ASEAN Environmental Data Monitoring and Evaluation Framework

IGES
Institute for Global
Environmental Strategies

ASEAN Environmental Data Monitoring and Evaluation Framework

1.1 Introduction

The ASEAN Secretariat proposed that the preparation of the sixth State of Environment Report (SOER6) should include the development of Key Performance Indicators (KPI) which could serve as a monitoring tool for the progress of implementation of the ASEAN Strategic Plan on Environment 2016-2025 (ASPEN), and as the basis for data requirements during the preparation of future State of Environment Reports (SOERs). To move this suggestion forward IGES has prepared this Discussion Paper.

The approach to this output in the context of the DPSIR methodology is to examine (i) the wide range of indicators used for the SDGs, IPBES, UNFCCC, GEO and other global and regional assessments; (ii) national level environmental and natural resources assessments; (iii) national environmental standards and monitoring reports; and (iv) other environmental assessments at global, regional, and national levels[1].

From this compilation of environmental indicators, the current data management approaches and national capacities in ASEAN to select and prioritize KPIs, and to monitor and report on these, will be documented. Relevant ASEAN institutional frameworks, vision, and blueprints, as well as sectoral work plans and their programme/output-level indicators, if any, will also be considered. The gap between global, regional, and national reporting requirements and the capacity of ASEAN Member States (AMS) to provide accurate, timely, and validated data for these indicators will be assessed.

From this gap assessment, the feasibility of enhancing and/or expanding the monitoring and reporting capacity in the region will be assessed and recommendations provided on how this expanded capacity could be achieved.

1.2 Global environmental indicators

The following sections illustrate the wide range of indicators included in global strategies and plans and multilateral environment agreements (MEAs) that ASEAN Member States are expected to report on.

1.2.1 Sustainable Development Goals

The official sustainable development goals (SDGs) indicators cover the 17 goals and 169 targets, with 231 unique indicators (the total number is 247 but 12 indicators repeat for more than one target) (UNDESA 2021a). These indicators are intended to be refined annually and will be next reviewed at the 2025 Statistical Commission session. Global indicators are expected to be complemented by regional and national indicators depending on the context. ASEAN Member States (AMS) are expected to regularly report on these indicators on a voluntary basis. The 2030 Agenda for Sustainable Development encourages Member States to "conduct regular and inclusive reviews of progress at the national and sub-national levels, which are country-led and country-driven" (paragraph 79) and the voluntary national reviews

---

[1] An indicator is defined as "a parameter, or a value derived from parameters, which points to/provides information about/describes the state of a phenomenon/environment/area with a significance extending beyond that directly associated with a parameter value" (OECD 1993).

(VNRs) are expected to serve as a basis for the regular reviews by the high-level political forum (HLPF).

Partially reflective of the set of "environmental" indicators, the United Nations Environment Programme (UNEP) is the custodian agency for 6 SDGs and 26 indicators, as shown in Table 1.1. The UNEP custodian role is shown in red, while other indicators are black.

Table 1.1 UNEP's custodian role for 26 SDG indicators

SDG	Targets	SDG Indicators (UNEP custodian role in red, others in black)
SDG 6 – Clean water and sanitation	6.1. By 2030, achieve universal and equitable access to safe and affordable drinking water for all	6.1.1 Proportion of population using safely managed drinking water services - WHO
	6.2. By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations	6.2.1 Proportion of population using safely managed sanitation services, including a hand-washing facility with soap and water - WHO
	6.3. By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	6.3.1 Proportion of wastewater safely treated - WHO 6.3.2 Proportion of bodies of water with good ambient water quality
	6.4. By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity	6.4.1 Change in water-use efficiency over time - FAO 6.4.2 Level of water stress: freshwater withdrawal as a proportion of available freshwater resources - FAO
	6.5. By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate	6.5.1 Degree of integrated water resources management implementation (0-100) 6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation
	6.6. By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	6.6.1 Change in the extent of water-related ecosystems over time – Ramsar Convention
	6.a. By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies	6.a.1 Amount of water- and sanitation-related official development assistance that is part of a government-coordinated spending plan - WHO
	6.b. Support and strengthen the participation of local communities in improving water and sanitation management	6.b.1 Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management - WHO
SDG 8 – Decent work and economic growth	8.1. Sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 per cent gross domestic product growth per annum in the least developed countries	8.1.1 Annual growth rate of real GDP per capita
	8.2. Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors	8.2.1 Annual growth rate of real GDP per employed person
	8.3. Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services	8.3.1 Proportion of informal employment in total employment, by sector and sex
	8.4. Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-Year Framework of Programmes on Sustainable Consumption and Production, with developed countries taking the lead	8.4.1 Material footprint, material footprint per capita, and material footprint per GDP 8.4.2 Domestic material consumption, domestic material consumption per capita, and domestic material consumption per GDP

	8.5. By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value	8.5.1 Average hourly earnings of employees, by sex, age, occupation and persons with disabilities 8.5.2 Unemployment rate, by sex, age and persons with disabilities
	8.6. By 2020, substantially reduce the proportion of youth not in employment, education or training	8.6.1 Proportion of youth (aged 15–24 years) not in education, employment or training
	8.7. Take immediate and effective measures to eradicate forced labour, end modern slavery and human trafficking and secure the prohibition and elimination of the worst forms of child labour, including recruitment and use of child soldiers, and by 2025 end child labour in all its forms	8.7.1 Proportion and number of children aged 5–17 years engaged in child labour, by sex and age
	8.8. Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment	8.8.1 Fatal and non-fatal occupational injuries per 100,000 workers, by sex and migrant status 8.8.2 Level of national compliance with labour rights (freedom of association and collective bargaining) based on International Labour Organization (ILO) textual sources and national legislation, by sex and migrant status
	8.9. By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products	8.9.1 Tourism direct GDP as a proportion of total GDP and in growth rate
	8.10. Strengthen the capacity of domestic financial institutions to encourage and expand access to banking, insurance and financial services for all	8.10.1 (a) Number of commercial bank branches per 100,000 adults and (b) number of automated teller machines (ATMs) per 100,000 adults 8.10.2 Proportion of adults (15 years and older) with an account at a bank or other financial institution or with a mobile-money-service provider
	8.a. Increase Aid for Trade support for developing countries, in particular least developed countries, including through the Enhanced Integrated Framework for Trade-related Technical Assistance to Least Developed Countries	8.a.1 Aid for Trade commitments and disbursements
	8.b. By 2020, develop and operationalize a global strategy for youth employment and implement the Global Jobs Pact of the International Labour Organization	8.b.1 Existence of a developed and operationalized national strategy for youth employment, as a distinct strategy or as part of a national employment strategy
SDG 12 – Responsible consumption and production	12.1. Implement the 10-Year Framework of Programmes on Sustainable Consumption and Production Patterns, all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries	12.1.1 Number of countries developing, adopting or implementing policy instruments aimed at supporting the shift to sustainable consumption and production
	12.2. By 2030, achieve the sustainable management and efficient use of natural resources	12.2.1 Material footprint, material footprint per capita, and material footprint per GDP 12.2.2 Domestic material consumption, domestic material consumption per capita, and domestic material consumption per GDP
	12.3. By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses	12.3.1 (a) Food loss index and (b) food waste index Part (a) - FAO
	12.4. By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment	12.4.1 Number of parties to international multilateral environmental agreements on hazardous waste, and other chemicals that meet their commitments and obligations in transmitting information as required by each relevant agreement 12.4.2 (a) Hazardous waste generated per capita; and (b) proportion of hazardous waste treated, by type of treatment
	12.5. By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse	12.5.1 National recycling rate, tons of material recycled
	12.6. Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle	12.6.1 Number of companies publishing sustainability reports

	12.7. Promote public procurement practices that are sustainable, in accordance with national policies and priorities	12.7.1 Degree of sustainable public procurement policies and action plan implementation
	12.8. By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature	12.8.1 Extent to which (i) global citizenship education and (ii) education for sustainable development are mainstreamed in (a) national education policies; (b) curricula; (c) teacher education; and (d) student assessment
	12.a. Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production	12.a.1 Installed renewable energy-generating capacity in developing countries (in watts per capita)
	12.b. Develop and implement tools to monitor sustainable development impacts for sustainable tourism that creates jobs and promotes local culture and products	12.b.1 Implementation of standard accounting tools to monitor the economic and environmental aspects of tourism sustainability
	12.c. Rationalize inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities	12.c.1 Amount of fossil-fuel subsidies (production and consumption) per unit of GDP
SDG 14 – Life below water	14.1. By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution	14.1.1 (a) Index of coastal eutrophication; and (b) plastic debris density
	14.2. By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans	14.2.1 Number of countries using ecosystem-based approaches to managing marine areas
	14.3. Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels	14.3.1 Average marine acidity (pH) measured at agreed suite of representative sampling stations
	14.4. By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics	14.4.1 Proportion of fish stocks within biologically sustainable levels - FAO
	14.5. By 2020, conserve at least 10 percent of coastal and marine areas, consistent with national and international law and based on the best available scientific information	14.5.1 Coverage of protected areas in relation to marine areas – UNEP WCMC
	14.6. By 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies, recognizing that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the World Trade Organization fisheries subsidies negotiation	14.6.1 Degree of implementation of international instruments aiming to combat illegal, unreported and unregulated fishing - FAO
	14.7. By 2030, increase the economic benefits to small island developing States and least developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism	14.7.1 Sustainable fisheries as a proportion of GDP in small island developing States, least developed countries and all countries - FAO
	14.a. Increase scientific knowledge, develop research capacity and transfer marine technology, taking into account the Intergovernmental Oceanographic	14.a.1 Proportion of total research budget allocated to research in the field of marine technology

	Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular small island developing States and least developed countries	
	14.b. Provide access for small-scale artisanal fishers to marine resources and markets	14.b.1 Degree of application of a legal/regulatory/ policy/institutional framework which recognizes and protects access rights for small-scale fisheries - FAO
	14.c. Enhance the conservation and sustainable use of oceans and their resources by implementing international law as reflected in the United Nations Convention on the Law of the Sea, which provides the legal framework for the conservation and sustainable use of oceans and their resources, as recalled in paragraph 158 of "The future we want"	14.c.1 Number of countries making progress in ratifying, accepting and implementing through legal, policy and institutional frameworks, ocean-related instruments that implement international law, as reflected in the United Nations Convention on the Law of the Sea, for the conservation and sustainable use of the oceans and their resources
SDG 15 – Life on land	15.1. By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements	15.1.1 Forest area as a proportion of total land area - FAO 15.1.2 Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type – UNEP WCMC
	15.2. By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally	15.2.1 Progress towards sustainable forest management - FAO
	15.3. By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation neutral world	15.3.1 Proportion of land that is degraded over total land area - UNCCD
	15.4. By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development	15.4.1 Coverage by protected areas of important sites for mountain biodiversity – UNEP WCMC 15.4.2 Mountain Green Cover Index - FAO
	15.5. Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species	15.5.1 Red List Index - IUCN
	15.6. Promote fair and equitable sharing of the benefits arising from the utilization of genetic resources and promote appropriate access to such resources, as internationally agreed	15.6.1 Number of countries that have adopted legislative, administrative and policy frameworks to ensure fair and equitable sharing of benefits - CBD
	15.7. Take urgent action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products	15.7.1 Proportion of traded wildlife that was poached or illicitly trafficked - CITES
	15.8. By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species	15.8.1 Proportion of countries adopting relevant national legislation and adequately resourcing the prevention or control of invasive alien species - IUCN
	15.9. By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts	15.9.1 (a) Number of countries that have established national targets in accordance with or similar to Aichi Biodiversity Target 2 of the Strategic Plan for Biodiversity 2011–2020 in their national biodiversity strategy and action plans and the progress reported towards these targets; and (b) integration of biodiversity into national accounting and reporting systems, defined as implementation of the System of Environmental-Economic Accounting
	15.a. Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems	15.a.1 (a) Official development assistance on conservation and sustainable use of biodiversity; and (b) revenue generated and finance mobilized from biodiversity-relevant economic instruments
	15.b. Mobilize significant resources from all sources and at all levels to finance sustainable forest management and provide adequate incentives to	15.b.1 (a) Official development assistance on conservation and sustainable use of biodiversity; and (b) revenue generated and finance mobilized from biodiversity-relevant economic instruments

	developing countries to advance such management, including for conservation and reforestation	
	15.c. Enhance global support for efforts to combat poaching and trafficking of protected species, including by increasing the capacity of local communities to pursue sustainable livelihood opportunities	15.c.1 Proportion of traded wildlife that was poached or illicitly trafficked - CITES
SDG 17 – Partnerships for the goals	There are 19 targets here. UNEP is responsible for SDG 17.7 and 17.14 as shown below.	
	17.7. Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed	17.7.1 Total amount of funding for developing countries to promote the development, transfer, dissemination and diffusion of environmentally sound technologies
	17.14. Enhance policy coherence for sustainable development	17.4.1 Number of countries with mechanisms in place to enhance policy coherence of sustainable development

Clearly, however, UNEP's custodian role does not cover all the environmentally relevant SDG indicators. In fact, there are 49 custodians sharing the 247 indicators and some observers suggest that there is at least one environmental indicator in every one of the SDGs (Elder and Olsen 2019). With this profusion of SDG data custodians, it may also appear that some of the indicators are difficult to monitor or may vary considerably from one country or source of information to another. Accordingly, maximum effort has gone into developing the **metadata** for these indicators (UNDESA n.d.) and further refinement is being made continuously. The current indicators are divided into three tiers:

"Tier 1: Indicator is conceptually clear, has an internationally established methodology and standards are available, and data are regularly produced by countries for at least 50 percent of countries and of the population in every region where the indicator is relevant".
"Tier 2: Indicator is conceptually clear, has an internationally established methodology and standards are available, but data are not regularly produced by countries".
"Tier 3: No internationally established methodology or standards are yet available for the indicator, but methodology/standards are being (or will be) developed or tested".

In its most recent assessment of SDG progress in East and Southeast Asia, UNEP measured progress in 92 environment related indicators but found that only 42% had sufficient data to confidently measure progress (UNEP 2021). Environmental indicators were found in 15 of the 17 SDGs, with the only exceptions SDG 10 on reduced inequalities and SDG 16 on peace and justice[2]. Of the indicators where progress could be measured, 67% showed progress towards achieving the SDGs. In East and Southeast Asia, 65% of indicators had no data or insufficient data and only 23% showed a positive trend (Table 1.2). Note, however, that positive change towards the SDGs from 2000 to 2018 does not imply that the SDG will be achieved in the applicable time frame.

---

[2] Arguably, environmental justice indicators could be included in both these SDGs.

Table 1.2 SDG progress and environmental indicator data availability in East and Southeast Asia 2000-2018

SDG	Positive change 2000-2018	Minimal change 2000-2018	Negative change 2000-2018	Insufficient data	No data is available
1. End poverty			Disasters: persons affected (1.5.1)	Disaster risk reduction strategies (1.5.3)	Land tenure (1.4.2) Disasters: economic loss (1.5.2) Disaster risk reduction strategies for local govt (1.5.4)
2. Food security			Local breeds for agriculture (2.5.2)		Sustainable agricultural practices (2.4.1) Secure genetic resources for food (2.5.1)
3. Health	Unintentional poisoning (3.9.3)			Air pollution mortality (3.9.1) Water-related mortality (3.9.3)	
4. Education					Education for sustainable development (4.7.1)
5. Gender					Women agricultural landowners (5.a.1)
6. Water	Handwashing facilities with soap and water (6.2.1) Water related ecosystems (6.6.1) Investment in water and sanitation (6.a.1)		Water stress (6.4.2) Local water management (6.b.1)	Wastewater treatment (6.3.1) Water efficiency (6.4.1) Water resource management (6.5.1)	Safe drinking water (6.1.1) Water quality (6.3.2) Water cooperation (6.5.2)
7. Energy	Reliance on clean fuels (7.1.2) Energy intensity (7.3.1) Clean energy research and technology (7.a.1) Investment in energy efficiency (7.b.1)		Renewable energy (7.2.1)		
8. Decent work and economic growth			Domestic material consumption (8.4.2)		Material footprint (8.4.1)
9. Industry, innovation and infrastructure	CO_2 emissions (9.4.1)				
11. Cities and communities	Urban solid waste management (11.6.1)		Disasters: persons affected (11.5.1)	Ambient air pollution (11.6.2) Disaster risk reduction for local	Access to public transport (11.2.1) Land consumption (11.3.1) Urban planning (11.3.2)

					government (11.b.1)	Investment in cultural and natural heritage (11.4.1) Disasters: economic loss (11.5.2) Public land in cities (11.7.1) Disaster risk reduction strategies (11.b.2)
12. Responsible consumption and production	Information transmitted under Chemicals and Waste Conventions (12.4.1) Hazardous waste generation (12.4.2) Research for sustainable lifestyles (12.a.1)		Domestic material consumption (12.2.2) Fossil fuel subsidies (12.c.1)	Action plans for sustainability (12.1.1) Food loss (12.3.1a) and food waste (12.3.1b)	Material footprint (12.2.1) Recycling (12.5.1) Corporate sustainability reporting (12.6.1) Sustainable public procurement (12.7.1) Education for sustainable lifestyles (12.8.1) Sustainable tourism strategies (12.b.1)
13. Climate action			Disasters: persons affected (13.1.1)	Disaster risk reduction strategies (13.1.2)	Disaster risk reduction for local government (13.1.3) Climate change action plans (13.2.1) Greenhouse gas emissions (13.2.2) Education for sustainable development (13.3.1) Resources mobilized for climate action (13.a.1) Climate action support for LDCs (13.b.1)
14. Life under water	Marine protected areas (14.5.1)			Fishing regulations (14.6.1) Scientific knowledge, research capacity and transfer of marine technology (14.a.1)	Marine pollution and coastal eutrophication (14.1.1) Management of marine areas (14.2.1) Ocean acidification (14.3.1) Sustainable fish stocks (14.4.1) Fisheries subsidies economic benefits to SIDS and LDCs (14.7.1) Instruments for conservation and sustainable use of oceans and their resources (14.c.1)

