INTERNATIONAL FOUNDATION FOR SCIENCE

International Foundation for Science Research Support:
A description of the scope and areas of research that is supported

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The clusters of research supported by the International Foundation for Science

The Context of IFS Research Support

We live in a time when the climate is changing, biodiversity is declining and environmental degradation is increasing. Each of these already affects and will in the future affect many people's livelihoods and well being, positively or negatively according to how natural and other resources are distributed and available to different groups of people. There is, at the same time, a global consensus that extreme poverty and hunger must be eradicated. We wish to belong to a world where these resources are harnessed, further developed where appropriate and fairly governed so that they can be accessible and used in the best interests of people in need of them on a sustainable basis. Addressing the global, national and local challenges that this implies requires coordinated actions at different levels.

The development and application of biological, water and energy resources requires an understanding of the dynamic relationships between people and nature, and how the resources can be channelled in ways that further individual and social goals. Many powerful interests compete to use resources for their own gain, and biological, water and energy resources are in many parts of the world unevenly and often unjustly distributed and inadequately accessed by poor people who tend to lose out in the competition. In such cases, one may even identify policies that contribute to undermining people's right to an adequate standard of living as established in international human rights law, by directly or indirectly denying them access to resources for a decent livelihood. Parallel to these challenges, there are however opportunities. There is a consensus that the advances in natural science and technology and engineering can contribute new tools that are needed to counteract declining resources and identify opportunities for better or new ways of using underutilised resources. Similarly, the various social sciences can provide new insights and tools to show how creative livelihoods may be sustained.

IFS investment in support of research on biological, water and energy resources, both through the natural and the social sciences is a contribution to the larger agenda for meeting global challenges and exploiting future opportunities, including: building human capability, investing in an enabling research environment including infrastructure, promoting innovation, stimulating entrepreneurship and improving the governance of innovations on a sustainable basis. IFS believes that research is an essential precursor to innovation, and to the policies and institutional changes needed as a foundation for promoting sustainable development and which can help realise the economic, social and cultural rights of all groups of people under changing ecological, socio-economic and political circumstances.

On the one hand, we need to understand the planetary and biophysical limitations and opportunities determining what resources can be sustained, increased or improved with new insight and technology. Research into biological, water and energy resources can help us to define and live within these limitations and to develop innovations for enhanced sustainable livelihoods.

On the other hand, research in the social sciences can provide insight into economic and social processes and the forces that determine people's access to essential resources as well as the opportunities to utilise such resources to improve their livelihoods, and as a result how freedom from poverty can be promoted. This may include, inter alia, understanding issues of land tenure, people's access to fisheries and forests, the role of gender, the processes and procedures whereby agricultural and other products are commercialised and markets accessed, the freedom of 'action' of poor people (eg to invest in farm production) or to what extent there are any social protection mechanisms for the economically and socially most vulnerable groups.

In all of these areas there may be conflicting interests which influence the kinds of policies that those with decision-making power will favour. To ensure that biological, water and energy resources are managed in the immediate and long-term interests of both people and the environment, IFS encourages the participation of relevant stakeholders in the research process, not only those directly involved in the research but also, where relevant, those actors concerned with decision making and policy development. This enhances the possibilities for natural and social science research to contribute to evidence-based policy and helps improve transparency and accountability on the part of those finally responsible for policy making and interventions.

A major challenge for those doing research on biological, water and energy resources is how to address the interactions amongst these areas that shape the natural world and the actions of societies that wish to exploit them. Thus, even if specific research tasks must be narrowed to manageable proportions, IFS believes it is important to highlight how research fits into broader scientific and development contexts and how its application can benefit people. This is reflected in the way IFS' new calls for applications are now structured according to three larger clusters of issue areas, rather than according to separate disciplines as was the case earlier. Excellent disciplinary skills of individuals will continue to be necessary, but so will the ability to identify how a given research input can point to interventions that can serve societal or human needs on a sustainable basis, through more holistic and cross-disciplinary thinking and actions.

The IFS 10-year strategy emphasises building a scientist's capability (in the sense of opportunity and ability to generate valuable research outcomes) within the scope outlined through the three IFS research clusters. The strategy aims to promote exceptional individual and collaborative actions, and to harness the transformational power of relevant science, technology, information and communication. In this way, IFS hopes to contribute to efforts to safely and fairly ensure the stewardship of our natural resources.

The IFS strategy describes three approaches that will be used:

- To offer small competitive research grants and provide Capability Enhancing Support to individual early-career scientists in the developing world in support of high-quality research.

This is in line with what IFS has done for many years to help early-career scientists to become established and this will remain IFS' core activity. Usually at this level, research is not necessarily multidisciplinary, but all researchers should be mindful of the need to think through the relevance the research can have for applications to meet human, societal and environmental interests.

