IWCAM INDICATORS MECHANISM AND CAPACITY ASSESSMENT

PART TWO

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GEF Project on "Integrating Watershed & Coastal Areas Management in Caribbean Small Island Developing States (GEF-IWCAM)"

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1. Introduction

The preparation of this indicator template constituted the second component of the assignment 'IWCAM indicators mechanism and capacity assessment', under the Project "Integrating Watershed and Coastal Areas Management in Caribbean Small Island Developing States (IWCAM)", which is funded by the Global Environment Facility (GEF), co-implemented by the United Nations Development Project (UNDP) and the United Nations Environment Programme (UNEP), and co-executed by the Caribbean Environmental Health Institute (CEHI) and the UNEP Caribbean Regional Coordinating Unit (UNEP CAR-RCU).

In order to evaluate in concrete terms if IWCAM goals and objectives are being achieved at the national level, and to take appropriate adaptive and corrective measures, regular assessment, evaluation, and monitoring must be an essential component of any IWCAM programme. Monitoring and evaluation is widely recognized as an indispensable tool in project and programme management, and monitoring and evaluation is an essential requirement of the entire life cycle of GEF projects (Text Box 1).

Text Box 1: GEF M&E

In the GEF context, monitoring is the continuous or periodic process of collecting and analyzing data to measure the performance of a programme, project, or activity using well defined and relevant indicators. As an integral and continuing part of project/programme management, it provides managers and stakeholders with regular feedback on implementation and progress towards the attainment of national, regional and global environmental objectives. Monitoring enables management to take appropriate corrective action to achieve desired results. An essential component of a monitoring and evaluation plan is a suite of appropriate indicators.

Indicators can provide crucial guidance for decision-making in a number of ways. For instance, they can translate scientific knowledge into manageable units of information that can facilitate the decision-making process by helping in priority setting, measuring and calibrating progress towards sustainable development goals, and providing an early warning of economic, social and environmental damage. They are also important tools to communicate ideas, thoughts and values. There have been several affirmations of the importance of indicators of sustainable development at international fora, such as the Johannesburg Plan of Implementation (JPOI), which was adopted at the World Summit on Sustainable Development (WSSD) in 2002, and which encouraged, *inter alia*, further work on indicators for sustainable development at the national level.

An assessment and monitoring framework, with a suite of appropriate indicators is of paramount importance for the long term success of national IWCAM programmes. While there have been a number of past efforts for developing environment statistics and indicators in the region (see Part I), strategic plans for collecting, analyzing, and disseminating environmental data and statistics in a well-coordinated and coherent manner have been limited. So too have been focused efforts to define national

environmental indicators to be monitored on a regular basis. In recent decades the Caribbean SIDS have seen the onset of, *inter alia*, Agenda 21, the BPoA, and Multilateral Environmental Agreements (MEAs); meeting their obligations and reporting requirements all demand the collection of environmental statistics and the use of indicators.

The major objective of this component was to develop an indicators template to monitor changes in the state of the watershed and coastal environments, monitor the trends in socioeconomic pressures and conditions in watershed communities and coastal towns, and to assess the efficacy of IWCAM in addressing these issues and mitigating harmful impacts, both during the project and in the post-project period. In the longer term, the selected indicators should be adopted and tracked by the participating countries, according to their particular circumstances or needs. Each country would need to determine the baselines and benchmarks for each indicator, since these would vary among countries and issues.

The template is based on the three types of indicators (Box 2) recommended by GEF for

Text Box 2: The three types of indicators used in GEF International waters projects

Process indicators (PI) focus on the processes or outputs that are likely to lead towards a desirable outcome, and demonstrate actual, on-the-ground institutional and political progress in solving the problems. These process indicators assist in tracking the domestic, regional institutional, policy, legislative, and regulatory reforms necessary to bring about change. They establish regional or national frameworks/conditions for improving environmental/water resources quality or quantity but do not in and of themselves deliver stress reduction or improved environmental/water resources quality or quantity. The establishment of process indicators is essential to characterize the completion of institutional processes on the multi-country level or national level that will result in action on needed policy, legal, and institutional reforms and investments. Examples of PIs are:

- Formulation and documentation of a National Intersectoral Committee to address and coordinate IWCAM issues;
- Country ratification of regional or global conventions and protocols pertinent to the project.

Stress reduction indicators (SRI) relate to the specific on-the-ground measures implemented by the countries to address the particular issue or concern, and which characterize and quantify specific reductions in environmental/water resources stress on water bodies or increases in stress-reduction measures. These indicators document on-the-ground results of demonstration scale pilot projects, investments, and implementation of sectoral reforms, i.e., they show the rate of success of specific on-the-ground actions implemented. Examples of SRIs are:

- Non-point source pollution programmes implemented (area treated with best management practices);
- Area of eroded land stabilized by tree planting (estimated sedimentation reduction).

Environmental status indicators (ESI) are goal-oriented and focus on actual improvements of ecosystem or environmental quality (state) as well as any associated socioeconomic improvements that usually extend beyond the lifetime of the project. These indicators are usually 'static' snapshots of environmental and socioeconomic conditions at a given point in time and, like Stress Reduction, are usually reported against a baseline year and level to show change/improvement. A number of socioeconomic indicators (SEI) are also indicators of the impacts of environmental change on human survival and wellbeing. Examples of ESIs are:

- Improved (measurable) chemical, physical (including flow regimes), or biological parameters;
- Improved hydrological balance as vegetation cover increases as a result of reforestation programmes.

Note: SRI reflects the source (input) of pressure or stress on the environment (e.g. volume of untreated

use in its International Waters Projects (Duda 2002): Environmental Status/Water Resources Indicators (ESI), Stress Reduction Indicators (SRI), and Process Indicators (PI). Among other commonly used assessment and monitoring frameworks and associated indicators are the Driver-State-Response (DSR) and its variations such as Driver-Pressure-State-Impact-Response (DPSIR) and Pressure-State-Response (PSR) (OECD, 1993; EEA, 1998; UN and World Bank, 2001).

2. Selection of Indicators for the Template

Environmental problems in the watersheds and coastal areas of the Caribbean SIDS are diverse, with many possible solutions and a variety of settings regarding capacity, institutional, and policy frameworks, among others. Hence, there can be no one standard list of indicators that applies to all the countries; each country would select a set of indicators for use in their respective IWCAM programmes. The indicators selected would be determined largely by the objectives for IWCAM, the nature of the proposed interventions or activities, the feasibility and cost of collecting various types of information and data, and the institutional capability for incorporating them into analysis and decision-making processes. Indicators that measure project impacts quantitatively as opposed to indicators that simply identify direction of change in environmental performance are particularly useful. Selection criteria for environmental indicators are listed in Text Box 3. These also embody the so-called "SMART" concept of indicators[1].

Text Box 3: Selection criteria for environmental indicators

Each indicator should meet as many of these criteria as possible:

- Serve as a robust indicator of environmental change;
- Reflect a fundamental or highly valued aspect of the environment;
- Be either national in scope or applicable to regional environmental issues of national significance;
- Provide an early warning of potential problems;
- Be capable of being monitored to provide statistically verifiable and reproducible data that show trends over time and, preferably, apply to a broad range of environmental regions;
- Be scientifically credible;
- Be easy to understand;
- Be monitored regularly with relative ease and cost-effectiveness;
- Have relevance to policy and management needs;
- Contribute to monitoring of progress towards implementing commitments in nationally important environmental policies;
- Where possible and appropriate, facilitate community involvement;
- Contribute to the fulfillment of reporting obligations under international agreements;
- Where possible and appropriate, be consistent and comparable with other countries' indicators.

The selection of indicators for inclusion in the template was based on three main criteria:

1. *The objectives and expected outcomes of the overall GEF-IWCAM project and of the demonstration projects*. These objectives and outcomes reflect national IWCAM and sustainable development issues in the participating countries, as revealed in the project document, country reports prepared for the project, and other pertinent

[1] "SMART" concept of indicators:

- ***S***imple (easily interpreted and monitored)
- ***M***easurable (statistically verifiable, reproducible and show trends)
- ***A***ccessible (regularly monitored, cost effective and consistent)
- ***R***elevant (directly address issues or agreed objectives)
- ***T***imely (provide early warning of potential problems)

documents. Six major IWCAM objectives, each with a number of significant issues, were considered to be of interest under the project (Table 1). Core and supplementary SRI, ESI, and SEI were arranged according to these objectives and issues. Core indicators are those indicators that were judged to be most pertinent to IWCAM and are relevant to other national, regional, and international frameworks, as discussed in Part I (Indicators Mechanism and Capacity Assessment). According to the approach used by GEF, the SRI, ESI, and SEI should be stated as an increase or decrease (as appropriate) in the indicator.

2. *Relevance to other regional and international frameworks* such as the CSME, OECS St. George's Declaration, Latin American and Caribbean Initiative (ILAC), MEA and action plans, MDGs, and UN Commission on Sustainable Development indicators for sustainable development. Wherever possible, the core indicators are common to regional and international initiatives, so that they represent a common tool to assist governments in meeting international requirements for reporting and avoid imposing an unnecessary burden on governments and other partners. This would also help improve information consistency at the national, regional, and international levels.

3. *Availability of data and statistics for compiling the indicators*. A number of initiatives for developing and compiling environmental statistics have been undertaken in the Caribbean, both at the national and regional levels. The indicators mechanism assessment in Part I revealed the existence of several indicator mechanisms and associated data and information related to a number of themes pertinent to IWCAM. However, while some data are available for a number of the indicators, the lack of data for others or significant gaps in existing data are evident in all the participating countries.

The draft indicators template was presented at the GEF IWCAM Indicators Workshop, Ocho Rios, Jamaica, 2008 (see workshop report in Part III). Additional indicators were suggested by the workshop participants and are also included in the template.

Table 1: Major objectives and issues related to IWCAM in the participating countries

IWCAM OBJECTIVE	ISSUE
Sustainable water resource use	Declining water resources; human health risks
Conservation/protection of ecosystems and natural living resources	Forest loss Land degradation Coral reef degradation/loss Mangrove degradation/loss Seagrass degradation/loss Biodiversity loss Degradation of water quality Beach loss Unsustainable fisheries exploitation Unsustainable tourism development
Sustainable agricultural practices	Harmful agricultural practices
Pollution control/reduction	Solid waste

	Industrial waste Sewage/domestic wastewater; human health risks Atmospheric emissions
Improved water quality	Reduction in quality of coastal/marine waters Reduction in quality of freshwater
Reduction in exposure to natural disasters	Increased vulnerability to natural disasters

3. Indicators Template

3.1. Stress Reduction and Environmental Status Indicators

A number of SRI, ESI, and SEI are given in Table 2. Further details (Description/meaning, rationale, policy relevance, data, and lead agencies) are provided for 17 core SRI and 25 core ESI/SEI indicators that are relevant to the principal regional and international environmental/sustainable development frameworks, and considered to be very pertinent to IWCAM. These descriptions are partly based on a number of sources including United Nations and World Bank 2001[2]; CBD 2003[3]; United Nations 2003[4]; UNEP/World Bank/University Costa Rica 2004[5]; UNESCO 2006[6]; UNDESA 2007[7]. Where possible, the descriptions have been adapted to reflect the situation in the Caribbean SIDS.

[2] United Nations and World Bank. 2001. Indicators of Sustainable Development: Guidelines and Methodologies. United Nations, New York. http://www.un.org/esa/sustdev/natlinfo/indicators/indisd/indisd-mg2001.pdf
[3] CBD (2003). Proposed Biodiversity Indicators Relevant to the 2010 Target. http://www.cbd.int/doc/meetings/sbstta/sbstta-09/information/sbstta-09-inf-26-en.pdf. See also http://www.cbd.int/2010-target/indicators/database.shtml
[4] United Nations (2003). Indicators for Monitoring the Millennium Development Goals. Definitions, Rationale, Concepts, and Sources. United Nations, New York.
[5] UNEP/World Bank/University of Costa Rica (2004). Latin American and Caribbean Initiative for Sustainable Development Indicators Follow-up. ILAC 2004 Indicators.
[6] UNESCO (2006). A Handbook for Measuring the Progress and Outcomes of Integrated Coastal and Ocean Management. IOC Manuals and Guides, 46; ICAM Dossier, 2. Paris, UNESCO, http://unesdoc.unesco.org/images/0014/001473/147313e.pdf
[7] UNDESA (2007). Indicators for Sustainable Development. http://www.un.org/esa/sustdev/natlinfo/indicators/isdms2001/table_4.htm

Table 2: Proposed Stress Reduction and Environmental State/Socioeconomic Indicators
(Core indicators are shown in bold italics. The frameworks under which the core indicator is relevant are shown in parentheses).
Note: a number of indicators could be applied to more than one issue

