Scientific and Technical Advisory Panel

GEF/R.7/Inf.10
September 26, 2017

Second Meeting for the Seventh Replenishment of the GEF Trust Fund
October 3-5, 2017
Addis Ababa, Ethiopia

## GEF-7 REPLENISHMENT

# DRAFT STAP WORKING PAPER: WHY THE SCIENTIFIC COMMUNITY IS MOVING TOWARDS INTEGRATION OF ENVIRONMENTAL, SOCIAL, AND ECONOMIC ISSUES TO SOLVE COMPLICATED PROBLEMS

## (PREPARED BY THE SCIENTIFIC AND TECHNICAL ADVISORY PANEL)

**DRAFT STAP WORKING PAPER: WHY THE SCIENTIFIC COMMUNITY IS MOVING TOWARDS INTEGRATION OF ENVIRONMENTAL, SOCIAL, AND ECONOMIC ISSUES TO SOLVE COMPLICATED PROBLEMS**

## 1. The issue: The importance of integration

"*When you are living in a globalized economy and a globalized world, you cannot live in isolation; all the problems and solutions are interconnected…"* Kailash Satyarthi, Nobel Peace Prizewinner

*"When we try to pick out anything by itself, we find it hitched to everything else in the Universe."* John Muir

The Global Environment Facility (GEF) is uniquely positioned, as the only entity focused on the Global Commons, to lead the way on the science of integration and "systems thinking" to deliver global environmental benefits. There is a limited amount of scientific literature that analyzes projects that have employed integration techniques to identify the benefits or tradeoffs involved as a result of greater complexity. This draft STAP Working Paper summarizes available relevant literature.

The ecosystems, biomes, and processes that regulate the stability and resilience of the Earth systems are under severe pressure[1]. The science indicates that several planetary boundaries have been breached, including loss of biodiversity, land use change, and climate change[2]. As the GEF approaches its quadrennial replenishment in June 2018, it is timely to reflect on how our understanding of tackling environmental problems has shifted, and what factors make for successful outcomes. To make a dent in burgeoning global environmental problems, it is clear that we need transformational change, and at scale.

In the World Economic Forum's *Global Risks Report 2017*[3]*,* four of the top five risks, in terms of impact, are environmental. There is an increasing recognition that a deteriorating global environment poses significant threats to the prospects for future economic growth and development. Further, we will not succeed in delivering the Sustainable Development Goals (SDGs)[4] in the absence of a stable and healthy Earth system[5].

The notion that environmental problems can be dealt with singly in silos is long gone. Reducing the loss of biodiversity simply by setting up protected areas, when much biodiversity is found in areas under production, both in agriculture and in the seas, will not succeed. Further, as the climate changes and shifts the ideal range of species, ecosystems within protected areas will be dramatically altered. Protected areas are important, of course, but only part of the answer. We need, therefore, innovative ways of integrating development and protecting biodiversity. We also need to ensure that we do not inadvertently make things worse, for example, by expanding agriculture in ways that deplete soils, use water unwisely, harm pollinators and increase deforestation. Otherwise, our efforts to increase food production will eventually prove to be self-limiting.

Biodiversity loss, pollution of land and water resources, land degradation, and poverty are interrelated problems that result from multiple interacting causes and are further exacerbated by climate change and its impact on the environment and livelihoods. Some factors are synergistic while others are antagonistic, leading to the risk of trade-offs[6]. Because of their close interactions, our requirements for food, energy, and water need to be considered simultaneously, along with the need to maintain the biophysical resource base – the land, hydrological, and biological resources – to ensure sustainable delivery of ecosystem services.

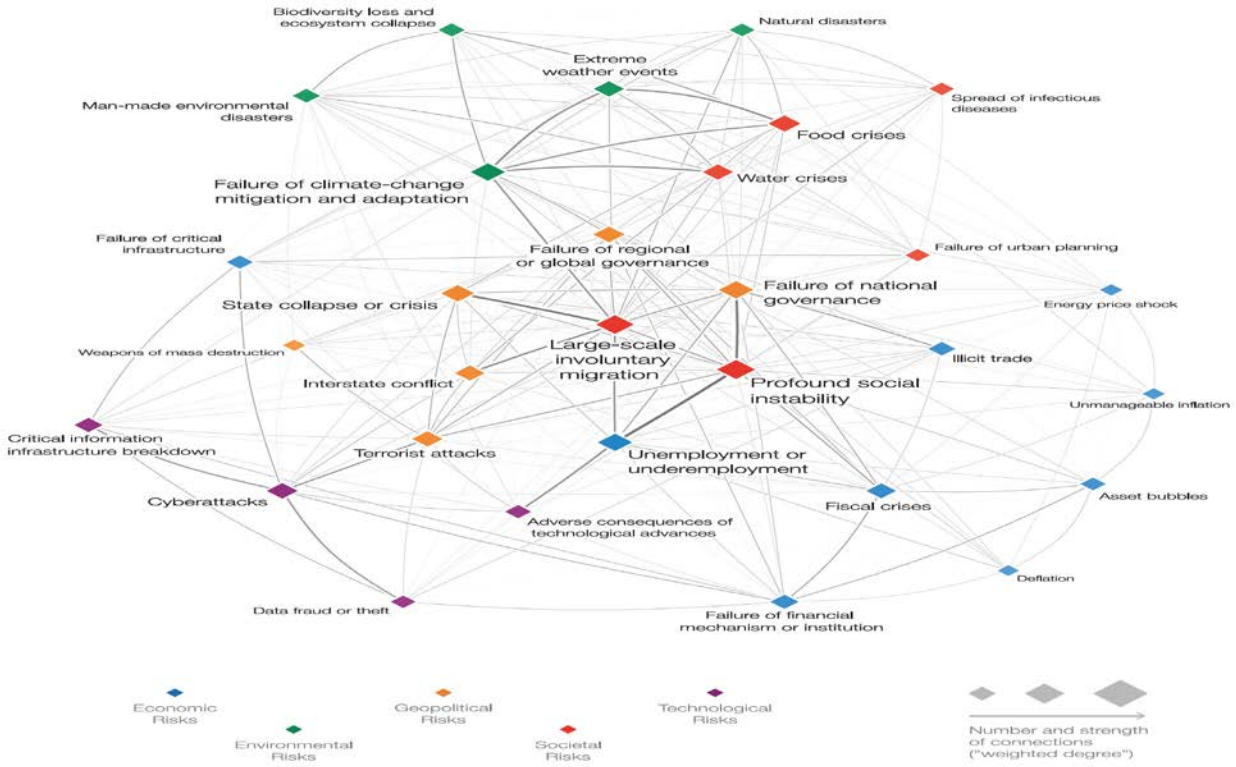
Interconnections at many scales and levels are important: across different driving factors; across socio-economic and environmental objectives; across environmental issues; across spatial scales; across different parts of the system; across stakeholders groups[7].