- To offer small competitive research grants and provide capability-enhancing support to small teams of researchers.

This is a new approach to encourage and build capability for researchers to collaborate either within single disciplines, or in cross-disciplinary projects where more than one speciality is needed. The team approach offers researchers an opportunity to investigate problems which can best be solved through a multidisciplinary approach.

- To provide capability-enhancing support for building links to networks and organisations that can help scientists to contribute to innovation.

This too, is a new approach to help early-career scientists to put their research into use in policy or entrepreneurial domains.

In the following, we further describe the scope and areas of research that IFS will support.

The Target Group of IFS: The Future Belongs to the Young

"As for the future, your task is not to foresee it, but to enable it." Antoine de Saint-Exupéry (1900-1944)

A question that one might pose in relation to Antoine de Saint-Exupéry's statement is: to enable the future for whom? The answer is, of course, the next generation and those who follow. Young people today constitute the largest youth cohort in human history, with the vast majority in developing countries.

IFS believes that science in developing countries needs to expand and that young scientists in the developing world are well placed to identify the challenges they face. IFS would like to encourage scientists to carry out transformational research, to progressively engage in negotiations regarding global, national and local opportunities, and ultimately to contribute to innovation for a sustainable future. IFS believes that discovering the benefits of working in this way, already early in a research career, may be the key to making a difference. IFS recognises that the immediate post-Masters and post-PhD years are vital in science careers; it is during this time that the expertise, skills and passion for research developed through post-graduate studies are cemented, additional skills and greater confidence developed, first publications achieved, and new research conceived and initiated with a view to influencing change. IFS is convinced that supporting individual early-career scientists is of the utmost importance to help them become established nationally and internationally, and in doing so, to enable them to pursue research programmes which will contribute to the priority issues of the day.

However, IFS knows that many post-graduates struggle to establish their careers in these early years. Therefore, IFS aims to address these difficulties through the provision of small research grants and capability-enhancing support to individual scientists, including training in scientific proposal writing and science publication and more. IFS understands that supporting individual early-career scientists is of the utmost importance to help them become established nationally and internationally and, in doing so, to enable them to pursue research programmes which will contribute to the priority issues of the day. Furthermore, through collaborative research, IFS emphasises collegiality and communities of research. Support by IFS will continue to strengthen the possibilities for young researchers to productively engage in the global undertaking to reduce poverty, fight food insecurity and hunger, and support sustainable development.

IFS aims to play its part to contribute to the scientific basis for addressing the various challenges and new opportunities in the fields of biological, water and energy resources with a view to improving human livelihoods sustainably. In doing so, IFS takes a broad view of the role of science and research that it will support based on applications from young researchers who are at the start of their planned scientific careers and who are preparing themselves in the management, governance and utilisation of biological, water and energy resources for social relevance.

More precisely, IFS welcomes applications from a wide range of applicants with at least a relevant master level background in any of the natural sciences, to some extent biomedical sciences, or the social sciences (economics/sociology/social anthropology/human geography/political science) or even the legal sciences when relevant (e.g. issues of tenure and other use of land, human rights, intellectual property rights etc.).

The Scope and Areas of IFS Research Support in the Coming Decade

Today, our planet appears small, and its biological and water resources base is vulnerable and interconnected. The development solutions we seek to support through our grantees' research must be sustainable within defined bio-physical boundaries; they must also be socially just and help advance freedom from poverty and deprivation.

In this context, doing research includes striving for greater efficiency in sustainably transforming natural resources to meet human needs. It also demands of us all far greater consideration of equity – between and within countries, social groups, between women and men and amongst members of households – in access to and use of natural resources.

Some research issues may be addressed as a discrete scientific question, but many applied research questions can also be considered in one or more social contexts. Awareness of some of the interconnections can go a long way in choosing and positioning research themes within a broader perspective than that defined by a natural science discipline. Thus, to set out to elucidate the full complexity of biological, water and energy resources when it comes to their availability, use and sustainability, needs also researchers with a background or insight in one or more of the social sciences. It means understanding the contextual complexities of the resources and addressing how global change risks, impacts, perceptions, experiences and responses differ across different regions and cultures of the world, across social classes, gender, and race or faith groupings and across a range of personal or professional traditions and identities. It also means understanding the political economy of the resources and other processes of environmental change, and to understand how these processes may relate to a multitude of social crises. And it may entail in-depth historical analysis that can explain the complex trajectories and processes that have led to today's unsustainable lifestyles and models of progress, and to draw lessons from earlier processes.

Furthermore, and depending on the topic of the project, IFS encourages researchers to consult with relevant stakeholders during the conceptualisation phase of a research project, including where possible people who may in any significant way be affected – positively or negatively − by the research, to help ensure relevance to society.

