)



Science festival / New Caledonia.



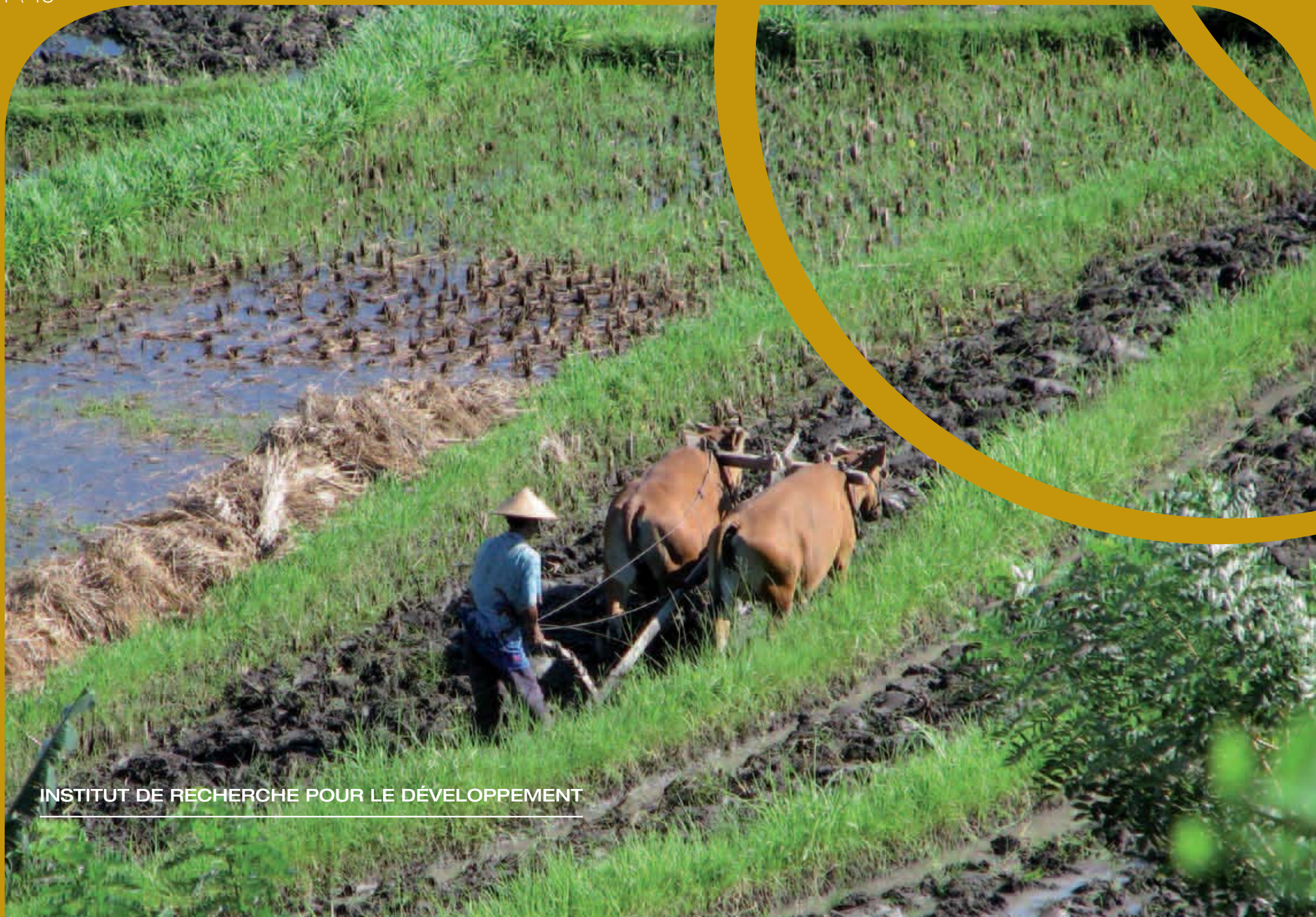
IRD Tunisia website.



Faunafri software.

<sup>2</sup> Internet portal for freshwater fish monitoring in Africa.





INSTITUT DE RECHERCHE POUR LE DÉVELOPPEMENT





# Working in partnership

## Partnerships around the world

○ International   ○ Overseas France



## MEDITERRANEAN

- **Framework agreements** signed in Egypt, Jordan, Lebanon and Syria and with the Arab Center for the Study of Arid Zones and Dry Lands
- **Launch** of a programme with the Egyptian Science and Technology Development Fund
- **Joint organisation** with CEDEJ (CNRS) of symposium on "Gender, cities and local governance in the Arab world and the Mediterranean region" in Cairo, Egypt
- **Round table** on legislative policy in Arab and Muslim countries, Cairo
- **Signing** of five research and training agreements with Lebanese academic and scientific institutions
- **Establishment** of a science and technology monitoring unit in Lebanon in collaboration with the National Council for Scientific Research, Lebanon
- **International workshop** on migration in the eastern Mediterranean, in Beirut
- **Start** of SudMed programme in Syria and Lebanon, on the functioning of hydro-systems in semi-arid regions
- **International workshop** on water in irrigated areas, at Al-Baath University, Homs, Syria
- **Joint organisation** with AUF (Agence universitaire de la francophonie) of a conference on remote sensing, climate change and environment in Monastir, Tunisia
- **Conference** of French-speaking countries on HIV/AIDS in Casablanca, Morocco
- **FRIEND** conference on water resources, Fez, Morocco
- **Symposium** on mycorrhizal symbiosis and Mediterranean ecosystems, Marrakesh, Morocco.