## 2. What does the science say?

Evironmental challenges are complex and interlinked, not only with themselves but also with social and economic issues. Solutions for one environmental problem (e.g., climate change) could lead to unintended negative consequences or create new environmental or socio-economic challenges[8]. For example, improving much-needed energy access for the poor through fossil fuels would increase greenhouse gas emissions, thereby accelerating climate change impacts and ocean acidification, while also degrading air quality, with consequent impact on human health[9]. It is also possible to have synergistic solutions that can help solve two or more environmental challenges. For instance, actions to mitigate climate pollutants such as black carbon, methane, and tropospheric ozone will help mitigate global warming while also providing health, agricultural productivity (and thus food security), as well as economic benefits[10]. Furthermore, many social-economic goals and targets aimed at improving human well-being, for example poverty reduction, improved human health, energy access, and economic growth, are linked to ecological factors and requires a functional Earth's life support system[11]. These interactions and interconnections require systems thinking[12]. Examples are presented in Box 1.

---

**Box 1: Global Risks Interconnections Map 2017**




A cluster of interconnected environment-related risks – extreme weather events, failure of climate change mitigation and adaptation, major natural disasters, and water stress – has consistently featured among the top-ranked global risks for the past seven editions of The Global Risks Report. Environment-related risks again stand out in the 2017 global risk landscape, with every risk in the category classified as higher-impact, and higher-likelihood (adapted from The Global Risks Report 2017, 12th Edition).

---

Lessons learned from the analysis of previous actions towards solving environmental problems and improving human well-being underline the lack of integration as a major detriment to achieving sustainability objectives[13]. For example, a review[14] of progress towards achieving global environmental goals, including those linked to the Multilateral Environmental Agreements (MEAs) supported by the GEF, underscored fragmentation as an important factor responsible for slow progress. The review emphasized the need for integration: between types of problems and identified solutions; between the responsibilities and resources available to implementing institutions; and in governance and institutional structures. An earlier study on the success of global environmental governance partly attributes the lack of improvement in the overall state of the environment, despite significant efforts, to the lack of integration in global environmental objectives[15]. This assertion is supported by a UN Environment analysis[16] that highlights several factors responsible for failure to achieve sustainable development goals:

- neglect of the interconnectedness between environmental objectives and their social and economic aspects;
- not targeting the root causes of problems; and
- the lack of coordination between design, implementation and monitoring. Furthermore, several analysis of natural resources management and biodiversity conservation efforts also show that the non-integration of ecological, socio-economic and cultural aspects is a major reason for failure of such efforts[17].

Solving environmental problems, or more broadly, achieving environmental sustainability, therefore, requires an integrated approach which entails "systems thinking[18]" and considers the relationship between the whole socio-ecological-economic system and its various components, as well as their interaction across space, time, and organizational levels[19]. The application of systems integration methods can assist in bringing together different objectives of the MEAs in a more holistic approach to planning and management, to maximize or deliver multiple benefits. It can also assist in enhancing synergy while managing trade-offs across scales (local, sub-national, and national) and sectors (e.g., increasing food production without degrading land, increasing greenhouse gas emissions, or polluting water resources). Systems integration methods can also untangle complexity between interactions, so that root causes can be identified and managed through focused interventions, while also anticipating feedbacks and building resilience[20]. Table 1 highlights some these benefits of system integration.

Several systems integration frameworks can be used to implement an integrated approach. Examples of those relevant for GEF work areas include the integrated landscape management, integrated natural resource management, integrated urban planning and management, integrated water resource management, integrated coastal zone management, life cycle assessment, the circular economy concept, integrated supply chain analysis, just to mention a few. These frameworks involve bringing together multiple aspects of human-nature interaction, through cooperation between relevant stakeholders along the impact pathway, to analyze the various elements of the systems, and to develop technologies, resource management strategies, governance arrangement, and institutional structures that can help meet desired socio-ecological-economic objectives[21].

| **Table 1: Examples of the benefits of systems integration** *(adapted from Liu et al., 2015)* | |
|---|---|
| **Benefits of system integration** | **Example** |
| Understanding complexity | Agricultural intensification schemes are assumed to lead to the sparing of land for conservation. However, when other socio-economic factors (including the resulting improved yield, increased agricultural rents, greater consumption, as well as increased economic activities and diversification) were considered, intensification was shown to lead to agricultural expansion and deforestation over the long term. This highlights how system integration can expose hidden interactions and complexities[22]. |
| Understanding policymaking | Using an integrated assessment model, the cost of delayed climate change mitigation action was estimated, taking into account geophysical, technological, social, and political factors. Political choices were shown to have the largest effects, followed by geophysical and social factors. Availability of technological solutions had the least impact. This can help in thinking about the relative importance of each factor for informed policy-making[23]. |
| Addressing multiple issues simultaneously | Systems integration can help in examining different technological and policy measures which yield multiple benefits simultaneously in the climate change-health-food security nexus, for example in climate change mitigation, reduced premature deaths, and improved agricultural productivity[24]. |
| Assessing the feasibility of multiple and conflicting goals | Integrated coastal zone management allows for multi-organizational management for competing interests such as recreation, fisheries, and biodiversity conservation[25]. |
| Identifying complementary policies and management strategies | Analysis of the interaction between global economy, energy security, and the impacts of climate change (the air-climate-energy nexus), shows that integrating energy security policies with optimal climate and air pollution policies would decrease oil consumption compared to implementing energy policies alone[26]. |
| Maximizing economic gains and minimizing environmental costs | Integrated soil-crop management systems can maximize grain yields, while minimizing applications of fertilizers, and greenhouse gas emissions[27]. |

Boxes 2 and 3 provide examples of integrated frameworks.

