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REPORT OF THE SCIENTIFIC AND TECHNICAL ADVISORY PANEL

DELIVERING GLOBAL ENVIRONMENTAL BENEFITS FOR SUSTAINABLE DEVELOPMENT

REPORT TO THE 5TH GEF ASSEMBLY, MÉXICO, MAY 2014

Scientific and Technical Advisory Panel

An independent group of scientists which advises the Global Environment Facility

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Delivering Global Environmental Benefits for Sustainable Development Report to the 5th GEF Assembly, México May 2014 Scientific and Technical Advisory Panel

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ABOUT THE GEF

The Global Environment Facility (GEF) is an independent financial organization that helps developing countries fund programs and projects to protect the global environment. The GEF provides grants for projects related to biodiversity, climate change, international waters, land degradation, the ozone layer, chemicals and waste management, and sustainable forest management.

ABOUT STAP

The Scientific and Technical Advisory Panel comprises eight expert advisers supported by a Secretariat, which are together responsible for connecting the Global Environment Facility to the most up to date, authoritative and globally representative science.

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DELIVERING GLOBAL ENVIRONMENTAL BENEFITS FOR SUSTAINABLE DEVELOPMENT

REPORT TO THE 5TH GEF ASSEMBLY, MÉXICO, MAY 2014

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EXECUTIVE SUMMARY – KEY MESSAGES

THIS STAP REPORT TO THE FIFTH GEF ASSEMBLY IS INTENDED TO DEMONSTRATE HOW THE GEF MUST INCREASINGLY:

- Deliver global environmental benefits within the context of **environmentally sustainable development**;
- Enhance technical and scientific support for **collective action** to sustain the Earth's life-support systems through targeted investments;
- Enable improved **human well-being, health, security, livelihoods and social equity** at the same time as environmental benefits;
- Support **innovation and transformational change** to tackle the root causes of inter-connected environmental problems; and
- Simultaneously meet **multiple environmental and developmental objectives** to ensure sustainable futures.

This Fifth GEF Assembly comes at a critical but exciting juncture of the Facility. In two decades, the GEF partnership has made demonstrable contributions to delivering global environmental benefits (GEBs) in accord with its mandate as the financial mechanism for the Rio Conventions. Yet threats to the global commons continue to grow – driven by human activities and lifestyle choices – resulting in pollution, biodiversity loss, degradation of land and water, fragmentation of ecosystems, and climate change. Responses to manage common pool resources and improve governance have tended to be fragmentary, partial, and only limited in success.

STAP believes that the linkages with sustainable development have to be central in GEF approaches to the generation of GEBs. It is insufficient simply to track developmental co-benefits. Rather, an integrated approach has to be followed from the outset, where the synergy between development and environment is pursued, and the generation of multiple benefits is promoted vigorously. This requires new

and innovative approaches, based upon an iterative process that emphasizes learning by doing – where design, implementation and monitoring and evaluation are connected through a robust knowledge management strategy. Sound understanding of social systems and governance will be key for the GEF moving forward.

The three key messages of this STAP Report to the Assembly are:

- ***Environmental degradation must be tackled in a more integrated and holistic way***, addressing individual focal area concerns in ways that yield multiple benefits, enhance ecosystem services, and improve governance systems within and across national boundaries.
- ***Sustainable development should be at the core of GEF interventions***, enabling improved human well-being, health, livelihoods and social equity at the same time as environmental protection.
- ***The GEF should continue to be catalytic and innovative while actively seeking to effect permanent and transformational change***. This will require effectively leveraging the best scientific knowledge from the design of projects through implementation and evaluation, as well as learning from the experiences of past interventions through successful knowledge management.

These changes are also sought in the new GEF Strategy, but will require significant scientific and technical support, and a clear commitment by both the GEF and its partner agencies. Revising internal results-based management (RBM) systems and monitoring and evaluation (M&E) will provide opportunities to harmonize and integrate across focal areas. New systems of information and knowledge management are required for GEF-6.

STAP has a key role to play in achieving the GEF-6 vision. The Panel stands ready to lead in gathering evidence from past projects, identifying lessons learned and best practices, and proposing ways to achieve multiple GEBs going forward. The urgency of an integrated response targeted at environmentally sustainable development has never been greater.

A. MOVING TOWARD INTEGRATED APPROACHES: THREE CURRENT GEF THEMES AND FUTURE THEMES

Currently, the GEF is structured around focal areas – biodiversity, climate change (mitigation and adaptation), land degradation, international waters, chemicals and wastes. STAP believes that a more systemic approach is now essential, building on the growing trend toward more multi-focal area (MFA) and multi-trust fund projects, but also acknowledging the GEF's catalytic role to integrate environment and development. STAP commends the proposed new Integrated Approaches as a start to developing a portfolio of priority themes. We discuss these below and suggest two future areas for consideration.

Sustainable Cities: Urban areas accommodate more than half the world's population, producing more than 90% of the world's GDP and more than 70% of global greenhouse gas emissions (GHGs). Appropriately, the GEF focuses one of its current Integrated Approaches on achieving more sustainable "green cities". Support for integrated and innovative approaches for greening cities, in order to reduce their ecological footprint and improve climate resilience, should include city governance and management frameworks that integrate:

- Information, energy, water use and materials flows;
- Urban design, planning and infrastructure;
- Integrated natural resource usage and waste management; and
- Improved climate resilience.

Food security: Global efforts to attain food security need to be water, land, and energy 'smart'. By 2050, global demand for food is expected to rise by 70%, met largely from intensification of agricultural production on existing cultivated land. Appropriately, the GEF Integrated Approach in this domain will initially focus on Sub-Saharan Africa, where food concerns are acute. Globally, the food sector is heavily dependent on fossil fuels, accounting for a third of global energy consumption and contributing over 20% of total GHG emissions. Challenges that STAP believes need addressing within a new integrated approach include sustainable food production and consumption from global-scale supply chains down to local consumption patterns and prevention of food waste. Particular issues for an integrated approach include:

- Understanding linkages and trade-offs at the water-energy-food nexus;
- Intensification to optimize efficiency in land use;
- Improved agricultural productivity in relation to inputs and incentives; and
- Investigating 'yield gap' as an indicator of sustainable land management.

Commodity supply chains and environmental degradation: Demand for agricultural commodities is having extensive and increasingly adverse effects on the global environment, especially on the rate and intensity of deforestation. The production of four of the most important agricultural commodities – beef, soy, palm oil, and pulp paper – is together responsible for almost 50% of annual deforestation of tropical forests. Unsustainable fishing practices continue to be a threat to ocean sustainability with almost 40% of global fish stocks, representing about 25 percent of global fish catch, considered collapsed or overexploited. STAP commends the proposed Integrated Approach on de-linking deforestation from commodity supply chains as tackling an integrated issue that is poorly understood and in need of redress. STAP encourages expanding the theme in coming years to include global fisheries and supply chains. An integrated commodities approach will need to encompass:

- Increasing the awareness of public and private decision-makers;
- Ensuring individuals are well informed when making purchasing choices;
- Building the capacity of producers to achieve certification; and
- Encouraging investment in sustainable commodities.

Climate Resilience: The recently released Fifth Assessment Report of the IPCC – Intergovernmental Panel on Climate Change – highlights the range of significant risks posed to key natural and human systems due to current and future climate change. Building climate resilience is essential in order to ameliorate the effects of climate change on ecosystems, agriculture, water, infrastructure and human health and well-being. A future GEF theme for enhancing climate resilience and global environmental benefits simultaneously should include:

- Evaluating and managing risks due to climate change in GEF focal areas;
- Pursuing 'win-win' approaches – such as ecosystem based adaptation – where strengthening ecosystem functions and services can both reduce vulnerability and enhance socio-economic systems; and
- Developing integrated approaches that seek multiple benefits and support climate-resilient development.

Environmental security: The importance of environmental security is based upon the observation that it is one of a number of important contributing factors to resource scarcity and environmental degradation which may lead to conflict between and within states and societies. While the relationship between environment and conflict is far from linear, such conflict and lack of security today represent a significant

barrier to environmentally sustainable development. The GEF could undertake a systematic effort to examine these connections. To ignore such linkages may lead to project failure. Integrated activities could include:

- Promotion of conflict avoidance by building trust between states;
- Sharing of benefits from natural resources management and use;
- Replication of effective governance systems for common natural resources; and
- Developing best environmental practices for conflict and post-conflict areas.

B. THE CURRENT FOCAL AREAS

Climate change mitigation is crucial in all strategies leading to environmentally sustainable development. Mitigation actions should endeavor to generate synergies with other societal goals while avoiding trade-offs that might undermine co-benefits in other areas. STAP encourages the GEF to increase support to sectors promising high mitigation potential, such as urban planning that combines transport, buildings, water supply, waste treatment, food supply and land use zoning into an integrated strategy.

Climate change adaptation in practice involves the mainstreaming or integration of climate change concerns into ongoing developmental processes and plans in different sectors and systems, including disaster risk management. Adaptation can include different planning and management, new technologies, and changes to governance structures. Adaptation actions are still nascent – most in the planning phases – and improved guidance on implementation, monitoring and evaluation, and revising strategies is needed to assist vulnerable communities to adapt to and benefit from climate change investments. A promising new approach is ecosystem-based adaptation for addressing climate change impacts that integrates biodiversity and ecosystem services into climate change adaptation strategies, and helps development proceed on climate-resilient pathways.

Biodiversity continues to be lost as a consequence of human-driven large-scale environmental change. Over a span of 20 years, the biodiversity focal area has accumulated a wealth of results that now need to be used to generate the evidence to guide and improve future investments. Integrating biodiversity with the strategic objectives of other focal areas would bring substantial co-benefits and help to support biodiversity objectives more sustainably and practically. Ensuring that the data and information assets generated by these efforts are available to the wider community will be an important contribution to environmentally sustainable development.

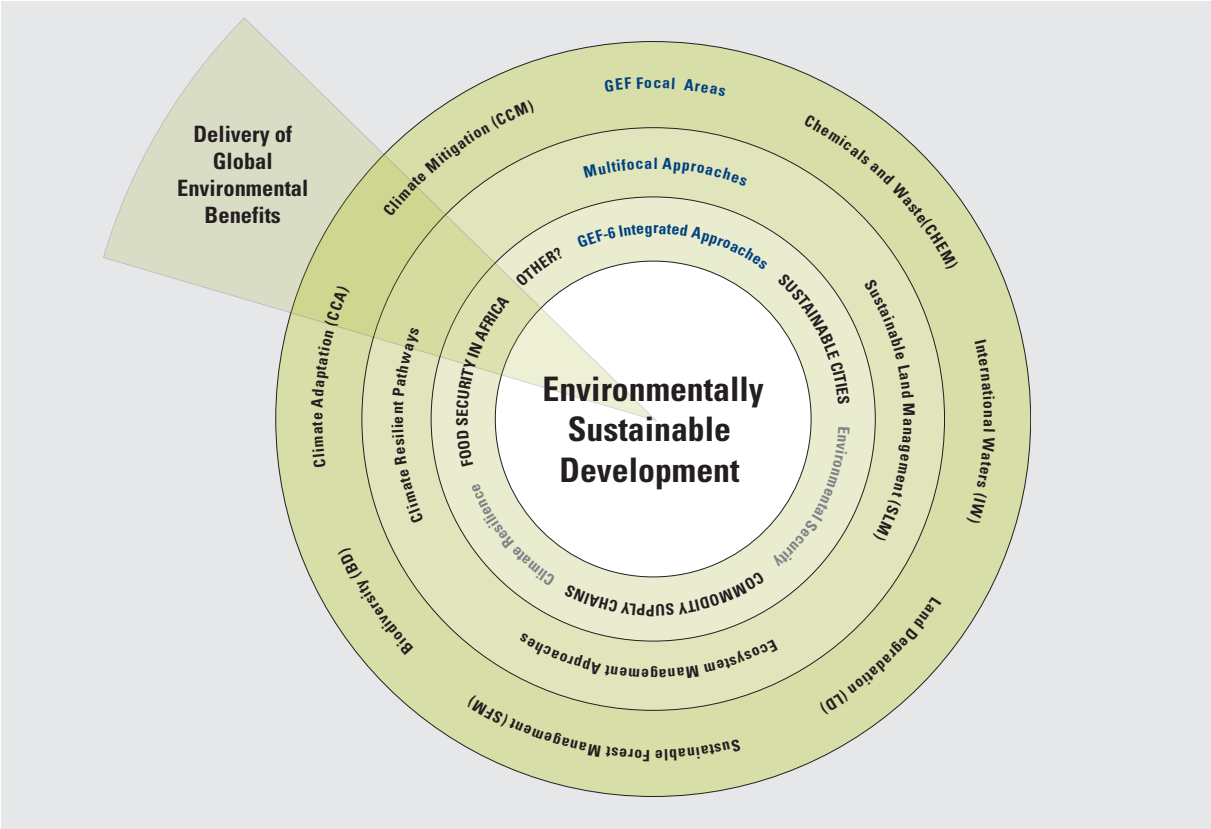
Land degradation activities during GEF-5 have involved STAP assisting the UNCCD to adopt truly integrated process indicators to show that investments in control of land degradation, deforestation and desertification deliver wider benefits for sustainable development. An important aspect of integration in the focal area is to adopt a 'whole-landscape approach' for identifying critical issues, analyzing key linkages, avoiding deleterious trade-offs and planning control measures. Implementing land management that reduces the risk of degradation would simultaneously support the broad goals of sustainable development through maintaining agricultural productivity, protecting ecosystem services and enhancing the resilience of agricultural systems, particularly with respect to the emerging and anticipated impacts of climate change.

International waters issues involve science playing an increasingly important role in explaining the complex interconnections between freshwater, coastal systems and the oceans with effective governance across political

boundaries. Embedding water into sustainable development will be further enhanced regionally through the water-energy-food nexus approach and its relation to human well-being. Collective and collaborative management approaches in international waters offer promise for regional integration and more sustainable environmental benefits. Important aspects include: comprehensive and integrated governance frameworks that can adapt to varied environmental, social and economic contexts; understanding the interdependencies between freshwater, coastal and marine ecosystems; and employing the synergies and avoiding the trade-offs between water, energy and food.

Chemicals and wastes continue to threaten ecosystems and human health, significantly jeopardizing sustainable development and adversely affecting other GEF focal areas. STAP will help with the conceptualization and implementation of the new Minamata Convention on Mercury, for which the GEF is the financial mechanism. One chronic challenge is the fact that soils contaminated with persistent organic pollutants (POPs) cover large tracts of land. With food demand increasing, the impact of accumulated pollutants in soils including mercury reduces the potential for sustainable development efforts and the delivery of global environmental benefits. Considerable investment will be required to investigate these and other inter-related scientific issues.

INTEGRATION IN THE GEF. THE GEF IS ON A PATHWAY TOWARDS GREATER PROGRAM INTEGRATION FROM INDIVIDUAL FOCAL AREA LED ACTIVITIES (OUTER), THROUGH MULTI-FOCAL APPROACHES, TO THE CURRENT GEF-6 INTEGRATED APPROACHES (INNER CIRCLE) – A TREND STAP SUPPORTS. THIS APPROACH ALSO UNDERSCORES THE FACT THAT SUSTAINABLE DEVELOPMENT AND THE DELIVERY OF GLOBAL ENVIRONMENTAL BENEFITS ARE TIGHTLY INTER-CONNECTED AND MUTUALLY SUPPORTIVE



Source: http://www.kaushik.net/avinash/lean-analytics-cycle-metrics-hypothesis-experiment-act/

C. STAP ACCOMPLISHMENTS IN GEF-5, AND ITS ROLE IN GEF-6

The past four years (2010-2014) have seen a significant intensification of STAP's role and responsibilities. STAP has continued both its strategic and operational roles in support of the GEF. It participated centrally in the drafting of the GEF-6 Focal Area Strategies; it has encouraged the expansion in number and scope of MFA projects in the GEF portfolio; and it has provided evidence in support of the replenishment process for the new phase of the GEF for 2014-2018 and the role of the Integrated Approaches. Operationally, STAP has screened 454 PIFs in GEF-5; it has organized 27 expert meetings or technical sessions and has been a major participant in 68 other meetings including the March 2012 London international conference, *Planet Under Pressure*; it has submitted 30 reports to the GEF Council and produced 6 further supporting documents. Recalling OPS-5 recommendations to improve the effectiveness and efficiency of STAP's strategic role in the GEF, STAP wishes to work with the GEF Council, the GEF Secretariat, and its host agency (UNEP) to support the GEF's fundamental mandate as the only global agency funding and delivering (in concert with its Agency and Convention partners) integrated global environmental benefits across all focal areas.

STRATEGIC PRIORITIES FOR STAP IN GEF-6:

- Enhancing the GEF mission to deliver **environmentally sustainable development**;
- Providing **independent scientific and technical advice** to the GEF partnership;
- Helping build the **scientific rationale and evidence base** for environmentally sustainable development;
- Identifying **new challenges and opportunities** in the delivery of GEBs;
- Delivering the science to support **integrated actions** and more systemic ways of working;
- Continuing to support developments in **knowledge management** in the GEF; and
- Having an enhanced role in **M&E and RBM** in order to derive lessons from the portfolio.

1 TOWARDS ENVIRONMENTALLY SUSTAINABLE DEVELOPMENT

1.1 OBJECTIVES OF THIS REPORT

Unsustainable exploitation of natural resources coupled with the impacts of climate change increasingly threatens the global environment. The cumulative impacts to Earth systems from resource use, production and waste flows associated with growing human populations have reached such dangerously high levels that scientists have suggested that humanity is now the single largest driving force of global change in this era[1]. These environmental pressures are undermining economic and social systems, negating many of the concrete gains that have been made in addressing global poverty and human development.

How should human society respond? Most current attempts to address environmental degradation have achieved only limited success. Fragmentary approaches focusing on parts of the Earth system sometimes bring short-term improvement in particular places, but invariably in the long-term fail to be sustainable. The fundamental reason for limited success is that the Earth system is, in reality, a complex interlinking and interacting "sphere" of processes and components, involving the geosphere, hydrosphere, biosphere, atmosphere, cryosphere and, most importantly, the anthroposphere – the part of the environment that is made or modified by humans for use in human activities and human habitats.

Another fundamental reason is that many of the "global" environmental problems have little salience in the 70% of the world that is grappling with near-term basic development issues. Even where the importance of the environment is recognized, global commons aspects such as emissions of greenhouse gases or loss of biodiversity have little resonance with those living in poverty; more immediate environmental quality attributes such as air and water quality or access to affordable food and shelter appear more urgent and critical. Unless we are able to effectively connect local issues with the global in a transparent, coherent and scientifically-valid manner, engendering large-scale, transformational change will remain a distant prospect.

An Earth system perspective is now called for that allows multiple environmental problems to be tackled simultaneously with their developmental context[2]. What is needed is a recognition that the Earth system operates at multiple spatial and temporal scales, where changes rarely occur in linear and incremental ways but rapidly and sometimes spontaneously. A primary message of this Report to the GEF Assembly is, therefore, that environmental interventions must be connected both to improved human well-being and to environmental sustainability.

