



Approach for reporting on ecosystem services

Incorporating ecosystem services
into an organization's
performance disclosure



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Editor:

Jack Boulter

Designer:

Tuuli Sauren,
INSPIRIT International Communications,
The Sustainable Design and Promotion group,
Brussels, Belgium

Global Reporting Initiative



Sean Gilbert (*left GRI in June 2011*)
Maaïke Fleur

United Nations Environment Programme World Conservation Monitoring Centre



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www.unep-wcmc.org

Mônica Barcellos Harris
Sharon Brooks
Tristan Tyrrell

CREM BV



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Wijnand Broer
Jolanda van Schaick



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Executive Summary

Organizations around the world interact with the ecosystems around them: having positive or negative impact, and reaping benefits. 'Ecosystem services' (ES) is a term used to capture the benefits that people derive from ecosystems, such as food, pharmaceutical products, timber, soil fertility, pollination, and freshwater. This publication elaborates on what ES are, and in which ways organizations interact with them. Companies impacting the services that ecosystems bring are increasingly aware of the need to factor ES into their long term strategy and operations, and manage them responsibly.

Ecosystems services has become an important definition. The idea of defining the "services" that ecosystems offer to business and society was considered essential to highlight the importance of ecosystems to the existence of products and services, as well as to the quality of life of all people.

Because of the global scale of the current economic development model, the health and existence of ecosystems is under pressure. In order to access more and scarce natural resources, to extend already large production scales and to grow urban areas, society's activities are expanding and profoundly changing ecosystems' power of regeneration.

This is a pressing topic for companies now and will be for many generations to come: how to guarantee society's activities and the maintenance of ecosystems at the same time. Because of that, impacts on ecosystems tend to be a very prominent topic when companies report about their contribution to the future of society, and about the risks they run as a business.

In cooperation with the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) and consultancy CREM, the Global Reporting Initiative (GRI) has been assessing opportunities to translate emerging thinking around ES into sustainability reporting indicators and approaches that can be used as a starting point by organizations in all sectors.

The linkages between organizations and ES are numerous and can be described through impacts, whereby an organization's activities cause a positive or negative change to ecosystems and their capacity to supply services, and dependencies, whereby an organization relies on regular and stable provision of particular ES for the continuation of its operations. Impacts and dependencies may move an organization to undertake actions that change its relationship to ecosystems and their services. Organizations respond to changes in ES through a range of means, such as impact mitigation strategies and substitution strategies to reduce dependency.

The approach of the current GRI Guidelines has been used as a basis for assessing options to report on ES. A distinction has been made between narrative reporting on strategy and management, and data reporting on performance.

Narrative reporting on strategy and management can be used to elicit the basic information for stakeholders to understand an organization's relationships to ES. It may challenge organizations to systematically assess the benefits they receive from the natural environment in the context of ES, their dependence on such benefits to continue their activities, any impacts on the supply of ES or on other beneficiaries of ES, and the economic risk they run under current management regimes. Reporting on ES will also enable organizations to communicate their actions in response to ES performance.

Performance reporting contains unique, individual pieces of numerical information that will change year to year and may reveal trends. Current reporting in line with the Environmental Performance Indicators of the GRI Guidelines reveals information on ecosystems pressures and responses to a certain extent, for example through Indicators on water, emissions and biodiversity. This could be extended with additional Indicators to communicate better a reporting organization's performance in the field of ES. One option outlined in this publication is that indicator development

focuses on the principal threats to ecosystems¹ in order to capture the key ways that organizations could be contributing to those threats on ES, and are dependent upon ES that are threatened. A key challenge here is how to roll up data that by its nature is very site-specific into aggregate figures for reporting on an organization-wide basis. Taking this option into consideration, this publication features a table exploring example corporate-level indicators based on the principal key threats to ecosystems. These indicators could be options for an organization to report on its pressures, impacts, dependence on and responses to ES.

Many of the example indicators listed do not directly measure ES, but are used as proxies that could reveal information on the actual ES. Generally however, they would require additional

data to actually reveal such information. For most performance data gathered, the only available techniques are to contextualize it in terms of ES: providing information that enables readers to understand the implications of reported data for changes in ES, either in terms of scale, nature of changes, or chain reactions initiated. Performance data could also be reviewed in relation to service potential and ecological limits, which involves an assessment of the percentage of an ES supply consumed by the organization in relation to use by other stakeholders, and thresholds for sustainable use.

The publication concludes with an elaboration on possible future uptake of ES in GRI's sustainability reporting guidance.

¹ Habitat loss and degradation; overexploitation and unsustainable use; climate change; pollution and nutrient load; and invasive alien species. (Secretariat of the Convention on Biological Diversity, 2010).



Glossary of terms in this paper

Term	Definition
Beneficiary	A stakeholder who benefits from ecosystem services provided.
Benefit	The advantage gained by people as a result of the ecosystem service provision.
Biodiversity	A contraction of biological diversity. "Biological diversity" means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species (genetic diversity), between species (species diversity) and of ecosystems (ecosystem diversity).
Cultural services	The non-material benefits obtained from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experience, including for example knowledge systems, social relations and aesthetic values.
Dependency	The reliance that an organization or other beneficiary has on ecosystem services and their continued delivery in the future.
Ecosystem	The dynamic complex of plant, animal, and micro-organism communities and their non-living environment interacting as a functional unit. Humans, where present, are an integral part of ecosystems. Examples include a rainforest, desert, coral reef, or a cultivated system. Ecosystems vary in size and complexity of interactions, and are interconnected and impacted by natural processes and human-induced factors. Ecosystems have no fixed boundaries; instead their parameters are set to the scientific, management, or policy question being examined. Depending upon the purpose of analysis, a single lake, a watershed, or an entire region could be considered an ecosystem.
Ecosystem condition	The amount or quantity of underlying physical resources which influence the ability of ecosystems to support ecosystem processes and deliver ecosystem services.
Ecosystem function	The physical, chemical and biological processes by which ecosystems deliver services and benefits, including decomposition, production [of plant matter], nutrient cycling, and fluxes of nutrients and energy.
Ecosystem services	The benefits that people derive from an ecosystem. These might include: • production of goods, e.g., food, fibre, water, fuel, genetic resources, and pharmaceuticals • regeneration processes, e.g., purification of air and water, seed dispersal and pollination • stabilizing processes, e.g., erosion control and moderation of weather extremes • life-fulfilling functions, e.g., aesthetic beauty and cultural value • conservation of options e.g., maintenance of ecological systems for the future.

Term	Definition
Ecosystem service indicators	Statistic or other benchmarkable information that communicates trends in the health and stability of ecosystem services in relation to an organization's activities (e.g., number of operations in water scarce areas consuming beyond sustainable levels, or change in soil pH from natural levels resulting from pollution and/or nutrient load caused by an organization's operations). Such indicators can relate to the condition and functioning of an ecosystem, its potential to supply services and/or the quality of the service delivered.
Environmental indicators	Statistic or other benchmarkable information that communicates environmental trends in relation to an organization's activities. They cover performance related to inputs (e.g., material, energy, and water) and outputs (e.g., emissions, effluents, and waste). In addition, they cover performance related to biodiversity, environmental compliance, and other relevant information such as environmental expenditure and the impacts of products and services.
Flow	The transfer of ecosystem services from the ecosystem to the beneficiary. Benefits can be received in the same or different geographical location as they are provided, and the flow of services can depend upon a number of ecosystem interactions.
Impacts	Impacts result from pressures exerted on ecosystem services by operational activities. They refer to either a positive or negative change in the supply of services and can occur through changes to the stock and/or flow of ecosystem services. The impact of a specific organization can be defined when such a change can be attributed to activities of the organization in question or as part of cumulative effects with other stakeholders. <i>Significant impact, as defined in the GRI Guidelines</i> Impacts that may adversely affect the integrity of a geographical area/region, either directly or indirectly. This occurs by substantially changing its ecological features, structures, and functions across its whole area and over the long term. This means that the habitat, its population level, and/or the particular species that make that habitat important cannot be sustained. On a species level, a significant impact causes a population decline and/or change in distribution so that natural recruitment (reproduction or immigration from unaffected areas) cannot return to former levels within a limited number of generations. A significant impact can also affect subsistence or commercial resource use to the degree that the well-being of users is affected over the long term.
Narrative reporting	Description of key impacts, risks, and opportunities. It concerns the additional information an organization provides to supplement performance data in order to more thoroughly describe its relationship with ecosystems and the services provided.
Organization	Private, public, or non-profit operating entity, varying in size, sector, and location.
Other stakeholders	See Stakeholders.



Term	Definition
Overexploitation	The utilization of services that exceeds their sustainable limits, so as to affect the ability of ecosystems to continue their provision, either for an organization or for other stakeholders. Overexploitation may have immediate or delayed consequences.
Performance indicators	Indicators that elicit comparable information on the economic, environmental, and social performance of the organization. This may concern either qualitative or quantitative information about results or outcomes associated with the organization that is comparable and demonstrates change over time.
Pressures	Human activities affecting an ecosystem, as a result of production or consumption processes, that can be categorized as: • <i>Usage</i> Usage defines the amount of ecosystem services consumed. Organizations cause pressures on ecosystem services by using them as inputs for their operations, such as fresh water, raw materials, and genetic resources. • <i>Discharges</i> Operations result in the outflow of by-products into the natural environment that may pressure ecosystem services, such as air emissions, noise, radiation, light, vibration and waste. • <i>Other activities that result in ecological changes</i> Organizations can cause various impacts to ecosystem services through which they draw no direct benefit. For instance, activities such as flooding or the introduction of invasive species may be as a result of shipping traffic in a coastal area.
Provisioning services	The products obtained from ecosystems including, for example, genetic resources, food and fiber, and fresh water.
Proxy indicators	A representative measure used to provide insight into the area of interest when it is not possible to measure the issue directly. In the context of ecosystem services, for example, the number of people visiting natural areas could serve as a proxy measure for spiritual services. While the number of visitors does not directly measure the spiritual benefits people garner from ecosystems, it does serve as a proxy by providing some insight into the level of this service provided by the natural areas.
Regulating services	The benefits obtained from the regulation of ecosystem processes including, for example, the regulation of climate and water flows, and biological control.
Responses	An action that can affect any part of the chain between pressures and benefits. An example of a response related to pressures is using technological solutions to regulate SO ₂ levels in flue gases.

Term	Definition
Stakeholders	Stakeholders are defined as entities or individuals that can reasonably be expected to be significantly affected by the organization's activities, products, and/or services; and whose actions can reasonably be expected to affect the ability of the organization to successfully implement its strategies and achieve its objectives. This includes entities or individuals whose rights under law or international conventions provide them with legitimate claims vis-à-vis the organization. Stakeholders can include those who are invested in the organization (e.g., employees, shareholders, suppliers) as well as those who have other relationships to the organization (e.g., vulnerable groups within local communities, civil society).
Stock	Stock refers to the capacity of ecosystems to deliver benefits. An ecosystem that is degraded has a reduced stock of services, and the flow of benefits is lower as a result.
Supporting services	Ecosystem services necessary for the production of all other ecosystem services. Some examples include biomass production, production of atmospheric oxygen, soil formation and retention, nutrient cycling, water cycling, and provisioning of habitat.