---

**Box 2: Integrated Landscape Management**

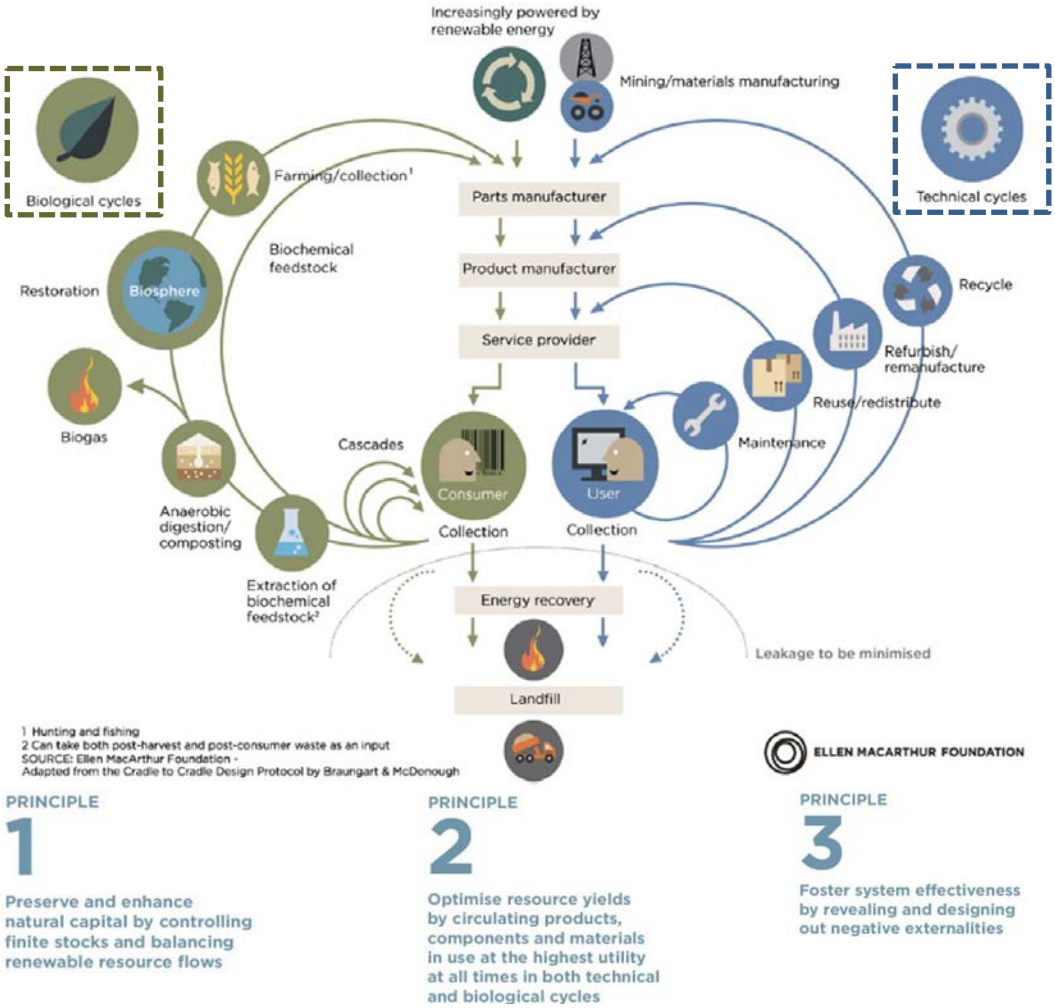

***The China Loess Plateau****. Source: World Resource Institute*

A landscape approach addresses competing land uses by implementing policies and integrated management practices that ensure equitable and sustainable use of land[28]. It aims to integrate social and economic development with ecological issues including climate change, biodiversity conservation, and land restoration through coordination across various scale and space[29]. The approach can facilitate sustainable agriculture; contribute to climate change mitigation, promote afforestation and reforestation – which would subsequently help reduce erosion and land degradation, protect water resources, reduce flood risks, provide potable water, and conserve biodiversity[30]. The achieved ecological improvements provide a basis for the enhancement of people's livelihoods, health, security, and resilience to climate variability and change[31]. The approach has been adopted in the implementation of several landscape restoration programs with reasonable successes. For example, the adoption of landscape approach in the Loess Plateau of China led to increase to 34% of perennial vegetation cover (from 17%) across the plateau within 10 years. This consquently resulted in diminished erosion and dust storms, as well as reduced sediment flow into the Yellow River by 100 million tons per year. Adopting the landscape approach also led to increased employment, a 62% growth in per-capital grain output, increased food security, and a near tripling household income[32]. Other case studies on the landscape approach are presented in the literature[33].

---

---

**Box 3: The Circular Economy Concept**




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[34]. 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[35]; 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[36]. Applying circular principles (see above figure) through a systems approach in GEF projects could help achieve:

- climate objectives, for example, the conversion of plastic waste to energy through industrial symbiosis resulted in an emissions reduction of 78,000 tonnes $CO_2$[37];
- chemical objectives, for example, innovation in green/sustainable chemistry to provide alternatives to toxic chemicals and encourage redesign of products to increase longevity, and to prevent wastage and pollution; and,
- land, water, and biodiversity objectives, for example, redesigning the food system can help reduce land degradation, prevent marine pollution, and improve biodiversity[38].

This approach will also yield socio-economic gains. The World Economic Forum reported that a material cost savings of up to $1 trillion could be achieved per year by 2025 by implementing the circular economy concept[39]. Transitioning to the circular economy in five European countries by 2030, apart from reducing carbon emissions by two-thirds, would also lower business costs and increase the workforce by about 4%, more than 1.2 million jobs[40].

---

## 3. Why is integration important to the GEF?

The GEF was established to support the implementation of the "Rio Conventions" on climate change, biodiversity and desertification, which emerged from the 1992 Rio Earth Summit; this Summit initiated global efforts to deliver environmentally sustainable development. Since its inception in 1992, the GEF has recognized that achieving environmental benefits requires a balance between the right of people to a healthy environment and the right to development. Integration was built into the design of the GEF: it is specifically tasked with "integrating global environmental concerns with national ones in the framework of national sustainable development strategies"[41]. Sustainable development is central to the delivery of global environmental benefits. STAP has stated that "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"[42].