15. Life on land	Forest area (15.1.1) Protection of key biodiversity areas (15.1.2) Forest area annual net change rate (15.2.1) Mountain protected areas (15.4.1) Strategies for sharing biodiversity benefits (15.6.1) Strategies for preventing invasive alien species (15.8.1)		Endangered species (15.5.1)	Land degradation (15.3.1) Mountain green cover (15.4.2)	Trade in poached or illicitly trafficked wildlife (15.7.1) Progress towards Aichi Biodiversity Target (15.9.1) Investment in biodiversity and ecosystems (15.a.1) Investment in sustainable forests (15.b.1) Protection against poaching, trafficking and trade (15.c.1)
17. Partnerships and means of implementation	Funding for capacity building (17.9.1)				Funding for environmentally sound technologies (17.7.1) Mechanisms enhancing policy coherence (17.14.1) Progress in multi-stakeholders monitoring frameworks (17.16.1) Statistical capacity for SDGs (17.18.1)
Number	20	0	11	16	45

One positive aspect of this assessment is that the number of indicators with sufficient data that can be used to measure SDG progress in Asia-Pacific has grown from 25% in 2017 to 42% in 2020, although this remaining data gap poses a significant challenge (UNESCAP 2020). The downside is that the region is likely to miss all 17 goals by 2030 and is going backward in some crucial environmental domains like sustainable consumption and production and climate change. On track indicators for 2030 include (i) 3.9.3 – unintentional poisoning; (ii) 6.b.1 – policies and procedures for participative water and sanitation management; (iii) 7.a.1 – international support for clean and renewable energy in LDCs; (iv) 9.4.1 – CO_2 emissions intensity; (v) 11.1.P1 – open defecation (urban); (vi) 12.c.P1 - fossil fuel subsidies; and (vii) 15.b.1 - ODA for biodiversity (LDCs) (UNESCAP 2020).

Southeast Asia is on track for SDG 4 – quality education and SDG 9 – industry, innovation and infrastructure, while making good progress on SDG 2 – zero hunger and SDG 3 – good health and wellbeing. Reverse trends were noted, however, for (i) 7.2.1 – renewable energy share; (ii) 15.1.1 – forest area; (iii) 15.5.1 – Red List Index; (iv) 1.5.2 – economic loss from disasters; (v) 11.5.2 – economic loss and affected infrastructure and services from disasters; (vi) 1.5.1 – deaths/missing/affected from disasters (also 11.5.1 and 13.1.1); and (vii) sulphur dioxide emissions (UNESCAP 2020).

One can also examine the SDG performance of individual countries in the VNRs submitted to the High-Level Political Forum (HLPF). Among the ASEAN countries, Cambodia (2019), Indonesia (2017, 2019, 2021), Viet Nam (2018), Singapore (2018), Philippines (2019), Brunei Darussalam (2020), Lao PDR (2021), Malaysia (2021), Myanmar (planned for 2021), Thailand (2021) have submitted VNRs. Of these, Indonesia is the most comprehensive with the 2021

VNR running to 786 pages (Table 1.3). A large proportion of the Indonesian indicators are aligned with UNEP's 92 environmental indicators listed in Table 1.2.

Table 1.3 Environmental indicator coverage in Indonesia's VNR 2021

SDG	Indonesia VNR Indicators (2021)	Coverage
1. End poverty	1.4.2 Proportion of total adult population with secure tenure rights to land, with legally recognized documentation, and who perceive their rights to land as secure, by sex and type of tenure, 2015-2020	Data cover 2015-2020, all provinces, disaggregation by urban/rural, gender of household head, expenditure quintile, owning vs. renting a residence
	1.5.1 Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population, 2015-2020 No data on 1.5.2, 1.5.3, or 1.5.4	Data cover 2015-2020, with and without Covid in 2020, deaths, injuries, and displaced persons
2. Food security	2.4.1 Proportion of agricultural area under productive and sustainable agriculture in 3 provinces in Indonesia, 2020 No data on 2.5.1, 2.5.2	Only one year, West and East Java and West Nusa Tenggara
3. Health	No data on 3.9.1, 3.9.3	
4. Education	No data on 4.7.1	
5. Gender	5.a.1 (1) Proportion of total agricultural population with ownership or secure rights over agricultural land; and (2) share of women among owners or rights-bearers of agricultural land, by type of tenure, 2020	Three provinces, West and East Java and West Nusa Tenggara, male and female, only one year
6. Water	6.1.1 Proportion of households using safely managed drinking water services, 2019-2020	Whole of Indonesia, by region, urban and rural, 2019-2020
	6.2.1 (a) Proportion of households using improved sanitation services, 2019-2020	By province, sex of household head, expenditure quintile, 2019-2020
	6.2.1 (b) Proportion of households using a hand-washing facility with soap and water, 2017–2020	By province, sex of household head, expenditure quintile, 2017-2020
	6.3.1 (a) Proportion of industrial wastewater flows safely treated, 2019-2020	Whole of Indonesia, 2019-2020
	6.3.2.(a) Surface water quality as raw water (Water quality index), 2015-2020	By province, 2015-2020
	6.5.2 Proportion of transboundary basin area with an operational arrangement for water cooperation, 2015-2019	Indonesia and Timor Leste, 10 watersheds
	6.6.1 Change in the extent of water-related ecosystems over time, 2015 – 2020: Land Cover Quality Index and Land Quality Index No data for 6.4.1, 6.4.2, 6.5.1, 6.a.1, 6.b.1	Whole of Indonesia, all provinces
7. Energy	7.1.2 (a) Number of gas network connections for households, 2014-2020	Whole of Indonesia, 2014-2020
	7.1.2 (b) Ratio of household gas usage, 2012-2020	Whole of Indonesia, 2012-2020
	7.2.1 Renewable energy share in the total final energy consumption	Whole of Indonesia, 2015-2020
	7.3.1 Energy intensity measured in terms of primary energy and GDP No data for 7.a.1, 7.b.1	Whole of Indonesia, 2015-2020
8. Decent work and economic growth	No data for 8.4.1, 8.4.2	
9. Industry, innovation and infrastructure	No data for 9.4.1	
11. Cities and communities	11.2.1 (a) Proportion of population that has convenient access to public transportation, 2017 and 2020	By province, 2017 and 2020 By province, 2017 and 2020

	11.2.1 (b) Proportion of population served by public transportation, 2017 and 2020 11.5.1 Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population, 2015-2020 11.5.2 (a) Proportion of direct economic losses due to disasters relative to GDP, 2015-2019 11.6.1 (b) Proportion of national solid waste generated and managed, 2020 11.6.2 (a) Annual mean levels of fine particulate matter (PM10), 2020 11.6.2 (b) Air Quality Index, 2015-2020 11.b.2 Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies, 2015-2020 No data for 11.3.1, 11.3.2, 11.4.1, 11.7.1, 11.b.1	Deaths (with and without Covid in 2020), injuries, displaced persons, 2015-2020 Whole of Indonesia, 2015-2019, economic losses from forest and land fires, floods, earthquakes (2019) Whole of Indonesia, waste amounts and managed waste (tonnes) in 2020 Whole of Indonesia, PM10 compared to quality standard By province, 2015-2020 Whole of Indonesia, 2015-2020
12. Responsible consumption and production	12.3.1(a) Food loss index, 2019 and 2020 12.4.1(a) Percentage of Mercury reduction and removal from the baseline of 50 tonnes 12.4.1(b) Percentage of reduction in consumption level of Ozone depleting substances from baseline, 2016-2020 12.4.2 (a) Hazardous waste generated per capita, 2015-2020 (tonnes/capita) 12.4.2 (b) Proportion of hazardous waste treated, 2015-2020 12.5.1 (a) Amount of waste generated recycled, 2019-2020 12.6.1 Number of companies publishing sustainability reports, 2019 12.6.1 (a) Number of Companies Implementing SNI ISO 14001 Certification, 2015-2019 12.7.1 (a) Number of environmentally friendly products registered and Included in the procurement of Government goods and services, 2020 12.7.1 (b) Number of documents for application of environmentally friendly labels for procurement of Government goods and services, 2019-2020 12.8.1 (a) Number of formal education units and institutions/communities categorized as having environmentally friendly cultures, 2015-2019 12.8.1 (b). Number of public facilities which are implementing community service standard and registered, 2020 12.c.1 Amount of fossil-fuel subsidies per unit of GDP, 2015-2020 No data for 12.1.1, 12.2.1, 12.2.2, 12.3.1b, 12.a.1, 12.b.1	Whole of Indonesia, 2019-2020 Whole of Indonesia 2020, by sector (4) Whole of Indonesia, HCFC, 2016-2020 Whole of Indonesia, 2015-2020 Whole of Indonesia, 2015-2020 Whole of Indonesia, 2019-2020 Whole of Indonesia, 2019 Whole of Indonesia, 2015-2019 Type of product (6), 2020 Whole of Indonesia, 2019-2020, type of label (2) Adiwiyata Green School, 2015-2019 Listed facilities (6), 2020 Whole of Indonesia, 2015-2020
13. Climate action	13.1.1 Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population, 2015-2020 13.1.3 Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies, 2015-2020 13.2.2 Total greenhouse gas (GHG) emissions per year, 2015-2019 (Mt CO_2-equivalent) 13.2.2 (a) Potential reduction of GHG emissions and (b) intensity of GHG emissions, 2015-2019 13.3.1 (a) Number of cared and environmental cultured formal education units and institutions/communities, 2015-2019	Deaths (with and without Covid in 2020), injuries, and displaced persons 2015-2020 Whole of Indonesia, 2015-2020 Whole of Indonesia, sectors (5), 2015-2019 Whole of Indonesia, potential reduction compared to BAU cumulative emissions, 2015-2019 Adiwiyata Green Schools, 2015-2019 Allocation, realization, percentage, 2018-2020

