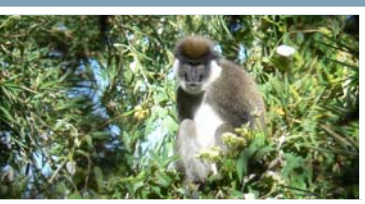
INTERNATIONAL FOUNDATION FOR SCIENCE

Annual Report 2011



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Cover photos (clockwise from top left) Anagaw Atickem; Sylvestre Raharimbola; Brian Porter; Brian Porter; Romaric Ogouwale; Lalith Suriyagoda
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Message from the Chair & Director

Foreword

Photo: Jürg Pfister

Jürg Pfister

All of our livelihoods and the economies to which we contribute are increasingly dependent on the development and sharing of knowledge. The knowledge generated from scientific research is especially valued, its' benefits to be made universally available, and the freedom to research enshrined as a Human Right. However, in practice, there remains a substantial divide in knowledge between developed and developing countries. This is apparent from differential publication rates, such that authors in developing countries are less well represented, especially in high impact journals. It is also common that the location of scientific research and its subject matter reflect more the issues of the developed world. Importantly, this is true in the fields of biological and water resources research which IFS seeks to support.

A quantitative analysis of the generation of scientific knowledge in the environmental sciences[1] illustrates this point. More than 80% of 6,400 papers assessed from a ten year period in this study are papers in and about temperate and cold eco-climatic zones. Only 13% are based on research in the dry sub-tropical and tropical zones, although these eco-climatic zones account for more than 52% of the world's land area. So whilst the sustainability challenges are global, there is substantial inequity in support for the scientific research that underpins the policies and actions required to address them.

Photo: Brian Porter

Graham Haylor

The 2011 United Nations Human Development Report[2] argues that the urgent global challenges of sustainability and equity must be addressed together, projecting a disturbing reversal of recent positive trends in poverty reduction if environmental deterioration and social inequalities continue to intensify, with the least developed countries diverging downwards from global patterns of progress by 2050.

The Report shows further how the world's most disadvantaged people suffer the most from environmental degradation, including in their immediate personal environment, and disproportionately lack political power, making it all the harder for the world community to reach agreement on needed global policy changes.

Science In Developing Countries Needs to Expand

Given the current low level of scientific support to the developing world, as well as the substantial need for location specific research in *the South*, IFS believes that now more than ever, science in developing countries needs to expand. Scientists in the developing world are well placed to identify the challenges they face, and able to propose transformational research, to build their resilience to global volatility, to engage in global negotiations, and to innovate for sustainable futures.

1 Sylvia Karlsson, Tanja Srebotnjak, Patricia Gonzales (2007). 'Understanding the North–South knowledge divide and its implications for policy: a quantitative analysis of the generation of scientific knowledge in the environmental sciences', *Environmental Science & Policy*, Volume 10, Issues 7–8, November–December 2007, Pages 668–684.

2 UNDP (2011). *Human Development Report 2011 Sustainability and Equity: A Better Future for All.*

The mechanism is Support for Early-Career Scientists

We believe that a sound basis for investment in expanding developing country science is to select and support the best early-career scientists who are based in the developing world. Young people today constitute the largest youth cohort in human history, with the vast majority in developing countries[3].

The immediate post-Masters and post-PhD years are vital in science careers when expertise, skills and passion for research and greater confidence are developed, first publications achieved, and new research conceived and initiated. That's why IFS directs its efforts towards early-career scientists, nurturing applications, provision of small grants to individuals and teams, and equipment and capability enhancing support. We expect that developing country scientists in the next decade will contribute significantly to the global endeavour to reduce poverty and support sustainable development.

The Objective is Sustainable and Inclusive Development

Today, our planet appears small, and its biological and water resources base is vulnerable and inter-connected. We believe that IFS should aim to contribute to the global priority of sustainable development within defined biophysical boundaries[4], beyond which we risk excessive stress on critical processes, which could lead to tipping points of abrupt and irreversible environmental change. At the same time IFS research should aim to underpin development that is equitable and socially just[5] and that contributes to supporting freedom from poverty and deprivation. Therefore, our new strategy supports researchers who aim to contribute to 'Sustainable and Inclusive Development', those who seek to improve natural resources management, and especially those who strive for equity, giving voice and securing entitlements to food, water and energy.

IFS-supported research examples featured in this report include: Participatory research aiming to restore soil fertility of degraded fields for enhanced crop productivity on smallholder farms in Zimbabwe; Understanding the responses of rice to drought and predictable climate change impacts in Sri Lanka; Evaluating indigenous browse species to improve the browsing capacity of the rangelands in Ethiopia; Contributing policy recommendations to reduce undesirable environmental consequences of the cotton industry in Benin; and, Assessing the biophysical and socioeconomic factors influencing the productivity of water in smallholder multiple crop irrigation schemes in Tanzania.

In the next decade we hope to contribute to building the capability and agency of the best developing country scientists, researching within the space between the social foundations and the environmental ceilings, generating knowledge which can help to determine the safe and just space for sustainable human development.

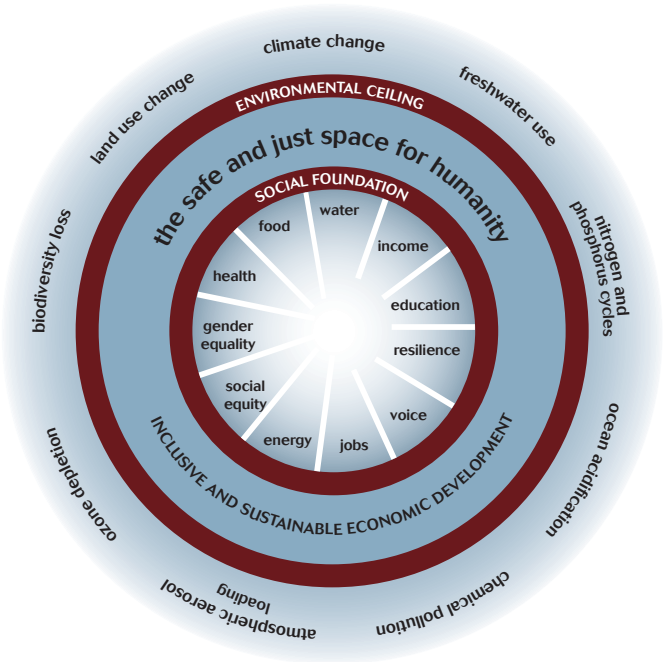


Figure 1: The safe and just space for humanity
(Source: Raworth K. (2012). *A Safe and Just Space for Humanity,* Oxfam Discussion paper).

Jürg Pfister
Chair of the IFS Board of Trustees

Graham Haylor
IFS Director

3 Justin Yifu Lin and Wendy Cunningham (2010). 'Seizing opportunity now will make the world fairer and safer', *The Financial Times,* 29 January 2010.
4 Rockström, J., *et al.* (2009a). 'Planetary boundaries: exploring the safe operating space for humanity', *Ecology and Society* 14(2): 32. [http://www.ecologyandsociety.org/vol14/iss2/art32/]. See also: Rockström, J., *et al.* (2009b). *Nature* 461, 472–475.
5 Raworth, K. (2012). *A Safe and Just Space for Humanity: Can we live within the doughnut?* Oxfam Discussion Paper, Oxfam International, February 2012. [http://policy-practice.oxfam.org.uk/publications/a-safe-and-just-space-for-humanity-can-we-live-within-the-doughnut-210490].

IFS Research Grants Programme

The IFS Competitive *Research Grants Programme* supports high quality practically orientated, development-relevant research, focusing on biological and water resources. A rigorous evaluation process by internationally established scientific experts ensures that only research of the highest quality is supported. The programme strives to ensure that the young researchers are fully supported to enable them to conduct research of a high quality throughout their projects and to maximise the likelihood that research will be used.

Relevant, Quality Research Supported

Whilst work progressed during 2011 on the development of systems and processes in support of the proposed Research Approaches for the new IFS strategy (IFS Strategy 2011–2020), the granting process was reopened following a brief suspension of the Programme, which enabled resources to be focused on the mapping of the most appropriate new and relevant strategies to competently deal with the research challenges of the 21st century's second decade and beyond. Applicants were invited to submit their research application in two time bound calls for proposals. Following these calls, a total of 1181 applications were received and processed by the Secretariat and reviewed by independent volunteer scientific experts. The comments and recommendations

Photo: Yves Agnoun

IFS Grantee, Yves Agnoun, evaluating the Rice Yellow Mottle Virus (RYMV) disease symptoms in a screenhouse in Benin.

Working toward the UN Millennium Development Goals

While IFS has an open research agenda for its grantee constituency, meeting the challenges of the 21st century and responding to the MDGs means that certain areas of research are so overwhelmingly critical that IFS actively encourages applications in those areas. Through its existing programme areas, IFS supports a broad spectrum of research projects, many of which address issues of eradication of extreme hunger and poverty, promoting gender equality and encouraging women to enter careers in science, ensuring environmental stability, and combating malaria and other diseases.

Some highlights of the grants awarded in 2011 are given in the next chapter.

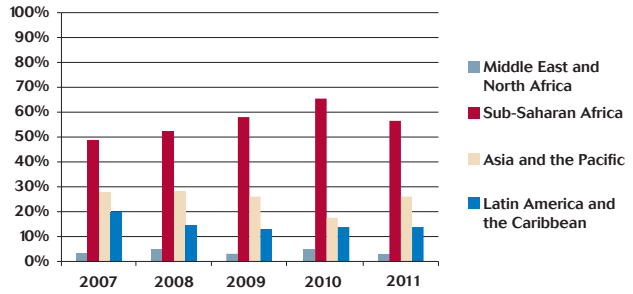


Fig. 1 Geographic distribution of IFS research grants 2007–2011.

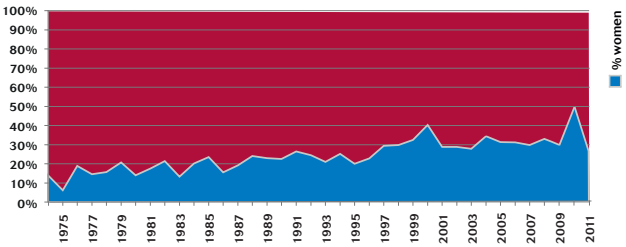


Fig. 2 Percentage of IFS research grants awarded to women.

from these external evaluators were assimilated by independent (volunteer) IFS Scientific Advisory Committees which made the recommendations as to whether an applicant's proposal should or should not be supported. Using the constructive criticism of all advisers, the Secretariat was able to provide detailed comments to the failed as well as the successful applicants. This kind of support is especially valuable to early-career scientists from countries with poor scientific infrastructure, and enhances all applicants' capacity in proposal writing, especially where this is most needed. In 2011, IFS awarded 219 (of 222 recommended) relevant, purpose-driven research grants that demonstrated high scientific quality and were approved for funding. One hundred and seventy four were first grants and 48 were renewal (second or third) grants. Twenty eight percent were awarded to women scientists. The successful scientists come from 46 countries.

Photo: David Chiawo

IFS Grantee, David Chiawo, is studying the impact of land use on avian pollinators in the dry coastal ecosystems of eastern Kenya.

Countries which are eligible for IFS support are defined using indicators for assessment of their economic development and scientific infrastructure.

Researchers based at institutions in the following categories of countries are, in principle, eligible to apply for IFS grants:

Low Income Countries (LIC), Lower Middle Income Countries (LMIC) and some Upper Middle Income Countries (UMIC) namely those with a below-average GNI/Capita of that category of countries.

IFS gives priority to research applications of satisfactory scientific quality from researchers based in countries classified as LICs and LMICs. This joint category includes most countries in Sub-Saharan Africa and some in Latin America and Asia. The rationale for this policy is that researchers based in UMICs in general have much better access to national research funding and infrastructure than their colleagues in LICs and LMICs.

IFS also gives priority to countries where young scientists have difficulty accessing research funding and research tools. It aims to allocate at least 70% of the research grants to scientists from its priority countries.

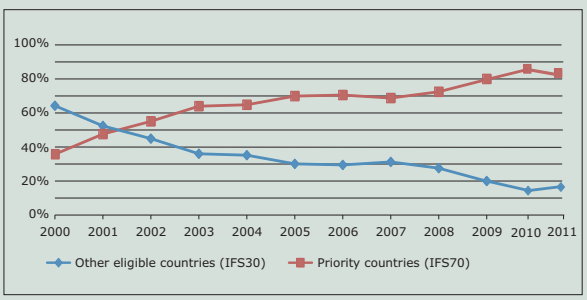


Fig. 3 Percentage of IFS research grants awarded to scientists in the IFS priority countries compared to other eligible countries, 2000–2011.

Selected Research Highlights

In our selected highlights section in this year's annual report we have chosen four areas that we wish to showcase: Sustainable Agriculture; Biodiversity, Conservation, Utilization and Management of Biological and Water Resources; Climate Change; and Improved Crop and Human Health.

1. Sustainable Agriculture

By many estimates, the global population will attain 9 billion people by 2050 and food production will have to increase 70 percent to meet the demands of a booming population. A profound change of the global food and agriculture system is needed if we are to adequately feed today's 925 million hungry and the additional 2 billion people expected by 2050. Research on increasing agricultural productivity and efficiency within the framework of sustainability for resources and the environment is an enormous challenge. Below are some examples of IFS research support in 2011 that will address some of these issues.

Restoring soil fertility of degraded fields for enhanced crop productivity on smallholder farms in Zimbabwe

A common problem in smallholder farms in Zimbabwe is that soil nutrients become exhausted and this is exacerbated by soil erosion. This has resulted in degraded and nutrient-depleted fields with poor crop productivity and low response to external nutrient inputs. Emerging evidence indicates that non-cultivated N2-fixing indigenous legumes adapted to these soils can produce > 10 t biomass per hectare per season when seeded in mixtures and can help degraded fields to recover. The objectives of the study of Mr Hatirarami Nezomba are therefore to (1) determine the key physico-chemical and biological determinants of soil degradation on continuously cropped fields on smallholder farms, (2) assess the effect of indigenous legume fallows on soil nitrogen levels (3) conservation and build-up of soil organic matter pools to help restore

Photo: Brian Porter

IFS Grantee, Hatirarami Nezomba, in Zimbabwe will assess the effect of indigenous legume fallows on soil microbial activity and maize production.

productivity of degraded soils and (4) assess the effect of indigenous legume fallows on soil microbial activity and maize productivity. The objectives of the study will be achieved through participatory research approaches, detailed laboratory analyses of soil and plant samples and field experimentation.

Ability of Sri Lankan rice varieties to grow in phosphorus- and moisture-limited and iron toxic soil conditions

Phosphorus (P) is a major nutrient required by plants, and it is a limiting factor for crop productivity in Asia and Africa. The availability of P is further reduced by drought and by the presence of high concentrations of iron (Fe) in acid soils, a common problem in most rice-growing areas. Likely future complications are that droughts are expected to increase in frequency in the predicted climate change scenarios and the price of P fertiliser will increase further. Therefore, it is very important to understand the responses of rice to drought, P and Fe in acid soils. So, the objectives of Dr Lalith Suriyagoda's project are to (1) examine the interactions of drought and P, and soil Fe and P concentrations on the dry matter production, grain yield, P-resorption, P-use efficiency (PUE), photosynthetic rates and water-use efficiency of a range of rice varieties, and (2) establish relationships between plant-available P, soil Fe, growth and plant internal P dynamics in greenhouse and field conditions. From the diverse array of characteristics, it should be possible to identify the varieties most sensitive to the interactions of drought, P and Fe, and differential varietal responses.

