

Environment and Climate Impact Assessment of the International Science Programme (ISP)

Summary

This document aims to provide an overview and analysis of the environment and climate impact effects of the International Science Programme (ISP) and its partner activities, operating mainly on Sida funding.

Opportunities. About 24 research groups and networks (out of 60) supported by ISP are engaged in activities promoting an environmentally sustainable development, in many cases relating to the Sustainable Development Goals (SDGs). Through the research conducted, supported groups and networks study contamination of food and environment, and provide technical solutions to environmental issues such as energy efficiency, renewable energy, waste management, water treatment, improved air quality, and water purification. Importantly, they are providing locally adapted solutions to local problems. Further, some of the supported groups and networks are, according to their reports to ISP, having positive impact on food safety, environmental issues, climate change, and disaster risk reduction, and are contributing to policy processes, national plans, and strategies.

Risks. Most of the supported chemistry partners and many of the physics partners are conducting laboratory research. This comes with many potential risks for health and the environment, mainly relating to the handling and disposal of chemicals and other hazardous waste. There is also a risk for neglect of ethical values in research. In addition, research collaboration and dissemination of results requires travel, often by air, which has negative environmental impact. The main problems identified by ISP regard two main areas:

1. **Laboratory safety.** Prioritized issues include dysfunctional fume hoods (or total absence of them), poor/unsafe handling and storage of chemicals, lack of secure attachments of gas cylinders, lack or no use of protective goggles and coats, lack of or no fire safety, poor or unsafe electricity arrangements, and lack of trained personnel.
2. **Laboratory ethics.** Prioritized issues are adherence to the Nagoya Protocol in research involving plant genetic resources, and the Declaration of Helsinki in research involving human and animal samples, and obtaining the appropriate ethical consent for research involving humans and other animals
3. **Environmental/Climate Risks.** Prioritized issues include poor/unsafe chemical and hazardous waste management, poor/unsafe handling of old/non-functioning equipment, and travel.

ISP effects. When it comes to direct adverse environmental and climate impacts from ISP, travel is identified as the main issue. ISP's activities require travels to visit partners, both for relation- and follow-up reasons. How and when ISP staff and partners travel is, therefore, important to consider.

Suggested actions. To address the prioritized issues ISP will:

- 1) Update and revise the form in the annual activity report to include a checklist of prioritized laboratory safety and ethics concerns and environmental/climate risks. This will make the form

useful as a follow-up tool and a basis for dialogue questions on site visits and in the grant application procedure.

- 2) ISP will revise ISP "indicator m" (addressing environmental impact), to capture the effects of partners' activities on environment and climate in a better way.
- 3) ISP will continue to follow Uppsala University's 'Guidelines for Environmentally sound work-related travel'.

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Introduction

The International Science Programme (ISP) at Uppsala University is devoted to strengthen domestic capacity for research and higher education in the basic sciences physics, chemistry and mathematics at academic institutions in lower-income countries. ISP is mainly supported by the Swedish International Development Cooperation Agency (Sida). Currently (2018), ISP provides financial support to 43 research groups and 19 scientific networks, who use the funding to equip laboratories, start PhD and MSc programs, and send students and staff on exchange and conferences, depending on their individual needs to strengthen domestic research capacity. In most cases, the scientific work is carried out in close cooperation with one or more research groups at more advanced collaborating host institutions located in Sweden, in other Nordic and European countries, as well as in the partner regions. Further, ISP also coordinates the Swedish side of several of the Sida's Bilateral Research Programmes.

When it comes to environment and climate impact there are several opportunities as well as risk with ISP's and its partners' mode of operation. This document aims to provide an overview and analysis of these, and suggest possible improvements. This document are based on questions from Sida Research Unit's 'Guidance for Dialogue and Assessment: Environmental integration in Sida Support for Research Programmes'.

Opportunities for positive environmental impact

Environmentally sustainable development targeting

More than 1/3 of the 60 groups and networks receiving ISP support in 2018 are engaged in activities promoting environmental sustainability (Table 1). In chemistry, supported activities address water treatment, water purification and tracing of pollutants and pesticides in water, food and environment. In physics, they address renewable energy and improved air and water quality, and mathematics applications they target i.e. climate change modeling.