1. Introduction

1.1 Background

Environmental conservation has undergone a rapid paradigm shift in recent years and is increasingly concerned with maintaining ecosystems for people's welfare and well-being. This shift has been driven by both scientific recognition of the importance of ecosystems as key building blocks of environmental strategies and the practical goal of creating clearer links between markets and environmental and social development. However, most work to date has been aimed at the scientific and policy areas and there is now a wish to include ecosystem services in tools for organizational performance measurement and reporting.

Organizations traditionally measure environmental performance in terms of inputs and outputs related to their operations. Such flows are expressed in environmental indicators that can be identified, managed, and ultimately measured by an individual organization. Measuring the quality and flow of ecosystem services is a more complex task, with shared responsibilities for those affecting and benefiting from them. Such complexity is shown, for example, when looking at nutrient cycling. The relevance of nutrient cycling is clear at a conceptual level for a company reliant on agricultural produce, but it is not obvious how to define or measure an organization's performance with respect to this service. Measuring the financial value of ecosystem services to support corporate decision making is also challenging. To date, tools developed for organizational use have focused mainly on communicating the concepts of ecosystems and ecosystem services, and on helping organizations to understand dependencies, impacts and associated risks, while performance measurements and reporting on ecosystem services are generally focused on management activities and consumption of a few natural resources such as water.

The GRI Sustainability Reporting Guidelines include Performance Indicators that elicit comparable information on the economic, environmental, and social performance of an organization.

The GRI Environmental Indicators cover performance related to inputs (e.g., material, energy and water) and outputs (e.g., emissions, effluents and waste). In addition, these cover performance related to biodiversity, environmental compliance, and other relevant information such as environmental expenditure and the impacts of products and services. Some of the GRI Sector Supplements refer to ecosystem services; these references are included in Annex II.

1.2 Ecosystem services and reporting

In cooperation with the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) and consultancy CREM, the Global Reporting Initiative (GRI) has been assessing opportunities to translate emerging thinking around ecosystem services (ES) into sustainability reporting indicators and approaches that can be used as a minimum starting point by organizations in all sectors. The aim has been to provide a blueprint for how to more effectively measure, assess, and benchmark an organization's performance in relation to ES. In this context, it should be stressed that the GRI Guidelines can support sustainability reporting across an organization, while ES are generally characterized by their site-specific nature. The challenge to combine these into an approach for reporting on ES has been discussed with participants at four expert meetings². Draft conclusions have been shared with an Advisory Group established for project consultation, which then provided written feedback. The approach for reporting on ES presented in this publication demonstrates that progress can be made in this field, despite the challenges.

It is acknowledged that individual companies in particular sectors, such as food and agriculture, could take greater steps and use more specific sector-based ES performance metrics than proposed in this report. Complexities arise when discussing ES performance in standardized

² Nagoya, side event at the tenth Conference of the Parties to the Convention on Biological Diversity, 25 October 2010.
London, Ecosystem Services Indicator Workshop, 3 February 2011.
Sao Paulo, Ecosystem Services Indicator Workshop, 16 March 2011.
Rio de Janeiro, Ecosystem Services Indicator Workshop, 17 March 2011.

sustainability reporting applicable across all sectors. This report presents an approach to help tackle such complexities.

1.3 Document structure

This publication has been written in a sequence that will give the reader an insight into the field of ES, the realities of monitoring their status and the influence of organizational activities, and the feasibility of incorporating this information into sustainability reporting. It concludes with a description of the process for possible inclusion in the development of new generations of the GRI Sustainability Reporting Guidelines.

The following questions form the basis for the different sections:

What are ecosystem services and how do they relate to organizations?

Section 2 considers the background theory on ES, and explains the relationships between ES and organizations. It highlights the challenges in measuring impacts and dependency on ES.

How could reporting on ecosystem services performance be shaped?

Section 3 deals with the question of how to measure relationships between ES and organizations. It explains how narrative reporting can be used to elaborate the basics for stakeholders to understand a reporting organization's relationship to ES. In addition, example performance indicators to report on pressures, impacts, dependencies and response actions in respect to ES are presented, together with an approach of ES contextualization in respect to performance data.

Ecosystem services in future GRI reporting guidance

Section 4 looks at the potential to include disclosure requirements on ES in future updates of the GRI Reporting Framework.



2. What are ecosystem services and how do they relate to organizations?

2.1 Introduction

All organizations are dependent on ES, regardless of their size, sector or location. The extent to which each organization is reliant on ES, and the specific ES that are critical, depends on the nature of their activities and/or those of their value chain partners. For example, the availability of hardwood trees may be especially essential for companies involved in furniture production and construction, but may not be as important to a service industry such as catering.

This section explains what ES are (Section 2.2) and elicits their classification (Section 2.3). Section 2.4 elaborates on the ways in which organizations interact with ES in terms of impacts, dependencies and responses.

2.2 What are ecosystem services?

2.2.1 Defining ecosystem services

'Ecosystem services' (ES) is a term used to capture the benefits people obtain from ecosystems. These benefits are also often relevant for other species in the ecosystem, but in order to be classified as an ES there must be a human beneficiary. The benefits provided include food, pharmaceutical products, timber, drinking water, liveable climate, soil fertility, pollination, purification of air and fresh water. They vary considerably in *geographic scale*, whereby some services are local (such as soil formation), others regional (such as tidal regulation) and some global (such as climate regulation). There is also variation in the spatial distribution and degree of overlap between services, whereby some are received in the same geographical area in which they occur (such as raw materials), while others are received in different areas (such as pollination of plants in the surrounding area, and downstream

water regulation services from upland forested areas).

Another important characteristic of ES is the *connectivity between them*, whereby impacts on one ecosystem can impact adjacent ecosystems and affect the provision of other ES. This is illustrated for a system of mangroves, seagrasses and coral reefs in Figure 1. For example, when a company clears areas of natural forest to build infrastructure, it is at risk of impacting coastal ecosystems through increased sedimentation, leading to a loss of storm buffering services and a potentially resulting (future) damage to that infrastructure.

2.2.2 Delivery of ecosystem services

The delivery of ES is a process that starts with a minimum condition of an ecosystem and its ability to function. Condition and function are the core ingredients to enable an ecosystem to maintain a supply of ES. Although healthy ecosystems generally provide a greater array of services, even degraded ecosystems can still deliver some services. A healthy and functioning wetland is needed, for example, for water purification, but less healthy wetlands can still deliver salt production.

Figure 2 illustrates the concept of ES. The stock of ES comprises the ecosystem condition and function that indicates the capacity of that ecosystem to yield services (e.g., soil organic matter, air quality regulation and aesthetic enjoyment). The realization of these services depends on both the existence of a beneficiary and the flow of that service to the beneficiary.

For the purpose of this publication, the role of biodiversity as a core component of ES, and to some extent underpinning their provision, is inferred. There is ongoing debate as to the extent of this underpinning (e.g., Balvanera *et. al.* 2006).

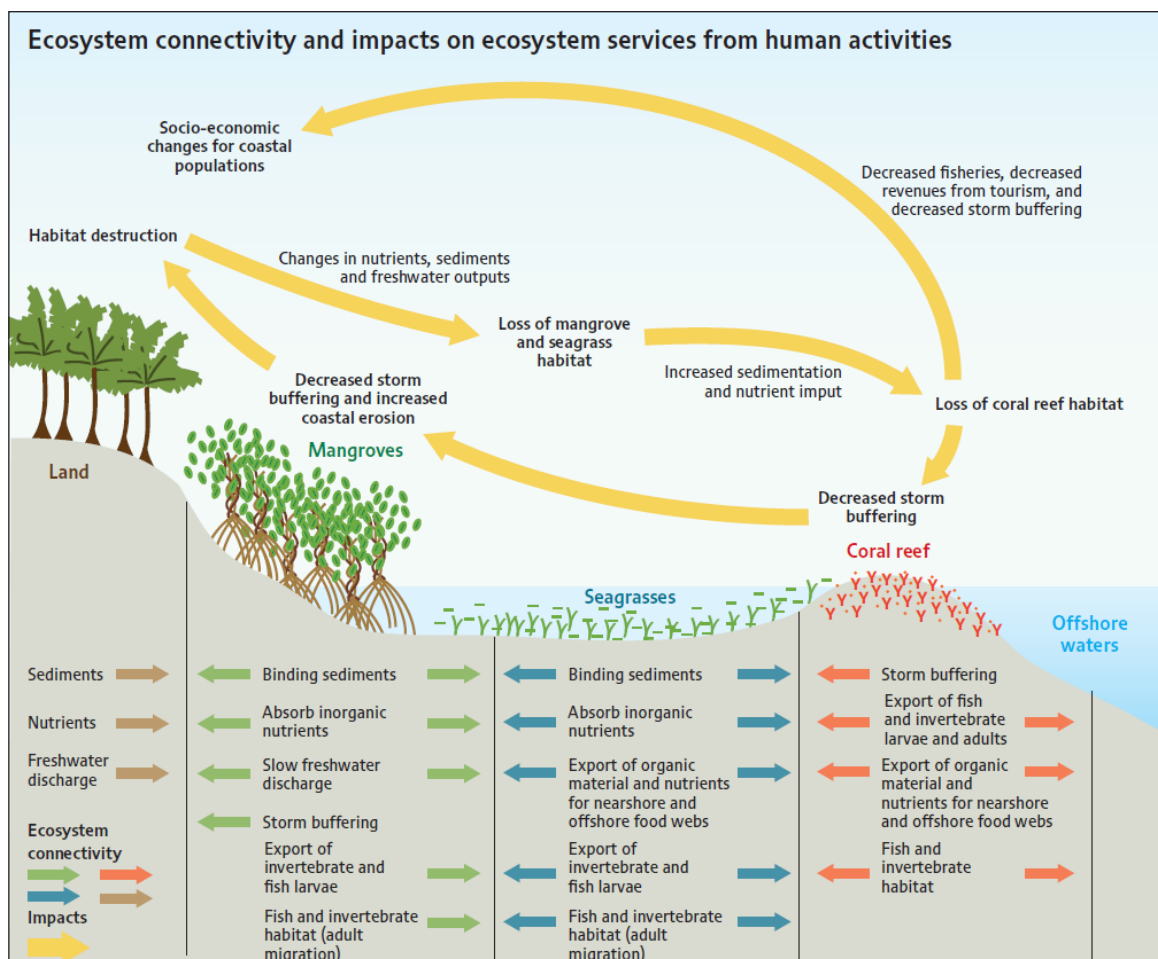


Figure 1. An example of ecosystem connectivity, showing mangroves, seagrasses and coral reefs. Ecological and physical connectivity between ecosystems is depicted for each ecosystem: terrestrial (brown arrows), mangroves (green arrows), seagrasses (blue arrows), and coral reefs (red arrows). Potential feedbacks across ecosystems from the impacts of different human activities on ecosystem services are also shown (yellow arrows). (Silvestri & Kershaw 2010).