	13.a.1 (a) Amount of public funds (budget tagging) for marking climate change, 2018-2020: Allocation and realization of low carbon development budgets No data for 13.1.2, 13.2.1, 13.b.1	
14. Life under water	14.1.1 (a) Percentage of reduction of waste disposed of into the sea, 2019- 2020	Comparison of 2019 and 2020 nationally
	14.1.1 (a) Percentage of reduction of waste disposed of into the sea, 2019- 2020: Amount of waste disposed to the sea in 2019-2020 (g/m^2)	Province (24), district/city (34), 2019-2020, plus national average
	14.4.1 Proportion of fish stocks within biologically sustainable levels, 2017-2020	Whole of Indonesia, 2017-2020
	14.5.1 Coverage of protected areas in relation to marine areas, 2015-2020	Whole of Indonesia, 2015-2020
	14.6.1 (a) Percentage of compliance of business actors, 2019-2020 No data for 14.2.1, 14.3.1, 14.7.1, 14.a.1, 14.c.1	Whole of Indonesia, 2019-2020
15. Life on land	15.1.1 Forest area as a proportion of total land area, 2015-2019	Whole of Indonesia, 2015-2019
	15.1.2 (a) Area of High Conservation Value (HCV), 2019-2020	Whole of Indonesia, 2019-2020
	15.2.1 (a) Number of Forest Management Unit (FMUs) that are included in the sustainable category, 2020	Production FMUs and Protection FMUs, 2020
	15.3.1 Proportion of land that is degraded over total land area, 2019	Whole of Indonesia, 2019
	15.4.1 Coverage by protected areas of important sites for mountain biodiversity, 2020	Area function (6), number of areas, area coverage and total, 2020
	15.4.2 Mountain Green Cover Index 2017, 2019	Land cover type (4), forest area, other uses, total, 2017 and 2019
	15.5.1 Red-List index, 2014-2019	By animal species (24), baseline number 2014, number in 2019, reduction/increase, index
	15.7.1 (a). Number of cases of illegal hunting or trade of wild plants and animals, 2015-2020	Whole of Indonesia, 2015-2020
	15.c.1(a) Number of cases of illegal hunting or trade of wild plants and animals, 2015-2020 No data for 15.6.1, 15.8.1, 15.9.1, 15.a.1, 15.b.1	Whole of Indonesia, 2015-2020
17. Partnerships and means of implementation	17.9.1 (a) Number of markings for international development cooperation activities including SSTC (billion Rupiah), 2014-2020	Whole of Indonesia, 2014-2020
	17.9.1 (b) Number of South-South and triangular cooperation programs/ activities, 2014-2020	Whole of Indonesia, 2014-2020
	17.18.1 (a) Percentage of data users who use BPS data as the basis for national development planning, monitoring and evaluation, 2020 No data for 17.7.1, 17.14.1, 17.16.1	Whole of Indonesia, 2020
Number	59	64% of the UNEP 92 environmental indicators

1.2.2 World Environment Situation Room

UNEP is also setting up the World Environment Situation Room (https://wesr.unep.org/) where all national and regional environmental data will be collected and stored. The data collection will cover the SDGs, environmental statistics, global monitoring data, foresight and early warning, environmental assessments, MEAs, and a digital library.

The SDG coverage currently has data for 10 of the 26 indicators that UNEP is responsible for. The 10 tier I and II indicators are:

- 6.3.2 Proportion of bodies of water with good ambient water quality
- 6.5.1 Degree of integrated water resources management implementation (0-100)
- 6.6.1 Change in the extent of water-related ecosystems over time

- 8.4.2 Domestic material consumption (DMC) and DMC per capita, per GDP
- 12.1.1 Number of countries with sustainable consumption and production (SCP) national action plans or SCP mainstreamed as a priority or target into national policies
- 12.2.2 Domestic material consumption (DMC) and DMC per capita, per GDP
- 12.4.1 Number of Parties to international multilateral environmental agreements on hazardous waste, and other chemicals that meet their commitments and obligations in transmitting information as required by each relevant agreement
- 12.c.1 Amount of fossil-fuel subsidies per unit of GDP (production and consumption).
- 14.5.1 Coverage of protected areas in relation to marine areas
- 15.1.2 Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type
- 15.4.1 Coverage by protected areas of important sites for mountain biodiversity

UNEP contributes this information to the UNSD global database and to the regular global SDG reports. The statistical database is being organized by the 17 SDGs, by country, and by region.

The global monitoring section covers air, biodiversity, biota, climate change, land, oceans and seas, pollution, risk, and water. It also has visualization of satellite imagery (Landsat and Sentinel 2). The climate change section, for example, has geospatial information, interactive graphs, DPSIR climate data platform (under development), the World Adaptation Science Programme, publications on climate change, and news items (especially from global conferences).

The section on "foresight: early warning, emerging issues and futures" has 25 foresight briefs which are intended to highlight an emerging issue or a currently "hot" topic, as well as to suggest possible policy solutions. The current brief is titled "working with plants, soil and water to cool the climate and rehydrate Earth's landscapes".

The assessments section covers (i) adaptation gap reports; (ii) emission gap reports; (iii) global environment outlooks; (iv) frontiers reports; (v) global assessment of sand and dust storms; (vi) global chemical outlooks; and (vii) global resources outlook, among others.

The section on MEAs provides hyperlinks to InforMEA (https://www.informea.org/en/goals) which is a useful source of all the relevant global environmental agreements, treaties, and principles as well as agreed goals (e.g., SDGs, Aichi targets). Currently this section contains 289 goals, each of which is hyperlinked back to the source MEA. InforMEA also has an interesting collection of relevant laws and court cases.

The 8 regional agreements covered for Asia and the Pacific are (i) Waigani Convention (chemicals and waste); (ii) Tehran Convention (marine); (iii) Noumea Convention (marine pollution); (iv) Antigua Convention (fisheries); (v) Apia Convention (species protection); (vi) ASEAN Agreement on Transboundary Haze (air pollution); (vii) Jeddah Convention (coastal protection); and (viii) Kuwait Regional Convention (coastal biodiversity). While not all these conventions have been analyzed, it is a reasonable assumption that they would also increase the number of indicators that ASEAN Member States are expected to report on. A few of the key global conventions are analyzed as follows.

1.2.3 Convention on Biological Diversity

The CBD Strategic Plan for Biodiversity (2011-2020) and the Aichi targets have been replaced by the Kunming-Montreal Global Biodiversity Framework at the 15th Meeting of the Conference of the Parties held in Montreal, Canada, in 2022 (UNEP-WCMC and IUCN 2020). The 20 Aichi targets were assigned 78 generic and 145 specific indicators (UNEP-WCMC, IUCN, and NGS 2018). For example, Target 11 provides for at least 17% of terrestrial and inland water and

10% of coastal and marine areas to be conserved in protected areas by 2020. One of the seven generic indicators is "trends in area of coastal and marine areas conserved", which is matched by two specific indicators: (i) percentage of marine and coastal areas covered by protected areas; and (ii) coverage of protected areas in relation to marine areas (which, in turn, is an indicator for SDG target 14.5). As of May 2021, 16.64% (22.5 million km^2) of land and inland freshwater and 7.74% (28.1 million km^2) of coastal waters are now within protected areas, illustrating the value of setting measurable targets (UNEP-WCMC and IUCN 2020).

