Guidelines for conducting Integrated Environmental Assessments

UN environment

Foreword

UN Environment is pleased to provide new Guidelines for Conducting Integrated Environmental Assessments. With the leadership of the Assessment Methodologies, Data and Information Group under the Global Environment Outlook, the participation of several of its members in the drafting and review process as well as a core group of authors, these Guidelines are now available for application by Integrated Environmental Assessment Practitioners and for consultation by the Integrated Environmental Assessment user community.

This document is the result of UN Environment Member State requests in both Governing Council and the UN Environment Assembly and is meant to provide guidance for a wide range of different types of Integrated Environmental Assessments. These can range from global to regional to rapid response assessments and emerging issues assessments. The Guidelines should be considered a 'living document' since they will be used and improved throughout the sixth Global Environment Outlook process as well as other on-going assessment processes.

We hope that Practitioners and Users alike will find the Guidelines informative and user friendly. We look forward to your thoughts and suggestions for improving them.

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Glossary

Some key terms used in the text below are defined here. The remaining sections of the glossary can be found here [link to glossary at the back of the document]

Advisory Bodies – Groups of individuals with particular expertise or responsibility in areas of interest in the Integrated Environmental Assessment. These groups may have policy, technical or scientific expertise and will guide the Secretariat and Practitioners on key questions and decision points during the Integrated Environmental Assessment process.

Assessment Findings – These can include: facts, data and information that establish the state of the environment; options for action that address the identified environmental challenges; pathways which might be chosen to achieve particular environmental objectives in the future.

Commissioning Entity – The body that establishes the mandate for the Integrated Environmental Assessment. This typically includes the definition of the timeline for the Integrated Environmental Assessment and the provision of funding to carry out the assessment.

Data: Consists of facts, numerical observations and statistics that describe some aspect of the environment and society, such as water quality and demographics (Abdel-Kader 1997). A basic component of indicator data needs to be processed so that it can be used to interpret changes in the state of the environment, the economy or the social aspects of society (Segnestam 2002).

Environmental Assessment - The entire process of undertaking an objective evaluation and analysis of information designed to support environmental decision making. It applies the judgment of experts to existing knowledge to provide scientifically credible answers to policy –relevant questions, quantifying where possible the level of confidence. It reduces complexity but adds value by summarizing, synthesizing and building scenarios, and identifies consensus by sorting out what is known and widely accepted from what is not known or not agreed. It sensitizes the scientific community to policy needs and the policy community to the scientific basis for action. (UNEP 2010)

Indicator: Observed value representative of a phenomenon to study. Indicators point to, provide information about, and describe the state of the environment with significance extending beyond that directly associated with the observation itself. In general, indicators quantify information by aggregating and synthesizing different and multiple data, thus simplifying information that can help reveal complex phenomena (EEA 2006).

Indices: Combination of two or more indicators or several data. Indices are commonly used in national and regional assessments to show higher levels of aggregation (Segnestam 2002).

Information systems: Any coordinated assemblage of persons, devices and institutions used for communicating or exchanging knowledge or data, such as by simple verbal communication, or by completely computerized methods of storing, searching and retrieving information (GMET-MHD 2006).

Integrated Environmental Assessment – an assessment that includes environmental, social and economic aspects in an analysis of environmental state and trends linked with policy analysis. It usually covers a broad spectrum of issues and policies and all aspects of the environment including habitats, species and ecological, physical and chemical processes. It may incorporate global, sub-global and national perspectives as well as historical and future

perspectives in an integrated analysis of environmental change and human and societal well-being.

Monitoring: Activity involving repeated observation, according to a predetermined schedule, of one or more elements of the environment to detect their characteristics (status and trends) (UNEP 2002).

Practitioner – The individual(s) or organisation(s) drafting the Integrated Environmental Assessment, including contributions to both analysis and narrative.

Reviewers – External experts or governmental representatives who are invited to review and provide suggestions for changes to the Integrated Environmental Assessment in the later stages of the process.

Secretariat – The organization that manages the process elements of the Integrated Environmental Assessment, including, among others:

- Nominations of experts to the process;
- Organization of meetings and working groups;
- Managing of peer review and intergovernmental review processes.

Users – Individual(s) or organization(s) who would consult the Integrated Environmental Assessment for policy relevant or scientific information, including governments, stakeholders, researchers, advocacy groups, the general public, etc. They may use this information for development of environmental policy, for academic research papers or other documents, for advocacy, awareness raising and educational purposes, etc.

1 Introduction

Integrated Environmental Assessments (IEA) are a powerful tool to help inform the development of evidence-based environmental policy and decision making, bring relevant scientific findings to a broad audience and raise awareness to changing environmental state and trends as well as identify emerging environmental issues. Integrated Environmental Assessments also provide a forum for stakeholders, including scientists, policy-makers, and decision-makers to interact and discuss environmental issues and potential solutions. For these assessments to be most useful, they must be performed in a consistent manner. For this reason, Member States of the United Nations Environment Programme (UN Environment) requested that guidelines be developed for conducting Integrated Environmental Assessments.

The Guidelines follow the structure of the Integrated Environmental Assessment Training Manual (2007) and contain the following chapters:

- Integrated Environmental Assessment Planning
- Choice of Integrated Environmental Assessment Method, Process Design and Organization
- Integrated Analysis of Environmental Trends and Policy Responses
- Assessment of Policy Effectiveness
- Methods for Conducting an Assessment
- Compiling an Environmental Outlook
- Communicating the Assessment Process and Findings
- Evaluating the Assessment

Who should use the Guidelines?

The guidelines are meant to be used by Practitioners conducting an Integrated Environmental Assessment. These Practitioners may be conducting a global or regional assessment, a thematic assessment (e.g. climate change) or a rapid response assessment (e.g. on an emerging issue such as marine plastics). The guidelines can be applied to all of these different types of assessments.

Users of Integrated Environmental Assessments may also choose to consult the guidelines to better understand the methods used for different parts of a particular assessment. They may also wish to understand the basic requirements that Practitioners have followed in conducting any assessment which follows these guidelines. This should help Users better understand the assessment process and lead to higher confidence in the findings of the assessment.

How are the Guidelines structured?

The guidelines provide a step by step approach to conducting an Integrated Environmental Assessment. They also provide a range of information on *how* the steps can be completed, not simply which steps must be completed. Finally, the guidelines provide real-world examples of the results that can be expected from these actions.

The guidelines are intended to be applicable at different scales – from global to local and long- term to rapid. The scale and detail at which methods are applied will be determined by the available data and the time frame for conducting the assessment. Guidance on the

choice of methods that should be used in conducting the assessment is provided in Chapter 1.

Box 1: What is an Integrated Environmental Assessment?

An assessment is the entire social process for undertaking a critical objective evaluation and analysis of data and information designed to meet user needs, and to support decision making. It applies the judgment of experts to existing knowledge to provide scientifically credible answers to policy relevant questions, quantifying, when possible, the level of confidence. (UNEP 2007). The main value added of an Integrated Environmental Assessment is the focus on addressing environmental issues in a holistic way, considering economic, environmental and societal factors which contribute to particular environmental problems or which may enhance actions to benefit or restore the environment.

The process of conducting Integrated Environmental Assessments has evolved over time and they are now moving from one-off reports towards conducting regular assessment processes, with frequent reporting to provide updates on the changing environmental situation, the effectiveness of policy actions and finally the policy pathways that can lead to a more sustainable future. Some policy actions might be based on findings from the assessment (enabling the evaluation of effectiveness), but the assessment can also report on other policies that influence drivers of environmental change. Regular assessment processes generally reduce the size of reports, because updates are based on accumulated experience and improved data collection and processing. Indicators of environmental change and data often support the key findings in the assessment relevant for policy and societal action.

An assessment may also need to be tailored according to where the environmental issue is in the policy cycle (Figure 1.1), to ensure that it addresses the relevant audience (e.g. governments, stakeholders, researchers, advocacy groups, the general public). Thus, an emerging issue may need to be documented as important (agenda setting), and evidence can be assembled to formulate policies that contribute to resolving the issue, along with an open dialogue can then be conducted for policy legitimization and finally government commitment can be obtained for policy implementation and evaluation. An Integrated Environmental Assessment can support this process by identifying the drivers and pressures that may be causing environmental change, accompanied by options for prevention and mitigation. For a mature environmental issue, monitoring of progress or recovery will become the focus of the assessment process in order to demonstrate policy effectiveness.

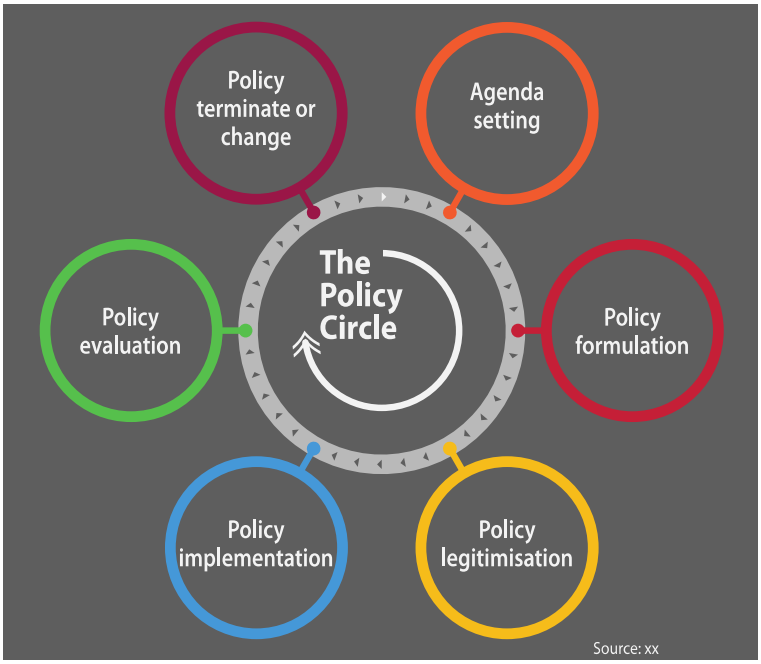


Figure 1.1: The policy circle

Assessment Findings are the key output of an Integrated Environmental Assessment. These findings are based on established facts and evidence from scientific analysis or observation. The findings can also include options for action (including policy action) which emerge from the analysis presented in the assessment. Finally the findings can provide pathways, using collections or groups of actions, to achieve particular environmental objectives on a chosen timeline.

The analysis in an Integrated Environmental Assessment produces these findings, which might be far ranging. Options for action can vary from a regulatory ban on a particular chemical substance to programmes which encourage changes in lifestyle choices which benefit the environment. The timing and urgency of the findings will typically be determined by the seriousness of the environmental issue, which may affect the options for action which are available to governments, businesses or society.

Typically, assessments that have the most impact are those where findings are not only well communicated but where there is also a plan for acting on these findings. These assessments are often produced using a results-based management approach based on a theory of change, including a communication and outreach plan as part of the design; making the assessment an integrated part of a larger project with efforts to communicate the results, discuss action points as well as follow up to ensure change and progress. Assessments that are linked to policy processes – and which officially inform or support these processes – are more likely to impact the relevant policy cycle and lead to change.

Essential actions that should be taken by the various actors are highlighted at the front of each chapter of the guidelines. Examples of how the Guidelines can be applied to a particular assessment process (e.g. thematic, global, regional or rapid response) are provided in annex 3. Users of these guidelines are encouraged to provide feedback to UN Environment and GRID-Arendal through the email address GEO.Head@unep.org.

1.1 Types of Environmental Assessments

There are many different types of environmental assessments (Table 1.1) and many of them overlap in scale (i.e., geographical extent/coverage) and/or scope (i.e., theme).

Table 1.1: Types of Environmental Assessments

Assessment type	Characteristics	Function(s) in decision making
Environmental Vulnerability Assessment for Climate Change, Natural Hazards, or Disasters (EVULA)	• Identify exposure and analyze the sensitivity of a system to the negative effects resulting from predicted climate change, natural hazards, or disasters • Assess adaptive capacity • Identify potential threats to the environment and people from the combination of economic, social, and environmental factors	• Develop, evaluate and implement climate change, natural hazard or disaster risk reduction options
Post-crisis Environmental Assessment (PCEA)	• Identify acute environmental risks caused by conflicts, disasters and industrial accidents • Assess the environmental impacts of crises on human health, livelihoods and security	• Support emergency response operations • Develop post conflict actions
Environmental Valuation Assessment (EVALA)	• Estimate the worth of environmental assets in monetary terms • Quantify the impacts of the economy on the environment and the contribution of the environment to the economy	• Provide information for planning and informs policies
Environmental Impact Assessment (EIA)	• Determine the potential impact of a project to the environment including to a limited extent economic and socioeconomic impacts	• Provide information to minimize, mitigate, or eliminate adverse impacts arising from the project

An Integrated Environmental Assessment (IEA) is a unique type of assessment in that it links science to policy by:

- analyzing and synthesizing existing environmental, social and economic data, to determine the state of the environment using the Driver-Pressure-State-Impact-Response (DPSIR) framework, taking into account all ecosystem components and processes;
- determining risk and uncertainty in the information;
- identifying and assessing past and potential management actions; and
- providing guidance for decision makers on the consequences of varying management actions, including inaction.

Integrated Environmental Assessments s can be conducted at varying temporal and geographic scales (i.e., short- to long-term and local to global) and scopes (coverage and environmental theme). Another key 'integrated' component of Integrated Environmental Assessments is that they should engage all relevant stakeholders (e.g. scientists, resource managers, governments, non-governmental organizations, and affected communities).

Adapted from UNEP (2015).

2 Planning

2.1 Establishing the mandate and determining the intended audience

In the planning phases of an Integrated Environmental Assessment, the actions taken by each actor would include:

Practitioner	• Should establish a theory of change for the assessment to ensure the goals of the assessment are clear; • Should ensure that the established theory of change demonstrates both the process of logic, assumptions and risks of the assessment are clear and identified. • Should include social and gender-based data in the assessment.
Secretariat	• Should engage in an initial meeting with *Users* (e.g. governments, planners and policy makers, business, community groups etc.) and potential *Practitioners* (e.g. scientists, researchers, consultants etc.) to help define the scope, objectives and process for the assessment; • Should consult with the *Commissioning Entity* to determine the intended audience for the assessment; • Should establish and monitor an impact strategy for the assessment; • Should establish a communications and outreach strategy that engages intended audiences throughout the assessment process.
Commissioning Entity	• Should provide a project charter that includes the need/justification for the assessment, objectives of the assessment, the time frame for its completion, high level project description and boundaries, high level risks, a description of the assessment approval process and a summary of the budget available for the assessment; • Should help determine who the intended audience is for the assessment.
User	• Should engage at the earliest possible stage in the assessment, and throughout the process, to ensure the assessment is relevant to their needs and that they have confidence in the process itself.

In order to produce useful findings in an Integrated Environmental Assessmnet and expect these to have both high levels of scientific credibility and policy relevance, an Integrated Environmental Assessment must also have a well-planned and well-managed process.

The ultimate success of an Integrated Environmental Assessment process depends on who is managing and who participates in the process, in which specific role, how the process is structured, and how it allows for flexibility to adapt to local cultural, administrative, legal and other conditions. The following sections review these different roles and how they can most effectively work together.

The Commissioning Entity

An assessment is usually only effective in leading to change if it fits into a policy or decision-making process and is intended to provide the scientific basis for possible policy actions. This policy or decision making process is usually the responsibility of the *Commissioning Entity* which needs the assessment to support a particular activity or process. Integrated Environmental Assessment mandates, to take action in order to realize change, can be conferred by bodies such the United Nations, through conferences of the Parties of the Multilateral Environmental Agreements, through regional intergovernmental organizations (such as the European Union, Secretariat of the Pacific Regional Environment Programme etc.), national governments, local governments, or even civil society groups wishing to influence policy or public opinion (e.g. Rothman *et al.* 2009).

An Integrated Environmental Assessment always begins with a mandate from a *Commissioning Entity* calling for the assessment to be undertaken, and usually includes the designation of a governing body or reporting agency (referred to as the *Secretariat* in these guidelines). In providing the mandate, the *Commissioning Entity* typically prepares a project charter document that should include the need/justification for the assessment, objectives of the assessment, the time frame for its completion, high level project description and boundaries, high level risks, a description of the assessment approval process and a summary of the budget, to ensure that the *Secretariat* has the human and financial resources needed to carry it out. Some of these elements may be subject to negotiation between the *Secretariat* and the *Commissioning Entity* to determine what is reasonable. In determining the terms of the assessment, the *Commissioning Entity* and the *Secretariat* should engage in an initial meeting with *Users* (e.g. governments, planners and policy makers, business, community groups etc.) and potential *Practitioners* (e.g. scientists, researchers, consultants etc.) to help define the scope, objectives and process for the assessment.

The *Commissioning Entity*, in consultation with the *Secretariat*, should help determine who the principal target audience is for the assessment. The *Secretariat* might use different tools and techniques such as expert judgment, stakeholder analysis and profile analysis meetings to help refine the target audience. The *Commissioning Entity* itself may not be the target audience – for example, an assessment could be commissioned by a federal government to inform decision making in the private sector or other levels of government.

The Integrated Environmental Assessment Advisory Bodies

The Advisory Bodies help guide the assessment process to ensure that it meets the needs of the Commissioning Entity and the Users. Advisory Bodies typically will have a terms of reference to ensure they perform their role effectively and so that the roles and responsibilities of two or more Advisory Bodies do not overlap. For example, one of the Advisory Bodies may be responsible for providing policy guidance while another may be responsible for ensuring scientific credibility. The Advisory Bodies also can promote engagement in the process through participation in outreach events and can be responsible for leading on the production of supplementary documents, such as the Summary for Decision makers.

The Integrated Environmental Assessment Practitioners

The Practioners are the individuals who will conduct the assessment and produce the report and other outputs. Practitioners are typically experts in a particular environmental field who have legitimacy and credibility within that community. This is primarily because the *Assessment Findings* will, in part, be the result of the type and quantity of information review by the Practitioner and the type of analysis used to reach the findings. If the Practitioner in question does not have established expertise or credibility in the subject matter, then the findings could easily be criticized.

Box 2: the Legitimacy, Credibility, Saliency model

One of the models for determining if the assessment will reach the intended audience is the Legitimacy, Credibility, Saliency model (Cash *et al.*, 2002)(Figure 2.1). This model highlights that a successful assessment must have a mandate from an important user community in order to have legitimacy, be based on information considered credible by this community

and address the information needs of this community. This model can help guide the design of the assessment.

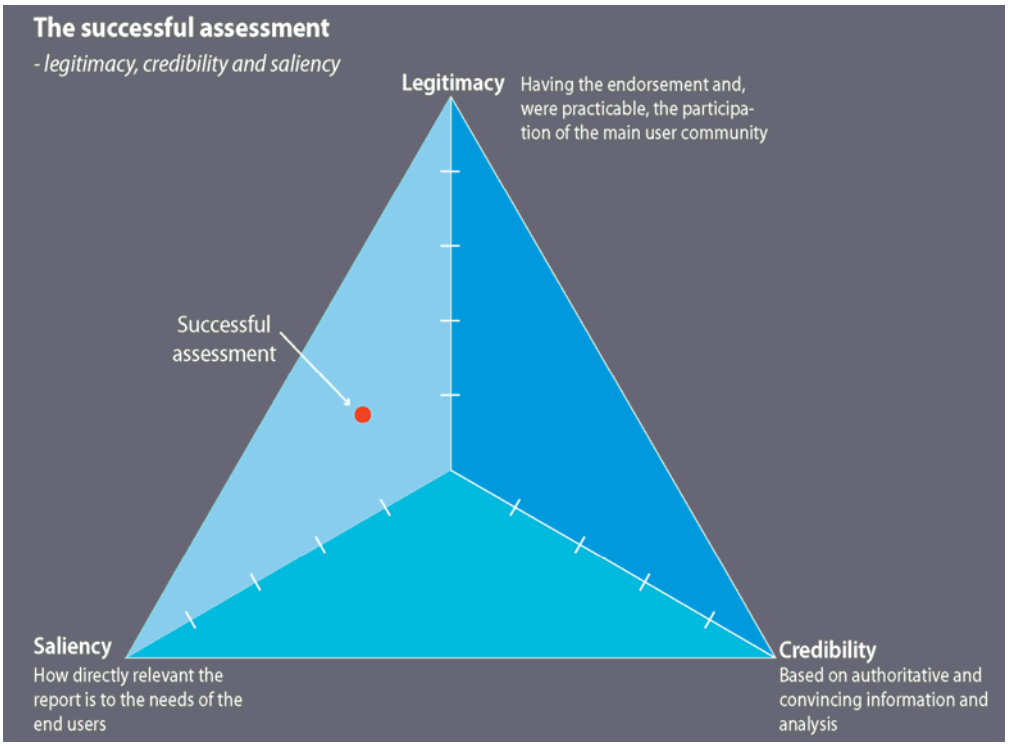


Figure 2.1: Legitimacy, Credibility, Saliency model (adapted from Cash *et al.* 2002)

Integrated Environmental Assessment Review Editors and Reviewers

The peer review process for an Integrated Environmental Assessment is an important element which ensures its scientific credibility but also its relevance to the user audience. In order for the review process to work effectively, a large enough pool of experts must be selected to ensure geographic balance and appropriate expertise. In addition, if an intergovernmental review is planned, a broad selection of countries should be invited to nominate experts to ensure a geographically comprehensive review in the eyes of the participating governments. Once the review period is over, authors must address the comments received in an appropriate way. This process is assessed by Review Editors who have been nominated into the process. Review Editors typically will write a summary report for the main scientific advisory body so that an evaluation of the review process can be made.

The Integrated Environmental Assessment Users

Experience shows that the target audience, or *Users*, should ideally be involved at the earliest possible stage in the assessment and throughout the process to ensure the assessment is relevant to the needs of the users and that they have confidence in the process itself. Working with *Users* can help identify relevant questions to ask in the assessment, and provides sufficient knowledge of the decision-making process to ensure that the assessment and the ways in which it is communicated are appropriate. Decision makers are not always accustomed to using science-based assessments to support their

decisions, therefore interaction may help to illustrate the relevance of the assessment to the decision making process.

There will always be additional audiences for the assessment, including the general public, whose support is often necessary to implement the policy or decisions taken. The results of the assessment can often be repackaged for delivery to different audiences and serve multiple purposes, including awareness raising and educational purposes.

2.2 Defining the theory of change for your assessment

Understanding the process by which an Integrated Environmental Assessment leads to broader changes is critical to the successful application of the assessment approach. Developing a model (often called a Theory of Change) that describes how and why a desired change is expected to happen in the context of a particular effort is a common theory-based method. In the context of an assessment, developing a Theory of Change is based first on identifying clearly the desired intent of the effort (e.g. particular output; policy change; systemic change) and then working back to identify all the conditions that must be in place for the goals to be realized. The Theory of Change can also aid in identifying the assumptions and risks that ought to be addressed for the goals to be realized.

At the centre of a Theory of Change is often a series of results that look similar to a logical framework (i.e. describing how activities will be completed and combined to deliver key outputs which, when combined with other factors will bring about direct and longer-term outcomes leading to a new and changed stable state or a new set of conditions;; with the help of other contributing factors the longer term intent may be realized). Long term effects such as the tradeoffs between economic and social benefits and/or costs can be incorporated into a Theory of Change. However, importantly, an effective Theory of Change captures insight into not just 'what' has to be done, but 'how' effort needs to be directed and 'why' certain people or events play an important role in bringing about change.

The Theory of Change therefore combines the logical steps of what needs to be done with:

a) contextual information about what other contributing factors (both internal and external to the assessment effort) are needed to bring about change, and
b) who needs to play which role as change agents to ensure change takes place.

Because the Theory of Change is highly contextual, incorporating key current factors and features that affect change processes, it can be reviewed and revised over time, but needs to be developed in a participatory manner so that decisions about priorities, and the relative importance of various factors, can be discussed and agreed upon. This exercise of clarifying the Theory of Change informs the design and planning for the conduct of the assessment. For example:

- if the ultimate goal is to track a particular environmental change over time, an assessment might need to pay attention to how other actors are also measuring that change or consider at which stages in the process a key policy maker needs to be included in the assessment process for them to act on the findings later; or
- if the ultimate goal is to improve the condition of a particular environmental parameter, different actors such as communities, or key groups having a potentially detrimental effect on the environment, will need to be involved at different points even if the assessment process itself follows essentially a common series of steps.

Within one Theory of Change several 'causal pathways' can be identified (e.g. the development of technical capacity among local practitioners might be one pathway when assessments are to be repeated or convincing the custodians of traditional environmental assessment methods that modern and traditional approaches can support each other might be another way of securing ownership of the process etc.). These causal pathways might be inter-dependent or mutually supportive and can be addressed simultaneously in planning for the assessment.

Some considerations to keep in mind when formulating an assessment's Theory of Change:

- The best time to develop a Theory of Change is at the beginning of the design process, when stakeholders can be brought together to develop a common vision for the assessment. While every effort should be made to ensure that the Theory of Change is developed at the beginning of the assessment process, in practice, this is not always possible due to a variety of reasons. In such instances, *Practitioners* and users should ensure that the Theory of Change is developed either in the course of the assessment or at the end of the assessment that is retroactively.
- Choosing one approach over another for establishing the theory of change is not a purely technical matter especially, if systemic change is the goal. Catalyzing societal change is a political and value-laden proposition Stakeholders in the assessment region are most likely to be able to say how the process should be handled and who needs to be involved, when etc. in order for it to stand the best chance of leading to change.
- Power dynamics and positions of influence shape society's capacity to affect specific change. Organizations and communities working within the framework of an assessment may all have different approaches that influence action strategies.
- Theories are always partial – there is no single, universally applicable Theory of Change. In any given context dialogue is the key for choosing the appropriate way forward.
- The Theory of Change has the potential to demonstrate how environmental policy, for instance, could lead to economic and social benefits and/costs - tradeoffs- which is at the core of the SDGs

A clear definition of the Theory of Change is still lacking as well as a detailed explanation of the difference existing between this approach and the logical framework. Both of them are aimed to describe how a certain program, through a critical thinking, will lead at specific results. In order to simplify, a Theory of Change provides an overview of the "real world" picture, including all the possible pathways leading to change, with a special focus on the reason behind their effectiveness.

A Logical Framework is more focused on a specific pathway which, through a clear structured approach, should lead to specific results, making the monitoring strategy easier.

2.3 Planning for Social and Gender Analysis

When planning to undertake an Integrated Environmental Assessment, access to information about social class and gender-based differences within the human community must be considered. At the same time a plan for how to generate or access and, then, analyze that information in relation to the broader environmental questions of the Integrated Environmental Assessment needs to be constructed. During the planning stages whether or not data exist on social and gender difference, and how these data will be accessed and mobilized, needs to be determined. There are many resources available such

as the *Global Gender and Environmental Outlook* (GGEO) report (2016) that examine the broad statistical evidence of gender and social difference in relation to environmental issues. At the same time, the point of an Integrated Environmental Assessment is to work with the specificity of a particular area and to consider its special complexities. Thus, the key questions to ask at the planning stage are:

- What are the geographic locations and subject areas, sectors and activities in which gender difference and social class impact one's relationship with the environment?
- Are there any other intersectional issues that might need to be considered (e.g, how different cultural groups use, imagine and/or relate to place and are there any conflicts between these groups)?
- How do general differences between socio-economic classes, in relation to the environment (as mapped in reports like the Global Gender and Environment Outlook) apply to the environmental issues undergoing assessment?
- What are the differences in behavior of men, women, boys and girls in relation to the environmental issues undergoing assessment (as mapped in reports like the Global Gender and Environment Outlook)?
- Are gender-disaggregated data available to understand that relationship or will it need to be collected?

Given that the aim of the assessment is to inform decision-making on the environment, any changes to the environment that could negatively impact upon women, for example, will also likely negatively impact the approach to environmental decision making. In this regard, it is important to keep in mind the close links between social and environmental issues when undertaking an assessment.

2.4 Impact and Communications Strategy

2.4.1 Communication and Outreach Strategy

The communication of assessment results is as important as the analysis that produced them. If the results are not communicated well, and to the appropriate audiences, then the assessment is unlikely to have significant influence.

However, designing communication and outreach strategies for assessments has not been a strength of most recent efforts. Fundamentally, this stems from a disconnection between the assessment effort and the story that needs to be communicated. Communication traditionally comes at the end of the process when results and information are downloaded to a passive audience. There is increasing commitment to change this mindset by:

a) embedding the communication cycle within the overall implementation of the Integrated Environmental Assessment, and
b) transforming how we communicate from a passive audience to a two-way information flow.

Audiences should not just be recipients of information but rather be engaged through conversation in contributing to and participating in the assessment throughout the entire process.

Shifting the style of communication, in addition to incorporating new media tools and strategies can increase the level of participation and ownership in the assessment process. It also allows for more collaboration between the experts and specialists developing the

scientific elements of the assessment and others who will either use the assessment results in their professional capacities, or communicate them in different ways that could lead to broader societal impacts. Figure 2.3.1 shows how this might work:

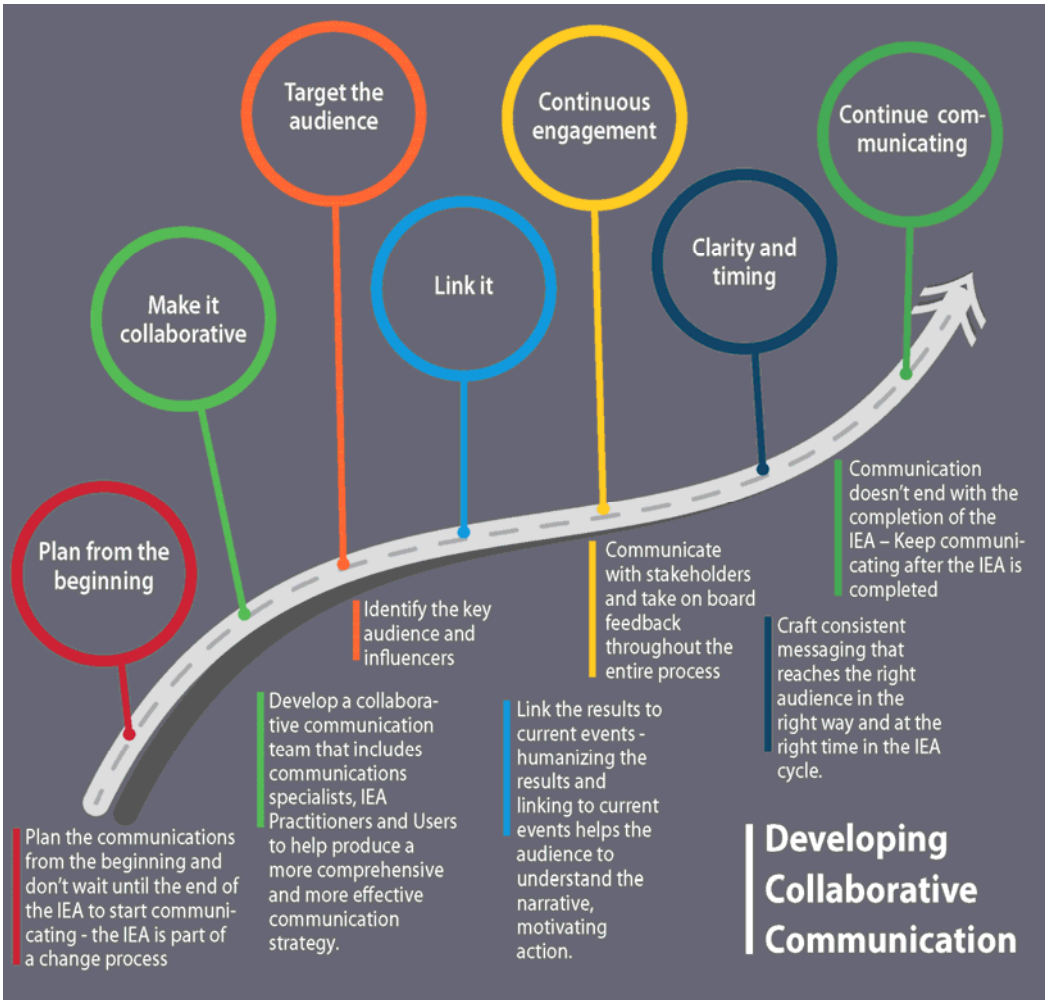


Figure 2.2: Linking communications

2.4.2 Targeting transformative impact

An impact strategy consists of steps taken to ensure that the assessment work will inform real progress on key issues or concerns. It is proactive in nature, and needs to be adapted to a public policy environment where priorities of governments and citizens can shift and change.

An impact strategy should be prepared at the beginning of the integrated environmental assessment process. The *Secretariat* for the IEA process should be responsible for developing and implementing the strategy and monitoring its outcomes.

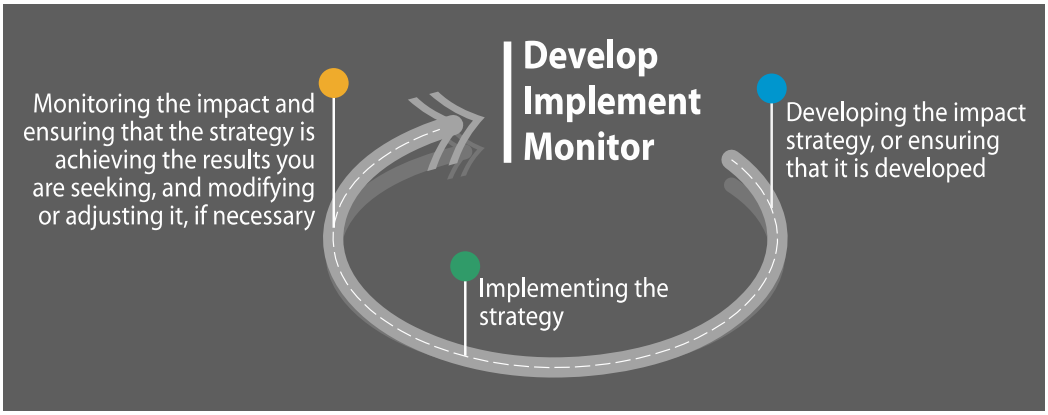


Figure 2.3: Developing Implementing and monitory an impact strategy (Source: GRID-Arendal)

In many jurisdictions, State of Environment assessments or sustainable development reports are mandated by statute and regulation. In others, there may be a strong policy context that has led to a government undertaking or participating in an assessment as a voluntary initiative. In some, the assessment/reporting programme may be part of a larger performance monitoring and evaluation programme for the government as a whole, across all departments.

While such requirements may initiate the process for an assessment, in designing the impact strategy, a broader view should be taken, which includes identifying potential uses for the assessment, examining what impact it might have on policy and planning, and what steps should be taken to ensure that the right people pay attention to the findings of the assessment.

Many integrated environmental assessments are not detailed scientific assessments (e.g. rapid response assessments). However, they may lead to more attention being paid to problem areas, and they may recommend a more detailed scientific assessment of root causes and downstream effects. The assessment results can shift the mood of the public, and lead to political pressure. They may educate a wide range of audiences on key issues, and as a result may trigger more detailed studies that are more directly linked to specific issues and decisions.

While there is often an underlying assumption of reporting that good information will lead to good decisions, it does not follow that decision-makers will act on it. Decision-makers are often quite well informed, but their priorities and intentions may be different from yours. The challenge is to take proactive steps to ensure that an assessment doesn't sit on a bookshelf once it is done, but that it makes a useful contribution to decision making. The assessment will lead to recommendations for actions that may require changes in policy and practice by the government. Consider from the outset how the findings from the assessment might be used, and how the priorities identified can become the priorities of the government and country.

These questions will also help shape the communications strategy. An impact strategy incorporates communications activities combined with a good understanding of government relations as practiced by advocacy groups and professional lobbyists. With communications strategies, it is necessary to identify key recipients of the assessment, prepare key messages and products that will help them grasp the essentials of the research, and identify

appropriate channels to deliver those messages and products, including the media, participation in events (e.g., conferences, workshops, town hall meetings), and electronic delivery via e-mail and web.

An impact strategy begins with articulating what changes the assessment is supposed to create. When conducting an IEA for the first time, it may not be possible to articulate a specific policy-related change that might be necessary, as there is no prior assessment identifying priority issues. Seeking better linkages between the findings of the report and formal decision-making process in government (e.g., departmental strategic plans, policy, priorities, budgets) may be the main objective. When conducting subsequent assessments, it might be possible to more specifically examine issues and necessary policy changes, as these will have been identified in the previous assessment.

In devising an appropriate impact strategy, it is important to understand the context in which the assessment is taking place. This includes investigating the external political and public environment. Figure 2.4 gives examples of some things to consider.

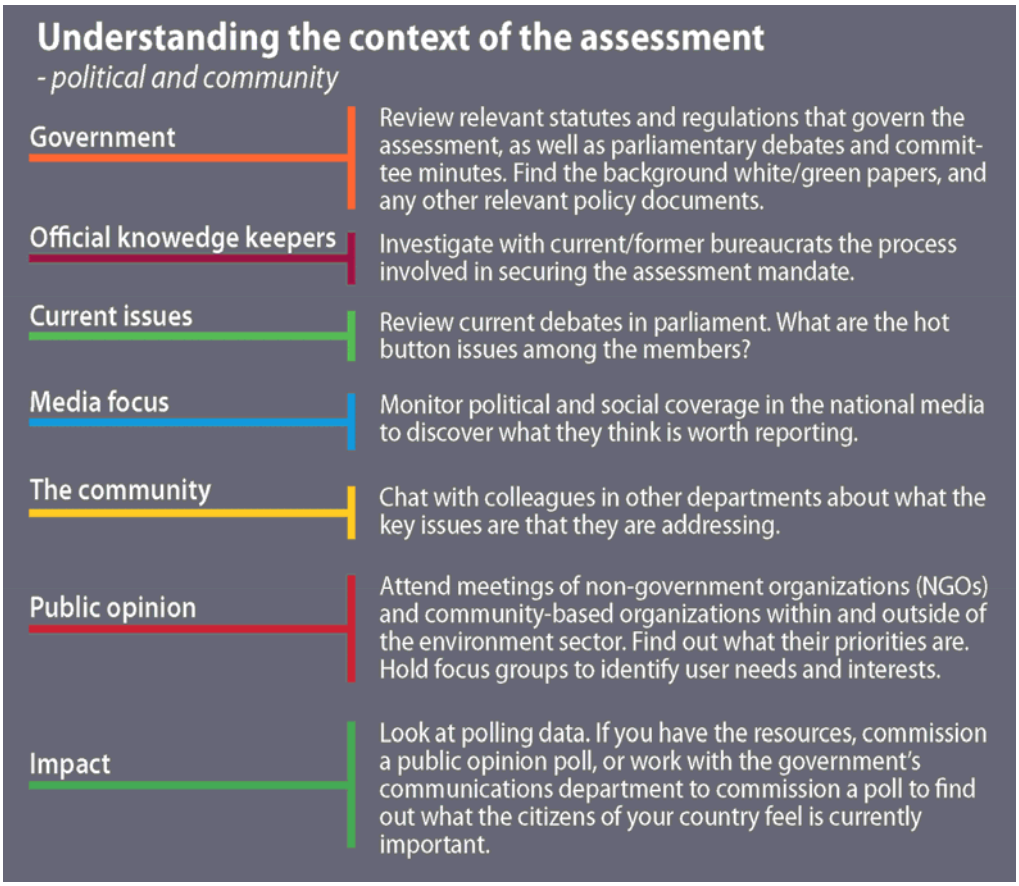


Figure 2.4: Understanding the context of the assessment (Source: GRID-Arendal)

2.4.3 Understanding the target audience

Translating assessment results into policy relevant recommendations, that will inform effective interventions, requires careful consideration of the target audience and development of appropriate communications methods. The target audience may be a

diverse group, from non- experts to the technically knowledgeable, so it is important to tailor information products to fit (see Annex 2 box 1).