The Scientific and Technical Advisory Panel (STAP) to the GEF has the mandate to "provide objective, strategic, scientific and technical

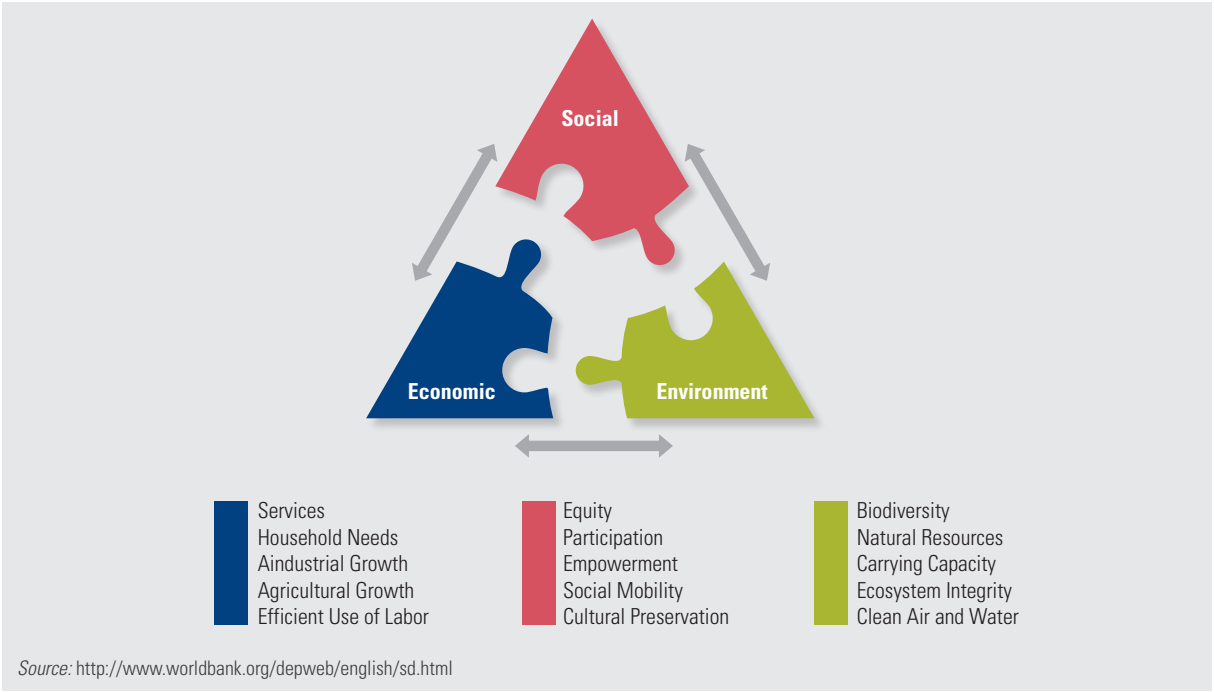
advice on GEF policies, operational strategies, programs and on projects and programmatic approaches."[3] GEF Assemblies are the appropriate occasion to take stock of current and emerging environmental challenges, and look to how a more sustainable future for both the environment and society may be supported by collective investments to deliver global environmental benefits (GEBs). Consequently, this report to the Fifth GEF Assembly has the primary goal of setting a strategy for STAP's role over the next four years in meeting the scientific and technical needs of the GEF. It focuses on four over-arching objectives as to how STAP may assist the GEF partnership strategically by:

(i) Enabling the GEF to secure its original mandate to deliver GEBs while increasingly promoting approaches that foster sustainable development;
(ii) Providing scientific support and advice for collective action to sustain the Earth's life-support systems through targeted investments that explicitly learn lessons, derive best practices and improve knowledge management;
(iii) Ensuring improved human well-being, health, livelihoods and social equity as co-benefits to environmental protection; and
(iv) Supporting innovation, integrative approaches and transformational change as the ultimate processes for a more secure and environmentally-sustainable future.

1.2 A MORE SYSTEMIC APPROACH[4]

Earth system science provides an initial theoretical framework for understanding the environment and its links to human society. It embraces the mainstream sciences of chemistry, physics, biology, ecology and mathematics as well as applied sciences such as hydrology, conservation, and agriculture, along with the social and economic sciences. However, the GEF requires

FIGURE 1: THE PRINCIPAL COMPONENTS OF ENVIRONMENTALLY SUSTAINABLE DEVELOPMENT



Source: http://www.worldbank.org/depweb/english/sd.html

a more nuanced approach that takes its original environmental protection mission into the wider territory of sustainable development. This new science needs to transcend disciplinary boundaries to treat the Earth as an integrated system that links society, economy and environment towards the goal of environmentally sustainable development (Figure 1).

As Figure 1 implies, the social and economic sciences must assume a greater importance in the GEF armory of interventions in support of the environment and the global commons. These are essential to any systemic approach, especially in determining how governance arrangements for environmental resources may be implemented. Numerous studies have shown that unless socio-economic factors are taken into account, applied biophysical approaches to conservation, such as some historically financed by the GEF, will likely fail to achieve long-term outcomes.[5] Especially important to incorporate are issues of livelihoods and well-being as precursors to transformational change in conservation. To be effective, very practical approaches such as carrying out fieldwork with local communities, data collection and curation, and developing relationships between the professional practitioner and the community being studied are needed. The range of social science methods must include standard qualitative and quantitative methods such as participant observation, interviewing and questionnaires, and more advanced methods, such as ethno-biological methods for documenting local environmental knowledge and change, and participatory rural appraisal (PRA) methods, including a toolbox that uses political economic approaches to understand governance challenges and solutions.[6] Economic valuation is also vital, including various forms of cost-benefit analysis and techniques such as contingent valuation.

The GEF has an acknowledged catalytic role, not only across different components of the environmental landscape, but also between the environment, writ large, and achievement of sustainable development. In the documented output to Rio+20 entitled *The Future We Want*,[7] the UN General Assembly calls on the GEF to enhance "coordination with other instruments and programs focusing on environmentally sustainable development", while preserving the GEF's mandate to support "country needs for the national implementation of their international environmental commitments". The existing architecture of international environmental governance, consisting of fragmented multilateral environmental agreements (MEAs) is considered ill-suited to assure global sustainability in the 21st century.[8] The challenge for the GEF continues to be its ability to deliver on obligations to Conventions while at the same time remaining innovative and a "partner of choice" within a rapidly evolving global framework for development and environmental finance in which regions and regionalism play a stronger role.[9]

'Environmentally Sustainable Development' serves well as an umbrella term to refocus and redesign the activities of the GEF. At its core, it describes an approach to balance different, and often competing, needs against an awareness of the environmental, social and economic limitations faced by human societies. All too often, development projects are driven by one particular need, without fully considering the wider or future impacts.[10] Already the damage this kind of approach can cause is evident, especially in the context of the global environment, such as changes in global climate resulting from dependence on fossil fuel-based energy sources. The longer unsustainable development is pursued the more frequent and severe its consequences are likely to become, which is why action is urgently needed.[11]

As prescribed in the GEF Instrument, operational and technical investments are structured around six focal areas – most relating directly to the MEAs to which the GEF is serving as a finan-

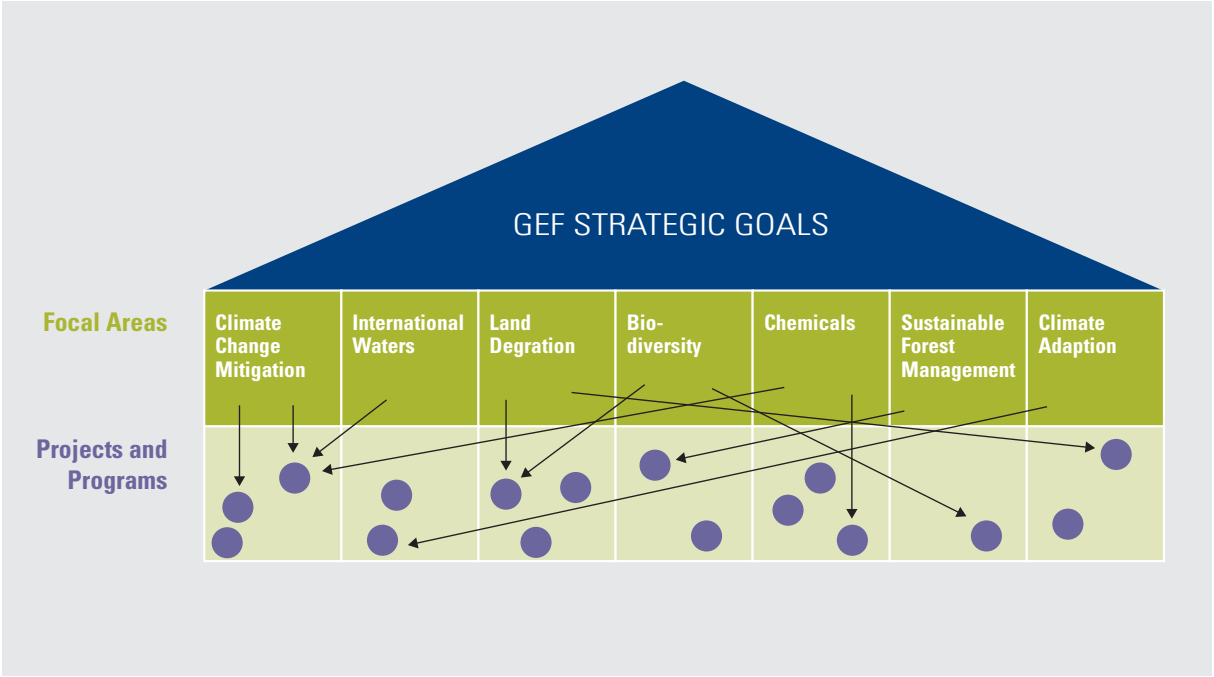
cial mechanism. The current Strategic Goals of the GEF are also formulated with respect to focal area specific responsibilities.[12] Evaluation of the GEF-5 focal area strategies has recently been undertaken. The Evaluation Office report revealed a number of problems with the focal area strategies.[13] Firstly, they are not based on a systematic identification of envisaged causal relationships between the strategic elements. This leads to the tendency for some projects to have stand-alone activities and outputs that fail to identify negative side-effects. Secondly, the causal chains between GEF activities and expected results are inadequately specified, leading to an inability to understand how outcomes are derived – and hence an inability to use results to draw lessons for other projects. Thirdly, the GEF-5 focal area strategies did not include a comprehensive approach to leveraging synergies (and managing trade-offs) between focal areas and within multi-focal area (MFA) activities. The lack of a strategic approach to MFA activities in the GEF is a central challenge to be overcome in GEF-6, especially as the MFA modality is becoming increasingly popular.[14] The evaluation suggested an alternative approach for the GEF program, based on explicit understanding of how elements from different focal area projects and programs could be linked to assure a "complete causal chain towards results".[15] All these conclusions point to the need for the GEF to adopt a more systemic approach, focusing on linkages, processes and synergies rather than on stand-alone outputs.

The GEF Evaluation Office observed that the GEF's central role as a catalyst to induce systemic change is impeded by the lack of a comprehensive approach to advance pathways leading to broader adoption through replication, scaling-up, change of market structures, or mainstreaming. Such pathways are key to attainment of broader sustainable development goals identified by countries and regions. In order for the GEF to remain the champion of global environmental benefits and the global commons, recognition of the inter-connectedness of healthy ecosystems, sustainable development and good governance should be central tenets of the GEF Program. STAP concurs that the potential for transformative impact of GEF's activities has been constrained with the fragmentation of focal area strategies.

To address both the urgency and need for transformational change for the GEF-6 Program, STAP proposed a re-alignment of the GEF portfolio around a small number of cross-cutting themes.[16] For example, STAP argued that tackling major current issues of energy, water, and food – the *water-energy-food nexus* – is essential for sustainable development, and hence essential for environmental sustainability. The 'nexus' approach integrates management and governance across sectors and spatial scales. It can support the transition to a Green Economy which aims, among other things, at resource use efficiency and greater policy coherence.[17] Water security is vital for human well-being and prosperity. Attaining this depends on maintaining a healthy and functioning hydrological cycle, reliable infrastructure, developing awareness about water management or security threats, mitigation plans, along with well-informed legal regimes, policies and effective governance systems.[18] Water is unique in the way that it connects all natural and social systems, and no sectoral initiative can be ultimately successful without proper consideration of issues related to water quantity and quality. For these reasons, freshwater security issues have been 'mainstreamed' into the four themes.

The current architecture of the GEF focal areas (Figure 2) is a structure that is often argued as essential for a financial mechanism such as the GEF to relate to individual MEAs. Together the focal area activities, including MFAs such as Sustainable Forest Management, contribute to the GEF Strategic Goals, but projects and programs may be structured according to any relevant combination of focal areas. A problem

FIGURE 2: GEF RESULTS FRAMEWORK. THE EXISTING GEF-5 "BUSINESS AS USUAL" STRUCTURE IN WHICH PROJECTS/PROGRAMS ARE DEVELOPED WITHIN FOCAL AREAS OR PROGRAMS (INCLUDING SFM). WHILE THEY MAY BE MULTI-FOCAL IN SCOPE, RESULTS ARE REPORTED WITH RESPECT TO MEETING STRATEGIC GOALS WITHIN FOCAL AREAS.

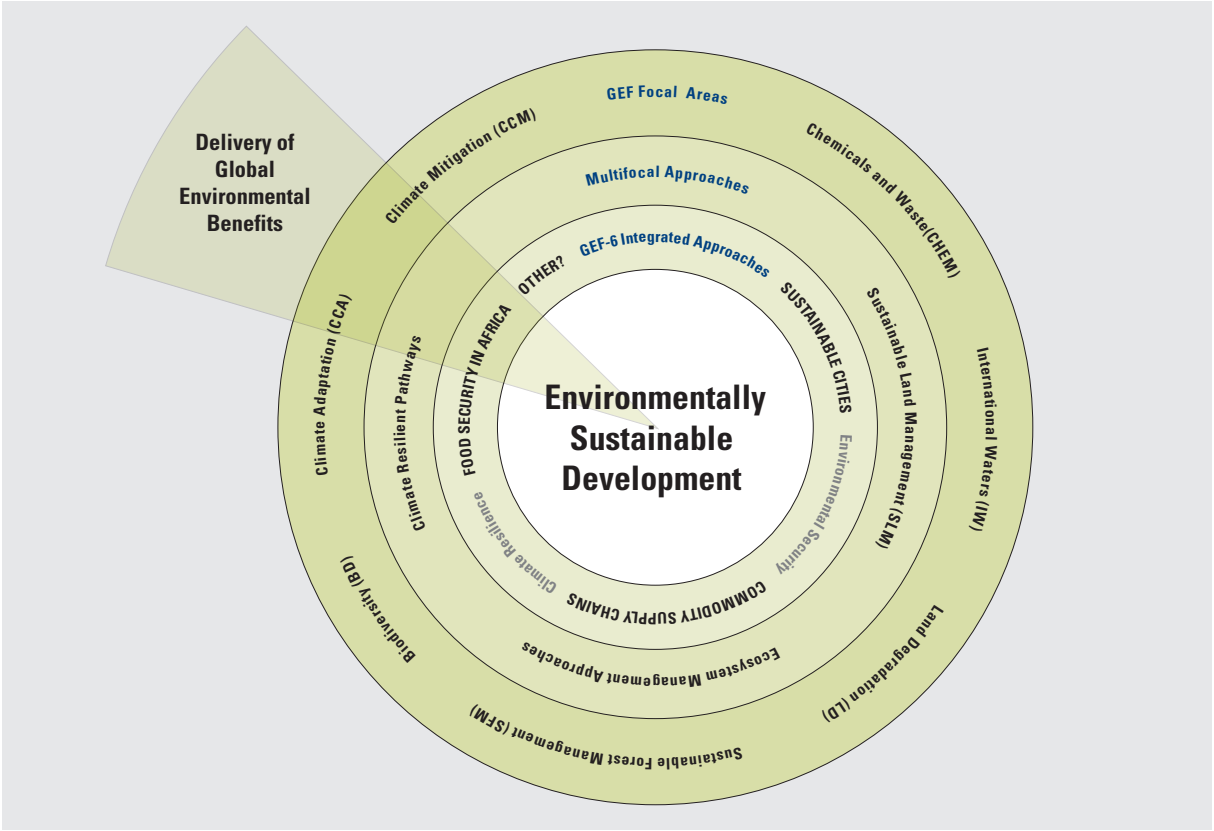


that STAP has found in some current MFA project proposals (shown in Figure 2 as projects that link to more than one topic in the green boxes), is that the multi-focal projects activities are often only loosely linked, and to all intents and purposes represent simply a combination of mono-focal activities. Working with the current 'business-as-usual' architecture will perpetuate singular benefits and isolated pockets of environmental protection.

STAP has for some years called for a new approach which integrates planning and program implementation across focal areas. STAP has welcomed the continuing trend towards more MFA projects appearing in the GEF portfolio. A more integrated approach to tackling urgent issues for the global environment was supported by the GEF-6 Replenishment participants. Therefore, an alternative structure can be suggested – see Figure 3. This can build on the foundation of the current focal areas, amplified by multi-focal areas and the new Integrated Approaches in moving toward the ultimate goal of environmentally sustainable development. The shorter-term outcome remains as now, the sustainable delivery of GEBs, which should be retained as the primary measure or indicator of success. To achieve these desirable outcomes, both long and short-term, the GEF should choose to work in certain 'opportunity spaces' or 'opportunities for action' as represented currently by the new Integrated Approaches but supplemented by additional carefully-chosen integrative themes.

STAP sees this more transformative approach as preferable because integration is built into the expectations of both projects and programs from the outset. Integrated Approaches are a good first step in this direction.[19] STAP anticipates such integrative actions will move the GEF partnership closer to becoming a true champion of the global commons for the co-delivery of global environmental benefits and sustain-

FIGURE 3: INTEGRATION IN THE GEF. THE GEF IS ON A PATHWAY TOWARDS GREATER PROGRAM INTEGRATION FROM INDIVIDUAL FOCAL AREA LED ACTIVITIES (OUTER CIRCLE), THROUGH MULTI-FOCAL APPROACHES, TO THE CURRENT GEF-6 INTEGRATED APPROACHES (INNER CIRCLE) – A TREND STAP SUPPORTS. THIS APPROACH ALSO UNDERSCORES THE FACT THAT SUSTAINABLE DEVELOPMENT AND THE DELIVERY OF GLOBAL ENVIRONMENTAL BENEFITS ARE TIGHTLY INTER-CONNECTED AND MUTUALLY SUPPORTIVE



able development. In Section 3 of this report, a number of integrative themes are discussed. STAP recommends that at least two more be developed in the coming years and is ready to propose candidates.

STAP believes that the accumulated learning and experience of the pilot GEF-6 Integrated Approaches could transform the GEF portfolio over time. Projects and programs within single or multiple focal areas would still remain the foundation of GEF operations. However, delivery of outputs and outcomes from these focal area initiatives would be articulated as contributing to integrated themes and the GEF's overall commitment to environmentally sustainable development. This approach will stimulate innovative design of projects and programs, both cross-spatially and across themes, while providing incentives for designing MFA projects and programs that address local, regional and global objectives. For this to happen, the GEF will need to agree on a conceptual framework for project design that builds on the current multi-focal area guidelines and the new Integrated Approaches – Figure 3 is perhaps a first step towards such a framework. Once agreed and implemented, such a framework would transform GEF operations into programs and projects that work systemically, utilizing aggregated impact indicators and objectives. In STAP's vision for transformational change, a new

conceptual framework design for the GEF would incentivize:

- *Better **communication** of GEF systemic impacts to both the environment and development communities globally;*
- *Opportunities for **private sector** engagement to give greater financial leverage and enhance GEF's catalytic role for systemic change;*
- ***Innovation** to enhance impact and scaling-up of outcomes for systemic change; and*
- ***Evidence-based design** and implementation to enhance learning and effectiveness of systemic interventions.*

In order to realize these fundamental changes, leveraging of outcomes and lessons learned from past and present projects and improved knowledge management from future investments will be needed to advance new approaches and best practices – see Section 2.3 in this report. STAP envisages that this framework could continue supporting the GEF in fulfilling its obligations to individual MEAs and participant countries in fulfilling their convention obligations. However, it will also encourage the GEF partnership to focus its efforts towards achieving outcomes *within* focal areas as well as through collaboration *across* focal areas.

The following sections of the report identify a number of key scientific topics and issues that will need to be addressed in the Integrated Approaches that have already been identified (Section 3), and some of the critical interlinkages that are important for each of the current focal areas of the GEF (Section 4) that will continue to be important for GEF-6 and beyond.

Photo: © David Cunningham, 2010

2 STAP'S VISION FOR GEF-6 AND BEYOND

2.1 PROMOTING INNOVATION AND TRANSFORMATIONAL CHANGE

The STAP sees the GEF and its Agencies as moving towards a more systemic, innovatory and transformational approach bringing environment and development more closely together. This will require robust systems of knowledge management and skills in cross-disciplinary analysis and project design. Transformational change differs from developmental or transitional change in being radical and in requiring whole system approaches.[20] The current move towards multi-focal area projects and programs is evidence that interest in transformational change is starting to be embraced. However, STAP believes – along with the GEF CEO (Box 1) that now is the right time to bring about more innovation and develop synergies between focal areas and between environment and development.