Applicants for support from the International Foundation for Science may submit their proposals through the following three thematic clusters and from different, even cross-disciplinary backgrounds as mentioned under the preceding section:

I. Biological Resources in Terrestrial Systems

II. Water and Aquatic Resources

III. Food Security, Dietary Diversity and Healthy Livelihoods

These three clusters are arranged to facilitate the applicant's identification of an appropriate framework for their submissions. The many topical areas within the three clusters are overlapping, and therefore cross-cutting research topics will also be welcomed and encouraged.

Before applying for individual or collaborative research support under one or more of these three clusters, individuals or teams should read carefully the description and rationale for forming these clusters as outlined below so as to identify that cluster which best hosts their research proposal.

- **Biological Resources in Terrestrial Systems**

This includes but is not limited to: research on biodiversity, forestry, animal production, crop science, underutilised species, natural products, renewable energy and climate variability, and technical research on all forms and aspects of food production; also, aspects of the social, economic, cultural and historical context for current and future practices, use and management of natural resources as well as the fostering of socio- economic resilience.

Along with climate variability related to, eg temperature, rainfall patterns, and ocean acidification,

changes in land use will continue to exert a significant effect on biodiversity loss. Studies on the effects of conversion of natural ecosystems into agriculture or into urban areas, of the changes in frequency, duration or magnitude of wildfires and similar disturbances, and of the introduction of new species into land and freshwater environments will be supported.

IFS supports natural and social science research relating to the sustainable use of resources found in these systems as well as research projects which contribute to understanding their complex ecologies and the effects of humankind's interactions with these systems.

The cluster will include research into crop production, including sustainable agronomy, eco-physiology, crop diversity, genetics, plant biotechnology, plant-microbe interactions, plant pests, soil fertility and plant nutrition, measures to reduce post-harvest and other food losses and waste throughout the food supply chain, crop water use and soil water balance, crop quality and soil contamination by heavy metals and organic pollutants. IFS will also support research into sustainable livestock production systems, and efforts to eradicate and prevent the spread of animal diseases, including those that can be transmitted to humans (zoonoses).

In order to promote the sustainable development and conservation of forests, woodlands, trees and their ecosystems, research funding will support management practices, forest policy, biometrics and mensuration, biotechnology, disturbance, terrestrial ecology, community ecology, forestry economics, ecosystem services, entomology, fire ecology, plant genetics and breeding, ethno-botany, plant pathology, plant symbiosis, physiology, production (including agro-forestry), remote sensing, landscape dynamics, water catchment, soil, silviculture, wood science and wood-based energy. In particular, innovative approaches to rural development in tropical forest areas that lead to sustainability and which curb deforestation are encouraged.

Vital research is needed into the isolation, identification, characterisation and synthesis of compounds from living organisms with potential for medicinal, biological, industrial and pest control applications. Research on traditional medicines and especially proposals addressing tropical diseases are welcomed. Research on bioremediation, biofuels, biopolymers, and chemical ecology, molecular aspects of enzymes and proteins, new technology in pharmaceutical product development, new methods for chemical and biological profiling and standardisation of active plant extracts, organic dyes, agricultural and industrial wastes are other examples. A special feature is the many uses of products for human consumption that are part of indigenous and local food cultures, or which form raw material for use in commercial processed foods.

Renewable energy research aimed at expanding knowledge of the various technologies of renewable energy will be supported, and includes experience with wind and solar power, hydro, tidal and wave power and biomass in the form of wood products, dried vegetation, crop residues, and aquatic plants.

Focusing on the identification, characteristics and opportunities for conversion of the resources may imply on the one hand, research confined within the biological, biophysical and agricultural sciences, and on the other hand, expertise is called upon to study social and cultural conditions and behaviour with regard to accessing and using natural resources by people for their livelihoods, or for industrial use and commercialisation. The two aims may or may not always go well together and various types of social science research are welcomed to unveil underlying conflicts and/or point to the need for equitable solutions in topical policies and programmes.

- **Water and Aquatic Resources**

This includes but is not limited to: water resources availability, conservation, use, and issues associated with water-related institutions; research on freshwater, brackish and marine aquatic organisms and their environments, as well as human and community access to such resources in the protection and improvement of their livelihoods.

Water is at the core of sustainable development and it is closely linked to a number of key global challenges. Alteration in the hydrological regime due to global climatic, demographic and economic changes puts water under considerable pressure provoking serious consequences for people and the environment.

IFS will support research that contributes to improving the existing availability and supply of water in rivers, lakes, reservoirs and aquifers. This may include research to enhance wastewater treatment, groundwater banking control, non-point source pollutants, understanding land use changes and best management practices on pollutant loading of waters, understanding and predicting the frequencies and consequences of severe weather (floods and droughts) as well as hydrological impacts of global changes.