OBJECTIVE/ISSUE	STRESS REDUCTION INDICATORS	ENVIRONMENTAL STATE AND SOCIOECONOMIC INDICATORS
1. Sustainable water resource use		
1.1 Declining water resources; human health risk	- ***Reduction in annual withdrawal of surface and groundwater*** *(CSME; UNCSD)* - ***Increase in area of river basin under management*** *(ILAC)* - ***Increase in number of watershed restoration programmes*** - ***Improvement in technology (or investment) for more efficient water use*** - ***Increase in aquifer recharge rate*** - Increase in water use efficiency leading to reduced extraction rate (m^3/ha/yr in irrigation) - Increase in watershed area with appropriate cover (see forest/vegetation cover) - Reduction in water demand/consumption *(UNCSD)* (see annual water withdrawal)	- ***% population with access to clean drinking water*** *(BPoA; CSME; Mauritius Strategy; ILAC; MDG 7, T10; UNCSD)* - ***Water availability/capita*** *(CSME; ILAC; St. George's)* - ***Water consumption/capita*** *(CSME; ILAC)* - ***River flow regimes*** *(CBD; CCD)* - ***Surface and groundwater levels*** (related to river flow regimes, aquifer recharge rate) - ***Mean annual rainfall*** (correlated with water levels and other relevant indicators) - ***Incidence of related diseases***
2. Conservation/protection of ecosystems and natural living resources		
2.1 Forest loss	- ***Reduction in deforestation rate*** *(Mauritius Strategy; UNFCCC)* - ***Increase in number of reforestation programmes*** - ***Reduction in population using solid fuels*** *(ILAC; MDG 7, T9; UNFCCC)* - ***Increase in forest area under sustainable management or protected*** *(CSME; CBD; ILAC; Mauritius Strategy; St. George's; UNCSD)* - ***Reduction in incidence of forest fires***	- ***% Forest/vegetation cover*** *(CSME; CBD;FAO;ILAC; MDG 7, T9; St. Georges; UNCCD; UNCSD; UNFCCC)*
2.2 Land degradation	- ***Increase in % municipalities with land use plans being implemented*** *(ILAC)* - ***Increase in area protected*** *(CSME)* - ***Increase in amount of land stabilized by tree***	- ***% Land use change*** *(CSME; ILAC; UNCSD)* (see forest cover) - ***Area degraded (erosion, desertification, etc)*** *(CCD; ILAC; UNCSD)*

	planting - Reduction in rate of erosion/topsoil loss - Increase in area of rehabilitated land - (see also Agriculture indicators)	- ***Soil fertility/nutrient balance*** *(CCD)* - ***Organic material content of soil*** - ***Total suspended solids in rivers and coastal areas*** *(GPA; LBS; CBD)* - ***Area/ population of urban formal and informal settlements*** *(CSME; ILAC; MDG; UNCSD)* - Exposed soil surface *(CCD)* - Ratio cultivated /natural cover
2.3 Coral reef degradation/loss	- ***Increase in area protected, no. MPAs*** *(CBD; SPAW; St. George's;UNCSD*)* - ***Increase in area under sustainable management*** - Increase in sustainable tourism practices *(Mauritius Strategy)* - Reduction in coral removal rate - Improved coastal water quality (see water quality indicators) - Increase in adoption of EIA practices for coastal developments *(Mauritius Strategy)* ** % marine area protected*	- ***% Live coral cover*** *(BPoA; CBD; GPA; SPAW; St. George's; UNCSD**)* - ***Fish species diversity and abundance*** (see Biodiversity) - ***Population abundance of indicator species*** (see Biodiversity) - % Algal cover - Area of coral reef ecosystem - Incidence/area of coral bleaching - Incidence of coral diseases - Coral growth rate - See also water quality ***area of selected key ecosystem*
2.4 Mangrove degradation/loss	- ***Increase in area protected*** *(CBD; SPAW; St. George's; UNCSD*)* - ***Increase in area under sustainable management*** - ***Increase in number of mangrove restoration programmes (area restored)*** - Reduction in mangrove removal rate - Improved coastal water quality (see water quality indicators) - Increase in adoption of EIA practices for coastal developments	- ***Mangrove area by type*** *(BPoA; CBD; GPA; SPAW; St. George's; UNCSD**)* - ***Productivity*** - See also water quality ***area selected key ecosystem*
2.5 Seagrass degradation/loss	- ***Increase in seagrass area protected*** *(CBD; SPAW; St. George's; UNCSD*)* - ***Increase in number of seagrass restoration programmes (area restored)*** - Reduction in removal rate - Improved coastal water quality (see water quality	- ***Seagrass area*** *(BPoA; CBD; GPA; SPAW; St. George's; UNCSD**)* - ***Productivity*** - ***Epiphytes*** - See also water quality

	indicators) - Increase in adoption of EIA practices for coastal developments	***area selected key ecosystem*
2.6 Biodiversity loss	- ***Increase in no. and area of protected areas (% territory protected)*** *(CSME; CBD; ILAC*; MDG 7, T9; SPAW Protocol; St. George's; UNCSD; WSSD)* - ***Increase in measures to protect threatened and/or indigenous species*** - ***Increase in measures to reduce habitat loss*** - ***Increase in measures to eliminate invasive species/reduce their introduction*** **marine diversity*	- ***Population abundance of selected marine and terrestrial species*** *(CBD; St. George's; UNCSD)* ***(incl keystone and indicator species)*** - ***No. and abundance of threatened, endangered species*** *(CBD; CITES; UNCSD)* - ***No. and abundance of invasive species*** *(UNCSD)* - Habitat diversity
2.7 Degradation of water quality	- ***Reduction in pollution loads to coastal and freshwater environments*** *(LBS, GPA)* - ***Increase in buffer zone along river banks and reservoirs***	- ***Water temperature*** ***A number of water quality indicators are available*** *(see ESI below)*
2.8 Beach loss	- ***Reduction in illegal sand mining*** - ***Reduction in land based pollution (see water quality)*** - ***Increase in number of coastal protection/stabilization measures***	- ***% coastline affected by erosion*** - Undisturbed beach/sandy shoreline area
2.9 Unsustainable fisheries exploitation	- ***Increase in % fish stocks sustainably managed*** (*FAO Code of Conduct*) - ***Reduction of fishing effort (e.g. no. boats, fishers) for overfished stocks*** (*FAO Code of Conduct*) - ***Increase in number of marine reserves/no-take zones*** - Increase in % fish stocks within safe biological limits *(FAO Code of Conduct; UNCSD)* - Reduction in use of destructive fishing practices (*FAO Code of Conduct*) - Reduction in IUU fishing (*FAO Code of Conduct*) - Increase in alternative livelihoods, poverty reduction initiatives in fishing communities	- ***Annual fisheries catch (total & by major species, incl. marine mammals)*** *(CSME; CBD; FAO Code of Conduct; ILAC; UNCSD)* - ***Mean sizes in catch of major species*** - ***Catch/unit effort (or abundance of major exploited species)*** *(FAO Code of Conduct; WSSD)* - % stocks within safe biological limits *(FAO Code of Conduct; UNCSD)* - Mean trophic level of catch - No. fishers, boats (by size, etc)

2.10 Unsustainable tourism development	- ***Increase in number of sustainable tourism initiatives (SEI)***	- ***Tourism intensity in coastal areas and the upper watershed**** (CSME, CTO, ACS) * several indicators exist – e.g. number of hotels by size, number of tourists/year, type of tourism, etc.
3. Improved agricultural practices		
3.1 Unsustainable agricultural practices	- ***Reduction in intensity of fertilizer use/increase in fertilizer use efficiency*** *(CSME; GPA; LBS Protocol; UNCSD)* - ***Reduction in intensity of agricultural pesticide use*** *(CSME; GPA; LBS Protocol;UNCSD)* - ***Increase in organic farming*** *(UNCSD)* - ***Increase in crop rotation practices*** - ***Increase in more efficient irrigation practices*** - Increase in area where sustainable agricultural practices are implemented - Reduction in volume of agricultural chemicals imported/year - Increase in contour farming	- ***Concentration of residual agricultural chemicals in water, soil, food chain*** (see water quality indicators) - ***Concentration of nutrients (N, P, K) in water*** (see water quality indicators) - ***Crop production/unit area*** - ***Production cost/unit area*** - ***Incidence of illnesses related to use and handling, and ingestion of agricultural chemicals***
4. Pollution control/reduction		
4.1 Solid waste	- ***Increase in % population with access to solid waste collection*** *(ILAC; St. George's)* - ***Increase in % solid waste properly disposed of/recycled/reused*** *(CSME; Mauritius Strategy; ILAC; St. George's; UNCSD)* - ***Reduction in quantity of solid waste produced (total; per capita)*** *(CSME; ILAC; UNCSD)* - ***Increase in number of sanitary landfills*** - Reduction in number of unofficial dump sites	
4.2 Industrial waste	- ***Increase in volume of waste treated, recycled, properly disposed*** *(CSME; ILAC; St. George's; UNCSD)* - ***Reduction in untreated waste discharges*** - ***Increase in no. of industries adopting cleaner production technologies and/or environmental management standards/system*** - ***Reduction in volume of pollutants (incl. toxic and hazardous substances) produced*** *(UNCSD)*	- See water quality and atmospheric emissions (ESI) - ***Incidence of related diseases (Socioeconomic-ESI)*** - ***Levels of contaminants in food chain*** (plant and animal tissue)

	- Increase in investment for cleaner technologies - Increase in number of companies using ISO certification *(ILAC)*	
4.3. Sewage/domestic wastewater; human health risks	- ***Increase in % population with access to sanitation facilities*** *(BPoA; CSME; Mauritius Strategy; ILAC; MDG 7, T10; UNCSD)* (Increase in % population with adequate sewage disposal facilities) - ***Increase in volume of sewage/wastewater treated*** *(ILAC; St. George's; UNCSD)* - ***Increase in number of functioning sewage treatment plants*** - ***Increase in investment for sewage treatment*** - ***Reduction in nutrient and bacterial loadings in aquatic environment*** - Reduction in untreated sewage discharges - Increase in consumers using non-phosphate detergent	- ***Faecal coliform concentration in surface and ground water*** *(GPA; LBS; UNCSD)* - ***Nutrient (nitrates, nitrites, total nitrogen, phosphates) levels in surface and ground water*** *(GPA; LBS)* - ***Incidence of related diseases*** (*CSME*)
4.4. Atmospheric emissions	- ***Reduction in CO_2 emissions (per capita)*** *(BPoA; CSME; St. George's; MDG 7, T9; ILAC; UNCSD; UNFCCC)* - ***Increase in proportion of renewable energy/total energy consumed*** *(CSME; ILAC; St. George's; UNCSD)* - ***Reduction in use of solid fuels*** (*CSME; MDG; UNFCCC*) - ***Increase in number of industries using emission control*** - ***Reduction in emission of other air pollutants (e.g. NOx, SO2, CH4, Pb,VOCs) from mobile and stationary sources*** *(CSME)* - Reduction in emissions of other GHGs *(UNCSD)* - Reduction in fossil fuel consumption/capita - Increase in efficiency of fuel combustion	- ***Ambient concentration of air pollutants in urban/industrial areas*** (*CSME; UNCSD*) - a number of substances such as lead, SO_2, particulates) - ***Energy consumption/GDP*** *(ILAC; MDG 7, T9)* - ***Energy use/capita*** *(St. George's; UNCSD)* ***Incidence of related illnesses*** (SEI)
5. Improved water quality		
5.1 Reduction in quality of coastal/marine	- ***Reduction in point and non-point pollution discharges to coastal waters (GPA, LBS, CSME, CBD, UNCSD)***	***Coastal water quality*** *(CSME; CBD; GPA; LBS;UNCSD;WSSD):* - ***Concentration of selected pollutants in coastal***

waters	- ***Reduction in average and peak sediment loads in coastal areas (GPA, LBS)*** - See also Pollution control/reduction	***water and sediments (e.g. faecal coliform; hydrocarbons and other chemical compounds; heavy metals; total suspended solids)*** - ***Nutrient loads*** - ***Chlorophyll-a concentration in surface waters*** - ***BOD/COD*** - ***Dissolved oxygen*** - ***Algae concentration in coastal waters*** - ***Incidence of HABs*** - ***Incidence of fish kills***
5.2 Reduction in quality of freshwater	- ***Reduction in releases of pollution to surface and groundwater recharge zones*** - ***Reduction in average and peak sediment loads in rivers and coastal areas***	As above, a number of indicators exists – dependent on the issue of concern (e.g. faecal coliform levels, BOD/COD; nutrients; chemical contaminants; suspended solids; salinity)
6. Reduction in exposure to natural disasters		
6.1 Increased vulnerability to natural disasters	- ***Establishment/enforcement of coastal setbacks for residential and commercial structures*** - ***Incorporation of hazard mapping into zoning, land use planning, and development approvals processes*** - ***Improvement in identification of disaster high risk zones*** - ***Increase in disaster response/early warning systems***	- ***Population in disaster-prone areas*** *(BPoA;UNCSD)* - ***Annual economic losses from natural disasters*** *(BPoA; CSME; UNCSD)* - ***Annual human losses from natural disasters*** *(BPoA; CSME; UNCSD)* - ***Frequency and intensity by type of extreme natural events*** (CSME) - ***Mean sea level***

Stress Reduction Indicators Description

1. Reduction in annual withdrawal of ground and surface water (% Total Renewable Water)	
Definition & meaning	Measures the total annual volume of ground and surface water abstracted as a percentage of the total annually renewable volume of freshwater. It is an important measure of a country's vulnerability to water shortages. It also captures the risk to terrestrial environments, aquatic ecosystems, and groundwater from over-extraction of freshwater resources.
Rationale	Freshwater is essential to support human life, ecosystems and aquatic living resources, and economic development. The global issues of health, poverty, climate change, deforestation, desertification, and land use change are all directly associated with water resource and its management. Scarce water could constrain sustainable social and economic development, and could also lead to loss of biodiversity. Many Caribbean islands rely on a single source of water, such as groundwater, rainwater, rivers, and other surface flows (UNEP

	2005). A number of these islands are vulnerable to variable freshwater supplies and shortages, and have been classified as 'water scarce' countries (FAO 2003). Among the threats to water resources in the SIDS are over-extraction of water, degradation of watersheds, climate change (increase in drought), and inefficient irrigation practices. This indicator can show the need for adjusted supply and demand management policy. When the indicator is calculated by sector, it can reflect the extent of water resource scarcity with increasing competition and conflict between different water uses and users.
Policy relevance	BPoA; ILAC; Mauritius Strategy; MDG 7, T10; St. George's Declaration; UNCSD; WSSD
Data and lead agencies	National agency responsible for water resources; FAO AQUASTAT (http://www.fao.org/ag/AGL/AGLW/aquastat/aquastat.htm); World Water Assessment Programme (UNESCO) – World Water Development Report; CIMH (www.cimh.org) CARDI/PROCICARIBE Caribbean Land and Water Resources Network (www.procicaribe.org/networks/clawrenet/index.htm)
Comments	Related indicators: Surface and groundwater levels; River flow regime; Increase in aquifer recharge rate (SRI); Water consumption/capita; Increase in more efficient irrigation practices (SRI).