These sentiments are endorsed by the conceptualization of environmentally sustainable development by an influential panel of Nobel Laureates. *Inter alia*, this panel said:

"Our predicament can only be redressed by reconnecting human development and global sustainability, moving away from the false dichotomy that places them in opposition. In an interconnected and constrained world, in which we have a symbiotic relationship with the planet, environmental sustainability is a precondition for poverty eradication, economic development, and social justice".[21]

BOX 1: TIME FOR TRANSFORMATIONAL CHANGE

The new Vision Statement for the GEF (2013) highlights that it should refocus its attention on transformational change – meaning a radical, possibly drastic, shift in mind-set, behavior and ways of working. Dr. Naoko Ishii, the GEF CEO, foresees a revitalized Global Environmental Facility that:

- Must remain a champion of the global commons – development and environment are co-dependent and cannot be separated;
- Has a mission to support innovation, and must be a strong promoter of it for global environmental benefits;
- Depends on the forging of productive, trusting and catalytic partnerships with its member countries, the private sector, civil society, the scientific community and GEF agencies; and
- Must remain a catalyst in the evolving architecture of environmental finance.

STAP fully supports this new Vision and will align its Work Program towards delivering quality science in support.

Source: http://www.thegef.org/gef/sites/thegef.org/files/publication/GEF-vision-Ishii.pdf

STAP believes that there is a substantial body of empirical evidence from past and current GEF projects to indicate that the reverse is also true: that addressing poverty, economic welfare, livelihoods and social justice are pre-conditions for environmental sustainability.[22]

A more systemic and integrated approach to environment and development should be developed, thus allowing the GEF to manage synergies and trade-offs more effectively and helping to ensure limited investments are focused and streamlined into national and regional development strategies, consequently leading to new opportunities for innovation and advancement. Integration should happen both across space and across domains (i.e., at multiple spatial levels from regional to local and cross-disciplinary) as well as across disciplines involving both the biophysical and social sciences. Integration also needs to be reflected in project and program design focusing on the delivery of innovation, especially through piloting new methods and interventions. To accomplish this will require making the concept of environmentally sustainable development operational in a manner that promotes synergies between the GEF's role as financial mechanism to the Multilateral Environmental Agreements (MEAs) and as a key organization in global and regional environment and development finance. The GEF's unique advantage includes working with developing countries and economies in transition to address the inter-connected global challenges of climate change, food, water, energy, land-use and waste, that are central to sustainable development, through collective actions to support, maintain and enhance Earth's life support systems.

2.2 SCIENCE TO SUPPORT INNOVATION IN THE DELIVERY OF GEBs

In this Section we present what STAP believes to be the key scientific and future-oriented topics for the GEF as a whole.[23] At the forefront must be the goal of promoting innovation using science and technology to find, create and deliver global environmental benefits (GEBs) more quickly and permanently. Two key elements of innovation in the GEF context are design and delivery of agreed outputs and outcomes. The GEF must continue to use the best science and technology that is peer-reviewed, wherever possible, in guiding future innovation.

STAP draws its vision and priorities for GEF interventions from two principal sources: 1) guidance from the following Conventions and their

Subsidiary Bodies: UNFCCC, CBD, UNCCD, Stockholm and Minamata, and 2) information from associated scientific networks. New scientific, technological and policy developments, as well as the outcomes of GEF projects, also inform its priorities. STAP plays a key role in all the GEF's initiatives (such as focal area strategy-building) to refine its approaches and Strategic Programs to reflect emerging scientific and policy developments. Global assessments, such as the IPCC's Fifth Assessment Report (AR5 – 2014)[24] have particular and timely relevance to the GEF. UNEP's *Global Environmental Outlook 5* (2012)[25] is titled *Environment for the Future We Want*. It provides important analysis of the state of the environment as well as policy options and appropriate global responses. STAP has also contributed to UNEP's Foresight Report on emerging environmental issues, entitled *21 Issues for the 21st Century*, which sets out the consensus thinking of leading scientists on the priorities for the current century.[26]

Effective knowledge management (KM) is the process by which organizations generate value from their intellectual and knowledge-based assets and expert communities of practice in an effort to address new challenges and develop solutions and best practices. As such, innovation and transformational change need to be deeply rooted in effective KM. Recognizing challenges and opportunities to bring innovation into the GEF, and the importance of supporting innovation through a KM framework, the GEF CEO outlined a vision for innovation in the GEF Partnership which STAP strongly endorses (Box 2).

There is a powerful case for the GEF to focus on design and delivery of scientifically-validated outputs. Innovation in the design of programs and policies in a manner that encourages early adoption and scaling up could be translated into GEF projects and programs that support testing of innovative ideas, their demonstration and deployment, such that they become ready for wider adoption and scaling up. The ideas that support sustainable development are the ideas that come about through an emphasis on integration and interlinkages – see Sections 3 and 4 of this report.

The GEF has a specific role to mitigate risk associated with the support for innovative ideas before they become adopted globally. Innovative delivery on the ground should make effective use of partnerships and the extensive knowledge of GEF agencies, the private sector, and research institutions. As a global institution working with multiple public sector entities, the GEF can leverage and support governments to develop conditions and incentives that can foster innovation in the field of environmental protection and development. Using the extensive expertise of its agencies and partners, relatively modest

BOX 2: INNOVATION, EXCELLENCE AND KNOWLEDGE MANAGEMENT

"The GEF was born with a mission to support innovation, and must remain a strong promoter of innovation for global environmental benefits. It must use its resources and network to introduce innovation in the design of programs and policies in a manner that encourages early adoption and scaling up. To be credible, the GEF must always operate from a position of technical excellence and world-class experience. It is vital that the GEF be strengthened to rise to the forefront of knowledge management pertaining to the stewardship of the global environmental goods."

Source: Vision Statement of Dr Naoko Ishii – http://www.thegef.org/gef/sites/thegef.org/files/publication/GEF-vision-Ishii.pdf

TABLE 1. POTENTIAL WAYS TO PROMOTE INNOVATION IN THE GEF

Innovation and Learning Objectives	Recommended GEF Response
1. Mainstream ideas into design (Goal 1)	
Bridge innovative ideas, processes/technologies with GEF practices	Introduce effective Knowledge Management and knowledge sharing platforms
Enhance generation of global benefits and returns on investment through improved project design	Introduce experimental project design for additional production of credible evidence on what works under what conditions[27]
Create criteria for innovation	Develop criteria for identifying and framing innovation in the GEF context
2. Create access to knowledge (Goals 1 and 2)	
Showcase new research and innovative practices	Introduce effective knowledge sharing platforms with a focus on the identified overarching themes such as Green Cities, Smart Agricultural and Food Systems, Healthy Oceans and Coasts, Resilient Ecosystems
Expand GEF collaboration and include partners that drive innovation	Partnering with organizations that are driven by innovative solutions, such as research institutions, the private sector, or foundations
3. Promote new ways to do business (Goal 2)	
Create incentives for break-through technologies/ ideas that bring systemic change across identified integrative themes	Create separate funding opportunities to promote applied R&D within the GEF [Revised Targeted Research Policy[28]]
Leverage know-how within the GEF partnership	Develop systemic knowledge exchange mechanisms (knowledge sharing platforms)
Create incentives to conduct applied R&D for the benefits of the GEF	Create separate funding window to promote R&D within the GEF
Help develop, demonstrate, and deploy new ideas	Create separate funding window to promote R&D within the GEF Consider co-investing with the venture capital
Scale-up via tapping into local expertise	Consider co-investing into regional applied research institutions, as regional clustering of innovation has been shown to an effective means of disseminating and embedding technological and economic innovation[29].
Ensure results-based financing	Support performance-based financing

GEF catalytic funding can support innovative solutions to global commons problems, making significant contribution to national competitiveness. Two mutually reinforcing **goals** have been proposed by STAP in this context:

1. Enhance the design of GEF policies, projects, and programs to encourage testing of innovative ideas, their demonstration and deployment for further adoption and scaling-up;
2. Improve delivery on the ground by utilizing knowledge and networks of the GEF partnership (this would include the private sector and greater reliance on GEF-relevant targeted/applied research).

These goals imply a flexible approach for new ideas. Table 1 identifies ways in which innovation could be promoted in the GEF. The access to knowledge and knowledge management are fundamental to promoting innovation, and STAP

fully supports the GEF's intention to become more active in these areas.

2.3 MANAGING INFORMATION AND KNOWLEDGE

STAP has long championed the improvement of knowledge systems within the GEF. With over 4000 projects completed or underway, the GEF presides over enormous untapped data and information assets which have the potential to contribute a prodigious amount of understanding as to how to promote environmentally sustainable development.

The notion of "systematically learning from the experience of GEF operations" has, therefore been a common theme, and ongoing challenge, in the GEF for over a decade.[30] In OPS-4 the GEF Evaluation Office highlighted a number of weaknesses in how the GEF manages and leverages knowledge assets from projects within focal areas and at the corporate level.[31] In response to these findings and at the urging of the GEF Council, the GEF Secretariat (jointly with STAP and the Evaluation Office) launched the Knowledge Management Initiative in April 2011 with two overarching objectives:[32]

1. Purposefully and methodically collect and compile lessons from projects;

2. Share data, information, and knowledge assets gathered with a wide range of stakeholders.

At the request of Council, the GEF developed its Results Based Management (RBM) system within an overarching KM strategy for GEF-6. STAP agrees that a focus on improving internal RBM systems is important to integrate and harmonize monitoring across focal areas as well as to mainstream reporting on impact, particularly in the context of the Integrated Approaches and the rapid growth of multi-focal and multi-trust fund projects. The GEF Secretariat, in consultation with Agencies, STAP, the Evaluation Office, and others, has been called upon by Council to develop a comprehensive work plan for building an RBM framework along with an overarching KM strategy, supported by a revamped technological platform that is fit for this purpose, by November 2014.[33] As part of this strategy, STAP proposes that the GEF consider the following approaches:

1. **Experimental design**: Investing in selected projects that are deliberately designed to evaluate environmental and social effects of project implementation including governance, and from which credible inferences can be drawn about whether or not the program is making a positive contribution in one or more global environmental areas.[34]

2. **Targeted research**: Although the GEF implementing agencies already disseminate knowledge on the *specific projects* they carry out, there remains a need to bring this knowledge together and synthesize it for the benefit of the GEF and its agencies.

BOX 3: DISTINGUISHING FEATURES OF THE PROPOSED GEF-6 INTEGRATED APPROACHES

- Ability to deliver on global environmental benefits beyond a single focal area of the GEF, building on existing linkages;
- Relevant for the evolving post-2015 agenda;
- A new way for the GEF to do its business and make financing available at multiple levels (local, regional and global), including with flexibility to engage upfront with key partners and bring them on board.

Source: http://www.thegef.org/gef/sites/thegef.org/files/documents/Signature%20Program_Revision_August23-2013.pdf

Targeted research (TR), especially at the *portfolio level*, would be an effective tool in this regard.[35] The TR modality would, if modified as STAP proposes, contribute to the scientific knowledge base for decision making in the GEF, support innovative project design in supporting integrated approaches, and be fully compatible with a future GEF KM system. It would align with improving quality assurance and the RBM process, and contribute to the evidence-base for the scientific strategies of the Conventions and other institutions.

3. **Systematic scientific reviews**: STAP could assist in the design (and implementation) of systematic reviews of the GEF repository of projects to identify data, lessons learned, and information that could be addressed in future projects to improve results to enhance value for money. As with targeted research outlined above, STAP can draw upon its expertise across focal areas to assess the overall effectiveness of GEF projects from a quantitative and scientific perspective with a view toward making recommendations to improve future project design and implementation. STAP would work closely with the GEF Independent Evaluation Office in this regard.

4. **Efficiency of resource use**: the GEF has underscored the need to "measure what matters" and use resources more effectively.[36] STAP could assist in the development of a common suite of indicators (and tracking tools), improving integration of these measures in project design, and help to ensure alignment with the emerging Sustainable Development Goals.

Finally, STAP believes that the GEF's area of greatest advantage, and part of its core mandate, lies in working with developing countries and economies in transition to address the inter-connected global challenges of climate change, food, water, energy, land-use chemicals and waste that are central to sustainable development. Managing and sharing information and knowledge on these complex topics will be essential for the innovation and design of new programs and new ways of structuring the GEF portfolio – see Figure 3. New program themes for the piloting of integrated approaches are now addressed in terms of key scientific issues and how the GEF might appropriately respond.

3 NEW AREAS FOR INTEGRATION

3.1 SUSTAINABLE CITIES

The GEF has, with good reason, included Sustainable Cities as one of its pilot integrated approaches, which clearly embraces the key features outlined in Box 3. Urban areas occupy less than 5% of the global landmass, but are home to more than half the world's population, producing more than 90% of the world's GDP and more than 70% of global GHGs.[37] There is an urgent need, therefore, to ensure that environmental considerations are properly integrated into urban development decisions. Cities are by far the largest consumers of electricity and transport fuels,[38] resulting in large amounts of chemicals and other pollutants, with concomitant increases in contamination of soil, air and water. The use and treatment of materials in construction (e.g., for fire prevention, pest control), increased use of pharmaceuticals and personal care products (PPCPs), use of household chemical products, generation of electronic waste, increased use of convenience articles and plastic packaging are exemplary of increasing environmental stress centered in urban areas.

Cities are centers of concentrated food and water consumption, impacting land use and ecosystem services, including biodiversity, fisheries and coastal environments, particularly in coastal cities where a third of urban environments are located. Moreover, recent meta-analysis of projected urban land expansion to 2030 indicates that the average rate of expansion in areas within 10 meters above sea-level and within 10 km of terrestrial protected areas is higher than for other areas.[39] In addition, there is little evidence of increased land use efficiency due to fragmentation and lack of coordination amongst governance institutions, which impedes sustainable urban development.[40]

Coastal cities face increasing risk of sea-level rise due to climate change. The IPCC SREX report[41] concluded that much of the recent increase in damage due to extreme weather events is related more to the extent of exposure to these hazards and less to their frequency or intensity. Population densities are increasing in regions with high climate risk. Urbanization is often happening in an unplanned manner, and many urban areas have large areas of built and natural environments which are not climate resilient.

The proposed GEF response and expected outcomes

There are multiple approaches to support integrated and innovative approaches for greening cities that reduce ecological footprints and improve climate resilience (see Box 4). These include support for:

- City governance frameworks integrating information, energy, water use and materials streams;
- Urban design, planning and infrastructure;
- Investments in improved and integrated natural resource usage and waste management; and
- Improved climate resilience.

BOX 4: THE URBAN INTEGRATED ASSESSMENT FACILITY (UIAF) – ONE OF A NUMBER OF EXAMPLES OF AN INTEGRATED APPROACH TO CLIMATE CHANGE MITIGATION AND ADAPTATION

The UIAF simulates the main processes of long term change at the scale of whole cities. It focusses on climate scenarios and climate impacts.

Originally developed for London, UK as its first case study city, it demonstrates scenarios of how economy, land use, energy, heat waves, drought and flooding could interact over the 21st Century on spatial scales from the whole city to individual neighborhoods.

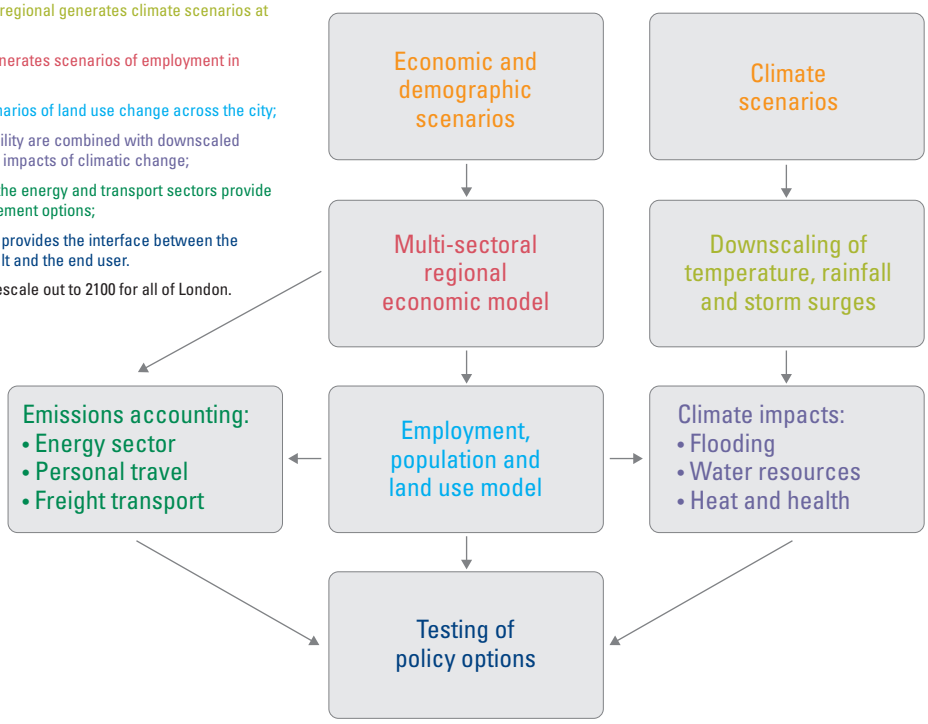
The UIAF provides tools for infrastructure designers to assess the long term sustainability of plans and policies.

It helps stakeholders and researchers begin to understand how urban and environmental policies can be devised that yield benefits to a number of objectives and avoid undesirable side-effects.

The integrated assessment involves:

1. Socio-economic and climate scenarios provide the context for the analysis;
2. A process of downscaling from regional generates climate scenarios at the city scale;
3. A regional economics model generates scenarios of employment in different sectors;
4. A land use model generate scenarios of land use change across the city;
5. Scenarios of changing vulnerability are combined with downscaled climate variables to analyse the impacts of climatic change;
6. Emissions accounting tools for the energy and transport sectors provide analysis of carbon dioxide abatement options;
7. The integrated assessment tool provides the interface between the modelling components, the result and the end user.

The analysis is conducted on a timescale out to 2100 for all of London.



Source: http://www.ncl.ac.uk/ceser/researchprogramme/integratedsystemsdemonstrationscities/Tyndall.pdf.pdf

These approaches should be applied in a coordinated fashion to maximize impact. The development of urban environmental profiles[42] represents an approach to frame priorities within the above framework. The GEF could support actions informed by these profiles that strengthen food, water, energy and land security issues in urban areas central to human well-being, and some examples of this approach currently exist.[43] Overall, the development of an approach which seeks to integrate information, energy and materials streams and minimizing waste should be seen as the optimal end-result. Low and zero-carbon energy technologies, improved energy

efficiency, local industrial waste management regulations, intensive recycling programs and increased interconnectivity through sustainable public transport systems are priorities currently reflected in the climate change mitigation and chemicals windows, while numerous opportunities exist in other focal areas as well.

Viewing the urban area as a subset of overall land use management, the GEF could work towards supporting urban development that:

- Successfully combines environmental sustainability and economic solvency by improving ecosystem services valuation and leading in 'green-tech' innovations;[44] and
- Promotes climate change resilience through ecosystem and community adaptation,[45] energy efficiency, use of local renewable energy resources, sustainable chemicals and waste management, efficient buildings, and low-carbon sustainable transport.

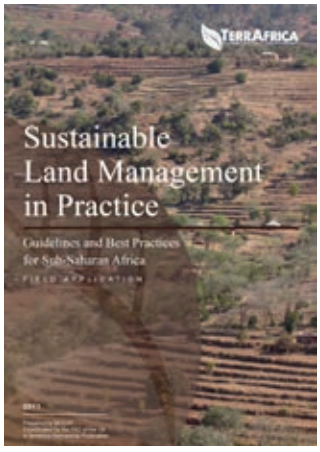
3.2 FOOD SECURITY

Another proposed Integrated Approach for the GEF is entitled 'Sustainability and resilience for food security in sub-Saharan Africa'. This approach is consistent with the Rio+20 Conference outcome document "The Future We Want", which identified sustainable agriculture and food security as priority areas, and called for their improvement by investing in biodiversity and ecosystems, land and water resources, and climate change resilience.[46] In this Section, STAP examines the wider context of food security as a priority integrated theme, and links it with agricultural production systems that have in-built resilience to climate change, use natural resources sustainably, and have modest energy demands.