The final text of the post-2020 Kunming-Montreal Global Biodiversity Framework aims to implement the prior 2050 vision of living in harmony with nature, and four long-term goals related to (i) increasing the "integrity, connectivity and resilience" of ecosystems while reducing threats to species and genetic diversity; (ii) valuing, maintaining, and enhancing nature's contribution to people; (iii) ensuring monetary and non-monetary benefits are shared equitably; and (iv) having the means available to achieve the framework's goals and targets (CBD Secretariat 2022a). The post-2020 Framework comprises 4 goals and 23 targets proposed for 2030, towards the longer-term vision of "living in harmony with nature" by 2050. Key targets (paraphrased) include:

- Target 3 - At least 30% globally of land, freshwater, coastal and marine areas conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and integrated into the wider landscapes and seascapes.
- Target 6 - Prevent or reduce introduction and establishment of invasive alien species by 50% by 2030, and control or eradicate such species to eliminate or reduce their impacts.
- Target 7 - Reduce nutrients lost to the environment by at least half, pesticides and highly hazardous chemicals by at least half, and working towards eliminating plastic pollution.
- Target 8 - Use ecosystem-based approaches to contribute to mitigation and adaptation to climate change and ensure that all mitigation and adaptation efforts avoid negative impacts on biodiversity.
- Target 18 - Redirect, repurpose, reform or eliminate incentives harmful for biodiversity in a just and equitable way, reducing them by at least US$ 500 billion per year by 2030.
- Target 19 - Increase financial resources from all sources to at least US$ 200 billion per year, with at least US$10 billion per year international financial flows to developing countries.

The post-2020 Framework has 36 proposed headline indicators, 10 for the four Goals (Table 1.4) and 26 for the 23 targets, including the 10 headline indicators (CBD Secretariat 2022b). Fifteen of these indicators match with an SDG indicator so they would be collected under SDG processes, not requiring further effort under the CBD. Several of these indicators will require further research. Note the reduced number of indicators compared to the Aichi targets.

Table 1.4 Headline Indicators for the Post-2020 Global Biodiversity Framework

Goal/Target	Proposed Indicator
Goal A. The integrity, connectivity and resilience of all ecosystems are maintained, enhanced, or restored, substantially increasing the area of natural ecosystems by 2050; Human induced extinction of known threatened species is halted, and, by 2050, extinction rate and risk of all species are reduced tenfold and the abundance of native wild species is increased to healthy and resilient levels; The genetic diversity within populations of wild and domesticated species, is maintained, safeguarding	A.1 Red List of Ecosystems A.2 Extent of natural ecosystems A.3 Red List Index A.5 The proportion of populations within species with an effective population size > 500

their adaptive potential.	
Goal B. Biodiversity is sustainably used and managed and nature's contributions to people, including ecosystem functions and services, are valued, maintained and enhanced, with those currently in decline being restored, supporting the achievement of sustainable development for the benefit of present and future generations by 2050.	B.1 Services provided by ecosystems
Goal C. The monetary and non-monetary benefits from the utilization of genetic resources, and digital sequence information on genetic resources, and of traditional knowledge associated with genetic resources, as applicable, are shared fairly and equitably, including, as appropriate with indigenous peoples and local communities, and substantially increased by 2050, while ensuring traditional knowledge associated with genetic resources is appropriately protected, thereby contributing to the conservation and sustainable use of biodiversity, in accordance with internationally agreed access and benefit-sharing instruments.	C.1 Indicator on monetary benefits received C.2 Indicator on non-monetary benefits
Goal D. Adequate means of implementation, including financial resources, capacity-building, technical and scientific cooperation, and access to and transfer of technology to fully implement the Kunming-Montreal global biodiversity framework are secured and equitably accessible to all Parties, especially developing countries, in particular the least developed countries and small island developing States, as well as countries with economies in transition, progressively closing the biodiversity finance gap of US$700 billion per year, and aligning financial flows with the Kunming-Montreal Global Biodiversity Framework and the 2050 Vision for Biodiversity.	D.1 International public funding, including official development assistance (ODA) for conservation and sustainable use of biodiversity and ecosystems D.2 Domestic public funding on conservation and sustainable use of biodiversity and ecosystems D.3 Private funding (domestic and international) on conservation and sustainable use of biodiversity and ecosystems

1.2.4 Sendai Framework for Disaster Risk Reduction

The Sendai Framework for Disaster Risk Reduction (2015-2030) set out 7 targets and 38 indicators, several of which overlap with the SDG indicators (Table 1.5).

Table 1.5 Sendai Framework for Disaster Risk Reduction (2015-2030) Indicators

Target	Indicators
A. Substantially reduce global disaster mortality by 2030, aiming to lower average per 100,000 global mortality between 2020-2030 compared with 2005-2015.	A-1. Number of deaths and missing persons attributed to disasters, per 100,000 population. A-2. Number of deaths attributed to disasters, per 100,000 population. A-3. Number of missing persons attributed to disasters, per 100,000 population.
B. Substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 between 2020-2030 compared with 2005-2015.	B-1. Number of directly affected people attributed to disasters, per 100,000 population. B-2. Number of injured or ill people attributed to disasters, per 100,000 population. B-3. Number of people whose damaged dwellings were attributed to disasters. B-4. Number of people whose destroyed dwellings were attributed to disasters. B-5. Number of people whose livelihoods were disrupted or destroyed, attributed to disasters
C. Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030.	C-1. Direct economic loss attributed to disasters in relation to global gross domestic product. C-2. Direct agricultural loss attributed to disasters. C-3. Direct economic loss to all other damaged or destroyed productive assets attributed to disasters. C-4. Direct economic loss in the housing sector attributed to disasters. C-5. Direct economic loss resulting from damaged or destroyed critical infrastructure attributed to disasters. C-6. Direct economic loss to cultural heritage damaged or destroyed attributed to disasters.
D. Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and	D-1. Damage to critical infrastructure attributed to disasters. D-2. Number of destroyed or damaged health facilities attributed to disasters. D-3. Number of destroyed or damaged educational facilities attributed to disasters.

educational facilities, including through developing their resilience by 2030	D-4. Number of other destroyed or damaged critical infrastructure units and facilities attributed to disasters. D-5. Number of disruptions to basic services attributed to disasters. D-6. Number of disruptions to educational services attributed to disasters. D-7. Number of disruptions to health services attributed to disasters. D-8. Number of disruptions to other basic services attributed to disasters
E. Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020.	E-1. Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015-2030. E-2. Percentage of local governments that adopt and implement local disaster risk reduction strategies in line with national strategies.
F. Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of this framework by 2030.	F-1. Total official international support, (official development assistance (ODA) plus other official flows), for national disaster risk reduction actions. F-2. Total official international support (ODA plus other official flows) for national disaster risk reduction actions provided by multilateral agencies. F-3. Total official international support (ODA plus other official flows) for national disaster risk reduction actions provided bilaterally. F-4. Total official international support (ODA plus other official flows) for the transfer and exchange of disaster risk reduction-related technology. F-5. Number of international, regional and bilateral programmes and initiatives for the transfer and exchange of science, technology and innovation in disaster risk reduction for developing countries. F-6. Total official international support (ODA plus other official flows) for disaster risk reduction capacity-building. F-7. Number of international, regional and bilateral programmes and initiatives for disaster risk reduction-related capacity-building in developing countries. F-8. Number of developing countries supported by international, regional and bilateral initiatives to strengthen their disaster risk reduction-related statistical capacity.
G. Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to the people by 2030.	G-1. Number of countries that have multi-hazard early warning systems. G-2. Number of countries that have multi-hazard monitoring and forecasting systems. G-3. Number of people per 100,000 that are covered by early warning information through local governments or through national dissemination mechanisms. G-4. Percentage of local governments having a plan to act on early warnings. G-5. Number of countries that have accessible, understandable, usable and relevant disaster risk information and assessment available to the people at the national and local levels. G-6. Percentage of population exposed to or at risk from disasters protected through pre-emptive evacuation following early warning.

1.2.5 UN Framework Convention on Climate Change

For the UN Framework Convention on Climate Change (UNFCCC), the UN Statistics Division has been preparing a draft list of climate change statistics and 134 indicators (UN Statistics Division 2021). These are now being reviewed by a wide range of stakeholders with a view to finalizing them in October 2021 and adopting them at the next Statistical Commission session in March 2022.

The draft set of indicators follows the following format:

- **Drivers** – GHG emissions, atmospheric concentration of greenhouse gases, energy production and supply, energy consumption, fossil fuels, transport, land and agriculture.

- **Impacts** – agricultural production, areas impacted by climate change, freshwater resources, water abstraction, supply and use, water quality, hazardous events and disasters, human health, climate change evidence, soil condition, distribution and status of species, ecosystems, production and consumption of materials, climate change impacts on transport and tourism.

- **Vulnerability** – food security, vulnerable species, ecosystems and services, buildings and infrastructure, vulnerable population, vulnerable areas of countries.

- **Mitigation** – renewable energy, mitigation policies, strategies and plans, mitigation technology and practice.

● **Adaptation** – adaptation policies, strategies and plans, risk management, disaster forecasting and early warning systems, public awareness and education, adaptation management and practice, monitoring, water management, waste management.