2. Increase in aquifer recharge rate	
Definition & meaning	Measures the total annual change (increase or decrease) in groundwater level or volume. It is an important measure of a country's vulnerability to water shortages, particularly if the country is highly dependent on groundwater resources.
Rationale	Groundwater is an important source of freshwater in the PCs. A number of these islands are vulnerable to variable freshwater supplies and shortages, and have been classified as 'water scarce' countries (FAO 2003). Furthermore, over-extraction of groundwater is leading to saline intrusion into groundwater aquifers in a number of the PCs. Groundwater levels are affected by a number of factors, including changing vegetation cover, land degradation, climate variability and water withdrawal rate. Monitoring of aquifer water levels over a period of time provides information on aquifer recharge rate, increase in which is a stress reduction indicator. This indicator can show the need for adjusted water supply and demand management policy, as well as for improved watershed management.
Policy relevance	BPoA; ILAC; Mauritius Strategy; MDG 7, T10; St. George's Declaration; UNCSD; WSSD
Data and lead agencies	National agency responsible for water resources; FAO AQUASTAT (http://www.fao.org/ag/AGL/AGLW/aquastat/aquastat.htm); World Water Assessment Programme (UNESCO) – World Water Development Report; CIMH (www.cimh.org) CARDI/PROCICARIBE Caribbean Land and Water Resources Network (www.procicaribe.org/networks/clawrenet/index.htm)

3. Increase in area of river basin under management	
Definition & meaning	Area of river basins (and aquifers) with integrated river basin management plans.
Rationale	It is well recognized that the river basin is the most appropriate geographic unit to plan and administer the multiple uses of water resources, and that an integrated approach is needed for effective river basin

	management. Among the Caribbean SIDS, the lack of integrated river basin management, as well as deforestation and other factors, is threatening the sustainability of their freshwater resources. In addition to integrated management of river basins, degraded watersheds need to be restored (SRI indicator: Increase in number of watershed restoration programmes). Monitoring of this indicator will show progress towards integrated river basin management, the success of which could be reflected by other indicators such as surface and groundwater levels.
Policy relevance	ILAC
Data and lead agencies	National agencies responsible for water resources, forestry.
Comments	Related indicators: Number of watershed restoration programmes (SRI); Number of reforestation programmes (SRI); Forest/vegetation cover; Increase in forest area under sustainable management (SRI); % land use change; Increase in aquifer recharge rate (SRI); Reduction in deforestation rate.

4. Increase in protected area	
Definition & meaning	This indicator measures the area of protected land ecosystems, inland water ecosystems, and marine ecosystems expressed as a percentage of the total area of the ecosystem in question. It represents the extent to which areas important for conserving biodiversity are protected from incompatible uses.
Rationale	Sustainable development depends on a healthy environment, which in turn depends on ecosystem diversity. SIDS possess fragile and unique biodiversity and ecosystems, on which their socio-economic development is highly dependent. Protected areas are essential for maintaining ecosystem and biological diversity, in conjunction with management of human impacts on the environment. Protected areas have also become places of high social and economic value, e.g. supporting local livelihoods; protecting watersheds from erosion; harbouring genetic resources; providing for science, research and education; and forming a basis for cultural and other non-material values. In the Caribbean SIDS, critical ecosystems and the biodiversity they support are increasingly under threat from human and natural pressures. While all these countries have established protected areas and reserves, including marine protected areas, the enforcement of related regulations continues to be a problem.
Policy relevance	CANARI; CSME; CCA; Mauritius Strategy; NBSAP; Ramsar; SPAW Protocol; St. George's Declaration; UNCBD; UNCSD
Data and lead agencies	Ministries of Environment and other agencies responsible for the designation and maintenance of protected areas. UNEP-WCMC, IUCN's World Commission on Protected Areas compiles the *United Nations List of Protected Areas*, which provides information on all protected areas of 1,000 ha or more (plus smaller areas occupying entire islands) for all countries. UNEP-WCMC/IUCN World Database on Protected Areas (http://sea.unep-wcmc.org/wdbpa/UN.cfm, www.unep-wcmc.org/wdpa/); IUCN (www.iucn.org); Global Biodiversity Assessment 2002 (CBD); Country profiles (www.cbd.int/countries/default.shtml); See www.mpaglobal.org for information on Caribbean SIDS; CBD NBSAP (www.cbd.int/doc/world/default.asp); IABIN (http://www.iabin.net/index.php)
Comments	Related indicators: Forest Area as a % of Land Area; Area of Selected Key Ecosystems; Species abundance.

	This indicator is most meaningful when accompanied by indicators of the status of ecosystem diversity, particularly of ecosystem modification and conversion.

5. Decrease in proportion of population using solid fuels	
Definition and meaning	Proportion of population using solid fuels is the proportion of the population that relies on biomass (wood, charcoal, crop residues and dung) and coal as the primary source of domestic energy.
Rationale	The use of solid fuels affects both the environment and the population that uses these fuels. Incomplete and inefficient combustion of solid fuels results in the emission of a number of compounds, many of which are harmful to human health or are greenhouse gases. There are important linkages between household solid fuel use, indoor air pollution, deforestation, and soil erosion and greenhouse gas emissions. In a number of the SIDS, the use of solid fuels such as charcoal and wood is widespread, and has resulted in major deforestation in these countries.
Policy relevance	ILAC; MDG 7, T9; UNFCCC Kyoto Protocol; Montreal Protocol
Data and lead agencies	Agencies responsible for forestry, environment
Comments	Related indicators: Reduction in deforestation rate (SRI); Forest/vegetation cover

6. Increase in % fish stocks sustainably managed	
Definition and meaning	% of a country's fish stocks that are appropriately managed for recovery of depleted stocks and prevention of overexploitation of healthy stocks. Management measures include limitation of fishing effort, protection of juveniles and spawning individuals, gear restrictions, prohibition of destructive fishing practices, and protection of critical habitats that maintain fish stocks.
Rationale	Marine fisheries are an important source of food, income and employment in SIDS. Fishing pressure beyond that required for maximum sustainable yield (or optimum yield) and destructive fishing gear have resulted in overexploitation of most of the inshore fish stocks in the Caribbean SIDS, as evidenced by declining fish catches and a decrease in individual sizes. Some offshore, migratory stocks are also in danger of overexploitation. Overfishing can also result in biodiversity loss, for instance, loss of top predators in the ecosystem through selective removal. In order for overexploited fish stocks to recover and to prevent overexploitation of healthy stocks, appropriate management interventions are needed. Another problem in sustainable fisheries management is Illegal, Unregulated, and Unreported (IUU) fishing, which, in addition to overfishing, also causes uncertainties in stock assessments because of unknown fishing effort and catches.
Policy relevance	CSME; FAO Code of Conduct; ILAC; UNCSD
Data and lead agencies	Fisheries departments; CFRAMP; CRFM; FAO State of the World Fisheries & Aquaculture; Yearbook of Fisheries Statistics; FISHSTAT; Figis (www.fao.org); Indicators for sustainable development of fisheries (www.fao.org/docrep/W4745E/w4745e0f.htm)
Comments	Related indicators: % stocks within safe biological limits (FAO Code of Conduct, UNCSD); Reduction of fishing effort; Reduction in IUU fishing.

7. Reduction in illegal sand mining	
Definition & meaning	Extent of beach/seashore affected by illegal sand/aggregate extraction.
Rationale	In a number of the SIDS, illegal sand and aggregate extraction in coastal areas is contributing to degradation of beaches and sensitive coastal habitats, both through direct removal and mobilization of sediments. In many Caribbean countries intensive mining of beach sand has led to increased coastal erosion and sedimentation. Sand mining and beach erosion are issues of great concern in countries such as St. Kitts and Nevis, St. Lucia, and St. Vincent and the Grenadines (UNEP 1999). This practice will increase, with rising demand for construction material by growing populations and urbanization. Sand mining also increases the vulnerability of coastal areas to erosion, storm surges and other extreme natural events.
Policy relevance	GPA; LBS Protocol
Data and lead agencies	Agencies responsible for Environment, Development Planning
Comments	Related indicators: Area of selected ecosystems; suspended solids in coastal areas

8. Reduction in pollution loads to coastal areas	
Definition & meaning	This indicator measures the total annual volume of pollution loads entering coastal areas from point and non-point sources (the latter is more difficult to measure). It captures the risk to coastal ecosystems and living marine resources, as well as to users of coastal areas, from land-based pollution.
Rationale	Pollutants from land-based sources constitute one of the greatest threats to coastal and marine ecosystems and to public health in the Wider Caribbean Region (UNEP 2005). Land-based sources of pollution are estimated to account for 80 - 85% of marine pollution in the region (OECS/UNDP 1994). These include industrial, residential, and agricultural sources from which pollutants are transported to the coast in streams and water run-off by leaching and infiltration in the soil as well as direct discharges to the sea. Sewage is a particular problem, and regarded as one of the most important and widespread causes of degradation of the coastal environment in the Caribbean (Siung-Chang 1997). Nutrient enrichment is also of growing concern in the Wider Caribbean, where there are indications that eutrophication is increasing (GESAMP 2001). Other pollutants of concern include POPs, heavy metals, petroleum hydrocarbons and sediments. Several coastal hotspots have been identified in some of the larger industrialized islands (Siung-Chang 1997) and are related to direct point or non-point pollution discharges. The latter is difficult, if not impossible to measure accurately, and proxy indicators might be useful (e.g. quantity of fertilizers applied/unit area). Pollution of coastal areas not only impacts on the structure and function of sensitive ecosystems such as coral reefs, but could contaminate seafood and harm humans and marine organisms through direct contact, and reduce the aesthetic value of coastal areas.
Policy relevance	GPA; LBS Protocol
Data and lead agencies	Ministry responsible for environment, UNEP CAR/RCU, CEHI, environmental laboratories
Comments	See also ESIs related to coastal water quality, waste management

9. Increase in % municipalities with land use planning	
Definition & meaning	Municipalities with land use plans being implemented.
Rationale	The state of terrestrial resources is influenced by land use patterns. Poor land use planning and land management practices, as well as incompatible or conflicting land uses, cause serious environmental problems. Poor land use and land management practices as well as heightened land use conflicts have led to degradation of a number of ecosystems in Caribbean SIDS (UNEP 2005), and increased the vulnerability of human communities to natural disasters. Current planning and policy practices result in the conversion of land from its natural state to other uses, with limited appreciation of the loss of the future value of the land as regards the natural goods and services it can provide. The changes in land use witnessed in the region over centuries have had the most dramatic impact on forest ecosystems. The lack of long-term planning as well as evaluation of the future value of the land and its goods and services, which may be lost in land use change, makes the conversion particularly problematic.
Policy relevance	ILAC
Data and lead agencies	Agencies responsible for housing, urban planning.
Comments	Related indicator: % land use

10. Reduction in generation of industrial and municipal solid waste	
Definition & meaning	The precise definition of what constitutes solid waste is variable, but principally it can be considered as that material which has no further useful purpose and is discarded. It is, therefore, perceived to have no commercial value to the producer. This does not, however, preclude it being of value to some other party. Municipal wastes are produced by a variety of establishments in the urban environment in addition to households, institutions such as schools, government buildings, commercial establishments such as hospitals and hotels, and some scattered sources of hazardous wastes. Solid waste is generally produced in three ways: through the production and consumption of goods and services; through the processing of wastes from these services; and through end-of-pipe control or treatment of emissions.
Rationale	Solid waste is explicitly expressed as a concern in the Caribbean SIDS, which lack the resources including capacity and land space for waste disposal (UNEP 2005). This is compounded by the change in the composition of the solid waste produced from organic waste to inorganic, non-biodegradable material. This indicator captures the risk to terrestrial and aquatic ecosystems, as well as to human health from municipal and industrial solid wastes. All such wastes need a suitable area of land for their eventual disposal. High waste loads present risks to all aspects of the environment and are aesthetically unpleasant. The effects of dumping large amounts of wastes into the environment and beyond its capacity to attenuate them would be especially important if there are many endangered species, sensitive ecosystems, and interactions with on-going human impacts.
Policy relevance	BPoA; ILAC; UNCSD; GPA; LBS Protocol
Data and lead agencies	United Nations Centre for Human Settlements: http://www.urbanobservatory.org/indicators/database http://www.who.orgWHO: http://www.who.org
Comments	Solid waste disposal (quantity properly disposed of), which is easier to measure, may be a suitable proxy measure for this indicator. Related indicators: Generation of industrial waste; % waste properly disposed of/recycled/reused

11. Increase in proportion of waste properly disposed of/recycled/reused (waste management)	
Definition & meaning	This indicator captures the proportion of wastes rendered less harmful through proper disposal, reuse or recycling. It shows the volume of waste which is properly disposed of/reused/recycled based on the volume actually generated at source on a per capita basis.
Rationale	Waste management is one of the major environmental issues in the CARICOM region. Growth in urban population, industrial activity, and tourism continues to outstrip infrastructural capacity to handle waste. Waste reuse and recycling are important components of a sustainable approach for waste management. Proper disposal, treatment, reuse and recycling of waste are effective means of reducing the overall waste load in a country and reducing its impact on the environment and human health. By stimulating recycling and reuse, landfill capacity is conserved and operational costs for waste management reduced. There is also the benefit of increased income generation for the urban poor through recycling schemes. While several of the Caribbean SIDS have embarked on waste recovery and recycling programmes (CEHI/UNEP 2003), they are still faced with a number of constraints (e.g. financial, technological, human capacity) as regards waste management (UNEP 2005).
Policy relevance	CSME; ILAC; LBS Protocol; Mauritius Strategy; St. George's Declaration; UNCSD
Data and lead agencies	Environment Ministry; United Nations Centre for Human Settlements: http://www.urbanobservatory.org/indicators/database http://www.who.orgWHO: http://www.who.org
Comments	Related indicators: Population with access to solid waste collection. It is also associated with some of the indicators for human settlements, industrial activity and financial mechanisms, such as percent of population in urban areas, and environmental protection expenditures. Also pertains to other types of waste (e.g. sewage)