Prevention of damage by bats to litchi crops while conserving their populations in Madagascar

All three fruit bat species in Madagascar feed on litchi crops and damage can be high and it is necessary to understand the factors which cause bats to feed on cash crops. Strategies such as the full canopy net used in other countries (e.g. Australia, Mauritius) to avoid fruit loss by bats may not be suitable in Madagascar because of differences in cultivation such as pruning techniques. However, the principle researcher, Mr Andoniaina Radosoa Andrianaivoarivelo, will investigate other strategies such as alternative attractant plants which can lessen damage by bats to litchi, and will taise awareness of growers in this regard. Likewise, awareness needs to be created that habitat loss through deforestation negatively impacts on natural bat diet and forces them to feed on agricultural crops. Therefore, this project will focus on the feeding habits of bats in in the vicinity of litchi plantations and means of deterring feeding on litchi without causing harm to the bat populations.

Photo : Lalith Suriyagoda

IFS Grantee, Dr Lalith Suriyagoda, observing the pot experiment conducted to study the interactions of drought and phosphorus on a range of rice varieties in Sri Lanka.

Photo : Sylvestre Raharimbola

A Fruit bat (Eidolon dupreanum) *being removed from the mist net erected in the lychee orchard at Anosibe An'Ala, East Madagascar by IFS Grantee Andoniaina R. Andrianaivoarivelo.*

Indigenous forage species in the Afar and Tigray Regions of Ethiopia: ethnobotany, biomass production and feed value

The introduction into Ethiopia of 'improved' exotic forage species for reversing rangeland degradation and improving feed scarcity has not been as successful as expected. So far, indigenous browse species remain to be fully evaluated. In this project, by Mr Balehegn Gebremikael Mulubrhan, indigenous people's experience and knowledge will be integrated with conventional techniques of nutritive analysis and biomass production evaluation to identify the options for forage plants which are both productive, socially acceptable, optimally impact on animal development and are environmentally adaptable. Browsing capacity of the rangelands will be estimated and such information will help farmers and ranchers to apply proper stocking management practices. At the same time, the project will yield information on how to conserve threatened plant species.

Genetic diversity in the Baoulé, a West-African cattle breed

Baoulé cattle are a highly important breed in West Africa exploited for meat, milk and as work animals. They are tolerant to sleeping sickness (trypanosomiasis). Over the last decades, they have been crossed with taller Zebu cattle that are more susceptible to this infection. The offspring are found through Burkina Faso, Mali, Côte d'Ivoire and Togo. The Baoulé breed and its crosses have been characterised using phenotypic and biochemical characteristics but scant data exist for molecular markers. The project of Dr Guiguigbaza-Kossigan Dayo, from Togo but working in Burkina Faso, is the first in a series in the four countries where the cattle are found to genetically characterise them using molecular markers (microsatellites) to establish the degree of purity and mixing. A total of 340 cattle will be sampled and genotyped using 20 microsatellites. The genotyping will be correlated with sleeping sickness infection and is expected to contribute to the conservation of livestock biodiversity.

Policy and institutional reforms and the environment in the cotton industry in Benin: an ecological modernization perspective

Mr Laurent Camille Glin will examine policy and institutional changes in the cotton sector in Benin and assess their potential for environmental improvement. Cotton is the most important cash crop in Benin and it is vital to the national economy as well as to the livelihoods

Photo: Romaric Ogouwale

IFS has supported a number of projects in Benin researching cotton.... In this photo, IFS Grantee, Romaric Ogouwale, is interviewing a cotton producer in the Okpara basin about his perception of climate change and the current rate of rainfall.

of millions of people. However, cotton is also a major driver of environmental destruction (deforestation, water and soil pollution, biodiversity reduction). Moreover, the cotton industry involves a range of processing activities that consume much water and energy, and cause pollution. Increasing environmental public awareness raises the question how and to what extent recent policy and institutional reforms in the cotton sector benefit the environment. In his second IFS project, Mr Glin shall apply an ecological modernisation perspective through a qualitative methodology. This research will generate theoretical knowledge and policy recommendations with the aim of reducing or eliminating undesirable environmental consequences of the cotton industry in Benin.

2. Biodiversity, Conservation, Utilization and Management of Biological and Water Resources

The tenth meeting of the Conference of the Parties (the governing body of the Convention on Biological Diversity – which advances implementation of the Convention through the decisions it takes at its periodic meetings), was held from 18 to 29 October 2010, in Nagoya, Aichi Prefecture, Japan. The meeting adopted a *revised and updated Strategic Plan for Biodiversity,* including the Aichi Biodiversity Targets (the strategic goals are shown below), for implementation between 2011 and 2020.

Natural resource conflicts in Mbire district, Zimbabwe: socio-ecological and political dynamics

Mbire district, in Eastern Zimbabwe, is characterised by immigration-fuelled population growth and rapid expansion of agricultural land which is causing land-use conflicts particularly with respect to wildlife. The district is the habitat of mega-fauna of global conservation importance. Over the past decades, a mosaic of land uses has emerged: areas where smallholder farmers use animal-drawn ploughs to cultivate relatively large pieces of land, areas where tsetse-fly infestation precludes animal traction causing cultivated lands to be small and shifting, state-designated wildlife conservation and hunting areas, and undesignated forest areas inhabited by wildlife. To understand natural resource-related conflicts in this mosaic, Mr Steven Matema will focus on possible boundary mismatches between differently defined land areas: (1) land-use based definitions (agricultural, grazing and wildlife areas), (2) political-administrative and socio-culturally defined entities (villages, wards, chiefdoms and spiritual areas), and; (3) resource-defined land uses (tsetse fly free/infested, dryland/riparian land). Building on qualitative research methodologies (key informant interviews, resource mapping, oral histories), the study aims to understand different stakeholders' perceptions of diverse boundaries as well as conflicts over them.

Assessing the effect of protection levels and habitat characteristics on the distribution and abundance of grouper fish species (Pisces: Serranidae) within lagoonal reefs on the Kenyan coast

The greasy grouper, *Epinephelus tauvina,* is a highly exploited and much appreciated food fish of coral reefs in the Indo-Pacific region. Effective conservation and protection of this fish, such as through the establishment of marine protected areas, requires knowledge of its habitat preferences and its response to fishing pressure. Mr Jelvas Maina Mwaura will study population assemblages of this fish, by assessing its relative abundance, biomass and size distributions in

Aichi Biodiversity Targets

STRATEGIC GOAL A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society

STRATEGIC GOAL B: Reduce the direct pressures on biodiversity and promote sustainable use

STRATEGIC GOAL C: Iimprove the status of biodiversity by safeguarding ecosystems, species and genetic diversity

STRATEGIC GOAL D: Enhance the benefits to all from biodiversity and ecosystem services

STRATEGIC GOAL E: Enhance implementation through participatory planning, knowledge management and capacity building

The next ten years (2011 – 2020) are critical as it's the timeframe for implementing the Strategic Plan for Biodiversity.

Photo: Jelvas Mwaura

IFS Grantee, Jelvas Mwaura, assessing reefbenthic features within lagoonal reefs on the Kenyan coast.

different reef habitats under different levels of protection from fishing along the Kenyan coast. This knowledge will be useful in marine park design and spatial management strategies for fisheries conservation and protection of grouper species.

Productivity of water in small irrigation schemes in the upper catchment of the Great Ruaha River Basin, Tanzania

The concept of productivity of water (PW) – the net return for a unit of water used – is increasingly becoming a cornerstone for sustainable river basin water resources management. Dr Makarius Victor Mdemu will study PW in the Great Ruaha River basin in Tanzania. Due to a rapid population growth, the area is characterized by increasing demands for multiple water use, such as for agriculture, livestock production, fisheries, as well as for domestic and environment use. Dr Mdemu will specifically look into the current levels and dynamics of PW in smallholder multiple crop irrigation schemes in the basin through

Photo: Anagaw Atickem

An adult Bale Monkey sitting on bamboo branches in the Odobullu Forest of southern Ethiopia. Currently, little is known about this monkey, but IFS Grantee Addisu Mekonnen Kassie at Addis Ababa University is studying its distribution, population size and behavioural ecology.

water balance analysis and socioeconomic analysis of production processes in relation to water uses. The study will contribute to improved understanding of the biophysical and socioeconomic factors influencing PW in semi-arid irrigation systems.

Ecology and behaviour of the Bale monkey *(Chlorocebus djamdjamensis)* in southern Ethiopia

The Bale Mountains in South East Ethiopia are home to many of Ethiopia's endemic animals including the Bale monkey *(Chlorocebus djamdjamensis)*. So far, little is known of its distribution, population size, and behavioural ecology. Recent studies by Mr Addisu Mekonnen Kassie, from Addis Ababa University, with an international team of scientists, revealed that these monkeys in their natural habitat almost entirely depend on bamboo, making this primate vulnerable to extinction. However, in contrast, these studies also discovered previously unknown populations of the monkey that continue to survive in fragmented habitats where bamboo forest had been nearly eradicated decades earlier, suggesting greater flexibility in diet than had previously been thought. In the present study Mr Mekonnen will determine the comparative behavioural ecology of the populations in the undisturbed remote areas of the Bale Mountains and the human-dominated fragmented landscape of Sidamo. In addition, the human-wildlife conflict between Bale monkeys and local people will be studied through questionnaire surveys and estimates of crop damage. The study is expected to generate recommendations for the future conservation and sustainable management of the species and their habitats.

3. Climate Change

Scientific consensus now holds that human activities contribute to global warming and the potentially catastrophic consequences that will flow from this if the process is not controlled. While the consequences of climate change may not seem to be imminent, certain tipping points – irreversible thresholds of climate change-induced transition – could happen in the short term. Whilst from a scientific viewpoint the threat of serious consequences is not yet absolute, IFS, in common with many other organisations and stakeholders, subscribes to a precautionary principle of encouraging action to combat climate change simply because the consequences of not doing so could be disastrous for the whole planet.

IFS does not support, at present, projects on e.g. the direct measurement of meteorological phenomena relating to climate change, but we do support projects which contribute to resilience through research, especially in vulnerable countries in the developing world, which mitigates the effects of climate change (e.g. drought tolerant crops) or which actually contributes to its prevention, e.g. study of carbon sinks in relation to forestry or the seas. Below, we highlight a selection of the projects we support which are relevant to climate change adaptation or prevention.

Improving drought stress tolerance in tropical maize in Kenya: silencing maize PARP1 gene

In Sub-Saharan Africa and Latin America, tropical maize is a major crop for home consumption and a stable source of income for the resource poor rural population. However, its growth, development and yield are greatly affected by current and predicted climatic conditions such as drought-stress and heat episodes. Alongside conventional and marker assisted breeding technologies, genetic engineering approaches are expected to contribute towards improving drought stress tolerance in food crops. In several other plant species it has been demonstrated that plants with reduced activity of poly (ADP-ribose) polymerase (PARP), an enzyme involved in DNA replication, are tolerant to a broad range of abiotic stresses. Dr. Sylvester Anami, a lecturer at the Mombasa Polytechnic University College, Kenya, will investigate whether PARP can also be applied to improve drought tolerance of tropical maize. The project will be carried out in close collaboration with scientists at Kenyatta University and the Kenya Agricultural Research Institute as well as with Ghent University, Belgium, where Dr Anami obtained his PhD degree.

Carbon metabolism in large lakes: a case study for tropical Lake Malawi

Carbon dioxide (CO^2) is one of the major greenhouse gases considered to contribute to global warming. The role of tropical lakes in carbon metabolism is still relatively poorly understood. Mr Maxon Ngochera will determine whether this African Great Lake serves as a net carbon sink or carbon source, and the role it plays in regional and global carbon budgets. He will assess spatial and seasonal variability of partial pressures of CO^2 (p CO^2) in Lake Malawi to provide information on energy flow processes and how they are influenced by biological properties and the physical limnology of the lake. He will study internal nutrient cycling, atmospheric deposition of nutrients and organic carbon, and riverine inputs of nutrients and carbon which are

Photo: Maxon Ngochera

IFS Grantee, Maxon Ngochera, ready to download data from meteorological station at the Senga Bay laboratory, Malawi. He is researching carbon metabolism in large lakes.

important mechanisms that may drive lake-atmosphere CO^2 exchange. The data generated will be useful for constructing a regional carbon budget, required for participation in any carbon trading programmes. Furthermore, the data will be useful to fisheries management in determining net carbon fixation available to support fisheries production in the lake.

Smallholder farmers' adaptation to climate variability and change in Zimbabwe

Smallholder farmers in Africa largely depend on rain-fed agricultural production. However, observed trends show a decline in total annual rainfall for most of Southern Africa and for Zimbabwe, while climatic modelling is showing that cyclical droughts will become more frequent and intense, overall rainfall pattern will decline by over 10%, crop yield potential will fall by 30-50%, and arid agricultural land will become marginalised. Traditionally, societies have inherent ways of dealing with the vagaries of environmental extremes such as droughts. This study by Mr Byron Zamasiya, seeks to document smallholder farmers perceptions of climate variability and perceived change, to determine the factors that influence farmers' perceptions and to identify their coping and adaptive strategies. Ultimately, the study seeks to evaluate the impact of dominant adaptive strategies on household food security in a semi-arid district in Zimbabwe.

4. Improved Crop and Human Health

In 2011 IFS has supported young researchers that addressed such topics as crop health, and also the use of natural products in relation to people's health. There are a number of factors that cause poor crop health – weeds, insects, pathogens, and others as well as consideration of the entire agronomic cycle from seeds to harvest, to consumable product. In the examples below we focus on fungal pathogens in yam and in banana. In addition, there are a number of natural products that can sometimes be effective in combating or mitigating human health problems, below is an example of work underway in Cameroon.

Antimycobacterial (TB) and anti-HIV activity of Cameroonian medicinal plants

Tuberculosis (TB) caused by mycobacteria, is still a very common disease in many developing countries and one of the most important public health concerns. It has been demonstrated that the risk of developing active TB, is ten times higher in individuals also infected with HIV. Limited progress has been made in the past decades in the development of new drugs against TB. However, some natural products, mainly from medicinal plants, show promising antimycobacterial activity. In an earlier IFS grant, Dr Victor Kuete, from the University of Dschang, in Cameroon, identified a number of plant extracts with promising anti-TB activity *in vitro*. Since mycobacteria reside intracellularly, Dr Kuete will now test the intracellular activity of his most promising plant extracts in a macrophage cell line model. In his renewal project he will also test these medicinal plants used in traditional treatments and their active ingredients for any anti-HIV activity.

Pathogenesis-related proteins and banana defence response to black leaf streak disease (Sigatoka)

Bananas and plantains constitute the main food for millions of people in the developing world. Their production can be seriously affected by diseases including black streak leaf disease, also known as black Sigatoka. The disease is caused by the fungus *Mycosphaerella fijiensi*, and affects photosynthesis which weakens the plants, and results in a serious decrease in fruit production and quality. So far,

Photo: Brian Porter

Bananas and plantains constitute the main food for millions of people in the developing world.

little is known about the defence mechanisms of banana against this fungus. Under contolled conditions, Mr Orelvis Portal, from Cuba, will study recently identified so-called pathogenesis-related proteins and their possible role as modulators of plant response against M. fijiensis using molecular tools. Defence responses in banana cultivars sensitive to the infection will be compared with the reactions in disease resistant cultivars.

Biological control of rot-inducing fungi in yam *(Dioscorea spp.)*

Yam tubers are one of the most important food crops in many countries in West Africa, including Côte d'Ivoire. During post-harvest storage, tubers are easily affected by rot and losses can reach more than 50%. Rot is caused by a variety of micro-organisms of which fungi are the most important. Treatment with pesticides is possible, but they are costly, resistance may develop and they pose environmental and human health problems. Earlier studies have demonstrated that palm wine from the oil palm *(Elaeis guineensis Jacq.)* harbours micro-organisms that show activity against the rot-causing fungi. Mr Assiri Elloh Patrice Kouamé from the University of Abobo-Adjamée in Abidjan, will isolate the micro-organisms from palm wine to study their effect in the control of rot in post-harvest yam tubers and to elucidate their mechanism of action.