1.2.6 Minamata Convention on Mercury

The Minamata Convention on Mercury was adopted in 2013 and entered into force in 2017. The Convention plus the Basel, Rotterdam and Stockholm conventions provide an extensive global regime for environmental management of chemicals and hazardous waste and protection of human health (UNEP 2019). Parties to the Convention (including 8 AMS to date) are expected to (i) establish national objectives and targets; prepare an action plan to control artisanal, small-scale gold mining and processing with mercury amalgam; and (iii) report to the Conference of Parties (COP) on the measures implemented and the reductions achieved. Parties are also expected to monitor and report on mercury levels in vulnerable populations and environmental media, such as exposed animals. The COP decided that full reports should be submitted every four years and short reports every two years on four questions marked by an asterisk in the full format (short reports). The first full reports were due by 31 December 2021, preferably using the online reporting tool. The short form reports include the following indicators:

- primary mines of mercury operating in the territory
- individual stocks of mercury or mercury compounds greater than 50 tonnes
- sources of mercury supply generating stocks of mercury greater than 10 tonnes per year
- use or disposal of mercury from such stocks or sources
- consent from importing countries for exports of mercury
- facilities for final disposal of waste containing mercury
- volume of such waste disposed in the reporting period

At least five of the AMS had submitted the short form reports by October 2021.

1.2.7 Education for Sustainable Development 2030

UNESCO's Education for Sustainable Development Roadmap builds on the UN Decade for ESD (2005-2014) and the Global Action Programme on ESD (2015-2019). ESD for 2030 was adopted at the 40th UNESCO General Conference (UNESCO 2020). The Roadmap sets out five priority action areas (i) policy; (ii) education and training settings; (iii) building capacities of educators; (iv) recognizing young people as key actors; and (v) local level action. An ESD for 2030 Network will be established at global and regional levels. The monitoring programme will aim to achieve SDG target 4.7 by 2030.

The goal of ESD for 2030 is "to build a more just and sustainable world through strengthening ESD and contributing to achievement of the 17 SDGs" (UNESCO n.d.). UNESCO plans to conduct two evaluations in 2020-2030. The key indicators to be monitored are:

- Policy: extent to which legal frameworks and policies are in place to promote ESD
- Learning environment: extent to which the learning environment promotes ESD and its whole institution approach
- Educators: extent to which educators are trained to teach ESD and apply whole institution approaches to ESD in the learning situation
- Youth: extent to which youth are engaged in ESD
- Community: extent to which ESD is promoted in local communities

- Progress of country initiatives: extent to which ESD for 2030 is implemented in countries around the world.

UNESCO as the custodian agency for SDG target indicator 4.7.1 will use the data collected through the 1974 recommended reporting process to monitor member states progress on ESD. Countries are expected to monitor achievements by country initiatives in each of the five priority action areas.

1.3 Global Reporting Frameworks

1.3.1 Framework for Development of Environment Statistics

The initial Framework for the Development of Environment Statistics (FDES) was published in 1984 and has guided many of the national statistics departments since then (see Annex 1). FDES is intended to assist in (i) defining the scope of environmental statistics; (ii) assessing data requirements, sources and gaps; (iii) guiding development of multi-purpose databases; and (iv) assisting coordination across multiple, responsible institutions (UNDESA 2017).

The basic set of environment statistics developed by the UN Statistics Division for FDES covers 6 components (i) environmental conditions and quality; (ii) environmental resources and their uses; (iii) residuals; (iv) extreme events and disasters; (v) human settlements and environmental health; and (vi) environmental protection and resource management expenditure. There are also 21 sub-components and 60 topics (UNDESA 2017). In total, 458 environment statistics have been identified in the Basic Set of Environment Statistics. Advice on methodologies is being systematically provided through methodology sheets that are part of a Manual on the Basic Set of Environment Statistics (UN Statistics Division 2022). Methodology sheets are currently available for soils, ecosystems and biodiversity, land cover and land use, forests, air quality, GHGs, marine water quality, mineral resources, energy resources, crops and livestock, water resources, waste, human settlements, and environmental protection expenditure.

In addition to the basic set, FDES also provides a core set which will allow countries to compile a more complete set of environmental statistics and to effectively respond to the global and regional needs to report on progress of various multilateral environment agreements (MEAs).

1.3.2 System of Environmental-Economic Accounting

As an adjunct to the System of National Accounts, which has been in place since the 1950s, the System of Environmental-Economic Accounting (SEAA) was introduced in 2012 in recognition of how the economy drives environmental change and the reliance of the economy on natural resources and the environment (United Nations 2014). Environmental and economic accounting compiles physical supply and use data, functional accounts, and asset inventories for natural resources. Information on "water, minerals, energy, timber, fish, soil, land, ecosystems, pollution and waste, production, consumption and accumulation" are brought together in a single measurement system. Physical and monetary data are combined in the topic being measured, using the same flow and stock concepts as the System of National Accounts. The SEAA Central Framework also provides a description of all items under the Classification of Environmental Activities which would provide an excellent structure for developing a national monitoring and evaluation framework (United Nations 2014).

A further development of the SEAA has been the recent release of the final draft of the System of Environmental-Economic Accounting – Ecosystem Accounting (SEAA-EA) (UNDESA 2021b). SEAA-EA is described as "a spatially-based, integrated statistical framework for

organizing biophysical information about ecosystems, measuring ecosystem services, tracking changes in ecosystem extent and condition, valuing ecosystem services and assets", and linking all this information to social and economic activity.

Changes in ecosystem extent, for example, supports development of indicators of deforestation, soil erosion, land degradation, desertification, land use conversion, and other aspects of ecosystem change, and these can be reported not only in tabular form but also as a variety of maps or geographic information system (GIS) overlays. There is even potential for 3-D representations, such as ecotypes in mountain ranges or oceanic ecosystem layers, or linear features like a river (UNDESA 2021b). As ecosystems don't have market prices, monitoring ecosystem condition is an important way of measuring the asset value, as pristine ecosystems are valued much more than degraded ecosystems and are generally more resilient to changes, like climate change. Biodiversity is an important indicator of ecosystem condition too, as species diversity contributes to ecosystem services.

Ecosystem condition can be broken down into six variables and multiple indicators, as the following example for tropical/sub-tropical forests shows: (i) physical state – soil water availability in the driest quarter; (ii) chemical state – soil organic carbon; (iii) compositional state – species richness; (iv) structural state – forest age class distribution; (v) functional state – dry matter productivity; (vi) landscape state – forest area density (UNDESA 2021b). Ecosystem condition accounts can be applied at any level and allow for aggregation, for example, for international reporting obligations.

Ecosystem services provide the clearest link to economic accounting, as they connect the ecosystem assets and the human uses made of those assets by firms, governments, or individuals. Measurement of ecosystem services in SEAA-EA fits into many previous initiatives on ecosystem services, including the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). A reference list of 37 ecosystem services is provided, covering regulating services, provisioning services and cultural services (UNDESA 2021b).

1.3.3 Singapore Index on Cities' Biodiversity

The Singapore Index is a self-assessment tool for cities to evaluate and monitor progress against their own baselines, in their efforts to promote urban biodiversity conservation (Chan *et al.* 2014; Chan *et al.* 2021). Following a brief "profile of the city", the Index lists 28 indicators that measure biodiversity in the city, with each indicator scored from 0-4, making a possible maximum score of 112. The year in which a city embarks on this scoring system is taken as the baseline year and will be measured against future applications of the SI to chart its progress in conserving biodiversity. Cities that have applied the SI have found that (i) the process facilitated capacity-building and networking in biodiversity conservation; (ii) the indicators also functioned as guidelines for biodiversity conservation and in master-planning of cities; and (iii) the quantitative scoring assisted in setting priorities for conservation actions and budget allocation. The assessment is intended to be completed every three to five years, so that the trend can be monitored. The indicators are arranged into three core components as follows:

Native biodiversity in the city – (i) proportion of natural areas in the city; (ii) connectivity measures or ecological networks to counter fragmentation; (iii) native biodiversity in built up areas (bird species); (iv) change in number of vascular plant species; (v) change in number of native bird species; (vi) change in number of native Arthropod species; (vii) habitat restoration; (viii) proportion of protected natural areas; and (ix) proportion of invasive alien species.

Ecosystem services provided by biodiversity – (x) regulation of quantity of water; (xi) climate regulation – benefits of trees and greenery; (xii) recreational services; (xiii) health and wellbeing – proximity/accessibility to parks; and (xiv) food security – urban agriculture.

Governance and management of biodiversity – (xv) institutional capacity; (xvi) budget allocated to biodiversity; (xvii) policies, rules and regulations – existence of local biodiversity strategy and action plan; (xviii) status of natural capital assessment in the city; (xix) state of green and blue space management plans in the city; (xx) biodiversity-related responses to climate change; (xxi) policy and/or incentives for green infrastructure as nature-based solutions; (xxii) cross-sectoral and inter-agency collaborations; (xxiii and xxiv) participation and partnership; (xxv) number of biodiversity projects implemented by the city annually; (xxvi) education; (xxvii) awareness; and (xxviii) community science.