12. Energy consumption	
Definition & meaning	The amount of energy - liquids, solids, gases and electricity– consumed in a given year in a given country or geographical area. The indicator is a widely used measure of access to and use of energy, individual and industrial energy consumption patterns and the energy intensity of a society.
Rationale	Energy is a key factor in industrial development and in providing vital services that improve the quality of life. However, its production, use, and byproducts have resulted in major pressures on the environment, both from a resource use and pollution point of view. The decoupling of energy use from development represents a major challenge of sustainable development in SIDS. The long-term aim is for development to continue through gains in energy efficiency rather than increased consumption and a transition towards the use of renewable energy resources. UNFCC and the Kyoto Protocol call for limitations on total greenhouse gas emissions, which are dominated by COs from the combustion of fossil fuels.
Policy relevance	ILAC; MDG 7, T9; St. George's Declaration; UNFCCC Kyoto Protocol
Data and lead agencies	UNDESA (www.un.org/Depts/unsd); UNFCCC Secretariat
Comments	Relate indicator: Proportion of renewable energy/total energy consumed (ILAC; St. George's Declaration)

13. Increase in consumption of renewable energy resources	
Definition & meaning	The percentage of a country's total energy consumption supplied from renewable energy sources. This indicator measures the proportion of energy mix between renewable and non-renewable energy resources.
Rationale	Chapter 4 of Agenda 21 calls for an improvement of efficiency in the use of energy sources and for a transition towards the use of renewable resources. Energy is a key aspect of consumption and production. Dependence on non-renewable resources can be regarded as unsustainable in the long term. Renewable resources, on the other hand, can supply energy continuously under sustainable management practices and their use in general creates less environmental pressure. The ratio of non-renewable to renewable energy resources represents a measure of a country's sustainability. While a number of the SIDS are slowly introducing renewable energy, of which there is considerable potential (e.g. wind, solar), they still remain largely dependent on fossil fuels.
Policy relevance	Agenda 21; ILAC; St. George's Declaration; UNFCCC Kyoto Protocol
Data and lead agencies	Energy Ministry

14. Reduction in carbon dioxide emissions	
Definition and meaning	*Carbon dioxide emissions per capita* is the total amount of carbon dioxide emitted by a country as a consequence of human (production and consumption) activities, divided by the population of the country. National reporting to the UNFCCC, which follows the Intergovernmental Panel on Climate Change guidelines, is based on national emission inventories and covers all sources of anthropogenic carbon dioxide emissions, less carbon sinks (such as forests). Annual CO2 emissions in tonnes. Emissions of CH4, N2O, HFCs, PFCs and SF6 can be converted to CO2 equivalents using 100 year global warming potentials (a measure of how much a given mass of greenhouse gas is estimated to contribute to global warming) provided in the IPCC Assessment Report 2001 (http://www.grida.no/climate/ipcc_tar/wg1/index.htm).
Rationale	The indicators signify the commitment to reducing carbon dioxide emissions and progress in phasing out the consumption of CFCs by countries that have ratified the Montreal Protocol. Carbon dioxide emissions are largely a by-product of energy production and use. They account for the largest share of greenhouse gases associated with global warming. Although SIDS contribute a very small proportion of total GHG, they are most vulnerable to the impacts of global warming and climate change.
Policy relevance	BPoA; St. George's Declaration; UNFCCC; MDG 7, T9; ILAC; UNCSD
Data and lead agencies	Environment Ministry; Energy Ministry; IPCC (http://www.ipcc.ch; UNFCCC (http://www.unfccc.int.

15. Reduction in emissions of greenhouse gases (GHG)	
Definition	Anthropogenic emissions, less removal by sinks, of the greenhouse gases carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF6), chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs), together with the indirect greenhouse gases nitrogen oxides (NOx), carbon monoxide (CO) and non-methane volatile organic compounds (NMVOCs). Emissions of CH4, N2O, HFCs, PFCs and SF6 can be converted to CO_2 equivalents using 100 year global

	warming potentials (GWPs) provided in the IPCC Second Assessment Report (1995).
Rationale	This indicator measures the emissions of the six main GHGs which have a direct impact on climate change, less the removal of the main GHG CO2 through sequestration as a result of land-use change and forestry activities. GHGs contribute in varying degrees to global warming depending on their heat absorptive capacity and their lifetime in the atmosphere. Although SIDS contribute a very small proportion of total GHG, they are most vulnerable to the impacts of global warming and climate change.
Policy relevance	ILAC; MDG; UNFCCC Kyoto Protocol
Data and lead agencies	Environment Ministry; Energy Ministry; UNFCCC Secretariat; IPCC

16. Reduction in the use of fertilizers	
Definition & meaning	Extent of fertilizer use in agriculture per unit of agricultural land area. The purpose of this indicator is to measure the intensity of fertilizer use in agriculture. Data on the quantities of fertilizers used are converted into the three basic nutrient components and aggregated. The three components are nitrogen (N), phosphorous (P205), and potassium (K20).
Rationale	This indicator shows the potential environmental pressure from agricultural activities. Extensive fertilizer use is linked to eutrophication of water bodies, soil acidification, and potential of contamination of water supply with nitrates. The actual environmental effects will depend on pollution abatement practices, soil and plant types, and meteorological conditions. Agriculture makes a significant contribution to the economy of most of the Caribbean SIDS, which annually import and apply large quantities of agricultural fertilizers. The steep topography of most of the islands and cultivation on hillsides promote the movement of fertilizers to coastal areas in these countries.
Policy relevance	CSME; GPA; LBS Protocol; UNCSD
Data and Lead agencies	Agriculture Ministry; FAO; FAO Compendium of Agricultural Indicators (www.fao.org/es/ess/os/envi_indi/part_11.asp)
Comments	This indicator does not include organic fertilizer from manure and crop residues, or the application of fertilizers to grasslands. The indicator assumes even distribution of fertilizer on the land. A more relevant and sophisticated indicator would focus on *nutrient balance* to reflect both inputs and outputs associated with all agricultural practices. This would address the critical issue of surplus or deficiency of nutrients in the soil. Related indicator: Nutrient loads in water bodies; Increase in organic farming.

17. Reduction in the use of agricultural pesticides	
Definition & meaning	Refers to the use per hectare /sale to the agricultural sector of substances that reduce or eliminate unwanted plants or animals, especially insect pests. They include major groups of pesticides such as insecticides, mineral oils, herbicides, plant growth regulators, bacteria and seed treatments, and other active ingredients.
Rationale	Agricultural pesticides add persistent organic chemicals to ecosystems. Pesticides can be persistent, mobile, and toxic in soil, water, and air; and can have severe impact on humans and wildlife through the food chain. Use of pesticides can have wide implications for the environment. They can accumulate in soil and biota, and residues may reach surface and groundwater through leaching. Some agricultural pesticides are banned by international trade agreements. The generalized use of pesticides and pest control is a key issue in the WCR (UNEP 1999).

	Agriculture makes a significant contribution to the economy of most of the Caribbean SIDS. These countries import large quantities of pesticides, which are extensively used in agriculture and reach the coastal and marine environments via rivers and atmospheric transport. The steep topography of most of the islands and cultivation on hillsides encourage soil erosion and the movement of pesticides to coastal areas.
Policy relevance	CSME; GPA; LBS Protocol; UNCSD
Data and Lead agencies	Agriculture Ministry; FAOSTAT http://apps.fao.org; FAO Compendium of Agricultural Indicators (www.fao.org/es/ess/os/envi_indi/part_11.asp)
Comments	This indicator provides an aggregation, which ignores toxicity, mobility, and level of persistence; and spatial and application variances. Related indicator: Increase in organic farming.

Environmental Status & Socioeconomic Indicators Descriptions

1. Surface and ground water levels	
Definition & meaning	Level of water in major rivers and streams, and in groundwater aquifers.
Rationale	Surface and ground water levels are affected by a number of factors, including changing vegetation cover, land degradation, climate and water withdrawal rate. Surface and ground waters are important sources of freshwater for human uses as well as for maintaining ecosystem health, and are the main sources of freshwater in the Caribbean SIDS (UNEP 2005). Changes in water levels could also reflect periods of floods or drought. Monitoring of aquifer water levels over a period of time provides information on aquifer recharge rate, increase in which is a stress reduction indicator.
Policy relevance	CCD; CBD; MDG.
Data and lead agencies	National agencies responsible for water resources. World Water Assessment Programme (UNESCO) – World Water Development Report; FAO Aquastat (www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm); CIMH (www.cimh.org) CARDI/PROCICARIBE Caribbean Land and Water Resources Network (www.procicaribe.org/networks/clawrenet/index.htm)
Comments	Related indicators: Reduction in annual withdrawals of surface and groundwater (SRI); Increase in aquifer recharge rate (SRI); River flow regimes.

2. River flow regimes	
Definition & meaning	Volume of water discharged per unit time from major rivers and streams. An indication of periods of floods and drought.
Rationale	Changing vegetation cover, deforestation, land conversion and land degradation generally affect the water holding capacity of ecosystems. These changes directly affect the magnitude and timing of run off and the intensity and frequencies of flooding and drought. Changes in flood and drought periods can provide a measure of the status of water control and water precipitation functions in the river basin. Increase in floods and drought periods also often reflect a change in weather patterns. The impact of climate change on water resources is a critical issue in the Caribbean (UNEP 2005), making it even more of an imperative for SIDS to protect their

	watersheds and water resources from further degradation.
Policy relevance	UNCBD; UNCCD
Data and lead agencies	National and regional hydrographic/hydrologic agencies, water resources agencies. World Water Assessment Programme (UNESCO) – World Water Development Report; FAO Aquastat (www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm)
Comments	Related indicators: Surface water level; Mean annual rainfall

3. Mean annual rainfall	
Definition & meaning	Average annual rainfall at country level (or average monthly rainfall for intra-annual rainfall variability).
Rationale	This indicator reflects the country's vulnerability to drought, dry spells, and stress on surface water resources, as well as to flooding. Deviation from the mean annual rainfall could indicate shifts in weather patterns and climate, and could negatively affect a country's resilience to other hazards (e.g. fires, water movements, ability of ecosystems to attenuate pollution).
Policy relevance	UNFCCC
Data and lead agencies	Meteorological offices; CIMH (http://www.cimh.org)
Comments	Related indicators: Water availability; River flow regimes; Surface and groundwater levels; Aquifer recharge rate

4. Area of selected key ecosystems	
Definition & meaning	Remaining area per ecosystem type per country or region, i.e. Remaining natural area not being converted into other uses. It is a direct measure of biodiversity loss: a loss of X% area of an ecosystem type will approximately result in a similar loss of the *mean* abundance of its ecosystem-specific species. The indicator does not measure the actual biodiversity and its loss within the remaining ecosystem (ecosystem quality), only its spatial potential.
Rationale	In the Caribbean SIDS, key ecosystems include forests, coral reefs, mangroves and seagrass beds, on which their wellbeing and socio-economic development depend. For instance, mangroves, seagrasses and coral reefs play an important ecological role. This includes harbouring high biological diversity, providing nursery grounds for the juveniles of many commercially important fish species, as well as providing coastal protection and stabilization against storm surges and erosion. Many biological resources, at gene, species and ecosystem level, are currently at risk of modification, damage or loss through destruction and degradation of key ecosystems, and through excessive living resource extraction. Physical alteration and degradation of ecosystems is among the principal environmental problems for the smaller islands (UNEP 2005). This indicator uses trends in the extant area of identified key ecosystems to assess the relative effectiveness of measures for conserving biodiversity (and natural resources) at ecosystem level and as a tool to estimate the need for specific conservation measures to maintain biological diversity.
Policy relevance	BPoA; CSME; CCA; CANARI; GPA; MDG; NBSAP; RAMSAR; SPAW Protocol; St. George's; UNCBD; UNCSD
Data and lead agencies	FAO; UNEP-WCMC/IUCN world database of protected areas (www.unep-wcmc.org/wdpa/); IUCN (www.iucn.org); CBD Secretariat: Global Biodiversity Assessment 2002, Country profiles

	www.cbd.int/countries/default.shtml), (www.cbd.int/doc/world/default.asp); IABIN (http://www.iabin.net/index.php) CARICOMP (www.mona.uwi.edu/cms/caricomp.htm; www.ccdc.org.jm/caricomp.html); Reefs at Risk in the Caribbean; AGRRA (coral.aoml.noaa.gov/agra/); UNEP-WCMC (www.unep-wcmc.org/GIS/coraldis/index.cfm); Reefcheck (www.reefcheck.org); GCRMN (www.gcrmn.org/default.aspx) UNEP-WCMC World Atlas of Seagrasses (www.unep-wcmc.org/marine/seagrassatlas/index.htm) FAO Global Forest Assessment; FAO Status & Trends in Mangroves; FAO country mangrove extent (www.fao.org/docrep/007/j1533e/J1533E03.htm#P1966_37230); UNEP-WCMC World Mangrove Atlas (bure.unep-wcmc.org/imaps/marine/mangroves/viewer.htm)
Comments	Does not always indicate the quality of the ecosystem. Related indicators: Area live coral cover; Area coral reef affected by bleaching/diseases

5. Abundance of selected key species	
Definition & meaning	This indicator uses estimates of population trends in selected species (including threatened, invasive, keystone and indicator species) to represent changes in biodiversity, and the relative effectiveness of measures to maintain biodiversity. Species abundance is a measure or proximate of the number of individuals of a single species. This can be measured in many ways. Because loss of biodiversity is characterized by a decrease in abundance of many species and an increase of a few other species, this indicator provides a direct measure of biodiversity loss.
Rationale	The CBD recognizes that biodiversity has its own intrinsic value and that biodiversity maintenance is essential for human life and sustainable development. Many biological resources in the Caribbean SIDS, at gene, species and ecosystem level, are currently at risk of modification, damage or loss as a result of human and natural pressures. The Caribbean SIDS have a high level of endemism and high species extinction rate (UNEP 2005). This indicator helps to track changes in abundance of key species and the success of/ need for measures to protect ecosystems and biodiversity. It illustrates the effectiveness of national measures designed to conserve biological diversity and ensure its use is sustainable, including the measures implemented in fulfillment of obligations accepted under the CBD.
Policy relevance	CANARI; CSME; CCA; CITES; IUCN; MDG; NBSAP; Ramsar; SPAW Protocol; St. George's Declaration; UNCBD; UNCSD
Data and lead agencies	National agencies responsible for biodiversity protection; IABIN; WWF (http://panda.org/livingplanet/lprreport.cfm); IUCN (www.iucn.org); UNCBD: Global Biodiversity Assessment 2002, Country profiles (www.cbd.int/countries/default.shtml), www.cbd.int/doc/world/default.asp; UNEP-WCMC/IUCN world database of protected areas (www.unep-wcmc.org/wdpa/), (http://www.unep-wcmc.org/species/reports/); IABIN (http://www.iabin.net/index.php); CARICOMP (www.mona.uwi.edu/cms/caricomp.htm; www.ccdc.org.jm/caricomp.html); Reefs at Risk in the Caribbean; AGRRA (coral.aoml.noaa.gov/agra/); UNEP-WCMC (www.unep-wcmc.org/GIS/coraldis/index.cfm); Reefcheck (www.reefcheck.org); GCRMN (www.gcrmn.org/default.aspx)
Comments	Related indicator: Area of selected ecosystems.