Photo: Brian Porter

Yam tubers are one of the most important food crops in many countries in West Africa. Here they are being sold at a road-side market in Ghana.

Capability Enhancing Support:
Workshops

Photo: Nighisty Ghezae

Participants at a Workshop on Climate Change and Gender in Kenya.

Capability Enhancing Support in 2011 continued to link competitive research grants with concerted efforts to build capability, amongst 222 developing country researchers from across Africa as well as trainers from a number of institutions. Through training of trainers, IFS aims to contribute to the creation of a lasting foundation of human and institutional capability to contribute to growing challenges.

Research Proposal Writing

Research Proposal Writing is recognised as a key constraint to the progress of many early-career researchers. In 2011, IFS conducted a capability building course in research proposal writing for 25 African women scientists from Ghana, Kenya, Malawi, Mozambique, Nigeria, Rwanda, Tanzania, and Uganda in collaboration with the Consultative Group on International Agricultural Research (CGIAR) Gender and Diversity Programme on African Women in Agricultural Research and Development (AWARD). The six day course aimed to provide participants with the skills and tools necessary for conceptualizing and writing successful research proposals related to agriculture, science and development. The course also addressed the importance of gender sensitive research. This goes beyond simply involving women in the research process but aims to incorporate a gender perspective into the objectives, the methodology, the research results, as well as implementation and the consideration of the impact of the research on different gender groups. The course was also designed to begin to equip participants with the knowledge of how to search for and access online different types of scientific literature and information, and how to use reference management software such as EndNote.

Science Writing

Science Writing has been identified as a key factor which limits the impact of research. In 2011, IFS conducted a capability building course on Science Writing, Communication and Presentation Skills in Mombasa, Kenya for 26 African women scientists from Ethiopia, Ghana, Kenya, Malawi, Mozambique, Nigeria, Rwanda and Uganda to build capability in science writing, communication, and presentation skills in collaboration with the CGIAR AWARD Program. The course aimed to provide participants with the skills and tools for writing and editing scientific papers intended for peer review, as well as presenting and communicating research evidence to inform policy, especially agricultural policy development and the public through the media.

Research Advances in Natural Products, Food Science and Nutrition

In March 2011, the National Research Council of Thailand (NRCT) in collaboration with IFS hosted a workshop in Bangkok, Thailand. Twenty nine participants from India,

Indonesia, Madagascar, Malaysia, Nepal, Pakistan, Sri Lanka, Thailand and Vietnam attended the workshop.
The workshop built young scientists capability in scientific methodology, shared the new research trends in natural products, food science and nutrition, and addressed the formulation of competitive scientific research proposals for grant applications to funding agencies. The programme included invited lectures from senior scientists, oral and poster presentations by participants, small group discussions in focused research themes and visits to research laboratories. Participants benefited from close interaction with senior scientists. The lectures related to research performance of the Association of Southeast Asian Nations (ASEAN), regional research collaborations, scientific methodology and new research trends in natural products and food science.

Advanced Capability Building on the Operation of Specific Scientific Equipment

Through the MacArthur Foundation supported Procurement, Installation, Service, Maintenance and Use of Scientific Equipment (PRISM) project of IFS, capability building was organized for 117 technicians and researchers in the management and operation of specific scientific equipment. Management of research laboratories was an important component of the course as well as the principles, instrumentation and application of advanced analytical techniques for research.

Cutting across all Capability Enhancing Support events in IFS is a development approach, which includes mentoring and upgrading the skills of local trainers in conjunction with each event, with emphasis on national training partners and thus contributing to institutional development.

As part of any training that IFS undertakes, there is a national institution involved and at least two trainees working with a skilled international trainer in IFS-related capability development activities. Trainees gain proficiency in: (1) methodologies, concepts and tools of self-directed instruction and learning, (2) the scheduling, design and logistics of a training activity, including the assessment of training needs, (3) testing procedures, the distribution of invitations, and certification procedures, (4) facilitation skills and methodologies, (5) planning and preparing future training activities, (6) monitoring and evaluation and (7) producing model training programmes that can be adapted to specific projects or training programmes in local contexts.

Writing Scientific Research Proposals in Environmental Sciences

The Institut de Recherche pour le Développement (IRD) organized a training workshop together with IFS for young Vietnamese researchers in environmental sciences with a specific focus on how to write scientific research proposals for submission to both national and international funding organisations. The workshop was held in Tam Dao, near Hanoi 4 – 9 December, 2011.

Twenty five Vietnamese participants were drawn from Can Tho, Haiphong, Hanoi, Hue, Ho Chi Minh City, Nha Trang and Vinh City. The workshop began to equip participants, who can sometimes struggle to find independent research funding, with the techniques and skills needed for the preparation of quality scientific research proposals. Furthermore, by bringing together a range of young researchers, the workshop facilitated the development of a research network in environmental sciences also contributing to the higher education training and research strategy of Vietnam and help the internationalization of Vietnamese science.

Indigenous Vietnamese foundations and academies were represented by the National Foundation for Science and Technology Development (NAFOSTED) and the Vietnam Academy of Science and Technology (VAST).

IFS Grantee, Deepak Subedi, from Nepal discussing his research with IFS Staff Nathalie Persson and Eva Rostig at the IFS workshop in Bangkok hosted by the National Research Council of Thailand (NRCT).

Photo: Eva Rostig

Capability Enhancing Support:
Travel Grants / Publication Grants

Photo: Rossana García Fernández

Rossana García Fernández pictured here in Dr Redecke's laboratory at the Institute of Biochemistry and Molecular Biology, University of Hamburg. Ms García Fernández, an IFS Grantee from Cuba, received a travel grant for a one month research stay at the University of Hamburg.

Photo: Amanuel Tamiru

Amanuel Tamiru from Ethiopia received an IFS grant in 2009 for research on the control of insect pests on maize, and received a travel grant in 2011 to attend SEMIO-11, a workshop on insect chemical ecology and multilevel pest management, hosted by ICIPE in Nairobi.

Fifteen grantees were given opportunities to interact with scientists working in related fields and consolidate their national and international contacts and networks.

In 2011, these opportunities comprised: (1) visits to mentors where the young researchers received individual training; (2) Visits to well-equipped laboratories where grantees received training and made use of advanced instruments that were not available in their home laboratories; (3) Travel grants in order to participate in scientific meetings towards the end of the research grant period, to enable grantees to present their research findings and form linkages with other scientists and (4) publication support.

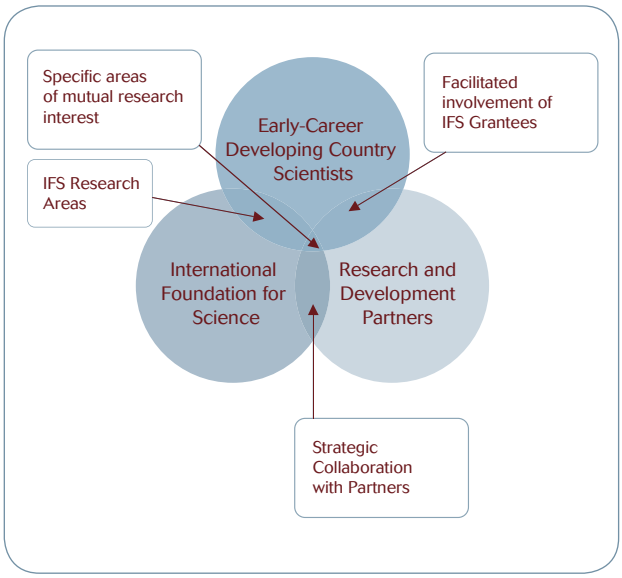
Applications were considered and allocations made for travel grants and publication and presentation support in the areas of Animal Production, Aquatic Resources, Crop Science, Food Science, Forestry and Natural Products.

- Grantees from Ethiopia took part in SEMIO 11 at African Insect Science for Food and Health (ICIPE) Nairobi. The topics included: Semiochemicals (i.e. odours and tastes carrying information between individuals); opportunities for low input sustainable insect management; the chemical ecology of pest insects and use in control strategies; invasive species; insect neuroethology, the chemical ecology of vectors and vector management, and multilevel pest management.
- Three grantees from Benin were able to attend the SUNRAY workshop on Sustainable Nutrition Research for Africa for the Years to Come.
- Grantees from Sudan, India and Cuba, respectively, were able to visit institutes and mentors in Belgium, Spain and Germany.
- Papers were published by colleagues from India and Philippines and presentations were supported from colleagues from Nigeria, Benin and Congo at meetings in United Arab Emirates, Germany, France and Italy.

Strategic Partnerships

In 2011, IFS has worked in partnerships and collaborative projects in areas of mutual scientific interest where the approach and skills of the foundation can add-value to the undertaking.

Such strategic partnerships provide IFS with the opportunity to engage with and progress in specific areas of contemporary research relevance from within the broader research areas that we seek to support. They also provide an opportunity to link IFS grantees with different stakeholders, partners and projects.



Sustainable Nutrition Research for Africa

One such area is that of sustainable nutrition, specifically within Africa, where IFS has an interest to both appraise and also, where feasible, to play a role in research agenda setting. Therefore, IFS, together with a group of international academic institutions and backed by the European Union (EU), launched a two year program (2011–2012) called 'SUNRAY-*Sustainable Nutrition Research for Africa*' to help develop a nutrition agenda for Africa, with specific emphasis on 34 Sub-Saharan countries. Our partners include: The Institute of Tropical Medicine, Antwerp, Belgium; OXFAM, Spain; IRD, France; Wageningen University, the Netherlands; Sokoine University, Tanzania; Makerere University, Uganda; North West University, Potchefstroom, South Africa and Abomey Calavi University, Benin.

The aim is to investigate what nutritional research has been carried out in Sub-Saharan Africa over the past 10 years, what constraints African nutritionists are facing, and which priorities African scientists want to establish in their nutritional research agenda to achieve solutions which are sustainable. This is facilitated by a multidisciplinary and a multi-stakeholder consultative approach. IFS attended the consortium management meetings in Antwerp, in January and August 2011, as well as the first SUNRAY regional workshop in Tanzania, November 2011. This event was aimed at consulting with scientists and stakeholders in nutrition from Eastern Africa, Nigeria, Gambia and Ghana. Participants agreed on priorities and set a research agenda for the years to come. IFS also met with scientists in Antananarivo, Madagascar in July 2011 to identify those who are strongly involved with nutrition research and could meet and interact with the consortium. Thanks to its broad network in Sub-Saharan Africa, IFS was instrumental in identifying scientists who could participate. Many IFS grantees are involved in the study.

The project will produce a roadmap document summarizing research priorities, strengths and gaps, resource requirements, opportunities for linkages and support between African and Northern institutions, and synergies between existing initiatives and research in other sectors. It aims to guide priority setting in African Institutions around nutrition interventions in the next 10 – 15 years – when Africa faces potential environmental changes, which will impact on nutrition.

Neglected and Underutilized Species (NUS)

Another area of strategic research interest to IFS stems from the world's agricultural preoccupation with a limited food resource base. That is support to researching so-called Neglected and Underutilized Species. Over time humankind has used more than 7,000 edible species. Today, 95% of the world's food needs come from around 30 species out of the total global agricultural biodiversity. 50% of the global requirement for proteins and calories are met by just three plants: maize, wheat and rice. NUS include hundreds of locally domesticated and wild species, which have unrealised potential to contribute to income generation, improved food security and nutrition. Meanwhile, the genetic diversity of NUS and associated local knowledge is rapidly being lost due to the intensification of agriculture and the commoditization of food markets towards a more narrow range of the most important food crops.

By definition, research has paid little attention to neglected and underutilised species, commercialization, or the policy frameworks to promote their use.

IFS, in partnership with seven institutions, has since 2009 been implementing an African, Caribbean and Pacific European Union Science and Technology Programme (ACP/EU S&T) project entitled *'Building human and institutional capacity for enhancing the conservation and use of neglected and underutilized Species*[1]*of crops in West Africa, and Eastern and Southern Africa'.*

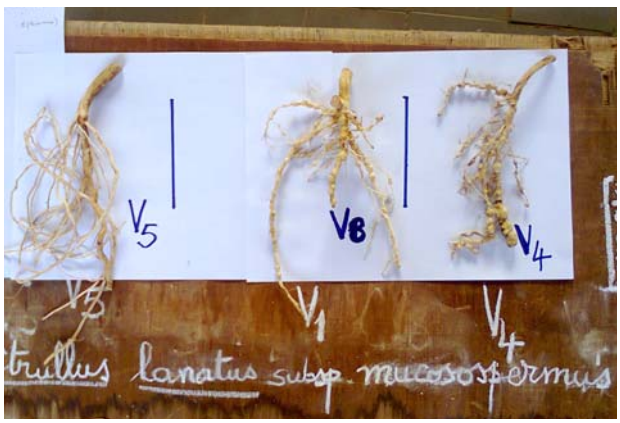


Photo: Antoine Affokpon

IFS is supporting many grantees interested in developing neglected and underutilized species (NUS). Here, IFS Grantee Antoine Affokpon, studies the reaction of different local cultivars of Egusi melon (Citrullus lanatus ssp. mucosospermus) to root-knot nematode attacks.

The partners include: the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM), Uganda, Bioversity International, Italy, the African Network for Agriculture, Agroforestry and Natural Resources Education (ANAFE), Kenya, the Institut de Recherche et de Développement sur la Biodiversité des Plantes Cultivées, Aromatiques et Médicinales (IRDCAM), Benin, the Plant Genetic Resources Research Institute (PGRRI), Ghana, the University of Nairobi, Kenya and the University of Malawi, Malawi.

The overall objective of the project is to contribute towards poverty reduction and create greater food and nutrition security through enhanced conservation and use of NUS. The project is funded by the European Union in cooperation with the ACP Science and Technology Programme during 2009 – 2012.

In 2011 as a continuation of the project implementation plan, the partners held a steering Committee Meeting in Kampala, Uganda and discussed progress, experience and lessons learnt in implementing the project, in order to make the best possible use of resources for year 2 activities. A Pan-African conference is proposed for year 3 of the project, and opportunities to progress the issue of Neglected and Underutilized Species beyond 2012 are being actively discussed.

With support from the Carnegie Corporation, in 2012, IFS will pilot the administration of collaborative research grants and support. For the pilot, collaborative research proposals will be sought from five countries within Africa (Ghana, Nigeria, South Africa, Tanzania and Uganda) within the broad concept of Neglected and Underutilized Species. Research teams will be supported to come together to begin to address themes such as: Crops that are a priority in West, East and Southern Africa; Cross regional comparisons to validate local research of, for example, value chain; Analysis of policies of relevance to NUS, such as the role of traditional crops for food security; Gender and NUS, such as the role of women in conservation and use of traditional food crops and food technology; Impact assessment research e.g. substantiate the role of NUS for nutritional security, and for resilience of production systems, based on evidence from country data; Genetic conservation of NUS, especially the complementarities between ex-situ and in-situ conservation; Loss of diversity in NUS, due to rural change and market

1 Neglected and Underutilized Species of plants (NUS) include hundreds of locally domesticated and wild species, which are rich in nutrients and adapted to low-input agriculture. 7,500 species are considered edible in the world today. Underutilized and neglected plants are those that could be – and, in many cases, historically have been – used for food on a larger scale. Alongside their commercial potential, many of the underutilized crops also provide important environmental services, as they are adapted to marginal climate and soil conditions.

forces, using participatory, community-based monitoring techniques; Methodologies for developing 'Red List' for agricultural crops and varieties; Research on strengthening capacities of scientists, value chain actors and community-based institutions in promoting NUS to improve people's livelihoods; Characterizing the seed supply and exchange systems of NUS to improve availability and farmer's access to quality seeds; and Research on indigenous knowledge on NUS cultivation and use to increase their value.

