INTERNATIONAL FOUNDATION FOR SCIENCE

IFS ANNUAL REPORT 2016

IFS – DEVELOPING SCIENCE, SCIENCE FOR DEVELOPMENT

The IFS Annual Report has a style which is designed to match our ten-year strategy and includes sections relating to the specific objectives to improve planning of research by early-career scientists, increase production of relevant, quality research in low- and lower-middle-income countries, and increase the use of quality research results produced by IFS. We hope you enjoy the report!

IFS Annual Report 2016

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Cover photo: IFS grantee Carolina Isaza Aranguren and Hernando "Vikingo" measuring and counting the leaf scars on the stem of *Mauritia flexuosa*, a wild palm species in the Colombian Amazon. Her project aims at contributing to developing sustainable harvesting practices of the edible palm fruits.
All photos according to bylines or by IFS. Inside cover photos by Déo Mushagalusa.
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Foreword

IFS is stepping up its commitment and efforts to nurture scientific research capacity and potential in response to the Sustainable Development Goals (SDGs).

PHOTO: MAGGIE BEVERIDGE

Malcolm Beveridge
Chair of the IFS
Board of Trustees

PHOTO: PRIVATE

Nighisty Ghezae
IFS Director

In the change-filled year of 2016, we continued on our "journey of repositioning" to better serve science, technology and innovation (STI) communities in developing countries. We progressed in implementing our current ten-year strategy (2011-2020) and continued building the capacity of early-career scientists to produce research findings of assured quality according to accepted academic principles, to avail of and gain access to collaborative research networks, and to promote the use of research. Here we highlight both some achievements in grants, services, events and systems, and also some of the challenges and changes we are experiencing, all with a sense of gratitude.

IFS grants to individuals

While supporting ongoing individual grantees' projects from previous years, IFS received 1400 new applications for funding. Of these, 1338 were pre-screened by IFS staff and 293 were assessed by the Scientific Advisory Committees (SACs). Seventy-two (72) individual research grants were approved, 20 of them to women and 52 to men. Fifty-seven (57) grants went to Sub-Saharan Africa, ten to South and Southeast Asia, and five to Latin America, all for renewal, rewritten or revised applications.

The multiplier effect of IFS grants

The IFS Secretariat monitors the contributions and achievements of previous grantees. In 2016 we were able to document such indirect results of an IFS grant as alumni supporting other colleagues and students, getting promoted and thus remaining in science, joining scientific networks, and putting their research results into use. In addition, we have tracked 250 scientific papers published from 2012–2016 that are direct outcomes of IFS grants.

IFS collaborative research grants

As the pilot 1 and 2 groups of the first rounds of our collaborative research approach continued their work, a third call for expressions of interest went out in January 2016, asking for people in Southeast Asia to collaborate on research into climate change adaptation and mitigation. It covered Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Thailand, Timor-Leste and Vietnam. Following the period requesting expressions of interest in January 2016, teams formed on a digital platform, and applications were pre-screened at the IFS Secretariat and sent for external review, with seventeen (17) teams (61 individuals) eventually submitting their applications by the deadline, in time for a collaborative SAC meeting in December. Of the 17 original teams, 12 (consisting of 21 women and 20 men) were awarded IFS collaborative research grants, and of these, Team AQUASafe and Team CHANGE were recipients of Carolina MacGillavry Awards.

Supplementary grants

This year 31 grantees benefited from an IFS supplementary grant, enabling them to fully and successfully implement their research activities.

Equipment procurement service

Another main activity in 2016 was the scientific equipment procurement service offered to grantees. During the year, 79 grantees benefited from this service, and 160 transactions were recorded.

Conferences, meetings, seminars, training and workshops

A total of 12 training workshops of approximately 400 participants were conducted through different partnership agreements and together with IFS Alumni Associations. Three sub-regional multi-stakeholder policy workshops and a concluding workshop, a component of an IFS/ACP-EU project, were held in cooperation with African and European partners. Three training workshops were held at the University of Abomey Calavi (UAC), together with the Benin Alumni Association and involving three cohorts of 25 young MSc and

IFS grantee Alfayo Koskei assessing habitat of endangered forest spiny reed frog (*Afrixalus sylvaticus*) in Shimba Hills, Kenya.

PhD researchers, on statistical tools, proposal writing, PowerPoint design, oral presentation and scientific article writing. In addition, the Benin alumni organised monthly seminars where new advances in a given scientific topic were debated after being introduced by a senior researcher from the university or from abroad. Another event was organised on collaborative research in conjunction with the African Academy of Sciences (AAS) in Nairobi, Kenya, and funded by the Carnegie Corporation of New York. Together with the National Research Council of Thailand (NRCT), IFS also organised workshops on natural products and agricultural sciences. A proposal writing workshop at the International Livestock Research Institute (ILRI) and a scientific writing workshop at BecA (Biosciences Eastern and Central Africa)-ILRI were also organised in Kenya. Finally, IFS joined with the Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA) to organise a workshop in the Philippines for the pilot 3 collaborative research initiative.

Making our grant systems work better

We have consolidated our systems into the single Salesforce platform to make them more efficient and automated. We have been working with the company Fluido (implementation partners for Salesforce in the Nordic market) to customize a configuration which best meets the needs of IFS. Among other features, it includes communities for applicants, reviewers and grantees, and applications for IFS staff to pre-screen applications and manage external reviews, SAC meetings and grants.

Meeting the challenges in alignment with the SDGs

In 2016 IFS experienced funding challenges that made it difficult to implement all planned activities to meet the growing demands and aspirations of our intended communities of scientists in developing countries. The refugee crisis and consequent diversion of funds by aid organisations have hit research-funding organisations hard – at the very time when intensified research efforts are needed to address

the extreme challenges of population increase and climate change which have serious impacts on, for example, traditional agriculture, forestry, water availability, biodiversity and the environment. These are difficult problems that can only be solved through strenuous research efforts. The situation started to improve at the end of 2016 when a new two-year contract (2017–2018) was signed with the Swedish International Development Cooperation Agency (Sida) and new contractual agreement discussions got under way with the Swiss National Science Foundation (SNSF).

As the world gears up to implement the SDGs, in 2016 IFS revisited its ten-year strategy to ensure that our program responds to them. To this end, a meeting of the IFS Secretariat, Trustees and present and potential donors was held in November 2016. We reviewed our strategy by considering emerging institutional, political and economic conditions and changes, and their consequences in terms of building scientific capacity and the broader application of results from scientific research. A significant conclusion was that the IFS-supported research areas are well aligned with the SDGs and that intensified research and program efforts are needed to reach our collective promise to attain them, working together with like-minded institutions and strategic partners.

We will also intensify our efforts to diversify our resource streams by focusing on potential donors from Canada, the European Union, USA, and the private sector. We will continue to seek funding support from donors in the form of core and program/project funds to enable us to achieve our mission in 2017 and beyond. We pledge to deliver the desired results and value for money at all times.

The changes continue

In 2016 we sadly bid farewell to four of our Trustees completing eight years of service to IFS: Board Chair Prof Olanrewaju Babatunde Smith, Dr Wenche Barth Eide, Prof Torbjörn Fagerström and Dr Eckart Ehlers. At the same time, with great joy, we announce that these dedicated IFS family members have agreed to be the first Senior Ambassadors for IFS. We also take the opportunity to congratulate and welcome the new Trustees Prof Berhanu Abegaz, Prof Kjell Havnevik and Prof Anders Malmer.

We look ahead with gratitude

IFS will keep on encouraging inquiring minds to explore new perspectives and insights to make the world a better place, as individuals are essential to the research enterprise and the very best people are needed to go into science and stay there. If we hope to continue to reap the benefits of research, we must invest in young researchers by enabling them to improve their scientific capacities, and encourage more developing-country researchers to pursue careers in science so that they can continue generating the knowledge required to achieve the SDGs.

On behalf of the whole IFS family, we take this opportunity to thank all those who support us through development grants, linkages and partnerships. We thank the volunteer members of our Scientific Advisory Committees for devoting their precious time to support IFS, our mission and our past, present and future grantees. We eagerly welcome new partners to join us in our work as we contribute to developing countries' research capacities as the world's scientific communities take part in realizing the SDGs.

Malcolm Beveridge
Chair

Nighisty Ghezae
Director

Fishing in Kankumbi village in Malaprabha river, India.
Photo by Vidyadhar Atkore.

Mission statement

The need

Science can be a significant driver of economic and human development. Used properly it can help to strengthen the human condition globally through improved livelihoods, food security, health and wellbeing. The scientists of tomorrow must contribute to securing accessible and affordable food, water and energy for a rising population within a scenario of environmental sustainability, as directed by the 2030 Sustainable Development Goals.

While low-income countries produce a sizeable number of scientists, they experience significantly high rates of brain drain as scientists migrate in search of facilitated conditions in the most developed countries. The International Foundation for Science holds that a sound basis for contributing to the establishment and expansion of developing country science and to help these countries retain scientific talent is to identify, select and support promising early-career men and women scientists, and offer them opportunities in their home countries to plan, produce and put knowledge and technology into use.

In the next decade, individual and collaborative research conducted by developing country scientists needs to contribute to global efforts to reduce poverty and support sustainable development to deliver on the global Sustainable Development Goals. Support by the International Foundation for Science will strengthen the possibilities for early-career men and women scientists to productively engage in innovation and policy domains of relevance and use in their own countries.

Over a period of 40 years, IFS has supported 8000 scientists from 105 countries, many of whom are now leading scientists or science leaders. Guided by its 2011–2020 strategy, IFS will continue to facilitate research on biological and water resources, with a focus on physical, chemical, and biological processes, as well as relevant social and economic aspects important in the conservation, production, and renewable use of natural resources.

The mission

IFS shall contribute towards strengthening the capability of young men and women scientists in developing countries not only to conduct relevant and high quality research, but to enhance opportunities to put it into use in their home environments.

The strategy

In its 10-year strategy, IFS aims to support excellent individual and collaborative research, to build capability of early-career scientists in the developing world, and to facilitate the process of innovation for the sustainable use and management of biological and water resources. An important goal is to enable young scientists to contribute to a global research community that is aiming to reduce poverty and support sustainable development. The primary focus will be 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 phased introduction of a collaborative research approach will provide support for research teams, which will combine researchers' strengths, expertise, and experience, to address a broader topic or 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 support young scientists in the actions they undertake to bring about change, in terms of their values and objectives. 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.

Résumé en français

En 2016, IFS a poursuivi sa stratégie et a continué à appuyer les jeunes scientifiques des pays en développement de début de leur carrière, les aidant à produire de nouveaux résultats de recherche de qualité validés par leur pairs, en bénéficiant des réseaux de recherche collaboratifs et leur permettant de promouvoir l'utilisation de leur recherche. En outre, IFS a amélioré son système de gestion des bourses, en automatisant le processus autant que possible.

BOURSES IFS INDIVIDUELLES

En 2015, pour prolonger les subventions accordées lors des années précédentes, un appel à durée bloquée (du 1er novembre au 31 décembre 2015) a été ouvert pour les demandes de subventions de recherche individuelles. Les candidats ont présenté leurs propositions dans trois groupes thématiques de recherche:

- Ressources biologiques terrestres
- Eau et Ressources aquatiques
- Sécurité alimentaire, diversité alimentaire et modes de vie modèles.

1400 candidatures ont été reçues, et, 1338 demandes ont été pré-sélectionnées par le personnel de l'IFS pour que 293 d'entre elles soient évaluées par les SAC (comités scientifiques experts).

Soixante-douze (72) bourses de recherche individuelles ont été décernées, dont 20 à des femmes et 52 à des hommes. Cinquante-sept (57) subventions ont été versées en Afrique subsaharienne, 10 en Asie du Sud et du Sud-Est et 5 en Amérique latine.

Ces subventions ont été attribuées aux candidats qui avaient soumis une demande de renouvellement, réécriture ou révision, apportant ainsi un suivi des postulants aux bourses IFS.

Nous avions prévu de suivre de même les boursiers retenus les années précédentes et d'accorder 120 nouvelles bourses de recherche individuelles, si la situation financière s'était améliorée au cours de l'année. Une deuxième session devait être organisée par invitation/demande d'envoi de demandes révisées et de demandes de renouvellement. En raison de la crise des réfugiés, notre budget a été réduit de 30%, et, seulement 72 subventions n'ont pu être attribuées et il n'y a eu aucune session d'invitation/demande spécifique pour les nouvelles applications révisées et les demandes de renouvellement.

En plus des subventions de recherche, l'IFS a apporté des soutiens, au travers des commentaires sur les propositions de recherche aux 1338 candidats, des conseils appréciés et une assistance dans l'achat d'équipement et de fournitures.