3 representations

63 staff • 23 individual fellowships awarded • 3 emerging IRD partner teams supported

## LATIN AMERICA AND CARIBBEAN

- **Post-earthquake** missions to Haiti and Chile
- **Creation** of two international joint laboratories for the study and promotion of Andean and Amazonian flora (LAVI) and on the Humboldt current system (DISCOH), Peru
- **In Brazil:** international conference on climate, sustainability and sustainable development in the semi-arid regions, in Fortaleza; symposium on Latin American diasporas, in São Paulo; symposium on the isotope geology of South America, in Brasilia
- **Delivery** of the results of the TOXBOL programme on metal pollution in the Andes, Bolivia
- **Workshop** on the variability of El Niño and climate change in South America, in Guayaquil, Ecuador
- **Symposium** on priority sites for the conservation of biodiversity in the Bolivian Amazon, in Santa Cruz, Bolivia
- **International workshop** on the western Amazon basin with special focus on biodiversity, in Iquitos, Peru

6 emerging IRD partner teams supported

8 representations

194 staff • 42 individual fellowships awarded

## WEST AND CENTRAL AFRICA

- **Cooperation** agreement with Malian water and energy ministry's national water and wastewater management department
- **Framework agreements** with Ouagadougou and Bobo-Dioulasso universities in Burkina Faso, Abomey Calavi and Parakou universities in Benin and Abdou Moumouni university in Niamey, Niger
- **Meeting** with founder members of CIREM international research and education centre, Mbour, Senegal
- **Scientific** partnership agreement with Senegalese NGO Espoir for bilharzia and malarif control research
- **Opnning** of a geology laboratory involving Institut Fondamental d'Afrique Noire, Cheikh Anta Diop University and the IRD, in Dakar, Senegal
- **Closure** of the programme on malarial infections in newborns, Benin
- **World rice congress**, Mali
- **Meetings** of emerging IRD partner teams working in the human and social sciences and health, in Bamako, Mali
- **Conference** on society-environment-climate interactions in West Africa (AMMA - RIPIECSA), in Abidjan-Cocody, Côte d'Ivoire
- **International** symposium of the Euro-African Association for the Anthropology of Social Change and Development (APAD) in Ouagadougou, Burkina Faso
- **Training** workshops in Niger, under the GVal project to support research on food security and nutrition.

3 emerging IRD partner teams supported

6 representations

315 staff • 68 individual fellowships awarded

# Partnerships around the world

## EAST AND SOUTHERN AFRICA AND INDIAN OCEAN

- **Launch** of the ERAfrica science and technology cooperation programme between Europe and Africa, in Pretoria, South Africa
- **ICEMASA** International joint laboratory (marine and atmospheric sciences) set up in South Africa
- **Agreement** with Makerere University in Uganda and Tshwane University of Technology, South Africa
- **Oceanography** summer school and theme school on microbial biodiversity and emerging pathogens, La Réunion
- **International** phytobacteriology congress, La Réunion
- **Regional geology** and gemmology workshop on tsavorite deposits, Nairobi, Kenya • **"Heritage, Memory and Politics"** seminar, Mombasa, Kenya.

partner teams supported

4 representations • 82 staff • 16 individual fellowships awarded • 3 emerging IRD

## ASIA • PACIFIC

- **Opening** of the Polynesian centre for the study of and income generation from island biodiversity, involving the University of French Polynesia, Institut Louis Malardé and IRD • **Lengguru-Kaimana** expedition: exploration of the biodiversity of Western Papua's karst country
- **Launch** of the PACE-Net scientific cooperation network, in Nouméa • **Delivery** of results of the expert panel review of energy and development in New Caledonia, in Nouméa • **Opening** of the Hanoi University of Science and Technology, Vietnam
- **Conference** on informal employment, seminar on nutritional strategies and prevention of anaemia in Southeast Asia, international symposium on flora, in Hanoi, Vietnam • **Symposium** on infectious diseases, Chiang Mai, Thailand
- **Three events organised**, respectively on health, rodents and transnational dynamics and recomposition of space in Southeast Asia, in Vientiane, Laos.

partner teams supported

6 representations • 205 staff • 23 individual fellowships awarded • 2 emerging IRD



# International

●● With its centres and facilities abroad acting as regional platforms, the IRD reaffirmed its relationships with higher education and research establishments in Southern countries. Closely involved in building the European research area, the Institute argues for the importance of a partnership ethic in which North-South collaboration starts at the project design stage and continues all the way to application of results. We are working in 55 projects under Europe's 7th Framework Programme and are coordinating

seven of them. As well as the research side, the framework programme finances coordination of international networks whose main purpose is to identify common research priorities and pool resources to strengthen R&D cooperation between the EU and the Southern regions concerned. The IRD is also involved in international joint laboratories, partnership structures that have emerged from several years of collaboration. Five such laboratories were created in 2009, in South Africa, India, Brazil, Chile and Morocco. Agreements were signed in Peru to set up two new laboratories: LAVI<sup>1</sup> for the study and beneficial use of Andean and Amazonian flora, and DISCOH<sup>2</sup> on the Humboldt current system. Both these laboratories stem from strong prior collaboration in the region, particularly in Colombia, Ecuador, Bolivia and Chile. ●●

**In West and Central Africa**, numerous framework agreements with universities were signed or renewed: with Ouagadougou and Bobo-Dioulasso universities in Burkina Faso, with Abdou Moumouni University in Niamey, Niger, and with Abomey Calavi and Parakou universities in Benin. Agreements were also formalised with the national universities of Equatorial Guinea and Ghana. CIREM, the international research and training centre in Mbour, Senegal, involves Cheikh Anta Diop University, Dakar, the IRD, Senegal's Académie nationale des sciences et techniques, the African Institute of Mathematical Sciences (Aims Senegal) and the International Union for Conservation of Nature. In Cameroon, a Master's in plant biology was launched in partnership with the universities of Paris 6, Cheikh Anta Diop, Dschang and Yaoundé 1. In Mali, the Mali Contemporain programme, under the aegis of AIRD, is intended to build the country's human and social sciences research capability. The regional collaboration on oceanography research in the tropical Atlantic and the Gulf of Guinea gave rise to a symposium in Benin attended by researchers from nine African countries.

**In East and Southern Africa and the Indian Ocean**, the IRD initiated a Europe-Africa science and technology cooperation programme, ERAfrica, and is coordinating it from South Africa. This programme involves a consortium of 13 partners and aims to establish a lasting framework for coordinating research, developing joint actions and building scientific capacities in this part of the world. Agreements were signed with Makerere University in Uganda and the Tshwane University of Technology in South Africa. Active collaboration on geology and gemmology continued in Tanzania, Kenya and Madagascar. On the initiative of the IRD and the universities of Dar es Salaam and Nairobi, research projects on the genesis of tsavorite deposits began following theme schools held in these countries. Programmes on health, marine ecosystems and the use of remote sensing were conducted in Réunion in synergy with other countries of the region. For example, work began on investigating the role of wild fauna in the introduction, dissemination and emergence of organisms pathogenic to humans and animals in five island nations of the southwestern Indian Ocean.

**In Asia**, the year was one of sustained regional cooperation involving the IRD and other national and international research bodies, Northern and Southern universities, the Association of Southeast Asian Nations, the European Union and the WHO. In Vietnam, a framework agreement was signed with Can Tho University and the IRD was a partner in the creation of the University of Science and Technology of Hanoi (USTH). The Institute's commitment here mainly concerns research training programmes in biotechnology, environment and the science and technology of information and communication.

