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INVESTING IN OUR PLANET

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REPORT OF THE CHAIRPERSON OF THE SCIENTIFIC AND TECHNICAL ADVISORY PANEL

Report of the Chair of the Scientific and Technical Advisory Panel (STAP) to the 53rd GEF Council

1. Introduction

This report provides an update on STAP's work, and progress in implementing its work program, since the last Council meeting in May 2017.

Over the last six months STAP has:

a. done further work on the science of integrated approaches (Section 2);

b. continued to work on other papers for the GEF Assembly on the circular economy as applied to food and plastics, and has invited the GEF agencies to participate in external reviews of these papers (Sections 3 and 4);

c. continued to support the development of the IAPs, and has begun work on programming for sustainable dryland management for GEF 7 (Section 5); and

d. contributed to replenishment discussions, and to the Conventions (Section 6), as well as reviewed 82 projects (Section 7).

2. Integration

STAP submitted a draft paper, "Why the scientific community is moving towards integration of environmental, social, and economic issues to solve complicated problems", to the second GEF-7 replenishment meeting in Addis Ababa, 3-5 October 2017: https://www.thegef.org/council-meeting-documents/draft-stap-working-paper-why-scientific-community-moving-toward The paper summarized the available scientific literature which concludes that integration or 'systems thinking'[1] is necessary to enhance positive outcomes and to avoid creating new problems or exacerbating others.

Environmental challenges are complex and interlinked, not only with themselves but also with social and economic issues[2]. The 3-legged stool of economics, environment, and social stability requires integration of all three factors. Solutions to global environmental problems therefore need to understand social-ecological systems, and their interactions; this will help us to identify the

[1] Systems thinking is an approach that seeks to understand how the parts are linked to make the whole and how the whole is more than the sum of its parts (Glouberman and Zimmerman 2002 - http://www.pol.una.py/cursosverano/images/2013/files/Complicated_Systems_ZimmermanReport.pdf). It looks at the relationships between inter-related, but independent, parts of a system, especially cause and effect relationships, and positive and negative feedback mechanisms. System thinking seeks to create solutions to a problem by first understanding the whole system within which the problem exists (by examining the linkages and interactions between the various elements that comprise the whole of the system) and ensuring that identified actions result in outcome that benefits all the elements that make up the whole system (http://environment-ecology.com/general-systems-theory/379-systems-thinking.pdf).

[2] Agricultural intensification is assumed to enhance biodiversity conservation. But when socio-economic factors (e.g. increased agricultural incomes, increased consumption) were considered, intensification practices may result in agricultural expansion and deforestation over the long term. Liu et al., 2015. Systems integration for global sustainability. Science, 347, 1258832. DOI: 10.1126/science.1258832

implications for biodiversity conservation, food security, ecosystem services, and livelihoods. Many social-economic goals and targets aimed at improving human well-being, for example poverty reduction, improved human health, access to energy, and economic growth, are linked to ecological factors and require a functioning Earth's life support system.

The application of systems thinking enables the examination of outcomes and effects of global environmental change on landscapes and seascapes. Systems thinking helps us to manage trade-offs across scales (local, sub-national, and national), and sectors, for example, increasing food production without degrading land, increasing greenhouse gas emissions, or polluting water sources. And systems thinking can also help us to untangle the complexity of inter-related actions, so that root causes are identified, and managed, feedbacks anticipated, and resilience built into our interventions.

Integration is important to the GEF and was built into its design from the outset. The Instrument (2015) tasks the GEF specifically with, "integrating global environmental concerns with national ones in the framework of national sustainable development strategies". Sustainable development is therefore central to the delivery of global environmental benefits. In its report to the GEF Assembly (2014), STAP said that, "an integrated approach should be followed from the outset, where the synergy between development and environment is pursued, and the generation of multiple benefits is promoted vigorously".

The GEF has a long track record on integration. In 2000, the GEF began to implement crosscutting initiatives with Operational Program 12 (OP12) on "Integrated Ecosystem Management." Following OP12, multiple focal area projects were specifically encouraged through the creation of the multifocal area portfolio in 2002[3]. Multifocal area projects now comprise 52% of the GEF portfolio.[4] In 2014, the GEF introduced large-scale, integrated programming with three Integrated Approach Pilot programs on food security, commodity supply chains, and sustainable cities. This integration modality was conceived in response to the GEF's 2020 Vision that focused on addressing drivers of environmental degradation and supporting broad partnerships to implement innovative programming. And in 2015, global policy makers reaffirmed the need to make progress across economic, social and environmental dimensions of sustainable development through the adoption of the "2030 Agenda for Sustainable Development", articulated as the Sustainable Development Goals.