IFS BOURSES DE RECHERCHE COLLABORATIVES

Tout en continuant à encadrer et à suivre les deux premières promotions de cette nouvelle approche de recherche collaborative, un troisième appel à manifestation d'intérêt s'est terminé en janvier 2016, appel adressé chercheurs d'Asie du Sud-Est ciblé sur des collaborations de recherche sur l'adaptation et l'atténuation aux changements climatiques. Il couvrait le Cambodge, l'Indonésie, la République démocratique populaire Lao, la Malaisie, Myanmar, les Philippines, la Thaïlande, le Timor-Leste et le Vietnam. Les «aspirants» éligibles ont été invités dans une plate-forme virtuelle spécialement conçue, appelée Chatter. Dans un «espace de travail commun», les participants ont ainsi découvert les profils de partenaires et vis à vis d'un appel d'offre sur des projets de recherche collaborative décrits sur cette plate-forme, ils ont pu avoir accès à un espace de travail par équipe sous Chatter, pour planifier et écrire leurs applications d'équipe en toute confidentialité.

Après la période réservée aux manifestations d'intérêt (du 10 au 31 janvier), des groupes de tchats se sont formés parmi les candidats pour un réseautage social, affiner le programme de l'équipe et les candidatures jusqu'au 30 juin (une extension a été offerte jusqu'au 3 juillet). Dix-sept (17) équipes (61 personnes) ont soumis leurs candidatures avant la date limite. Une première analyse des demandes a été effectuée en juillet par le Secrétariat de l'IFS. En septembre, les demandes ont été envoyées pour examen externe et une réunion commune des SAC a eu lieu le 2 décembre. Sur les 17 équipes originales, 12 équipes (composées de 21 femmes et 20 hommes) ont reçu une bourse de recherche collaborative IFS.

SUBVENTIONS SUPPLÉMENTAIRES

Cette année, 31 boursiers ont bénéficié d'une subvention supplémentaire IFS. Ces subventions sont attribuées aux bénéficiaires afin de mener à bien leurs activités de recherche malgré les difficultés rencontrées.

SERVICE D'APPROVISIONNEMENT EN ÉQUIPEMENT

Une activité importante mise en oeuvre en 2016 était les services d'approvisionnement en équipement scientifiques offerts aux bénéficiaires. Au cours de l'année, 79 bénéficiaires ont bénéficié de ce service et 160 transactions ont été enregistrées.

CONFÉRENCES, RÉUNIONS, SÉMINAIRES, FORMATIONS ET ATELIERS

Un total de 12 ateliers de formation impliquant environ 400 participants ont été menés dans le cadre de différents accords de partenariat et conjointement avec les Associations Alumni IFS. Dans le cadre d' une composante d'un projet IFS/ACP-EU, trois ateliers sous-régionaux sur les politiques multiacteurs ainsi que l'atelier de conclusion, ont été organisés en coopération avec des partenaires africains et européens. Trois ateliers de formation ont été organisés à l'Université d'Abomey Calavi (UAC), en collaboration avec l'Association des anciens boursiers du Benin, impliquant trois cohortes de 25 jeunes chercheurs (MSc et doctorat) sur les outils statistiques, l'écriture de propositions, la conception PowerPoint, la présentation orale et l'écriture d'articles scientifiques. En outre, les anciens boursiers IFS du Bénin ont organisé des séminaires mensuels sur les nouvelles avancées dans un domaine scientifique donné présentés par un chercheur senior de l'université ou de l'extérieur.

Une conférence IFS-Carnegie Corporation a également été organisée au Kenya sur la recherche collaborative.

Avec le Conseil national de recherches de Thaïlande, l'IFS a organisé des ateliers sur les produits naturels et les sciences agricoles. Un atelier de rédaction de propositions à l'ILRI et un atelier d'écriture scientifique au BecA-ILRI du Kenya ont également été organisés. L'IFS a également rejoint le Centre régional pour l'Asie du Sud-Est d'études supérieures et de recherche en agriculture (SEARCA) pour organiser un atelier aux Philippines à l'occasion de la troisième promotion de l'initiative pilote de recherche 3.

DÉVELOPPEMENT DE SYSTÈMES DE GESTION DES BOURSES

Nous avons consolidé nos systèmes sur la plate-forme Salesforce pour les rendre plus efficaces et automatisés. Nous avons travaillé avec la société Fluido (partenaires de mise en œuvre de Salesforce sur le marché nordique) afin de personnaliser une configuration qui réponde au mieux aux besoins de l'IFS. Parmi d'autres fonctionnalités, le système accepte les communautés de postulants, les examinateurs et les bénéficiaires, et l'accès aux projets pour le secrétariat de l'IFS afin d'orienter au mieux les dossiers pour les examens externes, les réunions du SAC, pour suivre les processus et la gestion des bourses.

Improving planning of research

by early-career scientists

It is a declared objective of IFS to improve planning of research by early-career scientists in low- and lower-middle-income countries that is relevant to those countries. We aim to do this by:

- Providing un-bureaucratic granting opportunities and capability-building support to young scientists to do research in the developing world;
- Recruiting and using numerous independent reviewers;
- Attracting large numbers of applicants;
- Providing all applicants with detailed feedback;
- Holding dedicated training and supporting alumni to associate and support others planning science, and through empowering other research councils to do the same.

IFS grantee Ravonjiarison Solofo Nasandratra, Madagascar, conducting a farmers' survey to study their knowledge and know-how on soil fertility.
PHOTO: PRIVATE

Strengthening links with IFS alumni and partner organisations

– through research planning workshops

Improving the planning of research by early-career scientists in IFS-eligible countries is an enormous global challenge. Although the efforts that have been dedicated to this cause around the world so far are insufficient to achieve this, IFS has contributed with activities to support young researchers to improve the planning of their research. Most of these are linked with training courses, conferences and meetings, conducted together with partner organisations and with our alumni associations.

Young researchers – either as individuals or members of inter-disciplinary teams – learn about carrying out high-quality research through an exploration of steps such as setting research goals, writing proposals, determining appropriate methods and tools, and writing up, publishing and presenting research findings. They produce results that are examinable by peers, using methodologies that can be replicated, and resulting in knowledge that can be applied to real-world situations.

IFS encourages young scholars to conduct research studies that contribute important knowledge to their communities and that are vital to successful solutions to societal challenges, thus fitting into broader scientific and development contexts where the application of science benefits people. They are additionally encouraged to design studies that can inform policy-makers with useful data and recommendations on which they can base decisions. This helps to narrow gaps that exist between those who create evidence and those who are positioned to act on research findings.

In 2016, IFS was jointly involved in these activities (descriptions follow):

- IFS-Carnegie Corporation Collaborative Research Conference
- IFS-NRCT-OPCW Collaborative Research Workshop on Natural Products and Agricultural Sciences
- IFS-ILRI Proposal Writing Workshop
- IFS-SEARCA Collaborative Research Workshop on Climate Change Adaptation and Mitigation
- BecA-ILRI Scientific Research Paper Writing Workshop
- IFS/ACP-EU Strengthening Capacities and Informing Policies for Developing Value Chains of Neglected and Underutilized Crops in Africa: Three sub-regional multi-stakeholder policy workshops and an expert meeting
- IFS alumni association activities

IFS-Carnegie Corporation Collaborative Research Conference in Kenya (February)

The purpose of the conference was to showcase the pilot approach and engage with organisations that wish to fund or support research collaboration using a similar approach. Early-career scientists representing the 19 IFS-supported collaborative research teams

The IFS-SEARCA Collaborative Research Workshop in the Philippines.

came from Benin, Burkina Faso, Ghana, Tanzania and Uganda to present the progress of their research through professionally prepared posters and to interact with participants from regional and international organisations such as AAS, ACPC, AfDB, AGRA, BecA, Carnegie, CODESRIA, IDRC, ICIPE, PASGR, RISE, SEARCA and WIOMSA. An IFS briefing document (http://ifs.se/ifs-news/new-briefing-document-and-video-from-ifs-collaborative-research-experience.html) based on the conference's wide-ranging discussions is available for those who are considering supporting and funding teams of African researchers to collaborate on discovering multidisciplinary answers to the continent's pressing issues. It explains the benefits and challenges of research collaboration and offers recommendations to improve collaborative research experiences in Africa. In addition, there is a video about the experiences of some of the scientists funded by the IFS collaborative research grants.

IFS-NRCT-OPCW Collaborative Research Workshop on Natural Products and Agricultural Sciences in Lao PDR (February)

With the support of the National Research Council of Thailand (NRCT) and the Organisation for the Prohibition of Chemical Weapons (OPCW), IFS jointly organised the 4th Collaborative Research Workshop on Natural Products and Agricultural Sciences in Luang Prabang, Lao People's Democratic Republic. Participants came from universities in Lao PDR, Myanmar, Nepal, Thailand and Vietnam. The emphasis was on natural products research and bringing results from the laboratory to the market. Researchers were informed about the latest developments in their fields in their own and other countries. Many participants stressed that they particularly appreciated gaining awareness about the importance of thinking beyond "the laboratory bench", especially at the conceptualisation stage of research, and that they had already started

The IFS-NRCT-OPCW Collaborative Research Workshop in Lao PDR.

thinking about how to implement what they had learned.

IFS-ILRI Proposal Writing Workshop in Kenya (February)

In response to a tender from the International Livestock Research Institute in November 2015, IFS submitted a proposal to undertake a proposal writing course at ILRI. This was accepted in February 2016. The original idea was to give one course for five days but this was later changed to two three-day courses. These were intended to be at different levels to cater for a mid-level and a more senior group of participants. The main purpose of the training workshops was to contribute to the ongoing efforts of ILRI staff to design and submit sound research proposals.

IFS-SEARCA Collaborative Research Workshop on Climate Change Adaptation and Mitigation in The Philippines (August–September)

The IFS-SEARCA Collaborative Research Workshop on Climate Change Adaptation and Mitigation was jointly held with the Southeast Asian Regional Center for Graduate Study and Research in Agriculture in Los Baños, Philippines. It gathered 55 out of 64 eligible participants, in 18 teams from Cambodia, Indonesia, Malaysia, Myanmar, the Philippines, Thailand, Timor-Leste, and Vietnam. From among more than 300 eligible aspirants who expressed interest in submitting grant applications, these 18 teams were invited to the workshop to build their capacity in collaborative research. There were also three IFS facilitators and resource persons, and three resource persons and a host of organisers from SEARCA. Six mentors from the first and second pilots of the IFS collaborative research grants programme in Africa – from Burkina Faso, Ghana, Nigeria, Tanzania, and Uganda – shared their practical experiences and insights as successful grantees in their region. They sat together with the Southeast Asian research teams to scrutinize the concepts and science inputs discussed, as well as the teams' final proposals to be submitted to the IFS-SEARCA grants programme for Southeast Asia launched in January 2016.

BecA-ILRI Scientific Research Paper Writing Workshop in Kenya (November)

The Scientific Research Paper Writing Workshop at the BecA-ILRI Hub was facilitated by an IFS staff member and an adviser, supported by BecA-ILRI staff. The workshop was attended by 29 scientists – 12 of them women

– from 12 different countries in eastern and western Africa. Participants were selected by BecA-ILRI capacity-building programme staff following a widely-announced call for applications. A majority of participants were BecA-ILRI alumni. The original workshop programme was developed by the IFS facilitators in consultation with BecA-ILRI staff and was thereafter continuously adapted during the workshop in response to identified needs and wishes expressed by the participants. While the ultimate aim of the workshop was to contribute to the ongoing efforts of the BecA-ILRI Hub to support and strengthen the research capacity of National Agricultural Research Systems (NARS) to drive agricultural innovation for impact, the main workshop objective was to provide early-career scientists with the skills and tools for writing and editing scientific papers intended for peer review. In addition, attention was also given to the communication of research results to non-scientists. The workshop was funded by the Australian Department of Foreign Affairs and Trade (DFAT) through partnership between the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the BecA-ILRI Hub; the Syngenta Foundation for Sustainable Agriculture; the Bill & Melinda Gates Foundation; UK Department for International Development (DFID); Swedish Ministry for Foreign Affairs through the Swedish International Development Cooperation Agency (Sida); and partially sponsored (in kind) by IFS.

IFS/ACP-EU Strengthening Capacities and Informing Policies for Developing Value Chains of Neglected and Underutilized Crops in Africa: Two sub-regional multi-stakeholder policy workshops in Kenya and one in Benin (October–December) and an expert meeting in Benin (November)

The first workshop was in East Africa targeting Burundi, Kenya, Rwanda, South Sudan, Tanzania and Uganda. The second was in West Africa targeting Burkina Faso, Côte d'Ivoire, Gambia, Ghana, Mali, Niger, Nigeria, Senegal and Togo. A third one for Southern Africa targeted Botswana, Malawi, Mozambique, South Africa, Zambia and Zimbabwe. These workshops brought together policy-makers and technical advisers from agriculture, conservation, and health and nutrition sectors to present and validate national action plans, in light of broader agricultural development trends, and to draw out sub-regional lessons for policy actors. The expert meeting on Neglected and Underutilized Species (NUS) Value Chains in Sub-Saharan Africa was held in Cotonou, Benin, organised by the partners of the project entitled *Strengthening Capacities and Informing Policies for Developing Value Chains of Neglected and Underutilized Crops in Africa*. The meeting marked the end of a three-year effort supported by the ACP-EU Science&Technology Programme 2014–2016. The meeting took stock of lessons learned during the project's work in Benin, Kenya and Zimbabwe and also brought insights from other invited organisations working on NUS globally. Thirty-two participants from 13 countries attended. Using a combination of presentations by project partners on results achieved, presentations by other stakeholders, group work and plenary discussions, the participants recommended a way forward for mainstreaming NUS in agricultural development, with a focus on Sub-Saharan Africa.