In 2000, the GEF began to implement crosscutting initiatives with Operational Program 12 (OP12) on "Integrated Ecosystem Management." This program pre-dated the land degradation focal area and served as the entry point for land degradation projects, combined with integrated investments in biodiversity, international waters, and climate change. Socio-economic benefits were a key part of OP12 projects because they were expected to integrate ecological, economic, and social goals to achieve multiple benefits[43]. Following OP12, multiple focal area projects were specifically encouraged through the creation of the multifocal area portfolio in 2002. Cross-focal area integration has been promoted by the STAP[44], and has been increasingly adopted across the GEF; this is reflected in the increasing proportion of multi-focal area projects, now comprising 52% of the GEF portfolio[45].

In 2014, the GEF introduced large-scale integrated programming with three Integrated Approach Pilot (IAP) programs, on food security, commodity supply chains, and sustainable cities[46].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[47]. From the inception of each of these IAPs, there has been a strong focus on understanding the scope of the full 'system' where change is to be effected, and on stakeholder engagement, from local to regional.

In 2015, 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 (SDGs). GEF interventions are expected to contribute delivering the SDGs[48], and the GEF is seeking to help countries coordinate their planning to deliver on their MEA commitments and relevant SDGs. Applying an integrated framework will contribute to a science-based analysis of the trade-offs between the various SDGs and MEA priorities, which is necessary to deliver a cohesive plan of action and achieve long-lasting, sustainable development outcomes[49].

In considering programming for 2018-2022, the GEF again recognized the need to apply "…integrated approaches for transformational change in economic systems"[50] to address drivers of degradation, as it had its 2020 Strategy.

## 4. Evidence of integration in the GEF portfolio

Recognizing the evolving science of integration summarized in section 1, STAP has been supportive of increased 'systems thinking' within GEF's portfolio - within Focal Areas (FAs), in Multi-focal Area (MFAs) Projects, in Programs, and in the Integrated Approach Pilots (IAPs). While clearly relevant to the design and implementation of MFA projects and the IAP programs, lessons have also been learned from integration in FAs.

The Independent Evaluation Office (IEO) highlighted examples of FA integration, in its recent OPS-6 report, "The GEF in the Changing Environmental Finance Landscape"[51]. Their findings in three focal areas are summarized below:

*Biodiversity*: "Mainstreaming (biodiversity) activities are associated with better outcomes and sustainability"; and "review of the terminal evaluations suggests that PA projects receive more satisfactory ratings when they have mainstreaming components." (page 42). (The GEF's mainstreaming strategy includes: developing policy and regulatory frameworks; spatial and land use planning; encouraging biodiversity-friendly production practices; and piloting financial mechanisms to incentivize the encouragement of biodiversity.)

*International Waters*: "The international waters focal area: was the first to shift toward a program modality, and demonstrated successes in that regard". The IEO notes that IW serves as a catalyst for integration with other focal areas; and places significant emphasis on learning and knowledge sharing (pages 55, 56, 57).

*Land Degradation*: The IEO notes that the land degradation focal area "has been gradually moving toward integrated approaches aimed at delivering global environmental benefits in multiple focal areas while generating local environmental and development benefits". It "has an opportunity to address complex interrelated drivers and generate local socioeconomic benefits", and "the potential to increase food production, mitigate GHG emissions, and increase climate resilience through adaptation" (pages 58, 62, 63).

In support of integration and systems thinking, STAP has offered the GEF guidance on: improved MFA design; and incorporating resilience into project design and implementation. We will briefly summarize these efforts in turn.

*Multi-focal Area guidance:* STAP evaluates each full size project proposal to be sure it has a sound "Theory of Change" (TOC) and that there is a sound basis for the proposed actions leading to identified outputs and durable outcomes. In the last few years, STAP has encouraged improved TOCs so that the actions chosen are clearly thought through to possible endpoints. Better quality TOCs were needed especially in MFAs because some of the early MFAs did not discuss synergies or tradeoffs across focal areas. To that end, STAP provided MFA guidance in 2016[52] .

STAP identified the following essential characteristics of good MFA projects:

- The project objective would not be achievable by addressing a single focal area.
- There are linkages and drivers of environmental degradation common to several focal areas.
- Integration of the different focal areas contributes to maximizing environmentally sustainable development, and minimizing trade-offs in relation to the project's objective.
- The project will develop a theory of change which will allow for a robust monitoring and assessment of each of the focal area outputs and specific indicators contributing to the project's objective.

Progress is being made. At the June 2017 Council meeting, the STAP chair reported that the more recent MFA projects reviewed had better TOCs and scientific justification for proposed actions, that integration is improving at the site or country level, there is an increased focus on governance, and that resilience thinking is being incorporated. In the August 2017 OPS-6 report, the IEO concluded[53]: "The multifocal area portfolio reflects global trends toward integration across sectors and between environmental and socioeconomic goals as stated in the three Rio Conventions and the SDGs." "The great majority of multi-focal area projects respond to convention guidance, as well as to both global trends and national priorities" (page 69). "Multifocal area projects have the potential for producing synergies and mitigating trade-offs" (page 71).

*Resilience:* Recognizing that there could be synergies in achieving goals of more than one of the Multilateral Environmental Agreements (MEAs), the UNCCD asked STAP to develop a common indicator of agro-ecosystem resilience. This was supported by the CBD, and was also relevant to the UNFCCC[54]. In response to this, STAP commissioned and produced a number of reports on "resilience thinking."[55] An adaptive management and learning component can be critical to successful GEF projects, as many conditions (including climate, demographics, and policies) may be changing over the course of the project. STAP guidance on embedding resilience thinking into projects was developed at GEF's request in 2016[56]. The resilience framework applies adaptive management during implementation, uses results from monitoring and assessment to revise strategies, and tests hypotheses underlying the project design. Agencies have been asked by the GEF to consider this guidance in future project designs.

In addition, a STAP panel member has been involved with each of the IAPs since their inception to assist in incorporating the science of integration. At the May 2017 Council meeting, the STAP chair noted that the IAPs had demonstrated good progress on elements key to the science of integration.[57] In particular, advances in IAP KM have been made by including a coordinating budget and dedicated management team, by having many face-to-face consultations, building databases, developing common indicators, and exchanging learning. As well, there has been broad stakeholder engagement and consultation - including at the local level, and coordination across child projects.