STAP acknowledges that, as identified by the IEO, complex projects targeting multiple environmental issues, crossing focal areas, involving multiple agencies and countries tend to have higher management costs, and slower progress in project preparation. Nevertheless, STAP encourages the GEF to pursue integrative projects, and to apply integration science, based on

[3] Global Environment Facility. "Review of the GEF Operational Program 12: Integrated Ecosystem Management". 2000.
[4] Global Environment Facility, Independent Evaluation Office. "The GEF in the Changing Environmental Financing Landscape". 2017.

systems thinking, which will lead to more efficient and effective approaches to planning, monitoring, and implementing complex projects.

The GEF seeks transformational change and sustainable outcomes. Balancing complexity and efficiency is a challenge. STAP's experience with the IAPs underscored a number of elements of good practice, including systems thinking, engagement, knowledge management, monitoring and evaluation and learning, and program management. And in OPS6, the IEO found that the IAPs demonstrated innovative features, compared with previous programs, beginning with the theory of change. For example, the food security IAP developed a theory of change which integrated engagement, scaling-up, and tracking. In the light of what has been learned, STAP recommends the following approach embodying six key points to improve integration in future GEF project design:

i. Develop a good understanding of the social-ecological system in which the project will be implemented **(systems description, and systems thinking)**;
ii. A **theory of change** to tackle the drivers of environmental degradation, by assessing assumptions, outlining causal pathways, as well as having a 'Plan B';
iii. Assess the potential **risks and vulnerabilities** of the key components of the system, to assess its **resilience** to expected and unexpected shocks and changes, and need for incremental **adaptation** or more fundamental **transformational change**;
iv. Devise a logical sequence of interventions, formulated as an implementation plan which is responsive to changing circumstances and new learning (**adaptive implementation pathways**);
v. Develop explicit plans and dedicate funding for **good quality knowledge management and learning**; and,
vi. **Engage stakeholders**, including local communities (not just government officials) from project inception and design, through to completion; this is crucial to identifying diverse needs, and to managing tradeoffs.

3. Circular Economy

STAP is preparing two papers: "The future of agri-food production systems and sustainable consumption" discusses the need for increased food production, and the effect this is having on the environment; and "Plastics and the Circular Economy[5]" reviews the literature on chemical

[5] The circular economy concept aims to change the unsustainable linear economic model which is based on 'take, make, use, and dispose,' to a production and consumption model that is restorative and regenerative by design (Ellen MacArthur Foundation, 2013. Towards the Circular Economy. Economic and Business Rationale for an Accelerated Transition.). It ensures that the value of products, materials, and resources is maintained in the economy at their highest utility and value for as long as possible while minimizing waste generation (EC, 2015. Closing the loop - An EU action plan for the Circular Economy. http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52015DC0614; Stahel, W.R., 2016. Circular Economy. Nature 531, 435–438, doi:10.1038/531435a.) thereby, building after-use, asset recovery and waste prevention pathways into product design, and underpinning products and service delivery with energy and materials from renewable sources.

toxicity of plastics and its effects on the environment and human health. Both papers examine how a circular economy approach could help in designing interventions that would improve efficiency, and reduce pollution, as well as identifying possible future GEF projects.

A circular economy approach would improve environmental management, encourage innovation, create entrepreneurial opportunities, and employment; and it would offer an opportunity for countries to leapfrog the linear 'take, make, use, and dispose' economic and development model.

a. Food

Future global food demand will be constrained unless more sustainable agri-food supply systems are adopted. The challenge is to increase in food production by 60% by 2050 to feed over 9 billion people, and to meet the increasing demand for protein from the rapidly growing middle classes – a combination of rising incomes, and changing diets.

There are a number of reasons why the current agri-food industry is not sustainable indefinitely, including: a heavy reliance on inputs of fossil fuels, both directly, and in the manufacture of fertilisers[6]; commodities are a major driver of deforestation; intensive farming can degrade soils (land degradation affects about 23% of soils); globally 70% of freshwater is used for agriculture[7]; two-thirds of global fish stocks are overexploited[8]; and future climate change is a threat to production, reducing productivity, and increasing the incidence of droughts, floods, and the spread of pests and diseases.