Table 1. ISP supported activities relating to environmentally sustainable development

Chemistry

- [BAN:04 - Studies of organic pollutants in food, water and environment](#), University of Dhaka, Bangladesh
- [BUF:01 - Antifungal agents formulation from local plants in view of crop protection and ensure food security](#), University of Ouagadougou, Burkina Faso
- [BUF:02 - Physiochemical characterizations and purification of surface water and groundwater in some localities in Burkina Faso](#), University of Ouagadougou, Burkina Faso
- [LAO:01 - Pesticide residue in food and environment in Lao PDR](#), National University of Laos, Lao PDR
- [MAL:01 - Physiochemical studies of clay raw materials from Mali](#), University of Science, Techniques and Technology of Bamako, Mali
- [RWA:01 - Environmental chemistry](#), University of Rwanda, Rwanda
- [UGA:01 - Environmental chemistry](#), Makerere University, Uganda
- [UGA:02 - Green chemistry project](#), Makerere University, Uganda
- [ZAM:01 - Sustainable chemistry and environmental project](#), University of Zambia, Zambia
- [ZIM:02 - Biomedical ecotoxicology](#), National University of Science and Technology, Zimbabwe
- [ANCAP - African Network for the Chemical Analysis of Pesticides](#)
- [ANFEC - Asian Network of Research on Food and Environment Contaminants](#)

Mathematics

- [EAUMP - Eastern Africa Universities Mathematics Programme](#)
- [BURK:01 - PDE, Modelling and Control](#)

Physics

- [BAN:04 - Biomedical physics & technology](#), University of Dhaka, Bangladesh
- [BUF:01 - Energy and environment research group](#), University of Ouagadougou, Burkina Faso
- [KEN:02 - Research and development of solar cells](#), University of Nairobi, Kenya
- [KEN:03 - Photovoltaics and materials science](#), University of Eldoret, Kenya
- [KEN:04 - Nuclear and associated analytical techniques](#), University of Nairobi, Kenya
- [TAN:01/2 - Materials Science and Solar Energy](#), University of Dar es Salaam, Tanzania
- [UGA:01/1 - Materials for energy conversion](#), Makerere University, Uganda
- [ZAM:01 - Solar Energy Materials and Photovoltaic Systems](#), University of Zambia, Zambia
- [ZIM:01 - Geophysics and groundwater studies](#), National University of Science and Technology, Zimbabwe
- [MSSEESA - Material Science for Solar Energy Network for Eastern and Southern Africa](#)

Technical solutions to environmental issues

Through the research conducted, supported groups and networks are studying food and environmental contamination, and are providing technical solutions to environmental issues such as energy efficiency, renewable energy, waste management, water treatment, improved air quality, and water purification.

To exemplify, the Materials Science and Solar Energy Network (MSSEESA) with research groups in six countries in Eastern Africa is contributing to the provision and solutions to affordable and clean energy in Eastern Africa. The research conducted by the Zambia node of the MSSEESA network will be scaled up by the Zambia National Science and Technology Council (NSTC) through the production of a prototype polymer solar cell. The support to research and activities in both chemistry and physics on air, soil, food, cattle and water pollution have resulted in raising awareness and finding technical solutions to these issues.

Importantly, many of the partners are finding local solutions to local problems. Meaning for example using available and affordable materials in their prototypes, i.e. concerning solar cell materials or water purification solutions.

Environment/climate policy impact

Some of the supported groups and networks are, according to their reports to ISP, having positive impact on food safety, environmental issues, climate change, and disaster risk reduction and are contributing to policy processes, national plans, and strategies. Both through their research and through their acquired skills and outreach activities. ISP observes that many research group leaders/members or network coordinators often are invited/consulted by local or national government committees and working groups on issues related to their expertise. Some examples from the granting period 2014-2019 include:

- In 2014, the group leader of IPICS BAN:04 at Dhaka University, Bangladesh acted as a convener of the writing Safe Food guideline for agricultural products for the Ministry of Agriculture and contributed to the guidelines for the chemical contaminants in food for the Ministry of Food in Bangladesh. She was also part of the committee creating the “Bangladesh Food Act 2013”, now a food safety law ensuring peoples’ right to access safe food in Bangladesh.