The IEO OPS-6 report concludes that the IAPs: "are broadly coherent in terms of their objectives"; "emphasize knowledge exchange through dedicated platforms for collaborative learning, and considerable efforts will need to be made to realize their potential"; "broader adoption" has been emphasized in the design of the IAP programs, and there are "innovative features beginning with the Theory of Change" (page 89).

The GEF has made considerable progress in designing and implementing integrated projects and programs. Applying the evolving science on complex systems will help the GEF achieve even more in the coming years.

Details of STAP's other work relevant to integration and systems thinking are in Annex A.

## 5. Next steps for the GEF on integration

The GEF is uniquely positioned, as the only entity focused on the Global Commons, to lead the way on the science of integration and systems thinking to deliver global environmental benefits.

The next generation of integrated projects in GEF-7 should build on the lessons learned from this experience, as well as that from both the practitioner and scientific worlds. STAP is strongly supportive of a continued focus on integration within FAs, across MFAs, in Programs, in IAPS, and in future IPs; and stands ready to provide further scientific advice. This should include strong elements of KM, adaptive management, integration of resilience thinking, indicators of progress, and strong theories of change.

The IEO, in OPS-6, has recommended, "Continuing focus on integration. The GEF should continue pursuing an integrative principle in its programming based on scientific and technical merits. A strong, cogent rationale for designing integrated programs and multi-focal area projects—based on demonstrated additionality, GEF experience, GEF comparative advantage, innovative contributions, environmental need, and national relevance — must be the basis for such interventions."[58] However, the IEO also noted that ''with their emphasis on integration, programmatic approaches and multi-focal area projects are relevant in addressing drivers of environmental degradation; however, complex program designs have implications for outcomes, efficiency, and management" (Conclusion 3, page 132).

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 (IEO, 2017). Nevertheless, STAP encourages the GEF to pursue integrative projects, and to apply integration science, based on systems thinking, which will lead to more efficient and effective approaches to planning, monitoring, and implementing complex projects.

Balancing complexity and efficiency as the GEF seeks transformational change and lasting outcomes remains a challenge. There are many elements of integration that can still be improved across the temporal, spatial, institutional, and governance contexts. However, building learning and adaptive management into project design, conducting serious mid-term evaluations, and planning for long-term knowledge management, are clearly elements needed to improve efficiency and integration while pursuing global environmental benefits.

STAP recommends the following approach to improve integration in future GEF project design[59]:

a) Develop a good understanding of the social-ecological system in which the project will be implemented. Describing the system will help to identify the key environmental, social, economic and governance issues to be addressed, and how these are interconnected, with an eye towards resilience and transformational change (**systems description, and systems thinking**).

b) Articulate a clear rationale for the project, its goals, and what the proposed interventions are expected to achieve. The expected environmental, social and economic objectives of the project should be clearly identified and pathway for achieving them presented. A **theory of change** to tackle the drivers of environmental degradation, by assessing assumptions, outlining causal pathways, as well as having a 'Plan B', should desired outcomes not materialize.

c) 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**.

d) Devise a logical sequence of interventions, formulated as an implementation plan which is responsive to changing circumstances and new learning (**adaptive implementation pathways**). Develop clear indicators that will be monitored to determine progress and success in achieving lasting outcomes.

e) Develop explicit plans and dedicate funding for **good quality knowledge management and learning** including: sustainable databases, which endure beyond completion of the project; simple, useful and usable common indicators; face-to-face consultations; and building the capacity of stakeholders. Good knowledge management is essential for adaptive management, developing 'lessons learned' (to inform future investments), and for 'scaling up'.

f) **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 trade-offs:

(i) apply a participatory process to refine the system description and devise the theory of change, and thereby develop a common understanding of the problem, and potential solutions;
(ii) form multi-disciplinary teams with wide ranging expertise to assess proximity to thresholds, and consequently, the need for adaptation or transformation;
(iii) involve stakeholders in characterizing and prioritizing actions to build, or maintain, resilience, or achieve transformation;
(iv) establish multi-stakeholder platforms and institutional partnerships to facilitate knowledge sharing and data collection for monitoring progress; and
(v) apply strategies starting at the local level in order to produce a shared vision for effective transformational change.

Acknowledging the additional effort required to apply this approach, the STAP suggests that GEF could facilitate improved integration by:

- allowing flexibility in project preparation to accommodate the additional transaction costs and time required to tackle complex issues through multi-agency teams. A possible approach is to allow the detailed project plan to be developed after approval, as the first stage of project implementation, to enable meaningful stakeholder engagement in devising the system description and assessment, and design of implementation pathways.
- encouraging integrated projects to start with a defined scope, and to 'learn by doing.' For example, they may focus on a specific aspect such as revising policy to encourage integration at institutional level; or take a staged approach, rather than attempting to traverse the whole development path through to adoption in a single project; or confine scope geographically, to demonstrate concepts before scaling up.

**Annex A:** STAP's further work on integration and systems thinking

STAP has:

(i) evaluated a number of completed MFA Natural Resource Management projects with an eye towards the science of integration;
(ii) studied projects the IEO deemed particularly successful in the Climate Change Mitigation and Chemicals and Waste areas to see what 'lessons learned' there might be[60].

Additionally, STAP has offered GEF guidance on:

(iii) Knowledge Management (KM).

*Integrated Approaches to Natural Resource Management (NRM):* STAP looked at integration across a number of completed Natural Resource Management (NRM) projects[61] Twenty-eight MFA projects were reviewed along with ten in-depth case studies of integrated programs and projects. The review concludes that integrated approaches need to be flexible and not become a 'straight jacket' or simply a 'check-list'. Attempts at embedding learning and adaptive management were included in all of the projects studied, but slightly less than half of the projected did this adequately. All of the projects included stakeholder consultations, but few projects practiced 'coproduction of knowledge' where local stakeholders are engaged from start to finish; advisory boards or steering committees were often limited to official government representatives. All projects took knowledge management into consideration, but there was not a clear indication that learning and adaptive knowledge management was taking place during project implementation. Thus, past NRM MFA projects show there are some good results on integration, but there is room for improvement.