In the longer term, there are other concerns: the nutrient cycle and chemical fertilizers - the export of nutrients from farmland in agricultural products reduces the fertility of soils, thereby threatening future productivity, and maintaining yields with chemical fertilisers has some negative environmental consequences; competition for productive land - to meet the increased demand for food, and competition from other uses, for example, for fibre, biofuels, and urban development; and freshwater shortages due to adverse climate change impacts, depletion of aquifers, and contamination of water sources.

Sustainability can be improved by a more efficient use of resources – reducing inputs per unit of food production, without a loss of productivity. STAP's review of the literature indicates that in the short term there a number ways to achieve this, including: better management of on-farm

(Ghisellini et al., 2016. A review on circular economy: the expected transition to a balanced interplay of environmental and economic systems', Journal of Cleaner Production, Vol. 114, pp. 11-32; Saveyn et al., 2016.)

[6] Agricultural production uses approximately one-third of total end-use global energy, mostly derived from fossil fuels, and contributes around one-quarter of total global greenhouse gas emissions. And it is also linked to almost two-thirds of terrestrial biodiversity loss, a third of land degradation, the depletion of two-thirds of commercial fish stocks, and over-exploitation of a fifth of the world's aquifers. FAO, 2011. The State of the World's Land and Water Resources for Food and Agriculture, UN Food and Agricultural Organization, Rome. Earthscan. 285 pp. ISBN: 9789251066140

[7] Food and Agriculture Organization, AQUASTAT data: https://data.worldbank.org/indicator/er.h2o.fwag.zs

[8] Rand, M. et al. (2010). Biodiversity Conservation: Challenges beyond 2020. September 2010. Vol. 329. Science.

production systems, crop residues, stubble and grazing lands; minimising soil erosion and enhancing soil fertility; reducing food losses during storage and in transport; more judicious use of chemicals, and water; pursuing sustainable land management practices and conservation tillage techniques; and greater energy efficiency, both on-farm, and in processing and transportation.

However, longer term, meeting the increased demand for food while achieving environmental sustainability, requires a better understanding of the changing drivers of consumption and production, the behaviors and preferences of consumers and producers, and the relationships between them. Knowledge gaps to enhance food production, healthy diets, and biosphere stewardship will need to be filled.

Environmental sustainability can be improved incrementally in the current conventional, linear agri-food systems, but dealing with the problem effectively needs a different approach, with a long-term vision and theory of change for improved productivity by adopting a circular economy approach to sustainable production and consumption.

To do this, there are several measures which the GEF could consider supporting, including:

- Closing the nutrient cycle by returning nutrients to farmland which will reduce the requirement for chemical fertilizers and helps solve waste management problems.
- Working to reduce competition for productive agricultural land and restoring degraded land. Using more marginal lands for urban development or biofuel and bio-material production may help.
- Reducing chemical fertilizer use, and novel low-carbon manufacture, such as using renewable electricity to provide hydrogen for use in producing ammonia. Leguminous crops fix atmospheric nitrogen for plant uptake and use, and reduce the demand for artificial fertilisers.
- Reducing freshwater use by implementing “smart irrigation” schemes, conserving water, and avoiding pollution of waterways. Recycled grey water can be used for intensive horticulture, livestock drinking water, and urban farms, where economically viable.
- Using an agro-ecological approach that encourages low-input organic production of crops and animals, conservation tillage and crop rotations, and integrated crop/livestock systems.
- Encouraging protein from alternative non-meat sources that use fewer resources, including pulses, vegetables, insects and chemical synthesis.
- Producing food within the urban landscape: rooftop gardens, community vegetable plots and living building facades are evolving and could provide significant volumes of food for local communities in the near term. In the longer term, there is a growing trend towards producing synthetic protein biochemically.

b. Plastics

Plastics are essential materials, and widely used in a range of activities, including packaging, construction, the automotive industry, furniture, household appliances, electric and electronic goods, as well as in agriculture. Between 1964 and 2015, the production of plastics globally increased twenty-fold to over 300 million tons a year. Future plastic production is projected to double in the next 20 years, and almost quadruple by 2050.

Between 5 and 13 million tons of plastic wastes were reported to be released into the marine environment in 2010 (Jambeck et al., 2015). Some plastics contain toxic chemicals, POPs such as bisphenol A, and phthalate and brominated diphenyl ethers, which have been linked to cancer, mental, reproductive and developmental diseases (Autian, 1973; Manikkan et al., 2013; North and Halden, 2013; Galloway, 2015). And because of their composition and chemical properties, plastics stay in the environment for a considerable time - some will take up to 500 years to break down. In the marine environment, plastics are broken down into tiny pieces (microplastics) and are eaten by marine organisms, subsequently ending up in the food chain, and hence, in human beings.