- In 2015, members of the chemistry group IPICS ETH:04 at Addis Ababa University, Ethiopia contributed to a national committee on major chemical pollution problems, in particular the effect of pesticide residues and the releases of effluents or hazardous waste from the upstream industrial areas.
- A presentation by the group leader of the IPPS KEN:01/2 research group at University of Nairobi, Kenya given to the residents of Mukuru Informal Settlements, to Nairobi City County officials, and to County stakeholders at a Kenya Resident Association (KARA) seminar, led to the inclusion of an urban air quality section in the Nairobi Integrated Urban Plan (NIUPLAN) of the City County in 2016.
- In 2016, the earthquake information provided by the Eastern and Southern Africa Regional Seismological Working Group (ESARSWG) was incorporated in local policies in Uganda, e.g. the Disaster Management Policy and the Construction and Building Policy.
- In 2017, the research lab of IPICS ZIM:02 at the National University of Science and Technology, Zimbabwe, was approached by the Environmental Management Agency (EMA) to assist with ways of controlling the spread of the water plant *Eichhornia crassipes*. The Environmental Management Agency established a partnership with the research group where they get advice on ecotoxicological issues and the research group can partner with EMA on workshops that focus on raising awareness on environmental issues.

Outreach activities and interaction with stakeholders

One way ISP is encouraging dissemination of scientific research results regarding environmental issues to the public and to decision-makers, is to request reporting on such instances in the annual activity reports. As a consequence, the reporting of such instances has increased substantially. Through their many outreach activities, the research groups and networks are providing stakeholders with information, using research results and skills. Examples includes organizing events open to the public at their universities/laboratories, reaching out to high school students and teachers, coverage in radio, TV and newspapers, participation and organization of awareness raising workshops or skills trainings and workshops for government agency employees. For example:

- The group leader of IPICS BAN:04 in Bangladesh gave an interview to a TV channel about plastic pollution and possible remedies from the environment. Further, the group organized a seminar on Food Safety in Bangladesh with the help of Sweden Alumni Network in Bangladesh where different stakeholders including academicians, government officials & Researchers, policy makers attended. The Chairman of Bangladesh Food Safety Authority, the Ambassador of Sweden in Bangladesh and representative from the Food and Agriculture Organization (FAO) in Bangladesh took part in the discussion.
- A member of IPICS network ANCAP participated in a national workshop to raise awareness of the National Environmental Research Agenda (NERA) 2017-2022 organized by the Tanzanian National Environment Management Council (NEMC) held at the National Carbon Monitoring Centre (NCMC), Sokoine University of Agriculture (SUA) Morogoro on 10th to 12th July 2018.
- A group member of IPICS UGA:01 is involved in a collaborative effort between an NGO-Community Integrated Development Initiatives (CIDI) and researchers from the University of Illinois, USA to set up a solid waste treatment plant in Rubaga Division, Kampala City, Uganda. In addition, he is also

participating in activities on a committee set up by the National Environment Management Authority (NEMA) in Uganda to oversee chemicals and waste management in the country.

- The group leader of IPPS MAL:01 in Mali is the General Secretary of an association of citizens of a rural municipality of the Western Sahel, where he advised to take into account the dimensions of climate change to improve the life of farmers and ranchers.

Risk of negative environmental impact

Risk management

Laboratory safety has primarily and historically been dealt with through dialogue. When visiting partners, laboratory visits are always carried out and laboratory safety concerns pointed out. In some cases, and upon request, ISP can provide support and take part in discussions with university management to help solve problems. One problem is, as pointed out above, that many of the laboratory safety concerns are recurring visit after visit, and similar among groups and networks. A more structured approach and clearer guidelines (checklist) to lab safety could therefore be one way to improve the situation.

Ownership and university hierarchy/management are two main issues ISP needs to consider in implementing such guidelines. Many of the requested actions that imply changes that might or might not be possible for the individual research group to request for university management. Nevertheless, internationally agreed standards for operating laboratories are very strict on laboratory safety including waste management.

Regarding environmental risks, ISP has since 2010 been asking groups and networks to fill out an environmental impact assessment in the annual activity report, including questions about laboratory waste management (Table 2). The answers have been used for ISP's environment "indicator m". Groups' and networks' environmental impact assessments have, thereby, been followed up on an aggregated level each year. Data at the resolution of each individual activity are at hand, but no systematic follow-up has been done per individual group or network to see if the implementation of these measures have improved with time, and no systematic discussion have been held on how the ones not yet fulfilled could be dealt with.

Table 2. ISP previous (2014-2019) Environment Impact Assessment parameters

Does your group/organization:	Yes	No
A strategy to reduce negative environmental impact caused by travelling and transportation?		
The use e-meeting techniques?		
A strategy to reduce the use of electric power?		
Considering environment impact criteria in procurement?		
Practicing sorting of waste categories for recycling?		
A system for scrapping decommissioned equipment?		
A management system for chemical and hazardous waste?		
Internal discussion of how any negative environmental impact of your activities can be reduced?		
Engagement in external activities – in research, dissemination and/or society outreach – on how negative environmental impacts may be reduced?		