2.4.4 Wording and messaging

Integrated Environmental Assessment communicators need to think widely and creatively when identifying the target audience. The right wording and messaging for the right target audiences also helps to ensure that the Integrated Environmental Assessment process remains not only responsive, but also accountable to the target audiences. For each target audience, the most appropriate wording and messaging should be chosen. In so doing, it is important to bear in mind the sphere and degree of influence of the particular target audience; their level of information needs; and the most effective channels of communicating with them. The channels of communication could include workshops, round-table meetings, town hall meetings, policy dialogue sessions, mass media (electronic and print), social media and policy briefs.

Box 3 Use of digital and social media - Assessments and the Information Age

It is important for the *Secretariat* to develop a social media strategy as part of the overall communication strategy for the Integrated Environmental Assessment. Many target audiences are increasingly using social media including, but not limited to Twitter, Facebook, Instagram, Google+, Snapchat and Youtube in their day-to-day communication. Many people spend time messaging, commenting, blogging, sharing and 'linking'.

Impact can be achieved by engaging target audiences in real time, online. This allows the Integrated Environmental Assessment process to be as interactive as possible, facilitating communication and feedback processes on a continuous basis. The use of social media also enables the assessment process to reach a much broader and diverse audience and communicate to the various audiences in a much more dynamic, real-time content using the wording and messaging that they relate to. It would also allow the *Secretariat* to allow *Practitioners* to communicate with the various target audiences in a manner that they can easily understand, remember and utilize in their day-to-day work. Carefully crafted catchy messages, for instance, are easy to access, read and recall and can potentially be another tool in influencing change and mobilizing action toward a desired environmental change.

Box 4 E-books and story maps

E-books are useful communication tools as they are visually interesting and allow other media such as video or audio files to be embedded into a report. They can also be a cost effective way of producing a publication. Story maps are communication tools that give a spatial component to a narrative. They use maps and graphics in a dynamic way to tell a story. They are a useful way to summarize key results or interesting findings. See story map examples at http://grida.no/publications/story-maps/.

Box 5 Steps in building an impact strategy:

There are five main steps to creating an impact strategy,

1. Creating the change statement. What should the impact of the assessment be?
2. Relationship management. Identify the key actors that you are seeking to influence, and build connections to them.
3. Knowledge management. Gather and analyse the knowledge for the assessment.

4. Opportunity management. Move the knowledge into the hands of those that need to be influenced.
5. Monitoring and improvement. Determine whether the impact strategy is working, and adjust it as necessary.

In addition to the core elements incorporated into an Impact Strategy, there is increasing awareness that being attentive to a broader number of final users, could lead to fundamentally transformational outcomes. 'First Mover Advantage' is a common concept in business where it is defined as: “a form of competitive advantage that a company earns by being the first to enter a specific market or industry. Being the first allows a company to acquire superior brand recognition and customer loyalty. The company also has more time to perfect its product or service.[1]”This same psychological incentive can be adapted towards creating incentives for desired environmental and social outcomes. An assessment can be designed to pay particular attention to key end users from government, private sector, civil society, citizen change makers, etc. to entice First Mover behaviors that can come in various forms, and create incentives for being the first enterprise to develop a new green technology being a leading country showcasing concrete environmental credentials ,citizen leadership that highlights key community successes as a catalyst for other communities and people

2.5 Defining the scope and scale of an assessment

The *Commissioning Entity*, in collaboration with the *Secretariat* and *Practitioners*, should define the scale and scope of the Integrated Environmental Assessment based on the purpose of the assessment and the characteristics of the involved systems, striking a balance between what is possible and what is needed (Figure 2.4.1). *Scope* represents the dimensions used to define the boundaries of the problem, e.g. geographical extent/coverage, and/or timescale, and the *scale* refers to the level of analysis for each dimension, which can be done at varying levels from short-term to long-term (temporal) and local to global (spatial). It is important to highlight that since social, economic and environmental processes do not necessarily operate at the same spatial or temporal scales, identifying or defining an operational scale (e.g the spatial and temporal level at which the problem is evident or relevant) is not always possible, therefore it is recommended to perform analyses at multiple spatial and temporal scales.

[1] Read more: First Mover Definition | Investopedia
http://www.investopedia.com/terms/f/firstmover.asp#ixzz46Y1ryWua.

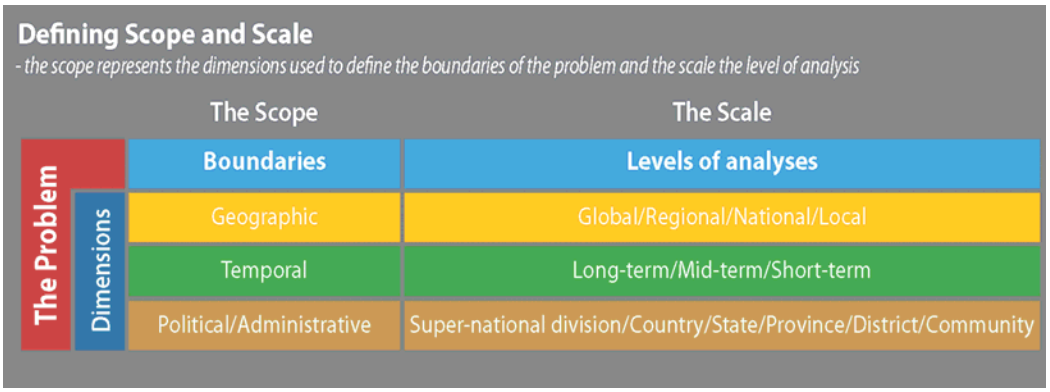


Figure 2.5: Defining scope and scale

In practical terms, the definition of scope and scale must be aligned to the resources available (e.g. expertise, time, funds and data and information) and the trade-offs associated to conduct assessments. The lack of balance between the scope and the available resources introduces the risk of either not attaining the desired outcomes, or having to reorient the entire assessment process during its operation. The importance of balance is exacerbated by the existence of tradeoffs. Thus, a global scale assessment might allow for a comprehensive analysis of relevant social and ecological systems and interactions between them, but it will demand more resources, and the findings may be more difficult to integrate into a focused policy-making process. On the other hand, a local-scale assessment or restricting the temporal, sectoral and other relevant dimensions of the analysis are cheaper and might facilitate coordination and integration with the policy- and decision-making process, but at the same time loses a wider perspective on important issues occurring outside the local area.

Local-scale assessments generally focus on issues most relevant to local stakeholders, making them participatory intensive, with divided opinions around controversial issues and the overall outcomes. At more broad spatial scales, stakeholder participation is a challenge since they might not recognize the relevance (or urgency) of the assessment because it covers issues beyond their interests or it is focused on problems that may not be as obvious. Therefore, these assessments require stronger communication and outreach initiatives. Clarifying the spatial scale and scope of the assessment are both important to define how and through which channels the products will be developed and distributed.

Ideally, the Integrated Environmental Assessment should be a multiscale and multidisciplinary assessment process, which builds on previous and ongoing assessments at diverse scales and incorporates them into one overarching assessment. Although in principle Integrated Environmental Assessments require larger amounts of time and resources, a well-designed one avoids duplication of effort, and ensures scientifically credible and policy relevant findings.

2.6 Choice of Integrated Environmental Assessment Method, Process Design and Organisation

For the choice of Integrated Environmental Assessment methods, the various actors should:

Practitioner	• Should consult decision trees provided in these guidelines to enable their decision-making process; • Should apply the tiered approach to determine which type of assessment they are conducting; • Should conduct a structured decision-making process to define the type of assessment that is being requested • Should carry out the work and writing of the assessment
Secretariat	• Should keep track of what is happening within the IEA and to take remedial action where problems are emerging. • Should be responsible for making meeting arrangements, keeping records of what is done and generally oil the wheels of the Integrated Environmental Assessment process • Should select the optimal methodology for the conduct of their assessment • Should gather the relevant stakeholders and potential Users together in a consultation process to help them identify priorities and key issues • Should avoid scope creep i.e. avoid a project growing beyond its original brief in order to include late requirements from key stakeholders
Commissioning Entity	-Should commission or mandate an Integrated Environmental Assessment -Should determine many of the parameters for the assessment, such as the time frame and available budget including, in some cases, the scope. -Should approve the synthesis approach - Should nominate the members of the Community of Practice
Reviewer	- Should discuss the assessment's strengths and weaknesses and make recommendations by consensus, if possible, on how to improve the document
User	-Should participate in the intergovernmental review when requested

There are primarily three methods used for integrate environmental assessments:

1) Indicator-based assessments;

2) literature-review assessments; and

3) Consultative assessments based on direct engagement with the community.

Indicator-based assessments are those based on quantitative primary measurements of field data that monitor a particular variable. The variable is chosen because its status is an indicator of the condition of an ecosystem or habitat. For example, water quality measures such as dissolved oxygen content or nutrient levels are commonly used as indicators of the overall status of estuaries (eg UKTAG, 2008).

Literature-review based assessments do not rely directly upon primary data sources but rather upon a survey of published literature and readily accessible information; the Global Environment Outlook (GEO) assessments and UN World Ocean Assessment are of this type.

Expert consultation based assessments rely on expert judgment supported by published and readily available data. Examples include UN Environment's Rapid Response Assessments (eg. Corcoran et al., 2010) and expert elicitation type assessments (eg. Sierra Leone EPA, 2015).

The three assessment methodologies are not mutually exclusive. Many assessments apply combinations of two or three methods. A combined approach is used, for example, by the Arab Forum for Environment and Development (AFED, http://www.afedonline.org/en/).

For the Integrated Environmental Assessment guidelines to be applicable to different types of assessments a tiered approach (Table 2.5.1), similar to that employed in the Intergovernmental Panel on Climate Change (IPCC,2014) Guidelines for National Greenhouse Gas Inventories, has been designed. In addition, decision trees are provided to assist *Practitioners* in choosing which method they should apply in their particular situation. This approach starts with the assumption that limited resources will be available to conduct the assessment; a decision must therefore be made at the outset of which methodology (or combination of methodologies) will be best suited to delivering the assessment. The tiered approach described here is designed to assist *Practitioners* in selecting the optimal methodology for the conduct of their assessment. Decision trees provide logical Yes/No answers that can help the Commissioning Entity, Secretariat or Practitioner determine the best assessment method for a given set of circumstances.

The tiers are defined by the 3 main characteristics of an Integrated Environmental Assessment:

1. The type of Integrated Environmental Assessment being conducted (e.g. global, thematic, rapid, etc.), which will likely be defined by the mandate given;
2. The available time for conducting the assessment (e.g. 1 year, 2 years, etc.), which will affect the level of detail or rigor that can be applied in conducting the assessment;
3. The type and level of detail of the information or data available for conducting the assessment, which is likely defined by how much research is available for the particular issue being assessed (indicators, literature and expert consultation).

In these guidelines, the timeframe available for conducting the assessment is defined as 1 – short (6 months or less), 2 – medium (approximately 1 year) and 3 – long (2 years or greater); the type and level of detail of the information or detail available is defined as A – indicator based, B – literature and data based, and C – expert based; and the type of assessment is defined by its name (e.g. global, thematic, rapid response) (Tables 2.5.1, 2.5.2 and 2.5.3).

Table 2.1: A simple matrix of the assessment types

	1 Short (~6 months)	2 Medium (1 year)	3 Long (2 years)
A Indicator	Tier 1A Short Indicator	Tier 2A Medium Indicator	Tier 3A Long Indicator
B Literature and data	Tier 1B Short Literature and data	Tier 2B Medium Literature and data	Tier 3B Long Literature and data
C Expert-based	Tier 1C Short Expert-based	Tier 2C Medium Expert-based	Tier 3C Long Expert-based

Table 2.2: Theoretical examples of different assessments and their Tier definition

Mandate	Timeframe	Information/Data	Assessment Definition
Global	2 years	Indicator based	Tier 3A Global
Country or region	1 years	Literature based	Tier 2B Thematic
Environmental Migration	6 months	Expert based	Tier 1C Rapid response

Table 2.3: Examples of completed assessments and their corresponding Tier definition.

Methodology	6 Months	1+ years	2-3 Years
Indicator based		Tier 2A UKTAG, 2008 UNEP, 2014	
Literature review based		Tier 2B OSPAR, 2010	Tier 3B Global Environment Outlook-5 UNWOA, 2016
Expert consultation (e.g. expert elicitation)	Tier 1C Nelleman et al (2009) Blue Carbon	Tier 2C Australia SOE, 2011 ; Feary *et al.*(2014)	

Nested within the three broad categories of methods there exists a range of different variations. Furthermore, it is generally the case that a mixture of these three different categories of methodologies is applied in the conduct of any particular assessment depending upon spatial scale, available time and available budget.

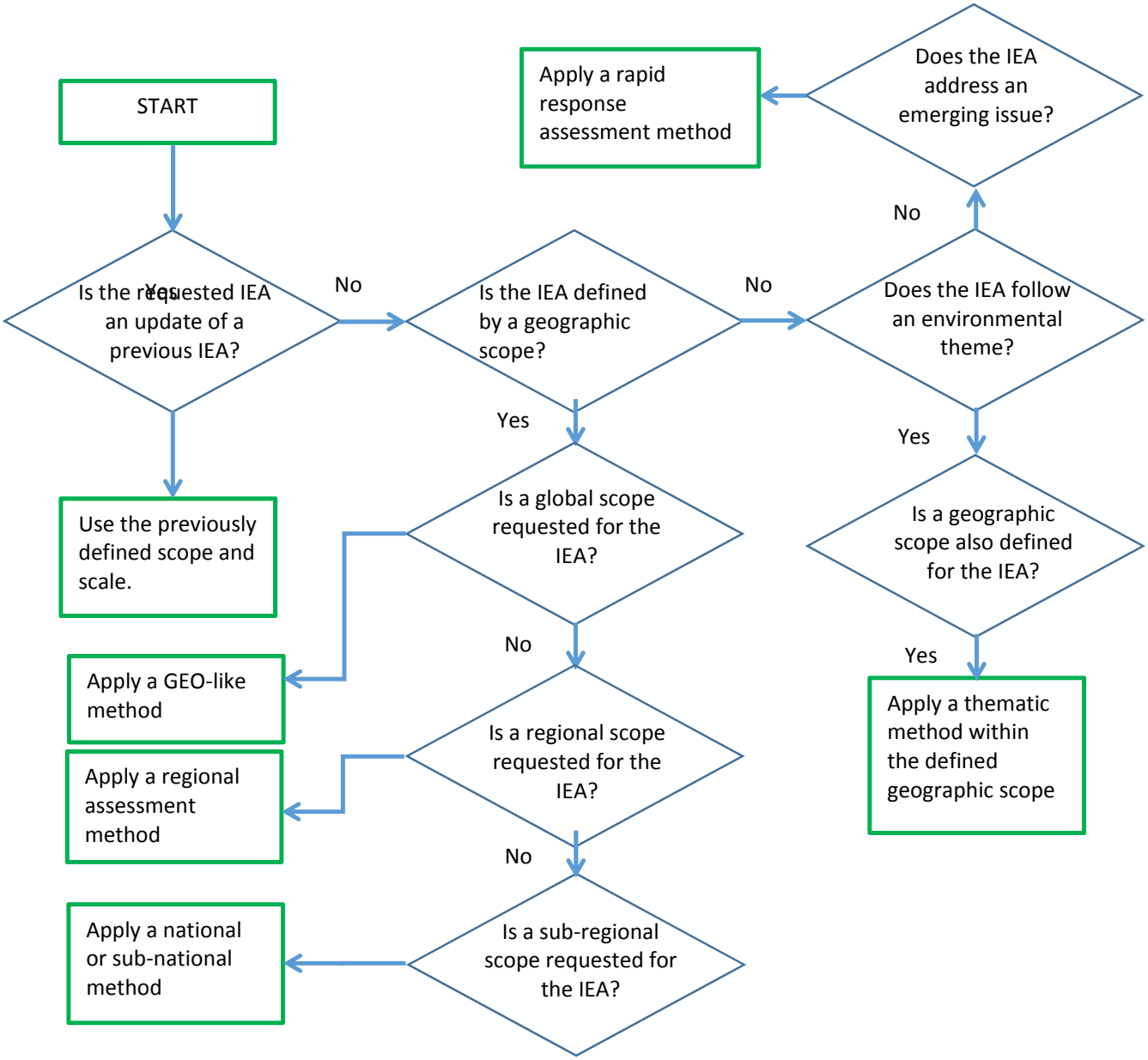
Arriving at a consistent definition of an assessment requires a structured decision making process, which can be supported by decision trees. Decision trees can be designed to help determine which type of assessment to conduct based on the mandate provided, the time available and the resources, expertise, data and type of information available. Decision trees provide logical Yes/No answers that can lead the *Commissioning Entity, Secretariat* or *Practitioner* to different conclusions.

2.6.1 Choice of method based on mandate

In most cases an Integrated Environmental Assessment will be commissioned or mandated by the *Commissioning Entity*. The *Commissioning Entity* will typically determine many of the parameters for the assessment, such as the time frame and available budget. In some cases, the scope will also be defined by the *Commissioning Entity*, or the scope will be implied by the fact that an update is requested to a previous assessment. In each of these cases either the *Commissioning Entity* or the *IEA practitioner* may wish to conduct a structured decision-making process to define the type of assessment that is being requested.

The decision tree in Figure 2.5.1 illustrates a decision process that the *Commissioning Entity* or the *IEA practitioner* could follow to decide on which type of assessment to conduct based on the mandate provided.

Figure 2.6: Decision tree for type of assessment



2.6.2 Choice of method based on timeframe for the Integrated Environmental Assessment

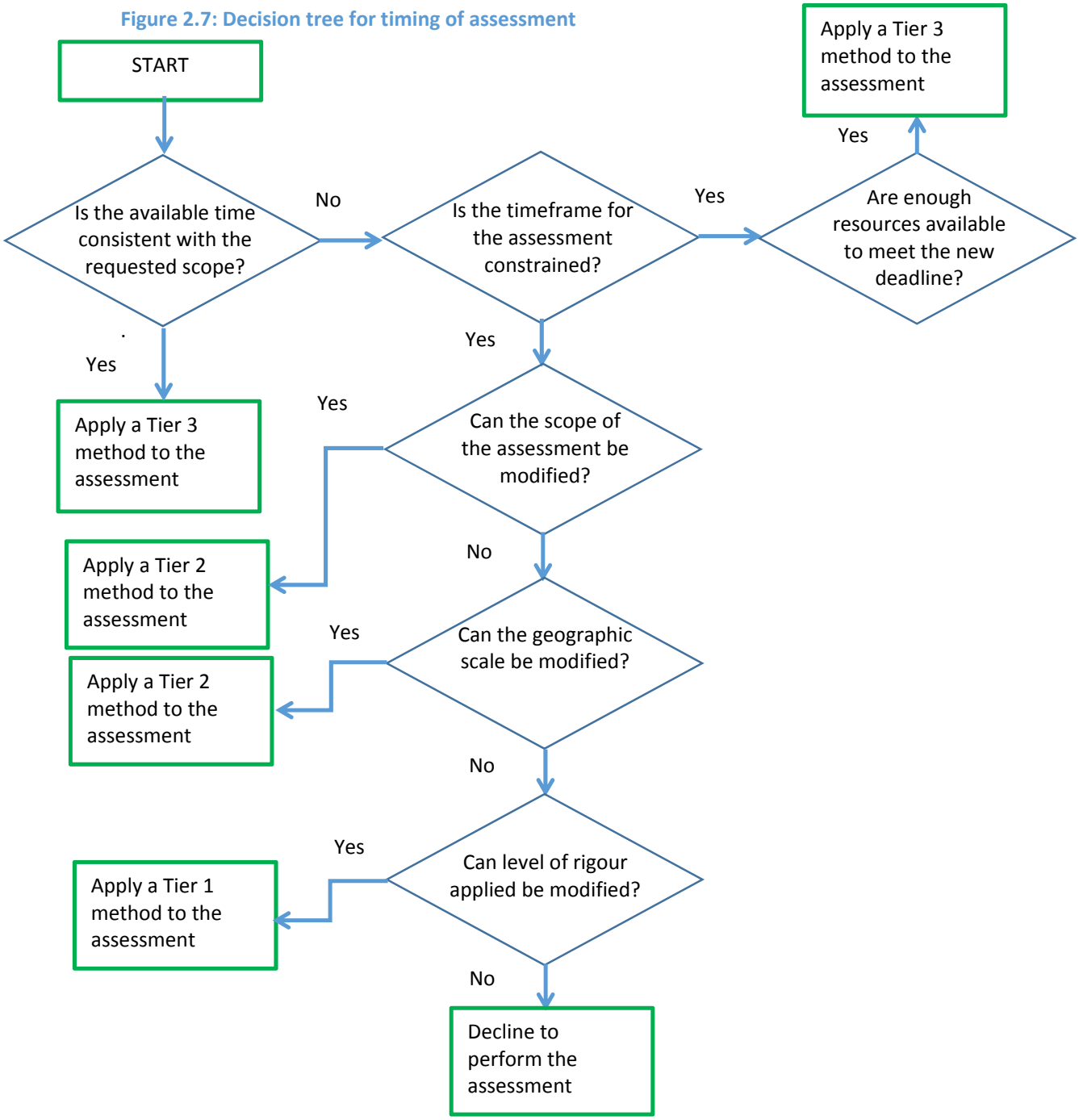
The length of time available to conduct the assessment will help define the necessary resources. For example, if a global assessment is requested to be completed in a short time period, it will require greater resources for engaging larger author teams and paying consultants to complete rapid drafting and editing tasks on short notice.

In this guideline the timeframe available for conducting the assessment will define the first Tier of the type of assessment to be conducted. For example, a global assessment requested in a 2-year time span would use a Tier 3 method, while a rapid response assessment requested over a 6-month time span would follow a Tier 1 method. In this context, the lower the Tier, the lower the level of rigour required in the analysis.

Of course, with a lower level of rigour the characterization of uncertainties surrounding the assessment's conclusions would have to be emphasized for decision makers to properly understand the applicability of the assessment to their policy making process.

The decision tree in Figure 2.5.2 illustrates a decision process that the *Commissioning Entity* or the *IEA practitioner* could follow to decide on which type of assessment to conduct based on the time available.

Figure 2.7: Decision tree for timing of assessment



2.6.3 Choice of method based on type of information available

When producing an assessment, existing materials may be available that enable a synthesis approach to be used for portions of the assessment. This synthesis approach should be approved by the *Commissioning Entity* and areas where the new approaches could or should be used will need to be identified by the choice of method for the assessment.

A synthesis approach typically consolidates existing assessment findings and adds new analysis where required. The need for this new analysis can be determined by a few factors:

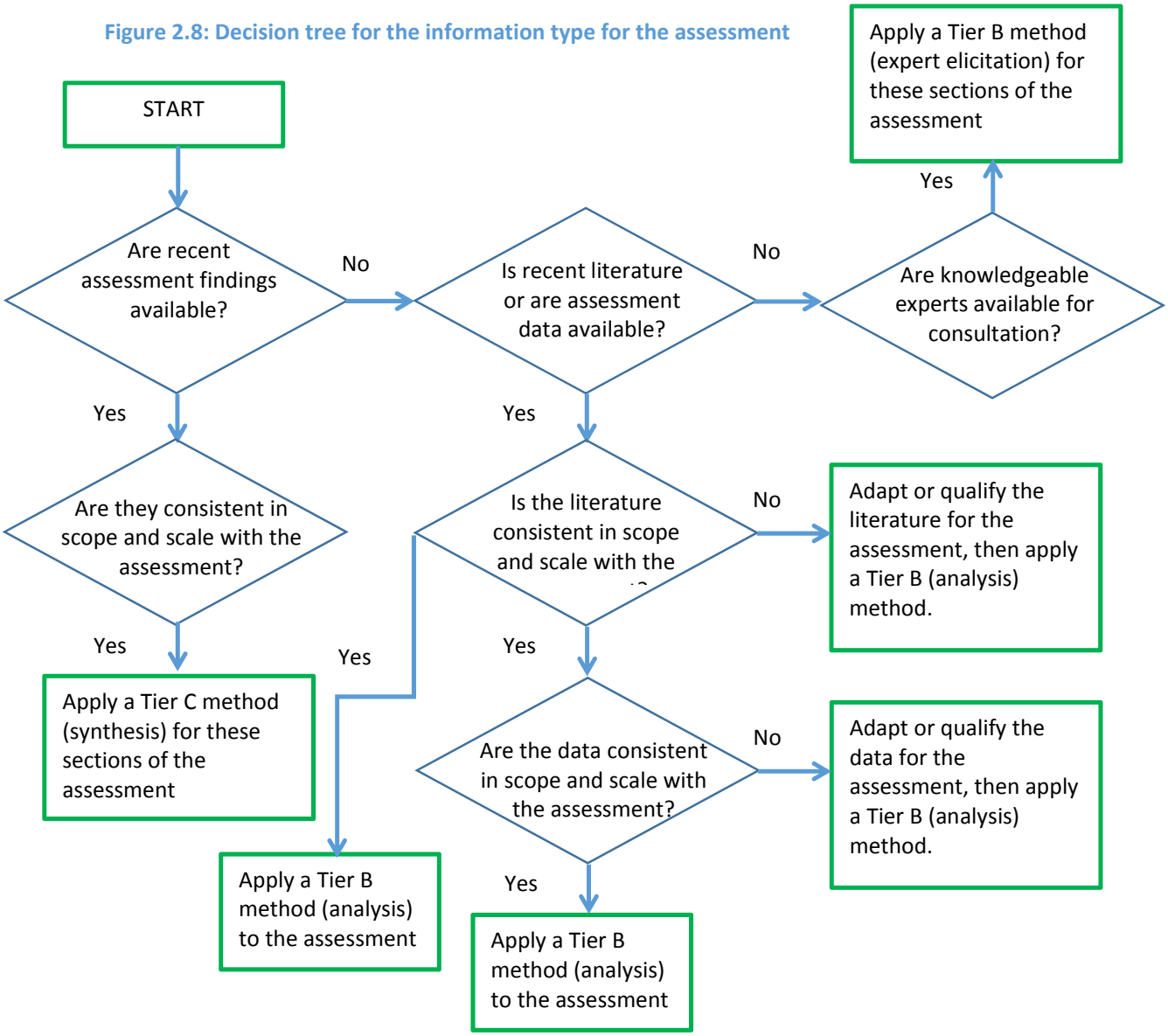
- Gaps exist between the scope and scale of the new assessment and the existing assessment findings;
- The level of rigour of the existing assessment findings is not sufficient to meet the requirements of the new assessment;
- Data used in the existing assessments needs to be updated in order to relevant in the new assessment.

Where findings from existing assessments cannot be used, new analysis will be required. The level of rigour and the approach for this new analysis will need to be defined based on the mandate, scope and scale of the assessment. The other main types of information that can be used for an assessment include:

- Scientific literature, including peer-reviewed and grey literature;
- Data and indicators, including citizen science and indigenous and local knowledge;
- Expert elicitation.

The decision tree in Figure 2.5.3 illustrates a decision process that the *Commissioning Entity* or the *Practitioner* could follow to decide on which type of assessment to conduct based on the time available.

Figure 2.8: Decision tree for the information type for the assessment



In each of these cases, some adaptation or qualification of the findings may be needed in order for the information to be applicable to the assessment. Transparency and uncertainty assessment will be important to ensure the credibility of how this information is adapted for use in the assessment. However, in all cases, some analysis of the information will be necessary in order to present the findings in the assessment.

2.7 Organizing the Integrated Environment Assessment

2.7.1 Oversight of assessment process – expert advice

Establishing an Integrated Environmental Assessment process requires careful advance planning. The various stages of the process create a structure around which activities and participation can be organized, capacities built, resources and time allocated, and release of outputs scheduled. Figure 2.6.1 gives an example of the steps involved in organising an Integrated Environmental Assessment.

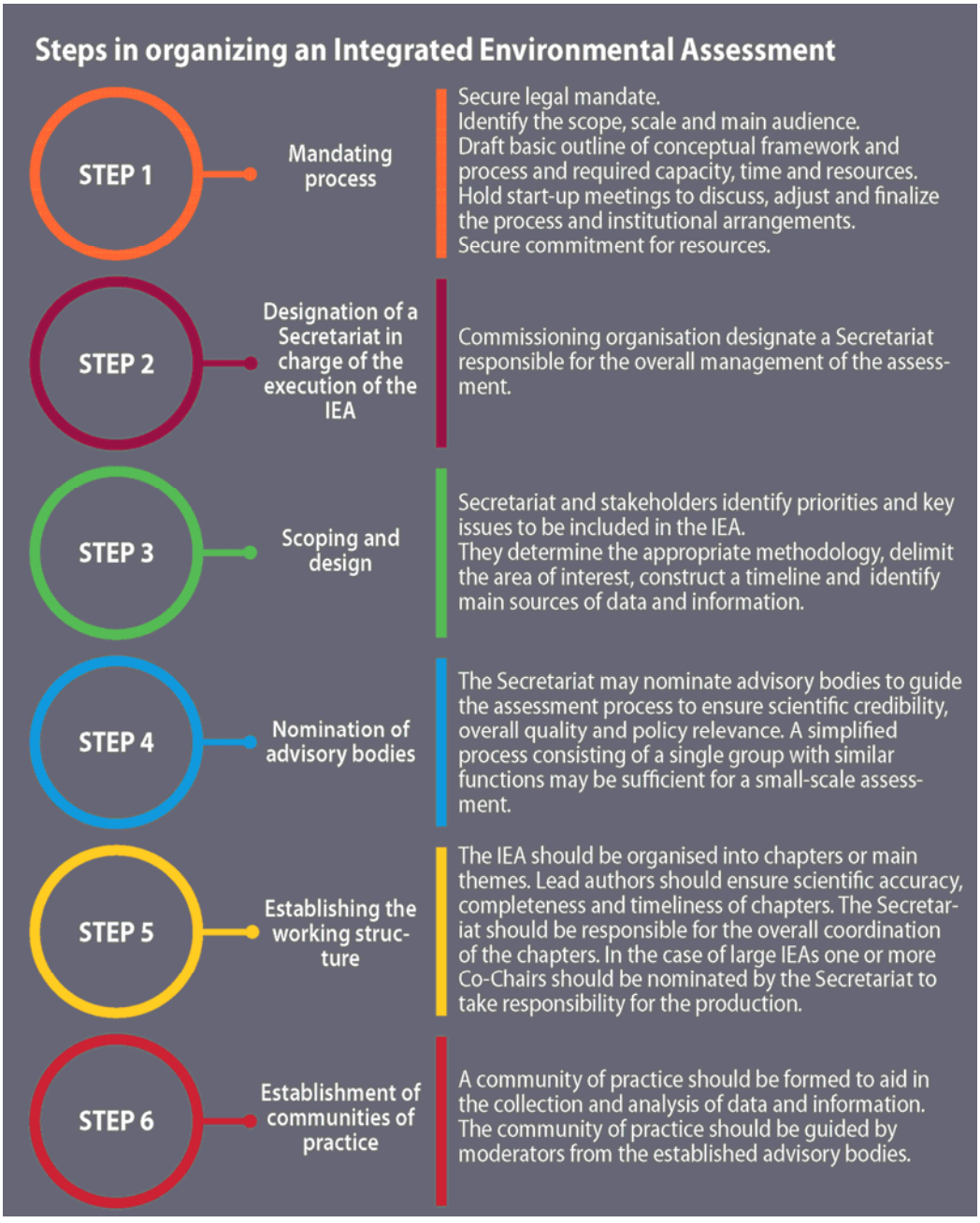


Figure 2.9: Steps in Organizing an Integrated Environmental Assessment

Details of the process may change place by place, and they may need to be modified as the Integrated Environmental Assessment proceeds and adapts to unfolding events.

As discussed above, all Integrated Environmental Assessments begin with a mandate. Usually, the Commissioning Entity will identify the priorities and key issues to be addressed by the Integrated Environmental Assessment. In cases where they have not, the Commissioning Entity will need to authorize the Secretariat (or governing body, steering committee or similar) to do so. In such a case, it is good practice for the Secretariat to gather the relevant stakeholders and potential Users together in a consultation process to help them identify priorities and key issues. The priorities and key issues then need to be developed into a general outline of the Integrated Environmental Assessment, which will provide the basis for further action. This outline should be submitted to the Commissioning Entity for its approval.

2.7.2 Stakeholder consultation and participation

Integrated Environmental Assessment can and often does provide a forum for continuous dialogue, although the number of actual participants involved in the assessment and reporting often needs to be kept at manageable levels.

Participation is important not only because it helps to identify key environmental issues from the different stakeholders' perspectives, but also because it can offer options for addressing those issues. If participation is open and transparent, it is more likely that interests of different stakeholders, including interests of poor, vulnerable groups and women will be recognized and better reflected in the formulation of policy responses. A basic definition of *stakeholders* includes those:

1. whose interests are affected by environmental problems, or whose decisions have environmental effects;
2. who have information, resources or expertise required for policy formulation and strategy implementation; and/or
3. who control key mechanisms for policy and strategy formulation and implementation. (UNEP/IISD, 2007)

Opening up for stakeholder consultation and participation will increase ownership and endorsement (or validation) of the assessment by a large community and can therefore contribute to improved effectiveness, accountability and transparency.

The identification of key stakeholders is critical for successful engagement. This task should be carried out using robust methods, and with reference to the specific objectives of the Integrated Environmental Assessment. A comprehensive "stakeholder map" should form the foundation of the implementation plan.

Potential stakeholders and partners whose support for the whole Integrated Environmental Assessment process is crucial may include the following:

- political leaders;
- officials of national and regional public offices (such as ministries, institutes, councils, directorates and the military);
- local authorities;
- political party representatives;
- scientific community;

- representatives of industry or entrepreneurial associations;
- private sector representatives;
- professional schools or associations;
- academia (universities and research centres);
- non-government organizations;
- mass media;
- youth groups, women groups;
- indigenous communities and groups;
- civil society organizations;
- community and religious groups; and
- opinion leaders

The identification of stakeholders and their needs should involve a targeted programme of open dialogue consultations with the stakeholders identified in the "map". A variety of engagement techniques should be designed for developing the most effective consultations that will identify particular stakeholder needs, knowledge or information gaps as well as potential new opportunities. These consultation techniques may include online public consultations, targeted consultations, meetings, workshops, town hall meetings, seminars and online discussion forums.

To ensure effective participation, it is essential to have sufficient political support, including:

1. full support for an effective participatory process from the national environmental
2. authority or lead environmental institution;
3. leadership and organizational support from of the national environmental authority
4. and/or other agencies to support the process; and
5. explicit commitment as possible to make use of the results, including considering
6. recommendations in policy formulation, budget processes and strategic planning.
7. You can increase effectiveness of participation throughout the process by paying particular attention to the following:
8. ensure participation is built into all relevant stages;
9. establish open communications among technical experts involved in the assessment to clarify uncertainties and verify assumptions;
10. increase ownership by involving stakeholders from the very beginning, including in the formulation of recommendations;
11. invite stakeholders to contribute based on their experience, and make sure they can recognize their inputs in the analysis and recommendations;
12. inform participants that their contribution and participation will be properly recognized in outputs; and
13. where possible ensure stakeholder inputs are recorded, and that records are made available to contributors. (UN Habitat, 2002)

Organizing the assessment can seem as complex as conducting the Integrated Environmental Assessment itself. However, setting up the structure to oversee, guide, and conduct the Integrated Environmental Assessment is a critical part of the process to ensure the Integrated Environmental Assessment is viewed as credible, legitimate, and salient. The exact Integrated Environmental Assessment process followed will vary depending on the scope and scale of the assessment, but there are some elements that should be common among all Integrated Environmental Assessments.

Running the Integrated Environmental Assessment process as outlined provides:

1. an opportunity to contribute to and have access to the assessment database;
2. development of analytic skills and capacities, using an integrated approach to environment and development problems; and
3. opportunity to contribute to addressing major environment and development issues at the policy level.

2.7.3 Integrated Environmental Assessment Structure and Functional Needs

An assessment process needs to ensure both scientific and political credibility; and policy relevance. There are a number of structural elements or functions that are necessary to deliver these goals. These functions can be structured in a number of ways, depending on the scale of the Integrated Environmental Assessment and the resources available. The main necessary structural functions are:

a) *Central decision-making*: A central decision-making function is necessary to enable decisions to be taken on a wide range of issues that the Commissioning Entity does not reserve for itself. Typically, these issues include: determining the structure of, and appointments to, the bodies carrying out the other functions; identifying and organizing the Practitioners; responsibility for resource mobilization and budgetary control; and arranging for the Integrated Environmental Assessment's review, communications, and evaluation. The structure established may require some of these decisions only to be taken after appropriate advice from one or more of the other functions, or may delegate some of the decisions to another function, subject to some controls.

b) *Scientific advice*: A source of scientific advice is needed that will ensure the scientific credibility and overall quality of the Integrated Environmental Assessment. The source of advice needs to be collegiate, including members with a range of expertise in the fields necessary to cover the identified priorities and key issues of the Integrated Environmental Assessment, including natural and social sciences and traditional and local knowledge. Those with experience in communicating, promoting, and incorporating science into the policy development process and with a proven ability to work in international scientific and policy processes are preferred for this function. The source of scientific advice should be involved in the preparation of the general outline for the Integrated Environmental Assessment, and should therefore be set up at an early stage in the Integrated Environmental Assessment process.

c) *Text management*: A text management function is necessary with the responsibility of considering the draft Integrated Environmental Assessment texts as they emerge and approve them for the next stage. This will include setting the timetable for the production and submission of drafts, approving texts for circulation for external review, approving the way in which comments made in the various review processes should be reflected in the text and the final approval of the text of the Integrated Environmental Assessment. When this function is separate from the source of scientific advice, it should be required to seek scientific advice from that source before reaching decisions.

d) *Practitioners*: A team of Practitioners are necessary to carry out the work and writing of the assessment. This team will need to include persons with authority to coordinate the various parts of the Integrated Environmental Assessment and the overall output. The core team may be supplemented by a wider pool of expertise,

the members of which can be asked to help with specific issues, especially those outside the expertise of the core team. The source of scientific advice should be asked to advise on appointments to both the team and any wider pool of experts invited to participate in conducting the Integrated Environmental Assessment.

e) *General Communication*: A communication function to transfer the Integrated Environmental Assessment and its information to the outside world.
f) *Stakeholder Communication:* Creating communication links between the Practitioners and the relevant public authorities and other stakeholders are crucial to ensuring buy-in from potential Users. This function enables a two-way flow of information and comments between the Practitioners and Users.
g) *General management and support*: A general management and support function is necessary to keep track of what is happening within the Integrated Environmental Assessment and to take remedial action where problems are emerging. It would also be responsible for making meeting arrangements, keeping records of what is done and generally oil the wheels of the Integrated Environmental Assessment process.
h) "*Expert and intergovernmental peer review*" function: a scientific and intergovernamental review function is vital to guarantee that the scientific quality is maintained, helping validate the research while increasing networking possibilities within research communities. It also guarantees that the Integrated Environmental Assessment findings respond to the mandate originally assigned by the *Commissioning Entity*.