The continued rapid growth in the production, and use of, plastics in the current manner would have a serious and deleterious effect on the global environment and the GEF's ability to deliver its objectives on climate change, biodiversity, water, and chemicals, and well as having harmful effects on human health and livelihoods.

However, there are scientific and technical innovations which could help, including producing some plastic types from alternative sources other than fossil feedstocks. For example, it is possible to use biomass-based sources such as sugarcane, as well as sewage sludge, and food products. Some types of plastic can be produced using benign and biodegradable materials - these sources could help decouple plastics from fossil feedstocks, thus reducing greenhouse gas emissions. Using plastic waste as a resource is also promising, capturing and recovering plastic waste for remanufacturing of plastics or conversion into other products. Recent studies suggest that some plastics, including polyethylene and polypropylene, a significant portion of manufactured plastics globally, can be broken down by bacteria and caterpillars.

The GEF could encourage sustainable business models that promote products as services, and the sharing and leasing of products; create a supportive policy and regulatory environment, and provide economic incentives, for example, for recycling and reuse of plastics; and support innovative applied research.

Finally, the Chemicals and Waste focal area and the Sustainable Cities Integrated Approach Pilot appear to lend themselves to a circular economy approach.

4. Papers for the GEF Assembly

In addition to papers on integration, and the circular economy, STAP is working on several other papers for GEF Assembly:

a. **Knowledge Management**: As the GEF moves further towards integrated approaches, KM becomes increasingly important in organizing knowledge assets from complex situations, and making these assets available to inform future investments. Inconsistencies need to be evened out and practitioners need to become more familiar with the KM-challenge and how to make it operational. STAP will propose how the GEF can respond to these challenges, so it is more effective at delivering transformational change.

b. **Supporting innovation**: Innovation in technology, business models, institutions and social arrangements, policy, and financing has been an essential element of the GEF's activities. Recent advances in all five domains offer a broad range of opportunities to foster innovation of various kinds in GEF projects to make them more environmentally effective, economically more efficient, and socially more equitable. This paper reviews experience of innovation in the GEF, and offers suggestions about how the GEF could finance innovation and experimentation more effectively. Some examples of findings and recommendations include: increasing the use of novel financing instruments; supporting innovative business models such as Pay-Go; index insurance for small farmers; and, promoting the use of low cost sensors.

c. **Strengthening the local commons to provide global benefits:** There is a growing recognition that local collective action is required to sustainably manage wild (or common pool) resources. Local collective action is integral to mainstreaming, and increasingly linked to protected areas and multifocal area projects that include land degradation, biodiversity and sustainable forest management components. Management of the local commons, for example, by establishing community title, effective community governance, and support, can be an effective means to deliver global environmental benefits.

d. **Environmental Security**: Tensions over access to natural resources driven by scarcity, drought, floods, wars, and other factors can lead to conflict. The concept of environmental security views ecological processes and natural resources as sources or catalysts of conflict, barriers or limits to human well-being, or conversely, as the means to mitigate or resolve insecurity. This paper considers how the GEF might consider these issues as it works in post-conflict areas or potential conflict zones.

e. **Novel entities:** Objects not occurring in nature, but created and introduced into the environment by human beings could have a disruptive effect on the global environment. They include, but are not limited to, biological pollutants, synthetic chemical pollutants, radioactive materials, genetically modified organisms, nanomaterials, and micro-plastics. The paper will highlight the current state of science about relevant novel entities that could

positively or negatively affect the work of the GEF, and what action the GEF could take in consequence.

f. **MEAs/SDGs**: There are obvious links between Sustainable Development Goals (SDGs) and Multilateral Environment Agreements (MEAs) – synergies, but also areas of concern, where the mode of advancing some of SDGs (e.g., economic growth, zero hunger) could interact with the goals of the MEAs. This paper considers ways the GEF could optimise the delivery of global environmental benefits, while concomitantly contributing to sustainable development goals and targets.

The STAP Chair has written to all the GEF Agencies about STAP's papers for the Assembly. She has invited them to participate in external reviews of these papers. The World Bank, UNEP, and UNDP are reviewing the first three papers (Integration, Knowledge Management, and Food), as are other Agencies which have expressed an interest.