6. Annual fish catch (Total and by major species)	
Definition & meaning	Annual catch of major species or total annual catch (all species) in relation to spawning biomass (not always known). This indicator, in particular, if the data on spawning biomass are available, can provide a snapshot of the present status of a stock/species in a given country/area with respect to past trends. A reduced spawning biomass or a very high ratio of the catch peak value with respect to present catches, can be considered as a warning that the fisheries could soon become unsustainable. However, it is necessary to take into account the high variability of populations of some commercial marine species as a consequence of changes of environmental conditions.
Rationale	Marine fisheries are an important source of food, income and employment in SIDS. Fishing pressure beyond that required for maximum sustainable yield (or optimum yield) and destructive fishing gear have resulted in overexploitation of most of the inshore fish stocks in the Caribbean SIDS, as evidenced by declining fish catches and a decrease in individual sizes. Some of the offshore fish stocks are also in danger of being overfished as a result of increasing fishing effort for these species. Overfishing can also result in biodiversity loss, for instance, loss of top predators in the ecosystem through selective removal. Trends in annual fish catch provide an indication of fisheries sustainability and the need for intervention to address overfishing.
Policy relevance	CSME; CITES; FAO Code of Conduct; ILAC; MDG; UNCBD; UNCLOS; UNCSD
Data and lead agencies	National Fisheries Divisions; CFRAMP; CRFM; FAO. FAO State of the World Fisheries & Aquaculture; FAO review of world fishery resources; Yearbook of Fisheries Statistics; FISHSTAT; Figis (www.fao.org); Univ. British Columbia Fisheries Centre Sea Around Us project (www.seaaroundus.org)
Comments	Related indicator: Reduction in fishing effort (SRI). Catch/unit effort is an indicator of fish stock abundance.

7. Forest/natural vegetation cover	
Definition & meaning	The amount of natural and plantation forest or natural vegetation cover in a country. As defined by the FAO Global Forest Resources Assessment, forest includes both natural forests and forest plantations. It refers to land with an existing or expected tree canopy of more than 10% and an area of more than 0.5 ha where the trees should be able to reach a minimum height of 5 m. Excluded are stands of trees established primarily for agricultural production, such as fruit tree plantations. A number of the SIDS do not have extensive forest cover (according to the FAO definition), and natural vegetation cover might be more appropriate in these countries. The proportion of land area covered by forest is the forest area as a proportion of total land area, where land area is the total surface area of the country less the area covered by inland waters. The comparison of forest/vegetation area over time using reference years allows the calculation of change in absolute values, and as a percentage of the deforestation rate.
Rationale	Forests fulfill a number of vital functions, including the provision of goods (timber and non-timber products) and services such as protection against flooding, habitat for biodiversity, carbon sequestration, watershed protection, soil conservation and a filter for pollutants. Deforestation could impact on coastal areas through, e.g., promoting

	soil erosion and deposition of sediments in coastal ecosystems. Changes in forest area reflect the demand for land for other competitive uses, and through timber extraction, fire, etc. The higher the deforestation rate, the more critical the forestry situation is in the country. In the past few decades, the Caribbean SIDS have experienced significant deforestation and associated impacts such as severe flooding and landslides (UNEP 2005).
Policy relevance	Agenda 21; CCA; CANARI; CSME; CITES; ILAC; MDG 7, Target 9; Ramsar; St. George's Declaration; UNCBD; UNCCD; UNFCCC; UNCSD
Data and lead agencies	National agencies responsible for forestry; FAO; Int'l Tropical Timber Org (www.itto.or.jp). FAO (2005). Global Forest Resources Assessment, 2005. http://www.fao.org/forestry/fo/fra. FAO (2003 and biennial). State of the World's Forests. http://www.fao.org/DOCREP/005/Y7581E/Y7581E00.HTM. Country data at www.fao.org/forestry/site/country/en/; FAO Aquastat (www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm); CARDI/PROCICARIBE Caribbean Land and Water Resources Network (www.procicaribe.org/networks/clawrenet/index.htm); National agriculture census (FAO); FAO Compendium of Agricultural Indicators (www.fao.org/es/ess/os/envi_indi/part_11.asp); Caribbean Vegetation and Landcover Mapping Initiative (edcintl.cr.usgs.gov/tnc/index.html); Caribbean Vegetation Atlas by country (edcintl.cr.usgs.gov/tnc/products/atlas.html); UNCCD (www.unccd.int/cop/officialdocs/menu.php)
Comments	The proportion of *total* forest cover (including both natural forest and plantation) may underestimate the rate at which natural forest is disappearing in some countries. The area figure does not give any indication of the quality of the forest, its ecosystem context, nor forest values or practices. Related indicator: % land use; Reduction in deforestation rate (SRI)

8. Land affected by desertification (land degradation)	
Definition & meaning	This is a measure of the amount of land affected by desertification (degradation) as a proportion of national territory. The indicator describes the extent and severity of desertification at the national level. *Land degradation* means reduction or loss of the biological or economic productivity and complexity of rainfed cropland, irrigated cropland, or range, pasture, forest and woodlands resulting from inappropriate land uses and other processes.
Rationale	This indicator shows the extent and severity of land degradation at the local/national level. Trend data over time can indicate success of response mechanisms. Land degradation has serious implications for sustainable development for many SIDS, which have limited land area. In these countries, human activities and habitation patterns are causing land degradation, which is caused by a number of processes such as soil erosion; deterioration of the physical, chemical and biological or economic properties of soil; and long-term loss of natural vegetation.
Policy relevance	Agenda 21; UNCCD; UNCSD; UNCBD
Data and lead agencies	Natural Resources, Agriculture, Forestry Ministries; FAO See also Forest/vegetation cover.
Comments	Related indicators: Forest/vegetation cover; % land use.

9. % Land use change	
Definition & meaning	% land under different uses (e.g. natural vegetation cover, urban areas, agriculture). Monitoring of the area under different land uses over time provides an indication of land use change.
Rationale	The state of terrestrial resources is influenced by land use patterns and the absence of initiatives that ensure sustainable land use results in the inefficient use of these resources and land use conflicts. The conversion of lands from their natural state due to urbanization, industrialization or agricultural development is a major issue in the Caribbean countries, which have been undergoing rapid land use changes (UNEP 2005). The present land use pattern in the Caribbean SIDS has developed primarily as a result of historical demands in developed countries for tropical export crops rather than from the characteristics of the climate, soil, topography, and natural vegetation (FAO 2002). Among the problems resulting from these demand-driven land use patterns is the issue of land tenure - land distribution in the region has been characterized by the inequitable distribution of property and the lack of land titles.
Policy relevance	CSME; ILAC; UNCSD; UNCBD
Data and lead agencies	Agencies responsible for planning, housing, agriculture, lands and surveys depts. See also Forest/vegetation cover.
Comments	Related indicators: Forest/vegetation cover; Ratio cultivated to natural land cover; Area formal and informal urban settlements.

10. Concentration of *E. coli*/faecal coliforms in surface and ground waters	
Definition & meaning	Refers to the concentration of *E. coli*/faecal coliforms in freshwater supply and aquatic ecosystems, as well as the proportion of freshwater resources destined for potable supply containing concentrations of faecal coliforms that exceeds the levels recommended in the WHO Guidelines for Drinking-water Quality. The indicator assesses the quality of water available to communities for basic needs and identifies communities where contamination of water with human and animal excreta at source or in the supply is posing a threat to health. It also identifies ecosystems where fecal contamination is a risk to ecosystem health and natural living resources as well as to human health (e.g. bathing beaches, aquaculture facilities, shellfish beds).
Rationale	The concentration of faecal coliforms in water bodies is an indirect indicator of contamination with human and animal excreta. Water contaminated with human and animal excreta poses a serious health risk and is therefore unsuitable for potable supply unless it has been suitably treated. *E. coli* is the preferred/recommended faecal contamination indicator. This measure indicates situations where treatment is required or has to be improved to guarantee safety of water supply. It also indicates the need for adequate treatment/ disposal of sewage. Sewage is regarded as one of the most important and widespread causes of degradation of the coastal environment in the Caribbean (Siung-Chang 1997). Microbiological pollution from the discharge of untreated sewage (because of inadequate sewage treatment/disposal facilities) is severe in the Caribbean SIDS and poses a serious threat to human health from direct contact with polluted waters or from the consumption of contaminated fish and shellfish (UNEP 2004a, 2004b). In the SIDS, faecal contamination of aquatic ecosystems is of major concern, especially in coastal areas that are important for fishing, tourism and recreation.
Policy relevance	Caribbean Action Plan; CSME; GPA; LBS Protocol; UNCBD; UNCSD

Data and lead agencies	Water supply utilities, Environment and Health Ministries, environmental laboratories (e.g. CEHI, IMA), GESAMP; public health laboratories, UNEP CAR-RCU, WHO
Comments	Related indicator: Increase in sewage treatment (SRI); Increase in population with access to sanitation facilities (SRI)

11. Algae concentration in coastal waters	
Definition & meaning	This indicator uses the concentration of algae growing in coastal waters to represent the health of the coastal ecosystem, and the effectiveness of measures to reduce nutrient inputs from land run-off and discharge.
Rationale	Inputs of nutrients from point sources such as sewage outputs and non-point or diffuse sources like fertilizer run-off from agricultural practices cause increases in growth of algae. Proliferations of microalgae in marine or brackish waters can cause massive fish kills, contaminate seafood with toxins, and alter ecosystems. Elevated algal concentrations in coastal waters reflect high nutrient inputs, which can represent serious threats to coastal ecosystem health. A large concentration of algae restricts the available light, reduces dissolved oxygen levels and may increase sedimentation, which smothers other organisms. Increasing concentrations of algae can also indicate threats to human and animal health by toxic algal blooms. Several of the Caribbean SIDS have reported elevated nutrient levels and algal blooms in coastal areas to be of concern. This indicator can illustrate the effectiveness of measures designed to reduce nutrient inputs in accordance with the goals of the Caribbean Regional Sea Convention and Action Plan.
Policy relevance	CSME; GPA; LBS Protocol; UNCBD; UNCSD
Data and lead agencies	Environment Ministries; GESAMP; GPA; GOOS; IMO; LBS Protocol; UNEP CAR-RCU
Comments	Direct measurement of nutrient inputs to coastal zones from both point and non-point sources could provide an alternative indicator, but would be costly. Related indicators: Chlorophyl-*a* concentration; Nutrient loads; indicators relating to fisheries, biodiversity, fresh water quality and fertilizer use.