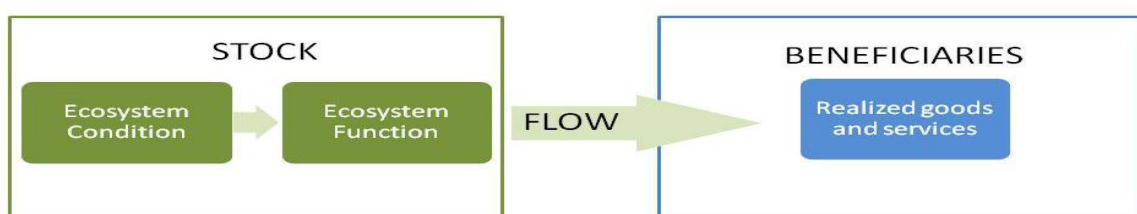


Figure 2. The concept of ecosystem services. Ecosystem condition and function comprise the 'stock' of ecosystem services. These 'flow' to 'beneficiaries' to become realized, now or in the future.



2.3 Classification of ecosystem services

The concept of ES gained significant attention through the Millennium Ecosystem Assessment (MA, 2005), which classified them as supporting (e.g., lifecycle maintenance), regulating (e.g., regulation of water flows), provisioning (e.g., food) and cultural (e.g., recreation). Nonetheless, the concept is continually evolving. A number of further definitions and classification systems have been developed as the concept becomes increasingly applied to valuation, assessment and reporting on ecosystems and their ability to sustain life. Some of the key frameworks developed are those of Fisher *et. al.* (2007), Balmford *et. al.* (2008), de Groot *et. al.* (2010), and the Ecosystem Services Indicators Database (ESID) framework developed by the World Resources Institute (WRI, 2010). For the purpose of this paper, the categorization in conformity with the MA classification is followed. Table 1 presents the classification of ES and details the service types that fall within each category.

2.4 The linkages between organizations and ecosystems: impacts, dependencies and responses

The linkages between organizations and ES can be described through *impacts*, whereby an organization's activities cause a positive or negative change to ecosystems and their capacity to supply services, and *dependencies*, whereby an organization relies on regular and stable provision of particular ES for the continuation of its operations. Impacts and dependencies can move an organization to respond, i.e., undertaking actions that can affect any part of the chain between pressures and benefits.

Impacts

Impacts refer to either a positive or negative change in the supply of services and can occur through changes to the stock and/or flow of ES.

The impact of a specific organization can be defined when such a change can be attributed to

Service category	Service types
Provisioning	1. Food 2. Water 3. Raw materials 4. Genetic resources 5. Medicinal resources 6. Ornamental resources
Regulating	7. Air quality regulation 8. Climate regulation (including carbon sequestration) 9. Moderation of extreme events 10. Regulation of water flows 11. Waste treatment 12. Erosion prevention 13. Maintenance of soil fertility 14. Pollination 15. Biological control
Habitat/Supporting	16. Lifecycle maintenance (e.g. migratory species, nursery habitat) 17. Maintenance of genetic diversity
Cultural [provide opportunities for:]	18. Aesthetic enjoyment 19. Recreation and tourism 20. Inspiration for culture, art and design 21. Spiritual experience 22. Cognitive development

Table 1. Classification of ecosystem services into provisioning, regulating, habitat/supporting and cultural services (UNEP-WCMC, 2011).

that organization's activities or as part of cumulative effects with other stakeholders.

Impacts result from pressures exerted on ES by operational activities. Pressures can be categorized as:

- **Usage**
Usage defines the amount of ES used. Organizations cause pressures on ES by using them as inputs for their operations, such as fresh water, raw materials, and genetic resources. Usage results in changes to ES by reducing availability to other stakeholders, future availability to the organization, or indirectly by removing a functional component of the ecosystem.
- **Discharges**
Operations result in the outflow of by-products into the natural environment that may pressure ES, such as air emissions, noise, radiation and light.
- **Other activities that result in ecological changes**
Organizations can cause various impacts to ES from which they draw no direct benefit. For instance, activities such as flooding or the introduction of invasive species may be as a result of shipping traffic in a coastal area.

Pressures may lead to a range of impacts on both the stock and flow of ES, which then can influence the benefits received from them. Many impacts involve a reduction in the resource base, for example through excessive extraction of water and materials, or through disturbance or degradation of ecosystems that provide the services. This may lead to a negative influence on the organization itself or on other stakeholders. In some cases, an organization can cause other stakeholders to have reduced access to services, thereby impacting the flow, without necessarily changing the stock of services available. This can occur through exclusion where access is denied, or through redirecting the service from one location to

another. While impacts can occur throughout the supply chain, they are often most dramatic at the production end of the chain. The extraction of natural resources and agricultural production are among those with the largest impacts on ES.

Dependencies

The reliance of an organization on ES and their continued delivery in the future defines an organization's dependence on ES. Organizations depend upon a large range of goods and services provided by ecosystems. These include the final products and raw materials of traded goods (e.g., fish, timber and medicine), those ES relied on to maintain productivity of systems (e.g., lifecycle maintenance, biological control), those ES that support manufacturing and extraction processes (e.g., flows of water), those ES that directly mitigate risk (e.g., moderation of extreme events through flood and storm defences), and those ES that offer less tangible yet valuable benefits (e.g., aesthetic enjoyment for recreation). Dependency can be both direct through usage, and indirect through non-consumptive reliance on ecological conditions.

While most dependency relationships with ES are realized in the present, they can also occur in the future, either through sustained supply or later opportunities for product development. This accounts for industries such as pharmaceuticals and cosmetics whereby the potential to discover new compounds and ingredients is incorporated into an organization's vision. Another example is bionics, whereby organizations apply methods and principles inspired by nature to the study and design of engineering systems and modern technology.

In order to fully understand dependency, an organization needs to be aware of the sustainability of service provision that they depend upon, which requires information on changes to the stock and flow of those particular services.



Box 1: The complexity of impacts and dependencies

Typically, impacts and dependencies are tied to the activities of an organization and its stakeholders, can be the result of single (such as tree felling) or multiple (such as infrastructure development) actions, and are often the result of cumulative actions and effects. Therefore, it can be difficult for individual organizations to isolate them.

Impacts can be categorized as follows:

- *Direct impact* – including excessive water use reducing water availability for all users in the area, pollution reducing numbers of pollinators, and carbon emissions affecting climate regulation.
- *Indirect or secondary impact* – including impacts resulting from direct effects of activities, such as water use causing a change in river flow that indirectly affects mangroves, leading to a loss of flood defence. Other examples include immigration to certain areas as a result of the availability of jobs or roads, leading to an increase in bushmeat hunting reducing wildlife populations. Indirect impacts also refer to effects further up or down the value chain of an organization - a trader in wood, for example, may itself cause little impact on the provision of ES but its activities cause impacts to occur elsewhere, such as increased demand potentially leading to unsustainable deforestation.
- *Cumulative impact* – impacts that occur in conjunction with other parties' actions. Examples include climate change as a result of cumulative GHG emissions, and water scarcity caused by a number of organizations using water from the same aquifer.

Dependency can be categorised as follows:

- *Direct dependence* – natural resources needed or used for an organization's operations (e.g., fresh water availability, timber products).
- *Indirect or secondary dependence* – many of the regulating and supporting services will indirectly benefit organizations (e.g., oceanic nutrient cycling essential to fish productivity, flood defence to infrastructure provided by a mangrove ecosystem). Moreover, indirect or secondary dependence refers to ES depended upon by supply chain partners, for example natural resources on which key suppliers depend.

The above impacts and dependencies can result in both linear and non-linear changes:

- *Linear change* – whereby changes to the provision of ES occur as a direct, straightforward consequence of a change in pressure produced by an organization, for example water quality declines with an increased level of effluent output.
- *Non-linear change* – whereby increases in pressure from an organization cause changes to the provision of ES in a more convoluted fashion. For example, changes only occur once a threshold of pressure is reached, often known as 'tipping points', which could lead to ecosystem collapse that is prohibitively expensive or even irreversible. Eutrophication is a good example of a non-linear ecosystem change.

Box 1 provides a synopsis of the differing forms that impacts and dependencies may take.

It should be realised for both dependencies and impacts that:

- These relationships are not mutually exclusive: more than one of the above relationships can take place at the same time. In fact, an organization's dependence on a service may also lead to an impact, although this is not always the case. Also, many of the direct impacts will lead to indirect impacts to occur. Reduced water availability leading to a loss of habitat and associated services is one example.
- All of these can occur over different geographical scales, from local to global impacts and dependencies, as well as over different timeframes.
- All of these can occur throughout the value chain, from production and manufacturing through to consumption and disposal.

Responses

Impacts and dependencies may move an organization to undertake actions that change its relationship to ecosystems and their services. Responses comprise all actions organizations take in relation to their linkages with ES. For example, an organization may implement mitigation measures to reduce negative impacts on ES as well as to maintain the capacity of ecosystems to render services, especially when an organization depends on specific ES. Apart from reducing a negative impact, an organization may also want to promote positive effects on ES through the adoption of sustainable management systems, or undertaking of specific initiatives such as payments for environmental services (PES) schemes. An example of the latter is when an organization reimburses forest owners or farmers for their contributions to conserve ES the organization uses. Responses can also include actions to adjust activities in order to shift away from the use of certain ES, for example because these ES are in decline.

The relationships between organizations and ES are numerous and are illustrated in Figure 3. The figure follows the flow of how combined pressures of an organization and other stakeholders, as well as natural causes, drive changes to the stock

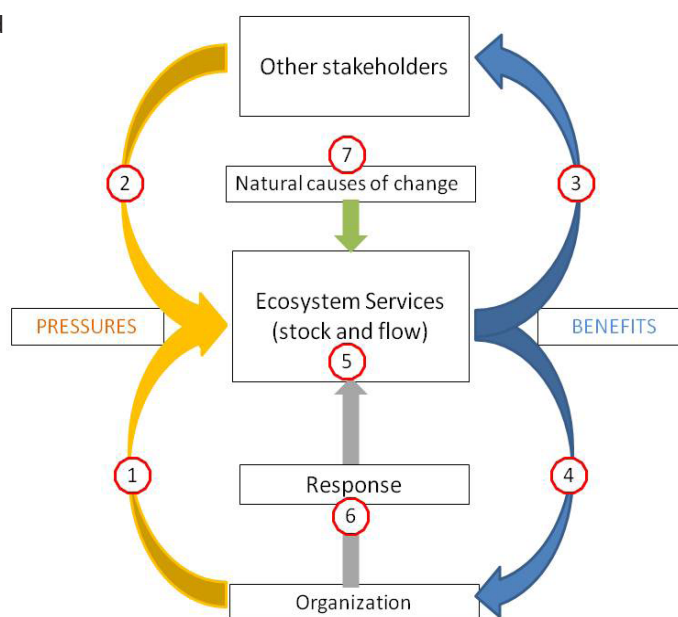


Figure 3. The linkages between organizations and ecosystem services. *The organization and other stakeholders generate pressures that can impact the stock and flow of ES. They also derive benefits from ES in the form of provisioning, cultural services, supporting and regulating services. ES stock and flow can also be impacted by natural causes of change, as well as by the responses of the organization.*

and flow of ES. At the same time, an organization and other stakeholders are drawing upon ES for their own activities (NB: ES impacted through operational pressures are not necessarily the same ES an organization depends upon). Organizations respond to changes in ES through a range of means (such as impact mitigation strategies, substitution strategies to reduce dependency). Each of these relationships provides an opportunity for developing metrics and indicators and these are detailed below (the numbers corresponding to those in Figure 3):

1. Organizational pressures. These consist of all pressures that an organization places on ES, including usage, discharge, and other activities that result in ecological changes (e.g., habitat clearance, introduction of invasive species).
2. Pressures of other stakeholders (usage, discharge, other activities that result in ecological changes).