<sup>1</sup> LAVI : Laboratoire andoamazonien de chimie du vivant.

<sup>2</sup> DISCOH : Dynamique du système du courant de Humboldt.



Farming / Senegal.

Other partnerships took shape, through new framework agreements with the Laotian National University and Ministry of Health and a memorandum of understanding with the Indian Institute of Sciences. Numerous scientific meetings were held, including the international congress on the informal economy in Hanoi, the 4th national health forum in Laos and regional workshops in Thailand on infectious diseases and malnutrition. Joint actions were conducted with AUF<sup>3</sup> and the AFD<sup>4</sup> to extend social science collaborations.

**In the Mediterranean region,** cooperation work was strengthened. In the Middle East, framework agreements were signed with the Lebanese National Centre for Scientific Research (CNRS), the Egyptian Science and Technology Development Fund, Jordan's Higher Council for Science and Technology, the University of Damascus in Syria and the Arab Centre for the Studies of Arid Zones and Dry Lands. These new partnerships concern priority fields such as environment and water management, food and agriculture, health and life sciences, application of space-based technologies and social science. Under the five research agreements deriving from these framework agreements we were able to start several programmes such as LIBRIS, on assessing seismic risk in Lebanon, and SUDMED, on water resources in Syria and Lebanon. In Egypt,

a joint fund of €7.2 million was set up for a period of four years to support scientific cooperation between French and Egyptian researchers. In Morocco, the process already begun with that country's institutions was reaffirmed and opened new prospects for synergy in research and training, through resource sharing, the creation of international joint laboratories, etc. The IRD took part in major regional symposiums, notably one in Rabat on migration dynamics, return migration and impact on societies of origin in North and West Africa, and the FRIENDS symposium in Fez, on the risks and dangers threatening water resources.

**In Central and Latin America,** the year was punctuated by some major events, particularly the World People's Conference on Climate Change in Tiquipaya, Bolivia, and the international conference on climate, sustainability and development in semi-arid regions (ICID+18). This conference, held in Fortaleza, Brazil, brought together over 2,000 participants from 70 countries and all continents. The IRD was a joint organiser of the event, mobilising its researchers to act as moderators for discussions on three-sided cooperation between France, Brazil and Africa. ICID's recommendations focus on making the most of United Nations conventions such as the one held in Cancún at the end of the year. At that conference the IRD presented

its research work in environmental science, particularly its scientific coordination of the French part of the Observatoire Cousteau for marine and coastal environments in Mexico, founded in 2009. Collaboration in Latin America produced other highlights too in 2010: the farming system on the Rio Negro was listed as intangible heritage of the Brazilian nation, an international conference on biodiversity in the Western Amazon basin was held in Iquitos, Peru, and the results of the TOXBOL programme on metal pollution in the Andes were delivered at a symposium in Bolivia. In the Andes region, where natural hazards are a major issue, the IRD took part in a French-Chilean scientific mission organised in the wake of the earthquake of 4 March. On the social science side, the Institute coordinated a major regional programme on issues of race and ethnicity, AFRODESC, in partnership with Mexican and Colombian academic and research institutions.

<sup>3</sup> Agence universitaire de la francophonie.

<sup>4</sup> Agence française de développement.



Memorandum of understanding with the Indian Institute of Sciences.

### ●●Launch of the international joint laboratory ICEMASA in South Africa●●

The international joint laboratory ICEMASA - International Centre for Education, Marine and Atmospheric Science over Africa - is the fruit of a shared desire by France and South Africa to strengthen scientific partnership on issues connected with climate change and its impacts on the natural environments and marine resources of Southern Africa and the Southern Ocean. It involves the IRD, Ifremer and the University of Western Brittany in France and two South African multidisciplinary structures, MA-RE (Marine Research Institute) and ACCESS (African Centre for Climate and Earth System Science).

The researchers are studying global climate change, its mechanisms and its effects on Africa's climate, ocean circulation, ocean-atmosphere exchanges and marine ecosystems and their exploitation. They share the common goal of training and empowering an African scientific community with expertise on these issues. The multidisciplinary MA-RE and ACCESS programmes (ocean and atmospheric physics, biogeochemistry, ecology, fishery and economics) involve 11 South African partners including the University of Cape Town where the French scientists working on ICEMASA are based.

[www.icemasa.org](http://www.icemasa.org)



Irrigation / Syria.

# Overseas France

●● The IRD's five centres in the French overseas territories are support bases for scientific cooperation in their respective regions and play a large part in developing multilateral relations with neighbouring countries. ●●

**The Centre polynésien** de recherche et de valorisation de la biodiversité insulaire (CPRBI) opened officially in 2010. Here the University of French Polynesia, the Institut Louis Malardé and the IRD work together on issues of biodiversity and sustainable use of natural resources in island environments. Two projects on pearl farming were under way in 2010. Under a project to professionalise the pearl farming business and assure its future, the IRD and Ifremer worked together to provide useful data on sea currents and the biological functioning of atoll lagoons. With support from the European Development Fund, a programme of training, research and international market research for Tahitian pearl farming delivered its results to the Tahitian Presidency. From this overall research momentum sprang the project to create the first Polynesian joint research unit (UMR) in oceanic island environments, involving all four establishments. The conclusions of a study on living conditions and approaches to poverty in the Windward Islands, conducted with the Agence française de développement, were greeted with keen interest by local decision makers.

**In Réunion**, with support from the Indian Ocean Commission, a regional symposium on climate and health was organised through the emerging diseases research centre CRVOI<sup>1</sup>. The central aim of the symposium was to assess the possible long-term impact of climate change on pathologies. In partnership with the University of Réunion, the IRD organised conferences and a summer school for recently-trained biological oceanography researchers. The environment ministry granted the summer school the International Year of Biodiversity label. Also in ecosystems research, an expert panel review on the coral reefs of Réunion was conducted and produced recommendations on their management. The satellite imagery receiving station in the south of the island, intended for environmental monitoring, neared completion as the project for the four-institution joint research unit Espace-Dev was finalised. The astrophysics observatory in Réunion, in which the IRD is a partner with INSU<sup>2</sup>, became operational.

<sup>1</sup> Centre de Recherche et de Veille sur les maladies émergentes dans l'Océan Indien.

<sup>2</sup> Institut national des sciences de l'univers.



Seabed / New Caledonia.



Flora / French Polynesia.



Réunion seen from space.