5. Supporting development of the Integrated Approach Pilots (IAP); and GEF 7 programming

a. Food Security

At the "Operational Launch Workshop of the Food Security IAP" in Addis Ababa, 5-7 July 2017, Annette Cowie, STAP member for Land Degradation, made a presentation on resilience, explaining basic aspects and key features, as well as introducing the Resilience, Adaptation Pathways and Transformation Assessment (RAPTA) Framework. Examples of the benefits provided by the RAPTA process when it was applied to designing the Nigeria and Ethiopia child projects were explained. Dr. Cowie also discussed the potential gains at the program level from applying the RAPTA to guide the monitoring and assessment of global environmental benefits.

STAP is a member of the IAP's new technical advisory committee – the work of which will include advising on regional indicators and baselines at the program level, and evaluating the program's impact on resilience.

b. Cities

For the 5th GEF Assembly in May 2014 STAP published, "Sustainable Urbanization Policy Brief: Proliferation of Urban Centres, their Impact on the World's Environment and the Potential Role of the GEF", and has contributed to several workshops and meetings in developing this IAP, including on suitable metrics, and indicators. Most recently, Dr. Ralph Sims, the STAP member for Climate Mitigation, attended the 2nd meeting of the Global Platform on Sustainable Cities (GPSC), organised by World Bank, in New Delhi, 30 October to 3 November.

c. Commodities

The STAP Chair, Dr. Rosina Bierbaum, attended the launch of the Good Growth Partnership on 6 September, in New York, and took part in a workshop on monitoring and evaluation. STAP has also contributed to this IAP with a paper on indicators proposed by the academic literature as well as those preferred by the agencies, and in discussions on the theory of change. STAP has also attended meetings organized by the Foundation/NGO community on tackling drivers of agro-ecosystem degradation.

d. GEF 7 programming: sustainable dryland management

STAP will review a draft concept note, and assist in conceptualizing the scientific and technical underpinning of the sustainable drylands program to respond to UNCCD COP guidance on migration, drought, salinization and dust storms.

6. Conventions

a. UNCCD

At the UNCCD's Thirteenth Conference of the Parties in Ordos, China, 5-9 September 2017, Annette Cowie, led the STAP side event "Applying Resilience & Land Degradation Neutrality (LDN) Frameworks to Assist with LDN Target Setting and Implementation". This side event focused on how resilience planning at the project level can contribute to the achievement of LDN. Dr. Cowie presented the scientific conceptual framework for LDN and illustrated how the framework can be used to establish baselines by defining what to measure, and how to assess LDN. She also presented the RAPTA Framework to illustrate how countries can conduct a resilience assessment to evaluate the capacity of land to continue delivering the same ecosystem services amid disturbance, and to assess its adaptive capacity and its likely trajectory under anticipated stressors and shocks.

In her capacity as a member of UNCCD's Science-Policy Interface, Dr Cowie presented the "Scientific Conceptual Framework for Land Degradation Neutrality" to the UNCCD's Committee on Science and Technology.

b. Minamata Convention

At the First Meeting of the Conference of the Parties to the Minamata Convention on Mercury (COP1), Geneva, Switzerland, 24-29 September 2017, Dr. Ricardo Barra, STAP member for Chemicals and Waste, gave a presentation at a joint STAP, UN Environment, and UNITAR event. The side event was titled: "How do we protect ourselves and the environment from mercury pollution? Transforming knowledge into action". Dr. Barra's talk highlighted how mercury data

needed for informed decision-making to protect vulnerable populations and ecosystems could be collected and analyzed, including information on fate and transport of mercury, sources of emissions and releases, and concentrations of mercury in biotic and abiotic media. Dr. Barra presented Phase 1 of the STAP-led Global Mercury Knowledge Platform project, and outlined plans for Phase 2, which will develop a functional interactive online platform to serve as a node for global mercury information and data.

c. UNFCCC

At the 23rd Conference of the Parties to the United Nations Framework Convention on Climate Change, Bonn, Germany, 6-17 November 2017, Dr. Ferenc Toth, STAP member for Climate Change Adaptation, spoke at a GEF side event about the science of integrated approaches. The event was titled: "Early lessons from GEF Integrated Approach Pilots: Increasing Impact in GEF-7". STAP attended the Forty-seventh sessions of the Subsidiary Bodies for Scientific and Technological Advice, and for Implementation, and participated in other side events including UN Environment events on the Emissions Gap, and Adaptation Gap reports.

7. Observations on STAP's screening of the GEF work program

To be presented by the STAP Chair at the Council.