3. Benefits gained by other stakeholders from ES (directly and indirectly).
 4. Benefits gained by the organization from ES (directly and indirectly).
 5. Changes in the stock and flow of ES. Those linked to identified pressures provide information on impacts, whereas changes in the stock and flow of ES depended upon can give information on the sustainability of supply.
 6. Responses of an organization to mitigate impacts, reduce dependency and/or increase the stock and flow of ES.
 7. Natural causes of change affecting ecosystems and services rendered.
- Indicators developed on the pressures and resulting change in ES stock and flow can be generically referred to as **IMPACT** indicators, whereas those that look at the benefits derived and the sustainability of supply can be referred to as **DEPENDENCE** indicators.

Box 2: Examples of the overall picture of linkages between organizations and ecosystem services

Examples of measurements that can be made to capture the important relationships between an organization's activities and ES illustrated in Figure 3 are presented for two hypothetical case studies below. They do not comprise the full range of potential measurements.

Example 1 – production of bottled water

1. **Organizational pressures** – withdrawal of water
2. **Other stakeholders' pressures** – water withdrawal, pesticide use, land conversion, soil erosion – all likely to affect water quality and quantity
3. **Other stakeholders' dependence** – freshwater quality and quantity from aquifer for irrigation, recreational use
4. **Organizational dependence** – freshwater quality and quantity from aquifer
5. **Change in ES** – change in aquifer water quality and quantity
6. **Responses by organization** – mitigation measures to ensure required quantity and quality of freshwater for an organization's operations: improve water quality through payments for environmental services (PES) schemes and decrease water withdrawal through implementation of new technologies in organization's bottle production
7. **Natural causes** – precipitation rate variation affecting groundwater table levels

Example 2 - shrimp farming

1. **Organizational pressures** – conversion of a natural system causing a loss of mangrove
2. **Other stakeholders' pressures** – any clearing of mangrove caused by local activities
3. **Other stakeholders' dependence** – aquatic resources, land protection, and water desalination
4. **Organizational dependence** – nutrients for shrimp production, water purification, water supply
5. **Change in ES** – change in water quality and nutrient supply, change in fish and other aquatic resource production, measurement of erosion and water salinity
6. **Responses by organization** – mitigation measures for an organization's operations, including replanting of mangrove, community support projects through supply of water, employment
7. **Natural causes** – precipitation rate variation affecting seawater level

3. Reporting on performance in relation to ecosystem services

3.1 Introduction

As illustrated in Figure 3 (Section 2.4), relationships between organizations and ES are numerous and can be categorized as impact relationships (pressures on and changes in ES), dependence relationships (direct and indirect benefits and sustainability of supply), and responses of an organization that can refer to both its impact and dependence on ES. This section searches for a line in reporting that captures these relationships.

In assessing options to report in the field of ES, the approach of the current GRI Guidelines has been followed. A distinction can be made between narrative reporting on strategy and management, and data reporting on performance. Generally, **narrative reporting on strategy and management** (Section 3.2) entails semi-structured text, usually in paragraph form, offering, for example, strategic and management implementation information, while **performance reporting** (Section 3.3) contains unique, individual pieces of information that change year-to-year and may reveal a trend. Both narrative reporting on strategy and management and performance reporting are needed in the field of ES reporting – since they are complementary – to provide the full picture of a reporting organization's impacts, dependence and responses.

3.2 Narrative reporting on strategy and management

GRI has included sections on 'Strategy and Profile' and 'Management Approach' in its Guidelines. These are defined in the current GRI Guidelines (p.19, G3 and G3.1 versions) as:

- **Strategy and Profile:** Disclosures that set the overall context for understanding organizational performance such as its strategy, profile and governance.

- **Management Approach:** Disclosures that cover how an organization addresses a given set of topics in order to provide context for understanding performance in a specific area.

As such, reporting on strategy and management offers an opportunity to elaborate on how an organization acts in specific fields, and how societal concerns and trends are responded to by an organization. A narrative discussion can be used to elicit the basics for stakeholders to understand an organization's relationship to ES. The broad themes of impact and dependency may serve as stepping stones for reporting on strategy and management, which require the reporting organization to provide an analysis of the data gathered on pressures, benefits and any impacts on the supply of ES, as well as on other beneficiaries of ES, and enable the communication of responses (e.g., impact mitigation strategies). Consistent measurement, analysis and reporting will enable an organization to detect long term issues and trends in ES impacted and depended upon in contrast to a once-only occasion, since in some systems there will be a lag between decline in the condition and function of ecosystems and delivery of benefits derived from them.

While a number of related assessment processes already exist (e.g., environmental impact assessments, social impact assessments, internal risk assessments), many organizations do not systematically assess the benefits they receive from the natural environment in the context of ES, their dependence on such benefits to continue their activities, and/or the economic risk they run under their current management regimes. In order for an organization to properly assess its relationship with ES, a number of fundamental questions should be considered:

Key impacts and dependencies

1. Does the organization understand which key ES it uses and on which it is dependent for continued supply to support its operations?



2. Has the organization mapped the key ES it has an impact on, both positively and negatively, quantitatively and/or qualitatively?
3. Do the organization's impacts limit or enhance the ability of others to benefit from these ES?
4. Which methodologies have been applied to identify and monitor key ES impacted and/or depended upon?
5. Has the organization's supply chain been included to identify key ES impacted and/or depended upon?

ES-related risks and opportunities

6. What are the conditions and trends in supply and demand of key ES services impacted and/or depended upon?
7. Has the organization assessed which risks and opportunities arise due to these trends?
8. Has a strategy been articulated in response to risks and opportunities? For example: Have efforts been undertaken to address potential risks related to a diminished supply of key ES? Will operational management be adjusted to, or purchasing procedures anticipate, possible changes in the availability of ES the value chain depends upon?
9. Has information on the availability of key ES and a potential rise in costs been factored into management plans?
10. Do key ES depended upon have cost-effective substitutes?
11. What are the linkages between an organization's activities, sustainable ecosystem service provision, and the long term viability and continuity of the organization?

ES governance

12. What is within the organization's scope for monitoring and mitigation/restoration activities to maintain the health of underlying ecosystems and contribute to the long-term provision of the quantity and quality of key ES? What is outside the organization's control (e.g., natural changes, use by other stakeholders)?
13. How does the organization manage trade-offs when prioritizing some ES over others?

14. Does the organization take into account values placed upon ES by local communities?

3.3 Performance reporting

3.3.1 GRI Performance Indicators

Current reporting in line with the Environmental Performance Indicators of the GRI Guidelines reveals information on ES pressures and responses to a certain extent, for example through Indicators on water, emissions and biodiversity (see Table 3)³. The data in response to these Indicators could be used to assess an organization's ES performance. Reporting on environmental pressures and responses could, however, be extended with additional indicators to better communicate a reporting organization's performance in the field of ES, especially since the Indicators currently included in the GRI Guidelines mainly cover only provisioning services.

In order to adequately qualify as a GRI Performance Indicator, certain criteria have to be met. These are explained in Box 3.

An indicator can be either *qualitative* or *quantitative*. An example of a qualitative GRI Indicator is "Water sources significantly affected by withdrawal of water" (EN8). Quantitative performance reporting requires a unit of measure to report upon in order to be comparable, consistent, and benchmarkable. Potential units of measure are in volume, numbers, mass, or size (e.g., litres, hectares, kilogram and CO₂e). As Table 2 shows, in relation to the indicator criteria in Box 3 there are a number of (mostly provisioning) types of ES for which a direct unit of measurement is known and therefore can facilitate reporting on ES.

3.3.2 Challenges to developing ecosystem services performance indicators

ES include a wide variety of service types: provisioning, cultural, regulating and supporting. Each individual ES can require a range of measurements to effectively capture its environmental and social dimensions, and its interconnectedness with other ES. Selecting a few

³ ES are also specifically mentioned in several GRI Sector Supplements, such as in the Mining and Metals Sector Supplement and the Food Processing Sector Supplement (see Annex II).

Box 3. Criteria for indicator design

GRI has defined Performance Indicators as 'indicators that elicit comparable information on the economic, environmental and social performance of the organization'. When Performance Indicators for GRI are being developed, there are five basic criteria to adhere to. These are:

- **Relevance** – Indicators should result in information about the organization that is relevant to decision making by report users. In addition, an indicator needs to be able to address the overall objectives of organizations and stakeholders.
- **Comparability** – Indicators should result in information that shows change over time and that can be compared with other similar institutions.
- **Unbiased/neutral** – Qualitative indicators should be unbiased/neutral in their phrasing or intent. For example, they should not use adjectives or other terms that imply a judgement. They should focus on objective information that enables readers to make decisions, and allow for changes over time to be recorded. Therefore, rather than asking: "whether the organization has implemented adequate management plans", an indicator should ask "how many management plans the organization has in place that contain x, y, z."
- **Clarity** – Indicators should be clear to a report preparer or user about what impacts or aspects of performance they are trying to measure. The language and terminology of an indicator should be clear enough that it will be interpreted and applied in a consistent manner.
- **Feasibility** – Indicators need to be feasible to measure and reasonable in order to expect disclosure.

Ecosystem Service	Potential unit of measurement for (part of the) quality and/or volume
Food	Volume or weight, e.g., kg, litre; area planted in hectares
Fiber	Volume or weight, e.g., kg, litre; area planted in hectares
Biomass fuel	Volume or weight, e.g., kg, litre; area planted in hectares
Freshwater	Litre
Genetic resources	% of DNA diversity
Biochemicals, natural medicines, and pharmaceuticals	Volume or weight, e.g., kg, litre; area planted in hectares
Recreation and tourism	Number (e.g., of visitors or jobs related to nature-based or eco-tourism), € (e.g., revenue from nature-based or eco-tourism)

Table 2. Ecosystem Services and their units of measurement.

to report on is quite challenging. Taking the list of ES types (see Table 1), it may be considered that all are important, but the focus and materiality would be different depending on factors such as a reporting organization's sector, a specific point in time, specific activities and a particular situation.