Getting and Using Equipment for Scientific Research in Africa

IFS continues its MacArthur Foundation funded research and is also now beginning to share widely its pioneering approach to participatory 'Procurement, Installation, Service, Maintenance and Use of Scientific Equipment' to support educational, research use development efforts in Nigeria and Madagascar. IFS has facilitated an inventory of the current status of equipment and scientific infrastructure at selected universities in Nigeria and Madagascar, and has been building capability in the large-scale participatory procurement of equipment, and in helping to develop procedures for purchasing, use maintenance, and use. Next year it is planned to share the approaches developed in Nigeria and Madagascar more widely across the continent in association with the African Academy of Sciences.

Co-funding of IFS Research Grants and Activities by Strategic Partners

In 2011, the Organization of Islamic Conference (OIC), Ministerial Standing Committee on Scientific and Technological Cooperation (COMSTECH) and IFS co-sponsored 18 grantees from OIC countries, the total COMSTECH contribution being USD 99,387, and helped to strengthen the individual and collective capacity of OIC member states in science and technology through mutual cooperation, collaboration, and networking of resources.

Photo: Onja Andriaharimalala

IFS Grantee, Onja Andriaharimalala, researching pollination mechanisms in Madagascar, collecting nectar from the flower of a Baobab tree (Adansonia rubrostipa).

Photo: Rashidul Islam

IFS Grantee, Md. Rashidul Islam, with the inoculated rice lines containing different resistant genes used for pathotypic assessment of different isolates of the bacterium Xanthomonas oryzae pv. oryzae *in Bangladesh.*

Also in 2011, the Organization for the Prevention of Chemical Weapons (OPCW) and IFS co-sponsored 25 grantees whose research comes under the umbrella of the peaceful uses of chemistry, the total OPCW contribution being USD 161,719.

IFS and the National Research Council of Thailand (NRCT) have joined forces to enhance research capacity of early-career scientists in the ASEAN countries. For 2011, co-sponsored activities included: the thematic workshop on Research Advances in Natural Products, Food Science Nutrition, 3-6 month research placements in Thailand, teaching early-career scientists advanced techniques, and mentor visits to scientists' laboratories in their home countries. The collaboration aims to build regional capability and stimulate systematic regional collaboration. Thailand will be graduating from eligibility for some elements of IFS support as a result of the more targeted poverty focus regarding country eligibility within the new 10-year strategy (please see the section in this annual report on country eligibility). Discussions with NRCT indicate that Thailand and NRCT are happy to continue to contribute to working with IFS to support its less developed neighbours.

Supporting Women in Science

Photo: Dorice Situma

IFS Grantee, Dorice Situma, prepares samples in an investigation of endocrine disrupting compounds in effluents from sewage treatment plants and industries in Nairobi.

Gender equality and the role of women in research and especially research for development are a key thematic priority for IFS. As an organisation that provides grants to young people with post-graduate qualifications we find that the eligible applicants to IFS from the regions that we already support comprise more men than women. This is of concern because women are currently unequally represented in science and also less likely than men to be involved in the planning, research, development or application of science. The underrepresentation of senior women scientists not only limits the added diverse themes and perspectives that can be derived from a more balanced gender representation within science, but also limits the role-models, mentors and professional networks available to girls.

With the support of Norad, IFS in 2011 has expanded its efforts towards *empowering women scientists in Africa*. Through a workshop co-hosted with RUFORUM in Uganda in March 2011, IFS brought women and men together from across Africa to inform its policy and operational modalities for grants and other forms of support. The discussions helped to frame the IFS approach to empowerment of early-career women scientists considering specific needs, effective to achieve this and value addition to on-going regional initiatives and strategies. Two issues in particular are (1) early-career women scientists tend to be older than their male counter parts as a result of, for example career breaks associated with starting families, and therefore there should be different age criteria for men and women regarding IFS support, and (2) the number of women scientists in Africa is extremely low compared to that of men. (Please see the age eligibility criteria of the IFS strategy).

In addition, IFS joined a consortium of eight partners to host a science competition to inspire African women scientists and to support and promote female role-models to girls, and to help families who may favour education for the male children to understand the vast potential of women to make a difference in the world through science. The consortium includes: NEPAD (New Partnership for Africa's Development), FARA (Forum for Agricultural Research in Africa), AGRA (Alliance for a Green Revolution in Africa), RUFORUM (The Regional Universities Forum for Capacity Building in Agriculture), ANAFE (The African Network for Agriculture, Agro-forestry and Natural Resources Education), ATPS (African Technology Policy Studies) and CTA (Technical Centre for Agricultural and Rural Cooperation). A competition established by the consortium, "Feeding 1 Billion in Africa in a Changing World", will promote excellence in science and innovation in agriculture, with a focus on its socio-economic impact, and the Women in Science competition identifies and recognizes outstanding women researchers who are engaged in communicating knowledge, technologies and new approaches to farmers and other key agricultural stakeholders, as well as advocating policy change to optimize the benefits from scientific and technological developments.

In 2011, 28% of the IFS research grants were awarded to women. Here follow some highlights of the research supported.

Photo: Cecilia Akintayo

IFS Grantee, Cecilia Akintayo, in her lab at the Federal University of Oye-Ekiti in Nigeria conducts thiolene polymerization of Albizia benth oil.

Photo: An Vo

Veterinarian, An Vo, at the Nong Lam University in Ho Chi Minh City, Vietnam, received her 2nd IFS Grant to continue her investigation of antimicrobial resistance in Staphylococcus aureus *isolated from pigs and cattle.*

Research Projects of IFS Supported Women Scientists

Characterisation of the medicinal tree *Warburgia ugandensis* in Kenya: east-west regional differentiation

Over 80 % of Africa's population relies on medicinal plants for health care, most of which are harvested from the wild. *Warburgia ugandensis* is a valued medicinal tree native to East Africa. However, in Kenya over-exploitation and fragmentation of its habitat has led to a notable decrease in its population size. In her previous IFS project, Dr Alice Muchugi, a tree geneticist at Kenyatta University in Nairobi, demonstrated significant genetic differentiation of the tree populations east of the Kenyan arm of the Rift Valley and those in the west, suggesting that these may have evolved into different species. In her second project, Dr Muchugi will further study the issue of speciation. She will also analyse if phytochemical extracts from trees from different regions differ in bioactivity. Such information is important in developing efficient conservation and utilization strategies.

Water quality of Cuban aquatic ecosystems: pathotypes of *Escherichia coli* as indicators of microbiological contamination

Consumption and utilization of water of low microbiological quality is one of the main causes of disease in developing countries. Microbial pollution of surface waters is mainly due to faecal contamination of human and animal origin. Due to rapid population growth and industrialization, several rivers in Cuba receive high loads of untreated sewage, industrial pollutants, and domestic waste water. These waters are used for recreational, irrigation and domestic purposes. Faecal bacteria such as *E. coli* and its different pathotypes are widely used as indicators for microbial water quality, but this is not yet done in Cuba. Ms Beatriz Romeu Alvarez will study the presence of diarrheagenic *E. coli* in Cuban rivers during the dry and rainy seasons to collect baseline information and to evaluate the applicability of standard faecal indicator bacteria for monitoring of water quality in tropical Cuban freshwater ecosystems.

Anti-caries agents from the mangosteen tree *Garcinia mangostana* L

Dental caries is a major problem in public health. There is an urgent need for new, safe and better anti-caries agents. An earlier screening study supported by IFS showed that ethanolic extract of the tropical tree *Garcinia mangostana* L. (mangosteen) is a potential source of antimicrobial agents to combat dental caries. Extracts of mangosteen strongly inhibited acid production, respiration and biofilm formation by *Streptococcus mutans,* which is a major cause of dental caries. In her second grant, Dr Thi Mai Phuong Nguyen at the Institute of Biotechnology in Hanoi, Viet Nam, will isolate the anti-caries compounds and study their mechanisms of action against the causal micro-organisms of dental caries with the aim of developing effective oral health care products.

Photo: Yenesew Mengiste Yihun

IFS Grantee, Yenesew Mengiste Yihun, measuring the canopy of her experimental teff crop using a LAI Plant Canopy Analyzer 2200.

Prevention of acrylamide formation in sweet potato *(Ipomoea batatas L. Lam)* crisps in Malaysia

Sweet potato crisps are a popular snack in many South East Asian countries. They are produced by deep frying of sweet potato slices. In recent years, it has been demonstrated that frying and baking of starch-rich foods may generate acrylamide which has been associated with increased cancer risk. The conditions for and mechanisms of acrylamide formation are not yet fully understood. Ms Pek Kui Lim at the Department of Food Sciences of the University of Putra Malaysia in Selangor, will study the effects of different types of widely available frying oils (palm oil, canola oil, soybean oil and coconut oil), and of processing and storage conditions on the formation of acrylamide. The final aim is to provide guidelines for improved food safety of this popular snack.

Overfishing of the white grouper, *Epinephelus aeneus,* in Senegal: age and growth studies

Fisheries play an important role in the national economy of Senegal, generating jobs, income and export opportunities for many people. The white grouper, *Epinephelus aeneus,* is one of the most valued fish species, and is the preferred key ingredient for one of the most popular national dishes 'tiéboudienne'. In recent years, catches have been consistently decreasing and this species is presently considered to be critically overfished. The biology of the white grouper in Senegal as well as in the region – from Mauritania to Guinea – remains largely unknown. Ms Khady Diouf plans to carry out age and growth studies of this species in the estuary of Sine Saloum in Senegal, which is considered to be an important nursery site for its juveniles. The study is expected to contribute to the development of sustainable management strategies.

Capability Verses Capacity:

A clarification of the distinction in use at IFS

IFS has ceased to use the term 'capacity' and started to use the term 'capability'. This is why.

As discussed in our Foreword, in the 10-year strategy of IFS, support to excellent early-career researchers in the developing world aims to also foster greater consideration of equity – within and between countries – in the use of biological and water resources, and greater efficiency in transforming those resources to meet human needs in an environmentally safe and socially just way.

As well as looking at the biophysical world, this approach also forces us all, to consider the contemporary understanding of the continuum of human development. Within the capabilities approach poverty is understood as capability-deprivation. The capabilities approach is predominant as a paradigm for policy debate in human development where it inspired the creation of the UN's Human Development Index (a popular measure of human development, capturing capabilities in health, education, and income). Furthermore, since the creation of the Human Development and Capability Association in the early 2000s, the approach has been much discussed by political theorists, philosophers and a range of social scientist, including those with a particular interest in development.

The IFS 10-year strategy 2011-20, which supports excellent science underpinning the sustainable and equitable management of biological and water resources, draws on the capabilities approach, whereby expansion of freedom is viewed both as the primary end and the principal means of research and development. It is noteworthy that the emphasis is not only on how human beings actually function, but also on their having the capability, which includes making a practical choice, to function in important ways if they so wish; such as early-career scientists selecting a career in research.

Capacity is the ability to contain. It is a precursor to capability and subordinate to it. Someone could be deprived of scientific research capabilities in many ways, e.g. by ignorance, lack of information, government oppression, inappropriate government or institutional policy, lack of financial resources, lack of science infrastructure, lack of engagement with the broader scientific community and so on. While the combination of a person's functionings represents their actual achievements, their capability set represents their opportunity freedom – their freedom to choose between alternative functioning combinations.

The approach emphasizes functional capabilities ("substantive freedoms", such as the ability to live to old age, engage in economic transactions, or participate in research activities); these are construed in terms of the substantive freedoms people have reason to value, instead of the controversial economics term 'utility' (happiness, desire-fulfilment or choice) or access to resources (income, commodities, assets) which is also a precursor to capability.

This approach to human well-being emphasizes the importance of freedom of choice, individual heterogeneity and the multi-dimensional nature of welfare. These elements are deep rooted within IFS but one could encapsulate the role of IFS as expanding the freedom of aspiring scientists by enhancing functional capabilities. The conceptual foundations of capability within human development points to its articulation in human rights terms, i.e. to acknowledge the existence of claims, by developing country scientists for the right to develop their research capability, and to enjoy the freedom to choose the research which they have reason to value.

Launching the IFS Strategy 2011–2020

What's New?

The niche of IFS and its relevance today

The sustainable management of biological and water resources is of huge contemporary significance. We live in a time when the climate is changing, biodiversity is reducing, and where environmental degradation is increasing. We wish to belong to a world where food, water and energy supplies are fairly governed. There is a global consensus to eradicate extreme poverty and hunger and an increasing understanding of the planetary boundaries within which humanity can operate sustainably. However, these are huge global challenges; they require committed coordinated actions, good governance and a host of new innovations. We will all need to draw on exceptional individual and collaborative actions, and to harness the transformational power of science, technology and communications in order for our generation to safely and fairly ensure the stewardship of our natural resources.

Photo: Zeleke A. Dejen

IFS Grantee, Zeleke A. Dejen, assessing water saving at Metahara sugar irrigation scheme in Ethiopia.

Continuing early-career support for individual research

Individual grants to young researchers are at the core of IFS' work and even though the new strategy includes additional activities, the niche of IFS remains its dedication to small individual grants which early-career scientists can propose based on the problems they see before them, and which they can manage in their entirety. Our calls for proposals bring a large number of applicants from a wide array of countries and our grant management functions are perceived as supportive and unbureaucratic. IFS Advisers and Scientific Advisory Committees aim to recognise the needs and capabilities of young researchers and respond accordingly. For many years they have engaged in carefully "nurturing" young researchers through the extensive feedback they provide on grant applications and many young postdoctoral researchers tell us that they see this as vital support from advisers and a way to learn about what constitutes a good research proposal.

The niche of IFS remains highly relevant today. For example, this year the British Academy and the Association of Commonwealth Universities identified six areas where support is needed to ensure brighter prospects for early-career researchers. Their report focused specifically on Africa. Key amongst their recommendations were a number of the long standing ways of working of IFS. These included: the time and assistance to define research agendas, design new projects, and secure funding; and access to modest seed funding to build on doctoral work and to explore new ideas. Other recommendations related to the new elements of the new IFS strategy such as the approach to collaborative research. These included: encouraging research and fostering collegiality and mentorship; and opportunities to stay connected to peers, locally, regionally and internationally, through networks and conferences, and through participating in research communities.

Online Applications

IFS is beginning to move from email based applications to online application processes. This will begin with the launch of Collaborative Research Grants in 2012 and will later be introduced for individual approaches. We hope the approach will help with our pre-screening tasks and allow more rapid responses. Our challenge is to link such an approach with our current database.

New Eligibility Criteria

Following the envisioning process, with substantial interactions with many IFS stakeholders, we have debated our eligibility criteria and the IFS Board of Trustees (BOT) has advised that our eligibility going forwards should reflect that we focus on early-career scientists from least developed countries.

Country Eligibility

To be eligible the applicant must come from, and conduct the research in a Least Developed Country (LDC).

IFS Least Developed Country (LDC) Definition

IFS defines an LDC as a country with a Gross National Income (GNI) per capita, calculated by the Atlas method (USD), that is at or below the average for Middle Income Countries at the time of the application, according to the World Bank's annual list, published at *http://data.worldbank.org/indicator/NY.GNP.PCAP.CD*.

Research Area Eligibility

Eligible research will be relevant to the sustainable management of biological and water resources, relevant to the needs of the country or region, and contribute to the advancement of knowledge.