If the assessment is conducted by the same group in the city each time, however, then progress trends may be more reliably identified. The system has been used effectively by several cities globally (e.g., Brussels, Edmonton, and Montreal), including Singapore's city planners and the Green Mark for Districts scheme (Chan et al. 2014).

1.3.4 OECD Programme on Environmental Information and Indicators

The Organisation for Economic Cooperation and Development (OECD) Working Party on Environmental Information (WPEI) of the OECD Environment Policy Committee has been developing guidance on environmental information and indicators which is being used in its series of country environmental performance reports (OECD 2020) (Figure 1.1). The OECD is also part of the global effort to further develop the System of Environmental and Economic Accounts. While AMS are not expected to follow OECD guidance, many of the donor countries may refer to this guidance in providing support to ASEAN. The Core Set of Environmental Indicators is about 50 indicators that follow the Pressure-State-Responses model (OECD 2008).
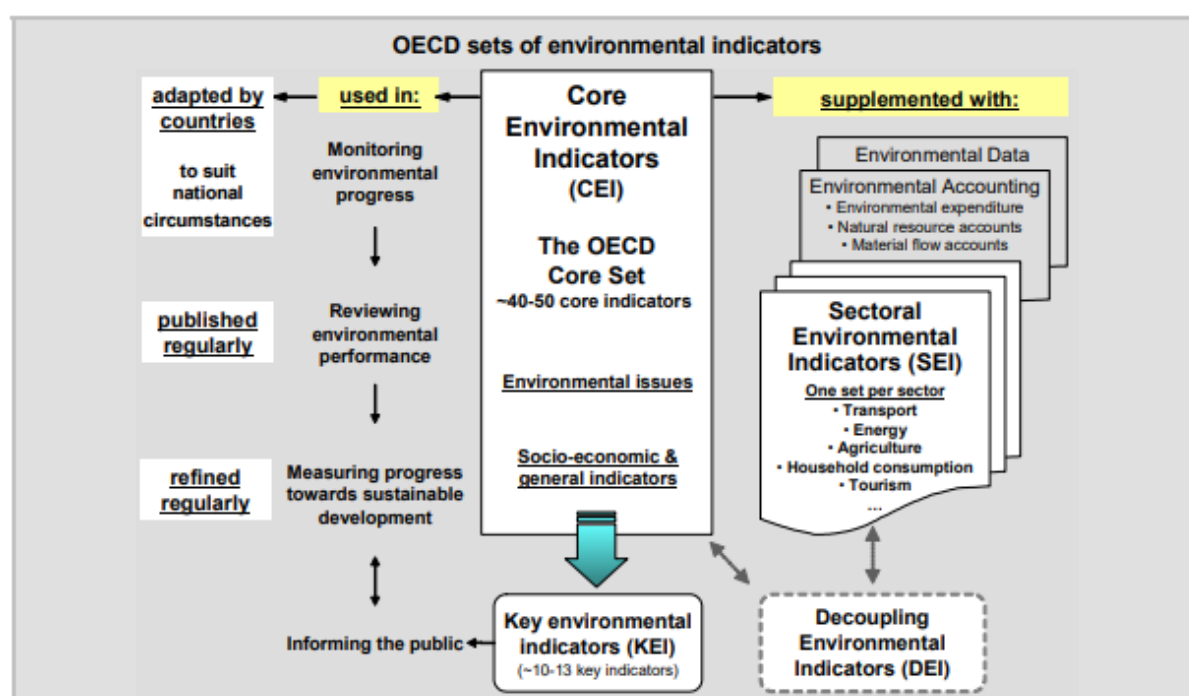

Figure 1.1 OECD's set of environmental indicators

Source: (OECD 2008)

The 2020 Environment at a Glance report covers climate change, air quality and health, freshwater resources, circular economy, waste and materials, biological resources and biodiversity (OECD 2020).

- Climate change indicators: GHG and carbon emissions, energy supply, energy intensity, share of renewable energy in the supply mix, and fossil fuel subsidies;
- Air quality and health: emissions of So_x, No_x, $PM_{2.5}$, human exposure to fine particulates in the air, related mortality rates and deaths;
- Freshwater: freshwater abstractions, water stress levels, connection rates to wastewater treatment plants;
- Circular economy, waste, and materials: use of materials, generation of waste, and recovery of materials from waste; and
- Biological resources and biodiversity: threatened species, protected areas, forest resources, and changes in land cover.

In addition to the above indicators, the earlier 2008 listing of key environmental indicators included (i) ozone layer (ozone depleting substances); (ii) waste generation (municipal waste generation intensity); (iii) forest resources (intensity of use of forest resources); and (iv) fish resources (intensity of use of fish resources) (OECD 2008). Recently, sustainable ocean economy has been added to the fields covered, with indicators on coastal urbanization, carbon dioxide emissions from international marine bunkers, technological innovation, marine and coastal protected areas, ocean-related taxes, and fossil fuel support (OECD 2020).

1.3.5 Strong Environmental Sustainability Index

The Agence Française de Développement (AFD) has used the environmental sustainability gap framework to develop a strong environmental sustainability index (SESI) composed of 22 indicators that represent environmental sustainability performance at the national level (AFD 2020). This index is being measured for the 28 Member States of the European Union, but its applicability for other countries is still being assessed (Usubiaga-Liaño and Ekins 2021). Global data is available for 9 of the 22 indicators, while proxies are needed for 11 indicators, and no common source is available for 2 indicators (Table 1.6).

Table 1.6 Strong Environmental Sustainability Index Indicators

Domain	Globally available indicator	Global proxy indicator	No global indicator available
Source Forest resources Fish resources Surface water resources Groundwater resources Soil erosion	1.1.2: Fish stocks within safe biological limits 1.2.2: Groundwater bodies in good quantitative status 1.3.1: Area with tolerable soil erosion	1.1.1: Forest utilization rate 1.2.1: Freshwater bodies not under water stress	
Sink Greenhouse gases Ozone depleting substances Ozone pollution	2.1.1: Per-capita GHG/CO_2 emissions 2.1.2: Stratospheric ozone depleting substances		2.2.1: Cropland and forest area exposed to safe ozone levels

Pollution by heavy metals		2.2.2: Ecosystems not exceeding the critical loads of cadmium / lead / mercury	
Eutrophication		2.2.3: Ecosystems not exceeding the critical loads of eutrophication	
Acidification		2.2.4: Ecosystems not exceeding the critical loads of acidification	
Surface water pollution		2.3.1: Surface water bodies in good chemical status	
Groundwater pollution		2.3.2: Groundwater bodies in good chemical status	
Marine pollution		2.4.1: Coastal water bodies in good chemical status	
Life support Terrestrial ecosystems	3.1.1: Terrestrial area with acceptable biodiversity levels		
Freshwater ecosystems		3.2.1: Surface water bodies in good ecological status	
Marine ecosystems		3.3.1: Coastal water bodies in good ecological status	
Human health and other welfare Outdoor air pollution	4.1.1: Population exposed to safe levels of PM2.5		
Indoor air pollution Drinking water pollution	4.1.2: Population using clean fuels and technologies for cooking	4.1.3: Samples that meet the drinking water criteria	
Bathing waters			4.2.1: Recreational water bodies that meet the 'excellent' quality criteria
Natural and mixed world heritage sites	4.2.2: Natural and mixed world heritage sites in good conservation outlook		

Of the 20 SES and proxy SES indicators supported by global data sources, 13 indicators are supported by data available for all UN Member States, 2 are supported by data that is available for most but not all member states, and 4 are available for only a minority of Member States. Twenty of the SES indicators are related to the SDG indicators (AFD 2020).

1.4 Regional agreements, strategic plans, and national environmental assessments

The following section highlights the wide-ranging indicators in various reporting requirements of AMS at the regional and national levels. Some of these reports are mandated in national laws (like national state of environment reports) while others are voluntary.

1.4.1 Regional State of Environment Reports

The fifth ASEAN state of environment report recommended in several chapters that ASEAN should devote additional effort to harmonizing monitoring programmes, such as air quality, fire hotspots, climate change, GHG emissions, biodiversity, water quality, fisheries, and illegal waste activities, among others (ASEAN Secretariat 2017). Some of the recommendations, for

example, were to (i) "develop consistent and systematic ways of monitoring air quality and pollution levels across ASEAN as data is often fragmented and not comparable across the region. ASEAN should support the establishment of standard air quality monitoring mechanisms, guidelines and databases"; (ii) "develop an effective monitoring and evaluation framework and conduct regular monitoring of the drivers, pressures, states, impacts and responses on key biodiversity and ecosystem issues"; and (iii) "implement more effective water-related data sharing to support a regional monitoring system on water quality and quality and assessing status of freshwater resources and potential impacts from key drivers in the region" (ASEAN Secretariat 2017).

As indicated in the purpose of this assessment, the draft ASEAN Strategic Plan on Environment (2016-2025) notes that key performance indicators will be developed for each strategic priority in line with the approved ASEAN Sociocultural Community Blueprint 2025 monitoring and evaluation system, as well as in relation to the SDGs. Some of the existing regional agreements have already set out a patchwork monitoring framework, although the extent to which these are followed is mixed, and most of them do not have a clear set of measurable indicators or an effective monitoring plan.