Moreover, as detailed in Section 2, for each ES in question, it is possible to report on a number of different factors including organizational

pressures, impacts, dependencies and responses on the ES stock and flow, as well as dependence and impacts of other beneficiaries. There are, therefore, a multitude of potential measurements that can be made. Measurements of pressures can often be carried out with a high degree of accuracy, since these data are generally held by an organization itself. Reporting on the change in ES stock and flow can be particularly challenging



for some ES, and often beyond the capabilities of individual organizations. Companies typically lack sufficient scientific staff and resources to undertake the necessary field assessments. Also, it can be questioned whether companies can be expected to undertake such exercises rather than this information being supplied by scientific institutions or authorities, for example. Moreover, scientific knowledge in the field of ecosystem services and the relationship between changes to function and condition, and changes (enhancement or disruption) to different services provided by a particular ecosystem, is still the focus of much ongoing research.

Another challenge for reporting is the fact that changes in ES may be the result of natural changes and may be caused by a combination of different pressures from a variety of stakeholders. Separating the changes in ES caused by an organization from natural changes and pressures of other stakeholders may prove very difficult. This is further confounded by the connectivity between different ES, whereby it may be difficult to determine the pressure that has caused any change identified.

Developing ES-related indicators is also challenged by their site-specific nature. Apart from a few exceptions, such as climate regulation, the optimal way to measure ES is site-specific, since the ecological characteristics and beneficiaries vary by location. To serve organization-wide reporting, indicators need to be developed in such a way that the information from various sites can be meaningfully aggregated.

To overcome such challenges, the following strategies for performance reporting are outlined:

1. Develop indicators based on the five key threats to ES (Section 3.3.3), using proxy indicators for ES performance in case metrics about the ES themselves are not deemed feasible for corporate level measurements.
2. Frame performance data in an ES context, in case additional information is needed to provide insights into a reporting organization's ES performance.

3.3.3 Strategies for developing ES performance indicators

As one option, it is suggested that indicator development focuses in part on the principal threats to ecosystems (CBD, 2010 - see References) in order to capture the key ways that organizations could be contributing to these threats, as well as being dependent upon those ES that are threatened. Moreover, these threats can be considered relevant for all organizations and sectors. Per the approach suggested in Figure 3, indicators are also suggested that will help to "tell a story" about the organization's impact and dependence on ES, as well as their response to mitigate threats and support those ES depended upon.

The main threats on ES for which indicators are suggested are:

- Habitat loss and degradation (impacting ES such as water cycling and erosion prevention)
- Overexploitation and unsustainable use (impacting ES such as the provision of food and raw materials)
- Climate change (impacting ES such as climate regulation and regulation of water flows)
- Pollution and nutrient load (impacting ES such as pollination and recreation)
- Invasive alien species (impacting ES such as biological control and genetic resources)

Performance Indicators within the GRI Framework are aimed at reporting on an organization-wide basis⁴. The key challenge here is combining ES-related data, which by its nature is *site-specific*, into aggregate figures. Some pressure data can be aggregated at the group level by adding up performance metrics, such as the amount of CO₂ emitted, the volume of pesticides used, or the size of natural land converted into production locations. Other metrics could be summarized

⁴ This paper addresses attention for ES in organization-wide reporting in conformity with GRI's general Reporting Guidelines. GRI has also issued Sector Supplements that would be fit for inclusion of specific ES indicators that take into account the characteristics of the sector in question (in this respect, see also Annex II for examples obtained from the Mining and Metals Sector Supplement and the Food Processing Sector Supplement).

by describing trends or frequency of occurrence across the organization's portfolio. For example, a site-based indicator may show the actual change in soil depth or soil pH, whereas a corporate-level indicator would show the number and location of sites where soil degradation is occurring. Scorecards for site-level application could be developed to obtain data to be aggregated on group level. Other examples are the percentage of farming operations that have access to healthy pollinator populations, or the percentage of production locations in water scarce regions. A basis for this kind of indicator can be the use of global ecosystem services maps provided by international institutions, and research organizations that provide information on ES around the world, such as water availability and soil quality. The location of production sites could be associated with information given on ecosystems. Some of the important pressures may be located further down the value chain and therefore not be within the direct scope of an organization. However, given that impacts on ES are often most severe at the production side of the supply chain, efforts need to be made to address them in reporting. Obtaining information on sites not directly managed poses the challenge of full transparency and cooperation throughout the supply chain.

In addition to indicators that work to aggregate site-level information on ES, corporate level indicators could work to highlight progress regarding management of ES. For example, the number of operations that have management plans on ES and their threats (such as the introduction of invasive species, climate change).

Such management-based performance indicators would work particularly well for individual sectors. For example, agricultural companies could report on the number of operations that use integrated pest management or precision agriculture, indicating limited use of pesticides and other agrochemicals. Or, paper and wood-based companies could disclose the percentage of inputs from certified sources, serving as an indication of their impact on natural forests and the ES they provide.

3.3.4 Example reporting indicators in the field of ecosystem services

Table 3 explores a range of organization-wide indicators based on the five key threats to ecosystems. These example indicators provide options for reporting organizational pressures, impacts, dependence on, and responses to, ES. In addition to presenting indicators that address pressures on ecosystems and ES, Table 3 suggests indicators that address impacts on other beneficiaries of ES, and responses to those impacts. Also included are GRI Environmental Performance Indicators from the current Guidelines that are relevant, but mostly do not sufficiently invite comprehensive reporting on ES in their current format. Many of the indicators listed do not measure ES directly; nevertheless, they may serve as meaningful proxies at organization-wide level.

Recognizing that, in some cases, an organization's *dependence* on a particular ES can also be a *pressure* (e.g., water consumption), there is some overlap between the pressure and dependence indicators.



Table 3. Examples of indicators related to the key threats to ecosystems⁵.

Key threats to ecosystem services	Available and potential performance indicators for reporting on ecosystem services			
	Possible future reporting indicators			GRI Environmental Performance Indicators with a (potential) link to ecosystem service related Pressures/impacts (P), Dependence (D) and Response (R)
	Pressures/Impacts on ecosystem services and their beneficiaries (P)	Organization's Dependence (D)	Response (R)	
Habitat loss and degradation	– Change in extent of natural land and/or intact biomes altered, broken down by size and type of alteration – Number of hectares of land area of buffer zones converted to other uses by the organization – Economic loss due to disruptions from organization-induced land-use change – Number of natural resource-dependent people impacted by organization-induced land-use change – Number of land disputes raised – Number of people with denied access to natural resources within areas of operation	– Location and size of land used directly (i.e., land owned, leased and/or managed by the organization) or indirectly (i.e., land exploited by value chain partners to produce input materials) for the purpose of the organization's operations, broken down by size and ecosystem type – Ecosystems/ ecosystem services present from which benefits are derived by the organization (e.g., flood defense, aquifer protection, raw materials, pasture) – Amount of natural resources needed in 5 years (e.g., (fertile) cultivated land, undeveloped land, raw materials (fish, timber) and water) to continue operations of the organization and those of its value chain partners – Level of exposure of the organization to natural disasters (e.g., flooding) as a result of habitat loss and degradation – Number and nature of pollinating species needed for operations of the organization and those of its value chain partners	– Adoption of credible, internationally recognized responsible production standards for natural resources harvested, produced, traded and consumed by the organization – Percentage of providers complying with credible, internationally recognized responsible standards (including nature of label and volume and identity of products) against the total number of providers – Number of community-based habitat restoration projects, including number of people addressed through these projects – Number of compensation programs for people impacted by land-use change, including number of people addressed through these projects – Number of hectares and type of restored habitats or reforested areas – Number and nature of policies implemented to counteract habitat degradation	– Location and size of land owned, leased, managed in, or adjacent to, protected areas and areas of high biodiversity value outside protected areas (EN11) (P) – Description of significant impacts of activities, products, and services on biodiversity in protected areas and areas of high biodiversity value outside protected areas (EN12) (P) – Habitats protected or restored (EN13) (R) – Strategies, current actions, and future plans for managing impacts on biodiversity (EN14) (R)

⁵ The relevance of indicators will vary by company and sector and can be assessed through the same types of materiality analysis as used on other issues and indicators. For example, a shipping and logistics company will be more likely than an automotive producer to have a direct role in increasing or slowing the spread of invasive species.

Key threats to ecosystem services	Available and potential performance indicators for reporting on ecosystem services			
	Possible future reporting indicators			GRI Environmental Performance Indicators with a (potential) link to ecosystem service related Pressures/impacts (P), Dependence (D) and Response (R)
	Pressures/Impacts on ecosystem services and their beneficiaries (P)	Organization's Dependence (D)	Response (R)	
Habitat loss and degradation		Revenues and employment realized from nature-based tourism	- Area of production site set aside to protect stocks of natural resources - Number of hectares of natural land and/or intact biotopes within production/concession areas being managed by the organization	
Overexploitation and unsustainable use	- Volume of water consumed by the organization by source related to total water availability in areas of operation, including identification of water sources significantly affected by withdrawal of water - Nature and amount of natural resources harvested, produced, traded and/or consumed (e.g., crops, fish, timber, fiber) by the organization in relation to safe ecological limits - Number of operations in water scarce areas consuming beyond sustainable levels - Number of water disputes raised	- Total demand for freshwater of sufficient quality - Number and location of operations in water scarce areas, set out against importance of sites for continuation of activities (e.g., in relation to supply) - Level of availability of natural resources (e.g., crops, fish, timber, fiber) needed for the continuation of the organization's operations - Level of genetic diversity indispensable for input natural resources and future product development	- Number of production sites under sustainable management (e.g., related to water, maintenance of soil fertility or pollinating species, flood protection) - Percentage of natural resources used that are recycled input materials - Volume of inputs from sources produced in compliance with credible, internationally recognized responsible production standards (including nature of label) - Number of community-based restoration or stock management projects, including number of people addressed through these projects - Implementation of activities to compensate for the exploitation of natural resources (e.g., support of protected areas)	- Materials used by weight or volume (EN1) (P) - Percentage of materials used that are recycled input materials (EN2) (R) - Total water withdrawal by source (EN8) (P) - Water sources significantly affected by withdrawal of water (EN9) (P) - Percentage and total volume of water recycled and reused (EN10) (R) - Initiatives to mitigate environmental impacts of products and services, and extent of impact mitigation (EN26) (R)