Personal Eligibility

Applicants should be at the beginning of their research careers and have a minimum academic degree of an MSc/MA or the equivalent degree. Going further the BOT has advised that the application age for women and men should be different. To be eligible, first time IFS grant applicants, should be younger than 35 years (men) and younger than 40 years (women). If the applicant's 35th birthday (men) or 40th birthday (women) is on or after the closing date of the call, then he/she is still eligible.

The rationale behind this change is as follows: Global statistics indicate that women are not only unequally represented in science but also less likely than men to be involved in the planning, research, development or application of science. The underrepresentation of senior women scientists limits the role-models, mentors and professional networks available to girls.

It is a priority for IFS to support women within developing world science, to enrich the scientific enterprise with the added diverse themes and perspectives that can be derived from a more balanced gender representation within science. The priority and the approach to empowering women in science, in the IFS strategy 2011–

The figures are calculated as described below.

GNI per capita (formerly Gross National Product (GNP) per capita) is the gross national income, converted to U.S. dollars using the World Bank Atlas method, divided by the midyear population. GNI is the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad. GNI, calculated in national currency, is usually converted to USD at official exchange rates for comparisons across economies, although an alternative rate is used when the official exchange rate is judged to diverge by an exceptionally large margin from the rate actually applied in international transactions. To smooth fluctuations in prices and exchange rates, a special Atlas method of conversion is used by the World Bank. This applies a conversion factor that averages the exchange rate for a given year and the two preceding years, adjusted for differences in rates of inflation between the country, and through 2000, the G-5 countries (France, Germany, Japan, the United Kingdom, and the United States). From 2001, these countries include the Euro area, Japan, the United Kingdom, and the United States. For more information please see the source: World Bank national accounts data, and OECD National Accounts data files.

Photo: Abdirahman Salah

IFS Grantee, Abdirahman Salah, conducts epidemiological studies of camel trypanosomosis in Somaliland.

2020, builds on the learning from the 2009 IFS initiative 'Developing Africa through Science, Technology, and Innovation in Agriculture: Women as key drivers', undertaken with the Technical Centre for Agricultural and Rural Cooperation (CTA) and RUFORUM, and from the IFS contribution to the CGIAR AWARD project. The approach aligns with the Norwegian Committee for Mainstreaming Women in Science, and contributes to the global agenda for gender equality and women's empowerment implied by MDG 3. The focus on Africa reflects the identified needs, that are found to be most prevalent in Sub-Saharan Africa and supports the African Union declaration of 2010-2020 as the African Women's Decade, which includes a thematic focus on the promotion of women in science and technology.

IFS believes that mainstreaming a gender perspective in Science, Technology and Innovation (STI) could enrich innovative problem-solving and decision-making, enhance social equity, women's rights and contribute to the more effective achievement of the Millennium Development Goals and the attainment of sustainable development. This priority within the IFS strategy is based on the premise that to strive for gender equity in science is not only an international obligation, but a wise approach to science management and governance.

Institutional Affiliation

Applicants must be attached to a national research institute (e.g. university, non-profit making research centre, or research oriented NGO) in a developing country. The institution is expected to administer the grant, guarantee that the applicant has a salary (or other source of income), and provide basic research facilities. Researchers doing part of their project at an international institute can apply for an IFS grant, if their principal affiliation is with a national institution

Launching a Collaborative Research Approach

In 2012 IFS will pilot a new approach to support researchers to work together. In collaboration with the Carnegie Corporation, IFS will launch a call for expressions of interest in *IFS Collaborative Research Grants.* As a pilot, this

call will be restricted to research by early-career scientists into *Neglected and Underutilized Species (NUS)* and will initially involve five African country partners: *Ghana, Nigeria, South Africa, Tanzania* and *Uganda*.

Working together on collaborative research can bring benefits, such as the sharing and pooling of knowledge, skills and techniques. Often, no single individual will possess all the knowledge, skills and techniques required in a research undertaking. Collaboration may provide a more effective and cost-efficient use of the combined talents. Collaboration is also a way of transferring new knowledge, especially tacit knowledge - learnt from doing, which may not yet be in some written form that can be shared.

For scientists early in their careers, building on individual research efforts, providing an opportunity for collaboration can aid in learning the social and management skills needed to work as part of a team later in their careers. Such skills cannot be readily taught in the classroom; they are best learned 'on the job' by engaging graduate students or young postdoctoral researchers in collaborative activities. However, such skills are vital for many collaborative research opportunities from other major donors.

In common with IFS individual granting, IFS team application procedures emphasize the capability building element of the undertaking by specifically supporting the process but giving preference to teams where the proposed Team Coordinator is an early-career scientist. The IFS online and written support for team applications also encourages teams to consider some of the issues that are known to give rise to problems within collaborative ventures. For example, information is provided about different organisational models suited to small teams undertaking collaborative research, and about selecting team roles. The process encourages teams to discuss early on, issues around intellectual property, publication and authorship, credit and data availability.

A key early challenge for collaborative research is to find and interact with potential collaborators. Recent advances in interactive web-2 technologies have given rise to useful digital workspaces that can be adapted and developed for the purpose of facilitating researchers to find out about each other and to 'meet' online. Eligible applicants can be invited into a specially developed digital social networking platform where they can search and filter each other's profiles and connect online with likely collaborators. As teams come together they will have their own team workspaces to develop their collaborative proposals, and mentors will be available in both workspaces to facilitate the process.

It is expected that the best 12–15 research team proposals will be supported through this pilot.

For IFS the pilot will begin to allow us to assess how such an undertaking can work, and which elements prove most effective. We will aim to assess how much collaboration in research may be a source of creativity. We will try to establish where collaborative research brings about a clash of views or a cross-fertilisation of ideas and if this in turn generates new insights or perspectives that individuals, working on their own, would not have grasped (or grasped as quickly). Whilst such benefits are likely to be largest when the collaboration involves partners from more divergent scientific backgrounds, the difficulties in interdisciplinary working are known to be greater!

It appears vital that in our changing world we harness the power of science to help to address the global challenges we face. To contribute to this end, we will continue to provide individuals with opportunities to research, but we also wish to encourage researchers to work together more. There is evidence that scientists who start collaborating early in their careers are more likely to be operationally orientated in their collaborative decision making. Therefore, the mechanisms IFS is putting in place through the Collaborative Research Approach aim to encourage early-career scientists to take a more organisational and strategic approach concerning their relations with partners, as this approach is known to lead to increased joint outputs.

Photo: Ezekiel Amri

IFS Grantee Ezekiel Amri in Tanzania uses rooted stem cuttings of African Blackwood (Dalbergia melanoxylon) to study the influence of arbuscular mycorrhizal fungi.

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Excerpt from the Audited Financial Statement 2011

The Board of Trustees and Director submit the annual financial statement for the year ended 31 December 2011.

Administration Report

Information about the activities

In 2011, after extensive consultations with a wide array of stakeholders, the IFS BOT agreed a revised mission statement and a new 10-year strategy for IFS. The *envisioning process* included face-to-face and on-line consultations, Regional Consultation Meetings for Latin America in Mexico, Asia and The Pacific in Thailand, and Africa in Uganda, and a large digital survey using Survey Monkey software to engage around 10,000 associates of IFS. The revised mission statement emphasises IFS support for high quality research, and moves beyond capability enhancement to also include building agency of young developing country scientists to put their research into use. The new 10-year strategy contains three key Research Approaches in support of Individual Research, Collaborative Research and Contributing Innovation (which includes putting research into use in entrepreneurial and policy domains). The new strategy includes revised eligibility criteria resulting in a stronger poverty focus for IFS support. Countries with a GNI per capita, at or below the average for Middle Income Countries (MIC) will be considered eligible for IFS support, the earlier threshold used by IFS was the average for Upper Middle Income Countries (UMIC).

The 10 year strategy will take the following approach to Capability Enhancing Support (CES). Because of the cost of such support, IFS recognises that it is not possible to offer face-to-face pre-grant support to all. IFS is building more online resources to help build skills and links for applicants. In 2011 IFS launched a new website, the Content Management System site is more interactive and information rich, with active news and blog posts and expanded searching facilities. From time to time, often with partners , IFS will make available CES to prospective grantees (those planning to apply). Such support can include building proposal writing skills, access to literature and information rich databases, and networking opportunities organised by IFS. Grantees will also be able to access CES including building science writing skills, understanding policy influence and accessing equipment and supplies. CES events will be advertised on the IFS website.

A funding agreement with Sida had existed up to March 2011, but a meeting in October 2011 was the first possibility to meet with the donor, due to substantive internal reorganisation taking place at Sida. In the meeting with Sida on October 12th 2011, Sida apologized for the hiatus and agreed retrospectively the funds for 2011 to IFS and invited IFS to apply for Sida funding for a further 3 years, thereafter a review would take place, prior to a likely further 2 years of Sida support. An application was duly submitted to Sida in November 2011.

Whilst work progressed during 2011on the development of systems and processes in support of the proposed Research Approaches for the new strategy, the granting process was reopened after being closed for the period of the envisioning process. Time-bound calls were introduced by IFS, with two grant application sessions advertised ahead of the strategy launch proposed for 2012. The deadline for the first session was 9th October 2011, and for the second session was to be 29th January 2012.

The IFS granting process includes the receipt and registration of the research grant applications and the

1 Recent partners have included: AuthorAid, L'Institut de recherche pour le développement (IRD), National University of Rwanda (NUR), African Women in Agricultural Research and Development (AWARD), National Research Council of Thailand.

internal pre-screening of all proposals. Thereafter, applications are sent to internationally established scientific advisers and experts for comment (IFS has approximately 1400 advisers in its database). The proposals are then reviewed and prioritised at the meetings of the Scientific Advisory Committees (SAC); these meetings were held once this year with the participation of advisers. Upon the recommendations of the SACs, the IFS Director approves the research grants for funding. Thereafter, the Secretariat draws up the contracts for signature by the grantee, head of institution and the IFS Director. During the research period (one to three years and renewable twice), IFS provides supporting services to the grantees. In 2011 IFS provided support to 1100 young scientists in developing countries in the form of research grants, feedback on research proposals including the failed applications, assistance in the purchasing of equipment and supplies, arrangement of workshops and training courses, and network support. 219 of 222 new research grants were approved while four capability enhancing support workshops were arranged for altogether 100 young scientists.

IFS ran a 4 month envisioning process ahead of developing the10-year strategy. 274 people from 43 countries attended the regional consultations (Africa 56%, Asia and The Pacific 20%, Latin America 10%, and Europe 14%). A further 4,100 people from 142 countries responded to an online survey (Africa 50%, Asia and the Pacific 30% and Latin America 20%).

In 2011 IFS introduced for the first time *distance spanning techniques* for its Executive Committee Meetings, with on-line video links saving funds and travel time, and reducing its *carbon footprint*. There were governance meetings in May and November and in October a facilitated meeting including SAC and BOT colleagues debated the implementation of the new strategy.

88 % of total expense for the year 2011 was spent on programme services totalling SEK 34 554 503, (EUR 3 869 269). The advisers and experts evaluations of proposals do not receive remuneration for reviewing nor for the SAC meetings. These contributed services are not reflected in this report.

In 2011 IFS concluded and appraised its pilot regional office (hub) for Eastern Africa located on the campus of Makerere University, Kampala, Uganda and hosted by the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM). The trustees agreed that whilst the hub model had not worked for IFS, a visible, supportive, regional presence could be highly beneficial. Ways to achieve this are now being sought including: expanding the evolution of alumni associations and increasing their role; Engaging with eminent alumni to represent IFS; Partnering with suitable, likeminded partners for mutual benefit; Negotiating a role with academies of science, research organisations, or governments of countries that are graduating away from eligibility for IFS Individual Grant Support, especially those that neighbour least developed countries; Engaging with Trustees to support and leverage support for IFS and activating our affiliated organisations.

IFS and the CGIAR AWARD project hosted a Research Proposal Writing Course in Mombasa, Kenya in January for participants from Ghana, Kenya, Malawi, Mozambique, Nigeria, Rwanda, Tanzania and Uganda, and a Scientific Writing Course in Tanzania in February for participants from Ethiopia, Ghana, Kenya, Malawi, Mozambique, Nigeria and Uganda.

IFS and the National Research Council of Thailand hosted a Workshop on Advances in Natural Products and Food Science which took place in Bangkok in March, with grantees participating from India, Indonesia, Malaysia, Nepal, Pakistan, Thailand and Vietnam.

The SUNRAY project consortium management meetings took place in Antwerp in January and August and there was a regional workshop in Tanzania in November to agree modes of operation and report progress on work package. IFS has been instrumental in indentifying scientists strongly involved with nutrition research that can take part in the study (many are IFS grantees) thanks to its broad network in Sub-Saharan Africa and through work carried out in Antananarivo, Madagascar in July.

A meeting took place in Abuja, Nigeria in December, of the MacArthur Foundation funded project 'Procurement, Installation, Service, Maintenance and Use of Scientific Equipment' (known as PRISM) which is managed by IFS and which will conclude the development of a new approach to equipment procurement next year.

IFS and IRD (L'Institute de recherche pour le développement) hosted a workshop on how to write scientific projects in environmental science at Tam Dao, Vietnam in December.

Plans for 2012

- ***Stewardship of IFS*** (resource mobilization, communications, managing change, improving efficiency and implementation of the new strategy).
- ***IFS Individual Research Approach*** (Specific Objectives: Capability of young developing country scientists built, to produce new research findings, relevant for developing countries and of assured quality according to current academic principals).
- ***IFS Collaborative Research Approach*** (Specific Objectives: Capability of researchers from developing countries to access collaborative research networks promoted, including links to the international research community).
- ***IFS Contributing Innovation Approach*** (Specific Objectives: The use of research in developing countries promoted and the demand for research increased).

Financial Result

The financial result for the year is a surplus of SEK 1 644 267 (EUR 184 118).

Recommendation for the disposition of the net result

Balance, 1 January	6 406 227	(EUR 717 342)
Board Designated Fund for Contingencies	800 000	(EUR 89 581)
Net Income less Expense for the Year	1 644 267	(EUR 184 118)
	8 850 494	(EUR 991 041)

The Board of Trustees and Director recommend that the accumulated surplus is carried forward to the following year.

8 850 494	(EUR 991 041)

The result of the organisation's activities, and the financial position at the end of the year, are reflected in the following Statement of Income and Expense, Balance Sheet and accompanying notes.

All amounts in the Audited Financial Statement are shown in Swedish Crowns (SEK) unless otherwise noted.