**In New Caledonia**, the IRD initiated a project to set up a higher education, research and innovation cluster in New Caledonia, known as PRESICA<sup>3</sup>. The island's main academic and research institutions agreed to join forces for the project. The initiative puts into practice the policy of improving responses to local authority needs, as stated in the Nouméa agreement and the constitutional by-law on New Caledonia's institutional development. Under the call for proposals on nickel and environment research issued by the CNRT<sup>4</sup>, the IRD's work in this field was strengthened with a view to encouraging sustainable management of mining resources such as to protect New Caledonia's natural and human environment.

**For the Pacific region** as a whole, the IRD is piloting the PACE-Net<sup>5</sup> project. The aim of PACE-Net is to develop a network for collaboration in science and technology between Europe, the 15 countries of the ACP (Africa-Caribbean-Pacific) group, Australia and New Zealand. The launch meeting took place in Nouméa and the first assessment was delivered at the University of the South Pacific in Suva, Fiji. The IRD is also coordinating the Great Observatory of South Pacific Environment and Land & Ocean Biodiversity, GOPS<sup>6</sup>, which involves 16 universities and research bodies. GOPS' work in 2010 included monitoring coral ecosystems

in New Caledonia and French Polynesia and environmental research in the Marquesas.

**In the Caribbean**, the Caribsat<sup>7</sup> and Caraïbe-Hycos<sup>8</sup> projects, both coordinated by the IRD, strengthen our partnership with the University of Antilles-Guyane and cooperation with neighbouring countries in ecosystem monitoring and water resource assessment. In Martinique, the problems of pesticide pollution in the soil prompted the IRD to take part in organising an international symposium on remediation of chlordecone pollution in the Caribbean and to strengthen its provisions for research on the subject at the Martinique agro-environment research platform.

**In French Guiana**, the IRD's partnership with the university and local authorities was strengthened with the project of creating an international research, training and innovation campus in biodiversity, environment and territorial dynamics. Premises were prepared at the Montabo site in Cayenne to house the campus, which is the result of the IRD's site policy and opens a new era of scientific collaboration with neighbouring countries – Brazil, Surinam, Guyana and Venezuela. The campus will conduct research and consultancy work throughout the Guyana shield, the Amazon and the Caribbean, relying on two facilities developed

and managed by the IRD: the SEAS Guyane satellite-based Amazonian environment monitoring station and the Cayenne herbarium. These facilities do much to boost the IRD's national and international profile. The programme *Ma Commune vue du Ciel* ("my district seen from the sky") produced with TV station France-Guyane and the mayors of 22 communes in French Guiana was a popular hit, while the OSE Guyamapá project is an integral part of the Amazon basin cross-border operational programme.

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<sup>3</sup> Pôle de Recherche, d'Enseignement Supérieur et d'Innovation Calédonien.

<sup>4</sup> Centre national de recherche technologique sur le nickel et son environnement.

<sup>5</sup> PACE-Net is an INCO-Net project funded by the European Union's 7th Framework Programme.

<sup>6</sup> Grand Observatoire de l'environnement et de la biodiversité terrestre et marine du Pacifique sud.

<sup>7</sup> Système caribéen d'information environnementale: du satellite à l'acteur.

<sup>8</sup> Système caribéen d'observation du cycle hydrologique.



Alcyonaria / New Caledonia.



●● **PACE-Net: fostering scientific cooperation in the Pacific** ●●

Part of the European 7th Framework Programme, PACE-Net is designed to network French and European research stakeholders (ministries, funding agencies and operators) with their counterparts in the Pacific. A particular goal is to identify research areas of common interest and work to have them taken into account in forthcoming European Union work programmes and calls for proposals.

As project coordinator, the IRD is the task leader for scientific discussions pursued through theme-based workshops, conferences and information days about European programmes. The purpose here is to reveal shared priorities and to enhance research and technology networking for the benefit of the Pacific countries in the ACP group.

<http://pacenet.eu/>



International campus / French Guiana.







# Resources for research

Human resources  
Information systems  
Shared facilities  
Financial resources



# Human resources

●● The IRD has a staff of 2,220. In terms of civil service staff categories these are 843 researchers, 1,048 non-research staff and 329 local staff. Average staff age is 45: 42 for women and 47 for men. Forty-three per cent of staff are women. In the researcher category, though still a minority, they rose from 26% in 2009 to 28% in 2010. In the non-research staff categories that figure was unchanged at 58%. ●●

## Governance reform

As a result of changes to the Institute's statutes, mainly involving governance reform and the creation of the agency function, the IRD's central services have been reorganised and are now divided between two divisions and three cross-cutting management departments.

The AERES assessment notes "a human resources policy that counts among the Institute's positive achievements in that it is increasingly consistent with the drive for a real overarching establishment policy". From this standpoint the centralisation of HR management at head office facilitates an HR policy geared to sending human resources to the South and a skills-based approach with profiling of 50% of posts put out to competitive recruitment.

## Recruitment and mobility

Fifty-two staff retired from the IRD in 2010. A drive to encourage mobility among the non-research staff categories gave rise to 28 new posts. In-house and external competitive recruitment of non-research staff (IT) opened 39 posts. As part

of the IRD's efforts to give greater job security to staff on short contracts, 32 tenured posts were opened. Ninety-seven non-research staff were promoted to a higher grade or category.

As well as a major campaign to recruit 56 researchers, 17 post-doctoral researchers were sent on mission to the South: 11 to Africa, 3 to Latin America and one to Asia.

Fifty-five researchers were honoured under the scientific excellence award scheme introduced in 2009 to reward commitment to research.

## Presence in the South

The IRD reinforced its presence in the South. Nearly 39% of its staff were working outside Metropolitan France. Of these, some 50% were in Africa and the Mediterranean, 15% in Latin America, 9% in Asia and 25% in overseas France. The number of long-term missions under way in the year increased significantly, from 121 to 160. The additional missions were mostly in Africa and the Mediterranean. Overall, Africa and Latin America are the main destinations for long-term missions.

### IRD STAFF AT BY CATEGORY AND STATUS

	TENURED	NON TENURED*	TOTAL
• Researchers	805	38	843
• Non-research staff	778	270	1,048
• Permanent local staff		329	329
• TOTAL	1,583	637	2,220

\*Short-term contracts, insourcing, youth volunteers, grantees and local staff.

### IRD STAFF BY SEX

	MEN	%	WOMEN	%	TOTAL
• Researchers	607	72	236	28	843
• Non-research staff	447	42.7	601	57.3	1,048
• Permanent local staff	221	67.2	108	32.8	329
• TOTAL	1,275	57.4	945	42.6	2,220



At work at the IRD / Bondy.