Key threats to ecosystem services	Available and potential performance indicators for reporting on ecosystem services			
	Possible future reporting indicators			GRI Environmental Performance Indicators with a (potential) link to ecosystem service related Pressures/impacts (P), Dependence (D) and Response (R)
	Pressures/Impacts on ecosystem services and their beneficiaries (P)	Organization's Dependence (D)	Response (R)	
Overexploitation and unsustainable use	– Number of operations where people have denied access to, or insufficient abundance of natural resources (e.g., fish, timber), as a result of the organization's operations – Economic cost of compensation to local communities for lost natural resources		– Number of sourcing areas prioritized for ecosystem service management and actions due to high ecosystem stress (e.g., water scarcity, land conversion or erosion) and/or input of natural resources of which the production is linked to degradation of ecosystems (e.g., due to agricultural practices or extraction methods)	
Climate change	– Nature and total amount of direct and indirect greenhouse gas emissions and ozone-depleting substances – Total loss or gain in area of forest as a result of organizational operations or those of its value chain partners – Mass of CO₂ emissions from deforestation as a result of organizational operations or those of its value chain partners	– Economic cost to the organization due to climate related disasters (e.g., flooding, crop failure) – Amount of natural CO₂ sequestration needed to make the organization's operations CO₂ neutral	– Adoption of energy saving devices and strategies – Area of forest planted by or by order of the organization, including amount of CO₂ sequestered – Percentage of sustainably produced green energy (own or purchased) in comparison to total energy consumption	– Direct energy consumption by primary energy source (EN3) (P) – Indirect energy consumption by primary source (EN4) (P) – Energy saved due to conservation and efficiency improvements (EN5) (R) – Initiatives to provide energy-efficient or renewable energy based products and services, and reductions in energy requirements as a result of these initiatives (EN6) (R) – Initiatives to reduce indirect energy consumption and reductions achieved (EN7) (R) – Total direct and indirect greenhouse gas emissions by weight (EN16) (P) – Other relevant indirect greenhouse gas emissions by weight (EN17) (P) – Emissions of ozone-depleting substances by weight (EN19) (P) – NO, SO, and other significant air emissions by type and weight (EN20) (P)
Pollution and nutrient load	– Change in soil pH from natural levels resulting from pollution and/or nutrient load caused by the organization's operations	– Economic cost of artificial pollination services within operation areas – Economic cost of water purification technologies adopted	– Number of production sites using precision agriculture – Volume of inputs from sources complying with credible, internationally recognized responsible production standards (including nature of label)	– NO, SO, and other significant air emissions by type and weight (EN20) (P) – Total water discharge by quality and destination (EN21) (P) – Total weight of waste by type and disposal method (EN22) (P) – Total number and volume of significant spills (EN23) (P)

Key threats to ecosystem services	Available and potential performance indicators for reporting on ecosystem services			
	Possible future reporting indicators			GRI Environmental Performance Indicators with a (potential) link to ecosystem service related Pressures/impacts (P), Dependence (D) and Response (R)
	Pressures/Impacts on ecosystem services and their beneficiaries (P)	Organization's Dependence (D)	Response (R)	
Pollution and nutrient load	– Proportion of production sites with water pH and salt content above set threshold levels – Total liters of effluents discharged measured against critical loads – Total water discharge by quality and destination, including identification of ecosystems significantly affected – Economic loss due to lost ecosystem services resulting from an organization's pollution (e.g., oil spill) and runoff – Economic loss resulting from a decline in harvested natural resources (e.g., fish, crops) as a result of polluted habitats – Number of people affected by polluted habitats as a result of organization's activities, e.g., through declines in harvested species and lack of clean water – Change in catchment level of river sediment yields caused by the organization's operations	– Nature and amount of natural resources used (e.g., reed fields, forest, wetlands) to purify discharges – Management of natural vegetation by an organization to control erosion	– Number of production sites under sustainable management directed at the mitigation of pollution (e.g., proper discharge of hazardous waste, ecologically safe discharges and reduced artificial nutrient application)	– Identity, size, protected status, and biodiversity value of water bodies and related habitats significantly affected by the reporting organization's discharges of water and runoff (EN25) (P)
Invasive alien species (IAS)	– Number of IAS introduced as a result of operations (e.g., construction of new production site, transport) – Number of production sites economically impacted by IAS (e.g., as a result of reduction of water quality or quantity)	– Economic cost of artificial pollination services within operation areas due to IAS – Economic costs of a loss of native harvested species as a result of IAS	– Number of operations with a monitoring plan for the identification of entry of IAS – Number of implemented policies to avoid the introduction of IAS (e.g., through special measures during transport)	– Significant environmental impacts of transporting products and other goods and materials used for the organization's operations, and transporting members of the workforce (EN29) (P)



Key threats to ecosystem services	Available and potential performance indicators for reporting on ecosystem services			
	Possible future reporting indicators			GRI Environmental Performance Indicators with a (potential) link to ecosystem service related Pressures/impacts (P), Dependence (D) and Response (R)
	Pressures/Impacts on ecosystem services and their beneficiaries (P)	Organization's Dependence (D)	Response (R)	
Invasive alien species (IAS)	– Number of people affected by a loss of native harvested species as a result of IAS from organization's activities – Economic impact of controlling diseases caused by introduced crop pests associated with the organization's operations		– Number of sites with an eradication plan for IAS in place, including the status of the plan	

Some example indicators are visualized in Figures 4, 5, 6, 7 and 8. They show how reporting could be based on aggregated site-level information to

measure and monitor performance over time, and how global maps can present an organization's activities related to ES.

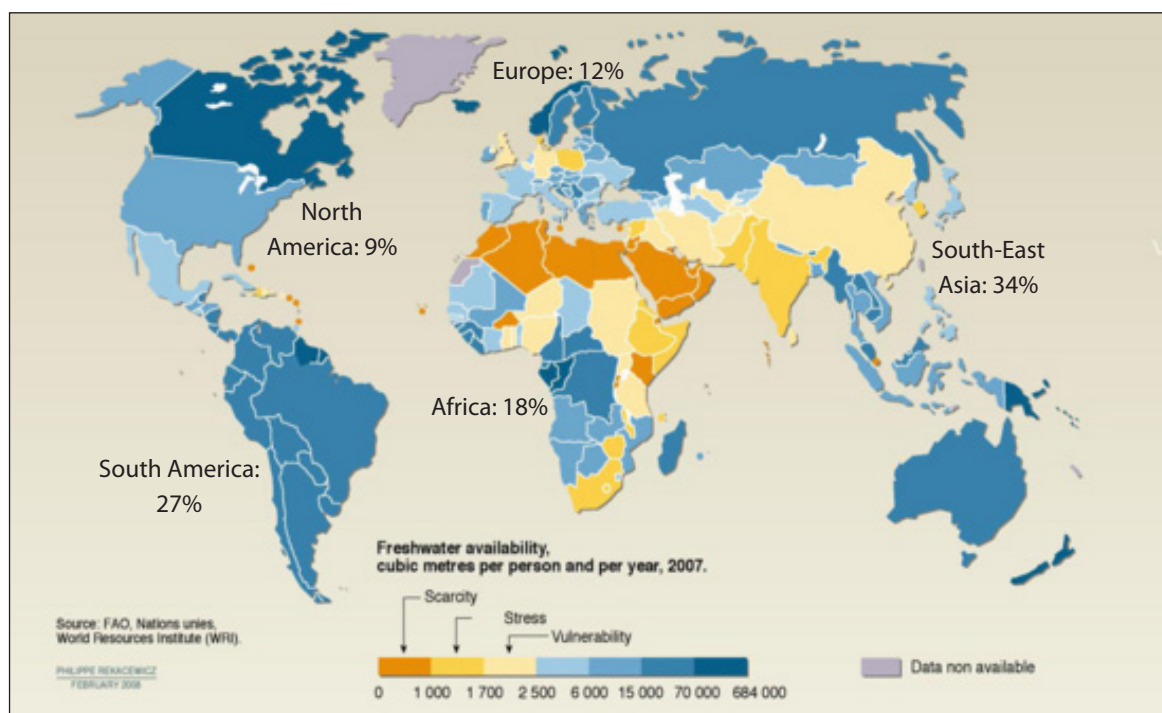


Figure 4. Example of reporting on possible future ES indicator: Sourcing regions mapped against global water stress and scarcity. An organization could prioritize its ecosystem service management and actions by focusing on sourcing regions that face high ecosystem stress (e.g., water scarcity, land conversion or erosion). The example given maps sourcing regions for the organization's operations against a global ecosystem service map with respect to water stress and scarcity.
(Source of map: <http://maps.grida.no/go/graphic/global-waterstress-and-scarcity>)

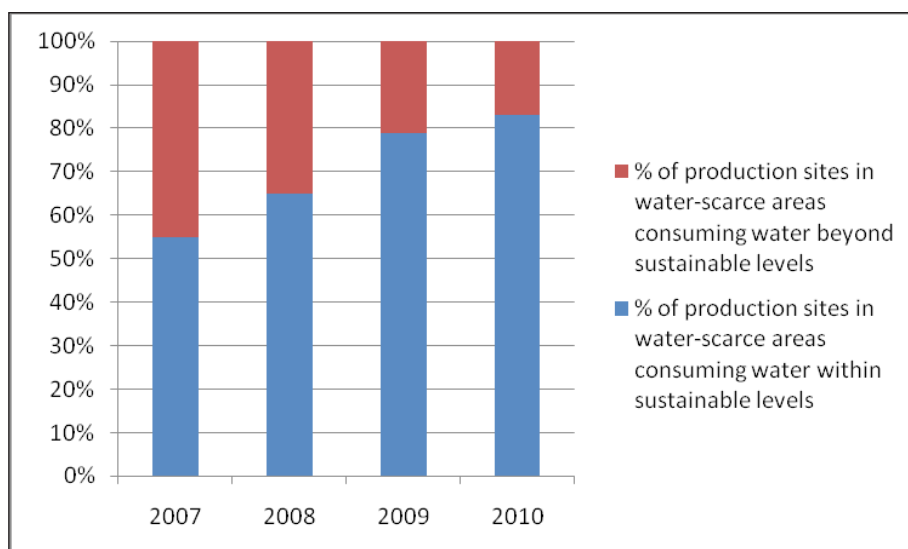


Figure 5. Example of reporting on possible future ES indicator: Water consumption performance of production sites in water-scarce areas. *The volume of water consumed by the production sites assessed against the total water availability in areas of operation may indicate whether or not consumption is beyond sustainable levels. It should be noted that such levels, or thresholds, may change over time due to reduced supply, an increase in the number of beneficiaries, or other reasons. These levels should, therefore, be investigated regularly.*

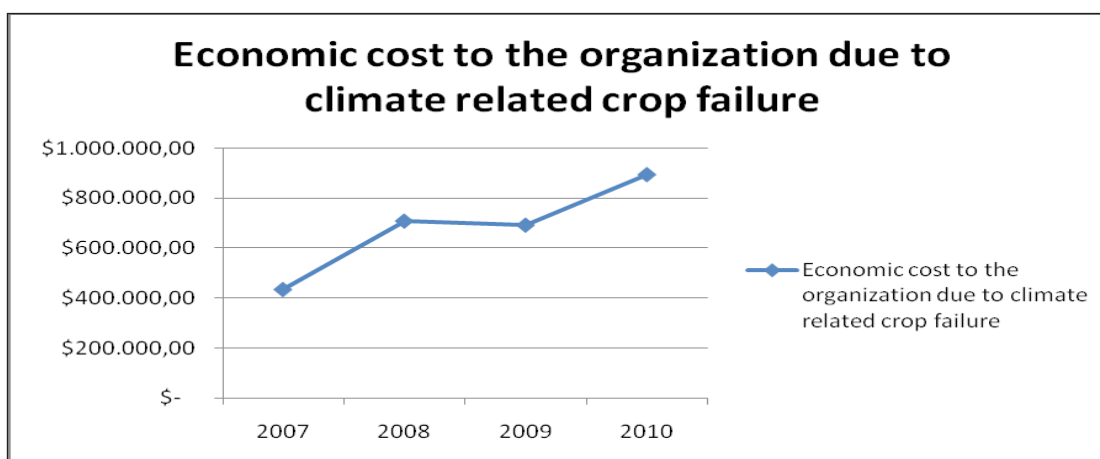


Figure 6. Example of reporting on possible future ES indicator: Economic costs to the organization due to climate related disaster. *Climate change could result in lost revenues or additional costs as a result of flooding or crop failure, for example. Figure 6 shows the economic cost to an organization due to climate related crop failure.*