IFS alumni association activities

In 2016, IFS alumni associations continued their activities by working more closely with their respective higher education institutions to demonstrate the key role they play to address the new SDGs. Of particular focus this year was the IFS Ghana Alumni Association which – together with the Science and Technology Policy Research Institute of the Council for Scientific and Industrial Research (CSIR-STEPRI), and in collaboration with AFRICALICS, GLOBELICS and its partners – organised a two-day innovation conference under the theme "Development Innovation – Putting the Pieces Together". The aim of the conference was to create a network of innovation practitioners and scholars to drive innovation research and practice in Ghana and West Africa as a whole. Furthermore, the conference aimed at mobilising champions for innovation from policy institutions, the private sector, academia (research institutions, universities and polytechnics), international organisations and civil society organisations. Participants presented papers under the sub-themes of defining innovation practice in Africa – principles and fundamentals; the nexus of innovation and entrepreneurship; challenges of innovation in developing economies and their antidotes; and promoting innovation in the key sectors of the economy – what to do and how to do it.

Increasing production of research

in low- and lower-middle-income countries

It is a declared objective of IFS to improve production of research by early-career scientists in low- and lower-middle-income countries that is relevant to those countries. We aim to do this by:

- Providing competitive research grants and capability enhancing support;
- IFS-funded researchers being supported with equipment procurement services;
- Well qualified IFS advisers and reviewers evaluating and feeding back to researchers;
- IFS grantees receiving travel grants to increase international exposure, networking and collaboration;
- IFS alumni associations nurturing and supporting research with early-career scientists.

IFS contributes to increased production of research by supporting the research by early-career scientists in low- and lower-middle-income countries, and by building capability to conduct research and engage with others in their research.

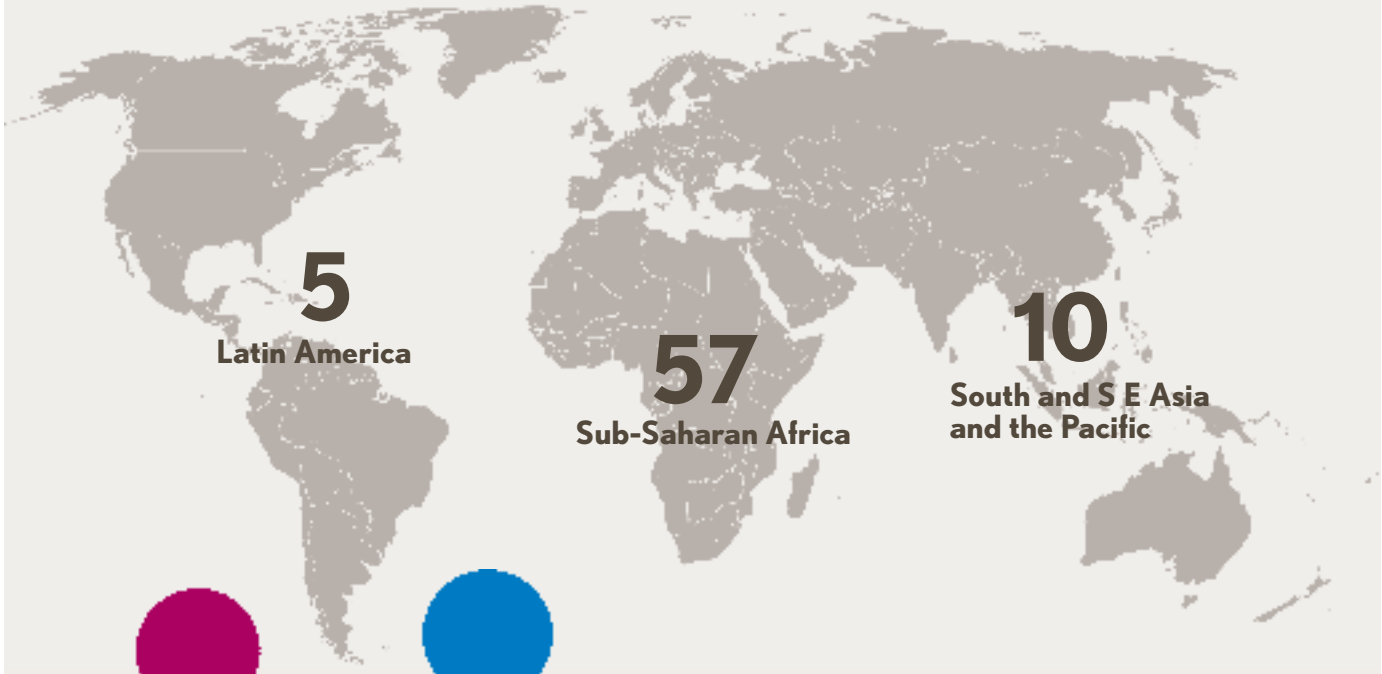
Searching for new drug candidates for treating asthma. IFS grantee Panumart Thongyoo (Thailand) is purifying synthesized peptidic inhibitors for targetting human-beta-tryptase.

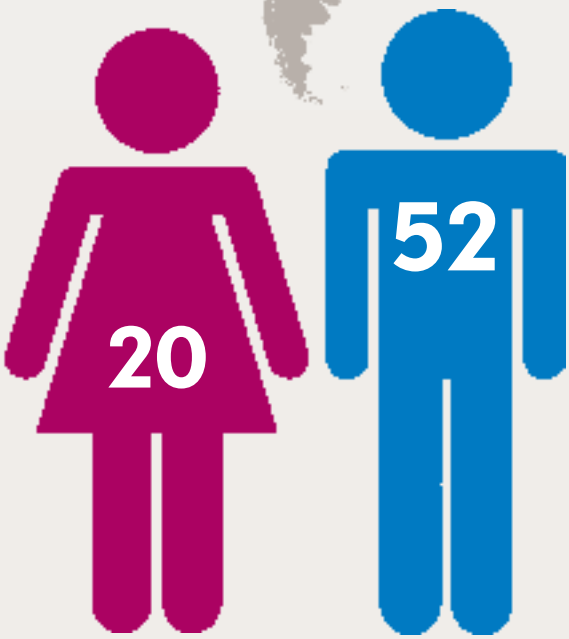
PHOTO: PRIVATE

Individual grants approved in 2016

A total of 1400 applications were received. Of these, 1338 applications were pre-screened by IFS staff and 293 of them were assessed by the SACs (Scientific Advisory Committees).

Geographic Distribution of the Grants





72 individual research grants were approved. The gender distribution of the grants was 52 male and 20 female. This also reflected the proportion of men and women among the applicants. These grants went to applicants who submitted either a renewal, rewritten or revised application.

The third IFS collaborative research pilot: A first collaboration with SEARCA

Collaborative research was introduced into the 10-year strategic plan of IFS in 2011 and first piloted in 2012–2013. The first call for expressions of interest asked for early-career scientists to collaborate on research into neglected and underutilized species. The Pilot 1 countries were Ghana, Nigeria, South Africa, Tanzania and Uganda, with financing from the Carnegie Corporation of New York. The second call for expressions of interest for 2013–2014 asked for applications for research on biodiversity. The Pilot 2 countries were Benin, Burkina Faso, Côte d'Ivoire, Ghana, Nigeria, South Africa, Tanzania and Uganda, and this pilot was financed by Carnegie and the Belgian Science Policy Office (BELSPO).

In 2015, IFS and SEARCA agreed to pilot collaborative research in a number of Southeast Asian countries where the two organisations are both active. The third call for expressions of interest went out in January 2016 asking for people to collaborate on research into climate change adaptation and mitigation. Pilot 3 is financed by the Carolina MacGillavry endowment and SEARCA. It covers Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Thailand, Timor-Leste, and Vietnam. But when choosing between applications of similar merit, teams with researchers from Cambodia, Lao PDR, Myanmar, the Philippines, Timor Leste, and Vietnam were prioritized.

Following the period requesting expressions of interest in January, eligible aspirants were invited into a specially designed social networking platform called Chatter. In so-called "plenary" workspaces people discovered each other's profiles, networked, and – against a call for collaborative research applications advertised on the platform – coalesced into teams. Each team received access to a private team workspace built on Chatter, where they planned and wrote their team applications. The applications that were submitted by the deadline at the beginning of July were pre-screened by the IFS Secretariat.

Representatives of the teams that passed pre-screening gathered in the Philippines in August for the IFS-SEARCA Workshop on Collaborative Research. Mentorship and feedback on the applications enabled the teams to prepare for a final submission in mid-September, by which time 17 teams (61 individuals) submitted research proposals. An external review was followed by a meeting of the Scientific Advisory Committee and the Director's decision in December. The grant administration and research phase was planned to begin in January–March 2017. Out of the 17 original teams, 12 (consisting of 21 women and 20 men) were awarded an IFS collaborative research grant. Their team names, project descriptions, and names of coordinators and collaborators appear below.

The following teams were funded:

PHOTO: SEARCA

TEAM AQUASAFE
(Awarded the Carolina MacGillavry prize)
The team aims to evaluate the application of biofloc technology for the improvement of productivity and environmental sustainability of white shrimp (*Litopenaeus vannamei*) production as a climate change adaptation strategy in the Southeast Asian shrimp aquaculture industry.
Coordinator: Magdalena Situmorang
Collaborators: Jomar Rabajante, Umaporn Uawisetwathana

PHOTO: SEARCA

TEAM CC FOOD & LIVELIHOOD
The team aims to assess the vulnerability of livelihoods to extreme climate events in mountainous areas of Vietnam and the Philippines. Policy measures to reduce the vulnerability of such areas will be suggested.
Coordinator: Nam Hoang Nguyen
Collaborators: Hanilyn Hidalgo, Thi Bich Nguyen Phuong, Tuan Tran Minh and Thi Nguyen Yen

PHOTO: SEARCA

TEAM CHANGE
(Awarded the Carolina MacGillavry prize)
The team aims to investigate the effect of climate change on the severity of acute hepatopancreatic necrosis disease (AHPND) outbreak against both the causative agent *Vibrio parahaemolyticus* (pathogen) and on shrimp susceptibility to the AHPND bacteria (host). They also intend to develop a practical cultured condition for solving this outbreak under laboratory conditions.
Coordinator: Walaiporn Charoensapsri
Collaborators: Pakkakul Sangsuriya, Viet Nguyen Vuong

PHOTO: SEARCA

TEAM CHITOSAN GROUP

The team will study the utilization of chitosan as a sustainable material for climate change adaptation and mitigation (CCHAM), with an aim to develop chitosan-based materials that will provide significant contributions to the field of CCHAM.

Coordinator: Bryan Pajarito
Collaborators: Hau Van Duong, Yuni Kusumastuti

PHOTO: SEARCA

TEAM CLIANDHH_NO1

The team will study the climate-induced vulnerability of farming communities and systems in delta areas of Cambodia, Myanmar and Vietnam to understand their adaptive capacities. Solutions will be formulated and recommendations made to address farmers' choices of climate change adaptation strategies.

Coordinator: Aung Tun Oo
Collaborators: Sovanndara Ky, Dao Duy Minh

PHOTO: SEARCA

TEAM CLIMADAP-SEA

The team aims to assess the adaptive capacities of smallholder farmers in selected upland farming communities in Southeast Asia, using the Philippines, Timor-Leste and Vietnam as sites. The research will generate technical and policy recommendations that will enhance the adaptive capacities of such communities.

Coordinator: Leila Landicho
Collaborators: Agustinho Da Costa Ximenes, Van Nam Le

PHOTO: SEARCA

TEAM CMV_EPACC_2016

The team will highlight how current resilient agricultural technologies contribute to socio-economic status by maintaining or improving livelihoods of rice farmers in Cambodia, Myanmar and Vietnam, and which technologies should be scaled up or scaled out.

Coordinator: Yarzar Hein
Collaborators: Sopheak Kong, Tam Ninh Nguyen Thi

PHOTO: SEARCA

TEAM FOREST CARBON

The team aims to estimate net ecosystem production (NEP) of forests in Malaysia, Thailand and Vietnam, to contribute to REDD+ (reducing emissions from deforestation and forest degradation). The research will provide results on carbon sequestration capacity of natural forests and simplify the NEP estimation method for applications where human and technology resources are limited.