STATEMENT OF INCOME AND EXPENSE

(in thousands SEK)

	1 January - 31 December 2011	1 January - 31 December 2010
Programme Revenue		
Core and Restricted Contributions	39,595	42,910
Grants Withdrawn	735	431
Other Programme Revenue	199	217
Total Programme Revenue	40,529	43,558
Programme Expense		
Programme Services	34,555	34,720
Fundraising and Partnership Building	2,362	2,117
Management and General	2,446	3,003
Total Programme Expense	39,363	39,900
Programme Income less Expense	1,166	3,658
Interest Income and Expense		
Interest Income	256	35
Exchange gain/loss	222	-206
Interest Income less Expense	478	-170
Net Income less Expense	1,644	3,487

BALANCE SHEET

(in thousands SEK)

	31 December 2011	31 December 2010
Assets		
Fixed Assets		
Tangible Assets		
Equipment, Furniture and Fixtures	365	257
Financial Assets		
Long-term Donor Receivables	294	432
Total Fixed Assets	659	689
Current Assets		
Current Receivables		
Donor Receivables	1,298	3,124
Other Current Receivables	800	929
Prepaid Expense and Accrued Income	1,623	726
Total Current Receivables	3,722	4,778
Short-term Investments	0	0
Cash and Bank Balances	33,566	28,497
Total Current Assets	37,288	33,275
Total Assets	37,947	33,964
Equity and Liabilities		
Equity		
Board Designated Fund for Contingencies	800	800
Total Designated Fund	800	800
Unrestricted Equity		
Balance, 1 January	6,406	2,919
Net Income less Expense for the Year	1,644	3,487
Total Unrestricted Equity	8,050	6,406
Total Equity	8,850	7,206
Current Liabilities		
Research Grants Payable	16,127	6,570
Deferred Restricted Contributions	10,006	15,651
Accounts Payable	128	86
Other Current Liabilities	821	764
Accrued Expense and Prepaid Income	2,014	3,686
Total Current Liabilities	29,096	26,758
Total Net Assets and Liabilities	37,947	33,964
Pledged Assets: provision for credit cards	400	400
Contingent Liabilities	None	None

IFS Affiliated Organisations 2011

National Organisations

Argentina
- Academia Nacional de Ciencias Exactas, Físicas y Naturales (ANCEFN)
- Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET)

Australia
- Australian Academy of Science (AAS)

Austria
- Fonds zur Förderung der Wissenschaftlichen Forschung (FWF)
- Österreichische Akademie der Wissenschaften (ÖAW)

Bangladesh
- Bangladesh Council of Scientific and Industrial Research (BCSIR)

Belgium
- Académie Royale des Sciences d'Outre-Mer (ARSOM)
- Académie Royale des Sciences des Lettres et des Beaux-Arts de Belgique
- Koninklijke Academie voor Wetenschappen, Letteren en Schone Kunsten van België (KVAB)

Bolivia
- Academia Nacional de Ciencias de Bolivia (ANCB)

Brazil
- Academia Brasileira de Ciencias (ABC)
- Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPQ)
- Fundaçao Oswaldo Cruz (FIOCRUZ)

Burkina Faso
- Ministère des Enseignements Secondaire, Supérieur et de la Recherche Scientifique (MESSER)

Cameroon
- Ministry of Scientific and Technical Research

Central African Republic
- l'Enseignement Supérieur et de la Recherche Scientifique

Chad
- Direction de la Recherche Scientifique et Technique, MESRS

Chile
- Academia Chilena de Ciencias
- Comisión Nacional de Investigación Científica y Tecnológica (CONICYT)

China
- Chinese Academy of Sciences (CAS)

Colombia
- Academia Colombiana de Ciencias Exactas, Físicas y Naturales (ACCEFYN)
- Centro para la Investigación en Sistemas Sostenibles de Producción Agropecuaria (CIPAV)
- Instituto Colombiano para el Desarrollo de la Ciencia y Tecnología (COLCIENCIAS)

Congo (Brazzaville)
- Direction Générale de la Recherche Scientifique et Technique, MENRST

Costa Rica
- Consejo Nacional de Investigaciones Científicas y Tecnológicas (CONICIT)

Côte d'Ivoire
- Académie des Sciences, des Arts, des Cultures d´Afrique et des Diaporas africaines

Cuba
- Academia de Ciencias de Cuba (ACC)
- Ministry for Foreign Investment and Economic Cooperation

Denmark
- Akademiet for de Tekniske Videnskaber (ATV)
- Det Kongelige Danske Videnskabernes Selskab (RDVS)

Ecuador
- Fundación para la Ciencia y la Tecnología (FUNDACYT)

Egypt
- Academy of Scientific Research and Technology (ASRT)

El Salvador
- Consejo Nacional de Ciencia y Tecnología (CONACYT)

Ethiopia
- Ethiopian Science and Technology Commission (ESTC)

Finland
- Delegation of the Finnish Academies of Science and Letters

France
- Académie des Sciences
- Centre de Coopération Inter-nationale en Recherche Agronomique pour le Développement (CIRAD)
- Institut National de la Recherche Agronomique (INRA)
- Institut de Recherche pour le Développement (IRD)

Germany
- Deutsche Forschungsgemeinschaft (DFG)

Ghana
- Council for Scientific and Industrial Research (CSIR)

Guinea
- Direction Nationale de la Recherche Scientifique et Technique

Guinea-Bissau
- Instituto Nacional de Estudos e Pesquisa (INEP)

Guyana
- Institute of Applied Science and Technology

Honduras
- Consejo Hondureño de Ciencia y Tecnología (COHCIT)

India
- Indian National Science Academy (INSA)

Indonesia
- Lembaga Ilmu Pengetahuan Indonesia (LIPI)

Israel
- The Israel Academy of Sciences and Humanities

Jamaica
- Scientific Research Council (SRC)

Jordan
- Royal Scientific Society (RSS)

Kenya
- Kenya Agricultural Research Institute (KARI)
- Kenya National Academy of Sciences (KNAS)

Korea DPR (North)
- Academy of Sciences of DPR Korea

Korea R (South)
- National Academy of Sciences (NAS)

Kuwait
- Kuwait Institute for Scientific Research (KISR)

Latvia
- Latvian Academy of Sciences (LAS)

Lesotho
- The National University of Lesotho (NUL)

Liberia
- University of Liberia (UL)

Madagascar
- Académie National Malgache

Malawi
- National Research Council of Malawi (NRCM)

Malaysia
- Malaysian Scientific Association (MSA)
- Ministry of Science, Technology and Innovation

Mali
- Centre National de la Recherche Scientifique et Technologique (CNRST)
- Comité National de la Recherche Agricole (CNRA)

Mexico
- Consejo Nacional de Ciencia y Tecnología (CONACYT)

Mongolia
- Mongolian Academy of Sciences

Morocco
- Centre National de Coordination et de Planification de la Recherche Scientifique et Technique (CNR)
- Institut Agronomique et Vétérinaire Hassan II

Mozambique
- Universidade Eduardo Mondlane (UEM)
- The Scientific Research Association of Mozambique (AICIMO)

Nepal
- Royal Nepal Academy of Science and Technology (RONAST)

Netherlands
- Koninklijke Nederlandse Akademie van Wetenschappen (KNAW)

Niger
- Université Abdou Moumouni

Nigeria
- Federal Ministry of Science and Technology (FMST)
- The Nigerian Academy of Science (NAS)

Norway
- Det Norske Videnskaps-Akademi (DNVA)

Pakistan
- Pakistan Council for Science and Technology (PCST)

Panama
- Secretaria Nacional de Ciencia y Tecnologia e Innovación (SENACYT)
- Universidad de Panamá

Papua New Guinea
- The University of Papua New Guinea

Peru
- Consejo Nacional de Ciencia y Tecnología (CONCYTEC)

Philippines
- National Research Council of the Philippines (NRCP)

Poland
- Polish Academy of Sciences (PAS)

Saudi Arabia
- King Abdulaziz City for Science and Technology (KACST)

Senegal
- Délégation aux Affaires Scientifiques et Techniques, MRST

Seychelles
- Seychelles Bureau of Standards (SBS)

Sierra Leone
- Institute of Agricultural Research (IAR)

South Africa
- National Research Foundation (NRF)

Sri Lanka
- National Science Foundation (NSF)

Sudan
- National Centre for Research (NCR)

Sweden
- Ingenjörsvetenskapsakademien (IVA)
- Kungliga Skogs- och Lantbruksakademien (KSLA)
- Kungliga Vetenskapsakademien (KVA)

Switzerland
- Council of the Swiss Scientific Academies (CASS)
- Swiss National Science Foundation (SNSF)

Tanzania
- Tanzania Commission for Science and Technology (COSTECH)

Thailand
- National Research Council of Thailand (NRC)
- Thailand Research Fund (TRF)

Tunisia
- Direction Générale de la Recherche Scientifique et Technique, MES

Uganda
- National Agricultural Research Organisation (NARO)
- Uganda National Council for Science and Technology (UNCST)

United Kingdom
- The Royal Society
- Natural Resources Institute (NRI)

Uruguay
- Programa de Desarrollo de las Ciencias Basicas (PEDECIBA)

USA
- American Academy of Arts and Sciences (AAAS)
- National Academy of Sciences (NAS)
- New York Academy of Sciences (NYAS)

Venezuela
- The Ministry of Popular Power for Science and Technology

Viet Nam
- Ministry for Science and Technology (MOST)

Zambia
- National Institute for Scientific and Industrial Research (NISIR)

Zimbabwe
- Scientific and Industrial Research and Development Centre (SIRDC)
- University of Zimbabwe

Regional Organisations

Africa
- Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA)
- Association of African Universities (AAU)
- Centre Regional pour l'Eau Potable et l'Assainissement à faible coût (CREPA)
- Institut du Sahel (INSAH)
- The African Academy of Sciences (AAS)
- West and Central African Council for Agricultural Research and Development (WECARD/CORAF)
- Western Indian Ocean Marine Science Association (WIOMSA)

Latin America and the Caribbean
- Centro Agronónomico Tropical de Investigación y Enseñanza (CATIE)
- The Caribbean Academy of Sciences (CAS)
- Caribbean Agricultural Research and Development Institute (CARDI)

International Organisations

- BioNET-INTERNATIONAL (The Global Network for Taxonomy)
- International Organisation for Chemical Sciences in Development (IOCD)
- International Union of Forest Research Organisations (IUFRO)
- The Academy of Sciences for the Developing World (TWAS)

Consultative Group on International Agricultural Research (CGIAR):
- CGIAR Secretariat
- Bioversity International
- Centro Internacional de Agricultura Tropical (CIAT)
- Centre for International Forestry Research (CIFOR)
- International Centre for Agricultural Research in the Dry Areas (ICARDA)
- International Centre for Research in Agroforestry (ICRAF)
- International Water Management Institute (IWMI)
- World Fish Center

Events arranged by IFS and its partners 2011

Country	Event
Kenya	IFS-AWARD Research Proposal Writing Workshop
Mexico	IFS Envisioning Meeting for Latin America
Tanzania	IFS-AWARD Science Writing, Communication and Presentation Skills Workshop
Thailand	Workshop on Research Advances in Natural Products, Food Science and Nutrition- and IFS Envisioning Meeting for Asia
Viet Nam	Hanoi IFS-IRD Proposal writing Workshop

IFS research grants awarded 2011

Country	Grantee	Research Project Title
Bangladesh	ISLAM, Md. Rashidul	Assessment of pathotypic and genetic diversity of a rice pathogen, *Xanthomonas oryzae* pv. *oryzae* in Bangladesh
	SHAHIDUZZAMAN, Md.	Investigation of *Cryptosporidium* oocysts in animal and human faeces and the different water sources in Bangladesh
	SULTANA, Nadira	Measuring water footprints in small-scale farming systems in Bangladesh: a challenge for food security
Benin	AFFOKPON, Antoine	Assessing damage to landraces of *Citrullus lanatus* subsp. *mucosospermus* by root-knot nematodes and developing sustainable control methods in Benin
	AGNOUN, G Yves Fructueux	Etude de la diversité génétique et de la résistance à la pyricularoise et à la panachure jaune des lignées intra- spécifiques du riz africain, *Oryza glaberrima*
	AMAKPE, Felicien	Study of the ecological adaptation of the honey bee *(Apis mellifera adansonii)* in the Republic of Benin
	ASSOGBADJO, Achille E (Renewal grant)	Investigating the ecological and anthropogenic factors that determine the natural regeneration patterns of the multipurpose baobab tree (*Adansonia digitata* L.) in Benin
	EKUE, Marius Rodrigue Mensah (Renewal grant)	Domestication of *Blighia sapida* in Benin: phenotypic variation in fruits and arils traits, germination testing and genebank establishment
	GLIN, Laurent Camille (Renewal grant)	Policy and institutional reforms and the environment in the cotton industry in Benin: an ecological modernization perspective
	OGOUWALE, Romaric	Changements climatiques, dynamique des états de surfaces et prospectives sur les ressources en eau dans le bassin de Okpara
	VODOUHE, Gbèlidji Fifanou (Renewal grant)	Diversité spécifique et valeur accordée aux Produits Forestiers non-Ligneux dans les terroirs riverains de la Réserve de Biosphère de la Pendjari au Bénin
	YEDOMONHAN, Hounnankpon (Renewal grant)	Ecologie de reproduction d'une espèce à haute valeur mellifère: *Syzygium guineense* (Will.) DC. (Myrtaceae)
Botswana	GONDWE, Mangaliso John G S	Phosphorus biogeochemistry in superficial sediments in the Okavango Delta, Botswana
Brazil	CANELLAS, Luciano Pasqualato (Renewal grant)	Biofertilizer production using humic acids and plant growth promoting microorganisms
	FOLLMER, Cristian (Renewal grant)	Binding of the herbicide paraquat to alpha-synuclein and its implications in the stability of protein aggregates
	RIBAS DÖLL, Maria Magdalena (Renewal grant)	Removal of carbon, nitrogen and phosphorous by upflow biological filter and bioenergy production from meat industry wastewater
	STANISCUASKI, Fernanda	Involvement of aquaporins in the tolerance to aluminium in different soybean cultivars
	VINSON, Christina Cleo	Genetic diversity, inbreeding and gene flow of *Dimorphandra mollis* and *D. wilsonii*
Burkina Faso	BADOLO, Athanase	Propriétés insecticides et répulsives de quelques extraits de plantes tropicales contre *Anopheles gambiae* et *Aedes aegypti*, moustiques vecteurs de maladies humaines au Burkina Faso

	BAYALA, Balé (Renewal grant)	Effets des tiges feuilleés de *Leptadenia hastata* (Pers.) Decne sur la fonction de reproduction et la croissance de jeunes boucs impubères
	DAYO, Guiguigbaza-Kossigan	Caractérisation et étude de la diversité génétique à l'aide de marqueurs microsatellites des taurins Baoulé
	DISSA, Alfa Oumar	Optimisation des paramètres de séchage solaire indirect de la *Spiruline platensis (Arthrospira platensis)* produite au Burkina Faso
	KABORE, Sibiry A	Dynamique et régénération naturelle assistée du karité *(Vitellaria paradoxa* C. F. Gaertn.) dans les systèmes agroforestiers du Burkina Faso
	KADEBA, Abel	Etude de la diversité floristique et des usages de la végétation des inselbergs de l'ouest du Burkina Faso
	KUELA/KPODA, Winkom Noëllie	Evaluation des risques sanitaires biologiques liés à la réutilisation des eaux usées et excretas humains traités dans le maraîchage urbain dans le domaine nord soudanien: cas de la ville de Ouagadougou, au Burkina Faso.
	MILLOGO, Vinsoun	Study on milk recording of yield, fat, protein and lactose content, which could be a help for selective breeding programmes in Burkina Faso
	SOMBIE, Pierre Alexandre Eric Djifaby	Evaluation du potentiel thérapeutique des galles de *Guiera senegalensis* J.F. Gmel (Combretaceae) pour le traitement du diabète de type 2 et/ou de ses complications au Burkina Faso
	SOMDA, Martin Bienvenu (Renewal grant)	Etudes expérimentales de la réponse immune anti-salive de glossines chez les bovins d'Afrique de l'Ouest: application à l'analyse de la trypanotolérance et à l'évaluation de l'exposition des tropeaux
	TRAORÉ, Oumar	Etude de la qualité bactériologique des eaux utilisées en marraîche culture et de recherche de vibrio dans les poissons (hôtes) en vue de la protection de la santé des populations
	WONNI, Issa (Renewal grant)	Etude de la variabilité génétique et pathogénique de *Xanthomonas oryzae* au Burkina Faso
Burundi	HAKIZIMANA, Dismas	Eco-éthologie de la communauté des primates du Parc National de la Kibira
Cameroon	BTATKEU K., Brice Donald	Application du fer metallique au traitement des eaux: mise sur pieds d'un filtre à l'usage domestique
	FRÉDÉRIC NICO, Njayou (Renewal grant)	An active extract from *Khaya grandifoliola* D.C and *Entada africana* Guill. et Pers.: studies on antihepatotoxic action mode – immunomodulatory activity and active compounds isolation
	GUY BERTRAND TCHAYA,	Modelisation et optimisation d'un séchoir solaire indirect par la régulation de température: application aux noix de karité
	HAKO TOUKO, Blaise Arnaud	Effet du gène cou nu (Na) sur l'adaptabilité de la poule locale *(Gallus domesticus)* et la réponse immunitaire contre la Newcastle disease à paramyxovirus de type 1
	JATSA, Hermine Boukeng (Renewal grant)	*Clerodendrum, Sida* et *Ozoroa:* Recherche des fractions actives contre *Schistosoma mansoni*
	KENGNE, Olivier Clovis	Evaluations écologiques des dispositifs de conservation de la biodiversité forestière au Cameroun
	KUETE, Victor (Renewal grant)	Antimycobacterial , anti-HIV effects and cytotoxicity of extracts and compounds from Cameroonian medicinal plants
	MUNE MUNE, Martin Alain	Procédé pour la production enzymatique d'hydrolysats protéiques de pois Bambara *(Vigna subterranea)* et de niébé *(Vigna unguiculata)* ayant des propriétés fonctionnelles optimales
	NFOTABONG ATHEULL, Adolphe	Dynamique spatio-temporelle des propagules de *Rhizophora* spp. dans les zones non, peu et très anthropisées de l'estuaire du Wouri (Cameroun)
	ZOFOU, Denis	New antiplasmodial compounds from *Dacryodes edulis* (G. Don) Lam. and *Coula edulis* Baill. selected medicinal plants used to treat malaria symptoms in western Cameroon