12. Incidence of HABs and fish kills	
Definition & meaning	Annual occurrence (number) of Harmful Algal Blooms (HABs) and fish kills. Areal extent of HABs and fish kills, and number of fish dead per incident, also provide further qualitative information on the severity of these phenomena.
Rationale	Elevated inputs of nutrients (mainly from landbased sources – sewage, agricultural fertilizers, but also from boats and ships) to aquatic ecosystems in the Caribbean SIDS cause eutrophication, algal blooms (sometimes toxic red tides) and fish kills. The severity of algal blooms can be affected by climate variability. The incidence of these phenomena has been reported in a number of the SIDS, where they frequently occur in semi-enclosed bays and harbours (e.g. Beltran *et al*. 2002; Webber and Clarke 2002). HABs are frequently the cause of very serious human illness when the biotoxins produced are ingested in contaminated seafood. The illnesses most frequently associated with marine biotoxins include paralytic shellfish poisoning and ciguatera poisoning. The risk of ciguatera poisoning is high where algal biomasses are significantly elevated due to eutrophication, such as in

	nutrient/sewage-enriched areas (PNUMA 1999). In addition to being a threat to human health, these phenomena also impact on ecosystem structure and function (incl. biodiversity).
Policy relevance	BPoA; GPA; LBS Protocol; SPAW Protocol; UNCBD
Data and lead agencies	CANARI; CCA; Environment Ministries; Fisheries Divisions; Environmental Health Laboratories (CEHI, IMA)
Comments	Related indicators: Nutrient loads in aquatic ecosystems

13. Heavy metals and POPs in the environment	
Definition & meaning	Concentration of heavy metals (e.g. lead, mercury) and persistent organic pollutants (POPs) in water, soil, sediments, and aquatic organisms.
Rationale	Heavy metals are very persistent in the aquatic environment, bio-accumulate in marine organisms, and are highly toxic to humans when consumed. Pollution by heavy metals arises from a number of sources, including industrial point sources, such as the petroleum industry (oil refineries and petrochemical plants), chemical industries, pesticide production, and metal and electroplating industries. Hg and Pb are of greatest concern because of their high toxicity in certain forms and their transport over long distances in the atmosphere. Other metals of concern are As, Cd, Cr, Cu, Ni, Se, Sn, and Zn. Elevated levels of heavy metals have been recorded in coastal areas near a number of heavily industrialized centres ('hotspots') in the Caribbean SIDS (GEF/UNDP/UNEP 1998, UNEP 1999, Beltrán *et al*. 2002). While POPs may not be a priority for the smaller SIDS with limited industrial development, studies in the Caribbean documented in UNEP/GEF (2002) showed that POPs such as aldrin, DDT, DDE, endosulfan, and lindane have been detected in some areas ('hotspots'), for example, in sediments in Portland and Kingston Harbour (Jamaica), the southwest coast of Cuba, and coastal areas of St. Lucia, as well as in marine biota in these countries. Several sources of POPs have been identified, with the most important being the agriculture, energy and industrial sectors, as well as incineration of domestic, industrial and agricultural waste (UNEP/GEF 2002).
Policy relevance	CSME; GPA; LBS Protocol; Rotterdam Convention; Stockholm Convention; UNCSD
Data and lead agencies	Environmental laboratories (e.g. CEHI, IMA); Environment and Health Ministries
Comments	Related indicators: Reduction in pesticide use (SRI); Concentration of agricultural chemicals and other pollutants; Increase in volume of industrial waste produced/treated (SRI).

14. Suspended solids in rivers and coastal waters	
Definition & meaning	An indication of soil stability within the watershed/coastal area. The rate of soil loss and thus river loads of suspended solids depend on a number of factors such as deforestation, unsustainable agricultural practices, climate and soil characteristics. Soils with high silt content (e.g., loess soils) are more susceptible to erosion than soils with low silt content. Therefore baseline values are river-basin specific.
Rationale	Increasing load of suspended solids, mainly sediments, in aquatic systems is related to soil erosion arising from conversion of natural ecosystems into agriculture, deforestation and degradation of ecosystems by human activities, among others. In many of the SIDS, this is exacerbated by cultivation and habitation of hillsides, which

	accelerate the mobilization and transport of sediments to downstream, including coastal areas. Suspended solids can have detrimental effects on aquatic ecosystems, particularly coral reefs, by blocking light penetration and smothering of organisms. Its deposition could also alter the flow of water. In a regional overview of land-based sources and activities affecting the marine, coastal and associated freshwater environments in the Wider Caribbean Region, almost all the countries, including several Caribbean SIDS, included high levels of sediments in the coastal zone among the major environmental problems they face (UNEP 1999). In fact, in the OECS, sediment mobilization was ranked as the first environmental priority.
Policy relevance	GPA; LBS Protocol; UNCBD; UNCCD
Data and lead agencies	National agencies responsible for agriculture, forestry, environment.
Comments	Related indicators: Sand mining; Forest/natural vegetation cover; Area of land degraded

15. Nutrient loads in water bodies	
Definition & meaning	Concentration of Nutrients (N, P, K) in rivers, coastal areas
Rationale	The predominant source of nutrients in aquatic ecosystems is the discharge of untreated sewage, as well as non-point agricultural run-off as a result of the large quantities of agricultural fertilizers applied annually in the SIDS. The total estimated nutrient load from land-based sources in the Caribbean Sea is 13,000 tonnes/yr of nitrogen and 5,800 tonnes/yr of phosphorus (UNEP 2000). Increasing population densities, conversion of natural ecosystems and intensifying agricultural production often result in increasing riverine nutrient fluxes. Elevated nutrient inputs into coastal areas are associated with a range of conditions, including HABs, changes in the aquatic community structure, decreased biological diversity, fish kills, and oxygen depletion in the water column. Low oxygen conditions have led to significant losses of fish and shellfish resources. Organic and nutrient pollution is among the most widespread and possibly the most serious marine pollution problem in the Caribbean (Siung-Chang 1997; GESAMP 2001), and several of the SIDS have reported high nutrient levels in coastal areas to be of concern (UNEP 1999).
Policy relevance	GPA; LBS Protocol; UNCBD; UNCSD
Data and lead agencies	Environmental laboratories (CEHI, IMA); Environment Ministries; Water Resources Agencies; UNESCO-IOC (Global Nutrient Export from Watersheds project – www.ioc-unesco.org)
Comments	Related indicators: Agricultural fertilizer use; sewage treatment; population with access to sewerage facility

16. Biochemical oxygen demand (BOD) in water bodies	
Definition	BOD measures the amount of oxygen required or consumed for the microbiological decomposition (oxidation) of organic material in water.
Rationale	The purpose of this indicator is to assess the quality of water available to consumers in localities or communities for basic and commercial needs. It is also one of a group of indicators of aquatic ecosystem health. The presence of high BOD may indicate faecal contamination or increases in particulate and dissolved organic carbon from non-human and animal sources that can restrict water use and economic development, necessitate expensive

	treatment and impair ecosystem health. Inadequate organic waste (including sewage) treatment and disposal in the Caribbean SIDS increases the potential for elevated BOD in their aquatic ecosystems. Increased oxygen consumption poses a potential threat to a variety of aquatic organisms, including fish. It is important to monitor organic pollution to identify areas posing a threat to health, to identify sources of contamination, to ensure adequate treatment, and provide information for decision-making to enhance water sustainability.
Policy relevance	CSME; GPA; LBS Protocol; UNCBD; UNCSD
Data and lead agencies	Environmental laboratories (e.g. CEHI, IMA); WHO; UNEP Global Environment Monitoring System (GEMS/Water) Collaborating Centre; UNICEF; United Nations Centre for Human Settlements (Habitat); FAO.
Comments	Related indicator: Those related to waste treatment and disposal, sewage facilities

17. Ambient concentration of air pollutants in urban and industrial areas	
Definition & meaning	Ambient air pollution concentrations of ozone, carbon monoxide, particulate matter, sulphur dioxide, nitrogen dioxide, nitrogen monoxide, volatile organic compounds including benzene (VOCs) and lead. The indicator provides a measure of the state of the environment in terms of air quality and is an indirect measure of population exposure to air pollution in urban/industrial areas. It also relates to atmospheric deposition of contaminants in coastal and marine areas.
Rationale	An increasing percentage of the population in the SIDS lives in urban areas. High population density and the concentration of industry exert great pressures on local environments. Air pollution from households, industry power stations and transportation (motor vehicles), is often a major problem in many of these countries. As a result, the greatest potential for human exposure to ambient air pollution and subsequent health problems occurs in urban areas. The domestic use of solid fuels also produces certain air pollutants, which endanger human health. Improving air quality is a significant aspect of promoting sustainable human settlements.
Policy relevance	CSME; UNCSD
Data and lead agencies	Environmental laboratories (e.g. IMA, CEHI); Environmental Management Authority (T&T); WHO air quality guidelines for all the pollutants of this indicator, except nitrogen monoxide (www.who.org). Many countries have established their own air quality standards for many of these pollutants.

18. Water availability/capita	
Definition & meaning	The amount of water needed to satisfy metabolic, hygienic, and domestic requirements. This is usually defined as 20 litres of safe water/person/day.
Rationale	A number of the Caribbean SIDS are vulnerable to variable freshwater supplies and shortages, and have been classified as 'water scarce' countries, i.e. available water/capita falls below the international limit of 1,000 m^3 /capita/year (FAO 2003).This situation is critical in the low limestone islands of the Eastern Caribbean. Water demand has increased in the past 30 years in the Caribbean SIDS, with growing population and increasing tourism, urbanization and industrialization, and has often surpassed natural capacity (UNEP 2005). This is compounded by transmission losses from poor maintenance of infrastructure, variable rainfall patterns and watershed degradation.
Policy relevance	CSME; ILAC; St. George's Declaration

Data and lead agencies	National agencies responsible for water resources; FAO; WHO/UNICEF (2000) Global Water Supply and Sanitation Assessment 2000 Report. http://www.who.int/docstore/ water_sanitation_health/Globassessment/GlobalTOC.htm World Water Assessment Programme (UNESCO) – World Water Development Report; FAO Aquastat (www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm); CIMH
Comments	Related indicator: Water consumption/capita

19. Population with access to clean drinking water	
Definition & meaning	Proportion of population with access to an improved water source in a dwelling or located within a convenient distance from the user's dwelling.
Rationale	Accessibility to improved water sources is of fundamental significance to lowering the risk and frequency of diseases associated with poor hygiene and unsafe water.
Policy relevance	Agenda 21; ILAC; Mauritius Strategy; MDG 7, T10; St. George's Declaration; UNCSD
Data and lead agencies	National Water and Sewerage Authority; Min. Health. International targets for this indicator have been established under WHO. WHO/UNICEF (2000). *Global Water Supply and Sanitation Assessment 2000 Report*. http://www.who.int/docstore/water_sanitation_health/Globassessment/GlobalTOC.htm. World Water Assessment Programme (UNESCO) – World Water Development Report; FAO Aquastat (www.fao.org/ag/agl/aglw/aquastat/dbase/index.stm); CIMH
Comments	Other related indicators: Water availability/capita (ILAC; St. George's); Water consumption/capita (ILAC); Water use intensity by economic activity (UNCSD); population with access to clean water

20. Population with adequate sewage disposal facilities	
Definition & meaning	Proportion of population (rural, urban, total) with access to facilities for human excreta disposal/collection in the dwelling or immediate vicinity. Facilities such as sewers or septic tanks, poor-flush latrines and simple pit or ventilated improved pit latrines are assumed to be adequate, provided that they are not public. International targets for this indicator have been established under WHO. Since access to sewage disposal facilities does not necessarily mean that the wastewater is adequately treated before entering the environment, this indicator should be used with other related indicators (see comments)
Rationale	This is a basic indicator for assessing sustainable development, especially human health. Accessibility to adequate excreta disposal facilities is fundamental to decrease the risk and frequency of associated diseases and reducing environmental impacts from sewage. Elevated nutrient levels from sewage input into the aquatic environment could lead to eutrophication, HABs, contamination of seafoods, etc. Contamination of ground and surface water resources from sewage poses a human health risk.
Policy relevance	Agenda 21; ILAC; Mauritius Strategy; MDG 7, T10; St. George's; UNCSD; WSSD
Data and lead agencies	Water and Sewerage Authorities; Health, Environment Ministries. WHO/UNICEF (2000). *Global Water Supply and Sanitation Assessment 2000 Report*.

	http://www.who.int/docstore/ water_sanitation_health/Globassessment/GlobalTOC.htm
Comments	The availability of disposal and treatment facilities does not always translate into their utilization or proper functioning. Could also be expressed as % population in urban/rural areas with/without access. See also SEI: Increase in proportion of waste properly disposed of/recycled/reused (waste management)

21. Environmentally-related illnesses	
Definition & meaning	Number of reported cases of environmentally-related diseases (e.g. gastroenteritis, typhoid, malaria, dengue, cholera, accidental pesticide poisoning, respiratory diseases, etc).
Rationale	A number of illnesses are related to poor environmental quality and the presence of toxic pollutants in the environment and in the food chain. For instance, poor water quality (and quantity) is correlated with increases in the incidence of water-borne diseases (UNEP 2005). Each year incidences of environmentally-related illnesses are reported in the Caribbean SIDS, which reveals the need for improved domestic, municipal and industrial waste management, and better handling of agricultural pesticides and other toxic substances.
Policy relevance	CSME
Data and lead agencies	Health Ministry; Public Health Depts; Epidemiology Centres (CAREC); Environmental laboratories (CEHI); UNEP; WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation (www.wssinfo.org/en/25_wat_dev.html; www.wssinfo.org/en/35_san_dev.html); PAHO/WHO
Comments	Related indicators: Access to clean water; Access to sanitation; Waste production and recycling; Level of toxic substances in food chain.

22. Human and economic loss due to natural disasters	
Definition & meaning	The number of persons deceased, missing, and/or injured, and the amount of economic and infrastructure losses incurred as a direct result of a natural disaster. Provides estimates of the human and economic impact of disasters in order to measure the trends in population vulnerability (i.e. to determine whether a country is becoming more or less prone to the effects of disasters).
Rationale	The Caribbean SIDS are highly vulnerable to natural disasters (particularly climate related disasters such as storms, hurricanes, floods, landslides), the impacts of which have been increasing as a result of a number of factors (e.g. climate change, concentration of people and infrastructure in coastal zones and other vulnerable areas). Natural disasters can have devastating short and long-term impacts on the environment, society and economy of any country, adversely affecting progress towards sustainable development.
Policy relevance	BPoA; International Strategy for Disaster Reduction (ISDR); Mauritius Strategy; UNCSD
Data and lead agencies	National/regional agencies for disasters; CDERA (www.cdera.org/doccentre/index.php); CRED global disasters database (www.em-dat.net/); ISRD Secretariat (www.unisdr.org)
Comments	Linked to other indicators such as population in vulnerable or disaster prone areas.