Coordinator: Van Tran Do
Collaborators: Jeyanny Vijayanathan, Mohd Afzanizam Muda, Phongthep Hanpattanakit

PHOTO: SEARCA

TEAM GDPP

The team will investigate the effects of climate change on tilapia aquaculture production in Cambodia, Malaysia, the Philippines and Thailand. The study will help to derive practices for zero waste fish production and low carbon footprint, provide useful baseline data for predicting models, and help improve local fish farmers' – especially womens – livelihoods.

Coordinator: Pattareeya Ponza
Collaborators: Leakhena Chin, Geraldine Dayrit, Giva Kuppusamy

PHOTO: SEARCA

TEAM GREEN ENERGY SMART FARM

The team will develop a low-cost, energy-efficient greenhouse system for producing good-quality tomatoes in ASEAN countries by employing solar photovoltaic (PV) and energy efficient technologies. The proposed smart greenhouse will help to increase crop marketability, small-scale farmer incomes and food security, and reduce poverty.

Coordinator: Nofri Yenita Dahlan
Collaborators: Nguyen Duc Luong, Siti Zaharah Sakimin

PHOTO: SEARCA

TEAM IK AND CC

The team will provide insights into how various ethnic minority groups living in different landscapes in the northern mountainous region of Vietnam are using indigenous knowledge to adapt to the effects of climate change. The study will provide recommendations for the government's climate change policy.

Coordinator: Ho Ngoc Son
Collaborators: Thi Thu Luu Giang, Nga Vu

PHOTO: SEARCA

TEAM RENEWABLE ENERGY

The team's research will help to stimulate interest in the use of rice husk for renewable bioenergy production and consequently reduce the amount of rice husk being burned in the field, to mitigate the effects of climate change in ASEAN countries.

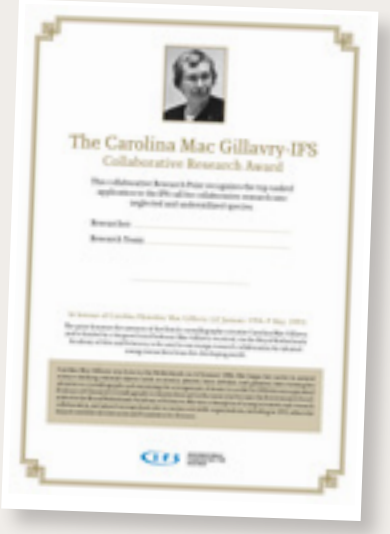
Coordinator: Menandro Acda
Collaborators: Bridgid Fui Chin, Elisabeth Rianawati, Pornkamol Unrean

The Carolina MacGillavry Award

The prize honours the memory of the Dutch crystallography scientist Carolina MacGillavry and its purpose is to encourage research collaboration by talented young researchers from the developing world.

Carolina MacGillavry was born in the Netherlands in 1904. She began her career in natural science studying celestial objects such as moons, planets, stars, nebulae, and galaxies, later turning her attention to crystallography and examining the arrangement of atoms in a solid. In 1950 she was appointed Professor of Chemical Crystallography in Amsterdam and in the same year became the first woman to be admitted to the Royal Netherlands Academy of Arts and Sciences.

She was a champion of young scientists and research collaboration, and played an important role in various scientific organisations, including in 1972, when she helped establish the International Foundation for Science.


The Carolina Mac Gillavry-IFS
Collaborative Research Award

In honour of the memory of the Dutch crystallography expert and erstwhile IFS Trustee, Prof Carolina MacGillavry (picture), following a bequest to IFS, we established the Carolina MacGillavry Award for the highest ranked team application(s). As Prof MacGillavry was a sponsor of the Dutch artist M C Escher, we were given permission from the Escher Foundation to use the image of the artist reflected in a metal sphere.

1 A selection of new individual research grants given in 2016

Biological Resources in Terrestrial Systems

Researching Biological Resources in Terrestrial Systems helps us to explore sustainable management of such systems. That is not just focused on exploiting nature for the benefit of mankind, but doing so in a way which will not jeopardise the wellbeing of future generations. Natural resource and ecological management is a complex and difficult issue to balance with social and economic demands, and it is about managing people as much as nature.

MR SIMON THIERRY OKIOBE, CAMEROON

Mycorrhizal fungi contribute to reduce soil greenhouse gas emissions from agricultural soils

This project will explore the potential of promoting AMF abundance to reduce N2O emissions from agricultural soils. It will contribute essential information towards our understanding of the roles and capacities of AMF in regulation of soil N2O emissions, and thus to the improvement of crop yield and mitigation of soil pollution and global warming.

DR OLFA FRIKHA-GARGOURI, TUNISIA

Development of biocontrol agents against bacterial phytopathogens Agrobacterium tumefaciens *and* Erwinia amylovora *based on lipopeptides and/or polyketides*

The development of an efficient biocontrol agent against *A. tumefaciens* and *E. amylovora* could have many interesting consequences including the reduction of the adverse negative effects of pesticide usages and the resistance development by phytopathogenic strains, limiting thus economic losses. Moreover, this project is also interesting as the produced compounds could be used in many other applications due to their broad range of application.

MR ALFAYO KOSKEI, KENYA

*Breeding success, phenology and population dynamics of endangered forest spiny reed frog (*Afrixalus sylvaticus*) in Shimba Hills, Kenya*

The study will address four specific objectives: to identify specific phenotypic attributes influencing the male mating success, to model breeding phenology of forest spiny reed frog within the reserve and human occupied realm, to document calling activity in terrestrial spiny reed frogs as a measure of habitat suitability for reproduction, and to compare selected population attributes within the protected area and human occupied hinterlands-adult sex ratio, age structure, population status, natality, mortality and predation levels.

MR GEZAHEGN NEGA, ETHIOPIA

*Interspecies interactions of Bale monkeys (*Chlorocebus djamdjamensis*) with sympatric congenerics and its conservation implication in human dominated landscape of Sidamo Mountains, Ethiopia*

This study will determine the distribution pattern, foraging ecology, and habitat use and habitat selection of the three sympatric species as examining the exploitative and interference competition in between. It will provide crucial baseline data for the conservation of the vulnerable Bale monkey and other biodiversity in the region.

DR PANUMART THONGYOO, THAILAND

Design and syntheses of novel fluorescent probes based on the bivalent SFTI-I scaffold for cellular imaging application

The aim of this project is to develop the synthetic approach of bivalent SFTI-I derivative via solid phase peptide synthesis (SPPS) strategy and also to fabricate a novel fluorescent probe showing a great quantum yield and appropriate biocompatibility. This will be a promising platform for a variety of sensing applications in biological and medical research areas.

DR PATRICK AMOATENG, GHANA

Pharmacological study of the antinociceptive effects of Synedrella nodiflora *in neuropathic pain*

The findings obtained from this study will provide useful information for subsequent development of the plant extract as a cheaper and safer alternative to available drugs in Ghana for the management of neuropathic pain.

IFS grantee Alfayo Koskei, Kenya (left) catching frogs with his assistant Erick Kigen.

Searching for new anti-human-beta-tryptase inhibitors for treating asthma. IFS grantee Panumart Thongyoo, Thailand, is evaluating an anti-tryptase activity from synthesized peptidic inhibitors.

Synedrella nodiflora, a plant used in a pharmacological study by IFS grantee Patrick Amoateng from Ghana.

2 A selection of new individual research grants given in 2016

Water and Aquatic Resources

According to the World Bank, 2.8 billion people live in areas of high water stress. Water stress takes many forms. At least 1.2 billion people do not have access to safe water, and pollution of water affects not just people but whole biological communities. Some of IFS's projects that relate to good water management are highlighted here, as well as projects which relate to sustainable exploitation of natural aquatic resources.

DR VAN KHUONG DINH, VIETNAM
How does thermal adaptation under global warming shape the susceptibility of tropical copepods to contaminants and toxic algal blooms?
Experimental evolution trials will study how a tropical copepod species *Pseudodiaptomus annandalei* responds to metal copper and toxicants from diatom algae under two different temperature regimes. Physiological mechanisms such as activity of oxidative enzymes will also be explored. Results may reveal insights of the vulnerability of tropical copepods to metals and toxic algae under warming and are timely for action plans to protect marine biodiversity and ecosystem services in Vietnam and other tropical countries.

MR ABDEL-KABIROU BOURAIMA, BENIN
No-tillage intercropped maize-peanut to reduce water and soil loss from cropland in Northern Benin
This research will provide knowledge on erosion and hydrologic responses of both conventional and intercropped maize and peanut systems, thus enabling the development of best management practices that conserve water, soil and nutrients. Such information will be used by extension specialists to recommend sustainable agricultural practices. In addition, the automated monitoring data produced in this research will be invaluable to calibrate process-based erosion models for these infrequently studied tropical cropland regions.

DR TRAN THI THU DUNG, VIETNAM
Distribution and potential release of potentially toxic elements (PTE) from sediments in Can Gio District of southern Vietnam
The research will map the distribution of PTEs and study the parameters controlling the enrichments in sediment in Can Gio area; assess the PTE contamination in sediment based on local background values; and assess the potential mobility of PTEs under effect of acidification and complexation. The results will provide information on PTE concentrations in sediments in Can Gio area in the context of anthropogenic disturbances to the system and the potential risk of these PTEs to the water environment when the external environmental conditions change.

MR ACHENAFI TEKLAY, ETHIOPIA
Modeling the impact of climate and land use change on hydrological response and sediment yield in Lake Tana Basin, Ethiopia
This study's integrated investigation of climate and land use will contribute to the existing challenges linking land use dynamics and watershed hydrology and more specifically unravel the understanding of the interface between land use/climate and water required to undertake adaptation strategies.

MR JEAN BIENVENUE OUOBA, BURKINA FASO
Characterization of hepatitis E virus (HEV) in wastewater and well water for environmental risk management
The study aims to evaluate and control HEV dissemination in the environment through investigations in wastewater and water drained by the rains to the wells. It will determine the HEV occurrence in wastewater of slaughter-houses and wells in Burkina Faso, identify the strains found using molecular assay, and determine the level and the ways of environmental contamination of HEV in Burkina Faso, to develop an efficient method of fight and also draw up an epidemiologic diagram of the virus.

IFS grantee Van Khuong Dinh, Vietnam, checking the presence of copepods in a sample taken from the sea, to start a culture for an evolutionary experiment of tropical copepods.

IFS grantee Jean Bienvenue Ouoba, Burkina Faso. Wastewater sampling site at the Bobo-Dioulasso abattoir. Wastewater flows through a meat and vegetable market.

IFS grantee Tran Thi Thu Dung (Vietnam) analysing organic carbon content in sediment samples.

3 A selection of new individual research grants given in 2016

Food Security, Dietary Diversity and Healthy Livelihoods

Food security exists when people have access at all times to sufficient, nutritious food in order to be able to lead an active and healthy life. There are many angles to food security – food safety, nutritional aspects, and simply securing entitlement to food. Below are some of IFS's projects dealing with these aspects.

MR EMMANUEL MENYA, UGANDA
Enhancing biogas production through optimal removal of lignocellulosic fractions and cyanide in cassava peels for co-digestion with cow dung and pig dung
This research will study the effect of anaerobic co-digestion of cassava peels with cow dung and pig dung, but with more focus on optimal pre-treatment of cassava peel to enhance biogas production. It will provide scientific information regarding optimum pretreatment processes for cassava peel necessary to enhance biogas yield during anaerobic co-digestion with animal manure.

DR JOEL LTILITAN BARGUL, KENYA
The role of biting flies (genus Hippobosca) in transmission of pathogenic animal African trypanosomes in northern Kenya
Preliminary findings from the research imply that hippoboscids could be important vectors of animal trypanosomiasis because they transmitted infection to experimental rabbits. Further research will study vectorial capacity of hippoboscids and the mechanistic details of parasite transmission. This study will provide information on vectors of animal trypanosomes and contribute to disease control.

DR LALITH D B SURIYAGODA, SRI LANKA
Diversity of Sri Lankan rice germplasm in storing micronutrients and heavy metals in rice grains and potential of agronomic management in fortifying rice grains with micronutrients

IFS grantee Emmanuel Menya, Uganda. Characterization of the feedstock (cassava peels, pig dung and cow dung) for biogas production.

The study will evaluate the diversity of local rice germplasm for their capacities to take up and partition micronutrients and heavy metals to rice grains; promote the cultivation of varieties with relatively enriched micronutrient content in grains and use of those varieties in rice breeding programs; and evaluate the agronomic management options such as foliar fertilisation and irrigation water management for short-term solutions. This will open up avenues to find long-term solutions while the agronomic interventions would be useful in the short term to reduce the micronutrient malnutrition and heavy metal toxicity among the local community.

DR WILLIS GWENZI, ZIMBABWE
Development and application of a biochar-based technology for decentralised treatment of contaminated drinking water among poor communities in developing countries
The work entails synthesis of biochar adsorbents, their evaluation using batch and column experiments, and subsequent design and evaluation of a prototype for treatment of drinking water. Outputs from the study are critical for the provision of clean drinking water to poor communities.