ISP supported partners

Many of the ISP supported groups and networks in chemistry and in physics are conducting laboratory work. The main health and security risks identified by ISP in these groups and networks are similar for both chemistry and physics activities, and across countries and regions. The prioritized risk issues in need of attention can be divided into laboratory safety and environmental risks:

Laboratory safety

- No or dysfunctional fume hoods – implies a risk of exposure to hazardous chemical fumes or droplets
- Poor/unsafe handling and storage of chemicals in laboratories – implies a risk of exposure to hazardous chemicals, and of hazardous transformation processes in certain solvents (e.g. formation of explosive peroxides in diethyl ether)
- No or lack of safety equipment (emergency shower, eye wash stations, functioning fire alarm, fire extinguisher etc.) – implies risk of personal safety in case of accident or emergency
- Lack of secure attachments of gas cylinders – implies risk of damage to life and infrastructure, should a cylinder be tipped over (if the valve breaks of a pressurised gas cylinder, the jet of the expanding gas will thrust the cylinder like a torpedo, it can traverse thick walls, and hurt people seriously)
- Lack or no use of protective goggles and laboratory coats – implies risk of eye and skin damage, and of destroying personal clothes
- Poor/unsafe electricity arrangements – implies risk of electrical shock, which may be lethal
- Lack of trained laboratory personnel – implies risk of fatal mistakes due to insufficient knowledge of hazards.

Laboratory ethics

Laboratory exercises implying the use of plant genetic resources, animal or human samples or laboratory animals are obliged to adhere to the appropriate standards.

- The use of plant genetic resources should follow the Nagoya Protocol.¹
- Studies involving humans or other animals, including laboratory animals, or samples thereof, should follow the Declaration of Helsinki² and not be carried out before ethical consent has been sought with and approved by the responsible national authority.

Environmental risks

- Poor/unsafe chemical and hazardous waste management – implies risk of contamination and exposure to humans and biota
- Poor/unsafe handling of old/non-functioning equipment – implies risk of contamination and exposure to humans and biota
- Travel – implies risk of adding to the carbon dioxide burden of the atmosphere

What generally is seen by ISP is unsafe or poor chemical waste management by supported groups and networks, something that could have adverse effects on the environment and health, e.g. with chemicals ending up in fresh or ground water sources, in the soil or the ocean. Further, local regulation (institutional and country) is in many cases insufficient with regard to chemicals waste management.

¹ The Nagoya Protocol: <https://www.cbd.int/abs/>

² The Declaration of Helsinki: [https://www.who.int/bulletin/archives/79\(4\)373.pdf](https://www.who.int/bulletin/archives/79(4)373.pdf)

Because of these local regulations, the issue in principle lies outside ISP's mandate to rectify. However, since the handling of chemical waste is a serious risk to health and the environmental, a continued discussion is necessary to raise the awareness where the issue has not been properly addressed.

Another issue at supported institutions identified by ISP is the poor management of obsolete and non-functioning equipment. It may be stacked up in laboratories or piled up outside buildings at the university campus. This implies risk of contamination and exposure to humans and biota, of metals and in some cases radioactive materials. Proper disposal is in many cases obstructed by lack of local regulations for decommissioning obsolete equipment.

Emission of greenhouse gases

ISP's activities are requiring traveling to visit partners, both for relation- and follow-up reasons. The activities of ISP imply both long-range air travels (e.g. to monitor supported activities in other regions), medium range travel (to collaboration partners and host groups in Sweden and Europe), and short-range travels (to local meetings in e.g. Stockholm and Uppsala, and to Arlanda airport). ISP supported research groups and networks in developing countries are concerned correspondingly. How and when ISP staff and partners travel is, therefore, an important issue. ISP staff adheres to Uppsala University's 'Guidelines for Environmentally sound work-related travel',³ meaning:

- To generally decrease the travel by air by combining purposes (i.e. visiting several partners; combining bilateral and core program travel) when paying visits to supported and other activities in the regions. Every tentative trip to be considered from an environmental point of view.
- To use train and car/bicycle to an increased degree for medium and short-range travel, respectively, where this can be regarded as the most efficient alternative. In use of taxis and rental cars, environmentally friendlier alternatives to be favored.
- To use e-mail as main point of contact and correspondence and use e-meeting techniques to an increasing degree, where feasible.