Furthermore, research that helps understand the multiple uses of water, i.e. determinants of water use in the agricultural, domestic, commercial, public and institutional sectors, is supported by IFS. There is a need in all sectors to understand how to promote more efficient water use, and optimise the economic return for water used, for example, by developing improved crop varieties for use in dryland rainfed and irrigated agriculture, and to understand the behaviour of aquatic organisms and ecosystems in a broad systematic context including their water requirements. This would encompass research to promote, enhance and support more sustainable management of aquatic resources in marine, brackish and freshwater environments, including fisheries and aquaculture. The research may also stress the crucial role of healthy marine and freshwater ecosystems, sustainable fisheries and sustainable aquaculture for food security and nutrition and in providing for the livelihoods of coastal and freshwater riparian communities as well as distance communities through market links.

In this context, IFS also recognises the need to maintain aquatic ecological processes that support aquatic resource production systems. IFS believes that this is not only an issue for external technology transfer, but even more a subject of relevance for research seeking local knowledge and practices through widespread engagement with farmers, fishermen, entrepreneurs and those who make and shape policy for managing such resources. Such an approach also provides valid experience for capability enhancement amongst IFS grantees.

Water-related institutions have the roles and responsibilities to decide who will get what water when and how. How property rights are defined, who benefits from these rights and how they are enforced are all central issues that need further research for clarifying water policies and legislation. IFS will for example support research which can help to develop legal regimes that promote groundwater management and best use of surface water and groundwater, research that can improve equity in existing water management laws - between social groups and between women and men, research that can contribute to the development of new methods for estimating the value of non-market attributes of water resources, and research that explores the use of economic institutions to protect public policies and cultural values related to water resources.

- **Food Security, Dietary Diversity and Healthy Livelihoods**

This includes but is not limited to research encompassing agricultural and livestock production systems including socio-economic and farming systems research, research on the conditions for the enjoyment

of food security beyond food production, distribution and overall availability, and also research on access to food or resources for food for socio-economic resilience and improved livelihoods, health and well being in rural and urban areas.

IFS believes that a key area of its research effort should be committed to enhancing food security for households and individuals in ways that will enhance their access to nutritionally adequate, safe and culturally acceptable and diverse foods for healthy diets for present and future generations. Food production is an essential, but not in itself sufficient, prerequisite for enjoying food security for households without formal entitlement to land, paid work and other assets or social protection needed to access food on a stable and sustainable basis. A significant portion of the world's poor people live in rural areas, yet rural communities play an important role in the agricultural and economic development of many countries provided they have stable access to the resources needed to produce, sell or buy the food they need. IFS therefore emphasises the role of a strong research effort into the agricultural and rural development sectors in order to support diversified development in an economically, socially and environmentally sustainable manner. At the same time, there is a need for research on constraints and opportunities for city dwellers to access food which may be limited unless there is a balance between urbanisation and the need to keep viable links with food-producing areas, to strengthen local markets, and even mobilise for urban/peri-urban agriculture.

IFS applicants can propose individual or collaborative research that would contribute to our understanding of the production systems for crops and livestock, the benefits of agricultural and horticultural extension, training and education services, the root causes of excessive food price volatility in agricultural commodities and their consequences for food security and nutrition, and links between food, nutrition and health that can be promoted also through primary health care.

IFS will also welcome projects dealing with how to better address the need for various economically and socially vulnerable groups to have access to credit and other financial services, markets, secure tenure of land, forests and fisheries, health care, social services, education, training, knowledge and appropriate and affordable technologies including for efficient irrigation, reuse of treated wastewater and water harvesting and storage, and traditional sustainable agricultural practices including traditional seed supply systems. Because of the wide diversity of agricultural conditions and systems, IFS will consider proposals for research that endeavour to support sustainable agricultural practices, rural infrastructure, storage capacities and related technologies, research and development on sustainable agricultural technologies, developing where appropriate strong agricultural cooperatives and value chains, and strengthening of urban-rural linkages. Research proposals which also take account of the functioning of markets and trading systems and the role of public and private investment in sustainable agriculture, land management and rural development will also be handled by this area. IFS also recognises the need for significant research to reduce post-harvest and other food losses and waste throughout the food supply chain.

Applications addressing issues related to agricultural system vulnerability and resilience, adaptation to climate variability, peri-urban agriculture and neglected and underutilised crops will be welcome.

In addition to production systems research, IFS will accept research that aims to address the root causes of excessive food price volatility in agricultural commodities and their consequences for food security and nutrition, as well as research in participation with smallholder farmers and poor urban dwellers that need better access to food, jobs, and natural resources. IFS will also support research into forms and content of agricultural extension to enhance better use of available assets and improve local agricultural productivity.

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