23. Population (or area) of urban formal and informal settlements

Definition & meaning	Number of inhabitants living in urban formal and informal settlements. The indicator measures the size of formal and informal urban settlements by their population size. By focusing on the legality of human settlements, this indicator measures the marginality of human living conditions as well as the potential for degradation of land or other ecosystems. Formal settlements refer to land zoned residential in city master plans or occupied by formal housing. Informal settlements refer to: i) residential areas where a group of housing units has been constructed on land to which the occupants have no legal claim, or which they occupy illegally; ii) unplanned settlements and areas where housing is not in compliance with current planning and building regulations (unauthorized housing).
Rationale	Settlements characterized by illegality of tenure and unauthorized shelter are generally marginal and precarious, and do not cater to basic human needs such as affordable housing. They affect sustainable human settlements development, human health, and socioeconomic development. Illegal dwellers generally live in an unsafe and precarious environment, lack basic services, suffer from the absence of tenure security, and have no legal claim in case of eviction. Also, numerous illegal settlements are established on lands that are predisposed to natural disasters. Informal settlements have usually a much higher population density than formal settlements and these living conditions constitute a threat to human health.
Policy relevance	ILAC; MDG (G7, T11); UNCSD
Data and lead agencies	National agencies responsible for housing, planning and development; United Nations Centre for Human Settlements (Habitat): http://www.urbanobservatory.org/indicators/database; http://www.unhabitat.org/mdg.
Comments	Related indicators: Proportion of households with access to secure tenure (MDG Goal 7, Target 11); Population in disaster-prone areas.

24. Total population/population in coastal areas	
Definition & meaning	Total number of human inhabitants of the country. Another indicator is % of population living within certain distance from coastline (usually 100 km) including major rivers that empty into the ocean. However, because of the small sizes of the Caribbean SIDS, total population might be more appropriate.
Rationale	This indicator represents the impact population and population growth has on economic development as well as on the degradation of watersheds and coastal ecosystems. SIDS are heavily dependent on coastal areas and their natural resources for economic development, with the population and economic activities concentrated in coastal areas. As a result, these areas and resources are under increasing threat from growing population and increasing economic activities. Because of their small land masses, activities in inland areas also affect the coastal zone. In fact, the entire land mass of SIDS could be considered the coastal zone. A high concentration of population in the coastal zone can dramatically affect coastal ecosystems through habitat alteration or loss and high pollutant loads. These processes can lead to loss of biodiversity, influx of invasive species, coral bleaching, new diseases among organisms, hypoxia, harmful algal blooms, siltation, reduced water quality, and threats to human health.
Policy relevance	BPoA; CSME; GPA; LBS Protocol; MDG; UNCBD; UNCSD
Data and lead agencies	National agencies responsible for housing, planning and development; national statistical office; United Nations Centre for Human Settlements (Habitat). The Digital Chart of the World coastline can either be acquired on an individual country basis from the Pennsylvania State University Map Library web site (http://www.maproom.psu.edu/dcw/), or from ESRI (http://www.esri.com).
Comments	The width of the 100 km band may be too wide to capture within country variance of population pressure on coastal

	ecosystems in small islands, and might even encompass the entire island, if of very small size. Related indicators: Population in disaster-prone areas; population density.

25. Tourism intensity	
Definition & meaning	A number of indicators exist to represent tourism intensity, e.g. Number of tourist arrivals/year; Number and location of hotels/rooms by type; Ratio tourists/local inhabitants; etc.
Rationale	Tourism continues to play a prominent role in the economies of the Caribbean SIDS, and is a vital income source for all the countries, particularly Antigua and Barbuda, Bahamas, Barbados, Jamaica, St Kitts and Nevis, St Lucia, and St Vincent and the Grenadines. In the Caribbean SIDS, tourism infrastructure and activities are heavily concentrated in coastal areas. Poorly managed tourism is one of the most significant causes of habitat destruction, land use change, natural resource overexploitation and consumption and pollution in these countries.
Policy relevance	
Data and lead agencies	National agencies responsible for tourism; CTO; ACS (www.acs-aec.org/Documents/Tourism/Projects/ACS_ST_000/Tourism_Stats0603.pdf); ACS project -*Development of indicators for the Sustainable Tourism Zone of the Caribbean)*; WTO
Comments	Related indicators: Increase in number of ecotourism initiatives.

3.2. Process Indicators

Process indicators are arranged according to nine major categories (Table 3). Where appropriate, indicators are arranged according to Regional, national, and local levels. Descriptions are given for 11 main types of PI indicators.

Table 3: Process indicators at regional, national, and local levels. Generic indicators are given in bold italics, under which are given a number of specific indicators.

1. Systemic (enabling) environment - Policy and Legislation	
Regional	***Existence of policies and legislation enabling IWCAM*** • Appropriate policy and legislation in support of IWCAM objectives adopted at the regional level. ***Existence, status and coverage of regional IWCAM plans and strategies.*** • Sustainable political and financial mechanisms established to support coordination of IWCAM at the regional level. - *National and regional agreement on strategy and funding mechanism(s).* • Regional IWCAM coordinating mechanism established and operational. • Detailed regional IWCAM indicators guidelines that embrace requirements of regional conventions and treaties (e.g., LBS protocol) developed and disseminated.
National	***Existence and status of national IWCAM, policies, legislation, plan and strategy.*** • Reforms in policy, legislation and institutional arrangements in support of IWCAM as the overarching framework for natural resources and environmental management in the SIDS. • The coordinated implementation of sectoral initiatives in support of IWCAM. • National land-use and planning policies enacted that incorporate IWCAM principles. ***Ratification and implementations of all IWCAM-relevant regional and international conventions.*** • All PCs ratify and implement MEAs related to IWCAM (CCD, CBD, SPAW and LBS Protocols of the Cartagena Convention, UNFCCC Kyoto Protocol, Basel Convention, Ramsar Convention). • Legislation and regulations enacted to facilitate compliance with international and regional MEAs. • Legislation for mandatory Environmental Impact Assessments (EIA) enacted.

2. Institutional	
Regional	***The existence and functioning of a representative regional coordinating mechanism for IWCAM.*** • IWCAM regional mechanism adopted and supported by regional agreements and institutional

	arrangements. • Establishment of an inclusive and representative regional Partnership Forum for IWCAM- related issues with strong input from private sector and other potential funding partners. • Partnership Forum meets on a regular basis and provides positive recommendations that are implemented as appropriate. ***Regional IWCAM coordinating mechanism is mandated and established.*** • Regional IWCAM Strategy developed. • Effective regional cooperation and sharing of information and lessons on IWCAM. • Development and transfer of appropriate technologies and IWCAM-related techniques. ***Demonstration projects replicated in the region within five years of the end of the IWCAM project.*** • Demonstration project replication support strategy developed and endorsed by PC governments.
National	***Regional IWCAM Strategy endorsed by the Governments.*** ***Inter-ministerial Committees established to engage ministries with IWCAM responsibilities.*** ***High-level steering committee established to oversee and coordinate the preparation and implementation of a National IWCAM plan and strategy.*** ***Inclusive, participatory, national integrated watershed management council and inter-sectoral IWCAM committee established to address and coordinateIWCAM issues.*** ***Active management in areas covered by IWCAM plans.*** • An integrated management mechanism for IWCAM is developed and implemented. • National framework established to make operational the coordinated and integrated management of watersheds and coastal areas. • Annual strategic management assessment conducted to ensure that management effort, resource allocation (human, material and financial) and skills levels are adequate to support the sustained and coordinated implementation of IWCAM polices and measures. • IWCAM plans developed and implemented for major watersheds. ***National sustainable development policy incorporates IWCAM principles.*** • *National Sustainable Development Councils convene at least twice a year.* ***National IWCAM training-needs assessment and skills development programme approved and implemented.*** • National IWCAM training-needs assessment and skills development programme established. • National IWCAM training-needs assessment and skills development programme reviewed every three years on the basis of the skills assessment and gap-analysis exercise. • Increased knowledge, skills and use of participatory methods and practices by personal in government agencies with IWCAM responsibilities: Stakeholder identification, needs assessment, participatory processes and methods, conflict management.

3. Enforcement	
National	***National plan and strategy for the effective enforcement of environmental regulations is developed and enacted.*** • National agreement on strategy and funding mechanism(s) for environmental enforcement established and implemented. • 100% of approved land use requests comply with IWCAM criteria and existing environmental regulations. • Number of formal environmental impact assessments conducted and proportion of these that had a formal consultative process.
Local	***Participatory approaches to the enforcement of environmental regulations and the promotion of voluntary compliance.***
4. Stakeholder Participation	
Regional	***Level of stakeholder participation in IWCAM and satisfaction with IWCAM outcomes.*** • Regional participatory IWCAM policy and process enacted. • Regional stakeholder identification processes established and completed (e.g. regional representatives from the private sector, tertiary and research institutions, labour organizations, environmental NGOs, agriculture, fisheries, Gender Interests groups, professional organizations, water and waste water management, etc.).
National	***Level of stakeholder participation in, and satisfaction with IWCAM decision-making process.*** • National participatory watersheds and coastal areas management policy and plans enacted. • Documentation of stakeholder involvement in preparation and creation of stakeholder involvement plan. • Representative involvement of broad spectrum of stakeholders in project activities and development, especially key decision-makers and traditionally under-represented groups. • Project activities targeting the strengthening of stakeholder input and participation. - *Stakeholder identification established and processes completed.* - *Needs assessment processes established and completed.* - *Conflict management strategy developed and implemented.* - *Capacity development plan developed and implemented.* - *Formal mechanisms established for participatory IWCAM involving NGOs, CSOs, communities and other stakeholders.* • Number of NGO and CSO programmes and action plans addressing IWCAM. ***Suitably skilled CSOs and NGOs assist in stakeholder identification, needs assessment, conflict management and capacity development processes at the regional, national and local levels.***
Local	***NGOs, CSOs and CBOs actively involved in IWCAM.*** • Increase in number of CSOs, NGOs and community groups actively involved in IWCAM. • Evidence of increased levels of understanding and commitment of local authorities and communities

	to IWCAM objectives. • Community-based natural resources management programmes implemented in at least 20% of watershed communities. • Community forestry wardens appointed in major watersheds.

5. Financing and Economic Instruments	
National	***Formal agreements on sustainable funding for strategic approach.*** • Amount of investment in environmental/IWCAM enforcement. ***National agreement on strategy and funding mechanism(s) for community enforcement.*** • IWCAM initiatives supported by national public sector investment programmes. • Budgetary allocations for IWCAM specified in the annual estimates. • Annual national budget allocations made to departments, agencies, and community organizations in support of IWCAM. ***Economic instruments for effective IWCAM.*** • National IWCAM incentives strategy developed on the basis of stakeholder needs assessment. • Market and non-market incentives for improved watershed management identified and implemented. - *Benefits from watershed services valued and financing mechanisms developed (e.g. payment for environmental services by major potential "buyers" of watershed services (e.g. tourism, agriculture, housing, water utilities and transportation).* - *Codes of practice and standards for watershed stewardship established as the basis for certification and labeling schemes.* - *Efficacy and equity of existing tax and incentives schemes affecting watersheds and coastal resources assessed.* - *Incentives schemes designed to secure watershed services.* • Rates and fees sufficient to fund effective IWCAM on the basis of valuation of watershed services. • Water rates schedule rewards efficiency. • Increase in number of hotels participating in certification schemes for tourism (Green Globe). • Number of companies and government departments adopting ISO 14001 standards. • Deposit refunds on all glass, plastic, and aluminum containers - target: 50% (glass), PET (35%) return rate, 15% recycled. • Alternative income generating plans developed for major watersheds produced. • Specific alternative income initiatives under implementation in 20% of the major watersheds.

	• Quantifiable changes in livelihoods of targeted watershed communities, reducing the frequency of environmentally damaging activities

6. Public Awareness and Outreach	
Regional	***Regional IWCAM communications strategy developed and implemented.*** ***Regional awareness campaigns target all stakeholders.*** ***Regional campaign informed by national knowledge, attitudes and practices (KAP) surveys.***
National	***National IWCAM KAP baseline survey completed in each PC.*** • Baseline public awareness established through nested KAP studies (National/Watershed). ***National IWCAM communications strategy developed and implemented based on KAP baseline survey.*** ***National public education and outreach (PEO) programmes established to improve knowledge of IWCAM.*** ***End of project KAP assessment undertaken to determine change in KAP and effectiveness of project interventions.*** ***IWCAM concepts incorporated in national school curricula. Effective teaching materials available.*** • IWCAM project establishes awareness of IWCAM concepts, goals, and benefits in 20% of the high school and adult population. • Schools and school-based NGOs and environmental clubs actively involved in IWCAM-related projects.

7. Monitoring and Evaluation	
Regional	***IWCAM indicators mechanism.*** • Regional mechanism for harmonization of indicators and monitoring. • Regional agreement/framework for capacity building and sharing of expertise and resources for monitoring.
National	***PCs endorse and adopt a monitoring and evaluation (M&E) plan that incorporates IWCAM process, stress reduction, and environmental status indicators (PI, SRI, ESI).***

	Routine monitoring, evaluation and adjustment of IWCAM initiative. • IWCAM indicators mechanism assessment and indicators template endorsed by all PCs. - *PCs endorse and adopt an M&E plan that incorporates IWCAM process, stress reduction, and environmental status indicators*. ***IWCAM indicators mainstreamed into national IWCAM planning and decision-making processes.*** • A suite of IWCAM SRI, ESI, and PI, determined by national needs and circumstances, adapted and used by the relevant PCs or agencies with watershed and coastal areas management or monitoring responsibilities. - *Traditional and local knowledge is reviewed, assessed and incorporated into the indicators mechanism where appropriate.* - *Natural resource and water resource inventories completed and baselines established.* - *Environmental and water quality standards established against which SRI and ESI are assessed.* - *Valuation of watershed services conducted (e.g. water production, flood control, soil stabilization, biodiversity conservation, agro-productivity).* - *Annual national assessment of IWCAM process for adaptive management is undertaken with the full participation of all IWCAM-related entities.* - *Annual application of GEF IWCAM tracking indicators shows increased scores throughout life of project.* - *National environmental statistics report produced every three- five years.*

8. Data and Information	
Regional	***Existence of common procedures and standards for data collection endorsed and adopted by all PCs.*** • Existence of common metadata standards and protocols. • Existence of institutional coordination mechanism to ensure the production of compatible results by management, research and monitoring programmes. ***Regional database and information exchange facility established.*** • Permanent and sustainable institutionalization for regional IWCAM data and information storage and transfer established. • Effective regional cooperation and sharing of information and lessons on IWCAM. • IWCAM Clearing House effectively networks Demo Lessons and Practices database, and provides linkages to other pertinent information databases. • IWCAM website established. - *Cross-linkages between Clearing Houses and databases*.