Global efforts to attain food security need to be water, land and energy "smart".[47] By 2050, global demand for agricultural production is expected to rise by 70%, delivered largely from intensification of existing cultivated land.[48] The food sector is heavily dependent on fossil fuels, accounts for a third of global energy consumption, and contributes over 20% of GHG emissions.[49] Agriculture currently uses 11% of the world's land surface for crop production, and accounts for 70% of all water withdrawals – largely from underground aquifers, but also streams and lakes. Crises in water quality and quantity occur in a wide variety of temporal and spatial dimensions throughout the world. Demand for fresh water (inland surface waters and groundwater) will continue to increase over the coming decades, while the supply and quality of these resources is expected to decrease.[50] The environmental footprint of the food sector in the developing world is increasing progressively as nutrition preferences change, particularly with the higher share of meat and dairy products in diets.

For centuries, farmers have faced challenges to improve their use and management of land and water resources. Where conditions are conducive, they have adopted more sustainable land

BOX 5: EXAMPLES OF SUSTAINABLE LAND MANAGEMENT IN PRACTICE – AN EXAMPLE OF A WAY FORWARD FOR DEVELOPING 'SMART FOOD SYSTEMS'



Source: World Overview of Conservation Approaches and Technologies (WOCAT) – www.wocat.net

and water management practices with appropriate institutional, policy and technical support (see Box 5 for reference to a compendium of examples of good practice as compiled for the GEF-financed *Terr-Africa* program). Because of growing population and the impacts of climate change, farmers are currently confronted with increased competition for land, soil and water resources. Demographic pressure on ecosystems combined with declining land quality, the impacts of agricultural chemicals, and climate change effects on the environment all conspire to create the conditions for food insecurity.[51]

Concomitantly, food security for many coastal and lake-side communities is under severe threat from diminishing fish catches. Unsustainable fishing practices, for instance, is a key issue affecting the oceans, with almost 30% of assessed global fish stocks considered collapsed or overexploited in 2009, while a further 57% are fully exploited and need to be carefully monitored and managed to prevent overexploitation.[52] The cumulative economic impact of poor ocean management is estimated to exceed $200 billion dollars per year. Illegal, unregulated and unreported (IUU) fishing alone accounts for catches worth as much as $23.5 billion annually – this is equivalent to about one-fifth of the reported global catch.[53] About 25% of stock from the high seas (so called Areas beyond National Jurisdiction, ABNJ) is considered overexploited or collapsed. Overall, the annual global economic loss from unsustainable fishing is estimated to be $50 billion per year with an estimated net present value of $2.2 trillion.[54] Mismanagement is compounded by $15–$30 billion a year in subsidies to an inefficient fishing industry, helping underpin declining trends.

Food production systems, whether terrestrial or marine, are highly susceptible to climate change. Current projections forecast damage to present farming systems even at a global mean temperature rise constrained to below 2°C.[55] Food insecurity and poverty are crucially inter-twined and affect large proportions of the world's populations in rural and urban areas, particularly in sub-Saharan Africa and South Asia. Climate change is of particular significance in these regions where many farmers and communities depend on variable rainfall for subsistence and commercial agriculture, and where poverty may hinder their ability to address climate change risks.[56]

Agriculture is recognized as one of the major contributors to greenhouse gas emissions (GHGs), and a key driver of land-use change, including deforestation. At the same time agriculture may well provide significant opportunities for climate change mitigation and adaptation, with some scientists speculating that agriculture provides the highest mitigation potential of all major economic sectors – above industry or transport.[57]

Projections indicate that land area expansion in developing countries will contribute about 20% to expected crop production needs between 1999 and 2030. Nearly half of the 3 billion hectares of suitable arable land (from the world's total surface area of 13.4 billion hectares) is already cultivated. The remaining potentially arable land is largely under forest cover in the tropics. Projected impacts vary across crops and regions and adaptation scenarios, with about 10% of projections for the period 2030-2049 showing yield gains of more than 10%, and about 10% of projections showing yield losses of more than 25%, compared to the late 20th century. After 2050 the risk of more severe yield impacts increases and depends on the level of warming.[58] Agricultural production is, therefore, at a crossroads; food production must increase while per capita land and water resources decrease, and climatic risks escalate.[59] Reduction in crop yields will have the effect of raising agricultural commodity prices, thereby reducing access to food, particularly for the poor. In Sub-Saharan Africa, climate variability and climate change are expected to adversely influence crop yields

(and livestock systems) due to extensive areas with already marginal and variable rainfall, small-holders' limited resources, and weak policies.[60] Nonetheless, the region is projected to contribute significantly to global crop production by 2050 through expansion of cropland.

The proposed GEF response and expected outcomes

Climate-smart agriculture and sustainable fisheries intersect with a number of GEF priorities. Approximately one-fifth of irrigated land in the developing world has been impacted by waterlogging and/or salinity, a common phenomenon of land degradation, especially in drylands. Salt accretion reduces soil fertility and productivity. Commodity supply chains, ecosystem degradation, and stress on land resources together cause the substantial amount of food waste at different stages in the production and supply chains.[61] Water, like energy, is central to development. Inadequate water management, along with ecological processes which sustain freshwater systems, may in turn be sources of conflicts. The global agricultural sector faces the challenge of improving land management practices while simultaneously supporting "energy-smart" food that improves the energy intensity of the whole supply-chain, displaces fossil fuel inputs with local renewable energy systems, and helps provide energy access for all. This challenge, however, can only be addressed with support for enhancing resilience of agricultural and food systems to mitigate future impacts of climate change.

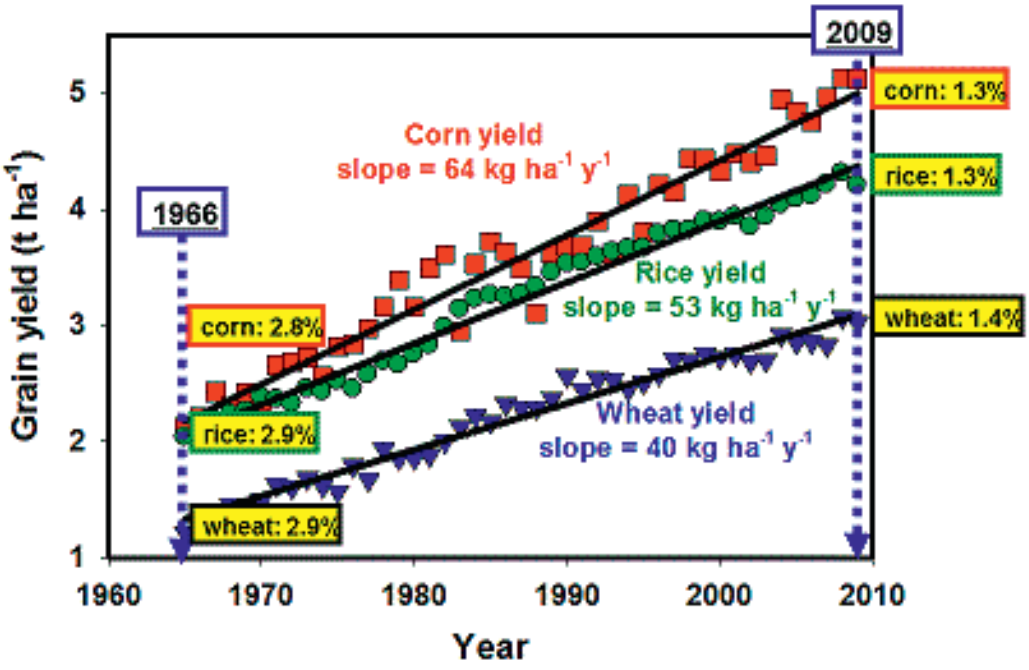
Despite its limited resources, the GEF seeks to respond to the challenge to meet food demand while improving environmental benefits.[62] A systemic approach to food production and climate change provides significant opportunities for achieving food security and improving livelihoods, while lessening the impacts of global environmental challenges. Through its Integrated Approach on "Sustainability and Resilience for Food Security in Sub-Saharan Africa", the GEF aims to invest in ecosystem services for the sustainability and resilience of food production systems. This aligns closely with the 'smart food systems' theme proposed by STAP, wherein food supply commodity chains employ sustainable land management, and are both energy efficient and climatically resilient. The GEF plans to achieve this through four components:

i) Soil and water conservation;
ii) Diversification of production systems;
iii) Integrated natural resource management in agro-pastoral systems; and
iv) Policies and institutional frameworks that support food security.

Some of these issues are well known and have long been implemented (e.g., soil and water conservation) which entails learning from past experience as well as developing new, more participative approaches. Other issues are less commonplace in the context of building food security (e.g., diversification of production systems); they will require cross-disciplinary analysis and new frameworks. The above components and their global environmental outcomes are based on the principles of sustainable land management, an intrinsic part of the land degradation focal area strategy. Similarly, a vital part of the international waters strategy is the development of sustainable fisheries. The principles involved include the enhancement of the delivery of ecosystem services; maintenance of agricultural productivity; improvement in the efficient use of inputs; and contribution towards climate change mitigation (sequestering carbon and reducing greenhouse gas emissions) and climate change adaptation (adaptive capacity). Food security is an outcome of sustainable management of agricultural land and fisheries, generating local benefits and global environmental benefits. While grounded in the land degradation focal area (or IW for fisheries), the integrated approach cuts across the focal areas of biodiversity, climate change mitigation and

BOX 6: THE YIELD GAP

Current rates of yield growth will not meet demand



The relative rate of gain in crop yield has fallen from ~2.9% of average yields in 1966 to ~1.3% today, which is not fast enough to meet expected food demand without a large expansion of crop production area (source: FAOSTAT)

Source: http://www.yieldgap.org/

adaptation, international waters, and chemicals and waste management. It also builds on the objectives of the CBD, UNCCD, and UNFCCC.[63] By striving systematically to integrate environmental and development priorities, the pilot program serves as a catalyst for broader integration in the GEF – including the opportunity to embrace further commonalities with the LDCF/SCCF on adaptive capacity and vulnerability reduction through agricultural production systems.

The GEF response should also include targeted research for which STAP has an important mandate. Fulfilling the desired outcome of meeting the food demands of 9 billion people is extremely complex and multi-faceted. Particular research issues that STAP believes need addressing for this Integrated Approach include:

- Sustainable intensification to optimize efficiency in land use.[64]
- Agricultural extensification and its role in GHG emissions.[65]
- Agricultural productivity in relation to inputs, incentives and monitoring systems.[66]
- Investigation of 'yield gap'[67] (see box 6) as an indicator of sustainable land management, food security and climate resilience.[68]

With reference to the last point above, the panel has been invited to work jointly with the UNCCD to develop a conceptual framework and climate resilience indicator, possibly based on yield gap (see Box 6). Yield gap is a good proxy of crop productivity based on biophysical suitability (e.g., soil nutrients) and the effects of agricultural policies on crop production (e.g., access to external inputs, agricultural extension, market prices). Monitoring yield gaps can further our understanding about the extent that biophysical properties or agricultural management (e.g., factors influencing small-holders' choices, and thereby their ability to narrow yield gaps) influence crop productivity. This also informs policies and responses on sustainable land management and its ability to generate ecosystem services, such as food security and climate regulation. The STAP and the GEF will further assess the research needs of the integrated approach program during the course of GEF-6.

3.3 COMMODITY SUPPLY CHAINS AND ENVIRONMENTAL DEGRADATION

The production of agricultural commodities is having extensive and increasingly adverse effects on the global environment, in particular on rates and intensity of deforestation. The production of four of the most important agricultural commodities – beef, soy, palm oil, and pulp paper – is responsible for 49% of annual deforestation of tropical forests.[69] This has consequent environmental impacts for key issues in the GEF Program, especially forest biodiversity, land and water quality, and carbon sequestration, all of which have concomitant impacts on human livelihoods and well-being. Yet, in many sectors, the impact of commodity demand on forests is imperfectly understood (see Box 7). Targeting the links between commodity supply and deforestation is, therefore, a relevant issue for the GEF in its proposed Integrated Approach, "Taking deforestation out of commodity supply chains".

Rising global demand for agricultural commodities continues to drive production and associated environmental and socio-economic impacts. However, the extent and severity of these impacts are often magnified by contextual factors both within production areas and all the way up the supply chain to consumers. These factors include, *inter alia*, a lack of understanding of the issues by decision-makers and producers; inadequate institutional capacity to designate and effectively manage protected areas; policies and perverse incentives that influence smallholders to expand production areas; inequalities in product value and benefits along the chain; and a lack of transparency in production processes.[70]

BOX 7: UNDERSTANDING AND APPRECIATING THE POTENTIAL IMPACTS OF COMMODITY SUPPLY CHAINS – A MAJOR CHALLENGE

"In a year of extreme weather events, commodity price spikes and supply chain disasters, the latest data …. reveals that the business community remains largely unaware of the deforestation risks in their own supply chains"

Source: Global Canopy Programme Applying Tropical Forest Intelligence – http://www.globalcanopy.org/

Action by governments to mitigate the impacts of commodity production on deforestation through policy intervention has been relatively limited.[71] The situation is not entirely bleak and some positive approaches have been tested. Typically, in the cases where the commodity supply chain is known and understood, individuals, consumer groups, and non- and inter-governmental organizations have worked in partnership with business and production sectors on a variety of initiatives that include building sustainable production capacity, establishing forest monitoring networks, and creating a fragmented but growing number of voluntary commodity sustainability standards. More recently, certain inter-governmental organizations have begun working with financial institutions to align investments with sustainable production goals.[72]

The proposed GEF response and expected outcomes

The STAP enthusiastically supports the steps that the GEF-6 Program is taking towards catalyzing the actions of all stakeholders, including financial institutions, to address this challenge in a comprehensive way. The GEF has long been a financial innovator in this field, and has been especially involved with initiatives related to voluntary certification standards. Building upon this success, integrating expertise and resources from multiple focal areas to move these initiatives from niche markets to standardization across entire commodity sectors represents a logical and targeted deployment of the GEF's resources, as it has the potential to deliver substantial global environmental benefits. STAP supports this strategy where it is intended to address an integrated commodities approach by:

a) Increasing the understanding of public and private decision-makers;

b) Strengthening the enabling environment;

c) Building the capacity of producers to achieve certification; and

d) Encouraging investment in sustainable commodities.

This integrated approach does, however, require further design considerations, not least of which is the necessary outcome monitoring and evaluation, and knowledge generation. In STAP's preliminary analysis, this should ideally involve investigation and research in the following complex topics, each of which STAP endorses:

i. *Identifying key environmental and socio-economic metrics*: Deforestation associated with commodity production has environmental and socio-economic impacts that extend across a range of focal areas and academic disciplines. Adequately assessing the effectiveness of projects and programs requires the identification of appropriate and measurable metrics of these varied impacts.[73]

ii. *Establishing comprehensive commodity supply chain analysis approaches that incorporate metrics*: The proposed Integrated Approach correctly emphasizes identifying intervention opportunities throughout commodity supply chains, rather than only in the production phase. Comprehensive supply chain analyses that incorporate identified indicators could both inform (e.g., identify potential synergies and value adding opportunities) and evaluate this approach. Several relevant analytical frameworks that have already been developed and applied to commodity supply chains include Multi-Region Input-Output Modeling, Global Commodity Chain Sustainability Analysis and Life Cycle Assessment.[74]

iii. *Designing projects and programs in a way that is conducive to knowledge generation*: The GEF has a unique opportunity to increase global awareness and under-

standing of strategic interventions that are effective at removing deforestation from commodity supply chains. Therefore, the GEF should, wherever possible, ensure that projects and programs are designed to be experimental or quasi-experimental, and thus produce credible evidence.[75] This would allow for post-intervention supply chain analyses to be reliably compared to counterfactual outcomes.

iv. *Meeting global commodity demand in a way that minimizes deforestation.* There is some debate within the scientific and development community about how exactly the projected 100% increase in global food demand by 2050 can be met without significant deforestation. Some advocate that efforts should focus on intensifying production on existing agricultural lands,[76] while others argue that food waste and distribution issues need to be considered first and that agriculture need not result in net biodiversity or even tree cover loss.[77] A comprehensive investigation of the relative merits of various sustainable production techniques and processing and distribution strategies for key commodities in the context of current and future global demands would help to inform project goals and focus.

v. *Modifying the value chain to distribute economic benefits among smallholders while also generating global environmental benefits.* There is an increasing trend among sustainable development policies and programs to focus efforts on modifying commodity value chains to economically empower smallholders and producers, whether through certification or sustainability standards, or by increasing access to information and communication technologies.[78] Although this can have positive benefits for poverty alleviation, there is mixed evidence about its direct effects on the environmental impacts of commodity production.[79] Exploring this relationship would be an opportune way to identify potential synergies between sustainable development and global environmental benefits.

vi. *Motivating smallholders and producers to adopt more sustainable practices.* Financial incentives and disincentives such as payments for environmental services and certification premiums are the most commonly used methods of changing the behavior of commodity producers, especially where regulatory action is lacking. However, recent research in behavioral economics has questioned the assumed effectiveness of "extrinsic" motivators.[80] Instead, there is an increasing recognition of the lasting effectiveness of leveraging "intrinsic" motivators, such as the desire to achieve status or acceptance within a group.[81] Given that the majority of GEF projects and programs involve attempting to change human behavior in one way or another, understanding the underlying forces that govern it could open up entirely new avenues of approach.

These research needs will continue to evolve as the Integrated Approach is implemented, monitored and evaluated over the course of GEF-6. The STAP intends to maintain an open dialogue with both the GEF and the scientific community to continue to identify and explore issues of concern relevant to the deforestation impacts of commodity supply chains. STAP encourages expanding the theme in coming years to include global fisheries and supply chains.

3.4 CLIMATE RESILIENCE

Building resilience to climate risks is an important and urgent issue requiring a comprehensive and integrated approach that connects the specific efforts for climate change adaptation under the SCCF and the LDCF, with the broader work of the GEF across the different focal areas. The recently released contribution of IPCC's Working Group 2 to the Fifth Assessment Report cite the increasing risks posed by climate change to natural resources, ecosystems and human socio-economic systems, consequently affecting the benefits expected from current and future GEF-supported interventions in these regions, sectors and systems.[82] The Fifth Assessment Report also emphasizes the importance of mainstreaming as an effective approach for responding to climate change. In the context of the GEF, climate resilience may therefore be considered at three levels:

i. *Resilience as risk management*: A first level of response emerges from pure risk management considerations: sustained delivery of future GEB's is at risk from climate change; therefore, projects ought to be screened for climate risks, and suitable risk management measures should be developed and adopted in project design and implementation. This would increase the resilience of the GEF portfolio to climate change. Such a de-risking approach is now being widely adopted by most multilateral and bilateral funding organizations, starting with the development and adoption of screening tools.

ii. *Resilience as a co-benefit*: GEF focal area interventions offer the opportunity of enhancing resilience of human socio-economic systems to climate change; it is therefore worth seeking resilience co-benefits of GEF focal area interventions, or in some cases, use approaches practiced in other focal areas, specifically for enhancing the climate resilience of human systems. This is the underlying logic of ecosystem-based adaptation, where ecosystem restoration serves as a means for reducing the vulnerability of human socio-economic systems.

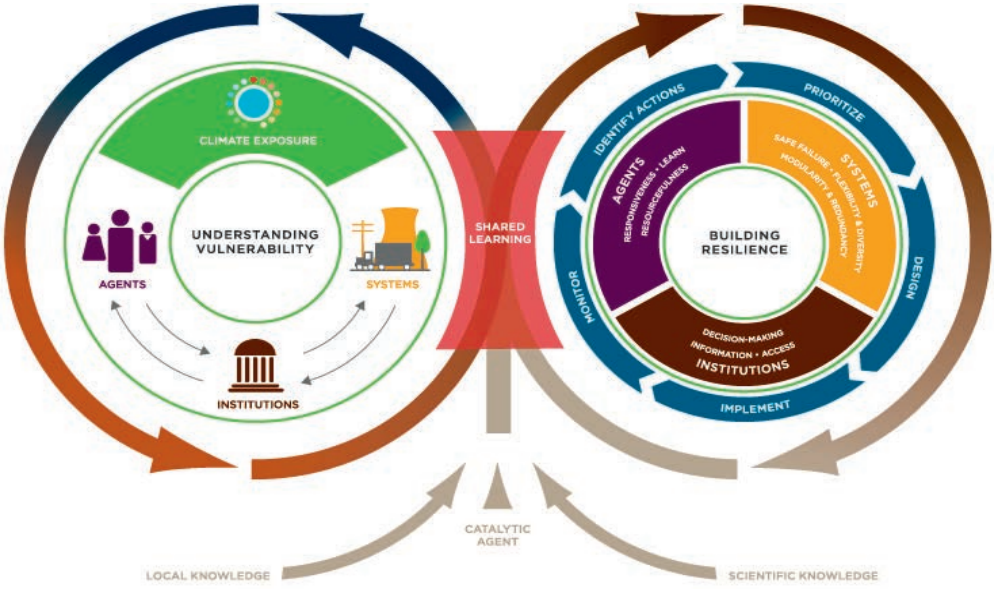
iii. *Resilience integrated into a Multiple Benefits framework*: It is increasingly important to develop frameworks and approaches that allow multiple objectives and multiple benefits to be achieved simultaneously across social and natural systems. In this framing, resilience is not seen as an add-on (additional risk to be managed) or a co-benefit, but rather as a system property that needs to be considered together with all of the other system properties, and thus linked to the idea of sustainable development.