Of 843 researchers more than 50 are guest researchers at the IRD and are working abroad (85%) or in overseas France.

## Training

The in-service training drive continued with the implementation of the 2010-2012 three-year plan. Eight hundred and sixty-

five staff received further training – 5% up on the previous year. All in all 40,150 hours of training were provided, spread over 13,031 days. New courses were offered: management training for executive staff, training in annual assessment interviews for unit directors and representatives, training for administrators and bookkeepers, etc.

### PERCENTAGE OF IRD STAFF OUTSIDE METROPOLITAN FRANCE, BY CIVIL SERVICE CATEGORY

Excl. permanent local staff

	2004*	2005*	2006**	2007**	2008**	2009**	2010**
• Researchers	34%	35%	37%	35%	34%	32%	34%
• Non-research staff	29%	24%	26%	25%	21%	22%	23%

\* Until 2005, percentage based on budgeted posts \*\* Since 2006, percentage based on IRD staff at 31/12 (excl. local staff).

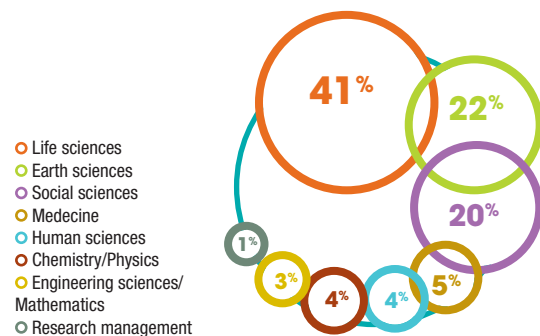
### NUMBER OF LONG-TERM MISSIONS

	2006	2007	2008	2009	2010
• Africa	54	67	56	43	68
• America	44	38	33	42	47
• Asia-Pacific	24	17	21	25	25
• Europe	3	-	7	1	5
• Overseas France	-	3	13	10	15
• <b>TOTAL</b>	<b>125</b>	<b>125</b>	<b>130</b>	<b>121</b>	<b>160</b>

Source: Sorgho at 31/12/2010

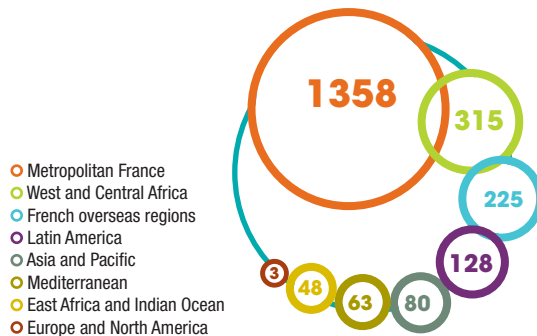
### IRD RESEARCHERS BY DISCIPLINE

Excl. permanent local staff

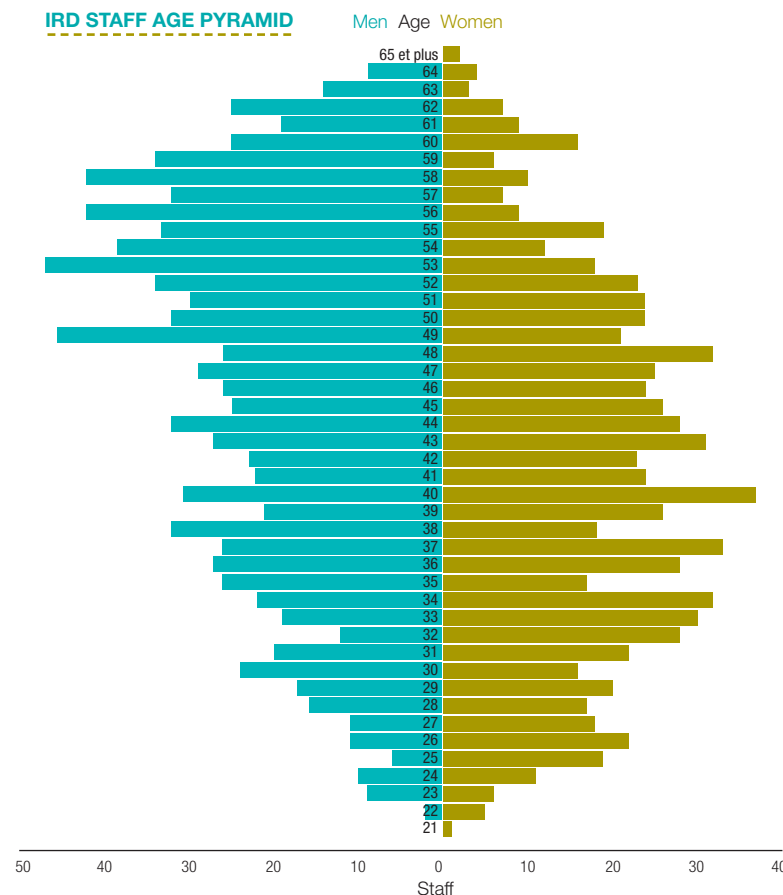


### IRD STAFF BY GEOGRAPHIC ZONE

Incl. permanent local staff

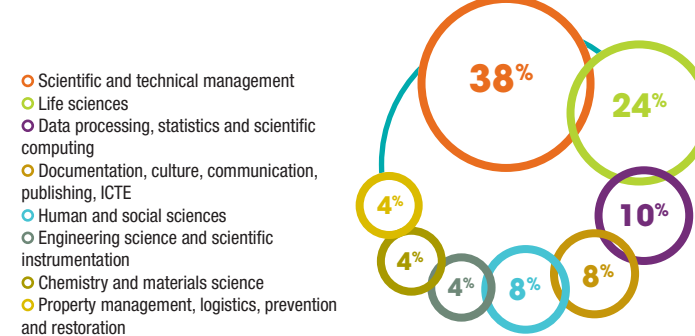


### IRD STAFF AGE PYRAMID



### IRD NON-RESEARCH STAFF BY OCCUPATIONAL CATEGORY

Excl. permanent local staff





## Welfare policy

The IRD launched several projects under its staff welfare policy. We now keep staff informed of their pension rights through computerised individual pension accounts. We also now focus on psycho-social risk prevention and have instituted a social barometer.

On the health and safety side, attention was focused on chemical risk prevention in the Montpellier research units. This will shortly be applied to other sites as well. Health and safety inspections by the Ministry of Higher Education and Research continued. The Ministry team inspected the IRD's French Polynesian premises and assisted the New Caledonia centre in implementing the recommendations made in 2009.