The personnel involved in these functions should show an appropriate geographic and gender balance, including individuals (where relevant) from developed and developing countries and countries with economies in transition.

There are a number of existing models for structuring these functions. Several Integrated Environmental Assessments, such as the Global Environmental Outlooks, have been managed with a five-part structure of:

a) A Secretariat with responsibility for the central decision-making, the text-management, the communication, and the general management and support functions.
b) A Scientific Advisory Panel with responsibility for the scientific advice function.
c) A High-Level Governmental and Stakeholder Group with responsibility for stakeholder communication. Advice from this Group is often required before the Secretariat can take decisions. In some cases, the non-official stakeholders are full members of the Group; in others, they are observers.
d) A team of Practitioners responsible for the work and writing of the Integrated Environmental Assessment.
e) A designed group of experts and governments' members responsible to conduct the review process.

Another model is to create a Steering Committee that covers what are defined above as the responsibilities of the Secretariat and the Science Advisory Panel. A third model would allow such a Steering Committee to undertake in addition some, or all, of the work of the team of Practitioners, as was used in the World Oceans Assessment.

Decisions on the structure to be adopted need to made, or approved, by the Commissioning Entity.

2.7.4 Creating a Community of Practice

To aid in the gathering of data, information, and analyses for conducting the Integrated Environmental Assessment, a Community of Practice should be formed, for Integrated Environmental Assessments whose scale and scope is sufficiently large to justify it. A *Community of Practice* is "a collective of stakeholders who collaborate together to generate knowledge around issues of importance to them" (UNEP/EA.1/INF/14). The members of the Community of Practice should consist of individuals nominated by the Commissioning Entity and other relevant stakeholders, as well as approved individuals who have requested to join based on their expertise in the areas being addressed by the Integrated Environmental Assessment and whose expertise and status meet specified requirements. The Community of Practice should be guided by moderators who should be identified by consensus between the scientific advice function and the members of the Community of Practice. Support for the Community of Practice and its moderators should be provided by the general management and support function.

2.8 Selecting Practitioners

For an assessment to be credible and have an impact, there must be confidence both in the individuals selected to develop it and in the processes for its preparation. Any suggestion that vested interests or partisan politics could have biased the Integrated Environmental Assessment will undermine its credibility. Especially in cases where the issue is controversial, attempts may be made to discredit the assessment, so all procedures followed must be above reproach. This includes the quality of the data, the objectivity of the scientific analyses, and the consideration of all stakeholder perspectives. Therefore, transparent, objective, and inclusive selection of Practitioners (i.e., Practitioners, contributors, and review editors) is a necessary part of the Integrated Environmental Assessment process.

Before selecting Practitioners, it is important for a basic outline of the assessment to be developed. The outline will help those giving scientific advice to start a human resource management plan to determine the range of expertise needed, when they will be needed, and how they will be acquired/recruited to cover the following roles and responsibilities for developing the Integrated Environmental Assessment: (i) coordinating lead authors (individuals responsible for coordinating all chapters or sections), (ii) lead chapter or section authors, (iii) contributing authors, and (iv) review editors. Experts should be selected based on whether they represent the following criteria:

a) The required range of scientific, technical, and socio-economic expertise;
b) Geographical balance, with appropriate representation of experts from developing and developed countries and countries with economies in transition;
c) The diversity of knowledge systems that exist; and
d) Gender balance.

Apart from the above formal conditions, the selection process should take into account the previous involvement of the candidate in any previous Integrated Environmental Assessment and his/her availability to regularly contribute to the assessment production during the entire process. This could be controversial especially when we are dealing with a TIER 3 (long > 2 years) assessment (see section 2.5 for definition of Tier 3).

Once the Practitioners have been selected, it will be possible to establish staff assignments and start the development of the Integrated Environmental Assessment chapters or sections should commence. The production of the draft Integrated Environmental Assessment may be conducted using several tools including, but not limited to, individual writing assignments

and Practitioners meetings. Consideration of how the Practitioners will work will be an essential part of formulating the budget for the Integrated Environmental Assessment, especially whether in-person meetings are needed.

In appointing the team of Practitioners, some will need to be designated as having a coordination role. Such coordinators for specific chapters or sections will need to agree with the other relevant members of the team (and any extra helpers from a wider pool of expertise) how the chapter should be structured within the general outline, what the timetable for delivering drafts and revisions should be, and how the final draft of the chapter or section will be agreed upon and submitted to the entity handling the text-management function. Practitioners will also need to be designated to coordinate between chapters to ensure that the overall Integrated Environmental Assessment text is coherent, comprehensive and consistent.

Ensuring that Practitioners are communicating within their chapter team and with other chapters will be a challenge, so the Integrated Environmental Assessment should develop appropriate approaches and plans for managing communications based on the participants needs, and requirements and to ensure that the Integrated Environmental Assessment represents the general view and not that of a single individual. This responsibility should not rest solely on the shoulders of the Practitioner chapter or section leads, but shared with the entity responsible for the general management and support function. There are several tools available to provide a platform for discussion including holding regular (e.g. biweekly or monthly) virtual meetings using teleconference tools. In the event of a problem within or among chapter or section teams, it is important for Practitioners to know who they can speak with. The goal should be to address issues at the chapter or section level, but when this is not possible, there needs to be an identified body with the decision-making function to address matters of difference within and among author groups.

2.9 Funding and timing of the Integrated Environmental Assessment

After a Commissioning Entity has mandated an Integrated Environmental Assessment and stated its objective/scope, the first two questions to be answered are: how much will it cost and how long will it take? The answer is the same for both, it depends. The relationships between time, budget and scope are well described in the literature on project management

Funding and time can both be limiting factors, i.e., limiting the scope and scale of the assessment. If the Commissioning Entity has provided a funding amount and when they want it, then it is the job of the entities responsible for decision-making, scientific advice, and general management and support functions to determine what can be reasonably assessed with the time and funding available. If a due date has not been provided or a budget, it is important for the decision-making and general management and support functions to clarify what the Commissioning Entity wants, so that a reasonable budget and due date can be determined. Table 2.8.1 provides reasonable timelines for completing assessment of assessments, and thematic and rapid assessments at spatial scales ranging from local to global.

Resources mobilized for Integrated Environmental Assessments should be sufficient to cover costs related to supporting all the relevant functions (i.e., scientific advice, text management, stakeholder outreach, general communication, general management and support and contribution to *Practitioners).*

In addition to resource availability, timeframe can limit the Integrated Environmental Assessment's scope and scale. If only six months are available to conduct an Integrated

Environmental Assessment, then the scope and scale are going to have to be reduced in complexity or the funding increased to support a larger team of Practitioners. However, at some point, no matter how much funding you have, there is only so much that can be done with a limited timeframe and the Commissioning Entity needs to be aware of the limitations of what can be provided. Data processing and analysis, model development to fill in gaps in data, and writing take time. Conversely, ample time with limited resources will produce a product that is limited in scope and scale due to lack of funding.

The Secretariat should avoid scope creep i.e. avoid a project growing beyond its original brief in order to include late requirements from key stakeholders. It should have project control processes to predict, understand and constructively influence the time and cost outcomes of the assessment.

Table 2.4: Relationship of resources compared to time

Scope	**Thematic**		**Rapid**		**Assessment of Assessments**	
	Time	Funding	Time	Funding	Time	Funding
Global	5 years	$$$$$	1.5 years	$$$	2.5 years	$$$
Regional	3-4 years	$$$	1.2 year	$$	1.5-2 years	$$
National	2 years	$$	8 months	$	1 year	$

2.10 External Review of the Integrated Environmental Assessment

Once the assessment is complete, but before it is finalized, it is important for it to undergo an external, independent review. An external review is an essential part of the process in ensuring that the document is credible and legitimate. It also allows for additional points of view or expertise to be added to the document. The external review process to be used should be determined early on in the assessment process so that all stakeholders are aware of how the assessment will be evaluated.

There are different forms of external review – from a formal process by which a limited group of experts or intergovernmental representatives are tasked to review the document to a review by the Community of Practice that is open to all members. Each has its merits. The one thing that they all have in common though is that none of these processes include the Practitioners or members of the entities responsible for scientific advice, general management and support, or stakeholder communication functions that contributed to the Integrated Environmental Assessment. This is key to ensure that the review is independent and viewed as credible and respected by those external to the Integrated Environmental Assessment process. The types of reviews are as follows:

- A *Scientific and Technical peer-review* is a review conducted by individuals representing the range of scientific and management expertise within the scope of the assessment being reviewed. The individuals must be independent and free from conflict of interest (i.e., an appearance of impairment of objectivity based on activities or relationships with person or entities involved in conducting or authorizing the assessment). Three (at a minimum) or more individuals should be identified to review the document. These individuals should be selected by an independent body, not the Practitioners. The function responsible for scientific advice and relevant stakeholders should be asked for nominations, however, the selection and addition of other individuals will be at the discretion of the independent body.
- The Scientific and Technical peer-review can take the form of a panel and/or consist of individual, independent peer-reviews. A peer-review panel is an in person meeting

where the reviewers discuss the assessment's strengths and weaknesses and make recommendations by consensus, if possible, on how to improve the document. An individual peer-review, often called a mail review, is done independently, without the benefit of consulting other peers. A review process can use both a panel and individual reviewers. In the case, where both a panel and individual reviewers are used, individual reviews can serve as a way to provide additional expertise not well represented by the panel. The individual reviews are provided to the panel as background information to inform their discussions only, but are not binding.

- An *Intergovernmental review* is a review that is conducted by individuals nominated by relevant governments and may also include scientific and technical reviewers, as well as government representatives, Users, and other stakeholders. The reviews are individual and not consensus-based. An Intergovernmental review should occur after the Scientific and Technical Review Panel has occurred and their comments have been addressed to produce a revised document.
- A *Community of Practice or Public review* is a review that is open to members of the Community of Practice for this assessment or the general public. The review must be well-publicized and available for comment for a finite length of time to ensure that all Community of Practice members or the public have ample opportunity to provide comments on the document. The amount of time allotted for the review should be reasonable and commensurate with the size of the document. At a minimum, the review should be open and the document available for comment for at least 30-60 days. To enable the comments to be addressed in a timely manner, it is recommended that you assign line numbers to the document and/or provide a template for comments. The template can be as simple as two columns, i.e., line number and comment. While general comments are important for overall direction, specific comments should be encouraged as these will be most helpful in ensuring that the comments are incorporated.

The type of review chosen for the document will be dependent on the time available for a review. At a minimum, all Integrated Environmental Assessments should undergo a Scientific and Technical peer-review and an Intergovernmental review. If time permits, the most thorough review option would be to conduct a Community of Practice or Public review, followed by a Scientific and Technical peer-review, followed by an Intergovernmental review. After each review, a revised document would be created incorporating the comments received, so that by the time the Intergovernmental review occurs, they are reviewing the third draft of the document. After the Intergovernmental review occurs, a revised draft is developed and the document will undergo copy editing and formatting.

Box 6 Role of external reviewers

External reviewers validate the Integrated Environmental Assessment process and verify the findings.

Validation ensures that the Integrated Environmental Assessment is meeting the *Commissioning Entity* and stakeholder needs, while verification is concerned with whether the Integrated Environmental Assessment is well designed and the findings are of high quality, but does not ensure that the Integrated Environmental Assessment is useful.

3 Integrated Analysis of Environmental Trends and Policy Responses

Practitioner	-Should also determine whether there are other objectives and/or policy questions that could be addressed within the scope of the assessment

3.1 Introduction

The DPSIR framework (Drivers-Pressures-State-Impacts-Responses) is often recommended for undertaking Integrated Environmental Assessments. It is especially appropriate when it comes to understanding fundamental human-nature relationships in Integrated Environmental Assessments. However sometimes complementary frameworks can be more appropriate

Box 7: When the DPSIR may not be appropriate

The Opportunities Framework for example, as used in African Environmental Outlook 2, is particularly focused on looking at potential opportunities for reducing poverty and promoting sustainable livelihoods. It starts by taking an inventory of existing resources and looking at trends in the recent past at the scale of interest (local, national, sub-regional or regional) and explaining why the observed trends have occurred. While the DPSIR approach is environment-pressures centered, (i.e. we must reduce the pressures on the environment through decreased socioeconomic activity, changes in consumption patterns and improvement in technology), the Opportunities Framework focuses on the available assets and how they can be sustainably used for human and economic development.

3.2 DPSIR framework definition

The DPSIR framework was developed by the National Institute of Public Health and Environment of Bilthoven, Netherlands (Kristensen, 2004). The DPSIR framework has been adopted by the European Environmental Agency to give structure in presenting indicators to policy makers and enable feedback. It has also been adopted by the United Nations "Regular Process" for reporting the state of the global marine environment, including social and economic aspects.

The DPSIR framework is a systematic way of looking at what seems to be a complex situation, by breaking it down into components and showing the links among them. The components include drivers (D) or root causes of environmental change, which arise from human or societal needs that give rise to pressures (P) on the environment which are the human/societal activities that result from fulfilling those needs. These activities generally result in biological, physical, and chemical products, that cause changes to the environmental condition, thereby impacting on the state (S) of the environment and affecting its ability to provide services and goods to society (Kelble et al. 2013). This, in turn, could elicit responses (R), political, or otherwise, designed to mitigate the impacted environmental state, thereby improving the condition of human society or nature (Figure 3.2.1). The DPSIR can be used at any scale. It can also be applied in deriving specific indicators for summarizing data from a variety of sources. (https://archive.epa.gov./ged/tutorial/web/pdf/dpsir_module), and there is increasing interest for exploring its use for problem structuring and also for socioecological accounting,

replacing Impact by a change in an indicator of human welfare attributable to a change in State.

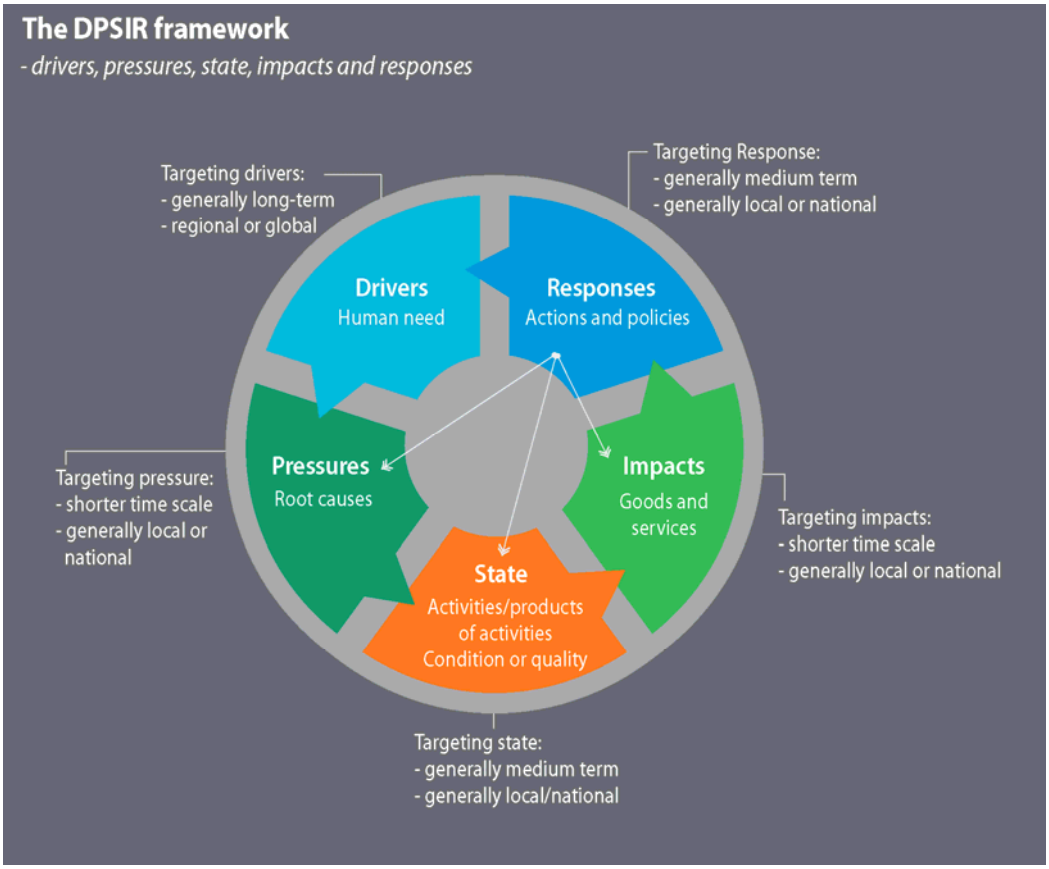


Figure 3.1: An example of the DPSIR framework

In using the DPSIR framework, it is helpful to ask the following questions in determining each component.

1. What is the purpose of the assessment or what is being assessed?
2. What is the state of the environment (S) or part of the environment (e.g. habitat)?
3. What are the pressures (P) responsible for the present state of the environment (S)?
4. What drivers (D) led to these pressures (P)?
5. What are the impacts (I) of the present state of the environment (S) on society?
6. What actions or responses (R) should be taken?

The DPSIR framework reduces a complex situation into a simpler cause-and -effect situation allowing better understanding. Ideally this cause-effect should be also reflected in the Theory of Change. Employing the DPSIR framework in an Integrated Environmental Assessment can direct policy makers where action should be focused. Nevertheless, empirical evidence indicates that although most studies using DPSIR address political and administrative systems, only a few studies integrate decision-makers into the participative process for the definition of the DPSIR elements and the subsequent adoption of recommendations.

3.2.1 Drivers

'Drivers' or 'driving forces' refer to the economic and social situations and needs of individuals, communities, nation states or businesses. Economic and social situations and needs are intricately related. Urbanization, demographic change, poverty and hunger could lead, for instance, to changes in land use systems exerting pressure on fragile ecosystems. Businesses are often driven by the profit maximization/cost minimization objective. Governments could have the stated objective of growing the economy, creating jobs and achieving socio-economic development, all of which can be 'drivers' of the state of the environment. In and of themselves, the 'drivers' do not exert any direct pressure on the environment, but are the underlying causes of the pressures on the environment. It is conceivable that there are 'primary drivers' and 'secondary drivers'. Poverty, for instance, may be considered as a primary driver while employment creation may be considered as a secondary driver. Some drivers, such as poverty and its many manifestations including the growth of slums and lack of access to potable water, can also be viewed as representing the observed state of the environment, highlighting the non-linear, dynamic and flexible nature of the DPSIR framework.

3.2.2 Pressures

The ‘drivers’ or 'driving forces' lead, inevitably, to human activities which exert ‘pressures’ on the environment. Pressures refer to actions; production and consumption processes, undertaken in response to the drivers which lead to changes in the condition of the environment. There are three main types of pressures: (i) excessive use of environmental resources, (ii) changes in land use, and (iii) emissions of chemicals, waste, radiation, and noise to air, water and soil (Kristensen 2004).

The relationship between ‘drivers’ and ‘pressures’ is non-linear and can indeed be rather nuanced with a single driver leading to a many 'pressures' and a particular 'pressure' triggering a 'driver' or 'driving force'. Poverty, as a driver of environmental change may lead to changes in the land use pattern and ecosystem encroachment, all of which may lead to deforestation and, consequently, increased carbon dioxide emissions. Rapid urbanization on the other hand may lead to the growth of slums, poor sanitation and waste management and increased incidence of water-borne diseases. The pursuit of economic growth may lead to increased mining activities, which may lead to habitat loss and pollution; and industrialization which may lead to environmental pollution. On the one hand, the pressures (e.g. poverty), intended to address the driver, may unintentionally lead become a 'driver' or driving force'. On the other hand, the situation of poverty and hunger may lead to increased agricultural production through the use of fertilizers which may result in polluted underground water. Similarly, impacts may trigger a different kind of pressure. Population pressure (Driver) may lead to over-fishing (Pressure) which may lead to declining fish stocks (State) which may lead to malnutrition among children (Impact). But malnutrition among children (Impact) could also lead to agricultural intensification (Pressure), which may lead to soil and ground water contamination (State).

3.2.3 State

Assessments of the state of the environment are carried out to assess human impacts on the environment, as well as the condition and trend in natural resources that provide a long term supply of goods and/or services that are used by industry and that support human well-being. This understanding provides governments and other stakeholders with information on the issues that they must confront, the gaps in knowledge that may exist and

the likely social and economic consequences that may follow from policies and legislative actions taken. In cases where governments have responded by enacting a policy, there is the added need of monitoring and measuring the condition and trend of ecosystems to verify that the policy is performing according to plan and yielding the desired outcomes.

The state of the environment includes the quality of the various environmental components (e.g. air, water, and soil) in relation to the functions that these components fulfil. The state of the environment is thus the combination of the physical, chemical and biological conditions that currently exist in a given environment. The assessment is normally carried out using selected indicators, which are environmental attributes that have been identified as being indicative of overall environmental condition and are measurable (e.g. population size and concentration of a chemical) and/or monitored for regulatory purposes. Assessment of the "state" is the part of the DPSIR that is quantifiable and provides direct feedback to policy responses allowing their effectiveness to be determined.

In forming judgments about the state of the environment, a “benchmark” (a point of reference for the condition) is needed. The establishment of a benchmark is for the purpose of quantifying environmental change relative to the present time and against which the current environmental condition is assessed. Ideally, the benchmark is the condition of the parameter prior to the time when human impacts started to occur. In practice, benchmarks are mainly chosen for convenience and to represent times when data are available. A benchmark can also be an agreed standard adopted by an authoritative body.

In addition to giving scores on the condition or “state”, the assessment will need to judge the trend in each parameter as declining, stable or improving. Trends may be assessed for both long and short time periods, the latter being to provide policy- and decision-makers with feedback on how policy responses have or have not had the desired effect.

3.2.4 Impacts

Impacts are the “changes in the physical, chemical or biological state of the environment [that] determine the quality of ecosystems and the welfare of human beings. In other words, changes in the state may have environmental or economic ‘impacts’ on the functioning of ecosystems, their life- supporting abilities, and ultimately on human health and on the economic and social performance of society” (Kristensen 2004). Examples of impacts may include loss of habitat, reduction in populations, loss of aesthetic value, loss in revenue, and changes in ecosystems.

Box 7 Emphasizing impacts on human welfare as a consequence of environmental impacts

When considering impacts from a policy perspective it is crucial to emphasize impacts on (indicators of) human welfare. For example, air pollution (state) leads to declining human health e.g. in terms of numbers of premature deaths (impacts). Without including human welfare indicators – such as those indicated by the sustainable development goals - Integrated Environmental Assessments will fail to translate environmental impacts into human and thus policy problems. For example, rather than framing climate change in terms of changes in ecosystems it is more effective from a policy process perspective to (also) frame it in terms of a risk to human health and (e.g. in case of increasing frequency and severity of extreme weather events) human life.

3.2.5 Responses

As environmental changes generate impacts, societies respond with formal (i.e. policies) and informal (i.e. behavioral changes) strategies. These are called responses in the DPSIR framework, and their purpose is to reduce the impact of the drivers and pressures on the environment, and minimize the impacts on human well-being and the environment (Integrated Environmental Assessment training manual, Module 1). These responses combine science and technology approaches, policies and institutions. For example, in a city with air pollution problems, these approaches might provide different, but complementary responses:

- Science and Technology Approach is to improve engine technology to reduce air pollutants.
- Policy Approach: The City Council promotes the use of public transportation instead of private cars; tax breaks for electric cars.
- Institutional Approach: Bicycle groups promote the use of this mode of transportation.

This example also highlights how responses may act with each other synergistically even though they are controlled by different actors. Many institutions have formal written rules (i.e. government policies and private association bylaws), while others work with more informal arrangements (i.e. forest management by traditional societies, social media groups, and civil society initiatives). In the case of environmental change, both types of responses are present. While governments have control over the formulation and implementation of environmental policies, communities and other social groups might have control over informal institutions, or exert pressure on governments and markets to react to environmental change impacts. For example, the demand for organic products by certain consumer groups has generated agricultural certification and verification schemes that require better agricultural practices that reduce environmental impacts. Unlike policies, that are mandatory, these schemes are voluntary for both the consumer and producer.

An important step in the analysis of responses is to identify the gaps (i.e., responses that could be taken to address environmental change), as well as those that have been adopted. An inventory of existing policies and other responses (e.g. civil society initiatives and market mechanisms) is important for identifying these gaps, as well as the non-governmental initiatives that may be promoted by policies. A well-defined and transparent set of criteria (e.g. lower cost, faster adoption) is needed to define which potential responses or combination of responses should be implemented. Furthermore, an evaluation of the efficiency of these responses (i.e., have they met the desired objectives or if they have unexpected consequences) should be carried out so policies that are not properly aligned with their objectives are adapted and corrected.

3.3 The DPSIR as a framework for policy and decision making

The ultimate success of employing a DPSIR framework, will be measured by the extent to which the assessment initiates policy discussions or influences important policy responses. Policy responses are often directed at the pressures, but they could also be directed at the impacts and even in exceptional cases, the 'drivers' or 'driving forces'. Ordinarily, the objectives of the assessment will have been spelled out by the Commissioning Entity, but the Practitioners should also determine whether there are other objectives and/or policy questions that could be addressed within the scope of the assessment. By involving the stakeholders or Users in the assessment, Practitioners could, for instance, help them

appreciate better the state of their environment and trigger local responses without necessarily having to rely on the national authorities, and/or Commissioning Entity, to act.

Integrated Environmental Assessments policy effectiveness understanding still remains underdeveloped mostly because shaping directly the public policy, make the accountability process very complex when referring to the multidimensional real-world policy processes.

The most referred method concerns the influence that Integrated Environmental Assessments key findings may have in the public speeches made by policy makers.

To improve the policy effectiveness of the assessment, it is often necessary to develop a clear communication and advocacy strategy targeting different audiences with tailor-made, contextually relevant and appropriate messages throughout the assessment process. In this context, it is also important that Integrated Environmental Assessments expected impacts are communicated well in advance to Integrated Environmental Assessments practitioners . This represents an important asset underpinning the intervention of various actors in multiple policy settings (Schmidt and Radelli, 2004).

4 Assessment of Policy Effectiveness

"No policy – no matter how ingenious – has any chance of success if it is born in the minds of a few and carried in the hearts of none." H. Kissinger.

When assessing policy effectiveness, the various actors:

Practitioner	- Should determine whether they have been given a mandate from the commissioning authority for assessment of policy effectiveness - Conducting a global-scale policy assessment should determine which MEAs to evaluate - Should determine an appropriate 'scale of success' which will demonstrate to Users the extent of progress that has been made - Should also provide examples of policy success stories to help Users to determine which policy pathways have been successful and why - Should determine if the CE's mandate has specified the inclusion of regional- and/or national-scale policy effectiveness assessment in the Integrated Environmental Assessment -Should determine the level of aggregation for the assessment, the heterogeneity of the policy and decision making systems, as well as the environmental goals against which the effectiveness assessment will be conducted - Should clearly understand the scope of the assessment and establish an analytical framework that addresses this specific focus - Should determine if the geographic scale allows for either a global, regional or national policy-effectiveness assessment - Should apply the assessment techniques appropriate for the geographic scale recognizing that more than one policy might be implemented in different places to address the same issue - Should use more focused assessment methods based on the type of policy intervention and the expected outcome - Should determine whether specific, measurable, assignable, realistic and time-bound (SMART) targets exist for these policies and whether monitoring data have been collected - If SMART objectives do not exist then Practitioners should consider using proxy indicators - Should take care since indicators may be better correlated with different drivers than those first expected - Should pay particular attention to the way in which the policy has different impacts on specific interest groups - When developing conclusions for this aspect of the assessment, Practitioners should consider overall costs involved and overall benefits gained.
Secretariat	- Should remain neutral and avoid advocacy
Commissioning Entity	- Should consider that the process for carrying out the policy assessment is likely to focus on different aspects of the Integrated Environmental Assessment than the initial stakeholders

The role of IEA group at each level should pay attention to different aspect in assessment of policy effectiveness. Commissioning Entity should consider that the process for carrying out the policy assessment is likely to focus on different aspects of the IEA than the initial stakeholders. the secretariat should remain neutral and avoid advocacy.

IEA Practitioner for assessment of policy effectiveness should get a mandate from the commissioning authority, determine the environmental goals at different geographic scales and of various IEA Users, establish an analytical framework that addresses this specific focus, determine an appropriate scale, method and indicator, and consider the overall costs. A set of SMART (specific, measurable, assignable, realistic and time-bound) indicators for these policies is recommended when monitoring data available, but the proxy indicators for IEA is

also possible. IEA Practitioner should also provide examples of policy success stories to help IEA Users to determine which policy pathways have been successful and why.

One aspect that makes an environmental assessment 'integrated' is that there is an attempt to establish causality between drivers, pressures, states, impacts and any policy responses. That is to say that, if a particular environmental impact can be linked to a specific pressure or driver, then a set of policy options can be identified to target that driver or pressure, with the best one(s) selected based on a transparent and previously defined set of criteria.

Once the selected policy is implemented a separate process can be initiated to determine whether the policy in question is achieving the anticipated outcome of reducing the environmental impact of that driver or pressure. This process is called an assessment of policy effectiveness. It is not part of all Integrated Environmental Assessments, but can be useful for policymakers and improve the policy relevance of the assessment. This section provides guidance to *Practitioners* on elements to be considered in this phase of the assessment, as well as on different methods that can be used to conduct such an assessment.

Practitioners should determine whether they have been given a mandate from the commissioning authority for assessment of policy effectiveness. This mandate may be specific or implied from the overall context of the assessment. Not all requests for Integrated Environmental Assessments will include this mandate. (See Annex 2 Box 2)

4.1 Determining the need and scope of the assessment

When conducting an assessment of policy effectiveness Practitioners should first determine whether the CE has included the assessment of policy effectiveness under its mandate. If it has, the CE should provide the need for and scope of the assessment, and should consider:

- The benefits and drawbacks of conducting an assessment of policy effectiveness. Benefits are likely to include increased focus on the implications of the Integrated Environmental Assessment findings for policy development. Drawbacks could include focusing attention on policies which cannot realistically be changed
- At which scale the assessment will be conducted (e.g. global, regional, national, or sub-national)
- Which policies will be assessed (i.e., is there a reasonable subset of polices that can be considered to be representative of the whole?)
- Which criteria will be used for determining the extent to which policies are effective. Such criteria will typically be policy-specific, since they will need to focus on the policy goals
- What techniques can be used to evaluate policies against such criteria. These techniques must be theoretically sound, operationally complete, and may look specifically at expenditures (economy), efficiency and effectiveness, but also might follow other approaches
- How findings on policy effectiveness will be formulated and presented in the assessment

4.1.1 A Question of Scale

Typically the scale of the policy assessment will depend on decisions during the planning phase, which defines which type of assessment is requested. The scale of the assessment can be defined by the CE in a number of ways:

- The geographic scale of the assessment can be defined (e.g. global, regional, national);
- The theme of the assessment may be defined (e.g. oceans, mountains, sand and dust storms, or marine plastics);
- The timeframe of the assessment may be defined (e.g. alert-type assessments, rapid response assessments)
- The resources available to conduct the assessment may also implicitly define the scale of the assessment.

4.1.2 Global-scale policy-effectiveness assessment

Assessments which focus on global-scale environmental analysis typically require a unique approach to policy assessment. Instead of assessing individual policies, the aggregate impact of a collection of policies should be determined. In particular, global assessments typically focus on whether global targets have been achieved. How the targets have been achieved may require an assessment of the groups of policies that have been adopted at the national or local scale, or there can simply be an assessment of the general policy direction taken by parties to the global agreement, typically Multi-lateral Environmental Agreements (MEA).

Practitioners conducting a global-scale policy assessment should determine which MEAs to evaluate. It may be necessary to determine a clustering of cluster MEAs that would be assessed.

Practitioners should determine an appropriate 'scale of success' which will demonstrate to Users the extent of progress that has been made. This may require graphic representation of this progress (e.g. graphs or infographics) to be developed.

Practitioners should also provide examples of policy success stories to help Users to determine which policy pathways have been successful and why. The CE may also wish to request examples of unsuccessful policies or policy implementation, as well as policy conflicts that result in negative environmental effects.

4.1.3 Regional- and National-scale policy-effectiveness assessment

At a regional-scale policy assessment can be more targeted and perhaps focus on assessing national-scale policies, as well as achievement of regional environmental targets.

Practitioners should determine if the CE's mandate has specified the inclusion of regional- and/or national-scale policy effectiveness assessment in the Integrated Environmental Assessment

If regional-scale policy effectiveness assessment is requested, Practitioners should determine the level of aggregation for the assessment, the heterogeneity of the policy and decision making systems, as well as the environmental goals against which the effectiveness assessment will be conducted. If data are limited for conducting the assessment, qualitative assessment techniques (cross-reference) or proxy indicators can be used.

If national-scale policy effectiveness assessment is requested, Practitioners should clearly understand the scope of the assessment and establish an analytical framework that addresses this specific focus.

4.1.4 Thematic-scale policy-effectiveness assessment

If an Integrated Environmental Assessment is theme-specific, Practitioners will need to determine if the geographic scale allows for either a global, regional or national policy-effectiveness assessment. This may also involve a verifying the views of the CE, which may specify at which geographic scale the policy-effectiveness assessment should be carried out and the time for the impact of the policy response(s) could be evident in the system.

If a policy-effectiveness assessment is requested, Practitioners should apply the assessment techniques appropriate for the geographic scale recognizing that more than one policy might be implemented in different places to address the same issue. Thus, at the global or regional level, policy effectiveness might require aggregating national/subnational policies, recognizing that impacts might cover multiple and diverse attributes, and acknowledging the risk that the policy/policies might have asymmetric effects. If national-level policy assessment is requested, Practitioners should use more focused assessment methods based on the type of policy intervention and the expected outcome. (e.g. cost-benefit, 3Es, multi attribute value functions and input/output analysis).

4.1.5 The framework for policy assessment: Determining performance indicators and monitoring methodology

Practitioners who are assessing the effectiveness of policies should determine whether specific, measurable, assignable, realistic and time-bound (SMART) targets exist for these policies and whether monitoring data have been collected. If targets and data exist, the data relevant to these targets should be used as the basis for a policy effectiveness assessment.

If SMART objectives do not exist then Practitioners should consider using proxy indicators. These indicators may be drawn from literature studies or expert elicitation. The correlation of these proxy indicators with the anticipated policy outcomes needs to be considered when determining their usefulness in the assessment. Practitioners should take care since indicators may be better correlated with different drivers than those first expected.

4.2 Considerations when conducting policy effectiveness assessment

Policy effectiveness assessment may include:

- The environmental themes of air, water, land and biota, in a way which mirrors the state of the environment assessment;
- Impacts on livelihoods and well-being;
- Gender and age-differentiated impacts;
- Changes in administrative burden of stakeholders;
- Performance of affected economic sectors;
- Geographic scale of effectiveness;
- Adverse or unintended impacts;
- Co-benefits on other environmental issues and socio-economic issues;
- Effects on public finances, where relevant;
- The result of cost-benefit of policy;
- The effects on competing and conflicting policies.
- Communication strategy and feedback loops for influencing new policies/new studies.

Sensitivity analysis

In considering the effectiveness of a policy, Practitioners should pay particular attention to the way in which the policy has different impacts on specific interest groups. Such interests include (depending on the nature, scale and type of policy) those of:

a) ***groups of people:*** people of different genders; people in different age groups; people with different levels of income or property; people with physical, mental or educational disadvantages; people of different origins; and people inside and outside the area in which the policy applies;
b) ***areas of land or water:*** areas judged worth specific conservation efforts on account of archaeology, biological diversity, cultural or historic importance or landscape or seascape value; areas of particular importance for the provision of specific foods or other consumable goods; and areas planned for specific future developments;
c) ***types of biota:*** families, genera, species, varieties, breeds or strains of animals, plants or microbes of particular significance either for the policy in question or for more general reasons;
d) ***other ecosystem services:*** clean air; food supply; waste disposal (both solid and liquid); and water supply (including for agricultural, industrial and public supply purposes).

Developing overall conclusions

When developing conclusions for this aspect of the assessment, Practitioners should consider overall costs involved and overall benefits gained. The calculation of costs should consider any potential efficiency gains identified.

The Commissioning Entity should consider that the process for carrying out the policy assessment is likely to focus on different aspects of the Integrated Environmental Assessment than the initial stakeholders. The affected economic sectors and the public authorities concerned may need to be involved in the policy assessment in a way that will lead to them accepting the conclusions.

When formulating conclusions on policy effectiveness, regional, political, economic and cultural sensitivities should be considered. This may require the balancing of positive and negative findings but the ultimate goal should be to nudge or recalibrate the policies that are assessed in order to make them as effective as possible and with the least negative impact.

4.3 Methods for Assessing Policy Effectiveness

Although several methods have been approached through the years, assessing the policy effectiveness of Integrated Environmental Assessments still presents incertitude. Some principles defined below can guide the users through this process.

Policies need to be assessed by criteria – that SDGs have already provided .

Appropriate methodologies will differ depending on the policy question that is being addressed by the Integrated Environmental Assessment; the scale of the policy focus; and other factors. These methodologies can even be quantitative (regression, etc.) and/or qualitative (process tracing, etc.)

The counterfactual scenario – meaning what would have happened if a policy or set of policies had not been implemented - is absolutely essential in the context of assessing policy effectiveness (in various dimensions) and requires careful consideration

4.3.1 The 3Es – Expenditure, Efficiency, and Effectiveness

Practitioners can use the approach of considering sequentially the ***expenditure*** on a policy process, its ***efficiency*** and finally its ***effectiveness*** – known as the "3Es." The first E defines the resources being devoted to the policy, the second E whether the same results could be achieved more economically, and the third E addresses the overall relation between resource demands and outcomes. This may require determining the costs or values of factors that are not currently monetized (e.g. ecosystem services).