Each of these levels of response and climate resilient pathways is described further below.[83]

(1) Resilience as risk management:
In the context of the GEF, the global environmental benefits of all focal areas are projected to be impacted by climate change, with some ecosystems already being impacted by recently observed climate changes. The world has already warmed by 0.8°C, and a further minimum warming of about 0.6°C (0.3°C to 0.9°C) is already built into the system due to emissions already in the atmosphere.[84] A warming of 2°C could be reached as early as the 2030s,[85] and a warming of 4°C by the 2060s.[86] "The benefits of strong and early action far outweigh the economic costs of not acting" (N. Stern[87]). Regardless of near-term successes to mitigate climate change, Earth systems are now on a trajectory of change – and for some ecosystems, tipping points[88] – and adaptation is required as never before.[89]

BOX 8: CLIMATE RESILIENCE FRAMEWORK – AN EXAMPLE OF AN INTEGRATED APPROACH TO BUILDING RESILIENCE

The Climate Resilience Framework (CRF) of ISET International is one of many analytical, system based approaches to building resilience to climate change. The goal of this structured framework is to build networked resilience that is capable of addressing emerging, indirect and slow-onset climate impacts and hazards.



Source: ISET-International – http://www.i-s-e-t.org/projects-and-programs/climateresilienceframework

The proposed GEF response and expected outcomes

Threats posed by climate – and ecosystem – change represent a multi-focal area challenge, requiring integrated approaches and actions within each focal area project. The example of the Climate Resilience Framework (CRF) in Box 8, illustrates how multi-stakeholder, cross-sector issues that arise when trying to address issues of climate change, uncertainty, and planning may be encompassed within one analytical framework. Following CRF guidelines, ten cities in Asia have produced resilience plans from which over 35 proposals have been written and over 20 of which have been funded.[90]

STAP has been a vocal advocate for mainstreaming resilience issues into GEF operations, results-based management frameworks, and projects and programs since 2010.[91] STAP extensively reviewed the observed and anticipated impacts of climate change on GEBs relevant for the GEF and, more specifically, to the GEF-5 focal areas and programs that will largely remain relevant for GEF-6.[92] Since the first GEF experience in climate resilience and adaptation, gained through implementation of the Strategic Priority on Adaptation (SPA)[93] which completed in 2010, resilience concepts and measures in GEF focal area strategies, projects and program have evolved. Of the 296 projects reviewed that reached CEO endorsement or approval during GEF-5, 40% provided information on climate change resilience, with two thirds being biodiversity projects (over half multifocal area projects). Yet the proposal in November 2012 by the GEF Secretariat to Council regarding a new approach and framework for enhancing climate resilience in GEF projects remains largely on paper.[94]

This resulted in the GEF OPS5 recommendation that "The GEF Secretariat should finalize the draft framework document that outlines climate change considerations across focal areas described in the next steps of the 2012 "Enhancing climate resilience in GEF projects: Update on GEF Secretariat efforts".[95] That recommendation calls on the GEF to complete a framework which includes key climate change risks and impacts for each of the focal areas, proposed response measures to enhance resilience, and options for integrating resilience at the PIF and CEO endorsement stages.

The science underpinning predictions from climate variability or change on natural systems is sufficiently robust to identify specific climate risks to ecosystems, along with risks for societies relying on their services. GEF investments are best protected by adopting approaches that simultaneously address climate risks and the objectives of focal areas. Enhancing both ecosystem and community resilience is the entry point for delivering co-benefits for all GEF focal areas, while also contributing to sustainable development. A strategic imperative exists, therefore, to identify the specific risks of climate change and possible technical, policy and institutional interventions in GEF focal area strategies, and to explicitly include climate risks in results-based management frameworks.

(2) Resilience as co-benefit:

The GEF increasingly seeks to enhance the resilience of terrestrial and marine environments, while strengthening adaptive capacities and reducing vulnerability to climate risks, by building complementarities with the Least Developed Countries Fund and the Special Climate Change Fund (LDCF/SCCF). In the land degradation focal area, a number of opportunities exist. This includes future programming priorities, such as the Integrated Approach on "Sustainability and Resilience for Food Security in Sub-Saharan Africa" that addresses increasing resilience and stability of agricultural and pastoral resources while contributing to vulnerability reduction of populations at high risk of climate change. Through this integrated approach, opportunities are present to generate global environmental benefits and adaptation benefits, thereby contributing to environmentally sustainable development through multiple pathways. The same holds true of Ecosystem-Based Adaptation (EbA) whereby adaptation approaches may include sustainable management, conservation, and restoration of ecosystems as part of an overall adaptation strategy that takes into account the multiple social, economic and cultural co-benefits for local communities.[96] The basis for EbA is the interactions between humans and the environment, and how ecosystem restoration, or conservation has helped with the provision of ecosystem services and reduced vulnerability to climate change.[97] This approach offers multiple prospects for catalyzing co-benefits between global environmental benefits (e.g., climate change mitigation) and climate resilience of human systems.

All GEF focal areas of the natural resource management (NRM) cluster consider support for projects addressing ecosystem restoration and resilience. This theme encompasses an inherent 'no regrets' adaptation approach as proposed by the IPCC.[98] The major areas where the GEF could consider coordinated actions include agro-ecosystems, selected marine environments, forest and tropical ecosystems, islands, and coastal settlements or cities that have been found to be especially vulnerable to climate change. GEF-6 focal area strategies individually identify programming opportunities directly related to the resilience and/or restoration of ecosystems, and support human well-being.[99] Supporting activities aimed at increased ecosystem resilience with human well-being co-benefits is in itself an incentive for developing multi-focal area projects and programs.

(3) Resilience integrated into a Multiple Benefits framework:

It is often the case that there is complementarity and convergence between the resilience of natural systems and vulnerability reduction to climate change.[100] In this regard, as discussed in Section 1.2 above, socio-ecological systems emphasize integration, and the dynamic relationships between humans and the environment.[101] Socio-ecological systems involve multiple actors with various degrees of understanding, information, and capacity to learn or adapt. The degree to which these actors can influence the amount of change in the system (social, economic, or environmental) so that it remains within critical thresholds also varies. In this regard, socio-ecological systems integrates adaptive ecosystem management (e.g., resilience of ecosystems), flexible institutional arrangements (e.g., rules that mediate ecosystem management by humans), and climate change responses (e.g., capacity to adapt to changing circumstances). The integrative attributes of this pathway can generate multiple benefits that lead to a sustainable and resilient future. As such, the scientific community continues to strengthen conceptual frameworks on socio-ecological systems so that the impacts of adaptation, and the prospects of climate-resilient pathways, may be better understood.

Ecosystem restoration and resilience represents a strong inherent theme across the GEF focal areas. However, at present there is no overall framework or strategic focus guiding this effort which may lead to innovation, increased impact, or generate greater efficiencies that simultaneously include the important social and institutional considerations involved. Realizing the goal of environmentally sustainable development risks being jeopardized without a clear strategic focus for climate and ecosystem resilience. Focus in this area within GEF-6 could be framed and coordinated primarily within the NRM cluster of focal areas, with an important contribution from Climate Change Mitigation and Adaptation. From the STAP perspective, additional scientific and technical advisory work is necessary to advance new integrated approaches that could simultaneously achieve multiple benefits while making ecosystems and communities more climate-resilient.

3.5 ENVIRONMENTAL SECURITY

An important pre-condition for environmentally sustainable development to flourish is environmental security, a theme of integration which STAP is beginning to explore. 'Environmental security' is attracting its own discourse as an academic line of enquiry and analysis, especially where climate change may be causing conflict over natural resources such as water, land and forests.[102] The study of environmental security revolves around a central idea that environmental problems – in particular, resource scarcity and environmental degradation – may lead to violent conflict within and among states and societies. Proponents of environmental security argue that if environmental change is a potential source of social conflict, and if societies face dangers from environmental change, then security policies – including food security and climate security – must be redefined to account for these threats.[103]

Global environmental change has largely been framed by biophysical scientists who have focused attention on large-scale processes of the Earth system. As a result, important issues such as the political economy and political ecology of natural resources have been relatively muted.[104] This is due in part to the limited contribution of the social and economic sciences to the GEF, as noted in section 1.2, and in part to analytical models that fail to bring together political considerations and future scenarios work into the mainstream of ecological analysis and methods. The natural sciences will continue to form the basis for understanding and monitoring global environmental change; however, it is undeniable that nearly all ecological modifications we observe are the by-products of modern

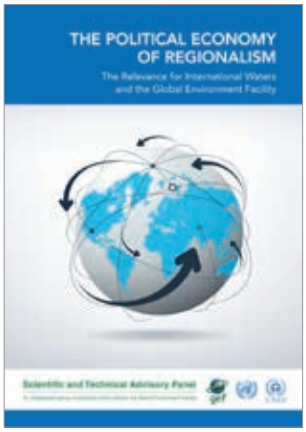
development practices and the intersection of human livelihoods with the biophysical environment. It is also clear that pressure over exploitation of natural resources is increasingly likely to foster human conflict and further degradation of the environment.[105]

In the biodiversity focal area, for instance, conflict often negatively impacts biodiversity through habitat destruction and fragmentation, loss of wildlife from poaching or land mines, over-exploitation and degradation of natural resources, and increases in water and land pollution.[106] The GEF has supported numerous biodiversity projects in areas impacted by conflict (for example, see GEF Project 1043: Establishing Conservation Areas Landscape Management (CALM) in the Northern Plains in Cambodia). Given that 90 percent of the major armed conflicts between 1950 and 2000 occurred within countries containing biodiversity hotspots, and more than 80 percent took place directly within hotspots,[107] and that the UN Convention on Biological Diversity (CBD) Aichi targets set a goal of 17% of terrestrial and inland areas to be covered by well-managed protected areas by 2020, it is likely that the GEF will continue to confront cases of conflict within the biodiversity focal area.

In the land degradation focal area, the UN Convention to Combat Desertification (UNCCD) noted that 40% of intrastate conflicts over a 60-year period were associated with land and natural resources.[108] While there are many intervening political, social and economic factors, there is evidence that pressure on vital resources such as water or arable land can act as a multiplier in inter-group tension.[109] In addition, conflict can result in large displacements of people and the creation of refugee camps, leading to enhanced degradation and deforestation.[110] In recognition of this, the GEF has supported projects under this focal area whose partial justification is to help prevent political insecurity that would undoubtedly result from aggravated land degradation (for example, see GEF Project 2377: Sustainable Land Management in the High Pamir and Pamir-Alai Mountains – an Integrated and Transboundary Initiative in Central Asia).

BOX 9: THE POLITICAL ECONOMY OF REGIONALISM

Within the context of globalization and accelerating regional integration, STAP explored how the GEF Partnership could effectively engage in the process of regionalism in the IW focal area.



Source: http://www.stapgef.org/publications/

The GEF international waters (IW) focal area is unique in that it has as an explicit objective to assist countries to work together to overcome tensions across large trans-boundary water systems. Projects supported under the IW portfolio are intended to build trust and institutions, help avoid conflict, and promote cooperation in recognition of the fact that water bodies and associated resources (e.g. fisheries) are not constrained by political boundaries. Many projects supported under the GEF IW focal area capitalize on existing networks and expertise available through regional economic and political institutions (for example, see GEF Project 842: Environmental Protection and Sustainable Management of the Okavango River Basin), and promote democratic governance, which can be critical for mitigating disputes and alle-

viating grievances.[111] In some cases, IW projects can even lead to the creation of a new regional Convention (for example, see GEF Project 1618: Towards a Convention and Action Programme for the Protection of the Caspian Sea Environment).[112] Much can be learned about how to promote democratic governance and enhance cooperation from the experiences of the IW focal area that could potentially be transferred to other focal and multi-focal areas (Box 9).

These examples illustrate how the GEF is already implicitly addressing the issue of environmental security in numerous ways. Africa in particular has been deeply and disproportionately affected by conflict. During the last forty years of the 20th century, approximately 40% of Sub-Saharan Africa experienced at least one period of civil war, mainly resulting from high levels of poverty, heavy dependence on resource-based primary exports, and failed political institutions.[113]

Given this context, STAP believes it is important to consider how the GEF could potentially contribute to preventing or lessening the consequences of conflict on both people and the environment, while at the same time facilitating cooperation over shared natural resources. Specifically, the GEF could enhance knowledge generation in this field and capitalize on its portfolio experience through the following actions:

i. Improve the understanding of the regional political and economic context, including the potential role of recipient country-led regional organizations, when designing regional GEF intervention.[114]

ii. Identify where the GEF has promoted cooperation between groups and states, and/or made a positive contribution toward conflict avoidance, resulting in shared environmental benefits.

iii. Use social science techniques such as stakeholder analysis and participatory diagnosis to gain a better understanding of the roles of different strata in society so that potential conflict can be identified and measures taken to mitigate impacts.

iv. Explore ways in which the GEF can improve, build on, and replicate effective governance projects such as in the IW sector in other focal and multi-focal areas.

v. Develop best practices for working in conflict and post-conflict areas based on lessons learned over the past two decades, including demonstrative case studies.

vi. Undertake targeted research in the field of environmental security that will help inform future GEF operations and collective action. For example, regardless of the exact nature and size of climate impacts, most agree that they will primarily affect the poor, suggesting a need to support efforts to more tightly link climate change and conflict models.[115]

Openly examining the issue of environmental security and capitalizing on the GEF's experience in this area will help to underscore the notion that environmental sustainability and human security are inextricably linked. Furthermore, it will provide new and useful information across focal areas on how to effectively develop and manage projects that can simultaneously achieve important development and environmental goals.

4 STRENGTHENING INTEGRATION AND SUSTAINABLE DEVELOPMENT LINKAGES IN THE GEF'S FOCAL AREAS

4.1 CLIMATE CHANGE MITIGATION

Climate change caused by increasing GHG emissions in the atmosphere serves as a multiplier in increasing stress on the already precarious state of Earth's life support systems. Energy supply chains and energy demand are already being affected by increasing climate variability and temperature extremes. New research predicts that sea level could rise between 0.5 to 2m towards the end of this century.[116] Land and water resources in many areas of the world are already stressed, and climate change will have an adverse impact on agricultural productivity in the coming decades.[117] Food insecurity is expected to increase, and climate change could adversely impact net primary productivity and carbon stocks of forests. Terrestrial ecosystems could undergo major changes: there are substantial risks of large-scale restructuring of the global biosphere and forests may shift from being a net carbon sink to a major carbon sorce.

Relevant to the GEF's focal area of climate change mitigation, the latest evidence continues to point to global warming of the climate system being "virtually certain" (Boxes 10 and 11). Atmosphere, oceans, sea level, and greenhouse gases have all suffered deleterious impacts.[118] These impacts have knock-on effects both for sustainable development and for the GEF's other focal areas.[119] For example, climate change directly affects the distribution of species by shifting the location of climates to which they are adapted.[120] Indirect impacts include changes in the availability and suitability of habitats. Climate change

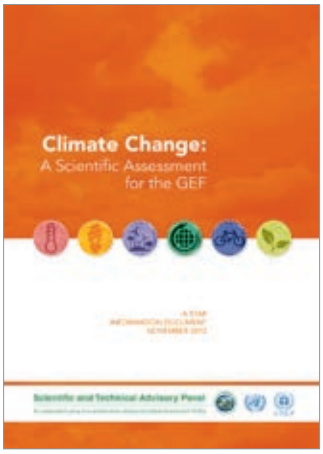
BOX 10: WORKING GROUP 1 EVIDENCE STRENGTHENS FOR MAJOR IMPACTS CAUSED BY CLIMATE CHANGE

"Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased." (IPCC, 2013)

Source: https://www.ipcc.ch/report/ar5/wg1/

BOX 11: ASSESSMENT OF CLIMATE SCIENCE FOR THE GEF

In advance of the recent IPCC reports, STAP prepared an overview of current climate science to help guide development of the GEF Climate Mitigation Strategy



Source: http://www.stapgef.org/publications/

therefore presents significant challenges to those whose livelihoods depend upon biodiversity. A similar argument applies also to sustainable land management and forests.

Climate change mitigation actions are widely available in all regions and across each of the transport, buildings, industry and energy supply sectors, with many co-benefits being evident including improved health, social cohesion, training, skilled employment, time and cost savings.[121] Deep cuts in GHG emissions to limit warming to 2°C relative to pre-industrial levels remain possible, yet will entail challenging technological, economic, institutional, and behavioral change. For less ambitious mitigation pathways, similar challenges will still have to be faced, but over a longer period of time.

Climate change mitigation is, therefore, crucial in any strategy to reduce its impact on sustainable development and other global environmental issues. Mitigation actions should endeavor to generate synergies with other societal goals while avoiding trade-offs – such as additional burdens of labor on land users – that might undermine co-benefits in other areas. These can be evaluated in a sustainable development framework incorporating the many diverse goals that society values (Box 12). Mitigation is not merely a technical exercise but involves effective governance relating to global common resources, education, behavioral changes and wide involvement in decision making at all levels, as outlined in the systemic approach framework described in Section 1.2 (Box 13). Actions need to recognize that there may be winners and losers. Transformation pathways involve a range of linkages with other policy priorities such as local air pollution, energy and food security, distribution of economic impacts, economic competitiveness, and environmental factors associated with different technological solutions.[122] The rates of GHG emissions reductions and the scaling-up of low carbon technologies both impact on long-term mitigation goals for cities, food supply, and land use change. Society will need to both mitigate and adapt to avoid harmful climate impacts, with the two strategies being complementary because more mitigation action reduces the need for future adaptation. Climate

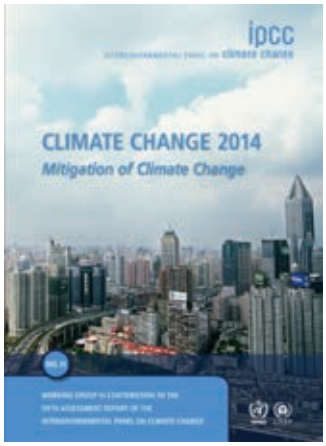
BOX 12: TACKLING CLIMATE CHANGE AND PROMOTING DEVELOPMENT – WHICH COMES FIRST?

"For many developing countries, development is the first order priority, with mitigation a second order priority. Advocates of mitigation therefore tend to be a priori constrained by this. If this is acknowledged, then the key to deepening mitigation action in a development setting is to 1) understand the development agenda very well in the first instance and, 2) consider how mitigation can work within this agenda. In some areas there may be synergies, where the mitigation activity may enhance the development activity, and in other areas it might require strategic thinking, patience and/or compromise."

Source: Development & Mitigation Forum, Cape Town, South Africa, January 2014

BOX 13: WORKING GROUP 3. MITIGATION IS A HUMAN INTERVENTION TO REDUCE THE SOURCES OR ENHANCE THE SINKS OF GREENHOUSE GASES

"As a global commons problem, effective climate change mitigation requires international cooperation. Efficiency enhancements and behavioral changes, in order to reduce energy demand compared to baseline scenarios without compromising development, are a key mitigation strategy. Policy-making for climate change raises issues of risk and uncertainty, of ethics, of social and economic goals and of sustainability. Analytic methods along with insights from behavioral research are available to inform policy-makers in managing these issues." (IPCC, 2014)



Source: https://www.ipcc.ch/report/ar5/wg3/

policies often entail incorporating climate issues into the design of strategies for equitable and sustainable development at regional, national, and local levels to give a range of co-benefits. Aims to overcome poverty, reduce inequalities in living standards, and generally improve well-being, determine how economic and social policies are linked to effective climate policies and building institutions and capacity for governance.