*Integrated Approaches to Climate Change Mitigation and Chemicals and Waste Projects:* To complement the review described above, STAP looked at twenty-six projects in climate change mitigation, and chemicals and waste projects that the IEO had identified as particularly successful or very unsuccessful.[62] STAP's goal was to evaluate what aspects of systems thinking and integration were involved in the projects with positive and durable outcomes. The findings suggest that projects which incorporate complex systems thinking were more successful in achieving their long-term goals, more likely to deliver social and economic benefits, including benefits across focal areas – and ultimately be transformational. Some key elements of those successful projects include: Fostering conditions for behavioral change across domains and scales; demonstrating the comparative advantage of an innovation or new technology; ensuring sustainability by building on-going processes and strengthening capacities; and planning for further adoption by including mainstreaming, replication, and scaling-up in project design. These elements offer guidance for developing future transformational projects.

*Knowledge Management:* Both Council and STAP have urged an increased attention to Knowledge Management (KM) in GEF projects. To facilitate that, STAP has recommended nine actions (http://www.stapgef.org/knowledge-management-gef) in support of the longer-term improvements. These include: embedding learning questions into project design; mainstreaming knowledge management into the project cycle; improving the PMIS system; adding indicators of KM into RBM; and building in incentives for dissemination of outputs and outcomes, among others. STAP continues its strategic engagement in the development of the GEF KM strategy, working closely with the GEF Secretariat and members of the GEF partnership.

## References


[1] W. Steffen, A. Sanderson, P.D. Tyson, J. Jäger, P.A. Matson, B. Moore III, F. Oldfield, K. Richardson, H.J. Schellnhuber, B.L. Turner, R.J. Wasson.2004."Global Change and the Earth System: A Planet Under Pressure" (2004), published by Springer-Verlag Berlin Heidelberg New York. ISBN 3-540-40800-2.

[2]Rockstrom et al 2009. A safe operating space for humanity. Nature 461, 472–475 (2009). doi: 10.1038/461472a; Steffen et al., 2015. Planetary boundaries: Guiding human development on a changing planet. Science, 347, 1259855, DOI: 10.1126/science.1259855

[3]WEF, 2017. The Global Risks Report 2017. 12th Edition, World Economic Forum, http://www3.weforum.org/docs/GRR17_Report_web.pdf

[4]http://www.un.org/sustainabledevelopment/sustainable-development-goals/

[5]Griggs et al., 2014. An integrated framework for sustainable development goals. Ecology and Society 19(4): 49. http://dx.doi.org/10.5751/ES-07082-190449

[6]Nilsson et al., 2016. Map the interactions between Sustainable Development Goals. Nature, 534, 320–32. doi:10.1038/534320a

[7] See for example: Vitousek et al., 1997. Human Domination of Earth's Ecosystems, Science 277, DOI: 10.1126/science.277.5325.494; Berkes et al., 2003. Navigating Social-Ecological Systems: Building Resilience for Complexity and Change, Cambridge Univ. Press, Cambridge, UK; Folke, 2006. Resilience: The emergence of a perspective for social–ecological systems analyses. Global Environmental Change 16 (2006) 253–267; Liu et al., 2007. Complexity of Coupled Human and Natural Systems, Science 317, 1513, DOI: 10.1126/science.1144004; Ostrom, 2009. A General Framework for Analyzing Sustainability of Social-Ecological Systems, Science 325, 419, DOI: 10.1126/science.1172133; Mooney et al., 2012. Evolution of natural and social science interactions in global change research programs. PNAS, 110. DOI: 10.1073/pnas.1107484110

[8]UNEP, 2012a. 21 Issues for the 21st Century: Result of the UNEP Foresight Process on Emerging Environmental Issues. United Nations Environment Programme (UNEP), Nairobi, Kenya

[9]Liu et al., 2015. Systems integration for global sustainability. Science, 347, 1258832. DOI: 10.1126/science.1258832; Nilsson et al., 2016. Map the interactions between Sustainable Development Goals. Nature, 534, 320–32. doi:10.1038/534320a

[10] UNEP/WMO, 2011. Integrated Assessment of Black Carbon and Tropospheric Ozone: Summary for Decision Makers. https://wedocs.unep.org/rest/bitstreams/12809/retrieve; Shindell et al. 2012. Simultaneously mitigating near-term climate change and improving human health and food security. Science, 335, 183–189. doi: 10.1126/science.1210026

[11] Vitousek et al., 1997. Human Domination of Earth's Ecosystems, Science 277, DOI: 10.1126/science.277.5325.494;A safe operating space for humanity. Nature 461, 472–475 (2009). doi: 10.1038/461472a; Griggs et al., 2013. Sustainable development goals for people and planet. Nature, 495. doi:10.1038/495305a

[12]Cumming et al., 2006. Scale mismatches in social-ecological systems: causes, consequences, and solutions. Ecology and Society 11, http://www.ecologyandsociety.org/vol11/iss1/art14/; Liu et al., 2015. Systems integration for global sustainability. Science, 347, 1258832. DOI: 10.1126/science.1258832

[13]UNEP, 2012b. Measuring Progress: Environmental Goals & Gaps. United Nations Environment Programme (UNEP), Nairobi, Kenya

[14]Jabbour et al., 2012. Internationally agreed environmental goals: A critical evaluation of progress. Environmental Development, 3, 5-24. http://dx.doi.org/10.1016/j.envdev.2012.05.002

[15]Najam et al., 2006. Global Environmental Governance. A Reform Agenda. International Institute for Sustainable Development. https://www.iisd.org/pdf/2006/geg.pdf

[16]UNEP, 2013. Embedding the Environment in Sustainable Development Goals. UNEP Post-2015 Discussion Paper 1. United Nations Environment Programme (UNEP), Nairobi

[17]for example, Kellert et al., 2000. Community Natural Resource Management: Promise, Rhetoric, and Reality, Society and Natural Resources. 13:705-715; Hagmann, et al., 2002. Success factors in integrated natural resource management R&D: lessons from practice. Conservation Ecology 5, http://www.consecol.org/vol5/iss2/art29/; Christie, 2004. Marine Protected Areas as Biological Successes and Social Failures in Southeast Asia. American Fisheries Society Symposium 42:155–164; Schenk et al., 2007. Factors influencing the acceptance of nature conservation measures—A qualitative study in Switzerland, Journal of Environmental Management 83, 66–79; Muhumuza and Balkwill, 2013. Factors Affecting the Success of Conserving Biodiversity in National Parks: A Review of Case Studies from Africa. International Journal of Biodiversity, 2013, 798101, http://dx.doi.org/10.1155/2013/798101; Plagányi, et al., 2013. Integrating indigenous livelihood and lifestyle objectives in managing a natural resource. PNAS, www.pnas.org/cgi/doi/10.1073/pnas.1217822110

[18] "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).