China	BAO, Yanyu (Renewal grant)	The study on chemical fractions and bioavailability of oxytetracycline in the soil environment
	LAN, Caixia	QTL mapping for adult-plant resistance to powdery mildew in common wheat
	LUO, Zhong-lai	Conservation biology of the highly endangered wild litchi *(Litchi chinensis)* based on reproductive and population genetic studies
	QI, Xiao-hua	Identification of powdery mildew resistance gene in cucumber based on digital gene expression profiling
	SHU, Yinghua	Mechanisms of genetically modified Bt-corn affecting the reproduction of non-target pests *Spodoptera* litura Fabricius and *Rhopalosiphum maidis* Fitch
	YANG, Bao (Renewal grant)	Covalent complexing between polysaccharides of longan fruit pericarp and endogenous phenolics induced by ultrasound
	ZHANG, Jin-zhi	Functional characterization of a novel F-box (PtF-box) gene from an early-flowering mutant of trifoliate orange and its application for shortening the juvenile phase in citrus
	ZHENG, Weiwei	Function analysis of odorant receptor OR83b in *Bactrocera dorsalis* and research for proteins interacting with it
	ZHOU, Xiang	Mycelial formulation of *Pandora delphacis* for the control of the rice pest, *Nilaparvata lugens*
	ZHU, Zhuoyi	A study on dissolved organic nitrogen in the Changjiang Estuary commencing with amino acids enantiomers
Colombia	DOMÍNGUEZ RIVERA, Isabel Cristina	Participatory modelling of catchment and human health in Andean rural micro-catchments
	ISAZA, Carolina	Assessing the ecological sustainability of fruit extraction of three palms in the Amazonas
	PABA MARTÍNEZ, Jaime (Renewal grant)	Cloning of laccase genes of *L. crinitus* and assessment of their expression in different culture conditions
	RAMOS RODRÍGUEZ, Freddy Alejandro	Perspectives of marine bacteria from the Colombian Caribbean as a resource of bioactive compounds. Phase I: bacteria from the soft coral *Pseudopterogorgia elisabethae*
	VASCO, Aida	Diversity, specificity and function of ectomycorrhizal (EM) fungi in a tropical rain forest dominated by *Pseudomonotes tropenbosii* (Dipterocarpaceae) in Colombian Amazonas
	VASQUEZ SARRIA, Nancy (Renewal grant)	Contact-stabilization activated sludge process for nitrogen compounds and organic matter removal
Congo	ENZONGA YOCA, Josiane Aphrodita	Evaluation de la qualité nutritionnelle du lait de graines de courges *(Cucumeropsis mannii* et *Citrullus lanatus)* et essai d'incorporation des résidus delipidés (tourteaux) dans l'alimentation des poulets de chair et des poules pondeuses
Costa Rica	ALFARO ALVARADO, Luis Diego	Ecology and conservation of jaguar and white-lipped peccary in Guanacaste, Costa Rica
	D´AMBROSIO, Ugo	Agroculinary transitions in Ngäbe households, Costa Rica: linking food plants, time and worldviews in Conte-Burica using participatory research
	ESCALANTE-MUÑOZ, Teresa (Renewal grant)	Effects of snake venom metalloproteinases on angiogenesis: applications in the design of new therapeutic agents for angiogenesis-related diseases
	HERRERA VEGA, María	Study of the bovine immune response towards the venom of the Lancehead snake *(Bothrops asper)*: design of an antiophidic vaccine to prevent cattle snakebite envenomation in Central America
	ORTIZ ARIAS, Beatriz	Study of genetic diversity of the phytobacterium *Xylella fastidiosa* present in different plant species in Costa Rica: a step looking for their geographical origin
Cote d'Ivoire	ADOU, Yao Constant Yves	Dynamique des communautés végétales dans la Forêt des Marais Tanoé-Ehy (FMTE), Sud-Est de la Côte d'Ivoire

	AHOULE, Dompé Ghislain Maxime	Pollution des eaux pluviales urbaines d'un bassin versant en amont de la baie de Cocody: caractéristiques, origines et impact sur la baie, Abidjan, Côte d'Ivoire
	AKA, Solange	Mise au point d'aliments probiotiques à partir des souches de bactéries lactiques isolées de différentes étapes de production du tchapalo, une bière traditionnelle de sorgho
	DJENI, N'Dédé Théodore	Valorisation de l'activité de production artisanale d'attiéké à travers l'instauration d'une démarche HACCP
	GONEDELÉ BI, Sery Ernest	Typage moléculaire de la viande de brousse en Côte d'Ivoire: mise en place d'un outil génétique de conservationà l'échelle des mammifères
	KOFFI, N'goran Mathurin	Diagnostic moléculaire et gestion durable de la chimiorésistance due à *Trypanosoma congolense,* pathogène majeur du bétail en Côte d'Ivoire
	KONÉ, W Armand	Intensification écologique de l'amélioration du sol sous *Chromolaena odorata* (Eupatorium) pour une production durable de l'igname *(Dioscorea spp)* en zone de savanes de Côte d'Ivoire
	KOUAMÉ, Assiri Elloh Patrice	Identification et utilisation de microorganismes antagonistes contre les champignons responsables de pourritures de l'igname (*Dioscorea* spp.)
	OUATTARA, Gnénéquidou Honoré (Renewal grant)	Nouvelle approche de la fermentation du cacao visant la maîtrise de la qualité des fèves marchandes à partir d'une microflore de type starter enrichie avec des souches pectinolytiques de bacillus
Cuba	ARANA LABRADA, Franklyn	Molecular caracterization and development of specific tools for diagnosis of pepper mottle virus isolated in Cuba
	CABRERA MEDEROS, Dariel	Biological and molecular characterization of Papaya ringspot virus isolates from *Carica papaya* L. var. Maradol roja in Cuba
	FRIAS SOLER, Roberto Carlos	Genetic characterization of two Flamingo colonies *(Phoenicopterus ruber)*
	HERNÁNDEZ-RODRÍGUEZ, Lester	Identification and characterization of viruses affecting the pineapple crop in Cuba: generation of tools for their diagnoses
	MARRERO COTO, Jeannette (Renewal grant)	Heavy metal removal capacity of highly nickel- and cobalt- resistant strains encoded by ncrABC genetic determinant: bioinformatics of its evolution
	MIRABAL ALONSO, Loreli De Los Angeles	Multifunctional role of AMF spore of *Glomus hoi*-like (INCAM- 4) – associated bacteria
	MONTERO ALEJO, Vivian	Identification and characterization of antimicrobial peptides from the hemolymph of the spiny lobster *Panulirus argus*
	PERERA BRAVET, Erick (Renewal grant)	Purification and characterization of trypsin-like enzymes from the spiny lobster *Panulirus argus*
	PORTAL, Orelvis	The role of pathogenesis-related proteins on banana defence response to black leaf streak disease
	RODRIGUEZ SILVA, Rodet	Molecular diversity of the genus *Gambusia* in Cuba: relevance for conservation and its use in vector control plans
	ROMEU ALVAREZ, Beatriz	Water quality of tropical aquatic ecosystems: role of *Escherichia coli* as indicator of microbiological contamination and characterization of *E. coli* pathotypes
	SALAS SARDUY, Emir	Cloning and expression in *Pichia pastoris* of plextatin, a cysteine protease inhibitor from the gorgonian *Plexaura homomalla:* purification and preliminary evaluation of its antiparasitic effect
	SALAZAR-GUTIÉRREZ, Iriam (Renewal grant)	Isolation and characterization of diazotrophs, endophytes or rhizobacteria, associated with Cuban rice, with capacity to promote the growth of rice plant
Ecuador	TOBAR, Jose	Genetic and morphological diversity of Capuli Cherry *(Prunus serotina* Erhr) in the Andean Region of Ecuador: perspectives on the future improvement of the crop
Ethiopia	ADNEW, Mekonnen	The temporal and spatial variability and trends of drought events in the Omo-Ghibe Basin

	BESHAWORED, Mamo Kebede	Reproductive ecology and population dynamics of four Afromontane tree species in southwestern Ethiopia: implications for forest ecosystem conservation and restoration
	BIAZIN TEMESGEN, Birhanu (Renewal grant)	Participatory development of appropraite in-situ rainwater harvesting for improved agricultural production in the Rift Valley drylands of Ethiopia
	BISHU, Kinfe Gebreegziabher	Risk perception, risk management and the role of livestock insurance in Tigray, Northern Ethiopia
	DEJEN, Zeleke Agide	Hydraulic and operational performance of irrigation systems in view of interventions for water saving and sustainability in Ethiopia
	FEYISA, Gudina Legese	Urbanization, urban climate and vegetation influence: the case of cities in Ethiopia
	GIRMA ABERA Jibat	Effect of moisture stress, organic N sources quality and litterbag placement on N mineralization dynamics, dry biomass production and nutrient uptake of maize (*Zea mays* L.) in southern Ethiopia
	MEKONNEN KASSIE, Addisu	Comparative ecology and behaviour of the Bale monkey *(Chlorocebus djamdjamensis)* in southern Ethiopia
	MUHIDIN, Jemal Ahmed	Land use/land cover changes and the perception of the community about land use/land cover changes: the case of Jijiga district, Ethiopia
	MULUBRHAN AMARE, Reda	Production risks, commercialization and rural poverty: bean and sorghum supply, and input demand in rural Northern Ethiopia, Tigray
	MULUBRHAN Balehegn Gebremikael	Indigenous browse species in Afar and Tigray Regions of Ethiopia: ethnobotany, browse biomass production, feed value and threats to natural regeneration
	TESFAYE GELETU, Kassahun	Agromorphological, biochemical and molecular diversity of Emmer wheat *(Triticum dicoccum* Schubler*)* in Ethiopia
	YIHUN, Yenesew Mengiste	Agricultural water productivity optimization in a water scarce semi-arid region of Ethiopia
Ghana	BADII, Kongyeli Benjamin	Management of major pests of Kersting's groundnut *(Macrotyloma geocarpum,* Harms) in northern Ghana using landrace varietal resistance and botanical insecticides
	BENSAH, Edem Cudjoe	Biochemical and microbial analysis of effluents from twenty biogas plants in Ghana
	FUTSE, James Edinam	Anaplasmosis vaccine development for West Africa: genetic analysis of endemic strains
India	BALANGE, Amjad Khansaheb	Use of phenolic compounds as cross-linkers, antioxidant and antimicrobial agents in fatty fish surimi
	BINDU, Thelakkad Narayanan	Dynamics of baculovirus infections in *Hyblaea puera* (Cramer) populations: patterns and prevalence of horizontal and vertical transmission
	BISWAS, Raja	Identification and functional analysis of probiotic bacterial surface associated proteins in preventing enteropathogenic infections
	JOSEPH, Shijo	Consolidation of fragmented landscapes in the Western Ghats biodiversity hotspot through networking of protected areas
	NANIWADEKAR, Rohit	Impacts of hunting on fruit removal, seed dispersal and recruitment in north-east India
	RADHIKA, Rajasree S.R.	Monitoring of bioavailability, toxicity and trophic transfer of manufactured metal oxide nanoparticles in marine ecosystems
Indonesia	EDI-SOETAREDJO, Felycia	Agricultural waste for heavy metal removal in waste water treatment
	KARTINI, Indriana (Renewal grant)	Highly stable Indonesian "Batik" dyes sensitized solar cells with novel synergistic blend of natural dyes and TiOx passivation layers
	WATURANGI, Diana Elizabeth (Renewal grant)	Prevalence and number of Vibrio cholerae and diarrheagenic *Escherichia coli* from salad vegetables in Indonesia
	YANTI, Yanti	Anti-inflammatory activity of lemon pepper extract *(Zanthoxylum acanthopodium* DC.) and its active fractions in macrophage cells treated with food-borne pathogen-associated immunostimulant

Iran	HEYDARIAN, Zohreh	Molecular basis of ABA and ethylene-induced paraheliotropic leaf movement of soybean in response to heat and drought stress
	SABAHI, Hossein	The use of pomegranate *(Punica granatum* L.) fruit powder as nitrification inhibitor and phytotoxin
Kenya	ALAKONYA, Emitati Amos	Exploring cross-species RNA interference as a management strategy against *Striga hermonthica* in Sub- Sahara Africa
	ANAMI, Elikana Sylvester	Tropical maize for food and income: improving drought stress tolerance in tropical maize through silencing the maize PARP1 gene
	AURA, Christopher Mulanda	Development of a preliminary macroinvertebrate index of biotic integrity for bioassessment of River Tana urbanized and forestry ecosystem, coastal Kenya
	CHIAWO, David O	The effects of land use on diversity and abundance of avian pollinators and frugivores in coastal ecosystems of Kenya
	IRUNGU, Beatrice Njeri	Evaluating antiplasmodial potential of semipurified and/or purified secondary metabolites from *Turraea robusta* Guerke
	KIVAI, Stanislaus Mulu (Renewal grant)	Assessment of habitat suitability for DeBrazza's Monkey *(Cercopithecus neglectus)* in Matthew's range forest reserve, Kenya: is relocation feasible as the last option?
	MUCHUGI, Alice (Renewal grant)	Phenotypic characterisation of Kenyan *Warburgia ugandensis:* the east-west regional differentiation
	MUGE, Edward Kirwa	Exploration for free cellullases in extremophylic ecosystems of Kenya
	MUNGA, Cosmas Nzaka	Ecological and socio-economic assessment of spear gun fishing in Kenyan marine artisanal fisheries
	MWAURA, Jelvas Maina	Assessing the effect of protection levels and habitat characteristics on the distribution and abundance of grouper species (Pisces: Serranidae) within lagoonal reefs on the Kenyan coast
	RUNO, Maina Steven	Production of maize hairy roots induced by *Agrobacterium rhizogenes* and infection with the parasitic plant *Striga* – novel tools for *Striga* research in Africa
	SIFUNA, Anthony Wawire	Investigating sources of *Salmonella* and *Escherichia coli* contaminating *Rastrineobola argentea*, water and the environment in the Lake Victoria basin, Kenya
	SITUMA, Dorice Soita	Risk assessment of endocrine disrupting compounds in effluents from sewage treatment plants and industries in Nairobi
Madagascar	ANDRIANAIVOARIVELO, Andoniaina Radosoa (Renewal grant)	To what extent will the means developed by Malagasy litchi fruit growers be able to sustainably control the loss of litchi crop by fruit bats without depleting bat populations?
	FAREZE, Lahimamy Paul	Modélisation de l'écoulement des eaux souterraines et le transport de contaminants dans l'aquifère sédimentaire du plateau Mahafaly, Sud Ouest de Madagascar
	RANDRIANJANAHARY, Miramasoandro Onitiana	Etude des effets de passages fréquents des cyclones sur les forets humides de Masoala, par la modélisation des cyclones passant Madagascar depuis 1961
	RAZAFIMAMONJY, Nivo A N (Renewal grant)	Ecologie et stratégie de la regénération naturelle de *Dalbergia chlorocarpa* Viguier dans la forêt de Kirindy Morondava (Madagascar)
	RAZOLALAINA, Toavina Mahatsangy	Prospective hydrosystémique complexe par modèle expert/neuronal. Cas du bassin versant de la Mandraka
Malawi	NGOCHERA, Maxon Jonasi	Spatial and temporal variability of carbon metabolism in large lakes: a case study for tropical Lake Malawi
Malaysia	HAQUE, A. A. M.	Bio-regenerative treatments of high-strength wastewater using bio-fringe and white jute *(Corchorus capsularis)* fibres
	HASSAN, Maizom	Enzymatic studies of farnesol dehydrogenase from *Polygonum minus* leaves