To stabilize GHG concentrations in the atmosphere at a level "preventing dangerous interference with the climate system", incremental reductions in GHG emissions are inadequate, and a transformational shift leading to significant "decarbonization" of energy supply and economic systems is required. While the existing GEF approach to climate mitigation through market transformation and investment is environmentally sound, and climate friendly technologies remain relevant, the GEF should strive to shift away from promoting single technology and/or single sector approaches towards supporting more complete systems that could encompass a combination of energy demand reductions, low-carbon option deployment, innovative IT systems, capacity building, energy security, and policy development, whilst leading towards sustainable development. Monitoring of such integrated projects and assessing their success will present challenges, so careful consideration will need to be given as to how this may best be achieved. STAP encourages the GEF to increase support to emerging sectors with high mitigation potential including urban systems combining transport, buildings, water supply, waste treatment, food supply and land use zoning; AFOLU (agriculture, forest and other land use); agri-food supply systems, as well as emerging and often controversial mitigation opportunities such as mitigation of short-lived climate forcers and carbon capture and storage.

4.2 CLIMATE CHANGE ADAPTATION

Although the global community has adopted a goal of limiting warming to 2°C above pre-industrial levels, there is insufficient action to meet this goal, and little confidence that adaptation can keep pace with the current and projected rates of change. A recent report from UNEP describes the significant gap between the current and anticipated levels of GHG emissions and the levels required for the 2°C target.[123] Of the four representative concentration pathways (RCPs) formulated for the IPCC Fifth Assessment Report, only one (RCP2.6[124]) represents a pathway that could lead to temperature change stabilization at or below 2°C. Global mean tempera-

BOX 14: THE IPCC FIFTH ASSESSMENT REPORT, WORKING GROUP 2 – RELEASED 31 MARCH 2014.

Source: https://www.ipcc.ch/report/ar5/wg2/

ture rise for the higher RCP's are likely to be in *excess* of 3 – 4°C. These levels of temperature rise will clearly increase adaptation challenges[125]; indeed, a recent World Bank report questions the possibility of effective adaptation if global warming moves towards 4°C.[126] STAP believes that the GEF should not only be cognizant of these risks, but also address them in a coordinated, coherent fashion. Treating mitigation and adaptation as two sides of the same 'climate change coin' would be sensible – it would allow for joint actions and would recognize that many mitigation actions (e.g., sequestering carbon in soils) also have adaptation benefits (higher yields of crops from soils with more carbon).[127]

It is now widely recognized that climate change adaptation in practice involves the mainstreaming or integration of climate change concerns into ongoing developmental processes and plans in different sectors and systems, including, for example, disaster risk management.[128] This is because in many cases, the most attractive adaptation actions are those that offer development benefits in the relatively near term, while leading to the reduction of vulnerabilities in the longer term.[129] Adaptation can rightly be conceptualized as mitigation set in its development context assisting vulerable communities both to adapt and to benefit from climate change investments (Box 14).

Ecosystem-based adaptation is a promising new approach for addressing climate change impacts that integrate biodiversity and ecosystem services into climate change adaptation strategies, and helps development proceed on climate-resilient pathways.[130] Well-integrated EbA can be more cost effective and sustainable than purely engineering or technological solutions,[131] and may help generate significant sustainable development co-benefits in the form of poverty reduction, sustainable environmental management, and even climate change mitigation.[132] Examples of EbA approaches include coastal and wetland maintenance and restoration, and sustainable water management.[133]

4.3 BIODIVERSITY

Global biodiversity loss continues to accelerate as a consequence of on-going, human-driven, large-scale environmental change.[134] This rapid deterioration of biodiversity impacts on a number of ecosystem processes and the numerous ecosystem services that are underpinned by them.[135] A loss in biodiversity not only increases the vulnerability of terrestrial and aquatic ecosystems to changes in climatic patterns[136], but also reduces the capacity to maintain resilience to disturbances and directional changes in environmental factors.[137] Land use change is projected to have the greatest adverse impact on terrestrial biodiversity by the year 2100, followed by climate change, nitrogen deposition, species introductions and changing concentrations of CO_2.[138] Marine ecosystems are severely threatened by climate change, acidification, pollution, turbidity, overfishing, habitat destruction, ad invasive species.[139]

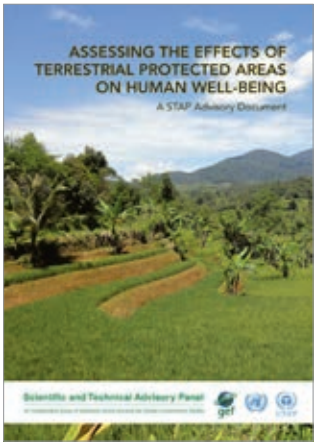
To date, conservation efforts have largely focused on creating and managing protected areas (PAs)

as the "first line of defense" to address the biodiversity crisis[140], and these areas now cover approximately 12.7% of the planet's land surface area[141], with a target of 17% by 2020 (10% target for coastal and marine areas).[142] Yet the impact of PAs on habitats and species is not entirely clear due to a lack of comprehensive evidence, and some studies conclude that global conservation targets based on area alone will not necessarily stem the loss of biodiversity.[143] Similarly, the evidence base vis-à-vis the impact of PAs on human well-being provides a range of possibilities to inform, but lacks information to help decision-makers maximize interventions (Box 15).[144] In addition, because of rapid and unprecedented climate change, it is unclear whether or not existing PAs will continue to be suitable for many of the species they were designed to protect.[145] An estimated additional two billion people by 2050, and a rising middle class with changing consumption patterns will also undoubtedly lead to increased pressures on critical natural ecosystems, such as tropical and sub-tropical forests where fragmentation is already a major concern and predicted to worsen.[146] In order to successfully tackle the global biodiversity crisis, particularly where resources are severely limited, it is essential that practitioners use the tools and methods available in their respective fields to critically examine the evidence to date on the effectiveness of various conservation strategies in diverse settings to guide future project design.

For example, there is considerable variation in reserve "health" due to environmental change outside of PAs, which is nearly as important as what is happening inside the reserves in terms of biodiversity preservation.[147] Studies using satellite remote sensing data have shown that many reserves located in tropical forests suffer extensive forest loss in the immediate buffer area due to human pressures.[148] With regards to marine biodiversity, there is growing concern that marine protected areas (MPAs) – though increasing in number and size – are being created in remote areas that are 'residual' to commercial uses, providing little protection to the most threatened species and ecosystems.[149] These and other studies should inform policy makers and practitioners in order to achieve biodiversity conservation in the long term, at the least cost, and under changing conditions.[150]

BOX 15. CAN WE MEASURE THE SOCIO-ECONOMIC EFFECTS OF PROTECTED AREAS?

A recent STAP report suggests that the GEF portfolio of protected areas initiatives could represent a rich evidence base for identifying key determinants of how protected areas may have a net positive or negative impact on the well being of people living near protected areas.



Source: http://www.stapgef.org/publications/

Over the past two decades, the GEF has accumulated an impressive record of helping to establish and maintain systems, with more than 1,000 projects in more than 155 countries and investments in over 2,800 PAs covering more than 700 million hectares.[151] With over twenty years of experience, the Biodiversity Focal Area has collected a significant amount of data and results that could be used to generate evidence that would form the basis for a greater understanding of important trends. This information could be used to improve future projects,[152] as well as to inform science and the practitioner community in this domain more broadly.[153] Inte-

gration with the strategic objectives of other focal areas would bring substantial co-benefits, and help to support biodiversity objectives more sustainably and practically. Experimental design methods can help to ensure the biodiversity program (including linkages with other focal areas) is more evidence-based. Ensuring that the data and information assets generated by these efforts are available to the wider community will be an important contribution to environmentally sustainable development.

With the use of targeted research, innovation should be fostered in the biodiversity program at different scales using a variety of tools and methods. For example, the geographic distribution of PAs is uneven – particularly with respect to the areas with the strictest protection levels[154], and there are gaps in the extent of biodiversity protection.[155] Moreover, we are increasingly aware that climate disruption decreases ecosystem stability and increases the amplitude and frequency of change in biological systems, human social systems, and the interactions between these systems. The GEF could consider supporting the use of remote sensing coupled with other spatially enabled data in a geographic information system (GIS) in order to a) visualize activities at multiple scales, b) better quantify results and impacts, and c) undertake targeted spatial analysis to correlate the underlying causes of change with observed outcomes and build this understanding into future project design.

Recently, a new inter-governmental platform, IPBES has been established (see Box 16). Its main aim is to strengthen the science-policy interface for biodiversity and ecosystem services for the conservation and sustainable use of biodiversity, long-term human well-being, and sustainable development. To achieve this goal, the Platform has four functions: to catalyze the generation of new knowledge; to produce assessments of existing knowledge; to support policy formulation and implementation; and to build capacities relevant to achieving its goal. It is obvious from these functions that there is a wide scope for synergistic action between this nascent initiative and the GEF.

BOX 16 IPBES – PUTTING BIODIVERSITY INTO ITS ECOSYSTEM CONTEXT

The Intergovernmental Platform on Biodiversity and Ecosystem Services was established in April 2012 as the leading intergovernmental body for assessing the state of the planet's biodiversity, its ecosystems, and the essential services they provide to society.

IPBES is founded on the need for scientifically credible and independent information that takes into account the complex relationships between biodiversity, ecosystem services, and people.

IPBES aims to strengthen capacity for the effective use of science in decision-making at all levels.

Source: http://www.ipbes.net/about-ipbes.html

4.4 LAND DEGRADATON

Land degradation is well-established in the GEF as a legitimate global environment and development issue.[156] During GEF-5, STAP has been assisting the Convention[157] (the UNCCD) to adopt truly integrated process indicators to show that investments in control of land degradation, deforestation and desertification can truly bring about wider benefits for sustainable development (Box 17).[158] The focal area now explicitly addresses the challenge of arresting and reversing land degradation, especially in

BOX 17: THE UNCCD'S PROCESS INDICATORS BY CONVENTION STRATEGIC OBJECTIVES DEMONSTRATE INTEGRATION IN PRACTICE

Strategic objective 1: To improve the living conditions of affected populations

- Trends in population living below the relative poverty line and/or income inequality in affected areas
- Trends in access to safe drinking water in affected areas

Strategic objective 2: To improve the condition of affected ecosystems

- Trends in land cover
- Trends in land productivity or functioning of the land

Strategic objective 3: To generate global benefits through effective implementation of the UNCCD

- Trends in carbon stocks above and below ground
- Trends in abundance and distribution of selected species

Source: http://www.unccd.int/Lists/OfficialDocuments/cop11/cst2eng.pdf

relation to desertification and deforestation, with the overarching goal of supporting livelihoods and alleviating poverty amongst the rural poor in the drylands. Therefore, the focal area in its definition intrinsically encompasses integration between the global environment and sustainable development.[159] The focus of effort is the promotion of Sustainable Land Management (SLM), which involves implementing agricultural practices that maintain vegetative cover, build soil organic matter (Box 18), use inputs (water, nutrients, pesticides) efficiently, and minimize off-site impacts (such as leaching of nutrients into groundwater, runoff containing agricultural chemicals). Carbon is a key integrating factor; sequestering carbon in soils requires building organic matter, which in turn is dependent on maintaining or enhancing net primary productivity (NPP: or plant growth). Thus, while SLM directly addresses land degradation, implementing management that reduces risk of degradation simultaneously supports the broad goals of sustainable development through:

- Maintaining or enhancing agricultural productivity, thus contributing to rural incomes and food security;
- Minimizing negative impacts on managed and natural ecosystems, thus protecting ecosystem services; and
- Enhancing resilience of agricultural systems, particularly with respect to the emerging and anticipated impacts of climate change.

The major linkages for Land Degradation with respect to sustainable development include interactions with Climate Change Mitigation (e.g., principally carbon sequestration and reduced non-CO_2 GHGs), Climate Change Adaptation (better plant-water-holding capacity in the soil, nutrient retention, and enhanced tolerance to drought). In addition, there is direct interaction with Biodiversity (e.g., higher soil organic matter increases soil biodiversity; sustainable intensification reduces pressure on conservation lands), the International Waters focal area, principally through nutrient retention and decreased erosion, and to a lesser extent the Chemicals focal area (e.g., SLM minimizes land contamination and off-site impacts of agricultural chemicals). Practical measures that protect or enhance carbon stocks in biomass and soil can efficiently deliver progress toward the goals of the multilateral environmental agreements. STAP has proposed that trends in terrestrial carbon stocks could be an indicator shared by each of the conventions because of the cross-cutting role of building organic matter in degraded sols.

An important aspect of integration in the land degradation focal area is the adoption of a "whole-landscape approach" for identifying critical issues, analyzing key linkages, avoiding deleterious trade-offs, and planning control

measures. Future food demand is projected to increase by at least 50% by 2050 in response to growing levels of per capita consumption, shifts to animal-based diets, and increasing population.[160] At the same time, there is a pressing need to reduce the atmospheric concentration of greenhouse gases upon which climate change is driven, and which progressively affects agriculture, coastal areas, human health, and many other sectors. Using a whole-landscape approach, an analysis of the synergies and trade-offs between food production and climate change reveals four themes:[161]

- The important roles of both forest and agriculture sectors for climate mitigation in tropical countries;
- The minor contribution from deforestation-related agricultural expansion to overall food production at global and continental scales;
- The opportunities for synergies between improved food production and reductions in greenhouse gas emissions through diversion of agricultural expansion to already-cleared lands, improved soil, crop, and livestock management, and agroforestry; and
- The need for targeted policy and management interventions to make these synergistic opportunities a reality.

From this whole-landscape, multi-sector analysis, it may be concluded that agricultural intensification is a key factor to meet dual objectives of food production and climate mitigation, but there is no single panacea for balancing these objectives in all landscapes. Place-specific strategies for sustainable land use emerge from assessments of current land use, demographics, and other biophysical and socioeconomic characteristics. Such more nuanced approaches, taking into account synergies and trade-offs, as well as impacts across whole landscapes, will have to become the norm.

BOX 18: IMPROVING CARBON STOCKS IN SOILS

Soil is one of the most vital and necessary components of ecosystem – particularly through its interactions in nutrient cycling, climate change processes and water management. This STAP Publication presents a well grounded overview of the current technical and scientific knowledge of soil organic carbon. It highlights how soil management should be an important component of the GEF's future strategy and for sustainable development.

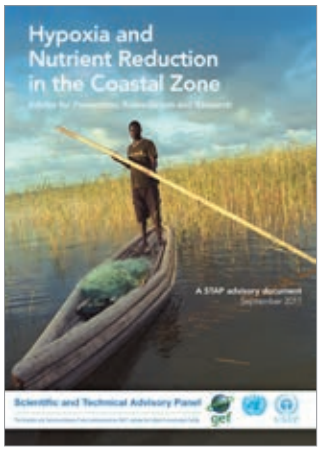
Source: http://www.stapgef.org/publications/

4.5 INTERNATIONAL WATERS

The challenges of managing human impacts on the world's aquatic systems are both escalating and evolving. Human activities are simultaneously polluting, melting, acidifying, warming, overfishing, and overusing water. Science plays an increasingly important role in explaining the complex interconnections between freshwater, coastal systems, and the oceans with governance across political boundaries so that potential synergies, integration opportunities, and priority areas can be identified.[162] Increasing global populations, with a growing middle class

BOX 19: PREVENTING AND REMEDIATING COASTAL HYPOXIC DEAD ZONES

Reported cases of coastal hypoxia or low oxygen areas have doubled in each of the last four decades, threatening global environment benefits in most of the Large Marine Ecosystems (LMEs) in which the GEF supports programs.



Source: http://www.stapgef.org/publications/

concentrating on urban centers (many of which are located in coastal areas), increasing demands for food production, and projected impacts of climate change are putting an even stronger pressure on the planning, use, and development of land and water resources within catchments and in coastal and marine areas. Coastal zones are essential parts of river basins, but are often managed in isolation. Activities on land and in river basins cause a range of environmental pressures to coastal and marine ecosystems, which are compounded by global development trends (Box 19).[163]

As the process of globalization continues and regional integration and collaboration are accelerating, approaches to synchronize national and regional concerns will become vital. Local incentives consistent with global environmental benefits will become important aspects of sustainability when collective management approaches are being developed in international waters. Most freshwater and marine systems are transboundary in nature, and therefore depend on a certain degree of regionalism and regional governance. The way these transboundary water systems are governed and managed is of vital importance for economic and social development, food security, biodiversity conservation, and the sustainable use and maintenance of ecosystem services, yet collective action on these regional resources tend to be weak. With the continued growth of international water projects presented as multi-focal areas, there is an increasing need for the support of comprehensive and integrated governance frameworks that are capable of being adapted to varied environmental, social, and economic contexts.[164]

These interconnections are complex, dynamic, and numerous – water links all biological systems on the planet, and therefore has the ability to transmit and transform local human impacts to regional and global scales. For example, local biodiversity losses, such as the destruction of coastal mangrove ecosystems, can result in global climate change impacts, both in terms of mitigation and adaptation. At the same time, climate change affects biodiversity loss through aquatic systems – ocean acidification and warming are projected to synergistically destroy a significant proportion of the world's coral reefs and marine biology,[165] and rising sea levels will likely reduce habitat quantity and quality of many coastal oganisms.

There is increasing global recognition that these interconnections extend beyond the biophysical into the anthropogenic sphere in ways that have and will continue fundamentally to shape human development. Traditional environmental issues such as freshwater ecosystem degradation, over-irrigation, agricultural and industrial pollutants, and poor groundwater management have all been acknowledged as major contributors to the current reality where over one billion people still lack access to safe drinking water.[166] Meanwhile, the latest IPCC report has

projected further sea level rises even with major climate change mitigation action,[167] potentially displacing up to 187 million people, mostly in developing countries.[168] Clearly, water will be a key factor in determining whether future sustainable development goals are achieved.

Complex issues often require multifaceted solutions, and any approach that the GEF takes to address the challenges related to human impacts on water systems will need to take into account their inherently integrated nature to be successful in the long-term. Fully a third of the GEF-5 projects that involved International Waters were Multi-Focal Area projects. As this number continues to grow, there is an increasing need for the development of a comprehensive and integrated framework that is capable of being adapted to varied environmental, social and economic contexts, as well as national and regional political economies.[169] The conceptualization of the *water-energy-food nexus* offers some promise, as it embeds water within sustainable development by linking together three essential components of human well-being.[170] The refinement and application of these integrated frameworks, as described in Section 1.2 above, would help to improve the effectiveness of the efforts of the GEF at reducing adverse human impacts on aquatic systems through actions in sectors such as fisheries and aquaculture, tourism, energy use and consumption, deep-sea minerals mining, and pollution prevention and reduction, while enhancing the resilience of livelihoods, economies, and ecosystems dependent on services provided by international waters.[171]

Future activities could include support for:

- **Research into ecosystem governance and management** in the terrestrial and the open sea areas, and by increasing the understanding of the interdependencies in the freshwater, coastal, marine, and ecosystems continuum;

BOX 20: THE CODE OF CONDUCT FOR RESPONSIBLE FISHERIES

"The Code recognizes the nutritional, economic, social, environmental and cultural importance of fisheries and the interests of all those concerned with the fishery sector. The Code takes into account the biological characteristics of the resources and their environment and the interests of consumers and other users. States and all those involved in fisheries are encouraged to apply the Code and give effect to it."

Source: http://www.fao.org/docrep/013/i1900e/i1900e.pdf

- **Spatial planning tools**, integrated coastal zone management, marine spatial planning, and other area-based conservation tools that build on the optimization of sustainable and equitable use of coastal ecosystem services (both on land and in the sea);
- **Greening the economies of small island developing states (SIDS)** by focusing on the integrated development of the five sectors – small-scale fisheries and aquaculture, water, tourism, energy, and solid waste;[172]
- **Integrated pollution & nutrient prevention**, and control measures applied at the programmatic level to coastal-related water supply and solid and liquid waste discharges, use of buffer zones and watercourse protection strips informing design and spatial planning decisions within Integrated Coastal Management systems. These activities could be strongly integrated with the options proposed under the Green Cities theme; and

- **A code of conduct for responsible fisheries**[173] (Box 20) for implementation, for example, in coastal aquaculture, integration of fisheries into coastal area management including eco-labelling linked to rights-based approaches and guided by the ecosystem approach to fisheries.