Expenditures. The following expenditures should be considered:

- Public sector expenditures to implement the policy, including staff overheads;
- Private sector expenditures necessitated by the policy;
- Change of economic value of public and private goods; and
- Change in non-monetarized values of public and private goods

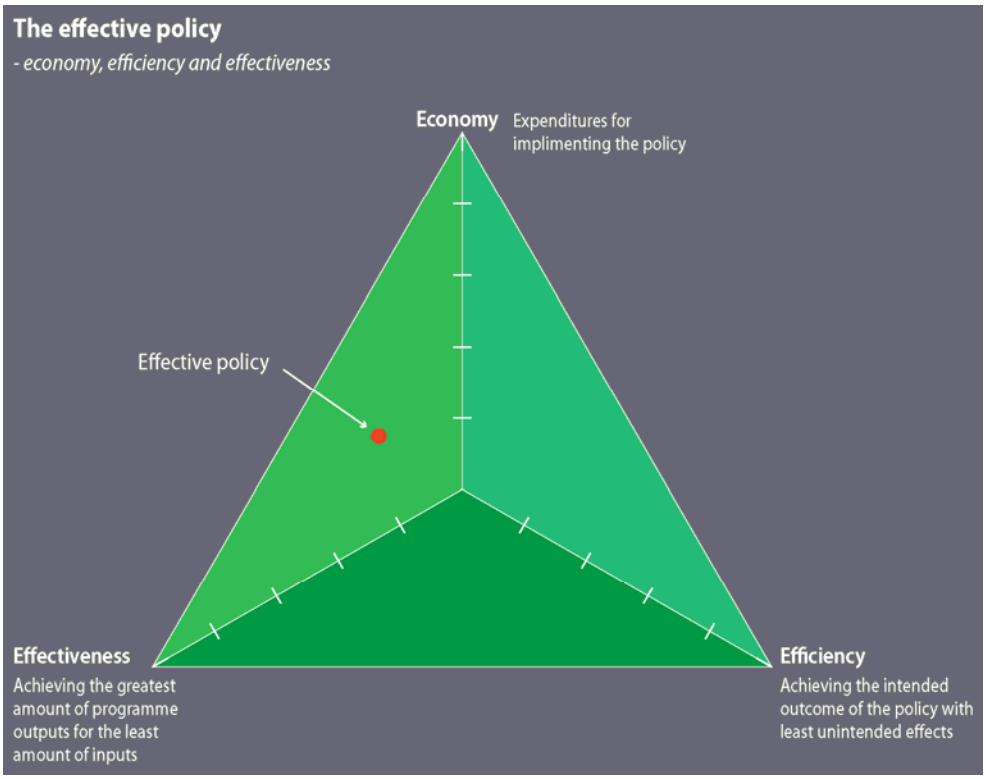


Figure 4.1: The 3Es – expenditure, efficiency, and effectiveness

Efficiency: Practitioners may also assess the efficiency of policies using an inputs/output approach. This assessment should consider the total resources being applied rather than simply direct expenditures. This assessment can consider free riders and other losses of efficiency. The following aspects should be considered:

- The type of policy instrument (e.g. command and control vs. education vs. market-based instruments);
- The scale of the impact; and
- Alternative policy delivery mechanisms (e.g. technology vs. personnel, leveraging of existing policies, or contracting out).

Effectiveness: Practitioners can also assess the effectiveness of policies by determining the extent to which the outcomes being achieved are delivering the aims of the policies. This may require an assessment of unintended consequences. The following aspects should be considered:

- The policy must get the attention of different stakeholders, including decision makers, investors, local people and the community;
- The functioning of the policy should be measured;
- The degree that the policy satisfies the target of environmental management, and new experiences, including lessons learned.

4.3.2 Other methods

A policy is not the end-point of a linear process but rather part of a cyclic exercise to always improve the 3Es of a certain measure. Therefore, policies need to undergo their own "performance" assessments. Especially because the environmental challenges that we face today are still very similar to the challenges that we faced 10-20 years ago, and this despite the introduction of several environmentally targeted policies. So it is almost a given that there is a need to make our current policies more effective. Depending on what is thematically been evaluated, one method will be more useful than another to recalibrate policy. Possible methods can be cost-benefit analysis, input/output analysis, and programme or project monitoring and evaluation. The latter should probably always be built in in the planning stage. One thing to keep in mind is to customize every method slightly depending on the scope and scale of each Integrated Environmental Assessment. Like with most of the guidelines outlined in this document, there is no one-size-fits-all recipe for policy assessment. One very important consideration when choosing a method to evaluate policy effectiveness will be the sensitivity of the outcomes of the policy assessment. The aim should always be to choose a method that will have the most chance of being validated by most stakeholders and embraced by the decision makers as it will also be them who can effectuate the changes that are needed.

4.3.3 Cost-benefit/ cost effectiveness Analysis

Cost-benefit analysis compares the increase in human wellbeing (benefits) and the reductions in social welfare (costs) of a given action or policy. In a cost-benefit analysis for a policy to be beneficial, its social benefits must exceed its social costs. Similarly, a policy may be viewed as economically successful if its benefits exceed the costs of implementation.

Cost-benefit analysis is usually carried out for certain policies for example, to assess policies to combat climate change, and health-environmental nexus issues. Questions should look at What is being environmental resource is being evaluated, i.e., who is impacted and who's benefiting and losing? What's the time span, i.e., what's deemed expensive in the short-term might pay off in the long-term? Are there alternatives? When evaluating a policy (or project), one needs to determine the value of the environmental resource(s) and its grade, degradation(cost), or improvement(benefit).

The difficult part is to give a monetary value to the environmental resource (which often doesn't have a real market value).

Alternatively, cost effectiveness analysis may be used to find the most effective action or policy to achieve a desired result in a given timeframe. An example of this may be achieving multilateral environmental agreement deadlines for compliance. Cost effectiveness analysis is also sometimes used in place of cost-benefit analysis when the monetary value of benefits is uncertain. For example, the cost effectiveness of a policy option can be calculated by dividing the cost of the option by physical benefit measures, such number of plant species preserved, tonnes of waste eliminated, area of farmland rehabilitated etc.

4.3.4 Input/output analysis

Input-output analysis provides a simple method for evaluating the linkages between economic consumption activities and environmental impacts, including the harvest and degradation of natural resources. Input-Output analysis is now widely used and continues to grow in popularity as a way to evaluate the relationship between economic activities and downstream environmental impacts (Kitzes 2013). This technique can be used to identify the economic drivers of any environmental impact, e.g. the emission of pollutants, the degradation or harvest of natural resources and the loss of biodiversity.

In the environmental literature, Input-Output analysis is generally used to accomplish one or both of two major goals:

1. To calculate the hidden, upstream, indirect environmental impacts associated with a downstream activity；
2. To calculate the amount of indirect environmental impact.

4.3.5 Range of policies that could be assessed

Policy assessment can cover a wide range of different environmental policies. These can be broadly characterized into policies which influence lifestyle choices, policies which improve the environmental performance of economic activities and policies which encourage the development of more environmentally friendly technologies.

Practitioners should ensure that all three of these broad categories are assessed, for example, policies which influence lifestyle choices could include:

- Bans (with or without compensation, fines, criminal penalties etc etc) .
- Charging(along the lines of polluter pays) .
- Building public understanding e.g. awareness campaigns .
- Incentives e.g. tax breaks .
- Voluntarily compliance with 100% adopting the behaviour e.g. wearing seat belts in some countries.

If exclusions of certain policy types are planned in the assessment, the types of policies excluded from consideration should be explained clearly, along with the reasons for excluding them.

4.3.6 Monitoring and evaluation of policy effectiveness

Monitoring and evaluation exercises are essential for working in a dynamic development environment like the policy development process, to determine if progress has been made in achieving expected outcomes and impacts of relevant policies. Successful monitoring and evaluation will reveal intended and unintended (positive and negative) consequences of a

policy and its strengths and weaknesses. It can also find the barriers which are preventing effective implementation and therefore lead to define where important improvements can be made.

Monitoring and evaluation is an integral part of policy development and a very effective tool to measure performance and give decision-makers an evidential basis by which to calibrate policies.

Generally speaking, monitoring continuously allows for data to be collected on the defined indicators to track progress and performance as such, while evaluation assesses periodically the degree to which a programme has reached its outcomes or goals.

Planned systematic and regular data-collection and assessment of it and ensure that relevant indicators (or proxies) are used to measure progress. Simple monitoring and evaluation procedures and a smaller and manageable number of indicators will make this process not only more manageable but the results will be easier communicated and addressed.

4.3.7 Multi-criteria approaches

Multi-criteria analysis or multi-objective decision making is a type of decision analysis tool that is particularly applicable to cases where a single-criterion approach (such as cost-benefit analysis) falls short, especially where significant environmental and social impacts cannot be assigned monetary values. MCA allows decision makers to include a full range of social, environmental, technical, economic, and financial criteria.

Multi-criteria approaches provide for the inclusion of intangibles in policy analysis, allow the consideration of both qualitative and quantitative data in the same model, and assist the structuring and trading-off of disparate criteria which are in basic conflict in complex decision making (for example, efficiency and equity).

The multi-criteria approaches, facilitate identifying policy objectives, value their performance not necessarily in monetary terms e.g. by using quantitative analysis (scoring, ranking and weighting) and then assess tradeoffs and compare and rank the different objectives.

Timescales and offsetting effects should also be considered in policy effectiveness assessment. These should consider short and long term impacts and analyze offsetting effects. For example, reducing shipping emissions (e.g. sulphates) may worsen climate change in the short term but be essential for meeting health and longer-term climate targets.

4.4 Policy impacts – how to assess positives and negatives

One of the challenges to policy making in the overall framework of governance is the traditional compartmentalization of government, academia, international organizations, and much of civil society into "silos", sectors or specializations (e.g. economy, finance, sociology, social security, education, environment, nature conservation, science, culture, and religion), each of which functions within its own framework of concepts and actions with little reference to anything outside. Getting government ministries or departments to cooperate, or different academic specialties to collaborate, will frequently meet with resistance or inertia. Policies to address problems in one field may inadvertently influence other sectors. For example, a policy of building to address a housing shortage may result in the loss of the best local agricultural land, while subsidies to maintain employment in the fisheries sector

generally result in overfishing and can lead to the collapse of the fishery. The same can be true for environmental policies adopted in isolation from their broader impacts.

Integrated Environmental Assessments are intended to address this problem, but it is not always easy to have access to all the relevant expertise, and particularly to develop the larger systems perspective necessary to identify linkages, interactions and unintended consequences of policies and management actions. This should be included in the design of the Integrated Environmental Assessment. Various tools of systems analysis and impact assessment have been developed to assist with this.

The challenge of integration and breaking down silos is clearly recognised in the UN 2030 Agenda, and the Sustainable Development Goals (SDGs) have been designed to provide an integrated framework for policy action that can be very useful in the Integrated Environmental Assessment process. New tools are being developed for this, and any Integrated Environmental Assessment should consider how it fits in any larger sustainability initiatives or adaptation of the SDGs at its relevant scale and scope. One element of the Integrated Environmental Assessment should be how it can contribute to the achievement of the SDGs, or how actions resulting from the Integrated Environmental Assessment might have negative impacts on other SDG targets.

One priority issue for policy is to ensure inclusiveness so that no one is left behind. Often when data are aggregated for assessments, significant detail is lost. A mean income can hide great disparities between rich and poor. The 2030 Agenda calls for disaggregation of data as appropriate to single out issues relevant for marginalized or disadvantaged groups, and the same could be considered for vulnerable environments. This is often where impacts may be the most significant and need to be singled out in an Integrated Environmental Assessment.

4.5 Science-Policy

An Integrated Environmental Assessment is a very important mechanism for strengthening the relationship between science and policy, and is a key practice through which science informs decision-making. The complexities and uncertainties of science need to be translated into concepts and language that are relevant to the policy-making framework for better decision making.

By integrating scientific evidence with social and economic impacts, an assessment can establish the importance of an issue. Where there is uncertainty or controversy about an environmental issue, a credible scientific assessment can provide an authoritative resolution of policy-relevant scientific questions, for example, as in the case of the Intergovernmental Panel on Climate Change (IPCC, 2014, 2007, 2000).

The breadth of an Integrated Environmental Assessment can include a discussion of technical solutions, and identify new research directions where scientific understanding is insufficient to provide reliable policy guidance. It is often necessary to propose new forms of data collection, standardized methodologies, or the calculation of new indicators in order to monitor an emerging issue, evaluate the effectiveness of a proposed policy, or guide management actions.

The Integrated Environmental Assessment can demonstrate the benefits, risks and costs of different policy options. Many actions involve trade-offs between benefits and impacts for different interests, or short-term benefits that imply longer-term costs. Financial benefits for a few may need to be weighed against externalities that raise costs for the public. While

decision-makers may not want an assessment to be policy prescriptive, they do want it to be policy relevant.

One way to improve the science-policy relationship is to include policy makers and other stakeholders as participants in appropriate steps in the assessment process. This both improves their understanding of scientific issues and approaches, and builds trust and understanding of scientists as relevant sources of information. The scientists also benefit from a clearer appreciation of the priorities, concerns and constraints of policy-makers and can make their assessments more relevant.

Box 8 Stakeholder involvements

Opening up policy-making to stakeholder input can contribute to making the process more transparent, accountable and effective. Those affected by laws understand better than anyone what impact they have, and can provide useful evidence to improve them. It is first necessary to identify the key stakeholders that may be impacted, which is not always evident. Impact could be by physical proximity. through influencing an economic activity, or affecting cultural or spiritual values, among others. It is then necessary to choose the appropriate methods to collect stakeholder input: public hearings or consultations, opportunities to comment on line, focus groups, interviews and other tools of action research, etc. It is important to build confidence in order to encourage the stakeholders to make the effort to comment, such as by providing feedback to show they were listened to, and explaining how the comments were treated and what was done to respond to them. A special effort may be needed to seek out stakeholders who are less apt to volunteer their views. Stakeholders will support a policy if it is seen to be just and to balance different stakeholder interests equitably.

5 Methods for conducting an assessment

Practitioners	-Should meet with representatives of the Users to identify drivers (causes of change in the environment) and pressures and develop a conceptual diagram - Should strive to use real-time data to describe the state of the environment - Should identify the data needed, where to collect the data, how to authenticate the validity of the dataset, and how to interpret the data, including scaling up (if necessary) - Should ensure that the collection method represents the standard used by that field of study - Should check on common issues with community-based monitoring data before citizen science findings can be used - Should present traditional knowledge in the context in which the knowledge was provided, including the descriptive and cultural setting
Secretariat	- Should be taken by the Secretariat to ensure that the indicators chosen for their Integrated Environmental Assessment are coordinated to provide an overall indication of ecosystem health - Should decide upon criteria that will guide the selection of individual writers - Should provide an electronic means for citations and documents to be organized in a central database/repository that all Practitioners can access when writing the Integrated Environmental Assessment - Should keep a copy of the data in a repository that can be made available upon request and the document should cite the source of the data used for their analyses.
Commissioning Entity	-Should lay out clear goals and objectives have been laid out in consultation with the Secretariat - Should clearly determine and articulate the overall intent driving its desire for an assessment
Reviewers	- Should be engaged and informed early of intended timelines
Users	-Should identify the drivers (causes of change in the environment) and pressures (biological, physical, and chemical changes resulting from the drivers that lead to the state of the environment) with the Practitioners - Should instruct the facilitator to draw in different ecosystem features or draw them in themselves - Should develop a conceptual diagram in collaboration with the Practitioners

5.1 Methods for applying the DPSIR framework

The DPSIR framework should be applied using a step-wise process that moves methodically from identifying drivers and pressures, to determining the state of the environment, identifying and assessing the impacts to ecosystem functions and human well-being, and identifying the political and societal responses.

5.1.1 Assessment goal setting as the core of the DPSIR framework

It is essential that clear goals and objectives have been laid out either by the Commissioning Entity and/or the Secretariat (or governing body) in consultation with the Commissioning Entity and Users. Specific goals and objectives will not only ensure that the Commissioning Entity receives the assessment and information it seeks, but it will also help Practitioners focus their efforts.

If the goal changes, for instance, from soil erosion control to land pollution control, all factors of the DPSIR should change correspondingly.

5.1.2 Drivers and Pressures

The first step in the DPSIR framework is to identify the drivers and pressures for the environment being assessed. The identification of the drivers (causes of change in the environment) and pressures (biological, physical, and chemical changes resulting from the drivers that lead to the state of the environment) should be done together using an in-person facilitated meeting of the Practitioners and a representative set of Users. It is critical that you have adequate representation at the meeting of the range of expertise necessary for determining the state of the environment, impacts, and responses. For large-scale assessments, it may be necessary to divide the environment being assessed into smaller, more manageable regions or themes to facilitate discussion. The goal of the in-person meeting should be to reach consensus on the key drivers and pressures effecting the environment, which are critical to addressing the assessment's objectives.

An effective method for identifying the drivers and pressures for the focal environment is to develop a conceptual diagram or pictogram of the environment (Figure 5.1.1). Developing the diagram during an in-person meeting encourages interaction among the Practitioners and Users and helps them build a shared view of the environment being assessed (Fletcher et al. 2014). The development of the conceptual diagram should be done using a large white board (or similar tool) where Practitioners and Users can instruct the facilitator to draw in different ecosystem features or draw them in themselves. This information is then translated by a graphics specialist onsite during the meeting, so that it can be further refined and used for identifying drivers and pressures through an interactive plenary session. Determining the difference between drivers and pressures can be difficult if individuals are new to the DPSIR process. Thus, it may be helpful to provide examples of what are considered drivers and pressures. If there are several drivers and pressures, it may be helpful to weigh their relative importance in impacting the state of the environment. There are several ways to do this (see Section 5.3.3 on expert elicitation). As you have the experts in the room, a simple way to determine weight would be asking participants to identify which are the top three drivers. This can be done by writing each driver on large sheets of paper spread throughout the room and providing each participant with a set of three colored circle stickers that they can adhere on the drivers that they think are the most important in driving the overall state of the ecosystem (Fletcher et al. 2014). If a participant feels that a particular driver is key to the overall state, they can adhere all three colored dots to the same driver to demonstrate their view.

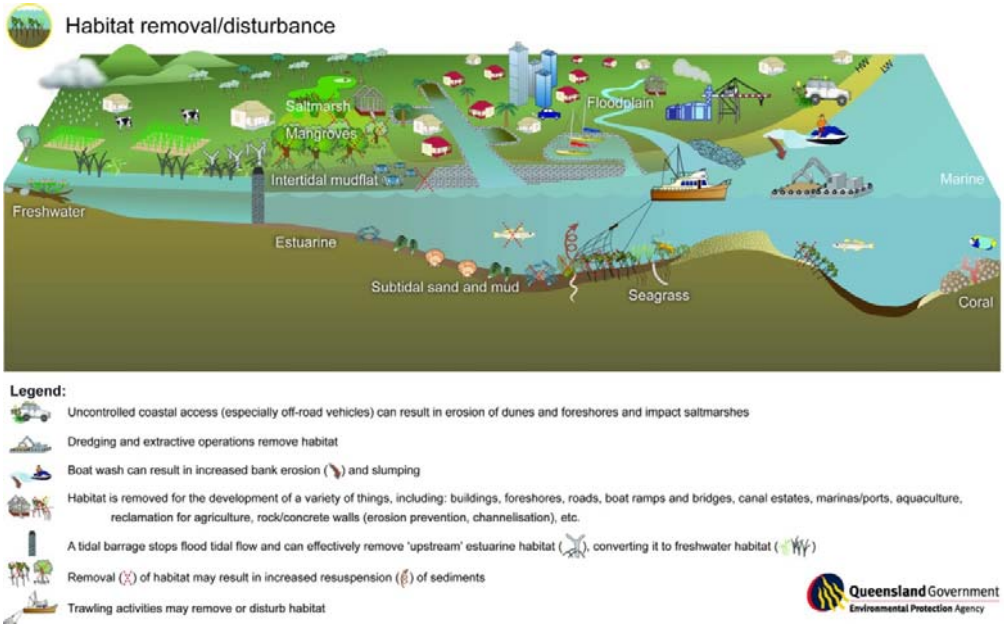


Figure 5.1: An example of a conceptual diagram to be developed by Practitioners and Users to help reach consensus on an overview of the environment being assessed and the key drivers and pressures
http://www.ozcoasts.gov.au/conceptual_mods/stressors/habitat_model.jsp).

5.2 Methodologies for determining the state of the environment

Generally, there are four main categories of methodologies for determining the state of the environment:

1. indicator-based, data-driven assessments;
2. desktop assessments conducted by one or more experts based on a review of available data;
3. assessments based on the analysis of views of experts gathered by questionnaire, using web-based surveys or in a workshop setting;

5.2.1 Indicator-based, data-driven assessments

As much as possible, Practitioners should strive to use real-time data to describe the state of the environment. Examples of real-time observational data are sea-surface temperatures and atmospheric parameters collected by the National Oceanic and Atmospheric Administration (NOAA). Data from the published literature may be several years old before its printed and by that the time, the environmental state may have changed. Thus, the response to mitigate the impact may not be relevant if is based on out-of-date information.

The challenge for the Practitioners is to identify the data needed, where to collect the data, how to authenticate the validity of the dataset, and how to interpret the data, including scaling up (if necessary). These are elaborated on in the following sections.

Should there be a need for the Practitioner to interpret, analyze, summarize, or compile the data, it is important for the Practitioner to double check that the data were collected using the same methods or time periods.

Sources of Data

For local- and national-level data, the Practitioner should contact relevant government agencies in charge of environment, planning and development. There may also be databases and information available through other entities such as universities, industry, and non-governmental organizations. Retrieving data outside of public/government sources may require permission. In addition, some of the databases and information may not be permanently stored in their repositories and retrieving those data again for future reference may not be feasible, so the Practitioner should take this into account when selecting data sources.

At the regional- and global-scale, data collection are done mostly through networks, consortia, and regional and international organizations. Again, accessing the datasets and information may require special agreements.

Big Data

There is an increasing wealth of data being generated from the use of mobile phones, the Internet, banking transactions, and other forms of so called "Big Data". These data represent high-volume, high-velocity and high-variety information assets that demand cost-effective, innovative forms of information processing for enhanced insight and decision-making.

These new sources of data could complement existing environmental data. For example, web analytics data on the number of people searching the web for different environmental topics from different locations provides some insight into public views on a particular topic.

It is important to keep in mind that transactional and other non-traditional data sources often do not include information from the poor persons, persons in remote areas, persons with disabilities and other vulnerable groups. Additionally, the volume of data generated within a country is usually related to the level of development of that country.

Data Authentication

Since the data to be used in the assessment have already been collected, the Practitioner should take extra steps in minimizing the uncertainties surrounding the accuracy, reliability and veracity of the datasets. By asking specific questions about the data such as who collected the data, what method was employed in the collection, how were the data interpreted, analyzed or summarized, the Practitioner should be able to obtain a certain level of confidence about the dataset and make an informed decision as to whether to use the data or not (see Table 5.2.1). If the Practitioner decides to use the data with a low confidence score, it should be stated clearly in the document, so Users are aware.

Some considerations in determining level of confidence in a dataset:

1. How were the data collected?
    - Each scientific field has standard/accepted methods used in the collection of data. When evaluating a dataset, Practitioners should ensure that the collection method represents the standard used by that field of study. This can be gauged by reviewing the published literature.
2. Has the dataset been ground-truthed or validated?

- This is especially crucial for summarized remote-sensing-derived data where scoring is based on colors which may not have been validated.

3. What is the state of the associated metadata?
   - The completeness of the metadata adds to the reliability of the data.

Table 5.1: A quick guide to data checking.

	HIGH = 3	MEDIUM = 2	LOW =1	SCORE
1. How were the data collected?	Standard/accepted Methods	Unvalidated methods	Unknown	
2. Has the dataset been ground-truthed or validated?	Ground-truthed using many sites	Ground-truthed only checking in a couple of sites	No	
3. What is state of the associated metadata?	Complete	Incomplete	None	
CONFIDENCE SCORE				

CONFIDENCE RATING: HIGH - 3; MEDIUM -2; POOR -1 AND 0
*Question 2 and 3 may only apply to specific datasets.

5.2.2 Desktop assessments

A literature review involves the evaluation of existing publications such as government reports, peer-reviewed literature, UN reports and other authentic sources. The choice of publications for evaluation is important to ensure that Integrated Environmental Assessments are scientifically credible and can underpin a solid environmental assessment process.

According to the UNGA 68/70, all information used in an Integrated Environmental Assessment needs to be accessible so that the quoted findings and conclusions can be checked and validated. Publically accessible information is often used by Practitioners, but findings from working papers can also be used based on expert judgement.

Use of other Practitioners published literature must be open and transparent, and should be cited and referenced. Use and citation of peer-reviewed literature is preferred, but the use of non-peer-reviewed sources (grey literature) is acceptable if the information is sound. Before drawing content from peer-reviewed or non-peer-reviewed sources, Practitioners must ensure the information and/or data are valid and of good quality. Non-peer reviewed literature or non-official statistics should be subjected to a thorough review by experts. Practitioners are discouraged from using complex modelling methods of referenced.

Assessments often involve multiple Practitioners and Reviewers. According to UNGA 68/70, such wide involvement is important as it ensures consideration of a wide range of views, and avoids situations whereby individual Practitioners solely impose their views on others.

5.2.3 Assessments based on expert elicitation (See Annex 3 box 2)

The third group of methods includes expert elicitation, a scientific consensus methodology, that utilizes the subjective judgment of experts in addition to the available data and published literature related to chosen parameters (EPA 2011; Morgan 2014; Ward et al. 2014). This method enables data gaps to be filled using expert judgment and to rapidly provide an assessment of the condition of the national or regional environment in a manner that can be used for reporting purposes (Ward 2014).

Expert elicitation is an advantageous method in that it is cost- and time-effective, utilizes existing knowledge of experts from the target region and can incorporate non-conventional and traditional knowledge and information. In addition, it can be applied at different geographical scales and multiple assessments can be nested to develop regional assessments. The method has been applied successfully to conduct environmental assessments in several instances, including the 2011 Australian State of the Environment Report (Australia State of the Environment 2011; Ward 2014; Ward et al. 2014), by the United States Environmental Protection Agency (U.S. EPA, 2011), and an assessment of the South China Sea (Ward, 2012; Feary et al., 2014), the Guinea Current Region of west Africa and in Sierra Leone (EPA, 2015) and of a marine protected area located in southern Norway (Harris et al., submitted).

Box 9 National societal-scale censuses

National societal-scale censuses are a recognizable analogy to the Expert Elicitation method. The 'citizen elicitation' process (everyone is an expert on their own situation) is highly influential on national government policies. A census involves the systematic acquiring and recording of specified information related to a population. Censuses need to be conducted at regular intervals on the same population in order to keep track of trends, variations and changes in condition. Results are tracked over long periods of time and are statistically analyzed to prescribed standards. Census data has strong influence over long-term national government planning. This recognized national tool can serve to inform how environmental expert elicitation approaches can be more structurally embedded in national planning processes. Perhaps national censuses themselves can be evolved to include environmental components.

The United Nations (2008) defines national censuses as "individual enumeration, universality within a defined territory, simultaneity and defined periodicity".

REF: United Nations (2008). *Principles and Recommendations for Population and Housing Censuses*. Statistical Papers: Series M No. 67/Rev.2. p8. *ISBN 978-92-1-161505-0*.

5.2.4 Citizen Science supporting expert elicitation

Comprehensive and regular assessment of ecosystem integrity is always hampered by the absence of complete data and lack of resources. As a way of filling this data gap, non-expert citizens are organized by governments, scientists or themselves to observe and track trends on some aspects of the environment (Conard and Hilchey 2010).

The findings from community-based monitoring through citizen science are often not published in peer-reviewed literature, a situation that presents challenges to their use in environmental assessments. In order to bring credibility and improve the quality of the science, some community-based monitoring programmes are being linked to universities and other research facilities. For example, the Community-Based Environmental Monitoring Network is linked to Saint Mary's University in Canada (Conrad and Hilchey 2010) and NOAA, a U.S. government agency, is providing citizens in its Phytoplankton Monitoring Network with smartphone microscopes that help them identify harmful algal blooms in Lake Erie and report them.

Practitioners need to check on common issues with community-based monitoring data before citizen science findings can be used. The common data issues to check include fragmentation, inaccuracy, and lack of objectivity by the citizens (Whitelaw et al. 2003). Through internet access getting data from citizen science is becoming easier and the

challenge is for Practitioners to use their expert judgment on the quality and completeness of the data. Citizen science initiatives that involve governments and academic institutions lend credibility to the utility of findings from citizen science.

5.2.5 Indigenous, local and traditional knowledge supporting expert elicitation

Indigenous knowledge is useful in capturing knowledge on the environment that has been passed between generations. In the case of the Intergovernmental Panel on Climate Change reporting process, indigenous knowledge has been found to be useful in bringing the potential of traditional climate adaptation strategies to the forefront, some of which are cost effective, participatory and sustainable (Robinson and Herbert 2001). Use of traditional knowledge is often hampered by the confusion over its meaning, and on who owns such knowledge for purposes of citation (Stevenson 1996). A commonly used definition of indigenous knowledge is "...factual or rational knowledge about the environment. It includes specific observations, knowledge of associations or patterns of biophysical, social and cultural phenomena, inferences, or statements about cause and effect, and impact predictions. All are based on direct observation and experience, shared information within the community and over generations (Mackenzie Valley Environmental Impact Review Board 2005)."

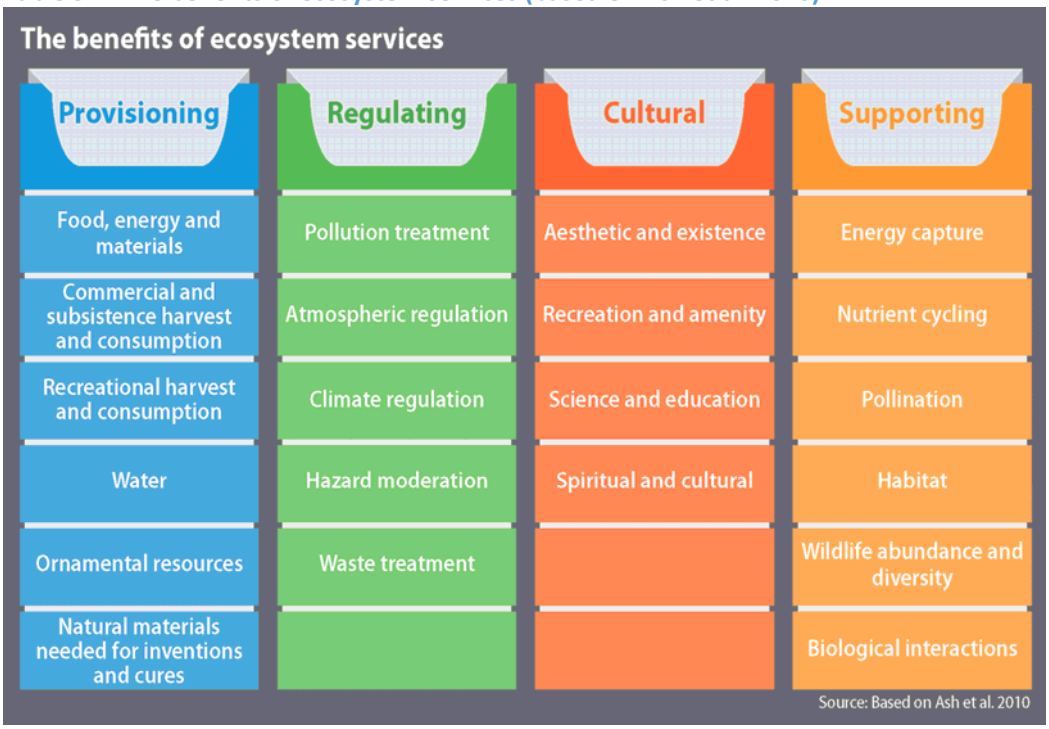
Practitioners should present traditional knowledge in the context in which the knowledge was provided, including the descriptive and cultural setting. With today's advances in social media, the involvement of knowledge holders in disseminating the information will reassure Users of its validity (Mackenzie Valley Environmental Impact Review Board 2005).

5.3 How to assess Impacts

By this point in the process, there should be a clear idea of the environmental features or ecosystem services to be measured to determine changes in their state over time resulting from the drivers and pressures. Measuring the impacts to human well-being and ecosystem services caused by the change in the state of the environment is key to identifying the proper policy responses to address the impacts.

The Millennium Ecosystem Assessment identified the following components of human well-being: basic material needs, freedom, health, good social relations, and personal security (Ash et al. 2010). It is necessary to establish the link between an ecological resource or service and its human benefit by identifying a causal pathway linking the service to the elements of human well-being it is thought to influence. Ecosystem services that benefit people directly are such things as food, recreation, and storm protection. These services provide life's basic needs and influence economic conditions, movement of people, regulation of climate and disease, recreation and cultural opportunities, and security (Table 5.3.1). Changes in these ecosystem services have wide-ranging impacts on human well-being (Ash et al. 2010).

Table 5.2: The benefits of ecosystem services (based on Ash et al. 2010):



5.3.1 Measuring impacts on ecosystem services and human well-being

Ecosystem service values can be measured through indicators of health, safety, economic security, effective governance, education, food/water, housing, access to critical services, social cohesion, social conflict and environmental use. Such indicators provide managers with information about social and economic status and their correlation with natural resource conditions. (Johns et al. 2013).

The Millennium Ecosystem Assessment developed methods for assessing trends that would correspond to impacts in the DPSIR framework. Such assessments of trends should ideally range from the relevant past to the predictable future, be adapted for slow and fast processes (tree growth versus deforestation), and be at an appropriate scale for both ecological and human processes (Ash et al. 2010, chpt. 4).

There are many quantitative and qualitative methods for valuing ecosystem services over time to determine impacts. The value is related to environmental conditions, and this value can be measured and reported in a monetary, cultural, or social context. The measurement can be of a stock (number of organisms per unit area) or flow (quantities per unit time). Single measures are state indicators. Changes in these values over time are what measure impacts, both on the environmental resources or processes themselves, and on the services and human benefits they provide. The individual indicators should be policy relevant, scientifically sound, simple to calculate and easy to understand, practical and affordable, sensitive to relevant changes, suitable for aggregation and disaggregation, and usable for projections of future scenarios (Ash et al. 2010).

In addition to indicators using benefit-cost analysis to show economic values, less tangible dimensions should be included, such as equity, considering who receives the benefits and who pays the costs of management alternatives, and sustainability or ecological stewardship

looking at the distribution of services over time. Cultural and ethical values may also place constraints on acceptable management decisions (Johns et al. 2013).

5.3.2 How to assess Responses

Methods used to identify government policy responses to environmental impacts and changes in ecosystem services should include the literature and database searches. Interviews with public servants and legal services experts can also be useful in identifying legislation that relates to addressing the environment.

It is more challenging to assess the response of societies and the private sector response, and how to assess policy effectiveness.

5.4 Use of Indicators

While "**data**" consists of detailed neutral facts, **indicators and indices** are *selected and/or aggregated* variables put in a policy context, connected to an issue identified in the Integrated Environmental Assessment process and ideally also a policy target. A limited number of variables are selected from a wealth of observed or measured data sets, based on relevance of the variables to major issues and general trends. Indicators become signposts to inform policy actors and the public in a way that make thick volumes of detailed statistics and other data on the state and trends of the environment more accessible for decision making purposes.

Indicators are what make data relevant for society and for policy making. They help us make decisions or plans because they help us understand what is happening in the world around us. As a society, we tend to choose measures that reflect our values. On the other hand, the information we receive also shapes what we value.

An indicator is a qualitative or quantitative entity that shows the existence of a particular condition or its state. In the DPSIR framework of an Integrated Environmental Assessment, indicators are identified or developed not only to ferret out the complex relationships between the DPSIR components, but more importantly to provide information and guidance to policy makers in making the appropriate responses.

Environmental state indicators describe the condition of the environment under study. Qualitative indicators give information on the presence/absence of an element or condition such as what fish species are found on the reef whereas quantitative indicators provide information on how abundant each species of fish is per unit area. As much as possible, the Practitioner should endeavor to use quantitative indicators to make assessment of the effectiveness of a response more accurate.

There are many types of indicators to determine environmental state – these could be physical (e.g., water temperature), chemical (e.g., water pH), biological (e.g., live coral cover), or ecological (e.g., degree of parasitism). Aggregated indicators such as Indices are also commonly used. One example is the Manthachitra Index (Manthachitra, 1994) which is an aggregation of 5 indices (mortality, condition, development, succession and other fauna) to determine coral reef health. UNEP (2014) noted that "the current use of marine ecosystem-based indicators and indices by regional entities is both overwhelming in terms of numbers being used and disparate in terms of the different indicators, systems and terminology employed. Thus, care should be taken by the Secretariat to ensure that the indicators chosen for their Integrated Environmental Assessment are coordinated to provide

an overall indication of ecosystem health, such as the list proposed by UNEP (2014; Table 5.4.1).

In addition, care should be taken by the Practitioner in selecting an environmental state indicator because studies (e.g., Niemeijer, and de Groot, 2008) have shown that this could be caused by pressure interaction. Therefore, the corresponding response must address the interacting pressures that caused the impacted environmental state.

Pressure indicators provide information on the type of human activities (e.g., mining) and or the resulting products of these activities (e.g., amount of copper in the water) that impact the environment. Many stressors could result from a single driving force and could interact with one another or with another pressure emanating from another driver producing a different environmental state compared with just one pressure causing an impact by itself. For example, silt from agriculture and increased water temperature due to climate change. By itself, the siltation may lower primary productivity by decreasing light penetration, but with the increased water temperature, both may stimulate the development of an algal bloom.

Impact indicators such as fisher's income reflect the effect of the environmental state on humans or society. For example, the fisher's income may be lower because of low fish catch. In identifying *Impact* indicators, the Practitioner should be guided by the 17 Sustainable Development Goals (https://sustainabledevelopment.un.org/sdgs) and their corresponding indicators. A list of proposed global indicators for the 2030 Agenda for Sustainable Development is available at http://unstats.un.org/sdgs/iaeg-sdgs/metadata-compilation/).

Response indicators are used in tracking and measuring the effectiveness, performance or efficiency of a response. It is important that the Practitioner determines which of these aspects is being monitored.

Table 5.3: List of pressures and proposed list of indicators from UNEP (2014).