IFS grantee Ravonjiarison Solofo Nasandratra, Madagascar, conducting a survey to study the knowledge and know-how of farmers on soil fertility.

DR MAMOONA RAUF, PAKISTAN

Generation of salt resistant tomato through genetic transformation with SERF1-DREB2A regulatory cascade

This research aims at tissue culture-based generation of salt resistant tomato cultivar through genetic transformation with recently identified salinity related SERF1-DREB2A regulatory cascade. Transgenic plants, thus generated, will be useful not only for dissecting the mechanism(s) of plant gene regulation upon salinity stress but also for obtaining physiologically better and commercially valuable salt resistant tomato cultivar suitable for growing in salinity-prone areas of the country.

DR DOROTHÉE BADANARO, TOGO

Risk assessment for insect consumption in Togo

This study will evaluate the sources contamination from chemical (heavy metals, polycyclic aromatic hydrocarbons [PAH] and possibly pesticide residues) and biological (pathogens) origins related to the consumption of insects in Togo. The study will provide data on their ability to bioaccumulate heavy metals and pesticide residues, on their content of PAH and their contamination by pathogenic microorganisms during harvesting, processing, storage and marketing.

MS RAVONJIARISON SOLOFO NASANDRATRA, MADAGASCAR

Farmer perception and management of soil fertility in connection with carbon sequestration: Agriculture conservation case in Lac Alaotra region of Madagascar

The objectives of the study are to analyze local knowledge on soil and its fertility, to check the correlation between farmer perception of soil fertility and soil carbon data, and to analyse farmer strategies on soil fertility. The challenge is to find a common language for a better compromise between socio-economic and environmental benefits in the agriculture conservation application.

Increasing use of research

results produced by IFS

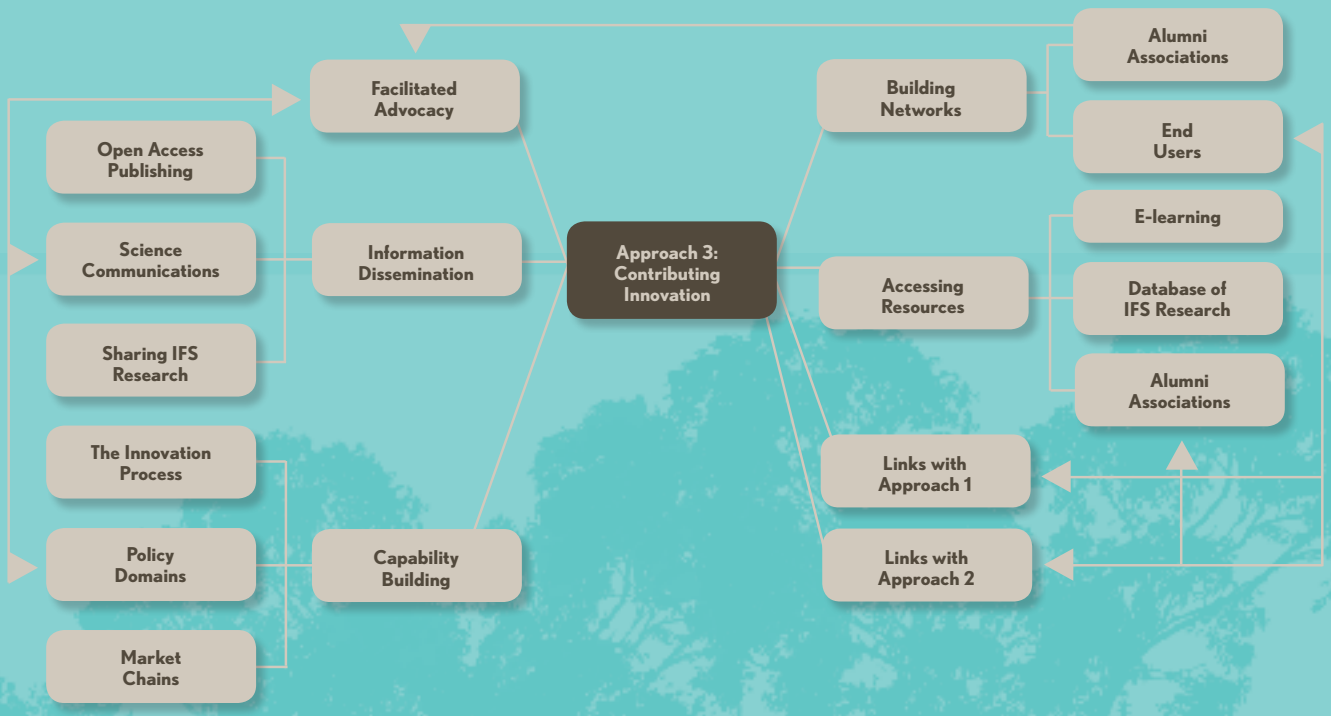
It is a declared objective of IFS to improve use of research by early-career scientists in low- and lower-middle-income countries that is relevant to those countries. We aim to do this by:

- IFS-funded research being accepted for presentation, or researchers funded by IFS grants being invited speakers at international conferences;
- IFS-funded researchers being recognised as experts in their fields and being invited to policy meetings or expert groupings;
- Well qualified IFS-funded grantees becoming IFS experts, advisers and reviewers ;
- IFS grantees disseminating their approved IFS-funded research results in popular form (TV, radio, workshops, policy briefs, booklets/cartoons);
- IFS grantees' research results in contributing innovation through being used in new products, services or policies.

IFS contributes to innovation through supporting research of early-career scientists in low- and lower-middle-income countries, building capability to share research and engage with policy processes and by building linkages to those who can support the use of their research.

Catching fish for sampling at Lake Tanganyika.
From left: Déo Mushagalusa (IFS grantee), Simon Mukerania, Mbirize Joseph, Muzaire M.
PHOTO: PRIVATE

Linkages between IFS initiatives that contribute to our innovation approach



Putting research into use

Knowledge of the sustainable management of biological, water and energy resources is not enough. To help to reduce poverty and attempt to solve some of the environmental challenges that we face, we also need to take action. That is why IFS undertakes a range of initiatives that can contribute to innovation and that is why the IFS mandate includes not only strengthening capability but also agency to put it into use.

Bhandura stream of Mhadei sub-basin, India.
Photo by Vidyadhar Atkore.

A selection of research results and achievements of IFS grantees

IFS grantees are contributing to significant changes in our world, through their motivation to scientific discovery, their passion to persevere in their studies and work, and their commitment to research results that have immediate and long-lasting impacts and use in their communities, larger societies and our world. While it is nearly impossible to choose from among the many early-career researchers in our IFS family, we have selected fifteen to highlight this year.

In the visible – and yet disappearing – natural world, our grantees are learning and teaching about species management, conservation and re-introduction, and they are making efforts to prevent animal and plant extinctions and protect threatened species and habitats. They are concerned with crop failure in a changing climate, pesticide-free and bee-friendly farming, improving food security, and putting their research into use through the commercialization of agriculture products. In less-visible natural realms, our grantees conduct studies on genetic characterization and molecule isolation for medicinal research, and create multi-decade historical inventories of trace metal accumulation.

In the professional – and ever-changing – world, our grantees are embarking on international and interdisciplinary collaborations and working with farmers on participatory action research methods, community-based conservation and environmental stewardship. They are pursuing further studies and degrees, getting promotions, awards and their first competitive grants, supervising students, and enabling their home institutions and laboratories to become better equipped. Their numerous publications are appearing in well-regarded national and international journals; they are presenting at high-profile conferences and staging exhibits at well-known museums; and they are the subjects of media interviews and news reports.

And in the often bewildering political world in which their science takes place and has an impact, they are lobbying governments, influencing and making policy and legislation in fields as diverse as farm mechanization and estuary management. We are proud of each one of these and all of our grantees.

MS KERRY REID
Department of Genetics
Faculty of Natural and Agricultural Sciences
University of Pretoria
SOUTH AFRICA
2012

Effects of paleoclimates on evolution and demography of South African antitropical marine fish taxa in the Atlantic Ocean: Historical perspectives for ongoing climate change

This research has provided insight into the origin of South African temperate fauna and the described population structure will inform future management of *Pomatomus saltatrix*. My institution also developed international relationships in the East Atlantic through this research. One of particular impact is a collaboration which was established with researchers in Senegal to use genetic analyses to better understand the heavily impacted Senegalese fishery.

PROF YOAMEL MILIÁN-GARCÍA
Departamento de Bioquímica
Facultad de Biología
Universidad de la Habana
CUBA
2012

Genetic characterization and hybridization of the genus Crocodylus in Cuba: Implications for conservation

The results have set the genetic basis for the conservation program of the Cuban crocodile at the largest and most important on-island captive breeding facility. They allowed the identification of hybrid individuals and their removal from the facility for reproduction purposes. The completed reintroduction program is the first one for the Cuban crocodile in its natural habitat in 58 years of captive breeding. In addition to five publications, our Faculty of Biology received recognition for its contribution to the conservation of Cuban biodiversity and particularly Cuban crocodiles, including interviews in *Science* and *Heredity*, and an exhibit at the American Museum of Natural History in New York. On a personal note, I completed the requirements to be an Auxiliary Professor of the University of Havana.

DR RENATO MASSAAKI HONJI
Departamento de Fisiologia
Instituto de Biociências
Universidade de São Paulo
BRAZIL
2012

Environmental influences on the mechanisms of sex determination and differentiation in teleost fish

This grant helped us to understand even more about the reproduction of this threatened fish in captivity. The IFS support was significant for the beginning of my professional career as it was my first grant supported by an international foundation and it resulted in three publications.

MR ALEMAYEHU MULUNEH
School of Biosystems & Environmental Engineering
Institute of Technology
Hawassa University, Awassa
ETHIOPIA
2012

Strategies to adapt to climate change in the Central Rift Valley of Ethiopia: Linking regional drought stress patterns to on-farm water management

The study's maize intensification field experiment proved that by using supplemental irrigation from water harvesting ponds, together with improved soil fertility and optimum plant density, it is possible to reduce maize crop failure from extreme dry spells, thus improving food security. Through the participatory action research method, farmers were also able to understand how optimum levels of fertilizer can significantly increase maize yield compared to what they were using (< 50% from the recommended amount).

DR JOYCE SIWILA-SAASA
Department of Clinical Studies
School of Veterinary Medicine
University of Zambia, Lusaka
ZAMBIA
2012

Investigations of Giardia infections in dairy cattle in Zambia: A preliminary study

The IFS support helped me to interact with small-scale farmers, understand some of the animal disease challenges they face, and give veterinary advice when required. Some of the farmers in Lusaka have started implementing hygienic measures in their farms. For example, they clean the calf pens regularly to prevent accumulation and concentration of cysts thus preventing further transmission. Our institution's parasitology laboratory now has a modern microcentrifuge which is being used by other researchers. The IFS support also enabled me to supervise my first MSc student and assisted the candidate to complete his research component and graduate.

DR SALI ATANGA NDINDENG
Programme Fruits
IRAD Nkolbisson, Yaoundé
CAMEROON
2007, 2012

Valorization of Dacryodes edulis *fruit (safou) through improved drying, packaging and processing into biscuits*

Agri-food processing companies such as Taless-Siemef in Yaoundé, Cameroon, are using the safou drying, packaging and processing methods developed under this project. Several women processors are now producing rice-safou biscuits and marketing them in respective communities. The Laboratory of Food Science and Nutrition at the Institute of Agricultural Research for Development (IRAD) also produces these rice-safou biscuits and markets them to local communities. AfricaRice has validated rice-safou biscuit as a scalable technology in countries where both low-grade rice and safou occur.

DR FRÉDÉRIC NICO NJAYOU
Département de Biochimie
Faculté des Sciences
Université de Yaoundé I
CAMEROON
2006, 2011

An active extract from Khaya grandifoliola *C.DC. and* Entada africana *Guill. et Perr.: Studies on antihepatotoxic action mode – immunomodulatory activity and active compounds isolation*

Although I have not yet produced any practical results, I have isolated one antioxidant, anti-inflammatory, hepatoprotective and antihepatitis C fraction from each plant studied. These fractions contain compounds acting in synergy since activities are not observed upon further fractionation. I am now seeking the means to develop an improved traditional antihepatitis medicine based on these fractions. In the meanwhile, my research has led to 12 publications.

MS EDEM MAHU
Department of Oceanography & Fisheries
Faculty of Science
University of Ghana, Legon
GHANA
2012

Geochemical assessment and novel evaluation of biotic impacts of petroleum hydrocarbons and trace metals to marine sediments in Ghanaian coastal waters

My project produced 100–150 years of inventories of trace metal accumulation records in six major Ghanaian estuaries using radio-isotopic dating. This is the first time such a study has been carried out in Ghana and the results currently serve as a baseline for any environmental monitoring of trace metal contamination in the Ghanaian coastal environment. The findings of the study are that anthropogenic processes, particularly those related to mining and industry, pose significant threats to the Ankobra, Pra and Sakumo II estuaries. As a novel study, a manuscript was accepted for publication in *Estuarine, Coastal and Shelf Science*. At the policy-influence level, plans were made to adopt the risk modelling approach used in my study for managing estuaries and other nearshore environments.