4.6 CHEMICALS AND WASTES

Chemicals are heavily impacted by climate change, not only from the perspective of the behavior and ecotoxicology of the molecules, but also in how the production and use patterns could be affected. This means that the many complex interactions between chemicals and biological systems (and humans) are likely to change in ways and patterns that are not always easy to predict. This has implications for human health, economy, agriculture, trade, land degradation and remediation, biodiversity, urban areas, international waters, and biodiversity. For example, climate change will have an impact on disease patterns, which in turn, will have an influence on the use of pharmaceuticals for human and veterinary uses.[174] Changing conditions related to climate are already associated with an increase in chronic diseases such as cardiovascular and respiratory diseases (e.g. caused by pollen). Even vector-borne diseases such as malaria could see changes in distribution patterns. In turn, this leads to an increase in the use of pharmaceuticals, even those currently not in common use. The behavior of these compounds after they inevitably reach the environment is quite unresolved under current conditions. Consequences could be substantial, even without the complications of climate change.

The Chemicals and Wastes focal area provides a number of pathways for greater program integration. Persistent organic pollutants (POPs) remain a serious and difficult issue to resolve, affecting other GEF focal areas and sustainable development, although significant advances have been made in their mitigation and reduction. With increasing food demand[175] placing additional stress on soils, the restrictions placed by pollutants reduces the potential of polluted tracts of land for agriculture, residence, industrial development, and conservation, all the while acting as a source of pollutants to the atmosphere,[176] runoff and ground water, and associated biota. However, the critical biological processes integral to soil regeneration may already be compromised by the presence of POPs and other pollutants.[177] Crosscutting approaches are being explored to tackle some of the impacts of POPs, such as phytoremediation of contaminated soils through the use of plants to return biological functionality and environmental safety to contaminated soils, thereby removing the need to excavate and remove contaminated soils.

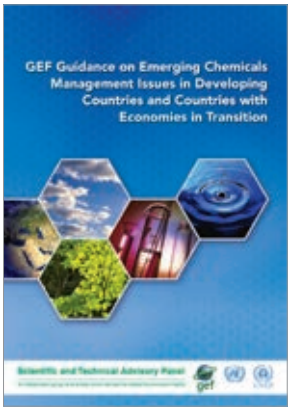
Increased temperatures will speed up volatilization and may make POPs and other pollutants more bioavailable for uptake and distribution away from the site, increasing the need to remediate soils while the POPs are still relatively concentrated. It is possible that climate change will induce the turnover of soil organic matter due to higher temperatures, and that rising CO_2 will have a fertilizing effect, possibly enhancing the biodegradation of POPs in soils. Innovative measures on how climate change may be harnessed to achieve cleaner soils will lead to healthier environments, cleaner cities, nutritious food, and protected areas.

With regard to chemicals and pollution, the GEF also has some major interlinkage challenges. Urban areas now generate about 1.3 billion tonnes of solid waste per year, which is expected to increase to 2.2 billion tonnes by 2025. Waste generation rates will more than double over the next twenty years in lower income countries[178]. Electrical and electronic equipment represents a new and fast growing hazardous waste stream in both developed and developing countries. Most waste management standards are national

or local, but sustainable waste management practices require a "cradle-to-cradle" approach along the entire supply and product chain including such means as extended producer responsibility. Where waste cannot be avoided, recovery of materials through recycling and remanufacturing into usable products or responsible waste-to-energy recovery should be undertaken.[179]

Release of chemicals to the environment from unsustainable consumption and production practices, often associated with inappropriate waste disposal, results in increased risks to ecosystems and humans – along with the proliferation of environmentally harmful chemicals. For example, of the 5.7 metric tons of pollutants released or disposed of in North America in 2006, 1.8 Mt were of chemicals considered persistent.[180] In addition to concerns for human and environmental well-being, issues such as increased trans-boundary movements of chemicals through trade or environmental release have also become more prevalent. The number of so-called emerging chemical management issues (ECMI) is on the rise and includes such issues as nutrients, plastics, endocrine disruptors, chemical mixture effects, heavy metals, polycyclic aromatic hydrocarbons and products of open burning, pharmaceuticals and personal care products[181] (Box 21) as well as plastics[182] (Box 22). Pollution of surface fresh and groundwater reserves by a wide range of chemicals have significant impacts on food security and public health and cumulatively on development. Integration and mainstreaming of chemicals management into the sustainable development agenda remains a formidable challenge for the international community. Existing chemicals governance should be strengthened, taking into account that impacts from chemicals throughout their life cycles are widely distributed and their severity depends on the vulnerability of human populations and ecosystems. Pollution and waste avoidance through employment of Information and Communication Technology (ICT)

BOX 21: EMERGING CHEMICAL MANAGEMENT ISSUES



Rapid globalization and demand for products, increased trade, expansion of manufacturing into Developing Countries and Countries with Economies in Transition (CEIT), new chemicals, uses, or products, coincided with an increased awareness of real or potential negative impacts of chemicals. These are commonly termed Emerging Chemical Management Issues (ECMIs). STAP identified and prioritized twenty-two ECMIs.

monitoring of releases, promotion of chemicals leasing management techniques, integrated chemicals services and other extended producer responsibility types of service models, and general actions to avoid emissions to water, land and air, must also be championed. Exploring the potential for the GEF to work with private sector partners would be valuable; it could help client countries that export chemicals and goods containing chemicals that will be regulated by the European regulation REACH (Registration, Evaluation, Authorization and Restriction of Chemicals) as its phased implementation continues.[183]

One area that will need to be more thoroughly explored in the GEF-6 Chemical focal area is prevention of mercury contamination and remediation. Unlike previous Conventions, the Minamata Convention on Mercury (opened for signature: October 2013) is supported by

comprehensive assessments to identify the sources of mercury emissions.[184] The GEF Council has allocated USD 10 million for Minamata Initial Assessments (MIAs) to help countries determine what national level mercury work they should prioritize, and the GEF Secretariat has provided guidance for the MIAs. Therefore, by the end of 2014, the GEF should be able to give some indication to countries as to activities fundable towards the implementation of the Convention.

Large uncertainties remain in global estimates of mercury emissions to the air, mainly because of lack of information concerning the mercury content of some raw materials, and the validity of assumptions regarding processes and technologies employed to reduce mercury emissions, including their rates of application and effectiveness. Preliminary analysis by STAP suggests a number of integrated and innovative actions and activities to improve knowledge on mercury:

- Implementing a permanent global integrated monitoring network to cover soil, water and biological aspects of mercury in the environment, with concurrent improvements in quality and coordination of measurements to determine spatial and temporal trends. This in turn would facilitate modelling and more accurate picture of the impacts of mercury emissions.

- Coordinated high altitude studies to generate better data on mercury distribution in the troposphere in order to understand long-range transport and source-receptor relationships, which will also help validate regional and global scale models, improving their prediction capabilities with regard to different policy scenarios.

- Improved understanding of key chemical and physical processes related to global transport and cycling of mercury. For example, the chemical form of gaseous oxidized mercury is unknown, and so reduction and oxidation rates for mercury in the presence of atmospheric oxidants need further study, including determining which oxidants are important.

- More systematic and consistent reporting of mercury releases to aquatic systems, including releases from contaminated soils to waters that may be influenced by climate and topography. Consistent approaches for measuring releases from point sources are needed to ensure comparability of data from around the world. In particular, the actual role of artisanal and small-scale gold mining (ASGM) in emissions to air and releases to water needs to be more accurately estimated.

- Links between mercury deposition, methylation, and uptake by living organisms needs further study, since there is inadequate understanding of the parameters that determine the rates of exchange of mercury compounds within ecosystems (i.e., between air and sea, air and soil, and air and vegetation). Methylation/demethylation rates, and their spatial and temporal variations and relationship to climatic factors, need to be determined in most of the world's major ocean basins, as well as in representative freshwaters.

BOX 22: MARINE DEBRIS

Marine habitats worldwide are contaminated with man-made debris, which damages fisheries and tourism, kills and injures a wide range of marine life, has the capacity to transport harmful chemicals and invasive species, and may represent a threat to human health.

STAP encourages GEF partners to consider mainstreaming interventions addressing marine debris into GEF projects and programs (including the five R's: Reduce, Reuse, Recycle, Redesign and Recover), specifically those projects supporting the management of Marine Protected Areas, Areas Beyond National Jurisdiction, and other sensitive areas.

Source: http://www.thegef.org/gef/sites/thegef.org/files/publication/cbd-ts-67-en.pdf

ANNEX:

STAP ACCOMPLISHMENTS IN GEF-5: MAJOR CHANGES SINCE THE 4TH GEF ASSEMBLY

This report is provided by STAP for the GEF-5 period to date during which the major reforms instituted in GEF-4 have become fully embedded into STAP's operational and strategic mandates. Operationally, STAP has screened nearly every full-size project proposal and every programme; strategically, STAP has been fully involved in the GEF-6 strategy-building as well as providing a number of key publications and activities that are listed below. In this Annex the major changes within the GEF are reviewed in order to provide a historical context as to where STAP is now positioned and the advice it has provided. A listing of the main STAP outputs is provided, all of which are accessible on STAP's newly-redesigned website – http://www.stapgef.org/.

A.1 MAJOR CHANGES WITHIN THE GEF AND THE CONTRIBUTION OF STAP

The past four years (2010-2014) have seen a significant intensification of STAP's role and responsibilities. STAP participated centrally in the drafting of the GEF-6 Focal Area Strategies (and the strategic programming documents for sound chemicals management and sustainable forest management) through its membership of each of the supporting Technical Advisory Groups for the focal areas. STAP has similarly been involved most recently in the strategic planning for GEF-6, supporting the replenishment process for the new phase of the GEF for 2014-2018. The GEF-6 Programming Directions document (GEF/R.6/20/Rev.01), prepared as a record of replenishment negotiations from 2010 to 2014 with the STAP's strategic advice on scientific and technical matters substantively anchored to this document.

For the GEF-4, GEF-5 and GEF-6 drafting processes, STAP has advised the GEF to strengthen cross-focal area integration. It is instructive to note that recent work programmes in GEF-5 contain 22% of multi-focal-area proposals (GEF OPS5). Some of these proposals are truly integrative, linking with issues of sustainable development; others are more fragmented, designed more to access funds rather than to promote true integration. The GEF's support and funding for more multi-focal area (MFA) projects is evidence that cross-focal area integration is now well-embedded. However, STAP still suggests a greater commitment to MFA projects because of their potential to maximise GEBs, deliver co-benefits for human development and increase overall impact across focal areas. Barriers remain – structural, institutional, technical and scientific; for example in the Resource Allocation Framework and in the GEF's segmented architecture.

A.2 INCREASING STAP'S EFFECTIVENESS

With the reforms at the start of GEF-4, STAP simultaneously underwent major change. GEF-5 has seen a consolidation of its new structure and method of working. One of the primary ways STAP has sought to increase its effectiveness is to work more closely and more collaboratively with the Evaluation Office of the GEF. STAP sees its role in providing independent advice on science and technology as paralleling the EO in its role for independent advice on evaluation. A number of evaluations[185] have been completed where STAP has been a significant partner with the Evaluation Office:

Publications of the GEF Evaluation Office involving significant input from the STAP

Total number: 7

Global Environment Facility Evaluation Office 2010. *OPS4: Progress Towards Impact. Fourth Overall Performance Study of the GEF*. Global Environment Facility, Washington DC.
Retrieved from: <http://www.thegef.org/gef/OPS4>

GEF Evaluation Office 2010. The GEF Monitoring and Evaluation Policy. Evaluation Document No. 4. Global Environment Facility Evaluation Office, Washington, DC.
Retrieved from: <http://www.thegef.org/gef/sites/thegef.org/files/documents/ME_Policy_2010.pdf>

GEF Evaluation Office 2010. Evaluation of the GEF Strategic Priority for Adaptation. Global Environment Facility Evaluation Office, Washington, DC.
GEF ID: GEF/ME/C.39/4

GEF Evaluation Office 2011. Evaluation of the GEF Strategic Priority for Adaptation. Evaluation Report No. 61. Global Environment Facility Evaluation Office, Washington, DC.
Retrieved from: <http://www.thegef.org/gef/sites/thegef.org/files/documents/spa-fullreport-LR.pdf>

GEF Evaluation Office 2012. Impact Evaluation of the GEF in the South China Sea and adjacent areas. Global Environment Facility Evaluation Office, Washington, DC.
Retrieved from: <http://www.thegef.org/gef/sites/thegef.org/files/documents/SCS IE Report FINAL FOR EDITING 10Dec2012.pdf>

GEF Evaluation Office 2013. Climate Change Mitigation Impact Evaluation: GEF Support to Market Change in China, India, Mexico, and Russia. Global Environment Facility Evaluation Office, Washington, DC.
Retrieved from: <http://www.thegef.org/gef/sites/thegef.org/files/documents/Impact-Climate Change Mitigation IE.pdf>

GEF Evaluation Office 2013. *Final Report of the Fifth Overall Performance Study of the GEF: At a Crossroads for Higher Impact*. Global Environment Facility Evaluation Office, Washington, DC, USA.
Retrieved from: < http://www.thegef.org/gef/sites/thegef.org/files/documents/Final%20OPS5%20Report%20-%20At%20Crossroads%20for%20Higher%20Impact%20unedited.pdf>

STAP noted in its last report to the GEF Assembly[186] the major opportunities for the application of sound scientific methods to meet the inter-linkages between global environmental issues such as loss of biodiversity, climate change, and freshwater and coastal systems degradation at different scales, as well as cross-cutting issues such as the world's oceans as the largest active carbon sink. STAP has continually highlighted the need to scale up efforts in areas such as climate change and biodiversity, taking existing

knowledge into practice through GEF projects. Through GEF-5, STAP has supported the application of several major global assessments conducted in GEF-4, including the Millennium Ecosystem Assessment, the IPCC Fourth Assessment Report (AR4), and UNEP's Fourth Global Environment Outlook (GEO-4) and the Global International Waters Assessment (GIWA). Each of these starkly outlined the huge challenges and reminded everyone in the GEF community how few the GEF resources are in comparison with the scale of the global environmental threats.

A.3 SUMMARY OF STAP ACHIEVEMENTS IN GEF-5

PIFs reviewed

Total number (including LDCF, SCCF, and March 2013 WP): ***454***

Publications and documents

Total number: ***36***

Global Environment Facility Evaluation Office 2010. *OPS4: Progress Towards Impact. Fourth Overall Performance Study of the GEF*. Global Environment Facility, Washington DC.
Retrieved from: <http://www.thegef.org/gef/OPS4>

STAP 2010. *Report of the Chairperson of the Scientific and Technical Advisory Panel*. Global Environment Facility, Washington, DC.
GEF ID: GEF/C.38/Inf.03

STAP 2010. *STAP Work Program for FY2011*. Global Environment Facility, Washington DC.
GEF ID: GEF/C.38/Inf.11

STAP 2010. *Report of the STAP Meeting, March 2010*. Global Environment Facility, Washington DC.
GEF ID: GEF/C.38/Inf.12

STAP 2010. *Programming Approach for Utilization of the Resources Set-Aside Outside the STAR*. Global Environment Facility, Washington, DC.
GEF ID: GEF/C.39/Inf.10

STAP 2010. *Report of the Chairperson of the Scientific and Technical Advisory Panel*. Global Environment Facility, Washington, DC.
GEF ID: GEF/C.39/Inf.13

STAP 2010. *The Evidence Base for Community Forest Management as a Mechanism for Supplying Global Environmental Benefits and Improving Local Welfare. A STAP advisory document*. Global Environment Facility, Washington, DC.
GEF ID: GEF/C.39/Inf.14

STAP 2010. *Environmental Certification and the Global Environmental Facility: A STAP advisory document*. Global Environment Facility, Washington, DC.
GEF ID: GEF/C.39/Inf.15

Institute for Transportation and Development Policy (Prepared on behalf of STAP) 2010. *Manual for Calculating Greenhouse Gas Benefits of Global Environment Facility Transportation Projects*. Global Environment Facility, Washington, DC.
GEF ID: GEF/C.39/Inf.16

STAP 2010. *Advancing Sustainable Low-Carbon Transport through the GEF. A STAP advisory document*. Global Environment Facility, Washington, DC.
GEF ID: GEF/C.39/Inf.17

STAP 2010. *Enhancing Resilience to Reduce Climate Risks: Scientific Rationale for the Sustained Delivery of Global Environmental Benefits in GEF Focal Areas*. Global Environment Facility, Washington, DC.
GEF ID: GEF/C.39/Inf.18

STAP 2010. *Recommendations of the GEF-STAP Cross-Focal Area Workshop: Approaches to Address Carbon Benefits in the context of Multiple Global Environmental Benefits in Implementing the SFM/REDD+ Program in GEF-5.* Global Environment Facility, Washington, DC.
GEF ID: GEF/C.39/Inf. 19

STAP 2010. *STAP Work Program for FY2012.* Global Environment Facility, Washington DC.
GEF ID: GEF/C.40/Inf.12

STAP 2010. *Report of the Scientific and Technical Advisory Panel to the Fourth GEF Assembly.* Global Environment Facility, Washington DC.
GEF ID: GEF/A.4/3

STAP 2011. *Report of the Chairperson of the Scientific and Technical Advisory Panel.* Global Environment Facility, Washington, DC.
GEF ID: GEF/C.40/Inf.13/Rev.1

STAP 2011. *Marine Debris: Defining a Global Environmental Challenge.* Global Environment Facility, Washington, DC.
GEF ID: GEF/C.40/Inf.14

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Meetings and events

Total number, up to and including STAP Retreat Jan 2014: ***95***

Name	Date	Location
Fourth GEF Assembly – side event: "New Science for a sustainable planet"	May 2010	Punta Del Este, Uruguay
UNCCD Secretariat Meeting	June 2010	Prague, Czech Republic
GEF Council Meeting	June 2010	Washington, DC
Two Ad Hoc Intergovernmental and Multi-Stakeholder Meetings on an Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)	June 2010	Washington, DC
Third IPBES Meeting	June 2010	South Korea
Global Expert Workshop on Biodiversity and REDD	September 2010	Nairobi, USA
UNGA Event on the International Year of Biodiversity	September 2010	New York, USA
STAP Workshop on SFM and REDD+	September 2010	Washington, DC
STAP Meeting	October 2010	Washington, DC
COP-10 (CBD)	October 2010	Nagoya, Japan
GEF Council Meeting	November, 2010	Washington, DC
UNCCD Technical Working Group meeting	December 2010	Bonn, Germany
STAP Meeting	March 2011	Vienna, Austria
5th International Marine Debris Conference – side event: "Seeking Global and Regional Solutions to Marine Debris Problem"	March 2011	Honolulu, USA
COP-5 of the Stockholm Convention – side event	April 2011	Geneva, Switzerland
GEF Council Meeting	May 2011	Washington, DC
Cross-Focal Area Workshop: Review of tools and methods to increase climate resilience of GEF projects and programs	June 2011	Washington, DC
STAP Meeting	October 2011	Washington, DC
Sixth GEF Biannual International Waters Conference	October 2011	Dubrovnik, Croatia
Carbon Benefits Project workshop	October 2011	Washington, DC
SAICM Open-Ended Working Group Meeting – side event: "Emerging Chemicals Management Issues in Developing Countries and Countries with Economies in Transition: Guidance for the GEF"	November 2011	Belgrade, Serbia
GEF Council Meeting	November 2011	Washington, DC