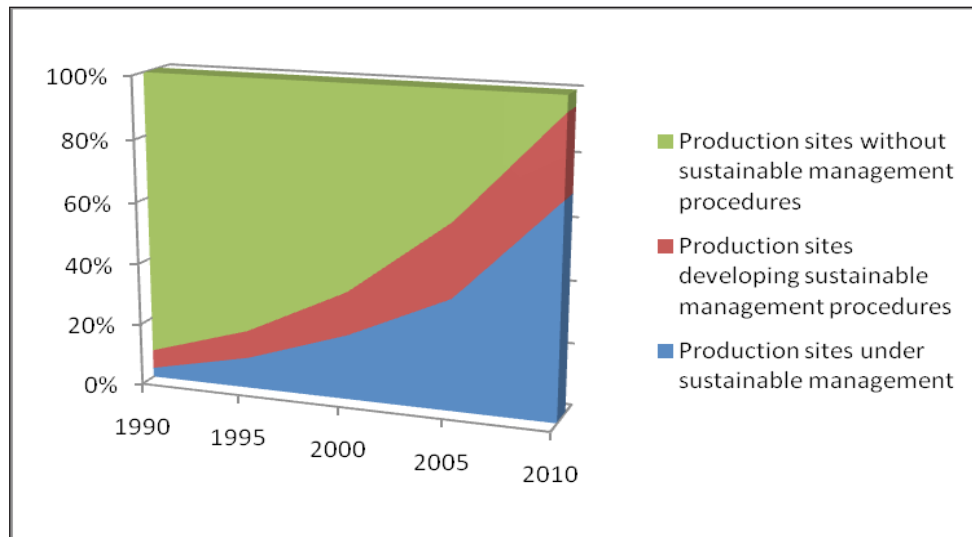


Figure 7. Example of reporting on possible future ES indicator: Percentage of production sites under sustainable management. Sustainable management can relate to, for example, water, maintenance of soil fertility or pollinating species, or flood protection. An organization could develop a scorecard inserting items that are relevant in terms of 'sustainable management' for its production sites.

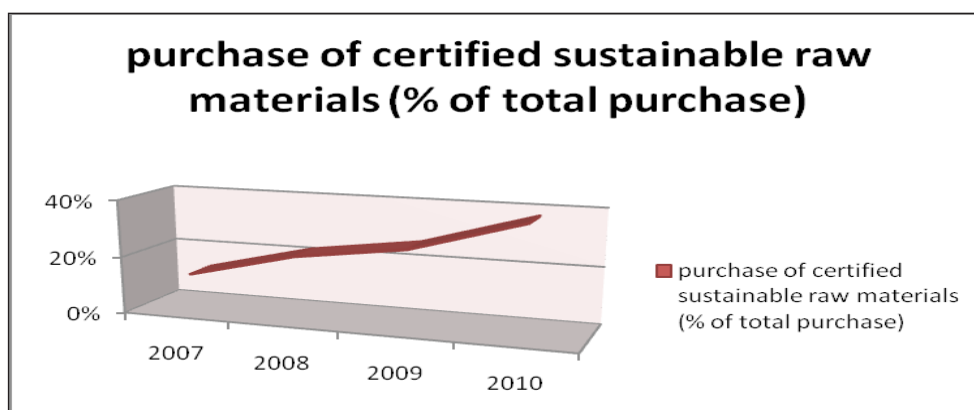


Figure 8. Example of reporting on possible future ES indicator: Purchase of certified sustainable raw materials. Credible, internationally recognized responsible production standards help to address key threats to ecosystem services such as overexploitation and unsustainable use. Organizations could adopt these standards for natural resources they harvest, produce, trade and/or consume.

No single indicator can tell the full story; however, a combination of indicators addressing pressures, impacts, dependence and responses, in addition to a narrative on strategy and management, ought to provide a comprehensive overview of an organization's ES performance.

Organizations may want to *connect* reporting on indicators, as some impacts and dependencies may not exist in isolation. Management and mitigation indicators can then be used to help an organization demonstrate to its stakeholders how it is responding to specific issues over time and at different sites. For instance, changing natural habitat for the purpose of road construction may also inadvertently cause the introduction of an invasive alien species, pollute nearby water courses, and increase CO₂ emissions, which the organization will address with different strategies on different sites.

3.3.5 Framing performance data into an ecosystem service context

Table 3 includes Indicators from the GRI Guidelines, as well as other potential indicators that could be used to assess a reporting organization's performance in the field of ES. These are linked to operational pressures, impacts, dependencies and responses, though generally are not ES metrics alone (section 3.3.2 explains the challenges in this respect). As such, some of the listed performance indicators are merely proxies for actual ES stock and flow; these indicators generally require additional information.

In a few limited cases, it is possible to rely on standard coefficients to estimate the impact on ES of particular levels of performance. For example, it is possible to estimate global warming potential of different air pollutants and place these in the context of their overall contribution to climate change. However, this can only be done for a small set of data. For most performance data gathered, the only available techniques are to contextualize the information in terms of ES, i.e., providing information that allows readers to understand the implications of reported data for changes in ES, either in terms of scale, nature of changes, or chain reactions initiated.

Context reporting

Placing reported data into an ES context can include techniques to present performance data in relation to total loading (e.g., placing an organization's specific discharges in relation to the total number of such discharges, as well as in the context of the capacity of ecosystems to process such discharge). Performance data could also be reviewed in relation to service potential and ecological limits, which involves an assessment of the percentage of an ES supply consumed by the organization in relation to use by other stakeholders and thresholds for sustainable use. While some of these data may have already been gathered as part of environmental impact assessments, such actual data may be difficult to obtain in reality. Narrative information to understand the implications of an indicator would be helpful in these cases. This can include an explanation of the chain of causality that links performance and ES change, or commenting on the potential scale of ES change without estimating actual numbers. For example, one of the key drivers of impact with respect to the ecosystem service of 'pollination' is the use of pesticides negatively impacting bee populations. Such a potential impact can therefore be directly linked to the nature and amount of pesticides used by an organization, which may already be reported on as part of the GRI Indicator 'Description of significant impacts of activities, products, and services on biodiversity in protected areas and areas of high biodiversity value outside protected areas' (EN12). Putting these data in a 'pollination' context to illustrate the relationships at play (even without knowing the exact number of bee populations impacted) is valuable and enables an organization to report on its relationship to ES.

Other examples of context reporting include explaining the:

- effect of fertilizers used for agricultural production and run off to the ground water in the context of local soil structure, absorption and transmission of chemicals, health of the local ecosystem and impacts on the water quality;
- contribution of CO₂ emissions from deforestation discussed in the context of climate



change (due to the loss of the carbon storage function and the release of stored carbon into the atmosphere) and its implications;

- effect of specific waste on the pH value of natural water bodies and resulting impacts on water quality and biodiversity;
- extent to which an organization's operational practices or products influence the spread of invasive species;
- contribution of NO_x emissions to acid rain and a description of impacts on the state of specific ecosystems affected;
- volume of SO_x discussed in the context of local

ambient air quality and the effects of emitting a certain quantity using available data on regional pollutant levels and dose-response functions; and

- potential beneficial outcomes of a forest restoration project for local communities (e.g., flood regulation, water regulation, access to non-timber forest products).

To support reporting, information on the condition of ecosystems gathered by others (e.g., government, research institutions, NGOs, and local experts) can be used to put information into context (e.g., coupling water scarcity data and water use data).

4. Ecosystem services in future GRI reporting guidance

The landscape of sustainability reporting is continuously evolving. More stakeholders than ever – including regulators, investors, rating agencies and NGOs – are asking for the non-financial (or sustainability) data which increasingly influences companies' financial results.

The GRI Sustainability Reporting Guidelines have followed this evolution closely. The general requests for reporting on such issues are summarized in the GRI Guidelines after formal and informal international consultations with representatives from business, civil society and labor, but also with investors, consultants and experts. GRI refers to this as an international multi-stakeholder process. The current version of the Guidelines - G3 and the expanded G3.1 - is available for free download from the GRI website. Details of the GRI Guidelines development are also available there.

In 2011, GRI started the development of the new generation of the Guidelines: G4. At the beginning of 2011, surveys targeted at GRI stakeholders asked for suggested improvements to GRI's guidance for existing reporting topics, and suggestions for new sustainability reporting topics that should be considered in the development of the updated Guidelines.

Not surprisingly, ecosystem services was among the topics suggested by respondents in the 2011 surveys. This guarantees that this topic will be part of the discussions about the future of reporting on the impacts companies' activities have on ES⁶.

As stated previously, reporting on existing GRI Performance Indicators may begin to indicate

the pressures, impacts and dependencies that an organization has on ES (see Table 3). On a high level, GRI Environmental Indicators that request data on the significant environmental impacts of products and services, and their transportation, may steer organizations towards a consideration of ecosystems and ES. Other GRI Indicators covering land ownership and management ask for data on habitats restored or protected, impacts on areas of high biodiversity value, and on strategy and plans for managing impacts on biodiversity. Indicators focused on water usage seek disclosure on sources of water withdrawal and impacts on these sources, on amounts of recycled and reused water, and on the biodiversity value of water bodies affected by discharges. Although ecosystems are not referenced specifically, the varied Indicators covering energy use and emissions may also direct organizations' attention towards ES, by providing data on energy consumption and efficiency, and emissions of GHGs, ozone depleting substances, and other significant air emissions.

ES is clearly implicated in two GRI Sector Supplements – for the Food Processing and Mining and Metals sectors (see Annex II). Both Supplements have amendments to their Indicators on biodiverse habitats, including water bodies being added to the type of habitats covered in the Food Processing Sector Supplement (FPSS). The FPSS also features new content on the sourcing of raw materials. This includes asking reporters to identify their most significant dependencies upon ecosystems, and guidance on how to report their sourcing strategy for the sector-specific Aspects of Protecting Natural Resources, Minimizing Toxicity, Traceability, Animal Welfare and Biofuels.

Furthermore, the introduction to the Mining and Metals Sector Supplement states that biodiversity includes ecosystems and “the goods and services that they provide”, with a definition of ES added to Indicator EN14 (Strategies, current actions, and future plans for managing impacts on biodiversity).

⁶ Following due process, the improvements and new topics suggested in such surveys are presented to GRI's Technical Advisory Committee for analysis. Selected topics then undergo further public exposure in order to be prioritized. Ultimately, GRI convenes multi-stakeholder Working Groups to develop first drafts of new Guidelines content. Working Group composition is influenced by the proposals for new content. Final drafts of guidance are influenced once again by international public consultation, before being presented to GRI's governance bodies, which vote for or against their release.



But – still – the most challenging task for the future of reporting guidance and impact measurement is: *how to create organization-wide reporting guidance focused on ES specifically*, rather than reaching ES disclosures via general environmental reporting or reporting on biodiversity and ecosystems.