Regional Seas Programme - Pressure and potential associated indicator	
Total inputs of nitrogen and phosphorus from agriculture, sewage and atmospheric nitrogen	Chlorophyll a concentration as an indicator of phytoplankton biomass
Inputs of marine chemical pollution	Trends for selected priority chemicals (e.g. PCBs)
Overall levels of marine litter	Quantification of beach litter items
Ocean warming Anthropogenic CO_2 in the ocean	Annual mean sea surface temperature Carbon dioxide flux (partial pressure of CO_2)
Losses due to extreme events	Insurance claims from climate change-related events
Fish landings	Fish catches within EEZs (tonnes) – total capture production
Aquaculture	Application of risk assessment to account for pollution and biodiversity impacts
Population pressure / urbanization	% built up coastline
Regional Seas Programme - State and potential associated indicator	
Eutrophication status	% problem areas (including occurrence of nuisance phytoplankton and algal toxins)
Pollution hot spots	Status of selected pollutant contamination in biota and sediments and temporal trends
Ocean acidification	Aragonite saturation
Level of exploitation of commercial fisheries	FAO stock status: % stocks overfished compared to MSY
Species replacement as consequence of capture fisheries	Marine trophic index
Endangered species	Distribution of Red List Index species
Loss of critical habitat	Trends in critical habitat extent and condition
Regional Seas Programme - Response and potential associated indicator	
National Action Plans to reduce input from LBS	% national action plans ratified / operational
Waste water treatment facilities	% coastal urban population connected
Incentive to reduce marine litter at source	% port waste reception facilities available
Climate change adaptation	% national adaptation plans in place
Fish harvested within safe ecological limits	Fisheries measures in place (by-catch limits, area-based closures, recovery plans, capacity reduction measures) and multilateral/bilateral fisheries management arrangements
Critical marine habitat under protection	% Marine protected areas designated
ICZM in place	ICZM guidelines and enabling legislation adopted for the region

Living and non-living resources
Water quality and contaminants
Socio-economic considerations
Management of global change

The Practitioners should first determine the scope and time frame involved in the assessment in order to choose the appropriate indicators. They should then conduct a review of literature and come up with a list of possible indicators. Afterwards, the Practitioner should construct a matrix of possible indicators per DPSIR component and determine the cause and effect relationships by drawing arrows. This is also a good way to see interaction points. For environmental state and impact characters, the Practitioner should choose the ones brought about with least interactions.

In order to use data and indicators for measuring performance, we need to identify **reference points** related to desired results. These reference points can be very generic and qualitative or, preferably, quantitative and time bound. The more specific the reference points, the easier it is to assess performance.

The next step is to prioritize the indicators based on whether or not baseline data are available and how comprehensive the data. There is no point in using indicators without baseline data. Finally, the Practitioner should determine whether data were collected after the baseline, how often and whether the method used was consistent with that used in collecting the baseline data.

Selecting good indicators

Because indicators influence decision making, it is important that the measures we use are proper ones. Poor indicators provide inaccurate and misleading information about what is being measured. An example of a poor indicator might be a measure that reflects change over a very long time scale when decision makers require knowledge about change over in a short time scale. In order to know the impact of fertilizer on land quality, it would be insufficient to measure and present just the soil organic matter, which changes on a decade long time scale. Inaccurate indicators could lead to policy actions that are over or under-reactive.

One of the challenges of selecting good indicators is that it may be easier to choose indicators based on ease of measurement or data availability, rather than what needs to be measured. As mentioned previously, filling data gaps can be a resource intensive process, which means that options in terms of indicator selection may be limited. Notwithstanding, it is still valuable for you to select indicators that have the best possible fit with the Integrated Environmental Assessment process. Part of the process of selecting good indicators is weighing them against a set of indicator criteria. Selecting indicators can be a balancing act, with trade-offs among such factors as ensuring they are relevant to society and policy-makers, scientifically sound and accurate, and easy to interpret with a reasonable degree of accuracy and precision. The following criteria, drawn from the World Bank (1997) and OECD (1993) are commonly cited as useful in the indicator selection process. Indicators should:

- be developed within an accepted conceptual framework;
- be clearly defined, easy to understand and interpret, and able to show trends over time;
- be scientifically credible and based on high-quality data;
- be policy relevant;
- be relevant to users, politically acceptable and a basis for action;
- be responsive to changes in the environment and related human activities;
- provide a basis for international comparison by providing a threshold or reference value;
- be subject to aggregation (from household to community, from community to nation);
- be objective (be independent of the data collector);

- have reasonable data requirements (either data that are available or data that can be collected periodically at low cost); and
- be limited in number.

An important consideration is selecting the appropriate number of indicators. Too many indicators may create "noise" that is difficult to interpret, while too few indicators limit the scope of understanding. Selecting indicators based on a select set of priority issues is an increasingly common way of limiting the number of indicators.

Indicators become especially useful when they can be interpreted in the context of performance. Distance to a specified target is a common way of measuring performance. These measures also promote accountability to policy-makers, particularly when policies are linked to environmental performance.

Trend analysis

Trend analysis is instrumental in understanding how the data are functioning over time, sometimes against targets, baselines and/or thresholds. Various possibilities exist to present the trends, which can easily lead to different interpretations and conclusions. For example, the presentation of an indicator as absolute value, percentage or index can make an important difference.

5.4.1 Proxy Indicators

In some cases, an indicator may be difficult or impossible to measure directly, hence the Practitioner may be forced to use proxy indicators. This may be due to cost, complexity and /or the timeliness of data collection. (http://www.undp.org/evaluation/documents/HandBook/ME-HandBook.pdf).

Proxy indicators are generally used in climate studies where no baselines are available in determining human and community welfare. For example, if one needs to determine rainfall patterns in the past for agricultural planning and no records exist, tree rings can be used as proxy indicator, since the distance between the rings has been found to be related to the amount of rainfall (citation). In terms of human welfare, proxy indicators of income such as ownership of assets, type and ownership of houses, educational attainment, amount of savings, or loans are oftentimes used.

In choosing which proxy indicator to use, the Practitioner should determine the heuristic property of the proxy and the level of accuracy by which it can identify the condition being determined. This will minimize arbitrariness in selecting proxies and ensures that the proxy being used has equivalent predictive power as the indicator itself. In practice, commonly used proxies are resorted since to these are assumed to be robust and tested over time. The predictive power is also enhanced through the use of multiple proxies in an aggregated index (e.g., poverty index).

5.5 Innovative frameworks, processes and tools

Completing a comprehensive synthesis of all cutting edge research that exemplifies innovations in how assessments in general could be conducted, is beyond the scope of this report. However, some recent innovations in methodologies, methods and tools that may assist in designing and conducting Integrated Environmental Assessments are presented.

5.5.1 Innovation in assessment framework design

The Donut Framework

The premise of the donut framework (Figure 5.5.1) emerges from the nine planetary boundaries concept developed by Rockstrom et al (REF). These boundaries describe 9 environmental categories, each with thresholds of allowable human impact that if transgressed, indicate unacceptable levels of degradation. In the context of Integrated Environmental Assessments, the environmental limits described by the planetary boundaries framework can be further detailed and sub-categorized using the 'donut' model as a starting point that defines the environmental conditions to be assessed. Each environmental label can be changed to ensure an appropriate representation of the context of application of the assessment (e.g. different global, regional, national, and local scales). This allows assessment-specific adaptability.

The donut framework links environmental and socio-economic considerations by establishing the 'social foundation' element, defined as the "environmentally safe and socially just space in which humanity can thrive" (REF): A Safe and Just Space for Humanity Oxfam Discussion Paper, February 2012). At a global scale, this social foundation consists of the 11 key social priority areas described in the Rio+20 outcomes. A social space existing below the minimum social foundation would be consider untenable resulting in ills such as hunger, poor health and livelihood insecurity. Just like with environmental labels, social labels can also be adapted in consideration of the context of application.

Lying between the environmentally safe limits and minimum social foundation lies the "environmentally and socially just space in which humanity can thrive". Assessments can be designed to monitor trends in that specific 'safe space' to inform decision makers with respect to desired goals. Another advance of the donut framework is the ability to nest assessment results that can clearly connect local to global environmental and social conditions.

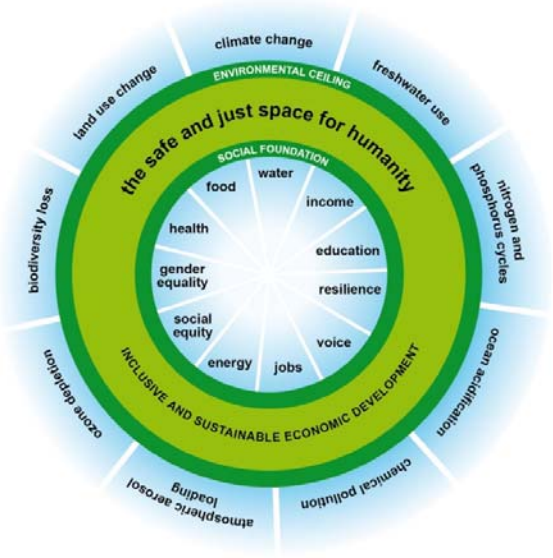


Figure 5.2: Example of fully integrated approach to social-ecological-economic assessment framework (from By Kate Raeworth (UNDP consultant check copyright)

Box 10

What perspectives can the donut framework provide as a useful source of inspiration to a new generation of Integrated Environmental Assessment?

From A Safe and Just Space for Humanity Oxfam Discussion Paper, February 2012:

"1. An integrated vision: With sustainable development as the central concern, it is clear that everyone's lives must be built on the social foundation of human rights while remaining below the environmental ceiling, and that economies must be structured and managed to make that possible. This framework highlights the interconnectedness of the social, environmental, and economic dimensions of sustainable development.

2. A refocusing of economic priorities: Within this framework, social and environmental stresses are no longer portrayed as economic 'externalities'. Instead, the planetary and social boundaries are the starting point for assessing how economic activity should take place. The economy's over-arching aim is no longer economic growth in and of itself, but rather to bring humanity into the safe and just space – inside the doughnut – and to promote increasing human well-being there.

3. Metrics beyond GDP: Economic development cannot be assessed in monetary terms alone. Whether economic activity is leading towards or away from planetary and social boundaries determines just how inclusive and sustainable economic development is. Policymakers must be more accountable for the impact of economic activity on planetary and social boundaries, defined both in natural metrics (such as tonnes of carbon emitted) and social metrics (such as the number of people facing hunger).

The Commissioning Entity should clearly determine and articulate the overall intent driving its desire for an assessment. Where the intent revolves around specific long term actions anchored in achieving, for example, sustainable development goals (i.e. SDG targets), the Commissioning Entity can explore Integrated Environmental Assessment frameworks inspired by new thinking that recognizes the interconnectedness of nature (i.e. natural environment, nature-based ecosystem services etc.) and the human economy. Assessments that inform in a collective manner the economic, development and environmental decision-making/policy-making fields are likely to yield more impactful and long term change than those targeting segregated decision-making fields.

5.5.2 Social spaces for effective synthesizing of assessment content

A Writers' Sprint can provide an effective mechanism for synthesizing an assessment. It brings together a group of experts to produce an assessment from knowledge and information that exists, such as publications, research outcomes and datasets. It may also include information, knowledge and data generated through an Expert Elicitation (if such as step is part of the assessment) or from other sources such as local/traditional/indigenous knowledge and citizen science. The Writers' Sprint technique aims to produce a consolidated version of the assessment which can be the basis for further commentary and review.

Preparation for a successful Writers' Sprint begins with the selection of the participants and a draft outline of the assessment content. The selection of the individual writers will have a clear influence on the tone, content and form of the final written product. The Secretariat, possibly in consultation with the broader assessment community, will decided upon criteria that will guide the selection of individual writers. The writers should ideally have had prior involvement in the assessment process (e.g. directly tasked with a component of the

assessment, part of a broader community of practice, etc.) and be well versed on the sources of data, knowledge, information etc. that have been assembled.

A process facilitator is generally appointed to guide the group, mediate disagreements and ensure the group adheres to key time sensitive deadlines. Generally speaking, the facilitator does not take part in the writing and does not provide opinion or commentary related to content or any other assessment-related topic. Their main role is to ensure active sharing and collaboration amongst the writers and the development of a collective sense of ownership.

Box 11

Online document collaboration for the production of Integrated Environmental Assessments

With the advent of increasingly reliable online document collaboration software, conducting environmental assessments with Practitioners dispersed globally, is becoming easier. As part of the production process of the current UN Environment Integrated Environmental Assessment Guidelines, an online document collaboration tool was integrated into the overall collaborative framework, allowing for a first hand evaluation of the approach.

The variety of available software (some requiring purchase and others open source) can seem daunting. However, at their core, they all provide the same basic function - allowing a number of remotely located individuals to participate in the collective drafting of a document. The most important feature to consider when choosing a software is the stability of the software and in particular, its ability to preserve and archive content even as multiple Practitioners may be writing at the same time. Document recovery capabilities are also a key need - safety first. Having the capability to recognize individual Practitioners is also an important feature. Some software packages allow for multiple Practitioners but are not able to attribute any particular content to a given contributor.

Key benefit: connecting a world of Practitioners

With respect to the UN Environment Integrated Environmental Assessment Guidelines, the initial content development step involved the gathering of a small core group of Practitioners in one place for a five day writers' sprint. The sprint produced the foundational draft for the Guidelines. From this point, an online document collaboration software package was selected in order to help broaden the participation base by reaching out to globally located experts. At first, the core Practitioners from the writers' sprint where invited to complete their contributions on a master document. Once that step was complete, a more extensive group of contributors were invited to the online document.

Online document collaboration alone cannot get to the end objective. Discussions and dialogue need to happen consistently in order to ensure all contributors have a clear understanding of expectations. Content conflict will always happen which requires more pro-active approaches to resolve.

Key limitation: keeping track of reviews

Although online document collaboration, when organized and coordinated properly can work very well to develop the content of an assessment through global participation, using it for a formal review process remains a challenge. The main limitation currently lies in the ability to properly record and archive the comments from individual reviewers and to keep track of the updates and revisions made. Proper archiving of a peer review process is a

critical requirement in the conduct of integrated assessments. Using an online tool to invite remotely located reviewers allows for quick access to the document. However a stand-alone review sheet remains the best and most efficient way to formally keep track and archive review comments. This functionality is sure to improve as online document collaboration software continues to evolve in response to real world needs. So stay tuned for the day when the entire life cycle of an assessment can be conducted through completely online means.

5.5.3 Using Global Information Systems for reporting

Environmental assessments are increasingly underpinned by spatial data. As such, the use of global information systems (GIS) is playing an increasingly important role. GIS provides a platform for the collation of environmental data and the integration of this data to support environmental assessments and reporting. Desktop GIS packages are routinely used by monitoring agencies to collate monitoring data and develop information products that can be used to assess the status of the environment. GIS tools are critical in understanding conditions at a set of monitoring sites relate to the broader environment using a range of spatial modelling approaches.

GIS tools are also critical for the collation and sharing of environmental information. Within the EU, the Natura 2000 network, the largest coordinated network of protected areas in the world[2], is managed to ensure both economic and environmental sustainability. Member states are required to report every six years on the conservation status of their Natura 2000 sites under article 17 of the EU Habitats Directive[3]. Spatial information from this reporting can be integrated into the European Environmental Agency data centre[4], which supports the collation of member states environmental information.

In other cases, specific GIS tools have been developed to support environmental assessment. The Department of the Environment and Energy in Australia has developed the Protected Matters Search Tool[5]. This tool visualizes the spatial relationship between different environmental information and generates a report of matters of national environmental significance or other matters protected by the national environmental act within an area of interest. The tool can be used to support environmental assessments for proposed activities.

Finally, The United National Environment Programme (UNEP) has leveraged GIS tools as part of its Environment Live platform[6]. This platform has been designed to collect, process and share the best environmental science and research, including spatial information. The platform allows relevant information to be visualized and accessed using a range of filters including country and thematic categories.

5.5.4 Data Management

Data management is often an afterthought in the Integrated Environmental Assessment process, however, it is as important as the assessment in ensuring that the Integrated Environmental Assessment is viewed as credible and legitimate. Data sources must be

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[2] http://ec.europa.eu/environment/nature/natura2000/index_en.htm
[3] ttp://ec.europa.eu/environment/nature/legislation/habitatsdirective/index_en.htm
[4] http://www.eionet.europa.eu/gis/
[5] http://www.environment.gov.au/webgis-framework/apps/pmst/pmst.jsf
[6] http://uneplive.org/

properly referenced and documented so that individuals wishing to test the validity of the Integrated Environmental Assessment and its conclusions have the information to be able to do so. The term data in this section means not only empirical data (see section 5.3) such as direct observations, literature, and expert elicitation, but also other types of non-written information such as graphics, photographs, videos, and maps.

Practitioners must document their data sources and provide proper citations. The UN Environment Publishing Policy (http://www.unep.org/policy/Pub_Policy_SecondEdition.pdf) must be followed and used for all Integrated Environmental Assessments. Use of citations ensures that ideas or thoughts borrowed from the work of others are acknowledged, helps support statements made in the document, allows for the source to be checked for validity, and identifies which ideas are original and belong to the Practitioner(s). Plagiarism, passing off another's ideas or thoughts as your own, in any form, is not tolerated as it undermines the credibility of the Integrated Environmental Assessment. Self-plagiarism, using text that you have written for other sources, is not appropriate. Authors may paraphrase their own work from other sources, but they must cite their source. Citing your own work should be used in moderation. It is important to cite the work of others to support the ideas presented to document that this is not one person's view, but the general view.

Citations must be used any time you are quoting, paraphrasing, summarizing, and/or using facts, information or data from another source. Information that is common knowledge does not need to be cited, e.g. the sun rises in the east. There is a fine line though between what is common knowledge and proprietary, when in doubt, cite your source. See the UN Environment Publishing Policy for guidelines on formatting citations.

The Secretariat should provide an electronic means for citations and documents to be organized in a central database/repository that all Practitioners can access when writing the Integrated Environmental Assessment. There are several different types of software or online tools that could be used for this purpose such as EndNote, Zotero, or EasyBib. More and more datasets are becoming accessible through online databases as governments increase public access to research results. As a result, Digital Object Identifiers or DOIs (unique codes) are starting to be issued for datasets and should be cited in the references section of the document, if available. For datasets that aren't publically available, the Secretariat should keep a copy of the data in a repository that can be made available upon request and the document should cite the source of the data used for their analyses.

When writing documents, it is common to use graphics, videos, maps, and photographs from various sources including the world-wide web. Even though these items are easily downloaded and often freely available, it is important to ensure that permission is obtained from the copyright holder for its use. UN Environment has a strict policy and procedure that must be followed. Authorization must be obtained in writing from the copyright holder before the item is used in a publication. If usage is granted, the graphic, video, map, or photograph must acknowledge the owner.

5.6 Uncertainty, risk, balance and ethics is preparing Integrated Environmental Assessment's

5.6.1 Practitioners act as independent experts

When contributing to the preparation of an Integrated Environmental Assessment for UN Environment, it is expected that Practitioners will act in their personal capacity as independent experts and not as representatives of a Government or any other authority or organization. They should neither seek nor accept instructions regarding their work,

although they are free to consult widely with other experts and with government officials, in order to ensure that their contributions are credible, legitimate and relevant. Authors are also expected to disclose to the persons coordinating the Integrated Environmental Assessment any conflicts of interest, or the possibility of the perceptions of conflicts of interest, before they accept appointment (and, after appointment, when any potential conflict may arise).

5.6.2 Information used in assessments must be accessible to users

Integrated Environmental Assessment Practitioners should, in general, base their assessment on publicly available information. Nevertheless, where significant information is not yet publicly available, Practitioners are free to use it, but should take such steps as are possible to enable the information to be accessed by those who are interested. If practicable, such steps should include depositing a copy of the information (or the means of accessing it on the internet) with UN Environment, to be made available on request.

It is acknowledged that, in some instances, assessments will not rely on peer-reviewed literature, although the citation of peer-reviewed information is to be preferred where it is available. Although not perfect, the peer-review process ensures that the study being considered has had the benefit of independent scrutiny and quality control before it is used in the assessment. UN Environment may accept the use of non-peer-reviewed sources. However, all contributors are responsible for critically assessing them, and reviewing their quality and validity before incorporating them into the assessment. Where a publication is referred to, but is neither peer-reviewed nor an official publication of a recognised authoritative source, it should be identified as such, so that UN Environment can consider whether its use would adversely affect the quality of the overall assessment. The objectives are to ensure that all information used in any Integrated Environmental Assessment receives critical evaluation, that its use is open and transparent, and that all references used are, as far as possible, easily accessible.

5.6.3 Strive for a balanced view

The prime audiences for most Integrated Environmental Assessment's are the policy makers at the global, regional and national levels. The focus of Integrated Environmental Assessment's is to provide an assessment which will be useful to these policy makers. The assessment must give a balanced view of the area under assessment as a whole, and not focus only on regions where there happens to be a lot of information. The identification of data gaps and regions where critical data are absent, are also important goals for the production of Integrated Environmental Assessments.

5.6.4 Characterizing and communicating uncertainty

Some conclusions of Integrated Environmental Assessment's are likely to be controversial. As such, they will be subject to intense scrutiny by stakeholders. However, all parts of the Integrated Environmental Assessment must be as accurate as possible since an error in any part can undermine the credibility of the entire assessment. To this end, Practitioners must exercise caution and discipline in describing the uncertainty associated with any statements made.

Uncertainty is characterized and communicated by describing how much is known about a topic (i.e., the quality and nature of the evidence available), and the probability that a particular event will occur. Each conclusion of an Integrated Environmental Assessment will

need to be accompanied by a judgement of its uncertainty. There are several different ways to express uncertainty:

a) Likelihood (e.g., "extremely likely" might indicate that a greater than 95 percent probability that a particular event will occur);
b) Confidence (e.g., "high confidence" might indicate an 8 out of 10 chance of being correct);
c) Level-of-understanding (described in terms of the amount of evidence available and the degree of agreement among experts);

The level-of-understanding scale is a convenient way of communicating the nature, number, and quality of studies on a particular topic, as well as the level of agreement among studies. This scale can be supplemented by quantitative likelihood or confidence measures, if such are deemed to be needed and appropriate.

Authors should avoid reporting conclusions with high levels of confidence for which there is little evidence, and should always seek clarity when making definitive statements. All conclusions should withstand scrutiny and be supported sufficiently by the available information cited in the assessment. To this end, Practitioners should use standard terms to qualify the level of confidence and risk.

Authors are encouraged to make statements about the likelihood of an outcome or event as explicit as possible, but must ensure that the methods that they use for estimating or otherwise evaluating probabilities or likelihood (expert judgement, analysis of data, modelling) are appropriate to the quantity, quality and nature of the information available.

5.6.5 Characterizing and communicating risk

All assessments will have to be prepared in ways that evaluate risks, and will have to be communicated in the context of those risks. "Risk" can be formally defined as the product of the likelihood of an event and the seriousness of the event if it were to occur. In all assessments when a risk is being described, both the likelihood and the potential severity of each consequence should be made as clear as possible.

There are two ways that "risk" can enter into decision-making. One is the "risk" that some pressure, either a natural event or a human activity, will have some undesirable consequence if it is not managed or mitigated effectively (this includes the risk of inaction). The other is the "risk" that a policy option intended to manage or mitigate possible undesirable impacts of a pressure could have its own undesirable impacts on some other (often unforeseen) ecosystem feature or benefit. Assessments should always consider both of these aspects of "risk" associated with selecting and implementing policies.

Given that Integrated Environmental Assessment's will often need to integrate information on diverse pressures and ecosystem properties globally and supra-regionally, it is expected that each assessment will have to accommodate a wide range in data quality and quantity, and in knowledge of relationships and impacts. Hence there will be no single best approach to risk quantification and communication.

5.6.6 Handling the full range of views

An assessment is intended to arrive at a judgment of a topic. Although all reasonable points of view should be considered, they need not be given equal weight or even described fully. What alternative viewpoints warrant mention is a matter of professional judgment.

Therefore, Practitioners have considerable influence over which viewpoints will be included in any Integrated Environmental Assessment.

Involving Practitioners with diverse viewpoints is the first step toward ensuring that a full range of views are considered. Equally important is combating "confirmation bias", that is, the tendency of Practitioners to place too much weight on their own views relative to other views. Authors should explicitly document that a range of scientific viewpoints has been considered, and editors should satisfy themselves that due consideration was given to properly documented alternative views.

5.6.7 Ethics in authoring and evaluating material for Integrated Environmental Assessments

It is expected that Practitioners will follow established protocols for ethics in scientific reporting. In particular, Practitioners are responsible for

a) Correctly citing the published work of others;
b) Accurately representing the conclusions of cited work;
c) Disclosing any conflict of interest (this extends to reviewers as well).

The preparation of an integrated environmental assessment can be based primarily upon existing assessments, which are themselves a synthesis of existing information relative to a particular geographic area. It is important that information cited can be tracked back to its original source (see also the section above on information). The credit for the production of synthesis products (maps, graphs, etc.) should be accurately attributed to the original Practitioners.

By their very nature, preparing an Integrated Environmental Assessment requires Practitioners to review and synthesize numerous large bodies of work, and to distil out the salient points of numerous studies. Throughout this process, it is important that the synthesis produced does not lose or misrepresent the essential conclusions, meaning and intent of the original works. Authors are responsible for ensuring that such misrepresentation does not occur.

The nature of preparing an Integrated Environmental Assessment for UN Environment (i.e., presenting a series of expert judgments on issues of great societal relevance) demands that it pays special attention to issues of independence and bias to maintain the integrity of, and public confidence in, its results.

6 Compiling an Environmental Outlook

Practitioners	-Should first see whether there are existing outlooks, scenarios or projections from which to draw relevant elements for their outlook - Should propose additional megatrends for consideration or inclusion in the outlooks assessment and provide rationale for their inclusion - If modelling is proposed as a method to produce the outlook, Practitioners should determine a quantitative method of integrating each megatrend into the modelling framework -Should keep in mind that, in the context of an Integrated Environmental Assessment, scenarios need to incorporate relevant policies explicitly, and that the scenario exercise will provide insights on the possible effectiveness of existing or proposed policies - Should apply a method to determine the uncertainty surrounding the conclusions of the outlook. This method may be quantitative or qualitative -Should use a structured process for eliciting expert opinion on uncertainties related to environmental outlooks. -Should communicate the level of uncertainty surrounding particular conclusions in the outlook clearly and in language that is appropriate to the intended audience - Should conduct gap analysis on environmental data, knowledge and capacity as part of developing the outlooks.
Commissioning Entity	- Should provide clear guidance on the overall scope and objectives of the Integrated Environmental Assessment, and the policy processes to which it is directed, so that the outlooks can be tailored to the Users - Should provide guidance to Practitioners on which megatrends may be considered to be relevant for the assessment

6.1 Purpose of the Outlook

The fundamental aim of an Integrated Environmental Assessment is to influence policy and decision-making to in order to achieve environmental, social and economic objectives. To determine if policy responses documented in the Integrated Environmental Assessment are likely to produce the desired objectives, it is essential to understand, where possible, the past and present state of the environment. While the future can never be predicted with certainty, decision-making can be guided by thinking about the future, and a variety of tools have been developed to assist in this process. This is the outlook dimension of an Integrated Environmental Assessment.

The purpose of outlooks is to think about possible future situations and their implications. What is the future we want? How does this differ from the possible futures before us? How do the choices we make now determine those possible futures? What can we influence and what is beyond our control? These are not predictions, but policy-relevant stories of plausible futures based on explicit assumptions about the choices to be made.

Outlooks are an important tool for the integrated approach because they combine environmental, social and economic processes and trends, and can help to identify trade-offs, such as between economic growth and sustainable consumption. They need to reflect a systematic approach, exploring the dynamics of the human and natural systems and their interactions over time. They may indicate when there will be winners and losers from an action, so that corrective measures can be considered. They can integrate the influence of drivers and megatrends within the scope of the assessment, and signal when the risk of surprises (wild cards) or tipping points with sudden changes in direction require efforts to increase resilience or reduce vulnerability.

The Commissioning Entity should provide clear guidance on the overall scope and objectives of the Integrated Environmental Assessment, and the policy processes to which it is directed, so that the outlooks can be tailored to the Users. The time frame for the outlook should also be agreed (15, 50, 100 years).

Practitioners should first see whether there are existing outlooks, from which to draw relevant elements for their outlook. Outlooks often contain several different scenarios. Scenarios can be as simple as policy relevant stories developed during a workshop or writers' sprint, or more elaborate analyses based on projected data trends and modelling. One option is to imagine the future that would be desirable in, say, 50 years, and then backcast what would need to be done over what time periods to achieve that outcome. The details of this are discussed below.

6.2 Identification and documentation of megatrends

The term 'megatrend' has emerged in the field of outlooks to represent other drivers, apart from the more traditional economic and social drivers, that could affect the trajectory of environmental change. These megatrends typically are outside the environmental field but have an impact on the environment. However, some megatrends, such as climate change impacts, are environmental in nature but can easily drive the trajectory of environmental change in other domains, such as air quality, water, land and biodiversity.

In addressing megatrends in environmental outlooks, the Commissioning Entity should provide guidance to Practitioners on which megatrends may be considered to be relevant for the assessment.

Practitioners should propose additional megatrends for consideration or inclusion in the outlooks assessment and provide rationale for their inclusion.

In assessing which megatrends to include, Practitioners should consider the following:

- The likelihood that the particular megatrends will have an impact throughout the timeframe of the outlook (e.g. over the full 30 years);
- Whether the megatrend may have a differential impact over that time period than other factors being considered in the outlook (i.e., a non-linear trend or a different trend than other major drivers);
- The importance of the 'likelihood' criterion needs to be combined with an 'impact' criterion in determining how to integrate the megatrend into the analysis.
- Data for the megatrend may be limited and therefore may need to be only integrated in the outlook in a qualitative way or expert elicitation could be used to better quantify the anticipated impact of the megatrend.

If modeling is proposed as a method to produce the outlook, Practitioners should determine a quantitative method of integrating each megatrend into the modeling framework. This may require sensitivity analysis to determine if the megatrend is having the anticipated effect on the modeling results.

6.3 Considering emerging environmental issues in outlooks

“The process of building scenarios is about asking questions as well as providing answers and guidance for action. It is intended to widen perspectives and illuminate key issues that might otherwise be missed or dismissed. By offering insight into uncertainties and the

consequences of current and possible future actions, scenarios support more informed and rational decision making". Millennium Ecosystem Assessment 2005, Chapter 2.

These are the unanticipated effects or the emerging issues that could affect the scenario. They can be both positive and negative, but generally have an element of uncertainty surround them.

6.4 Establishing the outlook

Since outlooks allow planners and decision-makers to think about the future, they can be powerful tools for extrapolating current trends into the future and of exploring potential policies and actions to put a region onto a sustainable development pathway. Thinking about these possible futures requires careful consideration of how drivers generate impacts in the environmental, social and economic dimensions. As discussed in Chapter 3, the DPSIR framework provides a useful tool for identifying and organizing the causal linkages between different actors and processes. In developing an outlook, the stakeholders involved should select a starting point (i.e. what are the beginning conditions) and a time scale (i.e. how far into the future we want to go).

Once the beginning and end point are defined, the following step requires the team developing the outlook to build one or more appropriate scenarios for the possible future(s). Such scenarios identify the key elements and processes, as well as the trends expected into the future. In other words, They define the assumptions about the future. The outlook based on such scenarios then represents the expected impacts and benefits in the environmental, social and economic dimensions. These possible futures explain, in a rich narrative way, how the DPSIR framework elements for a particular situation are assembled and how they evolve through time. In developing this narrative it can be useful to review existing outlooks such as those prepared by the IPCC, Global Environment Outlook, and the Millennium Ecosystem Assessment. Although most of these outlooks have been developed with different objectives and conceptual frameworks in mind, and for a global scale, they can provide key elements that might feed into the development of the DPSIR framework of the assessment. However, it is important to stress that relying exclusively on already developed outlooks is not advisable because they might not consider the specific questions that your Integrated Environmental Assessment is addressing. In other words, these outlooks can be used as guidance, but they have to be adapted for the specific context of each Integrated Environmental Assessment. It might even be necessary to develop a totally new storyline. In the context of the SDGs, Integrated Environmental Assessments should consider developing at least three alternative scenarios (Figure 6.1):

1. Business as usual: This storyline extrapolates current trends into the future and does not consider policy interventions to change trajectories. This scenario synthesizes how these trends affect environmental and socioeconomic variables.
2. Intermediate: In this scenario, the SDGs are considered as a goal in the future. Therefore, the outlook reflects an improvement in some socioeconomic and environmental variables. This is the result of the expected implementation of policies and interventions to achieve some of the targets of the SDGs.
3. High: As in the intermediate outlook, the SDGs are essential building blocks of the scenario. The focus here is to think of policies and interventions necessary to achieve to the SDG targets. Since this is probably a scenario with a need of new policies, it is important that the outlook tries to understand how these policies might interact with each other (i.e. interfering with each other, undesired and unexpected consequences).

As discussed in section 6.4.3 below, this type of scenario may fall into one of a number of families, depending on the nature of the assumptions made.

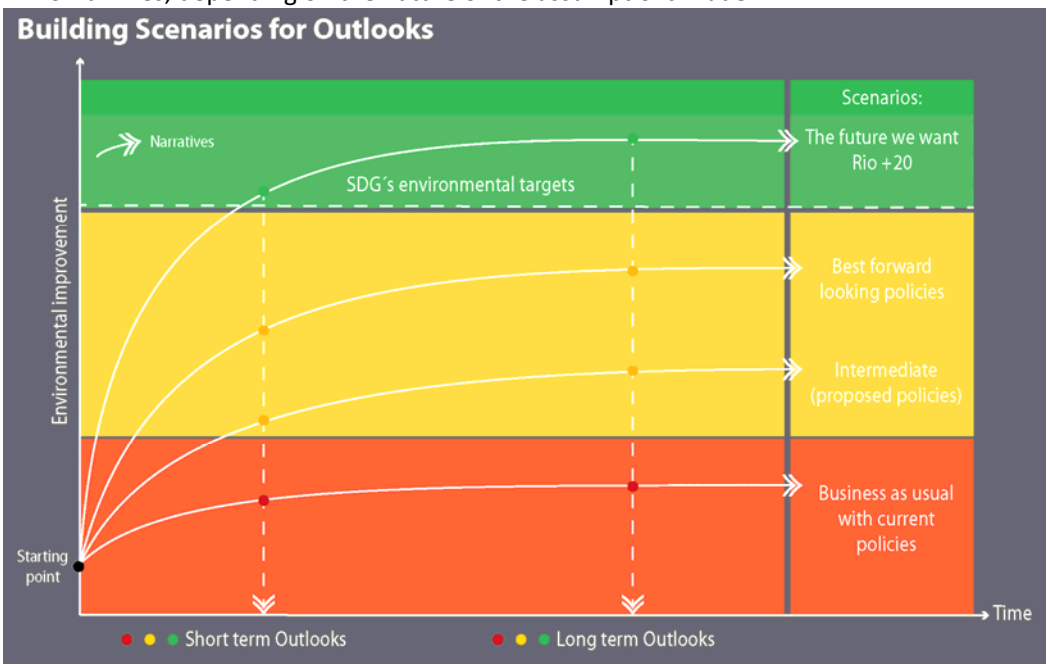


Figure 6.1: Scenarios for outlooks

These three basic scenarios fit into two categories: forward-looking and back-casting outlooks. In forward-looking outlooks, the trends defined by the scenario are extrapolated into the future and they tend to be exploratory. The business as usual is a good example of this type of scenario. There are also anticipatory or normative scenarios. In these, a vision of the future is defined, and they are constructed by back-casting - trying to build a path from the future into the current situation by thinking about possible policies (either new or adapted) that can be implemented. The High and Intermediate scenarios tend to fit this second category.

When developing the scenarios, an outlook team should include both Practitioners and Users. This helps ensure that the scenarios developed reflect how human activities are currently affecting, and will potentially continue to affect the environment and so aids in determining which existing policies can be enhanced and what new norms might be implemented for improving the environment and enhancing human well-being. Furthermore, these teams are a way of strengthening the science-policy interface, creating a better communication channel. The teams can also include stakeholders from other social groups (i.e., local communities, indigenous groups, minorities) whose vision of the future also needs to be incorporated into the outlooks. These mixed teams can help to identify gaps (i.e., policies that might be missing, lack of data or knowledge about a specific process or phenomena). Furthermore, the participatory nature of their development will also help different stakeholders to identify with the scenarios.

Scenarios can also be developed for specific questions or for introducing “surprises”. Not too many people expected the 2008 worldwide financial crisis. An event like this can alter significantly the outlook for the conditions of a specific region and by including it, it might be possible to anticipate some consequences of such events and see if existing policies and responses can be adapted to reduce the impacts.

Up to this point, the characteristics of the scenarios have been restricted to their qualitative nature (i.e. their driving forces, linkages and expected outcomes). The narrative expresses the causal linkages between the different elements and the trends of environmental impacts based on the logic specified by the scenario. Quantitative scenarios add numerical estimates to the narrative by using simulation and modelling techniques. In many instances, these modeling exercises help to check the internal consistency of the qualitative scenario by contrasting what the narrative and trends indicate, with future estimates of important parameters. Practitioners should be aware that developing these quantitative parts of scenarios requires additional time and money as modelers will need to be brought in as part of the team, and the narratives usually represent additional work that might not always be necessary. In other words, qualitative scenario(s) and the outlook based on it/them may be enough for a particular Integrated Environmental Assessment.

Besides their potential role as planning and policy formulation tools, scenario development can also serve two additional functions. Because they provide models of the relationship between driving forces and their possible outcomes, they can also be a tool of scientific exploration (i.e., "what if?" type of questions). Finally, scenarios can also be used as an educational and outreach tool because they present a possible future and how it is related to the present. Since scenarios are developed by a team of stakeholders, they are also a collaborative learning processes in which actors learn each other's views of the future, and a common view can then emerge from the process. Therefore, scenario development can be regarded as both a process and a product (Millennium Ecosystem Assessment 2005, Chapter 5).