[19]Fiksel, 2006. Sustainability and resilience: towards a system approach. Sustainability: Science, Practice, & Policy 2, 14–21; Biggs et al., 2010. Navigating the back loop: fostering social innovation and transformation in ecosystem management. Ecology and Society 15, 9. http://www.ecologyandsociety.org/vol15/iss2/art9/; Halliday and Glaser, 2011. A Management Perspective on Social Ecological Systems: A generic system model and its application to a case study from Peru. Human Ecology Review, 18, 1; Mooney et al., 2012. Evolution of natural and social science interactions in global change research programs, PNAS, www.pnas.org/cgi/doi/10.1073/pnas.1107484110; Liu et al., 2015. Systems integration for global sustainability. Science, 347, 1258832

[20]Berkes et al., 2003. Navigating Social-Ecological Systems: Building Resilience for Complexity and Change, Cambridge Univ. Press, Cambridge, UK; Liu et al., 2007. Complexity of Coupled Human and Natural Systems, Science 317, 1513, DOI: 10.1126/science.1144004; Biggs et al., 2010. Navigating the back loop: fostering social innovation and transformation in ecosystem management. Ecology and Society 15, 9. http://www.ecologyandsociety.org/vol15/iss2/art9/; Phelps et al. 2013. Agricultural intensification escalates future conservation costs. Proc. Natl. Acad. Sci. 110, 7601–7606. doi: 10.1073/pnas.1220070110; Chen et al. 2014. Producing more grain with lower environmental costs. Nature 514, 486–489. doi: 10.1038/nature13609.

[21]for example, Sayer et al., 2013. Ten principles for a landscape approach to reconciling agriculture, conservation, and other competing land uses, PNAS, www.pnas.org/cgi/doi/10.1073/pnas.1210595110; Ginkel et al., 2013. An integrated agro-ecosystemand livelihood systems approach for the poor and vulnerable in dry areas, Food Sec. 5:751–767, DOI 10.1007/s12571-013-0305-5; Orjan, 2017. Collaborative environmental governance: Achieving collective action in social-ecological systems, Science, 357, DOI: 10.1126/science.aan1114

[22]Phelps et al. 2013. Agricultural intensification escalates future conservation costs. Proc. Natl. Acad. Sci. 110, 7601–7606. doi: 10.1073/pnas.1220070110

[23]Rogelj et al., Probabilistic cost estimates for climate change mitigation. Nature 493, 79–83. doi: 10.1038/nature11787

[24]Shindell et al. 2012. Simultaneously mitigating near-term climate change and improving human health and food security. Science, 335, 183–189. doi: 10.1126/science.1210026

[25]Reis et al. 2014. Relevance of systems approaches for implementing Integrated Coastal Zone Management principles in Europe. Mar. Policy 43, 3–12. doi: 10.1016/j.marpol.2013.03.013

[26]Bollen et al., 2010 Bollen et al. 2010. An integrated assessment of climate change, air pollution, and energy security policy. Energy Policy 38, 4021–4030. doi: 10.1016/j.enpol.2010.03.026

[27]Chen et al. 2014. Producing more grain with lower environmental costs. Nature 514, 486–489. doi: 10.1038/nature13609

[28]Reeds et al., 2015. What are 'Integrated Landscape Approaches' and how effectively have they been implemented in the tropics: a systematic map protocol, Environmental Evidence 2014, 4:2, http://www.environmentalevidencejournal.org/content/4/1/2

[29]Scherr and McNeely 2008. Biodiversity conservation and agricultural sustainability: towards a new paradigm of 'ecoagriculture' landscapes, Phil. Trans. R. Soc. B, 363, 477–494, doi:10.1098/rstb.2007.2165; Phalan et al., 2011. Reconciling Food Production and Biodiversity Conservation: Land Sharing and Land Sparing Compared, Science 333, 1289, DOI: 10.1126/science.1208742; Reeds et al., 2016. Integrated landscape approaches to managing social and environmental issues in the tropics: learning from the past to guide the future. Global Change Biology (2016) 22, 2540–2554, doi: 10.1111/gcb.13284

[30]*Kremen and Miles, 2012. Ecosystem Services in Biologically Diversified versus Conventional Farming Systems: Benefits, Externalities, and Trade-Offs, Ecology and Society 17(4): 40. http://dx.doi.org/10.5751/ES-05035-170440; Milder et al., 2012. Landscape approaches to achieving food production, natural resource conservation, and the millennium development goals. In: Ingram, Jane Carter; DeClerck, Fabrice; Rumbaitis del Rio, Cristina (Eds.). Integrating Ecology and Poverty Reduction, p.77-108. Springer; Scherr et al., 2012. From climate-smart agriculture to climate-smart landscapes, Agriculture & Food Security 2012, 1:12, http://www.agricultureandfoodsecurity.com/content/1/1/12*

[31]*Milder et al., 2012. Landscape approaches to achieving food production, natural resource conservation, and the millennium development goals. In: Ingram, Jane Carter; DeClerck, Fabrice; Rumbaitis del Rio, Cristina (Eds.). Integrating Ecology and Poverty Reduction, p.77-108. Springer; World Bank, 2016. Investing in Landscapes for Integrated, Inclusive, and Climate-Resilient Development. The World Bank Group. http://pubdocs.worldbank.org/en/666921449003548382/Investing-in-Landscapes-Brief-World-Bank-ENR-GP-2016.pdf*

[32]*UNEP, 2012c. Avoiding Future Famines: Strengthening the Ecological Basis of Food Security through Sustainable Food Systems, United Nations Environment Programme, Nairobi, Kenya; World Bank Group: http://www.worldbank.org/en/news/feature/2007/03/15/restoring-chinas-loess-plateau*

[33]*See for example, Scherr et al., 2012. From climate-smart agriculture to climate-smart landscapes, Agriculture & Food Security 2012, 1:12, http://www.agricultureandfoodsecurity.com/content/1/1/12; Thaxton et al. 2015. Landscape Partnerships for Sustainable Development: Achieving the SDGs through Integrated Landscape Management, http://peoplefoodandnature.org/publication/landscape-partnerships-for-sustainable-development-a-policy-brief/; World Bank, 2016. Investing in Landscapes for Integrated, Inclusive, and Climate-Resilient Development. The World Bank Group. http://pubdocs.worldbank.org/en/666921449003548382/Investing-in-Landscapes-Brief-World-Bank-ENR-GP-2016.pdf*