Name	Date	Location
GEF Expanded Constituency Workshop (ECW) for Southern Africa	November 2011	Cape Town, South Africa
GEF Expanded Constituency Workshop (ECW) for Central American Countries	November 2011	San Jose, Costa Rica
Global Conference on Land-Ocean Connections – 2 STAP side events: "Marine Spatial Planning and Management using the Ecosystem Approach: From Principles to Practice", and "Addressing nutrient reduction and hypoxia through the GEF"	January 2012	Manila, Philippines
Workshop on Energy Efficiency for the GEF	February 2012	Washington, DC
AAAS Annual Meeting	February 2012	Vancouver, Canada
World Ocean Summit	February 2012	Singapore
LD-6 Advice on Portfolio monitoring	February 2012	China
Planet Under Pressure conference – 2 sessions: "Tragedies and hopes of the global commons: biodiversity, climate and the oceans as global benefits, and "Staying away from the edge: avoiding biophysical, ecological, and social tipping points" STAP's BD panel member delivered the Plenary Keynote on the "State of the Planet Ecosystems"	March 2012	London, England
STAP Meeting	March 2012	London, England
UN Conference on Sustainable Development – side event: "A Global Call to End Plastic Pollution"	March 2012	New York, USA
16th meeting of CBD Subsidiary Body on Scientific, Technical, and Technological Advice (SBSTTA) – 2 side events: "Marine Debris" and "Marine Spatial Planning"	April 2012	Montreal, Canada
GEF Expanded Constituency Workshop	May 2012	Antigua
GEF Expanded Constituency Workshop	May 2012	Columbia
SETAC World Congress/SETAC Europe 22nd Annual Meeting	May 2012	Berlin, Germany
2012 Adaptation Conference, Institute of the Environment (co hosted by the University of Arizona and UNEP)	May 2012	Tucson, AZ, USA
Urban Environmental Pollution Conference	June 2012	Amsterdam, Netherlands
UNEP/UNON Annual Briefing	June 2012	Nairobi, Kenya
UNEP Chemicals and IUCN Meeting	July 2012	Geneva, Switzerland
UNEP/DTIE and ICSU Meeting	July 2012	Paris, France
European Science Meeting	July 2012	Dublin, Ireland
GEF ECW Southern Africa	August 2012	Maputo, Mozambique

Name	Date	Location
97th Annual Meeting of the Ecological Society of America	August 2012	Portland, Oregon
24th Conference of the International Society for Environmental Epidemiology	August 2012	Columbia, SC
LD-7 Soil Organic Carbon and Carbon Benefits project review	September 2012	Nairobi/Tsavo, Kenya
STAP Meeting	September 2012	Washington DC
International Waters Science Conference workshop: "The role of international waters related science in support of regional cooperation"	September 2012	Bangkok, Thailand
GEF ECW Eastern Europe and Central Asia	September 2012	Yerevan, Armenia
CBD COP-11	October 2012	Hyderabad, India
WB's 6th Urban Research and Knowledge Symposium: "Cities of Tomorrow: Framing the Future"	October 2012	Barcelona, Spain
GEF ECW	October 2012	Delhi, India
SETAC North America 22rd Annual Meeting	November 2012	Long Beach, CAL
UNFCCC COP 18	December 2012	Doha, Qatar
UNEP Meeting	December 2012	Nairobi, Kenya
Workshop on Dioxin Technology Demonstration	January 2013	Hanoi, Vietnam
IPBES Meeting	January 2013	Bonn, Germany
Advisory Group of Technical Experts of the UNCCD meeting on impact indicators	January 2013	Bonn, Germany
UNCCD-UNFCCC Meeting	January 2013	Bonn, Germany
On-site partners meeting for the UWI for GEF Peri-urban Agricultural Project	January 2013	Bridgetown, Barbados
GEF Orientation Seminar	January 2013	Washington DC
Technical Advisory Groups for Biodiversity, LD/SLM, Cross-cutting Issues, and Chemicals	February 2013	Washington DC
GEF ECW Meeting	February 2013	Honduras
Heinz Center Seminar: Engineering a Transformational Shift to Low-Carbon Economies in the Developing World: The Role of the GEF	March 2013	Washington, DC
UNEP SCOPE Meeting	March 2013	Ispra, Italy
Green Chemistry Workshop and STAP Meeting	March 2013	Washington DC
UNFCCC Technical Workshop on Ecosystem-based Adaptation	March 2013	Dar es Salaam, Tanzania
GEF 1st Replenishment Meeting	April 2013	Paris, France

Name	Date	Location
UNCCD Second Scientific Conference	April 2013	Bonn, Germany
UNEP Meeting	April 2013	New York, NY
Negative Emissions and the Carbon Cycle Workshop	April 2013	Vienna, Austria
Chemicals TAG Meeting	May 2013	Geneva, Switzerland
SETAC Europe 23rd Annual Meeting	May 2013	Glasgow, Scotland
Management Training	May 2013	New York, NY
2nd STAP meeting regarding marine debris	June 2013	Cape Town, South Africa
Expert Workshop: The Political Economy of Regionalism and International Waters	June 2013	Washington DC
7th International Conference on Marine Pollution and Ecotoxicology	June 2013	Hong Kong
GEF Council Meeting	June 2013	Washington DC
UNEP Meeting – briefing of the STAP Chair to UNEP staff	June 2013	Nairobi, Kenya
Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection Meeting	July 2013	London England
11th International Conference on Mercury as a Global Pollutant	July 2013	Edinburgh, Scotland
UN MDP Training	July 2013	New York, NY
World Water Week	September 2013	Stockholm, Sweden
UNFCCC Adaptation Committee Planning Workshop	September 2013	Nadi, Fiji
UN MDP Training	September 2013	New York, NY
Biodiversity Mainstreaming Workshop	September 2013	Cape Town, South Africa
UNCCD COP 11 – 2 side events: "Carbon sequestration – a valuable global benefit of sustainable land management" and "Carbon Benefits Project – new tools to measure carbon and the GEF's experience applying the tools"	September 2013	Windhoek, Namibia
Administrative Management Meeting	September 2013	Nairobi, Kenya
Dinner Meeting with UNEP Executive Director	September 2013	Washington DC
ICLEI – EcoCity World Summit: "The city as a vital area of work to grapple with global sustainability issues", including the GEF 2020 Innovation Workshop/Consultation on Cities.	September 2013	Nantes, France
CSAB Annual Meeting, hosted by CMS	October 2013	Gaeta-Formia, Italy
STAP Meeting	October 2013	Washington DC

Name	Date	Location
STAP Special Session on Sustainable Land Management (including Diana Wall, Cheryl Palm, and Henry Janzen)	October, 2013	Washington, DC
Climate Change Adaption and Climate Resilience brainstorming discussion	October 2013	Washington DC
Preparatory Meeting to the Diplomatic Conference on the Mercury Instrument	October 2013	Kumamato, Japan
9th meeting of the Stockholm Convention POPs Review Committee Meeting	October 2013	Rome, Italy
CBD SBSTTA 16 – side event: Mainstreaming Biodiversity (outcomes of expert meeting)	October 2013	Montreal, Canada
GEF IW: Learn Conference	October 2013	Barbados
IPBES-2	December 2013	Antalya, Turkey
UN MDP Training	December 2013	New York, NY
Meeting with the UNCCD Executive Secretary	December 2013	Bonn, Germany
GEF CEO Forum on Innovation Partnerships	December 2013	Washington DC
Biodiversity and Climate Change Workshop	January 2014	Washington DC
GEF Chemicals Retreat	January 2014	Montreux, Switzerland
STAP Retreat	January 2014	Stockholm, Sweden

A.4 FIFTH OVERALL PERFORMANCE STUDY (OPS5) AND THE EVALUATION OF STAP

In their Fifth Overall Performance Study (OPS-5), the Independent Evaluation Office (IEO) concluded that the "…STAP is a useful and respected body…" that continues to successfully deliver on many of the growing number of functions and responsibilities that it is assigned.[187] However, there is room to enhance the effectiveness and efficiency of the STAP at meeting its core mandate as the GEF enters its Sixth Replenishment Cycle. The IEO called for several substantive and administrative adjustments and improvements, which have been synthesized into the following key recommendations:

1. **Formulation of clear priorities is critical in the context of increasing demands.** The STAP constantly balances energy and resources between its role in providing advice on global environmental issues and long-term strategic focus to the GEF, and its role in reviewing projects to ensure scientific and technical quality. As the demands associated with both of these roles continue to grow at a rate that outstrips budget and resource allocations, the STAP runs the risk of becoming stretched too thin. At the same time, there is a notable lack of systemic evidence of the effectiveness of STAP contributions, especially with regards to whether STAP recommendations in project reviews are actually implemented. A formulation of priorities that incorporates input and analyses from a variety of stakeholders within the GEF family would help to clarify STAP focus and strengthen its effectiveness in key areas.

2. **Administrative support for STAP should be both strengthened and streamlined.** Inefficiencies in administrative processes have increased the workload of the STAP Secretariat in supporting the Panel. A review of alternative administrative arrangements could identify opportunities for delegating authority to the STAP Secretariat in ways that increase administrative efficiency while maintaining oversight and quality of services.

3. **Strategies to improve knowledge management need to be developed and applied.** Opportunities exist to increase the flow of knowledge both to and from the STAP. On the one hand, the STAP does not receive systematic feedback on the degree to which its screening recommendations are incorporated into project design, which, to some extent, disconnects it from the realities of on-the-ground project implementation. On the other hand, the significant repository of scientific knowledge that the STAP generates – usually in the form of publications – is underutilized, or at times does not reach even its intended audiences within the GEF family. In addition to this, Targeted Research has largely been overlooked as a modality for project-based knowledge generation. These are missed opportunities to embed science within programme and project development. Strategies that increase multi-way communications and transparency between the STAP and the GEF and its implementing agencies, disseminate publications to broader audiences, and reinstate Targeted Research as a modality would help the STAP and the rest of the GEF family to learn from each other, improving the potential to deliver future global environmental benefits.

4. **"Science" and its role within the GEF need to be clearly defined.** There is a notable lack of shared understanding between the STAP and the GEF about what exactly constitutes science, and especially, the degree to which social science should be considered and included. In recent years, aspects of social science have increasingly been integrated into the design and implementation of GEF projects and progammes, a trend that has not been reflected in the official and

perceived role of science, and more specifically, the STAP in the GEF. Establishing a clear definition of science and its role within the GEF that is agreed upon by the GEF family in its entirety could increase the relevance of STAP work to the current GEF portfolio.

The findings of the IEO indicate that there are opportunities to improve the ability of the STAP to fulfill its core mandate. The IEO also concluded that the STAP needs to be provided with the "…necessary resources to increase its effectiveness", given its growing number of responsibilities and functions. In a world that faces increasingly complex and dynamic environmental challenges, the STAP has an evolving but critical role to play in helping the GEF to deliver global environmental benefits.

ENDNOTES

1 Zalasiewicz, J. et al. 2011. The Anthropocene: a new epoch of geological time? *Phil. Trans. R. Soc.* A. 369:835–841; and Jäger, J., and Patel, N. 2012. Chapter 7: An earth system perspective. In: *The Fifth Global Environmental Outlook* (GEO-5). United Nations Environment Programme, Nairobi, Kenya. Retrieved from: <http://www.unep.org/geo/pdfs/geo5/GEO5_report_C7.pdf>

2 Zalasiewicz, J. et al. 2011. The Anthropocene: a new epoch of geological time? *Phil. Trans. R. Soc.* A. 369:835–841; and Jäger, J., and Patel, N. 2012. Chapter 7: An earth system perspective. In: *The Fifth Global Environmental Outlook* (GEO-5). United Nations Environment Programme, Nairobi, Kenya. Retrieved from: <http://www.unep.org/geo/pdfs/geo5/GEO5_report_C7.pdf>

3 GEF, 2014. *The STAP's Mandate*. Global Environment Facility. Retrieved from: <http://www.thegef.org/gef/STAP>

4 This section is informed and builds on the following key documents: The Future We Want – Rio+20 Outcome Document; GEF Vision 2020; The GEF Instrument; Evaluation of the GEF Focal Area Strategies (GEF/ME/C.43/Inf. 01); GEF-5 Programming Document (GEF/R.5/31); RBM System: Process to ensure the quality of objectives, baselines, and results indicators (GEF/C.40/Inf.9).

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6 A recent guide to social science research methods that will be more important in both research and project implementation, especially with local communities is: Newing, H. 2011. *Conducting Research in Conservation: A Social Science Perspective*. Routledge, Abingdon, UK, and New York, NY, USA.

7 UNCSD 2013. *Future We Want: Outcome Document Adopted at Rio+20*. Paragraph 265. United Nations Conference on Sustainable Development. Retrieved from: <http://www.uncsd2012.org/content/documents/727The%20Future%20We%20Want%2019%20June%201230pm.pdf>

8 UNEP's Foresight Process completed in 2012 ranked the most important emerging issues related to global environment. It gave the issue of "Aligning Governance to the Challenges of Global Sustainability" the highest ranking (#1) of 21 issues. See UNEP 2012. *21 Issues for the 21st Century:* Result of the UNEP Foresight Process on Emerging Environmental Issues. United Nations Environment Programme, Nairobi, Kenya. 56 pp.

9 UN 2011. *The Regional Dimension of Development and the UN System*. A study sponsored by the UN Regional Commissions. ECA, ECE, ECLAC, ESCAP, ESCWA. United Nations, New York, NY, USA; Söderbaum, F. and Granit, J. 2014. *The Political Economy of Regionalism: The Relevance for Transboundary Waters and the Global Environment Facility.* Global Environment Facility, Washington, DC, USA.

10 See, for example, the reflections of one leading development practitioner, Robert Chambers – Chambers, R. 2005. Chapter 4: Critical reflections of a development nomad. In: Kothari, U. (ed.) *A Radical History of Development Studies: Individuals, Institutions and Ideologies,* Zed Books, London, UK.

11 For a fuller discussion of the imperative to pursue sustainable development, see the Sustainable Development Commission website: <http://www.sd-commission.org.uk/pages/what-is-sustainable-development.html>

12 In GEF-5, four GEF Strategic Goals were formulated: Strategic Goal 1 – Conserve, sustainably use, and manage biodiversity, ecosystems and natural resources globally, taking into account the anticipated impacts of climate change (BD, LD, IW); Strategic Goal 2 – Reduce global climate change risks by: 1) stabilizing atmospheric GHG concentrations through emission reduction actions (CC-M); and 2) assisting countries to adapt to climate change, including variability (LDCF/SCCF); Strategic Goal 3 – Promote the sound management of chemicals throughout their life-cycle to minimize adverse effects on human health and the global environment (Chemicals); Strategic Goal 4 – Build national and regional capacities and enabling conditions for global environmental protection and sustainable development (goal across all GEF focal areas).

13 Lele, U. 2013. OPS5 technical document #15: evaluation of the Scientific and Technical Advisory Panel (STAP) of the GEF. *Fifth Overall Performance Study*. Global Environment Facility Evaluation Office, Washington, DC, USA.

14 According to the Fifth Overall Performance Study, recent work programmes in GEF-5 contain 22% of multi-focal-area proposals.

15 STAP 2013. *Enhancing the GEF's Contribution to Sustainable Development*. Global Environment Facility, Washington, DC. GEF ID: GEF/R.6/Inf.03.

16 STAP 2013. *Enhancing the GEF's Contribution to Sustainable Development*. Global Environment Facility, Washington, DC. GEF ID: GEF/R.6/Inf.03.

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18 UNCSD 2012. Policy Brief: Water security for a planet under pressure. Rio +20 Policy Brief for London 2012 Conference: Planet Under Pressure. Retrieved from: <http://www.planetunderpressure2012.net/pdf/policy_watersecurity.pdf>

19 Note: for clarity, the figure does not show all links between projects, programs and themes.

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21 The Stockholm Memorandum 2011. Tipping the scales towards sustainability. 3rd Nobel Laureate Symposium on Global Sustainability, Stockholm, Sweden. Retrieved from: <http://globalsymposium2011.org/wp-content/uploads/2011/07/memorandum-signed.pdf>

22 See, for example, the UNDP evaluation of the 'poverty-environment nexus', where the majority of environment projects are GEF-funded: UNDP 2010. *Evaluation of UNDP Contribution to Environmental Management for Poverty Reduction: the Poverty-Environment Nexus*. Evaluation Office, United Nations Development Programme, New York, NY, USA. 95pp.

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26 UNEP 2012. *21 Issues for the 21st Century: Result of the UNEP Foresight Process on Emerging Environmental Issues*. United Nations Environment Programme, Nairobi, Kenya. 56 pp.

27 Ferraro, P. J. 2012. *Experimental Project Designs in the Global Environment Facility: Designing Projects to Create Evidence and Catalyze Investments to Secure Global Environmental Benefits*. A STAP Advisory Document. Global Environment Facility, Washington, DC, USA.

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30 GEF Evaluation Office 2013. *OPS5 Technical Document #11: Knowledge Management in GEF.* Global Environment Facility Evaluation Office, Washington, DC, USA. Retrieved from: <http://www.thegef.org/gef/sites/thegef.org/files/EO/TD11_Knowledge%20Management.pdf>

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38 See: Figure 3.2.1 in: UN Habitat 2008. *State of the World's Cities 2008/2009: Harmonious Cities*. United Nations Human Settlements Programme, Nairobi, Kenya. Retrieved from: <http://sustainabledevelopment.un.org/content/documents/11192562_alt-1.pdf>

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40 See: Global Change International Geosphere-Biosphere Programme, Issue 78, Stockholm, Sweden. Retrieved from: <http://www.igbp.net/download/18.1081640c135c7c04eb480001182/1376383108168/NL78-for_web.pdf>

41 IPCC 2012. *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change. Field, C.B. et al. (eds.). Cambridge University Press, Cambridge, UK, and New York, NY, USA, 582 pp.

42 Based on the first Rio summit's Agenda 21 related guidance towards sustainable cities, and considering the issues raised in the UNEP paper '21 Issues for the 21st Century'. See: <http://www.unep.org/publications/ebooks/foresightreport/Portals/24175/pdfs/Foresight_Report-21_Issues_for_the_21st_Century.pdf>

43 E.g., Resource usage: Singapore's "Closed Water Loop" which seeks to minimize the need for energy-costly treatment facilities, and increase the maximum amount of clean water for use; Dhaka's Organic Compost programme which integrates information dissemination, education and incentive programs to reduce overall waste and improve human and environmental health. Climate Resilience: the Gujarat State Disaster Management Authority's overlay mapping database is a risk management tool that increases the knowledge-base on potential damage from environmental disasters caused by climate change; the creation of wetlands, protection of blue forests ecosystems (e.g. mangroves) and the preservation of the coastal environment are the best ways to create a natural buffer zone against sea-level rise and are examples of ecosystem-based adaptation. The Ottawa Greenbelt is an example of creating sustainable reserves in or around cities, which combine biodiversity and environmental protection, provide cities with benefits such as natural carbon sequestration, anti-land erosion barriers, soil revitalization, social and leisure advantages.

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51 Between 1960 and 2010, world population increased by nearly 3 billion. During this period, population growth was accompanied by significant increases in crop and animal production. This growth was achieved through extensive (altering ecosystems for production) and intensive agriculture (high input use relative to land area) – both of which can degrade the land unless suitable conservation measures are employed.

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183 Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency. REACH entered into force June 2007 with a 10 year phased implementation.

184 The UNEP 2013 Global Mercury Assessment provides the most recent information available for the worldwide emissions, releases, and transport of mercury in atmospheric and aquatic environments. Aquatic pathways, transport and fate are also explored. The breakdown of mercury emissions across sources as of 2010, sees Artisanal Small-Scale Goal Mines (ASGM) bypass transportation as the lead emitting source of mercury. The breakdown details are as follows : ASGM – 37% (727t), Fossil fuels – 26% (500t), Metals production – 18% (348t), Cement production – 9% (173t), Products – 5% (96t), Chlor alkali -1% (28t), other – 4% (86t). See: UNEP 2013. *Global Mercury Assessment 2013: Sources, Emissions, Releases and Environmental Transport.* United Nations Environment Programme Chemicals Branch, Geneva, Switzerland. Retrieved at: <http://www.unep.org/PDF/PressReleases/GlobalMercuryAssessment2013.pdf>; Sectors for which emissions are not currently quantified include biofuel production and combustion, vinyl-chloride monomer production, emissions during secondary metals production and ferro-alloys, oil and gas extraction, transport and processing other than refinery emissions, industrial / some hazardous waste incineration and disposal, sewage sludge incineration, preparation of dental amalgam fillings and disposal of removed fillings containing mercury.

185 Not included in the list of evaluations are the many cases of a STAP member providing advice and modest input to the Evaluation Office. The list provided here is where STAP has had a formal and significant role.

186 STAP 2010. *Report of the Scientific and Technical Advisory Panel to the Fourth GEF Assembly.* Global Environment Facility, Washington, DC, USA. GEF ID: GEF/A.4/3.

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