A working group on safety abroad was organised jointly with Cirad to make sure staff are better informed before they leave on their missions. This preventive information drive will start in the second half of 2011.

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Bush laboratory / Congo.

# Information systems

Implementation of the master plan continued. Training management and individual pensions joined the administrative information system. Efficiency improved with the introduction of a new version of the SORGHO software package and a new service provider for system maintenance. Several head office sections were involved in designing the future payroll and employment management system. There is also now a collaborative e-mail system that facilitates staff travel and the sharing of diaries and address books. E-learning and Internet telephony facilities were introduced at the Montpellier centre.

Service continuity and system security were improved by transferring the servers to high-security premises and introducing round-the-clock, 7/7 help and supervision. Perceived and measured quality indicators are published monthly.

The department supported intensive calculus projects and ran workshops on computation grids and 'R' statistical tools in Dakar, Bobo-Dioulasso and Hanoi, facilitating feedback and skills transfer to our partners. The IRD also lent its expertise to the universities of Haiti and Benin to set up digital campus networks.

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•• **Contact** : [dsi@ird.fr](mailto:dsi@ird.fr)

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Working in a safe environment.

# Shared facilities available to partners

●● The IRD has established monitoring centres and technology platforms in many countries. By sharing and networking these infrastructures we offer researchers top class conditions in which to work. The data collected are made available to the international community and the research and training that draw on the data help to inform decision makers on policy choices regarding health, environment, risks and resources. ●●

There are several health and population monitoring centres in Senegal. Among the IRD's medical research facilities are a centre for integrated malaria control in Benin and an HIV platform in Thailand. The tropical flora herbaria in Cayenne and Nouméa, now fully digitised, have an important role to play in the conservation and study of biodiversity. Considerable resources are devoted to ecosystem observation through the SEAS satellite antennae network, seven observation systems for environment research and two ships, the *Alis* and *Antéa*, which are part of the French oceanographic fleet.

## Mbour Centre, Senegal

In November 2010 an international research and education centre, CIREM<sup>1</sup>, opened at one of the IRD's oldest centres, in Mbour, Senegal. The partners are Senegal's Académie nationale des sciences et techniques, the African Institute of Mathematical Sciences (Aims Senegal), Cheikh Anta Diop University in Dakar, the Centre de suivi écologique and the IRD. The aim of this new cluster is to promote science education and research in West Africa and in Senegal especially, with the goal of setting up an international technology platform. The Mbour centre has been known for its geophysics research for fifty years; its subject areas now include uses of the littoral zone, urban health and aquaculture. With the new centre, the IRD has opened one more channel for working in partnership with Africa.

## ALYSÉS, a new tropical soils and sediments analysis facility in Bondy

In 2008 the IRD launched AlysÉS, a new facility for tropical soils and sediments analysis and experimentation. The purpose is to offer a wide range of methods for observation and analysis of the physical, chemical, mineralogical and biological components of tropical soils and sediments. The project includes planned renewal of equipment for microscopy, infra-red spectroscopy, molecular biology, mineralogy, X-fluorescence and mineral and organic geochemistry. The facility has provision for storing tropical samples. A containment room for biologically active soil samples has already been built; this is the second in France, after the one at the Montpellier centre. The IRD's partner in this facility costing almost €1.5 million is Pierre and Marie Curie University, through its LOCEAN and BIOEMCO units. The Île-de-France Regional Council provided considerable financial help through its research support programme SESAME. This facility is unique in France. It is intended for all researchers and students from North or South who work on the biological functioning of tropical soils, soil or sediment organic matter characterisation, or markers of variations in environmental conditions in marine, lake or land sediments.

## ASTER, cutting edge instrumentation for isotope monitoring

Complementing the particle accelerator introduced in 2007, ASTER/CEREGE<sup>2</sup> isotope geochemistry facility at the Arbois technology hub in Aix-en-Provence is soon to acquire new equipment including a multicollector plasma-source mass spectrometer and a miniature accelerator mass spectrometer for carbon 14 measurements on small solid and gas samples. ASTER was selected as an *Équipement d'excellence (EQUIPEX)* under the government's programme of investment in promising research resources. The project extension was

promoted by Paul Cézanne University (part of the Aix-Marseille university cluster) and received institutional support from the CEREGE unit's parent bodies (CNRS, the IRD and Collège de France) plus INRA. Many Southern research projects will be relying on this infrastructure, particularly those working on water and climate variability in the tropical zone. The facility is also involved in two competitiveness hubs, on water and on risk management and vulnerable areas.

●● Contact : [dgds@ird.fr](mailto:dgds@ird.fr)

<sup>1</sup> CIREM: Centre international de recherche et d'enseignement de Mbour.

<sup>2</sup> CEREGE: Centre européen de recherche et d'enseignement des géosciences de l'environnement



The *Alis* / Polynesia.

# Financial resources

●● The IRD's budget priorities support its policy and role as key partner for scientific communities in the South. Three main trends stand out for 2010: operational capability based on cooperation instruments was consolidated, as was investment to achieve the scientific goals of the Institute and its partners, while the programme of work to modernise and safeguard the Institute's management and accounting system continued. ●●

## Key figures

In 2010 the IRD had a net income of €227.351 million and expenditure of €237.322 million, the balance being achieved by drawing on working capital. Sources of income were a government subsidy of €201.056 million (88% of the total), research contracts (€22.630 million, 10%) and service provision and research outputs (€3.664 million 2%). Staff pay amounted to €163.043 million or 69% of expenditure. All in all, the research units directly received nearly 58% of the Institute's financial resources.

## Increased spending on instruments to consolidate the research base in the South

Incentive credits for research teams and pilot operations supporting scientific work rose from €2.3 to €2.8 in one year.

They allowed for €750,000 in financial support for the regional pilot programmes (PPRs) that are designed to strengthen scientific partnerships with the South around shared geographical and thematic priorities. Contributions allocated to setting up these programmes amounted to €650,000. Examples are the GOPS<sup>1</sup> centre for long-term monitoring of terrestrial and marine ecosystems in the South Pacific and programmes on rural societies, environment and climate in West Africa, tropical rainforests, management and resources of coastal ecosystems, and ocean upwellings. A budget of €100,000 has been earmarked for PPRs still in the pipeline, including programmes on the Mediterranean region and on environmental and socioeconomic dynamics and resources in the Amazon basin. Credits provided for newly created joint research units and laboratories (LMI / UMI) amounted to €211,000.