6.4.1 Scenario development

There are several methods for developing an Integrated Environmental Assessment scenario (Integrated Environmental Assessment Manual 2007; 2010 Ecosystems and Human Well-being: A manual for assessment practitioners (Chapter 5: Scenario Development and Analysis for Forward-looking Ecosystem Assessments). These are summarized in figure 6.2. The approach for scenario development varies depending on the time and budget available, the degree of complexity and geographical scale involved, and the desired level of stakeholder and/or expert involvement. The 5 Ws of the scenario (what, why, when, where, who is doing it and for whom) can be used as a guide in scenario development. The first step in the exercise involves defining clearly the main parameters of the scenarios. This means establishing the nature and scope of the scenarios, their geographical and temporal scales, and identifying the possible stakeholders and selecting participants. It is also important to define the expected outcomes and why a scenario development exercise should be organized. Practitioners should keep in mind that, in the context of an Integrated Environmental Assessment, scenarios need to incorporate policies explicitly, and that the scenario exercise will provide insights on the possible effectiveness of existing or proposed policies. In developing the scenario exercise it is important to create an enabling environment, so the scenario-building process can be as smooth as possible. Therefore, the role of a facilitating team is key to the success of the exercise (Fig.6.4.2)

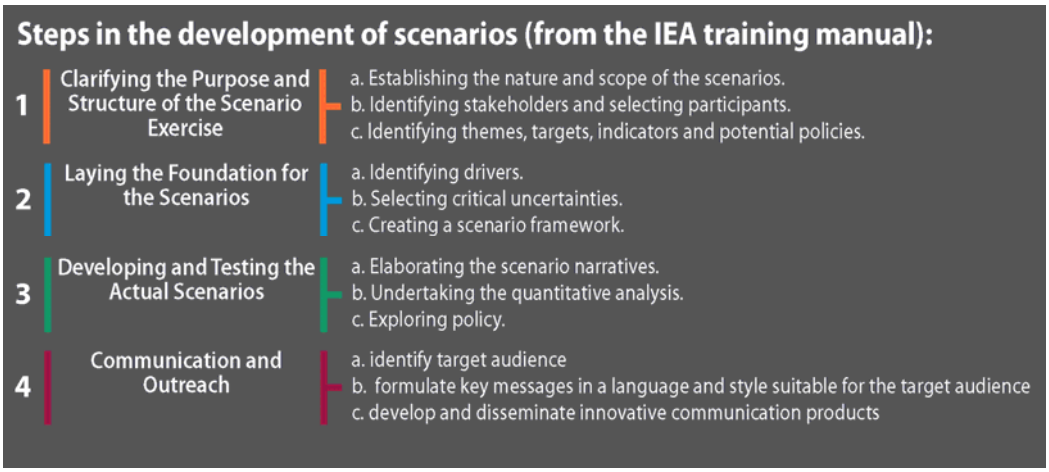


Figure 6.2: steps in the development of scenarios

6.4.2 Consideration of Barriers and Enablers to Progress

In order to influence policy and move in the direction of an improved and sustainable future with more responsible environmental governance, it might be helpful to identify and challenge the overarching systems that ar

e currently responsible for preventing us from moving into this direction, or for slowing down any progress that is made. This exercise will ideally reveal some specific measures for change and as a consequence, identify some very practical suggestions and hence opportunities where transformation is needed.

Barriers to progress can include political, economic and social systems, technological advances and deeply rooted cultural beliefs. Defining barriers will be especially important in the Integrated Environmental Assessment since very often progress in environmental sustainability will compete with economic and social progress. Similar to recommendations, they can be very important in the follow up process of an Integrated Environmental Assessment.

Barriers are different from drivers in a sense that barriers are not directly related to the theme that is under assessment. On the other side of the spectrum there might be powerful enablers that can boost progress. Like barriers, they are not really directly connected to any environmental issue. Incorporating these enablers into the assessment will also aid in developing action points once the Integrated Environmental Assessment is finalized. Examples here could be the use of citizen science, social media, advances in technology and innovative financing systems.

6.4.3 Assessment of existing scenarios

Scenario analysis is routinely used in many Integrated Environmental Assessments, including global assessments such as the IPCC's Assessment Report (IPCC, 2007, 2014), UN Environment's Global Environmental Outlooks (e.g. UNEP, 2007, 2012), the Millennium Ecosystem Assessment (MA, 2005) and the OECD Environmental Outlook to 2050 (Marchal et al 2010). These global assessments seek to organize and communicate large amounts of, both qualitative and quantitative, information into a form that can be used by policy makers to develop policies.

Van Vuuren et al (2012) analyzed assessments and concluded that there are a number of common characteristics that form the basis of many scenarios. This commonality allows the scenarios to be grouped into "families" – a term first coined in the IPCC Special Report on Emission Scenarios (IPCC 2000) to describe four different narrative storylines from which 40 scenarios were developed.

Van Vuuven et al (2012) classified scenarios from the literature into families that shared a similar storyline. They were able to recognize 6 scenario families that share assumptions on uncertainties and result in similar outcomes - (1) the economic- technological optimism/conventional markets scenarios, (2) the reformed market scenario, (3) the global sustainability scenario, (4) the regional competition/regional markets scenarios, and (5) regional sustainable development scenarios (together category 3 in section 6.4), and (6) the business- as-usual/intermediate scenarios (categories 1 and 2 in section 6.4). The Practitioners suggest that recognizing these families makes it easier to compare and combine information from different assessments. The different scenario families provide an opportunity to learn from the application of existing scenarios and also to extend or develop narratives that describe particular sectors or geographic scales.

6.5 Interpretation and presentation of findings

The UN 2030 Agenda and its Sustainable Development Goals (A/Res/70/1) (SDGs) will be the main policy framework for an integrated approach to environment and sustainability in the coming years. Many of the targets under the SDGs and the indicators that will be used to measure progress are highly relevant to any environmental outlook and the Integrated Environmental Assessment reporting process. Countries are expected to adapt the SDGs to their national context and to determine their national contribution to the global goals. Organizations and businesses at all levels are considering their own roles in implementing this ambitious set of goals by 2030. The SDGs are intended to be fully integrated across the social, economic and environmental dimensions of sustainability, so they provide an excellent framework for integrating assessments.

For most Integrated Environmental Assessments, it will be important to identify the SDG targets most relevant to the area and scope of the assessment and to incorporate them into the assessment framework. Where indicators for these targets have already been identified, they should be used to ensure consistency between the environmental outlook and the broad integrated policy framework represented by the SDGs. The analyses of the Integrated Environmental Assessment results should also be related to the 2030 Agenda and the SDGs, since governments will be reporting regularly on their progress, and this will increase their policy relevance.

6.6 Risk analysis and surprises

Most techniques for risk assessment are designed to evaluate the risks from a known event or hazard, but the methodology can be adapted for risk assessment within scenarios of the future. Risk assessment combines an evaluation of the probability of an event, whether natural or the result of human activity, and the severity of its impact or the magnitude of the potential loss. Assumptions and uncertainties are clearly considered and presented. A risk may be discounted if the cost of preparing for it is greater than the expected loss. Several events of moderate severity may represent less of a risk than a rare but extremely damaging event. Furthermore, while the probability of an extreme event may be low in the short term, it might rise considerably in the medium- or long-term. Where there is a range of possible outcomes, it is important to distinguish the worst case scenarios from others that may be

more probable. In addition to assessing the risk of an undesirable outcome, it is usually necessary to consider any risks from the measures that may be taken to avoid that outcome.

From a policy perspective, it is the rare events of great magnitude that are the most difficult to consider rationally in an outlook. These are sometimes referred to as wild cards, sideswipes, black swan events or surprises. Yet such events can cause a major loss of life, or a significant reduction in economic activity, or more often both. These represent a challenge for most policymaking, which has a much shorter time horizon than such events. A policymaker will usually not be ready to sacrifice the benefits of a 5-year perspective because of an unpredictable event that may not occur in his or her lifetime, even if it would represent a major disaster. The issue will be what measures to reduce vulnerability can reasonably be taken, perhaps with shorter term co-benefits, to provide some protection or resilience in the face of the unexpected.

Since scenarios are not predictions of the future, they can include a consideration of the risks of unknown and unexpected events, processes or factors that could influence their outcome, and thus help policy-makers to appreciate what those risks could represent. This could be an additional exercise added to an existing scenario. One approach is to imagine some plausible risks and consider how they would modify the scenario. This can be a useful exercise in adaptive management, in which policies or actions are modified to take into account new information. Another approach is to assess how robust the scenario would be when challenged with possible disruptions to the trends on which it is based.

Risks that might be considered could include an extreme climate-related natural disaster or a volcanic eruption disturbing the global climate for a few years, a collapse in the financial system or other severe economic disruption, a disease pandemic causing considerable loss of life and disruption of social functioning, or a rise in armed conflict, serious political conflict, various forms of terrorism and migration due to disasters. All of these have occurred one or more times in the last two centuries, so they cannot be completely discounted as future probabilities.

It may also be necessary to analyze the risk that a scenario or one or more of its parameters may be wrong and to consider the consequences of such errors. This is often taken as a justification for continuing business as usual, so the risk of doing nothing must also be assessed and compared to the scenario. From an environmental perspective, the risk of business as usual without further action on the environment will in most cases be greater than any alternative proposed in an outlook.

6.7 Uncertainty analysis

Uncertainty analysis is different from risk analysis. Risk analysis determines the likelihood that deviations from the scenario pathway could occur, while uncertainty analysis determines how precise the pathway is thought to be. This uncertainty can sometimes be quantified, if modelling is used to construct the outlook, or expressed qualitatively if an assessment of existing outlooks is undertaken.

Practitioners should apply a method to determine the uncertainty surrounding the conclusions of the outlook. This method may be quantitative or qualitative (See Annex 2).

Practitioners should communicate the level of uncertainty surrounding particular conclusions in the outlook clearly and in language that is appropriate to the intended audience.

- Be very clear on the limitations of your scenarios.
- The previous Integrated Environmental Assessment training manual has a method for identifying key uncertainties.
- Showing an error bar around the point estimates can be helpful.

6.8 Data, knowledge and capacity gap analysis

6.8.1 Data collection

Data, knowledge and capacity to support IEAs are often incomplete and improvements in their availability are often recommended by assessments. As environmental data, knowledge and capacity improve, assessments should become easier to perform and more authoritative in their conclusions.

6.8.2 Social Analysis

Social analysis can assist in better reaching the poorest and most disadvantaged. Social analysis starts from understanding the socioeconomic context while the findings of social analysis can guide the identification of priorities for intervention.

Social analysis can incorporate gender analysis, poverty analysis and vulnerability analysis and is very helpful to understand the complexities of social diversity (including gender and youth) and the various dimensions of poverty. Social groups need to be considered very carefully in social analysis. What may at first seem to be a single social group may not be a homogeneous entity, but a complex institutions where practices within the group have different implications for different sub-groups in determining access to, and use of, resources.

6.8.3 Gender analysis

Linked to the above Social Analysis of class dynamics is an analysis of Gender difference. Gender analysis invites consideration of the different lived experiences between not only the two most prominent genders—male and female—and their dominant or presumed heterosexual identities, but also those who identify as part of the wider Lesbian, Gay, Bisexual, Transgender and Intersex community (LGBTI) where gender and sexual identities are differently structured. The focus of the Gender Analysis component of an Integrated Environmental Assessment is on both how an individual experiences a given place or environment based on the vectors of social difference and how expectations of how one should behave are based on gender and shaped by the traditions and laws of a given society or religion. Thus when analysing relations between gender and environment although the central task will be categorising how men experience the environment differently to women, it is also important to both consider and work to accommodate instances in which minority groups might be differently affected by changes to the environment.

In the context of an Integrated Environmental Assessment the focus of the analysis is thus on how this broad understanding of gender differences affects one's relationship with the environment and, in a related sense, how particular social groups are likely to be affected differently by changes, developments, improvements or alterations to that environment. So, rather than treating humans as an homogenous mass, gender analysis brings to the fore the variety of experiences that are shaped by one's particular standing within a human community and their environment on the basis of their gender identity.

Gender analysis can assist an Integrated Environmental Assessment in many ways, by focusing not only on questions of class but how labour is divided up between genders and by asking, in turn, how these gendered dimensions of society are linked to the environmental situation being assessed.

As described by the Global Gender and Environment Outlook report, some of the key factors that relate to gender difference and the environment regard access to basic human necessity. For instance, women and girls in unpaid care work require daily access to drinking water, food, sanitation and energy (GGEO 2016), while men might have different kinds of access earning money and out of the domestic sphere.

Key factors that need to be analysed are:

- How will extant gender difference/bias in given societies be altered by any actions taken? What are the consequences in terms of gender-difference?
- Will this lead to greater inequality between genders?
- Who will be undertaking the work and what are their conditions?
- Are all parties equally exposed to the risks of a given action and/or will risks fall disproportionately on women and children, for example?

A rigorous gender analysis compenent of an integrated environmental assessment will genuinely connect human social and environmental issues and analyze them based on both ideal ecological and social justice outcomes.

6.8.4 Data Gap Analysis

Practitioners should conduct gap analysis on environmental data, knowledge and capacity as part of developing the outlooks. This may identify to decision makers the possible mechanisms for filling these gaps.

7 Evaluating the Assessment

When an assessment is completed and there has been time to measure its impact, an evaluation process should be used to determine the lessons learned from the assessment.

Secretariat	-Should contract the independent external consultancy in support of the evaluation

7.1 Importance of evaluation

Evaluation is a process that critically examines a program. It involves collecting and analyzing information about a program's activities, characteristics, outputs and outcomes. Its purpose is to make judgments about a program, to improve its effectiveness, and/or to inform programming decisions (Patton, 1987). When dealing with an Integrated Environmental Assessment, it refers to a systemic and objective examination of an Integrated Environmental Assessment, including its design, implementation and results. Evaluations can be ex ante, formative or ex-post depending on the needs and objectives and are normally carried out after the completion of an Integrated Environmental Assessment, but interim evaluations or reviews may also be made during its progress. Evaluations provide credible and useful information that enables lessons learned to be incorporated into decision-making processes and the design of future Integrated Environmental Assessments.

They can also provide a mechanism for accountability to funding bodies especially when the evaluation is commissioned and managed independently of the assessment production process.

Evaluations are important because they provide the requesting agency, Users and other stakeholders with evidence to verify, improve the quality, efficiency and effectiveness of assessments. In most cases, evaluations are thus an important component of evidence-based policy making, and provide internal insights and reflections, as well as external and independent perspectives, on three types of question:

1. ***Descriptive questions:*** the evaluation determines what has taken place in the Integrated Environmental Assessment and describes the processes, conditions and views of the various people involved;
2. ***Normative questions:*** the evaluation compares what has taken place with what should take place in an Integrated Environmental Assessment;
3. ***Causes and effects:*** the evaluation highlights the levels of use of the IEA and establishes what changes of behavior (outcomes) happened, or are likely to happen, as a result. The factors affecting actual or potential effects of the Integrated Environmental Assessment are identified and discussed.

However, Integrated Environmental Assessment evaluations are not only an important tool for policy-makers. They can be used by other Users, other requesting agencies and a broader set of stakeholders for establishing the credibility, legitimacy, salience, use and value for money of the Integrated Environmental Assessment for accountability purposes, and to facilitate learning, for example, how to negotiate changes in future Integrated Environmental Assessment procedures in order to increase their cost-effectiveness.

7.2 Independence of evaluation

The evaluation of an Integrated Environmental Assessment should be conducted through a transparent, impartial and independent process. Ideally, the design and implementation of

an evaluation should be clearly separated from the processes established for the production of the assessment and should not be under the control of, any organizational or institutional structures involved in the design and development of the assessment. However, particularly for Integrated Environmental Assessments carried out by small organizations, a degree of overlap in roles may be inevitable.

In this case, small organizations could form an Evaluation technical subcommittee with internal and external representatives under the auspices for their governance function.

Impartiality, along with full transparency and public access to all the documents produced during the evaluation, is an important baseline consideration, critical to ensure the credibility and trustworthiness of the process which may, in some cases, not be sufficient.

Independence is important at all stages of the evaluation process, including the planning of the evaluation process, the production of its terms of reference and the selection of the entity being evaluated (the "evaluand") and the contracting of any external consultants.

The budget allocated for the Integrated Environmental Assessment should include a separate budget for the evaluation process, whose amount and use should be careful discussed and approved prior to the start of the assessment.

An independent evaluation diminishes the risk of conflicts of interest, which could emerge in the case of an evaluation conducted by organizations related to the Practitioners of the assessment.

The independence of an evaluation can be safeguarded through a variety of mechanisms, although the precise functions and means of implementation may differ, depending on the bodies giving the mandate for the Integrated Environmental Assessment and the institutional framework in which the Integrated Environmental Assessment is developed. As a general rule, evaluation functions should remain under the control of the highest level in the organization giving the mandate for an Integrated Environmental Assessment and should be clearly separated from the management of the assessment itself. The individual in charge of the evaluation (the head or director of the unit) should be directly responsible for both the management of the evaluation and for the internal and external communication of its findings.

7.3 Possible forms of evaluation

The evaluation of an Integrated Environmental Assessment can be conducted through various approaches and methods. , The choice and execution of these are directly related to the management structure developed for the production of the assessment, and the nature of the institutions and the mandating body involved.

When evaluating an Integrated Environmental Assessment distinguish between:

- Internal reviews (not independent and often management led), used for learning purposes and course correction. Learning opportunities arise when there is a possibility or a pressing need to act in a new way. These opportunities naturally present themselves at the end of each stage of your Integrated Environmental Assessment and at the end of the whole Integrated Environmental Assessment cycle;
- Evaluations of performance for IEAs, used to measure whether the outcomes of the assessment have been achieved, are in line with what was expected and 'promised' in the design and assessing the quality, legitimacy, salience and use of the IEA.

- Influence and impact assessments' to measure the long-term effects stemming from IEAs often undertaken after a period of time following the completion of the IEA has elapsed.

It is important that, in the first place, the development of an Integrated Environmental Assessment should include from the start the arrangements for evaluation in its planning.

Where advisory bodies are established for the Integrated Environmental Assessment, they can also be used as advisory bodies to the evaluation. If there is a Scientific Advisory Panel it can be asked to provide guidance on the approach for evaluating the scientific credibility and overall quality of the assessment. If there is a High-Level Intergovernmental (or Governmental) and Stakeholder Advisory Group, it can be asked to provide guidance on the approach for evaluating the policy relevance, utility and feasibility of the assessment.

Evaluations conducted by independent, external consultants can be supported and strengthened by the advisory body review. In other cases, an independent, external consultancy can be used on its own. The possibility of such an external review should be considered, in the light of available resources, by the Integrated Environmental Assessment planning as a tool to enhance credibility and legitimacy of the assessment.

Such a consultancy, whose terms of reference and costs should be public, and make use of funds already allocated in the Integrated Environmental Assessment budget for this specific purpose. The consultants should complete their task in accordance with the term of reference in a spirit of mutual trust and collaboration. In particular, they should be granted access to all data sources and information used in the assessment and to the literature cited in the assessment.

Where the scale of the Integrated Environmental Assessment is modest, or where resources for an independent, external consultancy cannot be found, the task of evaluation should be confined to a specific small group drawn from a high level in the requesting agency, the members of which have had only limited involvement of the conduct of the assessment. Such a small group should then be supported by the Integrated Environmental Assessment secretariat and could be considered as an internal self-assessment.

All evaluations should be based on a combination of qualitative and quantitative methods in an effort to maximize the information on which their conclusions are based. The use of different techniques to gather information should be considered in conducting the evaluation, such as analysis of official data and information, web-based and e-mail surveys, and remote and face–to-face interviews.

7.4 Terms of reference for evaluation

Whatever arrangements are made for the carrying out of the evaluation, it is crucial that terms of reference for the evaluation are agreed among key stakeholders before work commences on the evaluation. The process for approval of such terms of reference should be similar to the process for approving the overall plan of the integrated environmental assessment (IEA), so that those commissioning the Integrated Environmental Assessment are equally committed to the evaluation. In designing the terms of reference, the work required to implement them must be commensurate with allocation of resources provided for the evaluation in the overall budget of the Integrated Environmental Assessment.

The terms of reference should make clear the aspects of the Integrated Environmental Assessment that are to be evaluated. These aspects can include:

- The broader relevance of and demand for the Integrated Environmental Assessment;
- The planning of the Integrated Environmental Assessment;
- The work of the secretariat of the Integrated Environmental Assessment;
- The roles of any advisory bodies created for the Integrated Environmental Assessment, including the way in which such advisory bodies functioned and the inputs that they made to the process;
- The collection of necessary data and information;
- The work of the experts involved in producing the Integrated Environmental Assessment;
- The peer-review of the draft Integrated Environmental Assessment;
- The arrangements for communicating the Integrated Environmental Assessment to the intended audiences.
- The use of the Integrated Environmental Assessment among target audiences and the assessment of the actual or likely intended effects of Integrated Environmental Assessment use.

The overall aim of the evaluation is to reach conclusions on how far the Integrated Environmental Assessment has been produced in line with the 3 main attributes of credibility, legitimacy and salience. The terms of reference therefore should be designed to ensure that the evaluation will show how the Integrated Environmental Assessment being evaluated approached the achievement of these important assessment attributes. Within this overall aim, the following questions should be considered for inclusion in the terms of reference:

a. ***Costs:*** What were the overall costs of the Integrated Environmental Assessment, and how do these compare with the agreed budget? What were the reasons for any excesses or underspends? Were all excesses authorized by the person at the appropriate level responsible for budgetary control? Have there been any questions about the propriety of any expenditure and, if so, how were these resolved?
b. ***Timetable:*** Did the production of the Integrated Environmental Assessment follow the planned timetable? If there were delays, what were the reasons for them? What steps could have been taken, within the agreed budget, to avoid those delays? If some elements were completed ahead of schedule, what permitted this?
c. ***Efficiency:*** Were there any areas of the planned work that proved to be particularly difficult to deliver? What were the reasons for any such difficulties? Were there any aspects where, with the benefit of hindsight, the necessary work could have been delivered more efficiently?
d. ***Methodologies:*** How well did the arrangements work for the collection of, and access to, the necessary data? Were there data elements that it would have been desirable to use, but which proved impossible or too difficult to deploy? How well did arrangements work for the collaboration of experts (meetings, information technology, writers' sprints, workshops, etc)?
e. ***Feasibility:*** Was it possible to address all the questions that were to be included in the Integrated Environmental Assessment? If there were difficulties in addressing any questions, what form did these difficulties take? Lack of, or problems in access to, data? Uncertainty about the quality of data? Absence of methodologies for assessing the data?

f. ***Scientific questions:*** Were there any issues on which criticisms were made of the scientific conclusions (including those on social and economic questions) on which the Integrated Environmental Assessment was based? If so, was the reliance of the Integrated Environmental Assessment on those conclusions justified? Could anything have been done to avoid the criticisms, either by better presentation, or by providing further information? On controversial questions, was a fair presentation of the different viewpoints achieved? Has the assessment identified new scientific questions with relevance to environment and sustainable development.

g. ***Communication:*** How successful was the communication of the Integrated Environmental Assessment:
    i. To those commissioning the Integrated Environmental Assessment?
    ii. To decision-makers in the fields covered by the Integrated Environmental Assessment and other policy-makers?
    iii. To the general public (where the Integrated Environmental Assessment was planned to be published)?
    iv. Was the timing of the communication appropriate? With the benefit of hindsight, could the process of communication have been better managed and, if so, how?

h. ***Usefulness:*** How far did those commissioning the Integrated Environmental Assessment consider that it was useful for their purposes? Did they find that the Integrated Environmental Assessment provided sufficient detail in, and justification for, its conclusions? Where the timing of the evaluation permits consideration of this question, has the Integrated Environmental Assessment been taken up and reflected in other publications, are there other examples of the use of the Integrated Environmental Assessment among target audiences?

i. ***Impact:*** Where the timing of the evaluation permits consideration of the question, what changes in policy, implementation or other measures have been adopted or implemented as a result of the Integrated Environmental Assessment?

j. ***Capacity building:*** What needs for capacity-building can be identified from the conclusions of the Integrated Environmental Assessment, both to improve future assessments and to improve the management of human activities that impact on the relevant parts of the environment?

7.5 Resources for evaluations

When the budget for an Integrated Environmental Assessment is being developed, resources and a time-frame should be allocated for the evaluation. Insufficient budgetary resources and an inadequate time allowance for the evaluation affect (i) the size and experience of the evaluation team and the quality of the analysis; (ii) the gathering of feedback from stakeholders; and (iii) the ability to collect information, interview key respondents or access secondary data.

The Integrated Environmental Assessment budget should therefore consider at least the following items:

a) ***Labour:*** the cost of the evaluation consultants/staff;
b) ***Travel:*** the cost of the travel required to meet programme staff and/or the requesting agency.

c) ***Other direct costs:*** the costs of items such as printing and postage, communications and other supplies and equipment;
d) ***Overhead costs and fees:*** operating expenses such as the cost of office space, utilities, etc.;
e) ***Programme costs:*** expenses under other programmes that are necessary to support the evaluation.

A common mistake that leads to evaluations being under-budgeted is to forget to include (i) the time of the assessment staff to meet with the evaluator; (ii) the staff time for facilitating connections between the evaluator and programme/site staff, (iii) time spent producing resources for derivative products, (iv) staff time and resources for quality control of evaluator products and the monitoring of activities.

As a rule of thumb, an evaluation may represent up to 1.5-3% % of the overall Integrated Environmental Assessment budget, but it may be higher or lower depending on what we want to learn from the evaluation and whether additional data is required (usually data collection represents more than half of the evaluation cost). This percentage strongly depends on the size and scope of the Integrated Environmental Assessment.

Evaluators should have access to, and analyze, the written material produced, complementing it with additional data e.g. interviews with internal and external agents. Lack of appropriate data can affect:

(a) The quality and detail of the evaluation design

(b) The quality of the analysis

(c) The generalizability of findings

Additional data collection may represent up to half of the evaluation cost. Semi-structured interviews with staff from the requesting agency, Users and decision makers are a low-cost alternative to fill data gaps. Cost effective approaches to carrying out interviews include phone-calls or videoconferences.

In some cases (e.g. collecting views and insights from EIA users), individual interviews can be replaced by group-level data collection, such as focus groups and PRA (participatory rural appraisal) techniques, but taking into consideration that might not be as quantitatively precise.

7.6 Finalizing the evaluation

Whatever method is chosen for carrying out the evaluation, it is important that as many as possible of those concerned in producing the Integrated Environmental Assessment have an opportunity to make an input to the evaluation before it is finalized. Such inputs are likely to be helpful both in improving the evaluation and in gaining acceptance of the findings, conclusions and recommendations of the evaluation.

Depending on the method chosen and the practicalities of that method, some of those involved in producing the Integrated Environmental Assessment will have been interviewed during the evaluation process. It will usually be helpful if these interviewees are given an opportunity to comment on the draft of the evaluation, both to ensure that any material drawn from those interviews is correctly represented and to allow any further insights prompted by the draft evaluation to be considered.

For the evaluation process to be transparent, credible and legitimate is is usual to offer those who commissioned the evaluation and those involved in the production of the Integrated Environmental Assessment the opportunity to comment on the draft evaluation of the Integrated Environmental Assessment.

In order to identify any obscurities or uncertainties that they find in the draft evaluation to be corrected before it is finally submitted.

7.7 Communication

Given the reasons set out in subsection 1 on the importance of evaluations, the evaluation should be in the form of a free-standing, separate document. Only thus can it provide the various stakeholders with the information needed for them to use it in improving environmental assessment processes. It is, however, not essential that such a document should be published on paper: depending on the circumstances, electronic publication can be sufficient.

The evaluation should be presented to those commissioning the integrated environmental assessment (IEA) to which it relates. It is desirable that it should be presented in a way that enables those who carried out the evaluation to be questioned about it, so that any potential lines of enquiry that the evaluation suggests can be pursued.

The evaluation should also be made available to all interested stakeholders in the field covered by the Integrated Environmental Assessment, and those stakeholders should be made aware that it is so available. Wider availability to the general public, where they request it, is desirable.

Box 12 Assessment processes can produce powerful results

“What we measure affects what we do; and if our measurements are flawed, decisions may be distorted.” Commission on the measurement of economic performance and social progress

When President Franklin D. Roosevelt was elected in the US in 1932, he ushered in the “New Deal” macroeconomic policy which depended on the government’s ability to closely monitor the state of the physical economy. The President instructed economists and statisticians to develop an assessment methodology to achieve this monitoring goal. In 1934, the economist Simon Kuznets introduced the Gross Domestic Product (GDP). Since then, GDP has become the most widely accepted measure of a country’s economic progress and the most dominant government decision-making tool. “As a basic definition, GDP is an estimate of market throughput, adding together the value of all final goods and services that are produced and traded for money within a given period of time. [1]. It established a growth-based economic and societal model that fails to recognize the physical limits of natural and social systems. It also fails to account for the negative ‘costs’ of natural degradation or social conditions that may be affected by unfettered materialism.[2] Moreover, GDP, is not an indicator a wellbeing and , fails to measure the distribution of financial wealth within society, that is, it does not take into account inequalities in income distribution. There is increasing interest to develop indicators and metrics to address the limitations of GDP (e.g. Index of Sustainable Economic Welfare ISEW, Genuine Progress Indicator GPI, Sustainable Net Benefit Index SNBI, Green GDP, Sustainable National Income SNI, Adjusted Net Savings, Human Development Index) changing the focus from “growth” to “progress” and from economic production to sustainable human well-being. However, despite its flaws, the policy- and decision-making processes that surround the GDP metric are by far the most influential in our governance

systems, easily recognised from the highest level of government right down to households and individuals. Focus on improving well-being offers vital learning opportunities to innovate and transform environmentally focused assessment efforts towards approaches and processes that can fundamentally affect behaviours, relationships and in the end, socio-environmental conditions.

7.7.1 Innovative assessment processes that enable change

Traditional top-down assessment approaches, which are not generally sensitive to local contexts and seek to impose a 'one-size-fits-all' solution, do not allow for creative, locally-based and historically and contextually-sensitive responses. These approaches suffer from a number of limitations that may impede transformative change (that is change that brings about effective, equitable and durable solutions to critical, complex problems). They often unwittingly reproduce conventional ways of thinking and may aggravate the very problem situations they seek to improve. As depicted in Figure 7.7.1, there are four levels of responding to change: reacting (level 1), redesigning (level 2), reframing (level 3), and regenerating (level 4). Most current institutional approaches tend to operate in the Level 1 (Reacting) and Level 2 (Redesigning) fields, which often constrain the potential for the assessment process to affect a systemic change.

The need for personal and collective ownership and collaborative decision-making at different levels of scale, in complex dynamic environments such as we face, requires a sophisticated theory of change and supporting change methodologies. The opportunities for enabling tangible change made available by evolving assessment approaches from levels 1 and 2 (Figure 7.7.1) to the desired Level 3 (Reframing) and Level 4 (Regenerating), are an effective motivator to consider the fundamental social process that underpins the conduct of an assessment. Change-enabling assessment methodologies can be designed to address personal and collective change and build the leadership and other capacities required to effect equitable and durable solutions. They need in particular to bring in the voices of those traditionally marginalized and typically not included in knowledge creation and decision making processes. They also need to serve as both conceptual frameworks and design principles. In combination with the extensive technical and scientific information, data and knowledge that can now be readily produced, a dynamic yet well framed social process can lead to a bridging of the assessment-to-policy-to-change gap. Table 7.7.1 compares traditional social/group processes applied to the conduct of assessments with innovative processes sourced from some of the diverse research in this field.

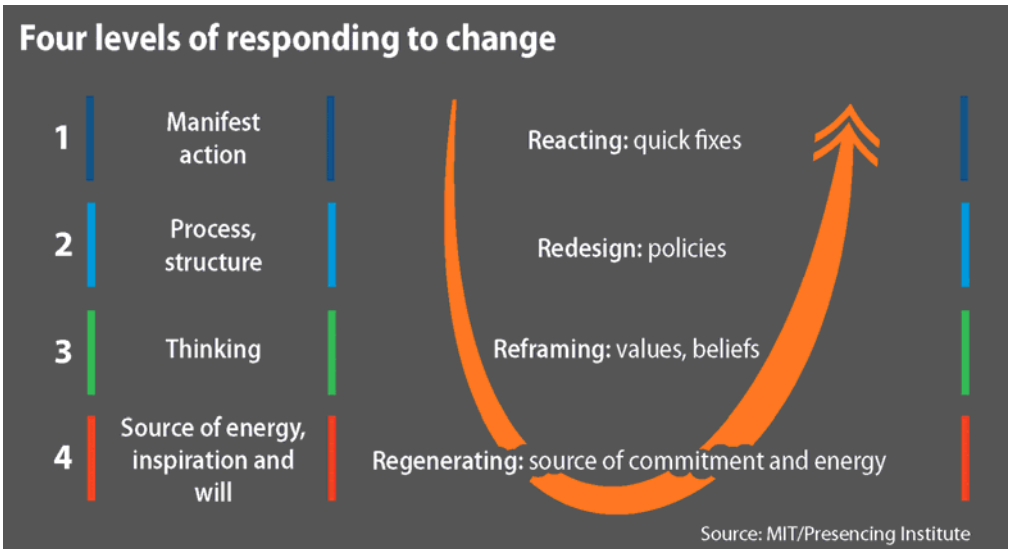


Figure 7.1: four levels of responding to change

Table 7.1: Social process qualities for traditional and innovative assessment approaches

Traditional assessment approach	Innovative assessment approach
Tend to be driven from the top down with limited external engagement, utilising traditional approaches	Engages multiple actors to work together creatively to develop fresh approaches
Tend to be conceived outside the area of application and therefore do not effectively engage with local practices and knowledge. This tends to reinforce dependency relationships and limits local capacity development	Conceived with local actors, taking into consideration local practices and knowledge, developing ownership and local capacity
Tend to separate both theory and practice and practice and policy, and therefore do not build local capability to name and frame complex challenges and design appropriate interventions	Endeavour to shifts the assumptions and mental models and ways people see the issue
They tend to utilise existing relationships, institutional arrangements and forms of knowledge	Endeavour to create a deeper web of human relationships that crosses cultural and institutional boundaries
They are seldom systemically conceived and therefore fail to address the key underlying conditions that have produced the symptoms that the initiative is seeking to address. They do not address what have been termed the 'structural disconnects', which produce systems that are designed to *not* learn.	They are systematically conceived to work with complex problematic situations that they want to transform, but that they cannot transform unilaterally or directly. They promote the emergence of communities of practice that generate new knowledge and can learn and adapt over time and under evolving conditions.

Annex 1: Applying the DPSIR framework

Short history of the DPSIR

Earlier analytical frameworks for environmental assessment included the Stress-Response (S-R) framework that was developed by Statistics Canada (1979), and addressed environmental stress, the state of the ecosystem and the ecosystem response (Friend and Rapport 1991). The S-R framework evolved into the Pressure-State-Response (P-S-R) framework in which the ecosystem response in the S-R framework was replaced by societal response and pressure was added to cover all releases into or abstractions from the environment by human activities. The P-S-R framework was first used by the Organisation for Economic Co-operation and Development (OECD) to evaluate environmental performance (OECD 1993). The P-S-R later evolved into the DPSIR framework (Svarstad et al. 2008) to include human activities, pressure, state of the environment, impacts on ecosystems, human health and materials, and political responses. The DPSIR framework was first applied by the European Environmental Agency in 1995 on the assessment of Europe's environment (EEA 1995). In between the years, countries presented reports on their State of the environment during the 1992 Rio Earth Summit. The majority of the countries presented on the State, which in itself became another framework for analysis.

The DPSIR framework has since been adopted as the analytical framework of choice for environmental assessment due to its capability to establish cause-effect relationships, as well as its adaptability. The DPSIR has been modified by serval studies for various reasons. Examples include: DPCER – where [SI] are replaced chemical (C) and ecological (E) state (Rekolainen et al. 2003); mDPSIR and DPSWR with a bias towards human welfare impact (ELME 2007, O'Higgins et al. 2014); DPSER – where impacts (I) were replaced with ecosystem services (E) to demonstrate both the negative effects upon ecosystems by humans and the positive benefits that humans gain from ecosystems (Kelble et al. 2013); and DPSEEA used by UN Environment and the World Health Organization to show the link between environment and health with EE focusing on exposure (to a diseases causing environment) and effects (of the exposure on human health; GRID-Arendal 2011).

Framwork	Driver	Pressure	State	Impact	Response
DPSIR (EEA, 2012) (EEA, 1999)	Social, demographic and economic developments in societies and the corresponding changes in life styles, overall levels of consumption and production patterns	Developments in (the) release of substances (emissions), physical and biological agents, the use of resources and the use of land	Indicator of condition of different environ-mental compart-ments and systems in physical, chemical or biological variables	Impacts on human beings, ecosystems and man-made capital resulting from changes in environmental quality	Responses by groups (and individuals) in society, as well as government attempts to prevent, compensate, ameliorate or adapt to changes in the state of the environment
PSIR (Turner, 2000; Turner et al., 1998)	Urbanization and transport/trade, agricultural intensifica-tion/land-use change, tourism and recreation demand etc.	Land conversions and reclamation, dredging, aggre-gates and oil and gas extraction, waste disposal etc.	Changes in fluxes across coastal zones, loss of habitats and biodiversity etc.	Consequential impacts on human welfare via produc-tivity, health, amenity and existence value changes	Policy response options
PSR/E (Schulze and Colby, 1994)	Underlying social and technological forces that drive economic activity Indirect human activities related to improvement of human welfare	Biophysical inputs and outputs that may exert immedi-ate stress on ecosystems	Ambient conditions and trends. Valued environ-mental attributes	Human health and welfare: Longevity, morbidity, value of ecological goods and services, other non-use values	Purposeful actions to address ecologi-cal, human health or welfare changes or impacts that are considered undesirable
PSR (OECD, 1993, 2003)	Human activities which lead to proximate pressures	Pressures directly exerted on the environment, e.g., emissions	Quality of the environment and the quality and quantity of natural resources	Relationships between two or more variables within any of the pressure, state and response categories	Actions to mitigate, adapt to or prevent human- induced negative impacts on the environment
FDES (UN, 1984, 1991)	Social and econom-ic activities, natural event	-	Environmental impacts of activities/events	-	Responses to environmental impacts
S-RESS (Friend, 1979)	Activities with the potential to degrade the quality of the natural environment, to effect (sic) the health of man, to threaten the survival of species, to place pressure on non-renewable resources, and to deteriorate the quality of human settlement	Elements that place pressures on, and contribute to the breakdown of, the natural and man-made environment	Observed effects of stress upon natural and man-made environments	-	Collective and individual responses Man's reaction to environmental changes

Source: Modified from Cooper 2013

Source: Cooper 2013.

One the most important steps when using the DPSIR framework for an Integrated Environmental Assessment is to define the Integrated Environmental Assessment's

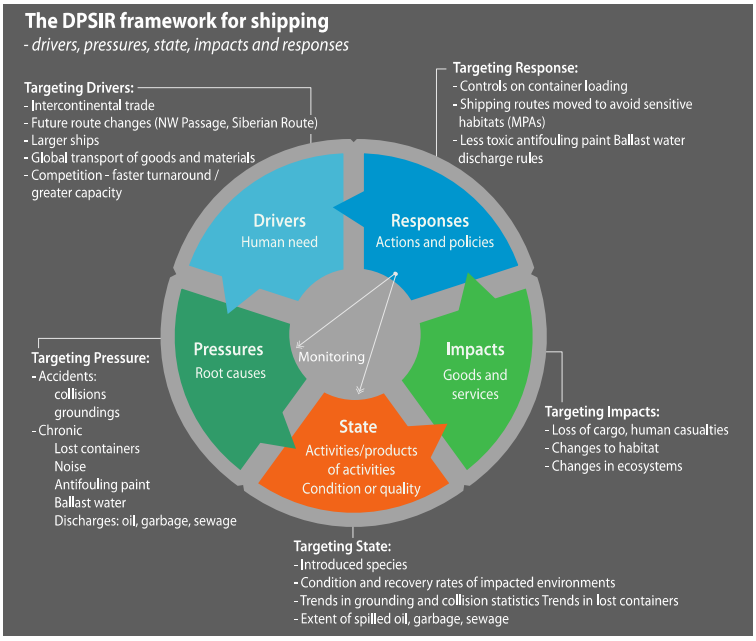
objectives clearly. Concise and unambiguous wording of the intended goals of the assessment helps in identifying and articulating the elements that make up the different components of the framework, who should be involved in the assessment, and what are the data and information needs to determine environmental change, its impacts, and the effectiveness of the actions undertaken to confront it.