DR MUHAMMAD FARRAKH NAWAZ
Dept of Forestry, Range Management and Wildlife
Faculty of Agriculture
University of Agriculture, Faisalabad
PAKISTAN
2012

Exploring the effects of soil compaction on the growth of major agroforestry trees of central Punjab in Pakistan

The study found that higher levels of farm mechanization resulted in more soil compaction, especially on clayey loamy soils, which could be detrimental for tree growth. It was also found that under severe soil compaction, germination and tree growth was greatly reduced. In the current scenario of state policies that prioritise farm mechanization, it was concluded that soil compaction can be a potential stress for woody vegetation. Moreover, farmers were not aware of the consequences of soil compaction and useful information was communicated to them about adapting necessary measures to reduce the soil compaction hazard for trees. With the IFS grant, our department procured new equipment like pH and EC meters, weight balance, soil penetrometer, hot plate with stirrer, soil solution extractor, deionised water plant, oven, refrigerator and glassware. This has helped our students to carry out their own research. (Dr Muhammad Farrakh Nawaz is sitting to the left in the picture.)

DR MANJU VASUDEVAN SHARMA
Conservation Programme
Keystone Foundation
Kotagiri, Tamil Nadu
INDIA
2006, 2012

Diversity and functional roles of arthropod fauna across agricultural landscapes of Nilgiri Biosphere Reserve in Western Ghats of India

The findings on organic versus chemical farms have been used to convince the State Horticultural Department and private estates to opt for pesticide-free and bee-friendly farming, and there has been some success in these stakeholder dialogues. The grant made a contribution with its impact on the conservation agenda of the organisation I work with and provided the resources needed for me to engage in capacity-building with field personnel. This is relevant to our approach to forest conservation, where the thrust is on community-based conservation and stewardship and efforts are underway in the direction of community-led ecological monitoring.

MS ALINE MARACI LOPES SARAIVA OKELLO
School of Biosources Engineering and Environmental Hydrology
University of KwaZulu-Natal, Pietermaritzburg
SOUTH AFRICA
2012

Using isotopes and hydrologic modelling to improve hydrologic understanding of Incomati River Basin

The results were used to produce a scientific publication and to assist decision-making regarding the location of water sampling equipment and sampling strategy regarding time, volume and loads in the Kaap and Crocodile catchments (subcatchments of the Incomati Basin). The support of IFS was important for my career because it opened doors for cutting edge research on water resources using isotopes, as well as other funding avenues. After receiving the IFS grant, I received an award and fellowship to continue my research and PhD studies.

DR ISABEL CRISTINA DOMÍNGUEZ RIVERA
Cinara Institute
Faculty of Engineering
Universidad del Valle, Cali
COLOMBIA
2011

Participatory modelling of catchment and human health in Andean rural micro-catchments

The primary information resulting from system characterization in relation to social determinants of health, stream and drinking water quality was shared with community leaders. Thus, the research provided them with new techniques for collecting qualitative and quantitative data to determine the status of their microcatchment, and equipped them with information to lobby the institutions responsible for implementing development programs.

DR VANVIMON SAKSMERPROME
Center of Excellence for Shrimp Molecular Biology & Biotechnology
National Center for Genetic Engineering & Biotechnology
Faculty of Science
Mahidol University, Bangkok
THAILAND
2010, 2012

Formulation of shrimp feed for prevention and inhibition of Laem-Singh virus infection in the black tiger shrimp Penaeus monodon

The formulated feed containing LSNV-dsRNA has been used routinely to control viral disease at Shrimp Genetics Improvement Center in Surat Thani, Thailand. The results have been published in three international journals and were presented at national and international conferences in the USA (2013), India (2011) and Thailand (2010). The project allowed me to perform interdisciplinary research by collaborating with researchers in the field of nanotechnology, and my research collaborations have been extended to faculty members and students in top universities of Thailand.

MS GLADYS ZACHARIA NG'UMBI
Tanzania National Parks (TANAPA)
Directorate of Resource Conservation and Ecological Monitoring Activities, Arusha
TANZANIA
2012

Assessing the influence of agriculture on nutrient status and buffer capacity: A study of pristine and impacted wetlands in Arusha National Park, Tanzania

The study contributed to the formulation of by-laws governing proper agricultural activities in areas adjacent to the villages bordering the wetlands of Momella, Rishateni and Tulusia so as to minimise loss of wetland functions (such as buffering capacity). This is intended to prevent degradation leading to a complete loss of wetland areal extent in which case they would cease to exist in those locations.

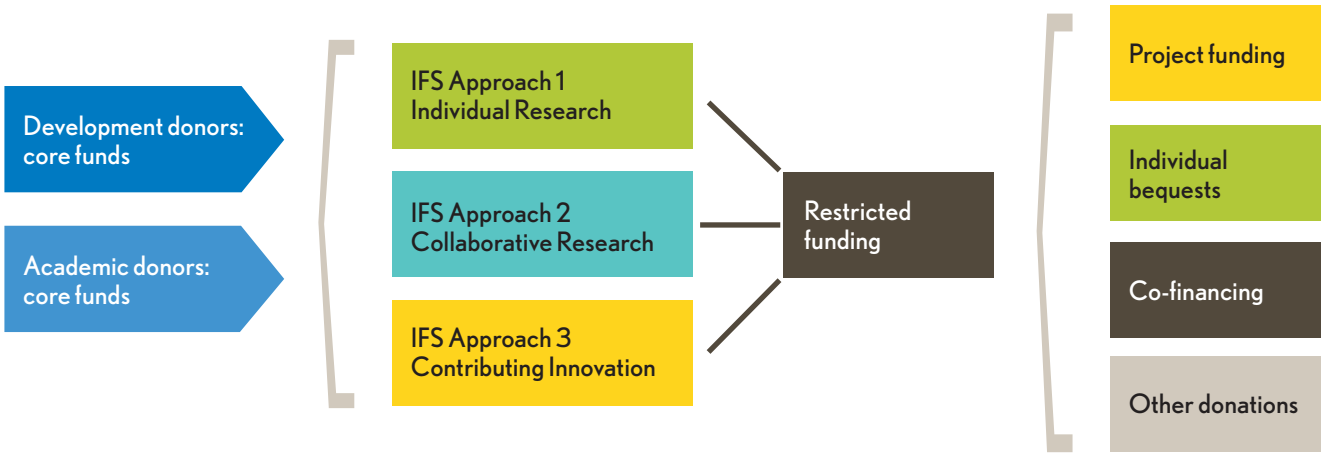
MR VIDYADHAR ATKORE
Ashoka Trust for Research in Ecology & Environment (ATREE), Bangalore
INDIA
2012

Quantifying characterstics of river fish diversity across multiple spatial scales: Implications for conservation in the Western Ghats of India

In addition to the 11 publications that arose from my study, I was invited to deliver talks on my research in schools and research institutions in India, and at two international conferences in China (2013) and Korea (2016). I was also interviewed on the Rajya Sabha television program Science Monitor episode of 6 June 2015 www.youtube.com/watch?v=S9nQJMPzAyQ&feature=youtu.be.

The support of IFS

A range of donors and funders support the work of IFS, or parts of it:



As an individual or a representative of an organisation, if you share the mission of IFS, and wish to help, please contact us about: core funding of IFS, financing general or themed research calls, supporting capability building, collaborating on approaches or projects, co-funding our work, commissioning us to deliver research calls or capability building events, providing or sponsoring travel or placements for grantees, tools, equipment or software licences.

To make a bequest or legacy in your will is a valuable and enduring way of assisting and a personal investment to benefit early-career scientists in the developing world. If you or someone you know would like to make a bequest of financial support to IFS, please contact, in the first instance, the IFS director.

IFS donors/sponsors in 2016:

- Belgian Science Policy Office (BELSPO)
- Carnegie Corporation of New York
- Carolina MacGillavry endowment, The Netherlands
- Deutsche Forschungsgemeinschaft (DFG), Germany
- Institut de recherche pour le développement (IRD), France
- Ministère des Affaires Étrangères (MAE), France
- Organisation for the Prohibition of Chemical Weapons (OPCW), The Netherlands
- Organisation of Islamic Cooperation Standing Committee on Scientific and Technological Cooperation (COMSTECH), Pakistan
- Podio Project Management Software Citrix Systems Inc.
- Swedish International Development Cooperation Agency (Sida), Department for Research Cooperation, Sweden
- Swiss National Science Foundation (SNSF), Switzerland
- The European Commission, Research Directorate-General

IFS-OPCW alliance:
Two decades of supporting research in the peaceful uses of chemistry

The Chemical Weapons Convention, whose entire name is the Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction, was opened for signature in 1993 and brought into force four years later. The Convention is a uniquely successful instrument of disarmament, and is the most universal disarmament treaty, with 192 States Parties. It is comprehensive, prohibiting not only the use of chemical weapons, but also their development, production, stockpiling, transfer and retention.

The Organisation for the Prohibition of Chemical Weapons (OPCW) is the international organisation overseeing the implementation of the Convention. Since the Convention came into force, OPCW has verified the destruction of almost 95% of the world's declared chemical weapons stockpiles. The Organisation has also conducted nearly 3400 industry inspections. Recognition of this success included the awarding of the Nobel Peace Prize to the OPCW in 2013. IFS and the OPCW have been cooperating on joint support of research projects dating back to 1998, in one of the first programmes implemented by the new-born organisation dedicated to promoting the peaceful uses of chemistry.

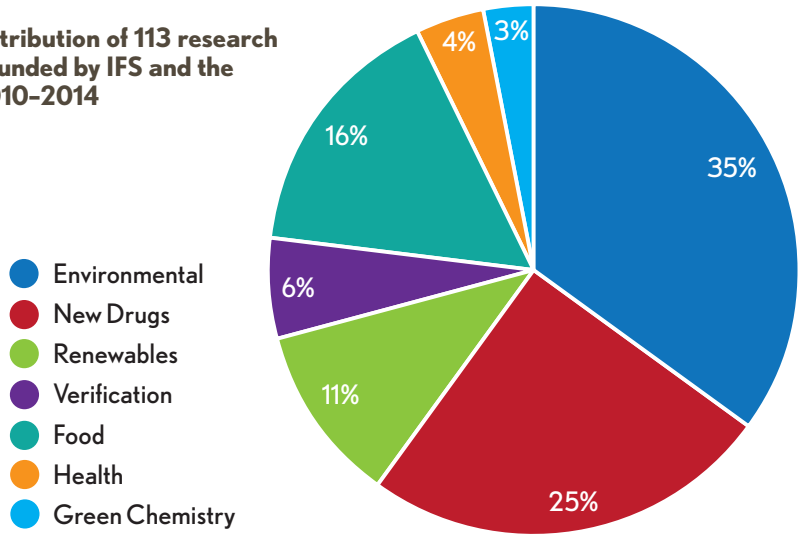
As exemplified by the collaboration with IFS, the OPCW supports projects in a vast variety of applications of chemistry – or the peaceful uses of chemicals – in such areas as agriculture and food, medicine and health, energy, water and the environment. It also supports research in other disciplines such as medicine, toxicology and bio-sciences whenever the project has relevance to the core objectives of the Convention, an example being protection and medical treatment/prophylactics against toxic chemicals and their effects on human health.

IFS-OPCW workshop participants.

As highlighted by the Director-General of the OPCW, Ambassador Ahmet Üzümcü, "Under its Article XI, the Convention provides for the promotion of international cooperation in the field of chemical activities for peaceful purposes. OPCW has for this purpose established a wide range of programmes and collaborative partnerships." On a yearly basis, a number of individual projects (which have been approved for IFS funding in the first round) are picked up by the joint IFS-OPCW selection panel to be co-funded by the two organisations. The cooperation on joint funding of research projects has been in place since 1998 and is governed by a Memorandum of Understanding between the organisations. Hundreds of projects have been sup-

IFS-OPCW grantee Nantenaina Rabetokotany.

Thematic distribution of 113 research projects co-funded by IFS and the OPCW in 2010–2014



ported since then. The data in the figure above show recent statistics on the thematic distribution of the co-funded research. Examples of the thematic areas of funded projects under the joint IFS-OPCW programme are quite diverse and include destruction of toxicants, analytical chemistry methodologies, studies of new materials as alternatives to toxic chemicals, environmental monitoring and clean-up, renewable resources, bio-catalysed synthetic pathways, new drug discovery and medical applications of natural substances.