Traveling by air is unavoidable when it comes to North-South collaboration and ISP does consider that some face to face visits to partners and their institutions is crucial. The physics and chemistry programs tries to visit their partners (31 in chemistry and 27 in physics, 2018) once every granting period, i.e. once every three years. On average, this means visiting 9-10 partners in each program per year. It should be pointed out that this does not necessarily mean the equal amount of air fares, as several groups and networks normally are hosted at the same university, or in the same country. The mathematics program has a considerable less number of activities (4), and therefore normally visits partners once per year, with the exception of somewhat more infrequent visits to partners in West Africa.

Suggested actions and the way forward

ISP could improve the work with environmental and lab safety assessments. In a first stage, the following actions will be applied:

1. ISP will update and revise the environmental assessment form included in the activity report to, besides environmental and climate actions from Sida Research Unit's 'Guidance for Dialogue and Assessment', also include a laboratory safety check-list. When revised to include these improved

³ <https://mp.uu.se/en/web/info/stod/miljo/rutiner-och-riktlinjer/tjansteresor> (in Swedish)

concrete measures, this list can be followed up during site visits and during the annual reporting and application process (see Table 3). Further, the answers provided in Table 3 will be used by ISP as a basis for dialogue during site visits and during the application process. A qualitative follow-up question will also be included in the activity reports/application forms, to give groups/networks a chance to elaborate on their answers. *“What are the major reasons behind parameters graded “to a small extent” and “not at all” in Tables 3 and 4? How can these be addressed? What are the major challenges? “.*

Table 3. Suggested Environment and Climate Impact Check List

<i>Grade to what extent your research group/network and the activities carried out:</i>	To full extent	To large extent	To small extent	Not at all	Planned action	Not applicable	Comment
Relates to the Sustainable Development Goals (SDGs)							
Targets environmentally sustainable development							
Contributes to environment/climate policy							
Contributes to discussion, exchange of information and enhancing knowledge of other stakeholders on environment and climate issues							
Offer technical solutions to environmental or climate related issues							
Practices sorting of waste categories for recycling							
Has a management system for chemical and hazardous waste that is environmentally safe							
Has a system for decommissioning obsolete equipment							
Has a strategy to reduce negative environmental impact from travelling and transportation							
Uses e-meeting techniques							

Table 4. Suggested Laboratory Safety Check List

Grade to what extent your laboratory:	To full extent	To large extent	To small extent	Not at all	Planned action	Not applicable	Comment
Has functioning fume hoods that are being used as intended							
Has safe use and storage of chemicals							
Has securely attached gas cylinders to walls							
Is using protective goggles and laboratory coats during laboratory work							
Has functioning emergency showers and eye showers in place							
Has functioning fire alarm and fire extinguisher in place							
Has safe and reliable electricity arrangements for equipment							
Has trained laboratory/technical personnel available							
Has procedures in place to manage research relating to plant genetic resources in a correct and sustainable way according to the Nagoya Protocol							
Has permission granted by the appropriate authority to carry out research involving humans and animals, including laboratory animals							

2. Revise ISP “indicator m”, to better capture the environment/climate impact as well as laboratory safety concerns. ISP suggest that the new indicator m will be based on data provided in Table 3. The revised, enhanced check-list with grading scale options (1-5)⁴, will provide ISP with a tool to better follow-up the progress of each individual group and network, as well as on an aggregated level. The quantitative indicator will be divided into m1) environmental/climate impact and m2) laboratory safety to better capture the two aspects and to take into consideration laboratory safety is not relevant for groups/networks in mathematics. The indicator will range on a scale from 0-100%, where the highest percentage indicates 100% environmental/climate aware groups and networks and 100% safe laboratory environments, respectively.⁵
3. ISP will continue to consider every tentative travel by air from an environmental point of view, plan trips carefully and combining purposes when traveling, following Uppsala University's ‘Guidelines for Environmentally sound work-related travel’. Further, when possible, ISP staff will use train and bicycle instead of cars/taxis and use e-meeting techniques when possible and feasible. The possibility to pay carbon offset on air travel has been explored, but currently is formally not permitted using faculty contributions from Uppsala and Stockholm University, or funds from the Sida contribution.

⁴ 1 being ‘Planned Action’ and 5 being ‘To Full Extent’.

⁵ The grading scale options corresponds to a number between 1-5, that are added up and divided by number of parameters to get the percentage share.