On September 25, 2015, Member States of the United Nations adopted *The 2030 Agenda for Sustainable Development* with a set of Sustainable Development Goals (SDGs) at its core. The 2030 Agenda commits all countries and all stakeholders to work together to promote sustained and inclusive economic growth, social development and environmental protection and to ensure that people can fulfil their potential in dignity and equality and in a healthy environment. The SDGs can be viewed as set of universal economic, social and environmental goals some of which, depending on the temporal and spatial scale of the assessment, are potential drivers of the state of the environment. These potential drivers include SDG 1 (to end poverty in all its forms everywhere); SDG 2 (to end hunger and achieve food security and adequate nutrition for all and promote sustainable agriculture); SDG 6 (to secure water and sanitation for all for a sustainable world); SDG 7 (to ensure access to affordable, sustainable and reliable modern energy services for all; SDG 8 (to promote inclusive and sustainable economic growth and decent work for all); SDG 9 (to promote sustainable industrialisation); and SDG 11 (build inclusive, safe and sustainable cities and human settlements.

Example of cases where DPSIR has been used

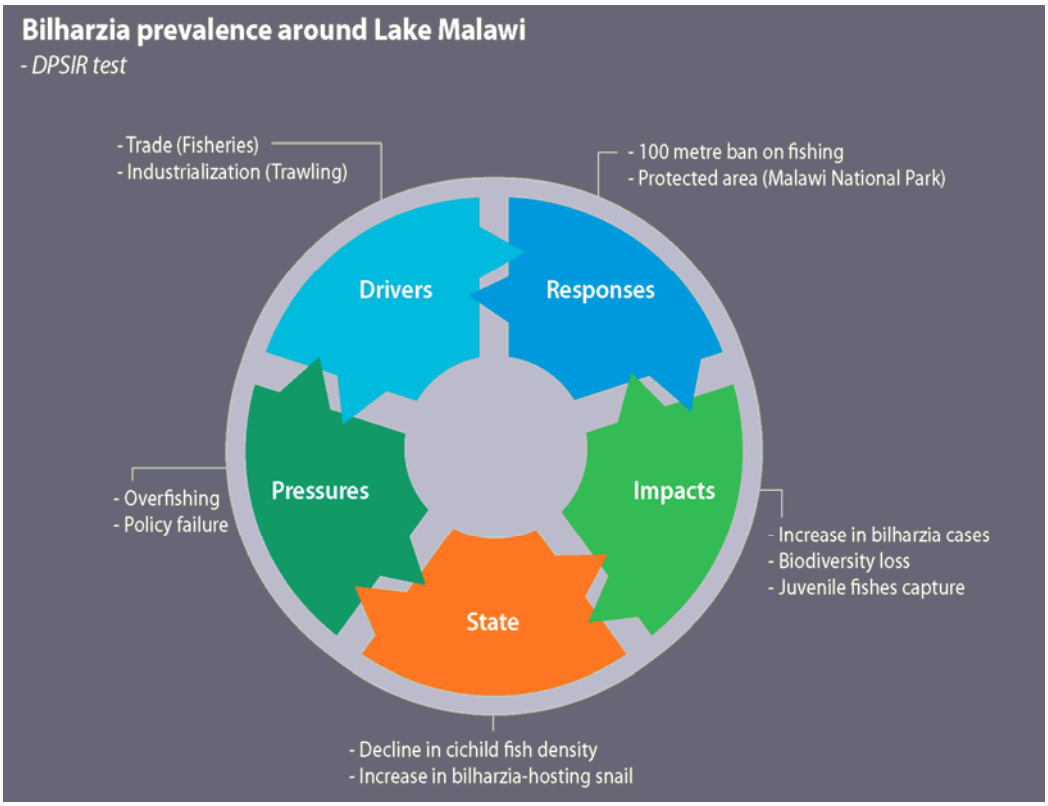
One approach to conducting Integrated Environmental Assessments is to consider human activities in a sectoral context, in which individual industries can be examined separately using the DPSIR. This makes sense from the perspective of governments that are commonly organized in a similar way (i.e., by departments), and whereby policies and legislation are developed to respond to pressures imposed by different sectors of the economy. It also permits examination of drivers that are specific to a particular sector.

For example, drivers that are important to the shipping industry include intercontinental trade, potential new shipping routes in the Arctic Ocean (that are opening due to reduced sea ice), the trend toward the construction of larger ships having greater capacity and competition between ports in their capacity to load and unload cargo (Figure 3.2). These drivers are relevant to the shipping sector but may not be considered as the main drivers in other sectors. For example, the main drivers for the oil and gas industry might be the global demand for energy and trends in production. There are overlaps between the two sectors, but the decision-makers working in these sectors would likely have differing views on priorities for policy responses to the (quite different) pressures, changes in state and impacts that arise from them.



A DPSIR framework for shipping

In the late 1990s, there was a dramatic increase in the transmission of the parasite bilharzia to local human populations around Lake Malawi (Impact) (Figure 3.3). Investigations showed that there was a strong correlation between the increase in bilharzia cases and the decline in cichlid populations. It was determined that the decline in cichlid populations was a direct result of overfishing (Pressure) in Lake Malawi (State) (Stauffer 1997). Some of the cichlids are predators of snails such as *Bulinus nyassanus,* which host the bilharzia parasite, *Schistosoma haematobium* (Stauffer and Madsen XXXX).

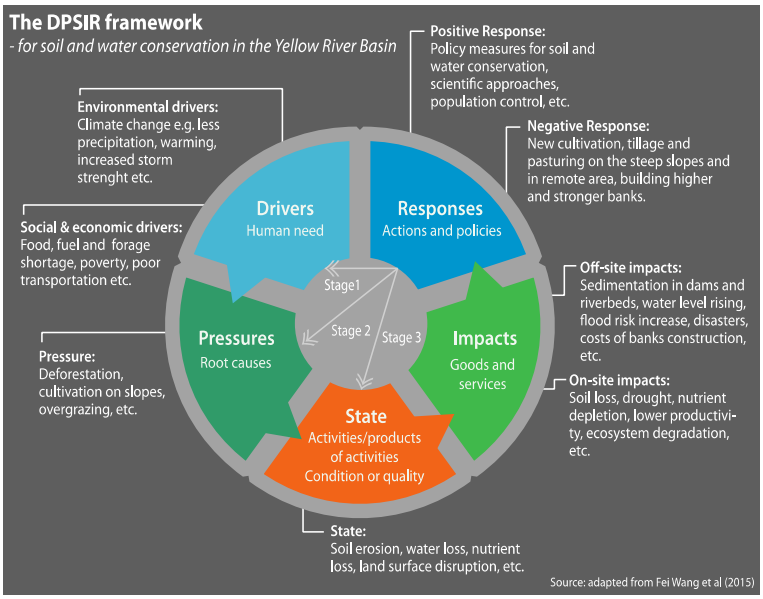


DPSIR framework for assessing Bilharia around Lake Malawi

The over-fishing of cichlids was largely driven by the commercialization of the fisheries (Driver) sector in the lake resulting in a biodiversity rather than a fisheries crises (Impact) since Lake Malawi's annual fish catch has consistently fluctuated between 1000-3000 tons (Weyl et al. 2005). While fishing is prohibited within 100 m of Lake Malawi National Park shoreline (Response), this is generally neither enforced nor respected (Pressure). As a result, seine net fishing from the shoreline is common, and includes the use of mosquito nets which capture juvenile fishes and negatively affect recruitment of fish species (Impact). This in turn impacts the cichlid populations ability to keep the snail population the hosts the bilharzia parasite in check.

The DPSIR framework has been used by Wang et al (2015) to retrospectively analyze the historical evolution of the Yellow River soil and water conservation policy (Figure 3.4). Since 1949 policy actions have evolved in response to the impacts of soil erosion, flooding and population increases. The Practitioners dive the policy reposes into 3 stages. Stage 1 (1945 – 1969) focused on reducing flood disasters by decreasing soil erosion and increasing irrigation to support rural development in eroded areas. During Stage 1 the policy response was largely driven by the need to increase food production to feed a growing population. In the absence of institutions, the policy was largely implemented by local farmers. During Stage 2 (1980- 1990) the policy focused on improving land and water usage through more integrated watershed control and holistic resource and environmental management (including ecological recovery). The increased complexity of the policy implementation required that management moved from the local farmers to community organizations. Stage 3 (1991- present) focuses on the prevention of environmental degradation, disaster mitigation and agricultural development. The implementation of Stage 3 of the policy is now the responsibility of government and multiple stakeholders.

Wang et al (2015) report that the evolution of the Yellow River soil and water conservation policy has been effective in reducing the area of grain crops while increasing food production, decreasing the sediment load of the river and reducing erosion by facilitating the conversion of farm land to forest.



DPSIR Framework for assessing soil and water conservation in the Yellow River Basin

The DPSIR Framework has been adopted in the Global Environment Outlook process since the beginning. In the case of Global Environment Outlook cities, for example, Interaction between urban and environmental components has been the key to prepare the reports.

To do so, account has be taken of:

- The urbanization process components needed to understand the pressure exerted on the environment, and
- The factors that make up the environment whose state, qualitative and quantitative, represented the report's objective.

Three main components have been found in the urbanization process: demographic dynamics, economic dynamics, and territorial occupation dynamics. These components are the driving forces that propel urban development: population, economic activities, and the territorial basis on which economic activities are developed. These factors, even though they have been classified as a central part of the process of interacting with the environment have been included in the matrix by means of different indicators, selected to allow an assessment to be made of the state of the local environment. To analyse the environment two components were considered: natural resources, from a broad perspective that includes water, air, soil and biodiversity; and ecosystems, considered as the result of the interaction of natural resources. Concerning ecosystems, account has been taken of local delimitations for each one, given the variations in terminology and concepts used to defi ne them (how many and which ecosystems in each locality). Applying the DPSIR matrix is a useful instrument which, together with the use of urbanenvironmental indicators, is capable of expressing the behaviour of the relevant factors and trends over time.

Global Environment Outlook assessments have been carried out at the global, regional, sub-regional, and national levels catering to information needs at these levels. The information gleaned through Global Environment Outlook assessment has been used frequently in decision-making for ums such as global and regional forums of ministers of the environment, and in environmental education at different levels. Regional bodies such as the African Ministerial Conference on the Environment (AMCEN) and the Twelfth Meeting of the Forum of Ministers (Barbados 2000) have formally adopted the Global Environment Outlook methodology in terms of integrated environmental assessment in their respective regions. Global Environment Outlook-3 materials were adapted in many of the regional Preparatory Committee Meetings leading up to the World Summit on Sustainable Development in 2002. Before that, Global Environment Outlook-2000 was used in the preparation of the report of the UN Secretary General to the Millennium Summit in the year 2000.

Annex 2: Concrete examples and case studies

Box 1: Different messages for different audiences: example from the Millennium Ecosystem Assessment

The Millennium Ecosystem Assessment developed five synthesis products each designed for a different interest group. These synthesis reports were tailored to the needs of the users – the Convention on Biodiversity, the Ramsar Convention on Wetlands, the Convention to Combat Desertification, the business community and the World Health Organization. Each report is tailored to the expected audience group, emphasizing different aspects of the results and employing varying levels of detail.

Box 2 Absence of policy assessment in World Ocean Assessment I

The framework for the Regular Process for the Global Reporting and Assessment of the Marine Environment, including socioeconomic aspects, endorsed by the United Nations General Assembly, provided that the scope of individual assessments under the regular process would be identified by Member States in terms of, inter alia, geographic coverage, an appropriate analytical framework, considerations of sustainability, issues of vulnerability and future scenarios that may have implications for policymakers[1]. The Group of Experts of the Regular Process, set up to carry out assessments under the Regular Process, was required to draft an outline of questions to be considered in the main assessment to be undertaken in each cycle of the Regular Process, for approval by the Ad Hoc Working Group of the Whole (AHWGW) of the General Assembly. When the Outline for World Ocean Assessment I was developed, it was undoubtedly for an Integrated Environmental Assessment, covering all aspects of the oceans, environmental, social and economic, but the outline also repeatedly stated that "The First Global Integrated Marine Assessment will not include any analysis of policies."

Paragraph 20 of A/64/347, endorsed by paragraph 177 of resolution 64/71.

Annex II to A/67/87, approved by paragraph 222 of resolution 67/78

Box 3

Increasing efficiency of irrigation technology resulted in an unintended increase in ground water extraction.

The policy of the U.S. State of Kansas was to provide subsidies and cost-sharing to farmers to encourage them to move to more efficient irrigation technology to reduce groundwater consumption. However, contrary to the intended aim of the policy, the introduction of new drip irrigation systems resulted in a substantial increase in water consumption. Analysed data illustrated that farmers used the efficiency savings to either apply more water per acre (by increasing yields or moving to thirstier crops) or to leave fewer fields fallow (Pfeiffer and Lin 2014).

Annex 3: Examples of methods for expert elicitation

Box 1 Implied policy assessment

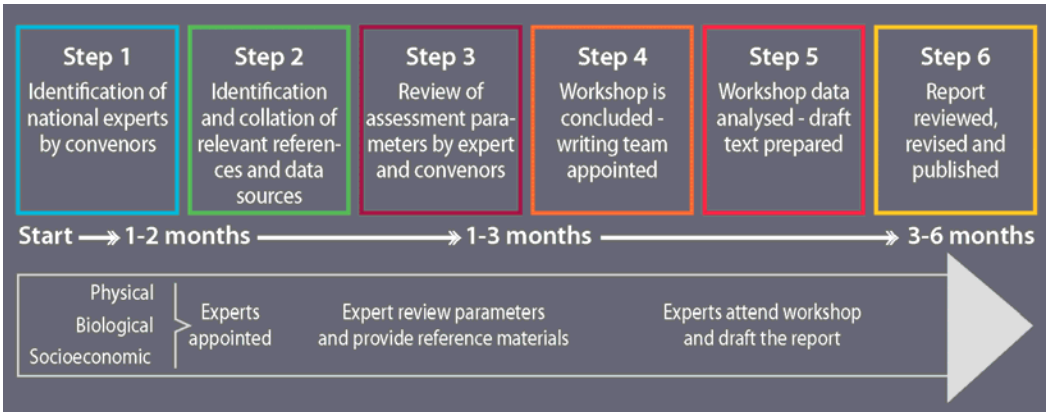
Results-based management frameworks in many governments now create implied obligations on programme managers to conduct evaluations or assessments of the effectiveness of their programmes. First, a set of performance indicators and a logic-frame are created for particular programmes and these are tracked periodically to determine if programme outputs are being delivered and whether they are leading to anticipated outcomes. For example, the Government of Canada's Treasury Board requires government programmes to conduct periodic evaluations of programme effectiveness, continued relevance and cost-effectiveness. This mechanism allows their Treasury Board to recommend periodic adjustments to the portfolio of government programmes when these are demonstrated to be ineffective or no longer relevant (PWGSC 2012)

[PWGSC, 2012; Program Evaluation Methods, Measurement and Attribution of Program Results, Third Edition; Treasury Board of Canada Secretariat]

Box 2 How to conduct an assessment using expert elicitation?

A “good” or “acceptable” expert elicitation depends substantively on the following: "(1) clear problem definition; (2) appropriate structuring of the problem; (3) appropriate staffing to conduct expert elicitation and select experts; (4) protocol development and training, including the consideration of group processes and methods to combine judgment, if appropriate; (5) procedures to verify expert judgments; (6) clear and transparent documentation, and (7) appropriate peer review for the situation. (U.S. EPA 2011)" The ultimate success in the production and the legitimacy of a report ensuing from an expert elicitation process depends on the thoroughness of the steps leading to and after the elicitation has been carried out. An ideal procedure should include the following steps, but may need to be revised to ensure it matches the needs and constraints of the state or region for which the report is being produced:

Timeline of idealized expert elicitation assessment process, including pre- and post-workshop activities needed to produce an integrated environmental assessment.



Step 1. Identification of National Experts and Stakeholders - This step begins with the clear definition of the assessment region and the purpose of the assessment. These will help with identifying the experts, stakeholders, and Users. In principle, the goal should be to try to involve a representative fraction of the experts and stakeholders from a range of

organizations as this will improve the quality of the assessment and ensure the report holds a legitimate basis for decision-making.

Step 2. Relevant information identification and compilation **-** The reporting agency, with the support of the experts nominated, should initiate the identification and collation of relevant information (publications, scientific papers, databases and data sets) and make it electronically available to all experts involved.

Step 3. Expert review of the assessment themes and parameters - A structure for the assessment built around a set of themes and parameters is needed. Ideally the parameters will have already been identified in previous assessments carried out in the region. Experts will be requested to review and make suggestions on the parameters for condition, threats and risk, and the determination of appropriate benchmarks. They will also review the assessment procedures and the collated relevant information and suggest additions.

Step 4. Expert Elicitation assessment - The expert elicitation assessment should be carried out using a workshop format (or series of workshops), attended by identified experts. The scores assigned to the parameters are recorded during the workshop. Notes are taken on the discussion by a rapporteur and the details of relevant reports, papers or other documents are recorded. The interaction and discussions during the workshop/s should allow the editorial board to identify potential Practitioners to participate in the subsequent report-writing phase of the process.

Step 5. Report drafting - The scores of the assessment parameters and any details are compiled, analyzed by the reporting agency and provided in a concise and organized way to the editorial committee. These are distributed to the different Practitioner/s appointed for the different themes/chapters who are tasked with producing draft chapters based on the outcomes of the expert elicitation assessment and any generic introductory insight they may want to bring in.

Step 6. Report reviewed, revised and published **-** Once the first draft is compiled by the Editorial Committee it should be circulated to all the experts involved in the expert elicitation assessment and writing of the report in order to be thoroughly reviewed. This review exercise could be done remotely but the organization of a validation workshop could bring added value as it would provide the editorial committee a good sense of the overall endorsement of the whole of the report by the experts that have contributed to its production. Next, the report should be peer reviewed by an independent, geographically diverse, group of experts that have not been involved in its production. The report is then revised by the Practitioners, taking into account the reviewer's comments. The peer-reviewed, final version of the report may go through technical edition, graphic design and layout processes prior to publication.

Assessment Parameters

The selection of parameters for the condition assessment: These normally would be expected to include habitats and the species they support, ecosystem processes (and services) including physical and chemical processes, pressures and socioeconomic benefits. Most condition parameters used are the same between all assessments, regardless of country or region, because they are common to all environments. For example, the habitats that most assessments will need to consider include rivers, mountains, estuaries, bays, etc. The assessment can also include policies and legal regimes established in response to pressures, changes in state and impacts on the environment and/or its socioeconomic aspects. Many regions already have programs in place to monitor specific environmental

indicators (see review by Johnson et al., 2013) that can provide input to the assessment and identify parameters for scoring. Other parameters can be added if they are viewed as being of particular importance to a given region. Using a standard set of parameters that have been widely considered in other regions enables direct comparisons to be made and reduces the risk of bias in the choice of parameters; for example, bias may arise where a list of parameters might appear heavily slanted towards those that are at risk in a particular region from a particular pressure.

Parameters may be chosen from any level of the natural biophysical and taxonomic hierarchy of ecosystems and biodiversity of the region under consideration. However, participants should recognise that state of environment reporting is of necessity a broad overview process. Each parameter will be the focus of an assessment, and so each parameter should be relevant to (or an important part of) the region as a whole.

In addition to the policy response and environmental condition assessment, the assessment may also include the assessment of the risks (risk assessment) faced by the components/parameters assessed. Risks are identified as impending threats to the condition of the components/parameters assessed. The risks could be assessed over both short (years) and long (decades?) timescales.

Grading scores and grading statements and confidence estimates: During an expert elicitation assessment workshop, scores are assigned by the expert participants to each condition parameter. A key part of the process is developing and applying a set of grading statements that have been uniquely derived for each major aspect of the assessment to represent the four grades of condition (Very Poor, Poor, Good, Very Good). Grading statements provide guidance to inform the experts about the thresholds they should use in determining a score. They are general, descriptive terms of the spatial extent, temporal extent, and magnitude of improvement or decline in condition of the parameters in relation to the selected benchmark. Each statement is associated with a range of numeric scores to guide the experts in reaching an agreed score for the parameter in question.

Each score is also assigned a confidence estimate (High, Medium or Low) based on the expert's current state of knowledge and judgment. In general terms, a high level of confidence implies that there are published, peer-reviewed papers or refereed reports that support the scores attributed to the parameter in question, with a high degree of consensus among the experts of the applicability of the evidence to the condition or trend score being awarded. A medium level of confidence may be based on one or more expert's knowledge of unpublished data, un-refereed reports or other information. A low confidence score may be given where the experts agree to assign a score based mainly on expert opinion and inference.

It is equally important for the experts to identify parameters that they are unable to assess due to lack of sufficient information. This is why it is important to start at the outset of the expert elicitation process with a list of parameters that would ideally be assessed; those parameters left un-assessed due to lack of data are thus easily identified as the data and knowledge gaps that need to be filled.

Benchmarks: In forming judgments about the condition of any parameter, a "benchmark" (a point of reference for the condition) is needed. A benchmark can be the condition of the parameter prior to the time when human impacts started to occur or a value that has been established by an authoritative source which if exceeded may be damaging to the environment or harmful to humans.

"Ideal" benchmarks will vary greatly from one part of the world to another; time-based benchmarks may be the time of European settlement in one place, or before the Roman Empire in another. Humans may have had significant impacts on some ecosystems prior to the "benchmark" time and impacts may have accumulated gradually over a long time period afterwards. Where it is difficult to identify an appropriate benchmark we recommend that the year 1900 be used. This date (1900) has the advantage that most scientific observations of the environment are subsequent to it.

Spatially-based assessment of environmental condition: In some cases, the EE grading scores of each condition parameter are assigned on a spatial basis, for example, the condition in the most-impacted 10% of the region under consideration, the condition in the least-impacted 10% of the region under consideration and the condition in most (the remaining 80%) of the region under consideration. Using this approach, the experts are asked to "think spatially" and consider the footprint of the parameter within the area undergoing assessment *relative to the benchmark* (i.e. the spatial extent of the parameter at the time of the benchmark). Most parameters will cover a subset of the total area under assessment. For some parameters it is simple to produce maps of their former spatial extent; for others it is more difficult and may not be possible. Capturing the (lack of) availability of spatial information about each parameter is part of the knowledge gap analysis and is valuable in its own right.

Assessing trend in environmental condition: In addition to giving scores and confidence estimates, the experts will next judge the recent trend in each parameter as declining, stable or improving. The trends are assessed in order to provide policy- and decision-makers with feedback on how policy responses have or have not had the desired effect. A confidence estimate is also assigned to trends agreed by the experts (High, Medium, Low). During the scoring process, experts are encouraged to provide comments and details of any key papers or reports that support the scores being assigned. Key papers may become "anchors" for establishing the condition or trend of a given parameter (or set of parameters).

Assessment of pressures and socioeconomic benefits: A fully-integrated assessment should consider all components of DPSIR. Human activities that exert pressures that affect the condition of the environment need to be assessed. The total environmental footprint of each industry should be examined and given a score based on the expert's judgment of the industries' impact on all aspects of the environment, including condition of habitat, species, ecosystem processes and physical-chemical processes.

To score the environmental impact of industries (pressure), experts should estimate a consensus score for the condition of the environment that coincides with the spatial footprint (i.e. the space where the industry operates and has an impact) of the industry (eg. relative to the baseline). This assessment should be completed within a spatial framework; for example to what extent has the condition of the environment changed within an area of the industry footprint (with reference to the benchmark). Changes in condition of the environment should be attributable only to the industry under assessment. For example, if two or more industries are impacting on the same habitat we try to score only the impact of the one industry we are assessing.

The second step is to assess the totality of all socioeconomic benefits that society receives from the industry. There are several aspects that should be evaluated, including:

1. whether it is a major national employer, paying fair wages, either through direct employment or supporting industries;

2. whether or not the state receives significant taxes, royalties and/or license fees and if a significant portion of profits remain in the country;
3. whether the industry exploits a sustainably managed renewable resource;
4. whether the industry contributes to education and training programs, human health or medical benefits for its employees;
5. whether the industry creates national infrastructure such as roads, communication systems or other facilities;
6. whether the industry is mainly or wholly owned by national interests (i.e. the profits from the industry remain in the country).

To score socioeconomic benefits of industries, experts should estimate a consensus score for the socioeconomic benefits derived from the industry. It is usually not feasible to make this assessment on a spatial basis and so only an overall score is elicited, while recording the main anchor references, and any commentary/notes relevant for the assessment of socioeconomic benefits.

Risk assessment: The condition, pressure and socioeconomic assessment part of the assessment methodology is backward-looking in time; it is essentially attempting to describe the state of the environment relative to a benchmark and recent trends in environmental condition manifested by changes in condition over the past few years. It is a statement of the current situation of the environment.

In contrast, the risk assessment part of the assessment methodology is forward-looking. Its purpose is to provide statements of the situation that the environment is likely to be in if current management of human activities is not changed. It is designed to provide policy- and decision-makers with feedback on the short-term (years) and long-term (decades) consequences of current management and to highlight specific risks that are deemed by the workshop experts to warrant the greatest attention. It is emphasised that the experts are instructed to only consider what is likely to occur if there are no changes to current policies; experts are not allowed to second-guess what decisions governments may or may not take in the future.

Sources of bias in conducting expert elicitation workshops

a) Types of individual bias

In making judgments in the face of uncertainty, most people unconsciously apply a set of simple rules that they have learned (known as cognitive heuristics); these rules are preconceived concepts that bias a person's view and influence their ability to provide an objective assessment. The cognitive heuristics that are most common and most relevant to expert elicitation are: availability**,** anchoring, confirmation and over-confidence. "Availability" refers to information that quickly comes to mind when asked to make a judgment. It is the information that is readily available to a person and will influence their first response. If the experts are asked to give a score for the condition of (for example) a habitat, but are first presented with an initial value, this can "anchor" the discussion and research shows that the experts will have difficulty moving away from this point (Morgan, 2014). In the discussion during a workshop, the data or ideas presented by others that match our own views are given more credit that those which do not; this is the "confirmation" bias. Experts tend to trust their own data and so they may find it difficult to accept information that seems to contradict what they believe. This willingness to give greater benefit of doubt to our own knowledge can lead to "over-confidence" in making a judgment. Over-confidence can lead to egocentrism (my view has more value than yours)

resulting in there being a difference between what is actually known and the degree of confidence we should really have in expressing our views.

b) Types of group bias

Working in a group brings its own set of pitfalls when trying to reach a consensus judgment. The main sources of group bias are dominance, groupthink, the halo effect and polarization. In any group there will always be individuals who are more senior and highly respected and it is natural for the group to defer to views offered by such "dominant" individuals. Also, in many cultures there are barriers to making public statements, especially where it may be seen to contradict a senior member of the group. In some cases, the group may avoid all confrontation to the extent that the focus is more on reaching consensus than reaching a carefully considered decision; this type of "groupthink" can lead to a biased (too conservative) result. In the opposite way, groupthink can lead to "polarization" where the group's position is more extreme than that of any one member. In areas where data are sparse, there is a danger posed by one or two data points having a "halo effect" such that they exert undue influence over the wider, unknown area.

c) How to deal with individual and group bias

To best manage individual and group bias, the workshop facilitators should remind the participants of the above sources of bias before the workshop begins. Individual bias has to be managed by each individual and the experts should be reminded that this is their personal responsibility. One approach to avoiding group bias caused by dominant individuals is for the facilitator to identify such individuals in advance and explain to them the situation and their added responsibility as senior leaders. It is best if the most senior person does not speak first on every topic, but holds back to allow others to express their views. Dominant individuals can also be asked to take over as the facilitator which transfers their role to that of a discussion leader. At the outset of the workshop, the facilitator should offer alternative ways for views to be expressed to ensure that no expert's knowledge is left out of the assessment; this can take the form of informal quiet conversations during coffee, or for people to be able to send text messages (for example) to the facilitator or another expert to be reported by them. In order to avoid the "anchor" bias, the best approach is for the facilitator to avoid making any suggestion about a score, but rather to start the discussion by asking the experts to first consider the "best" and "worst" examples that they can justify from what the group knows about the subject. These upper and lower bounds then constrain the score that can be assigned to "most" of whatever is being assessed.

Box 3 Methods to determine the uncertainty

Error propagation method

Uncertainty analysis requires the combination of probability density functions (PDF) for different parameters involved in conducting an outlook (e.g. model, input data, scenario assumptions) with the significance of that parameter to the outlook calculation. If all PDF functions are considered to be Normal or Gaussian, then an error propagation technique can be used to combine these using the following equation:

$$U_{total} = \frac{\sqrt{(U_1 \bullet x_1)^2 + (U_2 \bullet x_2)^2 + \ldots + (U_n \bullet x_n)^2}}{|x_1 + x_2 + \ldots + x_n|}$$

[Box on Monte Carlo uncertainty assessment]

Monte Carlo simulation is a useful technique for aggregating uncertainties when complex probability distribution functions (PDF) are involved and uncertainties around certain parameters are large. The technique is typically based on a computer model that simulates pseudo-random samples and through multiple iterations arrives at an aggregate PDF for the whole analysis.

Further information is available on applying these uncertainty assessment techniques to the field of greenhouse gas estimation at:

http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol1.html

in the volume on Uncertainties.

Expert elicitation for uncertainty assessment

Expert elicitation (Section 5.3) can also be used to determine uncertainty around certain parameters related to the environmental outlook. This technique uses a structured process of expert motivation, structuring, conditioning, encoding and verification to obtain views on the qualitative and quantitative uncertainties surrounding the outlook.

Additional information can be obtained at:

http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol1.html

in the volume on Approaches to Data Collection.

Annex 4: Applying the guidelines to specific types of assessments

Rapid Response Assessments - assessment of emerging or frontier environmental issues in a time sensitive manner

In response to the need to quickly produce reports targeting specific emerging issues on the environment, UN Environment has established a special report series known as Rapid Response Assessments (RRA). These are undertaken to shine light on an issue, catalyze research and develop recommendations for actions based on expert advice. Because of their design to focus on a specific emerging issue, they are not equivalent to a fully Integrated Environmental Assessment which typically covers "a broad spectrum of issues and policies and all aspects of the environment including habitats, species and ecological, physical and chemical processes" (as defined in the glossary of this report). Rather an RRA will focus on a specific issue, the associated policies and relevant aspects of the environment which may or may not include habitats, species or ecological, physical and chemical processes. RRA's usually conclude with a set of recommended actions that may include possible new policies. As such, an RRA may best be viewed as a sub-category of Integrated Environmental Assessment's.

RRAs typically take between 3 and 6 months to complete and typically average no more than 60 pages in total. They address issues that are international in scope and that are recognized as having a high level of importance to UN Environment's mission. They raise awareness among policy- and decision-makers of alarming developments, impending environmental crises or of acute policy gaps. RRAs are first and foremost a communication piece and as such must be stylized for a policy maker audience that is not necessarily versed in scientific terminology. RRAs rely on visualizations (e.g. maps, graphics, cartography) and on easily accessible language.

UN Environment has, in cooperation with GRID-Arendal, published 17 rapid response assessments since 2006; the reports are available here: http://www.grida.no/publications/rr/. These reports are highly influential, from both their impacts on policy development and on enabling a better science-to-society translation. Their impacts on policy include UN Environment Assembly resolutions (eg. environmental crime) and the development of new Global Environment Facility (GEF) programmes (eg. Blue Carbon). From a scientific perspective, the reports are highly cited (the RRA report series as a cumulative impact factor of 9.4 based on Google Scholar statistics).

RRAs adhere to the following basic procedure (allowing for some customization depending on context):

1) An RRA topic is identified by UN Environment, often with a partner organization (e.g. other UN agency; collaborating centers, NGOs).
2) An RRA is most valuable when commissioned and approved by UN Environment's Executive Director (ED) and/or by Division Directors; this helps to ensure proper high level and media attention in the lead up to a launch.
3) A concept note is developed by the initiator which:
    a) identifies the issue
    b) makes the case for it to be an RRA – urgent, topical, recently identified issue, not described in previous reports, newsworthy, often not a lot of data or information available.
4) Once the decision is made to conduct an RRA:

a) an RRA Coordination Team is agreed to with UN Environment (and when applicable with other core partner(s) and must be inclusive of a UN Environment focal point
b) A budget and timeline to produce the report is agreed and formalized (if applicable in a contractual agreement)

5) The RRA Coordination Team prepares and agrees to a clear Terms of Reference to:
   a) clearly state the intent and purpose of the RRA
   b) inform contributors of scale, scope, target audience and style
   c) inform as to production timelines, key deadlines and target launch event
6) The RRA Coordination Team prepares and agrees to a clear Table of Content that will reflect the scope and key messages of the RRA
7) The RRA Coordination Team informs the UN Environment Publishing Board at the beginning of the RRA process (typically by providing the Terms of Reference and the Table of Content)
8) The RRA Coordination Team identifies and appoints a lead author (or editor) and a team of authors are appointed (the lead author or editor is most often a member of the RRA Coordination Team).
   a) The authors should ideally include at least one expert who has been closely involved in the topic. Other experts who may not have published on the topic, but are knowledgeable about associated topics (e.g a marine litter expert may also be ocean transport specialist), may be invited. The author team should be diverse in their backgrounds to include scientific and socioeconomic aspects of the topic.
   b) There should normally be not more than ~5 authors for an RRA.
   c) The UN Environment Publishing Board and DCPI are notified in advance because RRAs require a special, fast-track procedure due to their urgency.
9) As early as possible in the RRA process, the RRA Coordination Team will identify and communicate with a broad group of expert reviewers. The RRA review process must be robust AND must be timely. Seeking early commitments from reviewers (and agreeing to the reviewer group with UN Environment) is critical. The review group is composed of two vital sub-groups:
   a) internal UN Environment reviewers: all relevant focal points that are needed should be engaged and informed early of intended timelines
   b) external reviewers: all desired external reviewers should be engaged and informed early of intended timelines and confirmation of interest and availability should be secured as early as possible
10) The editors develop an outline of the desired graphics in parallel to the development of text by authors – RRAs have historically been heavily dependent upon messaging through graphics and images.
11) Selected authors volunteer to develop the content for the various chapters. The writing style is geared to general readers without extensive scientific background, decision-makers and people with a general interest in the topic.
12) A draft text is produced and set of graphics are produced and sent for a short turn-around internal review followed by rapid external peer-review (see point 9).
13) The UN Environment Publication Board approves the RRA.
14) Final sign-off of the RRA is by both the UN Environment Division Director and the ED. All RRAs have in the least an approved Foreword by the ED which can be complemented by a Preface(s) of relevant individuals.
15) Early in the process, the RRA Coordination Team and UN Environment agree to a high level launch event (that should aim to involve the UN Environment ED) to ensure optimal visibility and impact.

The preparation of an RRA requires strict management and control from the RRA Coordination Team given the often controversial nature of the subject matter and demanding time-line. The time constraint is a decisive factor of any RRA; the objective is to put an emerging issue on the agenda of the decision-makers globally in a timely manner. However, the need for quick turn-around must be balanced against the need for rigor and clearly stating the levels of uncertainty inherent in the information that is communicated in all RRAs (See Section 2.10 on best practice for communication of uncertainty).

The identification of a subject suitable to be the focus of a Rapid Response Assessment is not based on any systematic process; rather, the concepts are identified by an "initiator" (typically these individuals become the lead editors of the RRA) in consultation with subject matter experts in UN Environment and in the broader scientific and science-policy communities. Many concept notes produced at step 3 in the above sequence do not qualify to become an RRA, based ultimately on the judgment of UN Environment's Executive Director (ED) and/or of Division Directors. UN Environment has started a process to attempt to systematize the identification of so-called "emerging issues" and this process may ultimately become a useful mechanism for the design of some RRA's in the future.

Applying the guidelines to a Global Environment Outlook-type assessments

This annex provides a description of procedures and guidelines for ensuring scientific credibility of the Sixth Global Environmental Outlook (GEO-6). In particular, it sets out indicative guidance and principles for promoting and maintaining the highest standards of scientific excellence and integrity for all aspects of the assessment process and its subsequent outputs. The paper is informed by a range of activities, standards and principles endorsed by the international scientific community including learned professional societies, universities, and institutions such the International Council for Science (ICSU) and National Academies of Sciences and intergovernmental processes such as the Intergovernmental Panel on Climate Change (IPCC) and the International Platform for Biodiversity and Ecosystem Services (IPBES). The paper offers a basis for discussion with participants of the first Global Environment Outlook-6 Intergovernmental and Multi-stakeholder Consultation, notably governments, major groups and stakeholders and the scientific community, with a view to reaching consensus on a robust and comprehensive set of guidelines and procedures that will be applied throughout the Global Environment Outlook-6 process.

Background

1. The *Global Environment Outlook* is a participatory process for conducting integrated environmental assessments (IEA); it is aimed at facilitating the interactions between science and policy, to support informed decision-making. The scientific credibility of *Global Environment Outlook* is an essential factor in ensuring that the analyses and insights developed in the assessments can be taken into account when developing policies and strategic plans.

2. For the purposes of this document, *scientific credibility* rests upon the assurance that i) the research, data and information used in the *Global Environment Outlook* assessments come from reliable and verifiable sources, are accessible and wherever possible openly available through Environment Live; ii) the assessment procedures and the application of different scientific methods approaches are validated with respect to their objectivity and scientific robustness; iii) the processes used to nominate and select experts, organize the work of the expert groups, writing teams, Communities of Practice, Scientific Advisory Panel and the High-level Intergovernmental and Stakeholder Group, are based upon criteria of excellence, transparency and declarations of interest and iv) the assessment, evaluation and peer-review of information and materials for inclusion into Global Environment Outlook-6 are undertaken in a transparent manner and by independent experts.

3. To strengthen the science-policy interface, Global Environment Outlook-6 will involve natural and social scientists, policy-analysts, indigenous peoples, major groups and stakeholders, and the policy-making community.

4. To ensure broad participation by governments and a wide range of relevant stakeholders, both essential for assessment processes which deal with complexity and uncertainty, and where societal awareness is needed to ensure effective implementation of response options, Global Environment Outlook-6 will establish an open and transparent nomination and engagement process at national, regional and global levels. In addition to relevant domain experts and researchers from the scientific community, Global Environment Outlook-6 will invite participation from governments, intergovernmental institutions, international organizations, UN bodies, Secretariats of Multi-lateral Environmental

Agreements, collaborating centres, national academies and their equivalent, plus major groups and stakeholders.