	LIM, Jitkang	Development of nanostructured iron oxide colloid augmented polymeric membrane to remove arsenic from drinking water for the bottom billion
	LIM, Pek Kui	Formation of acrylamide in sweet potato *(Ipomoea batatas* L. Lam) crisps during deep frying and kinetic study in palm olein medium
	SHAHUL HAMID, Fauziah	Characterization of landfill leachate and assessment of potential impact on aquatic ecosystem
	VADIVELU, Vel Murugan	Development and application of granular biomass in palm oil mill effluent (POME) treatment
Mali	COULIBALY, Ousmane (Renewal grant)	Etude agronomique et économique de la production du riz Nérika avec les urines comme fertilisant au Mali
	KORBO, Adama	Management of baobab for increased leaf production in common market garden systems and improved adaptability
Mongolia	TSEREN-OCHIR, Soyol-erdene	Risk assessment of exposure to toxic arsenic in drinking water in Mongolia (a survey of arsenic and other trace elements concentrations in surface waters and hotsprings of Mongolia)
Mozambique	MARIA, Ricardo Marcos	Using near infra-red spectroscopy for assessing soil properties and nitrogen management for maize and sorghum production in central Mozambique
Nepal	SHRESTHA, Bhupal Govinda	To study the anti-cancer activity of *Thermopsis barbata* and find the molecular insights to its effect.
	SUBEDI, Deepak (Renewal grant)	Development of a dielectric barrier discharge unit for the purification of water
Nigeria	ABIODUN, Oyinoduola Olajumoke (née Odula)	Identification of antiparasitic compounds in *Terminalia catappa* and *Vitex doniana* from Nigeria ethnomedicine
	AKINTAYO, Cecilia Olufunke (Renewal grant)	Thermally curable thiolene coatings based on epoxidised *Albizia benth* and *Plukenetia conophora* oil
	ATTAMA, Anthony, Amaechi (Renewal grant)	In vivo evaluation of some antimalarial drugs contained in solid lipid microspheres
	ESEYIN, A. Olorunfemi	Effect of some local vegetables on the effectiveness of chloroquine and artesunate
	EZEOCHA, Chinelo .v.	Improving the post-harvest quality and food product development from *Dioscorea dumetorum* in south-east Nigeria
	KENDABIE, Presidor	Genetic diversity and pattern of variation in mangrove plant species of the Niger Delta region in Nigeria
	KOLAWOLE, Ayodele Oluseyi (Renewal grant)	Glutathione system and antioxidant status of cowpea storage bruchid *(Callosobruchus maculatus)* subjected to chemical and allelochemical stress
	OBIADI, Izuchukwu Ignatius	Investigation and delineation of seepage pathways at mine dumps around Enugu metropolis using 2D and 3D electrical resistivity tomography
	OGUNDARE, Olasupo	Production of gold nanoparticles using cyanide solution from cassava
	OLAJUYIGBE (née Arogundade), Folasade Mayowa (Renewal grant)	Production and optimization of commercially viable alkaline proteases from *Bacillus* species isolated from selected hot springs and organic waste sites in Nigeria
	OLUJIMI, Olanrewaju Olusoji	The concentrations, distribution and health risk of phthalate esters (PEs) in the Kuils and Diep Rivers. Impact of effluents from wastewater treatment plants (WWTPs).
	SAIDU, Yusuf	Screening for Protein Tyrosine Phosphatase 1B (PTP 1B) and Dipeptidyl Peptidase IV (DPP IV) inhibitors from some Nigerian medicinal plants
Pakistan	AFZAL, Muhammad	To explore plant-endophyte partnerships in constructed wetland for the treatment for textile wastewater
	UL ABDIN, Zain	Development of environmentally benign novel natural bioinsecticides for effective insect control derived from the naturally occuring toxic genes in the female secretions of insect parasitoids

Peru	LOAYZA-MURO, Raúl (Renewal grant)	Benthic community responses to elevated ultraviolet radiation and metal pollution in high altitude Andean streams: effects of environmental changes on sensitive ecoregions
Philippines	LARANJA, Joseph Leopoldo Jr.	The application and mode of action of probiotic *Bacillus* species in the larviculture of *Penaeus*
Senegal	DIAGNE, Nathalie	Impact de microorganismes symbiotiques du sol sur la résistance au stress salin chez *Casuarina glauca* et C. *equisetifolia*
	DIOUF, Khady	Evaluation de l'âge et de la croissance des juvéniles d'un poisson emblématique surexploité au Sénégal, le mérou *Epinephelus aeneus*
	SENE, Bator	Evaluation de l'impact de systeme des bassins de retention sur la recharge artificielle de la nappe superficielle: cas d'adaptation aux changements climatiques
Somalia (Somaliland)	SALAH, Abdirahman	Epidemiological studies of camel trypanosomosis in Somaliland
South Africa	KEITH, Mark	Assessing the effect of megaherbivores on vegetation structure and the associated shifts in bat community composition
	MANN, Gareth Kerry Hamilton	Ecology of leopards *(Panthera pardus)* in the Gouritz region of the Little Karoo, South Africa
	MASANGO, Mxolisi Goodwill	Gene expression studies of diplonine, a mycotoxin synthesized by the maize fungus, *Stenocarpella maydis*
	MATAMBO, Tonderayi Sylvester	Biofuel production from cellulose material using termite gut bacteria
	TJELELE, Tlou Julius	Do grazing animals facilitate germination potential and seedling recruitment of woody plants?
	VORSTER, Barend Juan	The role of plant cystatins during plant stress
	ZUMA, Bongumusa Msizi	Low cost small-scale domestic wastewater treatment technology development
Sri Lanka	FERNANDO, T H P Sarojini	Development of integrated management strategies for white root disease of rubber *(Hevea brasiliensis)*
	SURIYAGODA, Lalith D B	Adaptive responses of a range of Sri Lankan rice varieties to grow in phosphorus- and moisture-limited and iron toxic soil conditions
	VITHANAGE, Meththika Suharshini	Natural dissolution mechanisms of serpentinite: possible toxic elements leaching to the environment
Sudan	ELBALOLA, Abdelrahim Adam	Assessment of rangelands condition, nutritive value and animal carrying capacity Eastern Nile and Western Khartoum State
Tanzania	AMRI, Ezekiel (Renewal grant)	The effect of timing of seed collection on seed germination, the influence of arbuscular myccorrhizal fungi on seedling growth and rooting cutting of *Dalbergia melanoxylon*
	MAGADULA, Joseph J (Renewal grant)	Bioassay-guided isolation of anti-HIV agents from fruits of *Garcinia semseii* and *Garcinia livingstoneii*
	MALEBO, Hamisi Masanja (Renewal grant)	Chemical modification of palmatine molecular framework and evaluation of chemical structure-antimalarial-cytotoxicity activity relationship of analogues
	MDEMU, Makarius Victor (Renewal grant)	Productivity of water in small irrigation schemes in the upper catchment of the Great Ruaha River Basin, Tanzania
	NJANA, Marco Andrew (Renewal grant)	Vegetation cover dynamics and their underlying forces in miombo woodlands, Tabora, Tanzania
Thailand	JANTAMA, Kaemwich	Production of succinic acid by metabolic engineered *Escherichia coli* from sucrose and cane molasses
	KANYANEE, Tinakorn	Development of cost effective portable capillary ion chromatograph for on-site water quality monitoring
	PONZA, Pattareeya	Molecular effects of photoperiods on expression of genes functional related to reproductive maturation of the giant tiger shrimp, *Penaeus monodon*

	THONGYOO, Panumart	Synthesis and biological activity against human-beta tryptase of bivalent SFTI-I inhibitor
	THREEPROM (SOM-AUM), Waraporn	Development of microfluidic device for arsenic monitoring in water samples
	VANGNAI, Alisa (Renewal grant)	Exploration of organic-solvent tolerant bacteria as a source of solvent-stable enzymes for industrial and environmental applications
Togo	KODOM, Tomkouani (Renewal grant)	Traitements des eaux par photocatalyse hétérogène à l'échelle pilote à base de nouveaux matériaux sensibles aux rayonnements solaires
	MABA, Dao Lamèga	Etudes moléculaires des *Lactarius* en Afrique de l'Ouest et caractérisations anatomo-morphologiques des ectomycorrhizes associés
	PEREKI, Hodabalo	Stock en carbone et productivité en bois énergie de *Pterocarpus erinaceus*, *Anogeissus leiocarpus*, *Vitellaria paradoxa* et *Parkia biglobosa* pour le Mdp dans les formations végétales du centre-est-Togo
	SEGBEAYA, Kwamivi Nyonuwosro (Renewal grant)	Etude d'impact des dechets urbains sur la securite sanitaire des produits maraîchers cultivés dans le bassin de la riviere Kara
	TOUNOU, Agbeko Kodjo	Impact of climate change on host-parasitoids interaction in cereal agroecosystem in Togo
	WEMBOU, Esso-nan P	Impacts des pratiques paysannes et de la protection des forêts sur la diversité génétique et la démographie de *Dioscorea praehensilis* dans les forêts de la zone écologique IV du Togo
Tunisia	AZAZA, Mohamed Salah	Optimisation of growth performance and protein utilization efficiency of cultured Nile tilapia (Teleos, Cichli): interaction between water temperature, feeding level and protein content of the diet
Uganda	TABUTI, John Robert Stephen	Important woody species, their management and conservation statuses in selected sub-counties of Kiruhura and Arua districts, Uganda
	WASIGE, John Ejiet	Improving nutmon methodology for quantification of soil nutrient balances in steep landscapes
Viet Nam	DAI LAM, Tran	Development of nanoconjugate based on biocompatible chitosan for multi-modal cancerous monitoring and magnetic drug targeting
	DAO, Thien	Modélisation de la croissance des moisissures dans le but de maîtriser la qualité microbiologique des fruits Vietnamiens
	DOAN, Van Thuoc	Isolation and characterization of bacteria from mangroves in northern Vietnam for polyhydroxyalkanoates production
	HUYNH, Minh Sang	Roles of prebiotic fructooligosaccharide (FOS) in the culture of black tiger prawn (*Penaeus monodon* Fabricius, 1798)
	LE Thi Phuong Quynh (Renewal grant)	Transfer of suspended solids and organic matter in the Red River system (Vietnam): confronting climatic and direct anthropogenic changes
	LE, Minh Hoang	Studies on physico-biochemical properties and preservation of sperm of tiger grouper (*Mycteroperca tigris* Valenciennes, 1833) in Viet Nam
	NGUYEN, Thi Mai Phuong (Renewal grant)	Anticaries agents from *Garcinia mangostana* L.: improved protection against dental caries
	NGUYEN, Thi Thuong	Effects of untreated industrial and domestic wastewater irrigation on quality of vegetables grown in urban area of Hanoi
	PHAM Hong Thai	Taxonomy leading to better understanding and conservation of the cicadas biodiversity of (Hemiptera: Cicadidae) northern Vietnam
	PHAM, The Hai	Enrichment of iron bacteria in a microbial fuel cell to be used as an on-site detector for iron and manganese in water sources (in Vietnam)
	TRAN THI, Thuy	Improvement of the pH profiles of phytases for feed application by structural design
	TRAN, Thi Nang Thu	Development of practical feeds for black carp *(Mylopharyngdon piceus)* reared in Northern Vietnam
	TRANG, Ngo Thuy Diem	Water resources management for long-term sustainability in climate change context: treatment and re-use of aquaculture water by eco-technology in the coastal zones of the Mekong Delta, Vietnam

	VO, An T. T. (Renewal grant)	Antimicrobial resistance in *Staphylococcus aureus* isolated from pigs and cattle in Ho Chi Minh City
West Bank and Gaza	SALMAN, Mazen	Possibilities of biological control of Peacock spot disease caused by *Spilocaea oleagina* on olive using bacteria
Zimbabwe	CHIROZVA, Chaka	Using scenario building to support stakeholder engagement on desired livelihood futures for communities living in the Great Limpopo Transfrontier Conservation Area
	HANDISENI, Maxwell	Evaluation of *Cleome gynandra* for biofumigation properties in smallholder paprika (*Capsicum annuum* L.) and tomato production irrigation schemes in Zimbabwe
	MATEMA, Steven	Socio-ecological and political dynamics of natural resource conflicts in Mbire district, Zimbabwe
	NEZOMBA, Hatirarami	Exploring mechanisms to restore soil fertility of degraded fields for enhanced crop productivity on smallholder farms in Zimbabwe
	ZAMASIYA, Byron	Assessing smallholder farmers perceptions of and adaptation to climate variability and change in Zimbabwe

Mission statement

The IFS Mission Statement as approved by the Board of Trustees (BOT), May 2001 and modified in November 2008 and June 2011.

The need

Scientific research provides an important input for sustainable management of biological and water resources. Scientific knowledge is central for rural, urban, industrial, and policy development, which will lead to improvement of people's livelihoods.

The mission

IFS shall contribute towards strengthening the capability of young men and women scientists in developing countries to conduct relevant and high quality research and to enhance their individual agency to put it into use.

The strategy

IFS supports excellent individual and collaborative research, to build capability of early-career scientists in the developing world, and to contribute innovation to the sustainable management of biological and water resources. The primary focus is the promotion of excellent science through early career research grants and capability enhancing support to researchers in developing countries. However, the interlinked development challenges that face humanity increasingly require scientists to work with each other, as well as with other professions and specialists. Therefore, the 2011 – 2020 Strategy, "Working Together", will introduce a collaborative research approach, providing support for collaborative research teams, some of which will be interdisciplinary, to combine researchers' strengths, expertise, and experience, to address a larger topic or a research issue where more than one discipline is required. A major change in our agenda is, not only to aspire to strengthen the capability of those embarking on a research career in the developing world, but also to link young scientists to those who can support their actions to bring about change, in terms of their values and objectives within the scope described for IFS research. In other words, to promote the individual agency of men and women scientists, early in their career in developing countries, to put their science into use.

IFS shall act in collaboration with Affiliated Organisations and other national, regional, and international institutions utilising the complementary strengths of such partnerships.

Supporting young researchers in developing countries

The International Foundation for Science (IFS) supports scientific capability building in developing countries. It gives research grants and supporting services to young scientists at the beginning of their research careers.

IFS was established as a non-governmental organisation in 1972, is funded by the academic, development and private sectors and has provided over 7,000 grants to researchers in 100 countries.

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