	• Regional indicator network and P, ES, and SR Indicator database established. - *All Indicator-related information stored and regularly updated in a suitable database.*
National	***National IWCAM data policy and strategy for the coordinated collection, centralized management, and use of selected IWCAM related data and indicators for adaptive management is enacted. Central coordinating data repository and clearing house for watershed and coastal areas data/information is established.*** • Central coordinating data repository and clearing house supports indicator network and data storage facility. ***National statistical unit compiles environmental statistics and indicators, and presents data on environmental status and trends in reports of national statistics.*** ***National IWCAM baseline data and indicators incorporated into existing GIS database(s) and updated annually.*** ***National capacity for development of indicators and monitoring strengthened.*** ***IWCAM data collection and monitoring programme established.*** • Programme is consistent with regionally endorsed data collection protocols. • Data collection protocols require all collected field data to be geo-referenced, as far as possible.

9. Capacity Development	
Regional	***Regional strategic plan to address the human resource deficiencies in IWCAM monitoring and indicators.*** • Mechanisms for the coordinated provision of technical assistance through: - *Pooling of expertise.* - *Exchange/sharing of trained staff.* - *Training of staff.* • Regional directory of training capacities and opportunities offered by regional and national tertiary institutions that support areas for environmental indicators development and management. • Training programmes in environmental monitoring and indicators development and management. • Tertiary level IWCAM – stream, with monitoring and indicators component, offered by at least one teaching institution in the region.
National	***National/local strategic plan to address the human resource deficiencies in IWCAM monitoring and indicators.*** • Capacities and training needs, and training solutions, required to establish IWCAM indicators mechanism identified.

	• Time frame established for completing training required to establish IWCAM indicators mechanism. • Dedicated budget for environmental monitoring and indicators training. • Annual training needs assessment for environmental monitoring and indicators incorporated into formal government training mechanism. • Environmental monitoring and statistics for adaptive environmental management mainstreamed into secondary and tertiary curricula.

Process Indicators Descriptions

1. Systemic (Enabling) environment – Regional IWCAM mechanism.	
Definition & meaning	The existence of a functioning and representative regional coordinating mechanism for IWCAM
Rationale	A regional coordinating mechanism will: • Facilitate the evolution of the current IWCAM initiative from a short-term, project-based approach to the development of IWCAM capacities for a sustained programmatic approach. • Ensure the coordination of the different regional actors influencing coastal, marine and terrestrial areas and natural resources and facilitate the participation of the relevant national and inter-governmental stakeholders. • Provide a regional mechanism for harmonization, sharing of experiences and lessons learned, resource mobilization, etc.
Data and lead agencies	Formal mandate, official documents, meeting records. CARICOM, National agencies with IWCAM-related responsibilities, Ministries of Foreign Affairs, Regional offices of international organizations (e.g. UNEP CAR RCU).

2. Systemic (Enabling) environment - Regional IWCAM plan and strategy	
Definition & meaning	Appropriate plan and strategy to direct and facilitate the implementation of IWCAM objectives adopted at the national and regional level.
Rationale	To provide a clear road map to facilitate and guide the coordinated development of capacity and implementation action necessary to achieve IWCAM goals and objectives.
Data and lead agencies	Formal mandate, official documents, meeting records, planning documents, strategy documents, budgets, CARICOM, National agencies with IWCAM-related responsibilities, Ministries of Foreign Affairs, Regional offices of international organizations (e.g. UNEP CAR RCU)

3. Systemic (Enabling) environment - National IWCAM policy

Definition & meaning	Existence of national policies and legislation enabling the development and implementation of an appropriate IWCAM indicators mechanism.
Rationale	The existence of adequate policy and legislation indicates the extent to which environmental monitoring and indicators mechanisms are supported by a tangible political commitment at the highest level, and clear and enforceable legislation. Legislation supporting environmental indicators mechanisms will define the authorities, obligations and relationships of stakeholders and administrative actors. Although legislation does not guarantee effective environmental monitoring or use of environmental indicators, it does provide an indication of national intent, incentives, and the accepted norms.
Data and lead agencies	Legislation, regulations, policy documents. Government agencies with responsibilities for environmental monitoring and development of national indicators mechanisms.

4. Monitoring and Evaluation - National IWCAM monitoring and indicator mechanism developed.	
Definition & meaning	An environmental monitoring and indicators mechanism that with clearly defined. • Goals and objectives for adaptive management. • Institutional arrangements. • Relationships to stated national sustainable development goals and objectives, and the policy, legislative and financial mechanisms established.
Rationale	To provide an inclusive and transparent roadmap to facilitate and guide the coordinated mainstreaming of IWCAM monitoring data and indicators in national policy and planning processes. The plan for the national environmental monitoring and indicators mechanism reflects the commitment of the relevant government agencies, private sector and civil society stakeholders to adopt an integrated, multi-disciplinary, multi-sectoral approach to the management of watersheds, coastal, and marine areas.
Data and lead agencies	Official documents, meeting records, reports, financial estimates, budgets, M & E reports, enforcement records. Government agencies with responsibilities for environmental monitoring and indicators mechanisms.

5. Enforcement	
Definition & meaning	National plan and strategy for the effective enforcement of IWCAM regulations is developed and enacted.
Rationale	An integrated natural resources management (INRM) objective is to manage natural resources in a way that ensures that the behaviours and strategies for the exploitation of natural resources are consistent with, and supportive of, national sustainable development objectives.
Data and lead	Natural resource management plans, management records, evaluation reports, enforcement records, permit records.

agencies	Government agencies with natural resources management responsibilities, monitoring and law enforcement agencies, national defence forces, national standards entities.

6. Stakeholder participation	
Definition & meaning	Level of stakeholder participation in IWCAM monitoring and natural resources management and decision-making processes (policy formulation, planning, implementation) and satisfaction with IWCAM mandates and outcomes.
Rationale	In order to be effective IWCAM plans and strategies must change the behaviours of all stakeholders that use and/or impact natural resources. In order to change behaviours, stakeholders understanding and awareness of IWCAM benefits, issues, goals, objectives, and management approaches must be developed. Participatory processes can provide a transparent mechanism for developing the awareness, capacities, commitment, and trust necessary to effect behavioural change and compliance. Participatory approaches also ensure that local and traditional knowledge, and the needs, concerns and aspirations of all stakeholders are considered in the policy, planning, and implementation processes. Although this consideration does not guarantee adoption or compliance, it does provide for the transparency required to effectively and objectively manage conflicts and foster adaptive approaches to management. Participatory approaches can also help in the identification, development, and acceptance of effective economic incentives and instruments. These factors influence the levels of stakeholder satisfaction with the participatory processes and with IWCAM outcomes.
Data and lead agencies	Meeting records, survey and interview results. Government agencies with NRM responsibilities and mandates, civil society organizations, NGOs, professional bodies.

7. Economic instruments	
Definition & meaning	Economic instruments to promote and support environmental monitoring and indicators development and use.
Rationale	Economic instruments can complement or serve as an alternative to regulatory instruments, providing an intermediate step, or an alternative to, the command-and-control approach to enforcement. Economic instruments and incentives help to correct the market distortions that often serve as incentives to the unsustainable use of natural resources.
Data and lead agencies	Documentation on the use of economic instruments and government records, interview and survey results. Government agencies with IWCAM responsibilities, chambers of commerce, CSOs, NGOs, businesses.

8. Public Awareness and Outreach

Definition & meaning	The incorporation of environmental monitoring and indicators into targeted messages, interpretive information products, signage, as well as educational and training curricula.
Rationale	Improved public and stakeholder awareness of INRM issues, vision, aims, objectives, and goals can lead to increased voluntary compliance, a process known as "interpretive enforcement". Improved public awareness can also contribute to more effective surveillance through peer-pressure and the voluntary reporting of infractions. The formal incorporation of the skills areas for developing and maintaining indicators mechanisms into educational curricula can address the need for new multi-disciplinary information management skills.
Data and lead agencies	University records, government agency annual reports, national schools curricula, media, educational institutions, Ministry of Education, Government agencies with IWCAM responsibilities, NGOs, CSOs, professional bodies.

9. Monitoring and Evaluation	
Definition & meaning	The routine monitoring and evaluation of a project, programme, or of environmental state, using pre-determined indicators and against set targets, goals, and objectives.
Rationale	An operational monitoring and evaluation mechanism is necessary to determine whether targets, goals, and objectives of an IWCAM project or programme are being achieved. Evaluation of achievements/progress against stated targets will allow the identification of adaptive measures, if these are deemed necessary.
Data and lead agencies	Project and programme performance evaluations, state of the environment reports, work programmes, patrol reports, budgets, etc. Government agencies with NRM and sustainable development responsibilities and mandates, national statistical offices, all stakeholders.

10. Data and Information	
Definition & meaning	Existence of the minimum amount of required data, as well as common procedures and standards for data collection adopted and implemented by the countries. Also includes appropriate data and information management system.
Rationale	Management is often hampered by a paucity of data, barriers to data sharing and access, and the incompatibility of data formats. NRM requires that planning and decision-making is informed by timely access to environmental data from a range of sources and thematic areas, as well as of relevant socio-economic data. This can be efficiently achieved through a centrally coordinated mechanism for establishing and maintaining standards, and coordinating data collection, management, reporting, and data-sharing. The effectiveness of NRM will depend on the availability of data and information on which to base the assessment of natural resource endowments relative to stated national sustainable development goals and objectives. This assessment process in turn provides the basis for decision-making in support of adaptive management.
Data and lead agencies	National Statistical agencies, all agencies with NRM responsibilities. National and institutional databases and spatial data systems. Government agencies with NRM and/or environmental data collection and monitoring responsibilities.

11. Capacity Development	
Definition & meaning	The formulation and adoption of formal capacity development mechanisms for IWCAM.
Rationale	The multi-disciplinary nature of IWCAM will require the coordinated development of capacities in the disciplines required to support and sustain the development of viable IWCAM programmes, including associated indicator mechanisms. Even when training opportunities are provided in the disciplines required to support national IWCAM mechanisms, not all PCs will have the resources to support the full range of disciplines. Strategies will be required to share and/or pool human resources on a regional or sub-regional basis.
Data and lead agencies	Documentation and reports: national schools curricula, curricula from tertiary teaching institutions in the region with environmental management/natural resources management programmes; regional and national strategies for capacity development and human resources resource sharing; directory of regional training opportunities and capacities; training needs assessments. Government agencies with NRM and/or environmental data collection or monitoring responsibilities. Ministries of Education, tertiary teaching and training institutions, regional IGOs, donor agencies.

4. Conclusions and Recommendations

Conclusions and a number of recommendations are given in Part I. Among the immediate next steps in the development of an IWCAM indicators framework are:

- Pilot testing of a set of core indicators in one of the PCs with more advanced indicators mechanisms, to be determined in consultation with the IWCAM indicators working group. This activity could also build capacity and generate lessons for replication in other PCs;
- Development of national indicators templates by the PCs, and a minimum environmental monitoring programme in support of the indicator framework based on existing data;
- Determination of the cost of the monitoring programme and identification of possible sources of funding;
- Establishment of the appropriate institutional arrangements and mechanisms, and agreement of roles and responsibilities for coordinated implementation of the monitoring programme at national level.

Please refer to Part I and the workshop report for further details.

To sum up, a number of challenges - institutional, methodological, and technical – exist with respect to developing indicators frameworks (adapted from Pintér and others 2005[8]):

From the *institutional* perspective, the key challenge is to ensure indicators are integrated into mainstream policy mechanisms, instead of being an environmental "add-on" to already existing statistical, measurement and reporting systems. Environmental agencies often do not have sufficient mandate, capacity and influence to ensure indicators are brought to bear on key policy decisions, such as the development of government budgets, sectoral policy frameworks, or long-term plans and sustainable development strategies.

From the *methodological* point of view, there are continuing uncertainties and debates about what and how to measure and how to link specific indicators to time-bound targets and thresholds. Comparability of indicators continues to be limited by a number of factors, including the use of different indicator frameworks that often adhere minimally to standards of how the same variables should be measured. Aggregated indices are attractive for communication with citizens but require high quality data for consistent, comparable, and complete indicator sets, as well as a political consensus on indicator weights that is difficult to achieve on the national or sub-national scale.

[8]Pintér, L. Hardi, P. and Bartelmus, P. (2005). Indicators of Sustainable Development: Proposals for a Way Forward. Discussion Paper Prepared on behalf of the UN Division for Sustainable Development, UN Division for Sustainable Development Expert Group Meeting on Indicators of Sustainable Development, New York, 13-15 December 2005.

Development of indicators also continues to be affected by serious *technical* challenges, particularly related to data. The challenges include not only data availability and quality, but also problems with common definitions and the lack of long-term, consistent monitoring mechanisms that would supply data with adequate temporal and spatial resolution. The issue, however, is not only the inadequacy of the right kind and quality of data, but also that in some cases the data that *are* collected at considerable cost have little apparent use in decision-making.

Making significant progress on any of these issues requires a serious investment of time, effort, and resources, as well as coordinated action of many agencies at the regional, national, and sub-national levels.

5. References and Acronyms

Please refer to Part I.