Within their agreement, IFS and the OPCW cooperate on the organisation of joint workshops which serve to disseminate results of the research supported through the cooperative programme and strengthen the networking and cooperation between the two organisations and the science and technology community, as well as among scientists. Such meetings are also useful to measure the programme impact and to attract a wider scientific community to participate. The next joint workshop dedicated to the research of chemistry for peace, security and sustainability is planned to take place in late 2017 and focus on Latin America. This workshop will be carried out as one in a series of events commemorating the 20th anniversary of the OPCW.

Some eligibility criteria are applied by the OPCW when selecting proposals for co-funding. The OPCW funding can only be provided to projects carried out by research groups or institutions based in its Member States which, at the same time, have to be developing countries or have economies in transition. The OPCW funding can only cover auxiliary costs, such as consumables and disposables, sampling and analysis, literature and other minor expenditures, with other costs being covered by IFS funding. The projects typically have durations from 1 to 3 years and can only include small-scale activities which are usually supported by existing infrastructure and resources. For a limited number of projects, funding can be provided directly by the OPCW and there is a specific application mechanism through the National Authority of the country of the applicant. The results of the completed projects are published in peer reviewed journals and remain the property of the institutions hosting relevant research.

The programmes of the OPCW are open to participation and cooperation of scientists and institutions from all eligible OPCW Member States. The OPCW and IFS invite others to become part of the family of "chemists for peace" by taking advantage of various support and collaborative activities, by helping to disseminate related information in your networks, as well as by conveying the principles of responsible chemistry serving society and promoting peace among the science community.

People, affiliates, grants and finances

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Mr Ulf Edin, Head of Administration
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Ms Eva Rostig, Programme Administrator, Natural Products and Water Resources
Ms Pirkko Tolamo, Office Manager

Prof Calixto M. Protacio:
IFS - Mission Accomplished!

PHOTO: PHILRICE

CALIXTO M. PROTACIO

Dr Protacio is a crop science professor and scientist. He has worked with various institutions, such as the University of the Philippines Los Baños as professor and director of the Institute of Plant Breeding and Crop Science Cluster, Executive Director of the Philippine Rice Research Institute (PhilRice), Philippine Agricultural Scientist as editor-in-chief, University of California, Riverside as post-doctoral research associate, Pennsylvania State University and Louisiana State University as graduate research assistant. He finished his Bachelor's Degree in Agriculture, Major in Horticulture, at the University of the Philippines Los Baños and PhD in Plant Physiology from Pennsylvania State University, USA.

Right after earning my PhD from Penn State (USA) in 1991, and a subsequent postdoctoral stint at University of California Riverside, I returned to my home campus, the University of the Philippines Los Baños, in October of 1992 with a slight trepidation. Luckily, I had a conversation with my cousin, a previous IFS grantee, who encouraged me to apply for an IFS grant. I was struck by IFS's objective of supporting young people so that returning early-career scientists would be suitably equipped and funded to do research in their home countries (and not leave for greener pastures). The short review and approval of the granting process was helpful as within a year of my homecoming, I had a research project ongoing. Fortunately, our department already had existing big-ticket but still serviceable equipment, a High Performance Liquid Chromatograph, so all I had to purchase were accessories like columns and those involved in sample preparation. The basic equipment I procured with IFS funds enabled me to continue previous research interests from my PhD work but applied to local conditions, resulting in minimal downtime. Thus, I was able to maintain research momentum. Three years later, another IFS research grant followed the initial one.

IFS encouraged presentations at research conferences, especially at international events, to establish networks and they gave travel grants for these purposes. Thus I found myself in Israel and Thailand presenting papers at the International Mango Symposium with

the papers being published in *Acta Horticulturae*. The IFS funding enabled me to establish a solid research track record which became the stepping stone for bigger grants. Research-wise, my career took off as I had a foothold in a scientific niche that was more basic than applied in nature, a field that would not have been supported (at that time) by local funding institutions. IFS funding paved the way for me to study the mechanism of potassium-nitrate-induced flowering in mango, a field of study languishing for twenty years since the discovery that potassium nitrate has bud-breaking capabilities in tropical mango. This line of research was capped by a Best Paper Award in the upstream category given by the Crop Science Society of the Philippines, roughly a decade after the initial IFS grant.

My research attracted local and international graduate students and collaborations with other scientists. The basic equipment from IFS was again used by the graduate students. Publications increased, translating to promotions in rank following the "publish or perish" culture in academia. Invitations also came to write book chapters or serve as an expert resource person in various development projects. Eventually, I became Chair of the Department of Horticulture, Director and Professor of the Crop Science Cluster, recently culminating in a stint as Executive Director of the Philippine Rice Research Institute. Although not directly attributable to IFS, the latter positions came as a result of the early professional growth spurred by the IFS grant. Indeed, IFS was right on target in choosing to support young, starting scientists with modest funding; I can attest to that. My thanks and congratulations to the IFS organization, its Board of Trustees and the personnel manning its ranks for a mission accomplished!

IFS Senior Ambassadors

PHOTO: BRIAN PORTER

OLANREWAJU SMITH

Chair in IFS Board of Trustees, Director, Lanrify Agriculture, Food and Nutrition Consulting Inc, Ottawa, Canada

PHOTO: ANNA LINDGREN

TORBJÖRN FAGERSTRÖM

Vice chair in IFS Board of Trustees, Senior Adviser, Swedish University of Agricultural Sciences (SLU), Uppsala, Sweden

PHOTO: UIO/GUNNAR LOTHE

WENCHE BARTH EIDE

Associate Professor, University of Oslo, Norway

IFS Ambassadors

Since its establishment in 1972, and as a result of its support of early-career scientists across the world, IFS has generated and nurtured professional and personal goodwill among thousands of people. Many of them have arrived at places in their own careers where they have a voice and influence on matters of importance when it comes to the support of scientific endeavors of all kinds.

The IFS Secretariat will invite volunteers to be Ambassadors from among past and present Trustees and Scientific Advisers, and the growing numbers of alumni, who themselves are now forming into associations in particular countries.

EXCERPT FROM

Audited financial statement 2016

Administration Report

Information about the activities

In 2016 IFS progressed in implementing its strategy and continued building the capacity of early-career developing country scientists, to produce new research findings of assured quality according to accepted academic principles, avail of and gain access to collaborative research networks, and promote the use of research. In addition, IFS developed its research granting system, to automate the process as much as possible.

IFS GRANTS TO INDIVIDUALS

In 2015, while following up the awarded grants of the previous years, a time-bound call (1 November–31 December 2015) for applications for individual research grants was opened. Applicants submitted their proposals within three thematic research clusters:

- Biological Resources in Terrestrial Systems
- Water and Aquatic Resources
- Food Security, Dietary Diversity and Healthy Livelihoods

Received by the deadline were 1400 applications. Of these, 1338 applications were pre-screened by IFS staff and 293 applications were assessed by the IFS Scientific Advisory Committees. IFS provided supporting services to 1338 applicants, i.e., feedback and valued counselling on applicant research proposals.

Seventy-two (72) individual research grants were approved (20 to women and 52 to men). Fifty-seven (57) grants went to Sub-Saharan Africa, 10 to South and Southeast Asia, and 5 to Latin America. These grants were awarded to applicants who submitted either a renewal, rewritten or revised application.

We had planned to follow up the awarded grants of previous years and award 120 new individual research grants and if IFS's financial situation had improved during the year, have a second session upon invitation/request only for revised new applications and renewal applications. Due to the refugee crisis, our budget was reduced by 30% and thus only 72 grants were awarded and there were no sessions for invitation/request only for revised new applications and renewal applications.

In addition to research grants, IFS provided supporting services, i.e., feedback on research proposals for unsuccessful applicants, valued counselling, and assistance in the purchasing of equipment and supplies.

THE IFS COLLABORATIVE GRANTS

While continuing to mentor and monitor pilot 1 and pilot 2 groups of the collaborative research grants, a third call for expressions of interest went out in the second week of January 2016, asking for people in Southeast Asia to collaborate on research into climate change adaptation and mitigation. It covered Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Thailand, Timor-Leste and Vietnam. Eligible "aspirants" were invited into a specially designed social networking platform called Chatter. In a "plenary workspace" people discovered each other's profiles and against a call for collaborative research grant applications advertised on the platform, coalesced into teams, each receiving access to a private team workspace built on Chatter, where they planned and wrote their team applications.

Following the period requesting expressions of interest (10–31 January 2016), Chatter groups formed among the applicants for the purposes of social networking, team building and making applications toward a deadline of 30 June (with an extension until 3 July). Seventeen (17) teams (61 individuals) submitted their applications by the deadline. Pre-screening of applications at the IFS Secretariat was done in July. In September applications were sent for external review and a collaborative SAC meeting was held on 2 December. Out of the 17 original teams, 12 teams (consisting of 21 women and 20 men) were awarded an IFS collaborative research grant.

CONFERENCES, MEETINGS, SEMINARS, TRAINING AND WORKSHOPS

A total of 12 training workshops involving approximately 400 participants were conducted through different partnership agreements and together with IFS Alumni Associations. Three sub-regional multi-stakeholder policy workshops and a concluding workshop, a component of an ACP-EU project, were held in cooperation with African and European partners.

Three training workshops were held at the University of Abomey Calavi (UAC), together with the Benin Alumni Association, involving three cohorts of 25 young researchers (MSc and PhD levels) on statistical tools, proposal writing, power point design, oral presentation and scientific article writing. In addition, the Benin alumni organized monthly seminars where new advances in a given scientific topic were debated as introduced by a senior researcher from the university or from abroad.

Another event was an IFS-Carnegie Corporation conference in Kenya on collaborative research.

Together with the National Research Council of Thailand, IFS organised workshops on natural products and agricultural sciences.

A proposal writing workshop at ILRI and a scientific writing workshop at Beca/ILRI were also organised in Kenya.

IFS also joined with the Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA) to organize a workshop in the Philippines for the pilot 3 collaborative research initiative.

GRANTING SYSTEMS DEVELOPMENT

We have consolidated our systems into the single Salesforce platform to make them more efficient and automated. We have been working with the company Fluido (implementation partners for Salesforce in the Nordic market) to customize a configuration which best meets IFS's needs. Among other features, it includes communities for applicants, reviewers and grantees, and applications for IFS staff to pre-screen applicants and manage external reviews, SAC meetings and grants.

93,4% of total expenditure for the year 2016 was on programme services, fund raising and partnership building. The advisers and experts who make evaluations of proposals do not receive remuneration for reviewing nor for their attendance at SAC meetings. These contributed services which can be valued at approximately 4 million USD in pro bono support are not reflected in this report.

PLANS FOR 2017

- **Stewardship of IFS** (resource mobilisation, 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 principles).
- **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 deficit of SEK 1 807 701 (EUR 188 636). The deficit is due to the use of, and in line with the purpose of, equity in designated funds from Carolina MacGillavry. The Carolina MacGillavry fund covered collaborative grants to a value of SEK 4 183 102.

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 and the Balance Sheet.

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 2016	1 January– 31 December 2015
Programme Revenue		
Core and Restricted Contributions	24,620	34,949
Grants Withdrawn	713	724
Other Programme Revenue	298	45
Total Programme Revenue	**25,631**	**35,718**
Programme Expense		
Programme Services	24,710	33,789
Fundraising and Partnership Building	1,715	2,199
Management and General	1,857	2,431
Total Programme Expense	**28,282**	**38,420**
Programme Income less Expense	**-2,651**	**-2,702**
Result from financial assets		
Income from other investments held as fixed assets	552	570
Interest Income	91	72
Exchange gain / loss	200	1,355
Asset Income less Expense	**843**	**1,997**
Net Income less Expense	**-1,808**	**-705**
Change of designated funds		
Net Income less Expense for the Year (see above)	-1,808	-705
Use of designated funds from previous years	4,183	652
Designated funds	-5,848	-1,159
Remaining amount/change of equity balance	**-3,472**	**-1,212**

BALANCE SHEET (in thousands SEK)

	31 December 2016	31 December 2015
Assets		
Fixed Assets		
Tangible Assets		
Equipment, Furniture and Fixtures	55	49
Financial Assets		
Other long-term investments	13,855	13,012
Long-term Donor Receivables	410	483
Total Fixed Assets	14,321	13,544
Current Assets		
Current Receivables		
Donor Receivables	1,507	1,544
Other Current Receivables	745	692
Prepaid Expense and Accrued Income	616	996
Total Current Receivables	2,868	3,231
Cash and Bank Balances	23,558	22,103
Total Current Assets	26,427	25,334
Total Assets	**40,747**	**38,879**
Equity and Liabilities		
Equity		
Board Designated Fund for Contingencies	14,400	9,843
Carolina MacGillavry Fund	11,719	14,611
Total Designated Funds	26,119	24,454
Unrestricted Equity		
Balance, 1 January	-2,025	344
Net Income less Expense for the Year	-1,808	-705
Total Unrestricted Equity	-3,833	-361
Total Equity	22,286	24,094
Current Liabilities		
Research Grants Payable	9,835	9,987
Deferred Restricted Contributions	6,275	2,099
Accounts Payable	0	413
Other Current Liabilities	592	741
Accrued Expense and Prepaid Income	1,759	1,545
Total Current Liabilities	18,461	14,785
Total Net Assets and Liabilities	**40,747**	**38,879**