## Increased investment in science and technology facilities in the South

Specific annual resource allocation for scientific capital equipment, now included in the incentive credits budget, amounted to €338,000.

Multi-year investment operations included in the budget cost €2.75 million. This went to fund the digital campus project in Bondy and set up a high-security insectarium in Montpellier. A further €875,000 was invested to maintain the oceanographic fleet at its current capacity. All in all the balance sheet for multi-year investment shows expenditure of €6.351 million.

Under the heading of "major research infrastructure" a €400,000 fund was established specifically for naval resources. This was in response to the strategic need to build up an international network of overarching science and technology facilities operating at region or sub-continent level.

## Modernisation of the IRD management system

The modernisation drive decided under the 2009-2011 agreement with the Direction générale des finances publiques and the Contrôleur General continued.

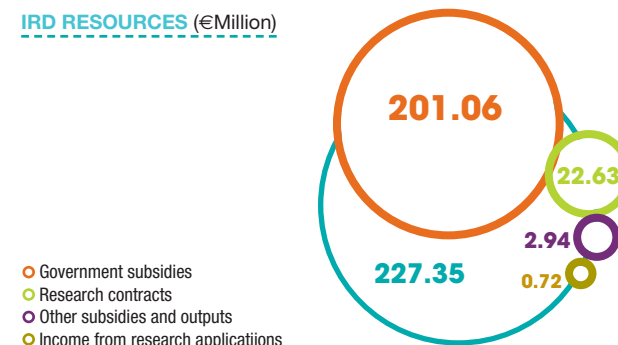
Measures taken focus on three priorities:

- improving accountancy quality with a view to certification of the accounts from 2011. A key operation to this end was the performance of a full inventory of the Institute's assets valued at more than €7,500 pre-tax;
- simplifying procedures and optimising management costs. This included introducing new joint contracts with providers (administrative transport, office supplies, etc.) and signing a partnership agreement with the public procurement organisation UGAP, so cutting prices for current purchases such as vehicle hire and office furniture;
- renovating financial management instruments with the introduction of the financial Infocentre, for use by all budget managers at head office, in the centres and in research units.

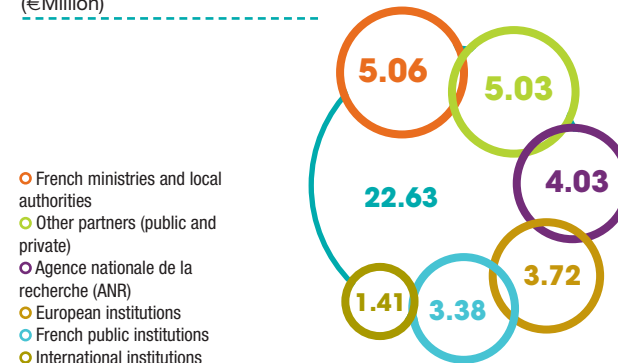
This work was in fulfilment of the information systems master plan. The master plan phase that began in 2006 is now completed, with the help of €8.6 million in exceptional funding drawn from working capital.

<sup>1</sup> Grand Observatoire de l'environnement et de la biodiversité terrestre et marine du Pacifique Sud.

## IRD RESOURCES (€Million)



## RESEARCH CONTRACT INCOME BY SOURCE (€Million)



## RESEARCH CONTRACT INCOME BY DEPARTMENT (€Million)

	AMOUNT
• Earth and Environnement department	4.26
• Living Resources department	6.36
• Societies and Health department	7.19
• Capacity-building support department	2.50
• Applications and consulting department	0.26
• Information and communication	0.24
• Scientific outreach	0.96
• Decentralised services	0.54
• Partners managed by the IRD (contracts with Europe, ANR, GIS, etc.)	0.32
<b>• TOTAL</b>	<b>22.63</b>



## RESEARCH UNIT EXPENDITURE (€Million)

Research department	PAYROLL	OPERATING COSTS AND INVESTMENTS	TOTAL
• Earth and Environment department	35.01	7.18	42.19
• Living Resources department	36.50	8.11	44.61
• Societies and Health department	40.04	9.61	49.65
• TOTAL	111.55	24.90	136.45

Research programme	PAYROLL	OPERATING COSTS AND INVESTMENTS	TOTAL
• Natural hazards and climate	4.54	0.89	5.43
• Sustainable management of Southern ecosystems	19.10	3.32	22.42
• Continental and coastal waters	21.44	4.89	26.33
• Food security in the South	21.07	4.94	26.01
• Public health and health policy	21.83	6.83	28.66
• Development and globalisation	23.57	4.03	27.60
• TOTAL	111.55	24.90	136.45

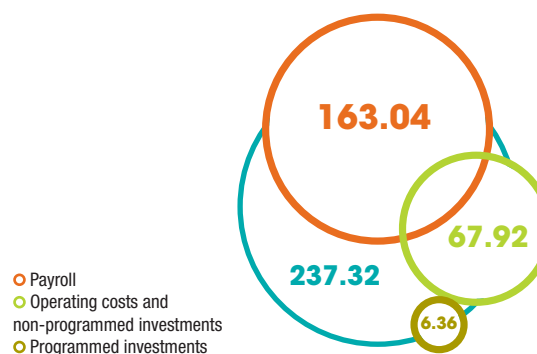
## EXPENDITURE ON CROSS-CUTTING ACTIVITIES (€Million)

	PAYROLL	OPERATING COSTS AND INVESTMENTS	TOTAL
• Capacity-building support	0.65	5.16	5.81
• Applications and consulting	0.58	0.90	1.48
• Information and communication	4.72	1.96	6.68
• International relations	9.34	4.61	13.95
• Scientific outreach	2.63	2.50	5.13
• Scientific assessment, ethics	0.44	0.44	0.88
• In-service training	0.19	1.31	1.50
• Contributions to partnerships	0.33	2.22	2.55
• Naval resources (operation and investment)	0.10	4.37	4.47
• Major scientific capital equipment	-	0.94	0.94
• TOTAL	18.98	24.41	43.39

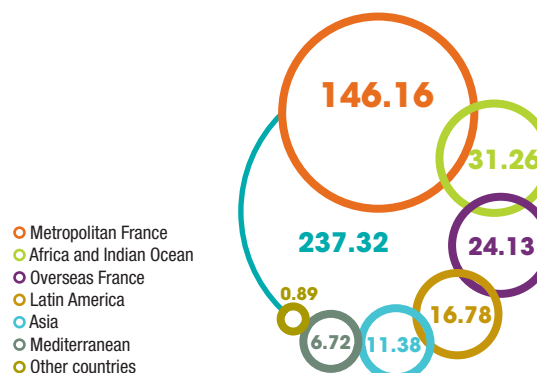
## SUPPORT FUNCTION EXPENDITURE (€Million)