5. To improve awareness of existing data, ongoing analyses and publications in different languages, strengthen interactions among participants and enhance inclusivity and facilitate the co-production of knowledge, a public Global Environment Outlook-6 Community of Practice (CoP), moderated by the Secretariat, plus a Global Environment Outlook-6 Intergovernmental Multi-Stakeholder (IGMS) Community of Practice and Regional and Global Community of Practice Working Groups, requiring separate registration, will be run through Environment Live. The IGMS and Working Group Community of Practices will be guided by moderators who have been selected through the nomination and engagement procedure. The Global Environment Outlook-6 IGMS Community of Practice and Regional and Global Community of Practices Working Groups will be comprised of government representatives, major groups and stakeholder representatives, and experts.

6. To guide the assessment process and ensure scientific credibility and the overall quality of Global Environment Outlook-6, a Scientific Advisory Panel will be established. Scientific credibility is a major factor contributing to buy-in by governments, stakeholders, policy and decision-makers. Hence, Global Environment Outlook-6 will ensure that all factors contributing to scientific credibility, as defined above, are considered at all stages of the content development process.

7. All Global Environment Outlook-6 experts will act with the highest level of professional ethics and scientific integrity, adhering to the following principle to place quality and objectivity of scientific and scholarly activities relating to all aspects of the production of the Global Environment Outlook-6 assessment including interpreting, communicating and reporting findings ahead of personal gain or allegiance to individuals or organizations.

8. To ensure the highest scientific credibility for Global Environment Outlook-6, the Regional and Global Working Groups and writing teams will undertake to:

i. use an open and transparent approach to engage the best available scientific and policy expertise, taking into account disciplinary, geographic and gender balance through a merit-based and transparent nomination and selection process;

ii. build on previous and ongoing assessment work to create synergies and avoid duplication; and incorporate all relevant scientific disciplines, including social, economic, natural, health, political, engineering, environmental, earth sciences and the humanities; integrate information from different knowledge systems, as appropriate and encourage the contribution of indigenous and local knowledge into all aspects of the assessment;

iii. engage with a wide range of global and regional experts, to include an appropriate balance of developed and developing country participants, in the assessment as authors, experts, peer-reviewers and advisors. Experts should include individuals from governments, intergovernmental institutions, international organizations, UN bodies, Secretariats of Multi-lateral Environmental Agreements, collaborating centres, national academies and their equivalent, plus major groups and stakeholders;

iv. draw on existing quality assured sources of data and promote the development of access to and use of credible, independent evidence-based information and modelling for the application of policy analyses;

v. promote consistency, applicability, availability of policy data and information through open access portals, standards and best-practice documentation, from local to global levels,

and make all Global Environment Outlook-6 data and information available in the public domain to the extent possible using existing communication conduits and primarily the online Environment Live platform; and

vi. assist authors and experts from developing countries and countries with economies in transition with participation, for example with access to scientific literature.

Key roles and responsibilities in Global Environment Outlook-6

9. The High-Level Intergovernmental and Stakeholder Group will be established to provide guidance to the policy assessment process, draft the Policy Makers' Summary, and to undertake relevant outreach activities. It will comprise 3 members from each of the UN regional grouping plus five stakeholder representatives.

Key roles and responsibilities (*Terms of Reference*):

- provide guidance for the policy aspects of the global assessment;
- draft the Policy Makers' Summary for endorsement by UNEA;
- undertake relevant outreach activities throughout the Global Environment Outlook-6 process.

10. The **Scientific Advisory Panel** will be established to guide the assessment process and to ensure scientific credibility and overall quality and integrity of Global Environment Outlook-6. The Panel will be selected through the nomination and engagement process and will comprise 2 experts from each UN Environment region and up to 6 global experts The SAP will be supported by the UN Environment Chief Scientist's Office.

Key roles and responsibilities (*Terms of Reference*):

- provide scientific leadership and guidance to the assessment process and ensure scientific credibility and overall quality of the Global Environment Outlook-6 process;
- ensure that mandates, scope and process are fully realised within the implementation plan;
- provide guidance on ensuring that the process for conducting assessments and consultations is credible, systematic and objective;
- review, inform and monitor adherence on standards and guidelines for use of source materials;
- advise on the process of ensuring a comprehensive scientific and expert review;
- advise on dealing with data and information credibility, grey literature including local and indigenous knowledge;
- in cases of uncertainty and/or contentious science related issues as raised by the Coordinating Lead

Authors, Community of Practice Moderators, government participants, the Global Environment Outlook Secretariat or expert reviewers, the Scientific Advisory Panel will make the final determination;

- conduct periodic internal evaluations of the Global Environment Outlook-6 assessment with respect to adherence to scientific guidelines, appropriate conduct of experts; methodology and content;
- actively participate in the Global Environment Outlook-6 Community of Practices and on-line discussions amongst SAP members and attend the SAP meeting;

- read, review and endorse the scientific credibility of the final Global Environment Outlook-6 report;
- where necessary, the Scientific Advisory Panel will provide recommendations to the Secretariat and coordinating lead authors and Community of Practice Moderators on ways to improve both methodology and content.

UN Environment Chief Scientist's Office, through the Scientific Advisory Panel, will provide scientific quality assurance and additional guidelines as needed to the Community of Practice Moderators, writing teams and expert contributors for the preparation of the Global Environment Outlook-6 assessments.

11. **Coordinating Lead Authors** (CLAs) will establish writing teams for each section in the Global and Regional assessments. Ensuring the scientific credibility and technical accuracy of Global Environment Outlook-6 content in the section that they are responsible for, will be one of the main tasks of CLAs. The global Scientific Advisory Panel, in consultation with the Communities of Practice Moderators, the Global Environment Outlook Secretariat and the UN Environment Chief Scientist, will select the CLA experts. The specific number of CLAs that Global Environment Outlook-6 will require is yet to be determined, and will be guided by the outcomes of the Intergovernmental and Multistakeholder Consultation and the Regional Environmental Information Network conferences.

Key roles and responsibilities (*Terms of Reference*)

- take the overall responsibility for coordinating and drafting sections to given deadlines, actively participate in the Global Environment Outlook-6 Community of Practices and work closely with the designated Community of Practice Moderator and Secretariat staff to provide oversight of the section;
- plan the relevant information, knowledge and data required for each section that will be accessed through Environment Live;
- lead writing "sprints" with the designated Community of Practice Moderators to deliver first drafts for each section;
- ensure that manuscripts are completed to a high standard, collated and delivered to the Secretariat in a timely manner and conform to the guidelines for scientific credibility;
- ensure that all review comments are dealt with according to specific guidelines;
- develop text that is scientifically, technically and socio-economically sound incorporating contributions by a wide variety of experts;
- ensure that any crosscutting scientific or technical issues, which may involve several sections (and/or) regional assessments of the Global Environment Outlook-6 are addressed in a complete and coherent manner; and
- contribute to preparing intermediate technical papers as required; and
- take responsibility for referring any scientific credibility issues such as uncertainties and use of grey literature to the SAP, when such issues cannot be dealt with within their writing team.

12. A core group of **Lead Authors** (LA) will be selected to join the various writing teams for each section in the Global and Regional assessments. Each writing group will comprise between 15 to 20 authors depending on the nature and scope of the section. The Scientific Advisory Panel, in close consultation with respective CLAs, the Secretariat and the UN Environment Chief Scientist, will select Lead Authors. Each Lead Author is expected to uphold the standards of, and guidelines for ensuring scientific integrity and credibility following principles laid out in this document.

Key roles and responsibilities (*Terms of Reference*):

- actively participate in the Global Environment Outlook-6 Community of Practices and play a lead role in drafting and revising the designated section of the Global Environment Outlook-6 report
- identify, collect and synthesize relevant material drawn from available peer-reviewed literature, the Environment Live portal, and other knowledge sources as appropriate;
- record expert views which cannot be reconciled with a consensus view but which are nonetheless scientifically or technically valid;
- take account of expert and government review comments when revising text and record how comments have been dealt with;
- identify data gaps on specific topics in consultation with the data and indicators working group
- ensure that the various components of the section are brought together on time, are of uniformly high quality and conform to the guidelines for scientific credibility; and
- work closely with the Coordinating Lead Authors to prepare text.

13. The **Assessment Methodologies, Data and Information Working Group** will be established to provide advice and inputs on assessment methodologies, data and information flows and quality assurance procedures. The members will be selected through the nomination and engagement process and will comprise of 3 experts from each UN Environment region, plus up to 6 global assessment, data and information experts The Assessment Methodologies, Data and Information Working Group will be supported by the UN Environment Live team.

Key roles and responsibilities (*Terms of Reference*):

- provide leadership and guidance on assessment methodologies, data and information sourcing and use and ensure overall quality of all data and information flows used in Global Environment Outlook-6;
- review, inform and monitor adherence on standards and guidelines for use of data and information in Global Environment Outlook-6;
- provide guidance on developing and implementing open access data policies;
- actively participate in the Global Environment Outlook-6 Community of Practices; and
- conduct periodic internal evaluations of the Global Environment Outlook-6 assessment with respect to adherence to data and information guidelines, appropriate conduct of experts; methodology and content.

14. **Communities of Practice Moderators** will be responsible for facilitating Working Group Community of Practices and provide the necessary leadership and coordinative support to enable knowledge sharing and partnership building within their Community of Practice (and across other Global Environment Outlook-6 Community of Practices).

15. **Moderators** will be connected to, and engage with one or more writing teams, where they will support CLAs in ensuring appropriate data/information flows, handling diverging viewpoints, responding to critical review comments, and developing content. Moderators are expected to uphold the standards of, and guidelines for ensuring scientific integrity and credibility following principles laid out in this document. The Community of Practice Moderators of the designated Global Environment Outlook-6 Working Groups will be

selected through the nominations and engagement process. The Global Environment Outlook Secretariat will provide technical support for the on-line platform and substantive support to the moderators.

Key roles and responsibilities (*Terms of Reference*):

- lead and foster useful and spirited Community of Practice discussions
- support the writing "sprints" to deliver first drafts for each section;
- motivate active participation in their Community of Practices;
- create a congenial, professional community by establishing and maintaining a setting with respectful and appropriate dialogue, knowledge-sharing and exchange of views;
- recognize members' varying levels of experience and comfort in operating with online platforms and the social media environment;
- advise on interaction with other relevant Community of Practice discussions;
- participate in the peer-review of designated sections and overall outreach of the assessment findings;
- act as an knowledge intermediary between Community of Practice and designated/ relevant writing teams; and
- support CLAs in ensuring appropriate data/information flows, handling diverging viewpoints and responding to critical review comments, and where appropriate, developing content.

16.**Global Environment Outlook-6 Fellows** will be selected through the nomination and engagement process. There will be 20 Fellows in total. Global Environment Outlook Fellows will be connected to, and engage with one or more Working Groups and may participate in the writing teams.

Key roles and responsibilities (*Terms of Reference*):

- actively participate in participate in the specific Working Groups and writing teams as relevant; and
- act as an knowledge intermediaries between Global Environment Outlook-6 Community of Practices.

17. **Review Editors and Reviewers** will be selected through the nomination and engagement process by Global Environment Outlook-6 Scientific Advisory Board in consultation with the Global Environment Outlook Secretariat, UN Environment Chief Scientist's Office and CLAs, prior to the first round of peer-review. The primary role of the Review Editors is to ensure that all substantive expert and government review comments are afforded appropriate consideration by the Writing Teams. Review Editors are not intended to be additional reviewers of the content, but rather provide quality assurance and oversight on the review process itself.

Key roles and responsibilities (*Terms of Reference*)

- provide oversight on the review process of designated sections;
- ensure all substantive review comments are afforded appropriate consideration;
- prepare written summaries of the most significant issues raised by reviewers;
- on a case-by-case basis, as requested by the Secretariat, carefully monitor and review the use and consideration of grey literature including the integration of local and indigenous knowledge sources;

- be available to provide responses to the SAP when requested, on the review process; and
- prepare final reports to the Global Environment Outlook Secretariat.

Procedural guidance

18. The Global Environment Outlook-6 assessment process will include the following actions and measures:

Nomination process

19. The selection and composition of experts is one of the most important decisions in the assessment process because the credibility of the assessment depends largely on the participation of respected experts, and similarly the quality of the content depends to a large extent, on the available capacity. It is imperative that the available pool of nominees reflects the best available scientists and experts from the various regions participating in the assessment.

20. The Global Environment Outlook-6 Nomination process aims to identify the best available expertise representing a range of disciplines, geography, human and economic development and gender, with particular emphasis on ensuring full representation from developing-country experts. Global Environment Outlook-6 will strive to expand and strengthen the pool of well-qualified experts from all countries, by facilitating for example, consultations with the InterAcademy Partnership (IAP) and national science academies, learned societies, and universities. To the extent possible, this will be carried out through the Global Environment Outlook-6 Communities of Practice.

21. Governments, major groups and stakeholders, institutions and collaborating centres and UN agencies will be invited to nominate experts and individuals for the various roles in Global Environment Outlook-6 through the Nominations Portal in the Environment Live Global Environment Outlook-6 Intergovernmental and Multi-Stakeholder Community of Practice. Guidance for the different roles is given below. There will be separate deadlines for submissions of nominations for the various roles with an overall deadline for the nomination process of 1 February, 2015.

22. The names, profiles and Curricula Vitae of all nominees and the identity of the nominator will be made available through the Global Environment Outlook-6 Intergovernmental and Multi-Stakeholder Community of Practice. Late nominations can be accepted by the Secretariat at its discretion.

23. The following generic considerations should be carefully weighed before nominating individuals:

- availability and willingness of candidate to commit to actively participating from the beginning of the process right through until completion of the Global Environment Outlook-6; bearing in mind the intensity of responsibilities of the respective role(s), including requirement to attend key meetings, subsidiary meetings and consultations, as appropriate (3-5 in total) - (see Information below for Terms of Reference for various roles);
- in-depth expertise in one or more areas relevant to the scope of Global Environment Outlook-6 including natural and social sciences, local and traditional knowledge, assessment and policy analysis; and

- experience in communicating, promoting and incorporating science into policy development processes.

24. The following criteria should be taken into account in nominating and selecting members as Global Environment Outlook-6 Global and Regional experts

- renowned expert as recognized by membership of a national academic society or equivalent, and corresponding record of publications or other relevant materials;
- at least five - ten years of documented professional experience, including assessment-work at the national/regional and/or global level;
- ability to assess and synthesize technical material;
- excellent drafting/ writing skills, (preferably in English, and/or other UN language).

25. The following criteria should be taken into account in nominating and selecting members as Global Environment Outlook-6 Coordinating Lead Authors (CLAs) and Lead Authors (LAs);

- world-renowned expert as recognized by membership of a national academic society or equivalent, and corresponding publication record;
- at least ten to fifteen years of documented professional experience, including assessment-work at the regional and/or global level;
- ability to assess and synthesize technical material rapidly;
- proven management and organizational skills; and
- excellent drafting/ writing skills (English and/or other UN languages).

26. The following criteria should be taken into account in nominating and selecting members as a Community of Practice Moderator include:

- at least ten to fifteen years of documented professional experience, including assessment-work at the regional and/or global level;
- ability to assess and synthesize technical material rapidly;
- excellent drafting/ writing skills (English and/or other UN languages);
- excellent interpersonal and organizational skills;
- multi-lingual would be highly desirable;
- ability to use the ICT platform and tools effectively.

27. The following criteria should be taken into account in nominating and selecting Global Environment Outlook-6 Fellows:

- at least three years of documented professional experience, including assessment-work at the regional and/or global level;
- ability to assess and synthesize technical material rapidly;
- good writing skills in English and/or other UN languages;
- excellent interpersonal and organizational skills;
- ability to use the ICT platform and tools effectively.

28. The following criteria should be taken into account in nominating and selecting members of the Assessment Methodologies, Data and Information Working Group include:

- at least ten to fifteen years of documented professional experience in assessments, assessment methodologies, national reporting obligations

and/or use of assessment related data and information at the national, regional and/or global level;
- proven knowledge of data and information services and structures, such as semantic ontologies, GIS, social media and big data;
- excellent analytical skills;
- excellent communication skills.

29. The following criteria should be taken into account in nominating and selecting members to the Scientific Advisory Panel:

- world-renowned expert as recognized by membership of a national academic society or equivalent, and corresponding record of publishing, editing and reviewing;
- at least fifteen years of documented professional experience with science – policy issues relating to environmental assessment and sustainable development;
- extensive expertise with the international science-policy agenda;
- previous experience on high-level panels in relation to science, environmental policy and sustainable development.

30. The following criteria should be taken into account in nominating and selecting members to High-Level Intergovernmental and Stakeholder Group:

- at least ten to fifteen years of documented professional experience with international environmental affairs and/or international sustainable development;
- extensive expertise with the international policy agenda;
- previous experience on high-level intergovernmental panels in relation to environmental policy and sustainable development.

Selection process

31. At the close of each Nomination deadline the Global Environment Outlook Secretariat with review the nominees with respect to the particular role that has been indicated by the Nominator, as described above. A provisional selection will be circulated to governments and stakeholders for a 15-day review period, after which a final selection will be published along with the associated comments by reviewers.

Establishing the knowledge base, access to data, and quality assurance

32. Global Environment Outlook-6 will strive to incorporate informational across all relevant scientific disciplines, including social, economic, natural, health, political, engineering, environmental, earth sciences and the humanities; and improve the knowledge-base by considering and integrating information from different knowledge systems, as appropriate, and encourage the contribution of indigenous and local knowledge into all aspects of the assessment. UN Environment is connecting existing networks of experts and government representatives within communities of practice, via the Environment Live platform, to enable greater interaction and sharing of knowledge, best practice, solutions and policy options relevant to Global Environment Outlook-6.

33. The role of data in Environment Live for Global Environment Outlook-6 is to provide a web-based knowledge management system to share, organize, utilize and disseminate national, regional and global data and knowledge more effectively and efficiently. The

knowledge made available on Environment Live is based on data and information from broad geographical and temporal scales. These data are then analysed through the prism of a variety of scientific, social and economic disciplines in the Global Environment Outlook-6 process.

34. Ongoing, regular monitoring of the environment requires access to big data and relevant analytics. These data range from spatial to statistical data, and also include remotely-sensed data from e.g. satellites and modelled data resulting from various types of analyses, projections etc. Regular processing of such data helps to highlight current environmental status and trends.

35. Environment Live will be used to transform data into various information products for Global Environment Outlook-6 such as indicators, graphics and maps ready to use in environmental assessment and reporting. Trend analyses in relation to other contextual parameters will provide knowledge on environmental dynamics. Examples of various data flows already incorporated within Environment Live to support Global Environment Outlook include:

- data and knowledge flows from countries/regions/international organizations, including data from the UN Statistical Division and many other UN entities, and nationally/regionally-sourced maps, data sets and graphs, as well as traditional knowledge;
- near-real time data flows such as those for sea-level, air quality and Arctic sea-ice thickness;
- interactive maps of the state of the environment: from global mapping of natural capital to regional map services such as GEOSur and country-level maps with environmental features.
- charting functions of key indicators using data from UN sources: each page on Environment Live allows users to chart data from global, regional or country-level data from UN sources.

36. Global Environment Outlook-6 will establish an Assessment Methodologies, Data and Information Working Group and associated Community of Practice to facilitate core data uptake including quality assurance, to the assessment process including through national Governments, interagency cooperation and collaborating centres. The Assessment Methodologies, Data and Information Working Group will also assist Global Environment Outlook-6 authors from developing countries and countries with economies in transition with access to scientific information, data and indicators.

37. The Global Environment Outlook-6 Communities of Practice will also support an open method of consultation and dialogue which involves continuous sharing of the underpinning data and information being used by section authors and which will allow data/information holders to check and verify.

38. Relevance (salience) is intended to reflect the ability of an assessment and its findings to address the particular concerns and knowledge requirements of a user. An assessment is relevant if the user is aware of it and it provides knowledge appropriate to support behavioral change or decision-making.

39. Global Environment Outlook-6 will identify its key target audiences (including policy-makers, the UN system, SDG-related bodies, national environmental assessment managers, resource sectoral users, business, and the media) in the planning stages and ensure effective consultation and communication with them throughout the process so that final products

are meaningful and owned by each audience. These processes will be further guided by the outcomes of the Intergovernmental and Multi-stakeholder Consultation, the Regional Environmental Information Network (REIN) conferences and the emerging science-policy dialogues facilitated through the various Community of Practices.

40. Establishing the knowledge base for Global Environment Outlook-6 should be guided by the following principles:

- draw on the widest possible range of publicly available scientific assessments and peer-reviewed papers, reports and authoritative data and information, ensuring that the interests of all authors have been declared;
- authors are required to prepare their manuscript such that the content can withstand rigorous scientific scrutiny. The manuscript should adhere to good practice expected of scientific/technical publications.

Manuscripts should be written with due consideration to specific structural guidance as provided by the IGMC in Berlin, Community of Practice Moderator and the outcomes of the Regional Environmental Information Network (REIN) Conferences;

- all Global Environment Outlook-6 experts including authors, Community of Practice members and advisors, will share data and information openly and promptly through the Community of Practices provided by Environment Live, if appropriate, while respecting the intellectual property rights of others;
- authors should use calibrated uncertainty language that expresses the diversity of the scientifically and technically valid evidence, based mainly on the strength of the evidence and the level of agreement in the scientific, technical, and socio-economic literature;
- all Global Environment Outlook-6 experts will disclose financial, personal, professional, and other conflicts of interest that could compromise the trustworthiness of their contributions to the assessment process including their work on committees, publications, research proposals, public communications and review activities;
- CLAs will acknowledge the names and roles of those individuals who made significant contributions (including generating ideas, data analysis and scientific discussions) to content development process;
- the scientific credibility and technical accuracy of all Global Environment Outlook-6 content shall be the joint responsibilities of the writing teams, coordinating lead authors, Community of Practice moderators, expert reviewers, the Secretariat, and the Scientific Advisory Panel; and
- all participating Global Environment Outlook-6 experts will not engage in fraud, misrepresentation, coercive manipulation, censorship, plagiarism, or other ethical misconduct that alters the content, veracity, or meaning of the assessment findings.

41. The following practices should be adhered to by all Global Environment Outlook-6 experts during manuscript preparation:

- *Copyright*: Any manuscript figure, table, chart, scheme, or equation that has appeared in an earlier publication should have a footnote citing the original source, even if that source is cited elsewhere in the text.
- *Plagiarism*: Material, including text, graphics, and tables, from other publications may not be used without attribution. As appropriate, permission

to use this material should be requested. Authors must identify the source of all information, except that which is of common knowledge.

- *Referencing Style*: Referencing and citing guidelines and standards for the Global Environment Outlook-6 are provided in the Global Environment Outlook-6 Style Guide
- *Uncertainties*: Global Environment Outlook experts should refer to the "guidance note for Coordination Lead Authors and Community of Practice Moderators of the Global Environment Outlook-6 assessment report on consistent treatment of uncertainties"; regarding issues relating to the consistent treatment of uncertainties;
- *Diverging Viewpoints*: Coordinating Lead Authors, Reviewer Editors and Community of Practice Moderators should give appropriate consideration to ensure that diversity in perspectives in the literature is reflected adequately in Global Environment Outlook-6; moreover, they should identify specific science and policy related contentious issues (that arise either during Community of Practice deliberations and/or in writing teams), where different viewpoints exist, and cannot be reconciled.

42. It is important that all relevant statements and lines of argument/discussion in the Global Environment Outlook-6 assessments are corroborated with adequate and verifiable literature, data and information.

43. The following guidance is provided to ensure that any use of grey literature, integrated assessments, subject reviews and social media adds value and does not compromise the scientific credibility or technical integrity of the Global Environment Outlook-6 content;

- all grey literature that has been published for non-profit or not controlled by commercial publishing interests e.g. government, intergovernmental organizations, non-governmental organisations, charities etc should be carefully validated, reviewed, quality assured and evaluated as to its contribution to the Global Environment Outlook-6 report. If used, it must be made available through Environment Live together with the Global Environment Outlook-6 reviewer's name;
- secondary sources and assessments that quote primary sources should only be used where they add value to the Global Environment Outlook-6 report; for example where a review provides new insights into an issue;
- the use of advocacy materials should be avoided;
- sources such as blogs, visual media, and social networks are only acceptable in exceptional circumstances; for example some citizen science programmes use social media combined with scientific/statistical sampling criteria for data collection and environmental reporting;
- the Scientific Advisory Panel in consultation with relevant CLAs, the Global Environment Outlook-6 Secretariat and Review Editors shall decide on a case-by-case basis any circumstances which are exceptions to the above.

44. For all non-published/non-peer-reviewed sources included in Global Environment Outlook-6 content, CLAs are expected to submit the following information, for each source, to the Global Environment Outlook-6 Secretariat for further verification:

- Document/report title
- Author(s); and/or the originating institution
- Name of publication in which it appears, if applicable

- Information on the availability of underlying data to the public
- English-language executive summary or abstract, if the source is written in a non-English language
- Names and contact information for 1-2 people who can be contacted for more information about the source.

45. In determining the appropriateness of including a grey literature document, the following questions aim to assist authors in determining whether a the material is of sufficient quality and validity to include in Global Environment Outlook- 6

- who (i.e., what person or organization) authored/published the document? What are their qualifications?
- what information/knowledge does the document add to the assessment? If this information/knowledge is marginal, is the document needed?
- is the information/knowledge contained in the document available from a peer reviewed journal source? If yes, is the document needed?
- are there lines of evidence from other (peer-reviewed or non-peer-reviewed) sources that support the document? If yes, is the document needed?
- does a scientific review of the material exist? If so, how wide or extensive was that review? How credible are the reviewers?
- why was the document written? How was the research funded? Could the researcher and/or publisher of the document be perceived as having a particular bias or agenda? If yes, what caveats are needed?

46. In order to be included in the Global Environment Outlook-6 report, manuscripts submitted for peer-review must meet the following requirements:

For inclusion in the first and second draft: It is acceptable to cite manuscripts *submitted for peer review*.

A copy of the manuscript must be provided to the Global Environment Outlook-6 section coordinators prior to the date when the draft is due to the Secretariat.

For inclusion in the final draft: The manuscript in question must be *accepted for publication* and a copy must be provided to the Global Environment Outlook-6 section coordinators prior to the date when the final draft is due to the Secretariat. Acceptance for publication must be substantiated by (i) letter from the editor, (ii) DOI-Nr., or (iii) published as accepted on the journal's website. Any reference that does not fulfill these criteria will be removed from the report together with the statement(s) that it supports if there are no other supporting references. It is therefore not advisable to base a line of argument or conclusion on a single, not-yet accepted paper.

47. All Reviewers and Review Editors should carefully take into consideration the above guidance regarding the use of peer-reviewed and non-peer-reviewed literature. It is the shared responsibility of the CLAs and Review Editors to ensure that authors comply with this guidance.

Inclusion of Indigenous and Local Knowledge (ILK) Systems

48. Where possible, Global Environment Outlook 6 will include meaningful and active contributions from indigenous and local knowledge holders.

49. Engagement guidelines will draw on those developed by the IPBES Task Force on Indigenous and Local Knowledge Systems[1]. Successful engagement among indigenous peoples and local communities, scientists and decision-makers requires mutual trust and respect. This means dedicating time and energy required to overcome misunderstandings, misconceptions and apprehensions which in some cases may be deeply-rooted, so as to come to a point of mutual acceptance and understanding of each other's observations, interpretations, values, worldviews and priorities. The success of knowledge sharing and collaborative action depends on the degree to which mutual respect and trust can be established, nurtured and maintained as part of a long-term relationship.

50. Indigenous peoples and local knowledge holders serve as primary sources of data and information that may be of direct relevance to Global Environment Outlook assessments. The challenge is to identify how best to integrate the relevant aspects of traditional and indigenous knowledge into Global Environment Outlook-6. While much knowledge is shared and familiar to all, acknowledged experts or specialists who exist within most indigenous and local communities may be specific older men or women, highly skilled and respected hunters, fisherfolk or gatherers, agriculturalists, crafts persons or traditional health specialists with unique knowledge of medicinal plants. Global Environment Outlook-6 participants will work with networks such as the UN Permanent Forum on Indigenous Issues (UNPFII), as well as the community of practice, to identify relevant Indigenous and Local Knowledge holders.

51. Relevant Indigenous and Local Knowledge experts for inclusion in the Global Environment Outlook-6 process may include, but are not limited to:

a) indigenous and local persons with first-hand and/or inherited expert knowledge about an environmental domain;
b) formally trained scientists from Indigenous and Local Knowledge holder communities;
c) individuals (indigenous or non-indigenous) with expert knowledge about local community networks, and who can assist in identifying the locally-recognized Indigenous and Local Knowledge experts (men and women) for a specific biodiversity or ecosystem service domain;
d) individuals with expert knowledge of the scientific and grey literature on Indigenous and Local Knowledge related to the targeted environmental domain;
e) individuals (indigenous or non-indigenous) with expertise in working with indigenous knowledge holders to record/compile/analyse relevant Indigenous and Local Knowledge; and
f) individuals (indigenous or non-indigenous) with expertise in facilitating a constructive dialogue between Indigenous and Local Knowledge holders, natural scientists and/or policy-makers.

52. Indigenous and Local Knowledge complements science and provides valuable additional data and understandings to improve environmental decision-making; it is however developed, owned, stored, shared, accessed and transmittedin ways that are very different from scientific knowledge. For this reason, procedures identified to incorporate Indigenous and Local Knowledge in Global Environment Outlook-6 assessment processes will differ from those designed for incorporation of scientific knowledge. Specific procedures will be further developed by the Global Environment Outlook-6 Scientific Advisory Panel and the Assessment Methodologies, Data and Information Working Group, in consultation with [1] http://unesdoc.unesco.org/images/0022/002252/225242E.pdf relevant experts and communities of practice. Lessons on how to incorporate Indigenous and Local Knowledge

into assessments can also be gleaned from the field of medicine and efforts to identify and verify Indigenous and Local Knowledge related to medicinal plants.

53. Whereas scientists separate science from technology and technique, and differentiate theory from practice, indigenous and local knowledge holders recognize that knowledge is linked to practice, and through this (seeing and doing), knowledge is transmitted and problems are resolved. When bridging between different knowledge systems, Global Environment Outlook-6 may thus consider relevant knowledge that is expressed through practice and techniques.

54. Information may be presented in different ways in the Global Environment Outlook-6 assessment. On the advice of the Global Environment Outlook-6 **Scientific Advisory Panel** and in consultation with the Global Environment Outlook-6 Secretariat, selected experts may be asked to create narratives and storylines based on Indigenous and Local Knowledge for inclusion in the Global Environment Outlook-6 report. For example, in Environment Live, changes in the migratory movement of resources are described in film and interviews and then reconstructed onto maps to show the impacts of climate change. Storylines mat then be verified and evaluated against criteria such as verifiability, specificity and relevance.

Multi-stage peer review

55. Transparent and rigorous peer review is necessary to achieve the highest scientific credibility possible. Peer review also plays a crucial role in achieving integrity, balance, transparency, and clarity for the assessment content. Building on past Integrated Environmental Assessment experience (including previous Global Environment Outlook cycles) Global Environment Outlook-6 will facilitate a multi-stage peer review processes using the Communities of Practice as the vehicle to facilitate and manage the process. Communities of Practice will be more transparent than traditional review methods and allow stakeholders to openly comment and share opinions on data, information and assessments, as well as comment on other stakeholder's comments.

56. The following principles governing the review of all Global Environment Outlook-6 content should be borne in mind. First, the best possible scientific and technical advice should be included to ensure that the assessment represents the latest scientific, technical and socio-economic findings and are as comprehensive as possible. Second, a broad circulation process, ensuring representation of independent experts (i.e. experts not involved in the preparation of the particular section they are reviewing) with particular emphasis on involving as manyexperts possible from developing countries and countries with economies in transition; and finally, the multi-stage review process should be balanced, open and transparent.

57. CLAs and Community of Practice Moderators, in collaboration with Review Editors will be responsible for keeping records of the response to each major review comment; and making publicly available all comments, responses and summaries of all contentious issues raised during the. Authors will be required to provide detailed written responses to the most significant review issues identified by the Review Editors, abbreviated responses to all non-editorial comments, and no written responses to editorial comments.

58. To help ensure that Global Environment Outlook-6 content provides a scientifically, credible, balanced and complete assessment of current information, each section will have designated **Review Editors**, typically two to three per section, who will be selected by the Global Environment Outlook-6 Scientific Advisory Panel in consultation with the Global Environment Outlook-6 Secretariat and CLAs, prior to the first round of peer-review. The

primary role of the Review Editors is to ensure that all substantive expert and government review comments are afforded appropriate consideration by the Writing Teams. Review Editors are not intended to be additional reviews of the content, but rather provide quality assurance and oversight on the review process itself.

59. The Review Editors will prepare written summaries of the most significant issues raised by reviewers shortly after review comments have been received. Once all stages of the Global Environment Outlook-6 review process have concluded, Review Editors will prepare and submit to the Global Environment Outlook-6 Secretariat, brief reports documenting the process and summarizing their impressions and judgements on whether CLAs and Community of Practice Moderators were able to address all substantive review comments and key concerns of overarching importance to their respective sections. These reports will be made public and shared with all relevant Global Environment Outlook-6 stakeholders.

60. The scientific integrity, ethical responsibilities and due diligence of all Global Environment Outlook-6 Review Editors should be guided by and adhere to following principles and actions:

- **Competence:** Reviewers should accept responsibility for reviewing a section only if they have adequate expertise to provide an authoritative assessment of the section's domain area. It is the responsibility of the reviewer to make his/her degree of competence known to the Secretariat through the section CLAs and Review Editor(s);
- **Confidentiality:** Draft sections/ manuscripts of the Global Environment Outlook-6 assessment are confidential materials; the reviewer should not share or discuss the content of the sections with anyone outside the reviewprocess unless necessary and approved by the Secretariat through the coordinating lead authors or section review editor(s);
- **Conflict of interest:** A potential reviewer with a conflict of interest or risk of biases should either decline the role of reviewer or disclose the conflict of interest to the section Review Editor(s). Where in doubt, reference should be made to the criteria for selection of reviewers (see below);
- **Constructive critique:** Reviewers are requested to provide comments that would help authors improve the contents of the sections. Positive aspects of the material under review should be acknowledged and negative aspects identified constructively, with an indication of needed improvements. It is important to note that comments are intended to be suggestions to authors to improve the sections; hence should be in an encouraging tone;
- **Specificity:** Reviewers should be as specific as possible in their comments. Their judgments should be explained and supported clearly, such that the editors and authors can understand the basis for the comments;
- **Integrity:** All comments should be impartial, written with integrity in mind, and capable of withstanding public scrutiny;
- **Timeliness:** Reviewers are expected to respond to the request for review and submit their comments in accordance with the overall Global Environment Outlook-6 work-plan and production schedules.

61. The review of the contents for both global and regions Global Environment Outlook-6 reports shall adhere to the following processes:

- At the stage of the first internal review (by authors, collaborating centres and Secretariat reviewers), 'draft zero' reports will be circulated by the Secretariat.
- Noting the need for a range of views, expertise and geographical representation, the first external review/consultation (by Governments and nominated experts) will take place early enough to ensure optimal and transparent results.
- All review comments will be made public on Environment Live no later than 15 days of receipt;
- A revised draft should be distributed by Secretariat through the coordinating lead author(s) or section coordinators to Governments through the designated focal points. Reviewers will include those nominated by governments and other stakeholders.
- Expert reviewers should provide comments to the Secretariat through the respective Community of Practices. Where possible, each Government should send one consolidated set of comments for each section to the appropriate CLA and/or the Secretariat through a designated government focal point by email.

62. The peer review process will follow an integrative multi-stage open review, facilitated by the Global Environment Outlook-6 Community of Practice. The precise sequencing of the stages will depend largely on the overall production schedule agreed and reflected in the outcome of the Global Intergovernmental Multi-stakeholder Consultation in Berlin, October 21-23, 2014.

Inclusion and treatment of diverging viewpoints

63. Managing, accommodating, documenting and integrating diverging viewpoints will be an important element of ensuring the scientific integrity and transparency of Global Environment Outlook-6. Assessment content across both the global and regional reports may include different scientific, technical and socioeconomic views on a given subject, particularly if they are relevant to the policy debate. This includes paying special attention to review comments that point out contradictions, unreferenced literature, or potential errors; and ensuring that alternate views receive proper consideration.

64. Coordinating Lead Authors, Review Editors, and Community of Practice Moderators should explicitly document during the content development and review phases of the assessment, where a range of viewpoints around data, science and policies have been considered, and Coordinating Lead Authors and Review Editors should satisfy themselves that due consideration was given to properly document alternative views.

65. Where an adequate consensus view cannot be achieved within the writing teams, particularly for highly contentious policy issues that are, nonetheless, scientifically, technically or socioeconomically valid, these matters should be submitted to Scientific Advisory Panel through the Secretariat.

66. If necessary, with guidance from the Scientific Advisory Panel, the assessment report may include in a footnote the differing views expressed in comments submitted by Governments during their final review of the document if these are not otherwise adequately reflected in the paper.

67. In preparing the first drafts of the Global Environment Outlook-6 assessment report and at subsequent stages of revision after review, authors should clearly identify disparate views

for which there is significant scientific, technical or socio economic support, together with the relevant arguments. Sources of uncertainty should be clearly identified, listed and quantified where possible. The implications for decision-making of the findings, including knowledge gaps, contrasting evidence and minority opinions, should be explicitly discussed.

68. The following additional guidance should be considered by CLAs, Review Editors in managing and accommodating divergent views:

- be objective, open, and transparent during all content deliberations;
- keep diligent record of divergent viewpoints among Global Environment Outlook authors and experts;
- identify those individuals holding each view and document;
- seek the best possible scientific and technical advice for all disputed and/or contentious issues;
- consensus does not imply a single view, but can incorporate a range of views based on the evidence; and
- explicitly and openly discuss contrasting evidence and minority opinions within the Community of Practices and drafting teams

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Global Intergovernmental and Multi-stakeholder Consultation
Berlin, 21-23 October 2014

Annex 5: Additional resources

Several manuals/sources identified:

- Integrated Environmental Assessment Training Manual (http://unep.org/geo/assessments.asp)
- Stockholm Environmental Institute (http://sei-us.org/Publications_PDF/SEI-ScenarioHandbook-07.pdf Developing Quantitative scenarios: A handbook for accidental practitioners)
- Ecosystems and Human Well-being: A manual for assessment practitioners (Chapter 5: Scenario Development and Analysis for Forward-looking Ecosystem Assessments http://www.unep-wcmc.org/resources-and-data/ecosystems-and-human-wellbeing--a-manual-for-assessment-practitioners)
- FOR-LEARN JRC European Commission (http://forlearn.jrc.ec.europa.eu/guide/4_methodology/meth_scenario.htm#Pros_Cons)
- University of Arizona tutorial (a university of Arizona course on methods and approaches for studying the future http://ag.arizona.edu/futures/tou/tut2-buildscenarios.html)

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Acronyms and Abbreviations

To be developed.

Additional Glossary

This glossary is compiled from citations in different chapters, and draws from glossaries and other resources available on the websites of the following organizations, networks and projects:

To be developed.