AFFILIATED ORGANISATIONS 2016

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
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JAMAICA
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LATVIA
Latvian Academy of Sciences (LAS)

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

MALI
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Comité National de la Recherche Agricole (CNRA)

MEXICO
Consejo Nacional de Ciencia y Tecnología (CONACYT)

MONGOLIA
Mongolian Academy of Sciences

MOROCCO
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Institut Agronomique et Vétérinaire Hassan II

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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

INDIVIDUAL RESEARCH GRANTS AWARDED 2016

BANGLADESH

MONIRUZZAMAN, Mohammad
Production of buffalo embryo from in vitro grown oocytes

BENIN

BOURAIMA, Abdel-Kabirou
No-tillage intercropped Maize-Peanut to reduce water and soil loss from cropland in Northern Benin

DABADÉ, Déley Sylvain
Effectiveness of 4-hexylresorcinol and catechin treatments in inhibiting melanosis and microbial growth in tropical brackish water shrimp (*Penaeus notialis*) during storage at 0°C and 7°C

KAFOUTCHONI, Konoutan Médard Thibaut
Assessing ethnobotanical knowledge and domestication potentialities for *Xylopia parviflora* (A. Rich.) Benth., a wild spice in Benin (West Africa)

SALIFOU, Chakirath Folakè Arikè
Identification des sérogroupes de *E.coli* producteur de shigatoxine présents dans le lait, les viandes et fèces des bovins, ovins et porcs abattus au Benin

SOCLO, Wilfried Parfait
Etude de la variabilité spatio-temporelle des paramètres hydrodynamiques dans la zone non saturée du plateau d'Allada: modélisation des flux pour une gestion rationnelle des ressources souterraines

TCHABI, Frontenel Lopez Yélognissè A.
Caractérisation chimique et pollinique des plantes d'aménagement (espaces verts) et leurs effets sur la santé en zone urbaine (cas de Cotonou)

BOLIVIA

PAREDES VILLANUEVA, Kathelyn
Isotopic characterization of forest species to verify regional provenance of Bolivian timber

BURKINA FASO

BONDE, Loyapin
Assessment of fruit production and economic value of shea tree (*Vitellaria paradoxa* C.F.Gaertn.) for an exploitation more profitable in Burkina Faso

DAMA, Emilie
Développement d'un biomarqueur d'exposition des bovins aux piqûres des mouches tsé-tsé basé sur une combinaison de peptides synthétiques salivaires

KABORE, Aminata
Phytorémédiation de la pollution toxique des eaux avec les protéines de graines de *Moringa oleifera*

KADEBA, Abel
Impact de la préparation de la bière traditionnelle sur la disponibilité des plantes utilisées dans sa phase de décantation: Rôle des milieux rocheux dans la conservation des espèces au Burkina Faso

KAGAMBÈGA, Assèta
Prévalence des pathogènes émergents d'origine alimentaire (*Salmonella typhimurium* et STEC) et épidémio-surveillance de leur résistance aux antibiotiques chez la volaille et le porc

OUEDRAOGO, Sambo
Productivité, valeurs éco-socioéconomiques, dynamique et distribution de *Balanites aegyptiaca* (L.) Delile Au Burkina Faso

OUOBA, Jean Bienvenue
Caractérisation du virus de l'hépatite E dans les eaux usées et aux de puits, en vue d'une gestion du risque environnemental

SAWADOGO, Boureima
Etude ethnobotanique et diversite genetique de l'amaranthe feuille (*Amaranthus spp*) du Burkina Faso

YAMEOGO, Florence
Analyse de la structure des populations de *Xanthomonas axonopodis* pv. manihotis et évaluation du niveau de résistance des variétés de manioc déployées au Burkina Faso

ZIDA, Issaka
Les mouches de fruits (Diptera; Tephritidae) infestant les fruits des ethno-variétés du karité dans les parcs agroforestiers du Burkina Faso: Bio-écologie, diversité et répartition spatio-temporelle

CAMEROON

OKIOBE, Simon Thierry
Mycorrhizal fungi contribute to reduce soil greenhouse gas emissions from agricultural soils

CONGO

MAKOUANZI EKOMONO, Chrissy Garel
Plasticité et réponses adaptatives aux changements environnementaux chez les eucalyptus du Congo

CONGO, D R

MUSHAGALUSA, Déo Cirhuza
Biological evidence and trophic position of Boulengerochromini (Teleostei, Cichlidae) from Lake Tanganyika: adaptation to environmental pressures in Congolese shores

COTE D'IVOIRE

AKA, Solange
Détermination des propriétés technologiques et valorisation des bactéries lactiques isolées durant la production du tchapalo, une bière traditionnelle ivoirienne

BOLOU BI, Bolou Antoine
Caractérisation et contrôle des principaux potyvirus du piment en Côte d'Ivoire pour leur meilleure gestion

KONÉ, Armand W
Intensification agroécologique de la production d'igname en Côte d'Ivoire: de «l'écosystème butte» à l'échelle parcellaire. Implication sur la manipulation de la couverture végétale des jachères

KOUAKOU, Laurent Kouakou
Domestication et valorisation des produits forestiers secondaires : Induction de la précocité de frutification de *Garcinia kola* (Heckel) par le greffage des arbres élites

OUEDRAOGO, Moussa
Caractérisation des aquifères souterrains en milieu de socle dans les zones semi-arides en vue de l'amélioration de la productivité des puits et forages lors des campagnes d'hydraulique villageoise (Nord Côte d'Ivoire)

CUBA

PEDRERA PUENTES, Lohans
Effect of the membrane biophysical properties derived of its lipid composition on the pore forming activity of sticholysin I, a pore-forming toxin from a sea anemone

REYTOR, Mey Ling
Studying the uniqueness of the CPA-SmCI-serine proteases simultaneous interaction: structural approaches and practical applications evaluating its effect as insecticide

ROMEU ALVAREZ, Beatriz
Pathogenic *Escherichia coli* producing extended-spectrum B-lactamases (ESBL) isolated from surface waters

SÁNCHEZ PÉREZ, Yaíma
Biotransformation of terpenes using fungi associated with *Piper aduncum* subsp. ossanum

ETHIOPIA

ANTENEH, Yilikal
Landscape transformation in the Upper Awash Watershed and its implications on the supply of potable water for the city of Addis Ababa in Ethiopia: the case of Legedadi and Dire Reservoirs

MENGISTU, Daniel
Climate extremes and their implications on the livelihood of local community: The case of Blue Nile River Basin (Abay), Ethiopia

MESFIN ACHEMO, Sahle
Modeling multiple ecosystem services for planning Guraghe Mountain landscape: The case of Wabe River Catchment

NEGA, Gezahegn
Interspecies interactions of Bale monkeys (*Chlorocebus djamdjamensis*) with sympatric congenerics and its conservation implication in human dominated landscape of sidamo mountains, Ethiopia

TEKLAY, Achenafi
Modeling the impact of climate and land use change on hydrological response and sediment yield in Lake Tana Basin, Ethiopia

WORDOFA, Muluken Gezahegn
Towards a cost-sharing approach in agricultural extension service provision: Analysis of willingness to pay by smallholder farmers in Eastern Ethiopia

GHANA

AMOATENG, Patrick
Pharmacological study of the antinociceptive effects of *Synedrella nodiflora* in neuropathic pain

PARRY-HANSON KUNADU, Angela
Enhancing food safety practices of informal smallholder chicken processing: A case study in Accra, Ghana

KENYA

ASUDI, George Ochieng
Identification of potential vectors and alternative plant hosts of *Hyparrhenia* grass white leaf (HGWL) disease in East Africa

BARGUL, Joel Ltilitan
The role of biting flies (genus Hippobosca) in transmission of pathogenic animal African trypanosomes in northern Kenya

KILONZI, Sheila Munanie
Nutritional quality, functional properties and cooking characteristics of dolichos (*Lablab purpureus*) varieties grown in Kenya

KOSKEI, Alfayo
Breeding success, phenology and population dynamics of endangered forest spiny reed frog (*Afrixalus sylvaticus*) in Shimba Hills, Kenya

TAMIRU ABAMO, Amanuel
Early herbivory defense trait introgression for effective cereal stemborer management in Sub-Saharan Africa

MADAGASCAR

RAMIFEHIARIVO, Nandrianina
Caracterisation spatiale des stocks de carbone (C) et des nutriments azote (N) et phosphore (P) des sols malgaches à l'échelle nationale pour une agriculture durable

SOLOFO NASANDRATRA, Ravonjiarison
Perception et gestion paysannes de la fertilité des sols en lien avec la séquestration de carbone, cas de l'agriculture de conservation au Lac Alaotra, Madagascar

MALAYSIA

MOHD OMAR, Fatehah
Treatability process of new emerging pollutants (nanoparticles) in potable water supply and industrial wastewater process using natural bioflocculants and waste by-product coagulant

PAKISTAN

FARID, Akhlaq
Understanding the role of 1-Methylcyclopropene in mango fruit ripening to reduce postharvest losses of mango in Pakistan

RAUF, Mamoona
Generation of salt resistant tomato through genetic transformation with SERF1-DREB2A regulatory cascade

REHMAN ARIF, Mian Abdur
Genetic mapping of adult plant stripe rust resistance in novel germplasm of wheat

SENEGAL

ASSOUMY, Abdou Moumouni
Qualité et résidus des antibiotiques utilisés en aviculture en Côte d'Ivoire

SOW, Ahmadou
Exploring biodiversity for sustainable management of the millet head miner, *Heliocheilus albipunctella* (Lepidoptera, Noctuidae), a key pest in Sahelian agroecosystems

SOUTH AFRICA

MASANGO, Mxolisi Goodwill
Production of *Stenocarpella maydis* mycotoxins for development of detection analytical tools

SWANEPOEL, Lourens Hendrik
The potential of small carnivore predation on rodent pests as an ecosystem service in rural small holding farms of the Vhembe District, South Africa

SRI LANKA

SURIYAGODA, Lalith D B
Diversity of Sri Lankan rice germplasm in storing micronutrients and heavy metals in rice grains and potential of agronomic management in fortifying rice grains with micronutrients

SUDAN

ABDELHALIM, Tilal
Introgression of the low germination stimulant genes (lgs) for striga resistance into Sudanese farmer-preferred varieties of sorghum

THAILAND

THONGYOO, Panumart
Design and syntheses of novel fluorescent probes based on the bivalent SFTI-I scaffold for cellular imaging application

TOGO

AMEGNAGLO, Kossi Béssan
Caractérisation, dynamique et vulnérabilité des formations végétales pâturées et interactions avec le climat du domaine soudanien au Togo

BADANARO, Fègbawè Dorothée
Evaluation des risques liés à la consommation des insectes au Togo

KAMOU, Hodabalo
Etude de la distribution spatiale des champignons ectomycorhiziens (EcM) pour une gestion durable des formations forestières au Togo

KINI, Kossi
Les bactérioses du riz dues au *Pantoea ananatis* au Togo: Diversité et identification des sources de résistance adaptées

TUNISIA

FRIKHA-GARGOURI, Olfa
Development of biocontrol agents against bacterial phytopathogens *Agrobacterium tumefaciens* and *Erwinia amylovora* based on lipopeptides and/or polyketides

UGANDA

MENYA, Emmanuel
Enhancing biogas production through optimal removal of lignocellulosic fractions and cyanide in cassava peels for co-digestion with cow dung and pig dung

VIETNAM

DINH, Van Khuong
How does thermal adaptation under global warming shape the susceptibility of tropical copepods to contaminants and toxic algal blooms?

DUNG, Tran Thi Thu
Distribution and potential release of potentially toxic elements from sediments in Can Gio district, Southern Vietnam

PHAM, The Hai
Follow-up improvements of lithotrophic microbial fuel cells for use as on-site detectors for iron in water sources (in Vietnam)

ZIMBABWE

GWENZI, Willis
Development and application of a biochar-based technology for decentralised treatment of contaminated drinking water among poor communities in developing countries

HANDISENI, Maxwell
Unravelling soil microbial population changes in soils amended with Cleome biofumigant cover crop and their correlation to suppression of soil borne pathogens

NYAMADZAWO, George
The effects of tied contours, crop intensification and integrated nutrient management on maize yields in contrasting soils in semi arid Marange smallholder farming

NYENDA, Tatenda
Plant community development on a chronosequence of abandoned gold and nickel mine tailings dumps in the great dyke region in Zimbabwe

TAURO, Tonny Phirilani
Evaluating the influence of climate gradient on microbial community structure and maize yields under integrated soil fertility management

TENDAUPENYU, Pamela
Sedimentation and sediment nutrient fluxes of a hypereutrophic subtropical lake; Lake Chivero, Zimbabwe

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