[34]*Ellen MacArthur Foundation, 2013. Towards the Circular Economy. Economic and Business Rationale for an Accelerated Transition. https://www.ellenmacarthurfoundation.org/assets/downloads/TCE_Ellen-MacArthur-Foundation_9-Dec-2015.pdf; Smol et al., 2017. Circular economy indicators in relation to eco-innovation in European regions. Clean Tech Environ Policy, 19, 669–678, DOI 10.1007/s10098-016-1323-8*

[35]*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*

[36]*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. Towards a better exploitation of the technical potential of waste-to-energy. EUR 28230 EN. DOI:10.2791/870953; Rizos et al., 2017. The Circular Economy. A review of definitions, processes and impacts. https://www.ceps.eu/publications/circular-economy-review-definitions-processes-and-impacts*

[37]*Sun et al., 2016. Eco-benefits assessment on urban industrial symbiosis based on material flows analysis and emergy evaluation approach: A case of Liuzhou city, China. Resources, Conservation and Recycling, 119, 78–88. https://doi.org/10.1016/j.resconrec.2016.06.007;*

[38]*Jurgilevich et al., 2016)*

[39]*WEF, 2014. Towards the Circular Economy: Accelerating the scale-up across global supply chains. World Economic Forum. http://www3.weforum.org/docs/WEF_ENV_TowardsCircularEconomy_Report_2014.pdf*

[40]*Wijkman, A; Skånberg, K. 2015. The Circular Economy and Benefits for Society. Club of Rome. https://www.clubofrome.org/wp-content/uploads/2016/03/The-Circular-Economy-and-Benefits-for-Society.pdf.*

[41] *Global Environment Facility. "Instrument for the Establishment of the Restructured Global Environment Facility". 2015.*

[42] *Bierbaum et al Delivering Global Environmental Benefits for Sustainable Development. Report of the Scientific and Technical Advisory Panel (STAP) to the 5th GEF Assembly, México 2014. http://www.stapgef.org/node/1602*

[43] Global Environment Facility. "Review of the GEF Operational Program 12: Integrated Ecosystem Management". 2000.

[44] *Bierbaum et al Delivering Global Environmental Benefits for Sustainable Development. Report of the Scientific and Technical Advisory Panel (STAP) to the 5th GEF Assembly, México 2014. http://www.stapgef.org/node/1602*

[45] *Global Environment Facility, Independent Evaluation Office ."The GEF in the Changing Environmental Financing Landscape". 2017.*

[46]*In "Fostering sustainability and resilience for food security in sub-Saharan Africa" the GEF is pursuing agricultural transformation and intensification which is both sustainable and resilient through the integrated management of natural resources – land, water, soils trees, and genetic resources - that underpin food and nutrition security. In "Taking Deforestation out of Commodity Supply Chains" the GEF is tackling the expansion of commodity production for beef, soy and palm oil, which accounts for about 70% of deforestation globally, through integrated supply chains which embed sustainability principles, and better practices, while supporting the conservation and protection of forests. In "Sustainable Cities" the GEF is implementing sustainable urban planning and management initiatives to deal with urban population growth and expansion as a driver of environmental degradation.*

[47] *Global Environment Facilty. "2020 Strategy for the GEF". 2014.*

[48] *The GEF contributes to SDGs 2, 6, 13, and 15 related to zero hunger, clean water and sanitation, climate action, and life-sustaining forests and biodiversity through the delivery of GEBs corresponding with multiple Multilateral Environmental Agreement targets" (IEO, 2017 ).*

[49] *International Council for Science. "A Guide to SDG Interactions: from Science to Implementation". 2017.*

[50] *Global Environment Facility (GEF). "GEF-7: Second Informal Update on Key Issues."2017.*

[51] *Global Environment Facility, Independent Evaluation Office ."The GEF in the Changing Environmental Financing Landscape". 2017.*

[52] *Scientific and Technical Advisory Panel of the Global Environment Facility (STAP/GEF)."Planning for integration: Addressing multiple benefits at project identification stage and in project design." 2016.*

[53] *Global Environment Facility, Independent Evaluation Office ."The GEF in the Changing Environmental Financing Landscape". 2017.*

[54] *Annette Cowie's letter to Monique Barbut and Braulio Dias, June 11, 2014: Recapping outcomes from meeting between Rosina Bierbaum, Monique Barbut, Braulio Dias, and Annette Cowie, Cancun Mexico 2014.*

[55] *O'Connell, D., Walker, B., Abel, N., Grigg, N. (2015) The Resilience, Adaptation and Transformation Assessment Framework: from theory to application. CSIRO, Australia.*

[56] *O'Connell, D., Abel, N.,Grigg, N., Maru, Y., Butler, J., Cowie, A., Stone-Jovicich, S., Walker, B., Wise, R., Ruhweza, A., Pearson, L., Ryan, P., Stafford Smith, M. (2016). "Designing projects in a rapidly changing world: Guidelines for embedding resilience, adaptation and transformation into sustainable development projects. (Version 1.0)". Global Environment Facility, Washington, D.C.*

[57] *Report of the Chairperson of the Scientific and Technical Advisory Panel of the GEF, May 2017.*

[58] *Global Environment Facility, Independent Evaluation Office ."The GEF in the Changing Environmental Financing Landscape". 2017.*

[59] *For step by step guidance on how to apply these elements, refer to the RAPTA guidelines: http://stapgef.org/rapta-guidelines*

[60] *Evaluation and monitoring of how successful GEF projects and programs have been in achieving their stated goals is the job of the Independent Evaluation Office (IEO); their guidance to the STAP on projects to evaluate for 'lessons learned' on integration and systems thinking has been invaluable.*

[61] *Tengberg, A., and Valencia, S. (2017). "Science of Integrated Approaches to Natural Resources Management" , A STAP Information Document. Global Environment Facility, Washington, D.C.*

[62] *Zazueta, A. (Draft) "'Principles for the Development of Integrated Transformational Projects in Climate Change and Chemicals & Waste. A STAP Information Document. Global Environment Facility, Washington, D.C.*