	PAYROLL	OPERATING COSTS AND INVESTMENTS	TOTAL
• Welfare	0.19	1.45	1.64
• Information systems	2.86	7.94	10.80
• Maintenance	-	0.98	0.98
• Major renovation	-	0.30	0.30
• Construction	-	1.04	1.04
• Decentralised services	9.78	5.06	14.84
• Central services	10.80	7.80	18.60
• Financial operations	-	0.21	0.21
• Other general expenses	8.89	0.19	9.08
• TOTAL	32.52	24.97	57.49

## IRD EXPENDITURE BY TYPE (€Million)



## EXPENDITURE BY GEOGRAPHICAL REGION (€Million)









# Appendices

The IRD's decision bodies

Central services: our gallery

The research units

IRD addresses world-wide



# The IRD's decision bodies

AT 1 JULY 2011

## ●● BOARD OF TRUSTEES

### Chairman:

Michel Laurent

### Representatives of parent ministries:

#### • Ministry of Higher Education and Research

Higher education

**Christiane Kerié**, establishment advisor to the General Directorate of higher education (DGES)

Research

**Florence Charlier**, head of the Department of performance, financing and contractualisation with research bodies

#### • Ministry of Foreign and European Affairs

**Hélène Duchêne**, Director for scientific and academic cooperation, Directorate General for international cooperation and development (DGCID)

**Nathalie Broadhurst**, Deputy director for development strategies, Directorate General of global economy and development strategies

#### • Ministry of the Budget, Public Accounting, Civil Service and Government Reform

**Grégory Cazalet**, Head of the Bureau for research and higher education budget monitoring

#### • Ministry of the Interior, Local Government, Overseas Territories and Immigration

**Philippe Leraître**, Assistant deputy director, Department of public policy

### External members:

**Rahma Bourqia**, Former President of Hassan II University – Mohammedia, Morocco

**Jean-François Delfraissy**, Director, "Microbiology and infectious diseases" multi-establishment institute, Inserm

**Alain Fuchs**, President, CNRS

**Nadine Lavignotte**, President, Blaise Pascal University, Clermont-Ferrand

**Rémy Genevey**, Director of strategy, Agence française de développement

**Achille Massougbodji**, Professor, Cotonou Faculty of Health Sciences, Benin

**Gérard Matheron**, President of the Board of Trustees, Cirad

**Pascal Saffache**, President, Antilles-Guyane University, French Guiana

### Staff representatives:

**Didier Bogusz**, representing STREM-SGEN-CFDT researcher grades – microbiologist, Plant diversity, adaptation and growth unit (DIADE)

**Éric Delacour**, representing SNTRS-CGT other staff categories – Montpellier centre  
**Alain Froment**, representing SNCS-FSU researcher staff – anthropologist, Local heritage unit (PALOC)

**Jean-Louis Janeau**, representing STREM-SGEN-CFDT other staff categories – hydrogeologist, Biochemistry and ecology of continental environments unit (BIOEMCO)

**Sonia Bouzid**, representing SNPRES-FO non-research staff – Bondy centre

**Nolwen Henaff**, representing STREM-SGEN-CFDT chercheur staff – economist, Population and development centre unit (CEPED)

## ●● SCIENTIFIC COUNCIL

The scientific council is the Institute's science policy think tank.

### Chairman:

**Éric Servat**, research director, IRD, director of UMR HydroSciences Montpellier – Hydrology

### Appointed members:

**Emmanuelle Auriol**, professor, University of Toulouse I – Economics

**Hélène Budzinski**, research director, CNRS – Chemistry

**Dominique Darbon**, professor, Institut d'Etudes Politiques, Bordeaux – Political science

**Pierpaolo Faggi**, professor, University of Padua (Italy) – Development Geography  
**Claire Infante-Rivard**, professor, McGill University (Montreal) – Epidemiology

**Claire Julian-Reynier**, research director, INSERM – Public health, epidemiology, biostatistics, health economics

**Sinata Koulla-Shiro**, professor, faculty of medicine, University of Yaoundé (Cameroon) – Microbiology, infectious diseases

**Louis Legendre**, professor, Pierre et Marie Curie University – Oceanography

**Pierre Mazzega**, research director, CNRS – integrated modelling of environment and society

**Catherine Perrot-Rechenmann**, research director, CNRS – Plant biology

**Silvia Restrepo**, professor, University of the Andes, Bogotá, (Colombia) – Plant biology

**Luiz-Augusto Machado**, director, CPTEC (Brazil) – Meteorology, climatology

**Annick Weiner**, professor and vice-chair for international relations, Paris-Sud University – Applied mathematics, molecular physics

### Elected members:

#### • Constituency I, IRD research directors

**Didier Fontenille**, medical entomology

**Jean-Pierre Guyot**, microbial ecophysiology: nutrition, food science

**Geneviève Michon**, ethnobotany, geography

**Luc Ortlieb**, paleoclimatology

**Sylvain Ouillon**, oceanography

#### • Constituency II, IRD researcher staff

**Vincent Corbel**, medical entomology

**Patrick Livenais**, demography

**Bernard Moizo**, socio-anthropology

**François Molle**, management, governance and politics of water

**Hugo Perfettini**, geophysics

**Henri Robain**, soil science, geophysics

#### • Constituency III, other staff categories

**Laurent Drapeau**, GIS, spatial analysis

**Nadine Dessay**, remote sensing

**Marc Soria**, eco-ethology

## ●● SECTORAL SCIENTIFIC COMMISSIONS (CSS) AND RESEARCH AND APPLICATIONS MANAGEMENT COMMISSIONS (CGRA)

### Chairs:

• **CSS1: Physics and chemistry of the global environment**  
**Serge Lallemand**

• **CSS2: Biology and medical science**  
**Lise Lejus-Jouanin**

• **CSS3: Sciences of ecological systems**  
**Raymond Lae**

• **CSS4: Human and social sciences**  
**Catherine Aubertin**

• **CGRA 1: Engineering and consulting**  
**François Gerlotto**

• **CGRA 2: Administration and management**  
**Hervé de Tricornot**

# Central services: our gallery



# The research units

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●● **TRIC Emmanuel** [IRD Unit 082]

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