While the challenges of this task are many, this publication is a vital resource for examining the available options. Its authors hope that it represents the beginnings of ES reporting guidance that is explicit, comprehensive and practical, increasing our potential to preserve the benefits of ecosystems for people, planet and profit.

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Annex I: Acknowledgments

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Pippa Howard, Fauna & Flora
Rachel Jackson, ACCA
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Robert Shaw
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Steven de Bie, Shell Nederland
Suzanne Ozment, WRI
Unica

Annex II: Reference to ecosystem services in GRI Sector Supplements

Sustainability Reporting Guidelines & Food Processing Sector Supplement

Contents

In this publication, Food Processing sector content has been integrated into the G3 Guidelines. The Disclosures and Performance Indicators in the Food Processing Sector Supplement make up the reporting framework for all organizations active in the food processing sector.

Relevance for reporting on ecosystem services

Parts of the Food Processing Sector Supplement that could (potentially) be linked to the topic of ecosystem services have been quoted below:

Sourcing

Sourcing has been identified by the Working Group for this Supplement and other contributors as a new issue of critical importance to the sustainability of the food processing sector. The sector depends on primary production, such as agriculture and fisheries, for its raw materials. Obtaining raw materials directly from primary producers, brokers, commodity markets or some combination of these carries inherent material risks (e.g. child labor, water scarcity), which can affect food processing companies and society. Primary production is often outside the direct control of food processing organizations and yet gives rise to major risks for this sector. It is therefore important to emphasize the need for the reporting organization to consider sustainability throughout the organization's supply chain (vertically), while recognizing that its scope for action is primarily through its direct (first tier) suppliers.

In order to address the immense variety of company influences on sourcing chains, any disclosure approach must allow companies and key stakeholders to focus their efforts on the most important issues in the sourcing chain by using the principle of materiality. The purpose of taking this approach is to enable the reporting organization to identify the most significant impacts that its supply chain has on society, the economy and the environment, as well as the

significant dependences⁷ on ecosystems and social services that may exist within its supply chain.

Disclosure on Management Approach

The following factors, among others, may contribute to increased material risk and could be used by the reporting organization in the materiality assessment of its supply chain.

The suppliers' raw material is:

- Produced in an area of resource constraint
- Produced in a region of high conservation value
- Produced in an area of social, political or economic vulnerability

For each identified material Aspect, the reporting organization should provide a concise disclosure of the sourcing management approach taken to the Aspects within each category of the G3:

- Economic
- Environment
- Labor
- Human Rights
- Society
- Product Responsibility

The reporting organization should also provide a disclosure of the sourcing strategy taken to the following sector-specific Sourcing Aspects:

- Protecting Natural Resources
- Minimizing Toxicity
- Fair Trade
- Fair Compensation for Labor
- Traceability
- Genetically Modified Organisms (GMO⁸)
- Animal Welfare
- Biofuels

⁷ An example of dependence on an ecosystem service is where a key supplier to the reporting organization is dependent on a steady supply of clean water from a water-scarce catchment. The steady provision of the water is a service provided by the ecosystem of the catchment. See the WRI Ecosystem Services review for a tool to assess dependence on ecosystem services. An example of social dependence is when a key supplier to the reporting organization depends upon the availability of casual labor to operate during peak periods of output.

⁸ GMOs and biofuels are included as an Aspect here because they are of significant concern to some stakeholders.



The reporting organization should explain how those of the above Aspects that are considered material are incorporated into the organization's sourcing strategies and processes. The reporting organization should state how it integrates sustainability considerations throughout its supply chain into its purchasing criteria. The reporting organization should indicate its management approach to sourcing under each of the elements listed below.

Policy

Briefly state the reporting organization's policies that define its overall commitment to the six G3 and eight Food Processing sector Sourcing Aspects listed above.

Goals

The reporting organization should state its goals for each relevant Sourcing Aspect.

Performance

The reporting organization should state the indicators that it is using to demonstrate its progress against its stated goals. Use indicators additional to the GRI Performance Indicators (as needed) to demonstrate progress.

Purchasing decision-making

The reporting organization should state how it ensures integration of sustainability considerations into its purchasing decisions.

Management responsibility

The reporting organization should state which level of management is responsible for managing the above Sourcing Aspects.

Training and awareness

The reporting organization should state how it raises awareness and provides training within the organization about the above Sourcing Aspects.

Monitoring and Follow-Up

The reporting organization should state its performance against the above goals, and any corrective and preventive actions taken.

Additional Contextual Information

The reporting organization should provide additional relevant information required to understand its performance, such as:

- Key successes and shortcomings

- Major organizational risks and opportunities
- Major changes in the reporting period to systems or structures to improve performance
- Key strategies for implementing policies or achieving performance

Sourcing Performance Indicators

Two relevant new core indicators have been inserted, being:

ASPECT: ACROSS ALL ASPECTS OF SOURCING

- | | | |
|-------------|---|-----------|
| CORE | FP1 Percentage of purchased volume from suppliers compliant with company's sourcing policy. | FP |
| CORE | FP2 Percentage of purchased volume which is verified as being in accordance with credible, internationally recognized responsible production standards, broken down by standard. | |

Environment

Environmental Performance Indicators

Three relevant commentaries have been made, being:

ASPECT: MATERIALS

- | | |
|-------------|--|
| CORE | EN1 Materials used by weight or volume. |
|-------------|--|

Food Processing Sector-Specific Commentary on EN1 Indicator Protocol:

Commentary added to specify wild caught and farmed seafood and other identified raw materials.

ASPECT: BIODIVERSITY

- | | |
|-------------|--|
| CORE | EN11 Location and size of land or waters owned, leased, managed in, or adjacent to, protected areas and areas of high biodiversity value outside protected areas. |
|-------------|--|

Food Processing Sector-Specific Commentary on EN11 Indicator Protocol:

Commentaries added to include waters.

EN13 Habitats protected or restored.

ADD

**Food Processing Sector-Specific
Commentary on EN13 Indicator
Protocol:**

ADD

Commentaries added to include water.

FP

Product Responsibility

Product Responsibility Performance Indicators

One relevant commentary has been made, being:

ASPECT: CUSTOMER HEALTH AND SAFETY

CORE

PR1 Life cycle stages in which health and safety impacts of products and services are assessed for improvement, and percentage of significant products and services categories subject to such procedures.

**Food Processing Sector-Specific
Commentary on PR1 Indicator Protocol:**

CORE

- Commentary added to include the assessment of significant environmental and social impacts across the life-cycle stages of products and services.
- Compilation added to report on procedures, steps and results.

FP

**Sustainability Reporting Guidelines &
Mining and Metals Sector Supplement**

Contents

In this publication, Mining and Metals sector content has been integrated into the G3 Guidelines. The Disclosures and Performance Indicators in the Mining and Metals Sector Supplement make up the reporting framework for all organizations active in the mining and metals sector.

**Relevance for reporting on ecosystem
services**

Parts of the Mining and Metals Sector Supplement that could (potentially) be linked to the topic of ecosystem services have been quoted below:

Environment

A relevant commentary has been made in the introduction, being:

**Mining and Metals Sector-Specific
Commentary:**

For the purposes of this Sector Supplement, the term 'biodiversity' includes ecosystems and the goods (e.g. timber, fodder, natural medicines, freshwater) and services (e.g. climate regulation, water purification, soil production, air quality regulation) that they provide.

MM

Disclosure on Management Approach

A relevant commentary has been made in respect of 'Emissions, Effluents, and Waste' (one of the Environmental Aspects to be reported upon in the Disclosure on Management Approach), being:

**Mining and Metals Sector-Specific
Commentary:**

The disclosure on management approach regarding Emissions, Effluents, and Waste should include discussion of:

- Processes to assess and manage risks associated with overburden, waste rock, tailings, sludges and other residues (for example, structural stability of storage facilities, metal leaching potential, and hazardous properties).

MM



- Types of tailings facilities that it owns or operates including riverine, lake and submarine tailings disposal, and the use of lined vs. unlined pits.
- Approaches taken to minimize waste and its potential environmental impacts.
- The management of fugitive emissions such as dust from mining and processing activities or noise and seismic impacts from explosives use through, for example, monitoring activities and compliance with regulatory limits.

MM

Environmental Performance Indicators

Five relevant commentaries have been made and three relevant new core indicators developed, being:

ASPECT: BIODIVERSITY

- CORE**
- EN12** Description of significant impacts of activities, products, and services on biodiversity in protected areas and areas of high biodiversity value outside protected areas.

Mining and Metals Sector-Specific Commentary on EN12 Indicator Protocol:

- Commentary added to emphasize the link to resettlement and closure activities.
- Compilation added to report on biodiversity impacts of resettlement or closure.

MM

- CORE**
- MM1** Amount of land (owned or leased, and managed for production activities or extractive use) disturbed or rehabilitated.

MM

- ADD**
- EN13** Habitats protected or restored.

Mining and Metals Sector-Specific Commentary on EN13 Indicator Protocol:

Compilation added to report on biodiversity offsets.

MM

- ADD**
- EN14** Strategies, current actions, and future plans for managing impacts on biodiversity.

Mining and Metals Sector-Specific Commentary on EN14 Indicator Protocol:

- Commentary added to describe the relevance of ecosystems services.
- Commentary added to compilation to invite reporting on ecosystems services and approaches.
- Definition added for 'ecosystems services'.
- References added.

MM

- CORE**
- MM2** The number and percentage of total sites identified as requiring biodiversity management plans according to stated criteria, and the number (percentage) of those sites with plans in place.

MM

ASPECT: EMISSIONS, EFFLUENTS, AND WASTE

- CORE**
- EN22** Total weight of waste by type and disposal method.

Mining and Metals Sector-Specific Commentary on EN22 Indicator Protocol:

Commentary added to clarify the scope of waste in relation to MM3.

MM

- CORE**
- MM3** Total amounts of overburden, rock, tailings, and sludges and their associated risks.

MM

- CORE**
- EN23** Total number and volume of significant spills.

Mining and Metals Sector-Specific Commentary on EN23 Indicator Protocol:

- Commentary added to clarify the scope of spillages.
- Compilation added to report on the outcome of spillage incidents.

MM

Society

Society Performance Indicators

One relevant new core Indicator has been developed, being:

ASPECT: RESETTLEMENT

CORE

MM9 Sites where resettlements took place, the number of households resettled in each, and how their livelihoods were affected in the process.

MM

Product responsibility

Disclosure on Management Approach

A relevant addition has been made in respect of Management Approach items to be reported upon, being:

The list of Management Approach items with respect to the Product Responsibility Aspects has been extended with:

- Materials Stewardship

Product Responsibility Performance Indicators

One relevant new core Indicator has been inserted, being:

ASPECT: MATERIALS STEWARDSHIP

CORE

MM11 Programs and progress relating to materials stewardship.

MM



Global Reporting Initiative
PO Box 10039
1001 EA Amsterdam
The Netherlands

Tel: +31 (0) 20 531 00 00
Fax: +31 (0) 20 531 00 31

www.globalreporting.org