1.4.2 ASEAN Coordinating Centre for Transboundary Haze Pollution Control

In some ways the transboundary haze problem in the ASEAN region has been the trigger for increased regional cooperation on environmental management, as it set in motion the ASEAN Agreement on Transboundary Haze Pollution, which provides for significant regional cooperation. The ASEAN Coordinating Centre for Transboundary Haze Pollution Control, to be hosted by Indonesia, is one of the planned cooperation mechanisms of the ASEAN Agreement on Transboundary Haze Pollution (ASEAN Secretariat 2016). The Agreement obliges AMS to prevent and monitor transboundary haze pollution caused by land or forest fires and to cooperate on development of monitoring, assessment, and warning systems. The standard operating procedure for the Centre is for National Monitoring Centres to monitor fire prone areas, land and forest fires, environmental conditions that may be conducive for fires, and haze pollution from those fires. These monitoring results are supposed to be communicated to the Centre on regular intervals but as for many other regional agreements the Transboundary Haze Agreement is missing a clear set of measurable indicators that would allow effective monitoring of progress. As a new Haze Roadmap is under preparation, it is expected that the new Roadmap will contain a set of measurable indicators.

1.4.3 ASEAN Clearing-House Mechanism

The clearing house mechanism was established by the ASEAN Centre for Biodiversity to support AMS in reporting on international MEAs, such as the Convention on Biological Diversity and the Aichi Biodiversity Targets (ASEAN Centre for Biodiversity 2015). The species database holds about 34,000 records, while the database on invasive alien species provides information for necessary action.

The ASEAN Biodiversity Dashboard provides a GIS coverage of 12 indices or indicators showing biodiversity trends in the region: (i) bioclimatic ecosystem resilience index; (ii) biodiversity habitat index; (iii) biodiversity records; (iv) fire alerts; (v) forest cover; (vi) forest loss; (vii) human footprint; (viii) human population; (ix) mangrove cover; (x) protected area connectedness index; (xi) protected area coverage of key biodiversity areas; and (xii) protected area representativeness index (ASEAN Centre for Biodiversity, n.d.).

The ASEAN Centre for Biodiversity is also implementing the Global Taxonomy Initiative Regional Action Plan for Southeast Asia (2017-2025) to overcome the lack of trained taxonomists in the ASEAN region (ASEAN Centre for Biodiversity 2017). Also, the Regional Action Plan for ASEAN Heritage Parks (2016-2020) aims to revise/finalise criteria and indicators for nominating new heritage parks, especially for marine protected areas, and adopt a common, participatory monitoring and evaluation system, with full involvement of indigenous peoples and local communities (ASEAN Centre for Biodiversity 2016).

1.4.4 Regional Marine Strategy

The Sustainable Development Strategy for the Seas of East Asia (SDS-SEA), which dates back to 2003, has been adopted by all AMS (except Myanmar) plus China, DPR Korea, Japan, Republic of Korea, and Timor Leste. SDS-SEA was updated in 2015 to align with contemporary global conventions and covers seven strategies, plus related objectives and proposed action programmes. The SDS-SEA Implementation Plan 2018–2022 sets out 3 priority management programmes (biodiversity conservation, climate change and disaster risk reduction, and pollution reduction and waste management) plus 3 governance programmes (ocean governance and strategic partnerships, knowledge management and capacity building, and blue economy investments and sustainable financing) (PEMSEA 2018). Each of these programmes has expected outcomes in 2022 as well as a range of progress indicators and targeted action and schedule. For example, one of the biodiversity outcomes expected is an increased area of healthy, resilient habitats. The corresponding indicators are (i) percentage of local governments implementing integrated coastal management programmes; (ii) coverage of coastal use zoning schemes; and (iii) published state of the coast reports (PEMSEA 2018). The extent to which progress has been achieved is intended to be reviewed in 2020-2021 and reported to the 2021 East Asia Seas Congress planned for December 2021, with a view to developing a further implementation plan for 2023-2027.

1.4.5 National State of Environment Reports

Most of the AMS have produced periodic reports equivalent to a national state of environment report. Myanmar produced an Environmental Performance Assessment in 2012 but appears not to have produced a similar report since then (ADB 2012). Brunei Darussalam produced a comprehensive State of Environment Report in 2006 (Department of Environment Parks and Recreation 2006). Lao PDR produced the Lao Environment Outlook in 2012 (Ministry of Natural Resources and Environment 2012). Cambodia produced an Environment Outlook in 2009 (Ministry of Environment 2009) and was due to release the fourth national report in 2020. Malaysia produced an Environmental Quality report in 2017, while the Department of Statistics produced a Compendium of Environmental Statistics in 2015 and the first Environmental Statistics report in 2020. The Philippines Statistics Authority publishes annual environmental accounts. Viet Nam produces annual national environment reports, and the 2021 edition is expected to focus on air pollution.

Rather than attempting to extract indicators from all these reports, Thailand's State of Pollution 2015 report indicates the type of data collected in these national state of environment reports (Table 1.7).

Table 1.7 Thailand's State of Pollution 2015

Environmental Domain	Indicators	Notes
Air quality	PM_{10}, $PM_{2.5}$, Ozone, volatile organic compounds, benzene, butadiene, dichloroethane, chloroform, sulphur dioxide, nitrogen dioxide, carbon monoxide, lead, total suspended particulates.	Air quality monitoring was undertaken with 61 automatic monitoring stations in 29 provinces; monitoring results were reported hourly on www.Air4thai.pcd.go.th and a smartphone application Air4Thai; $PM_{2.5}$ has been monitored since 2011 with 12 automatic monitoring stations in 10 provinces; plus 18 monitoring stations for lead and TSP in Bangkok and vicinity.
Noise	Roadside noise levels	There are 13 automatic monitoring stations located in 30 provinces, which monitored the noise level all year round and 19 temporary stations on Bangkok's roadside
Water quality	Water quality index (WQI) - dissolved oxygen, biochemical oxygen demand, total coliform bacterial, faecal coliform bacteria, and Ammonia-Nitrogen. Heavy metals - arsenic, lead, mercury, cadmium, manganese	In 2015, 366 monitoring stations assessed 65 major water sources 4 times per year for the WQI. Ten-year trends (2006-2015) were also reported. Trends in wastewater treatment were also reported (2011-2015). On average only 26.9% of the wastewater was treated.
Coastal water quality	Dissolved oxygen, Nitrates – Nitrogen, Phosphates – Phosphorus, bacteria, copper, pesticides, and toxic elements, such as Mercury, Cadmium, Total Chromium, Chromium Hexavalent, Lead, Cyanide and PCBs. In 2015, 18 instances of red tide phenomenon were recorded.	Coastal water monitoring results were from 202 sampling locations, which collected the sample twice annually for the Marine Water Quality Index (MWQI) - Dissolved Oxygen, Total Coliform Bacteria, Phosphate – Phosphorus, Nitrate – Nitrogen, Temperature, Suspended Solids, Acidity – Alkalinity (pH) and Ammonia – Nitrogen. Total petroleum and hydrocarbon level was measured in 133 areas as indicators for oil contamination.
Groundwater	Fluoride, iron, manganese, nitrate, sulphate, total hardness, total dissolved solids, chloride	In 2015, Thailand had 775 observation stations, which consisted of 1,408 wells. Arsenic, Lead, Cadmium, Mercury, and Selenium were monitored around landfills
Waste and hazardous substances	Solid waste in waste disposal centres Amount of waste generated, utilized and correctly disposed Waste recycling and reuse Recyclable industrial waste Municipal solid waste Hazardous wastes Hazardous substances (agrochemicals, industrial chemicals)	In 2015, there were 4,545 Local Administrative Organizations managing municipal waste, but 46% of waste was incorrectly disposed of. Hazardous waste comes from communities, hazardous waste from industrial activities, and infectious waste. Hazardous substances are imported into Thailand for agricultural and industrial activities, such as medical and healthcare. Management of wastes is covered under the National Waste and Hazardous Waste Management Master Plan (2016–2021).
Emergencies and pollution accidents	Chemical accidents Landfill fires Illegal waste dumping Oil slicks, tar balls and oil spills Pollution complaints	In 2015, 42 incidents were recorded, 20 emergencies from industrial plants and warehouses; 1 accident from chemical transportation; 7 incidents of illegal dumping of toxic waste and 14 due to other causes.
		The final sections dealt with environmental governance, budget and finance issues.

1.4.6 Environmental Performance Reports

The Asian Development Bank's Greater Mekong Subregion (GMS) Environment Operations Centre has been preparing environmental performance reports since 2003 for Myanmar, Thailand, Lao PDR, Cambodia, Viet Nam, and the Guangxi Zhuang Autonomous Region and Yunnan Province of the Peoples' Republic of China (ADB and GMS Environment Operations Center 2018).

The first round of reports from 2003-2005 used a Pressure-State-Response framework. Indicators derived from national statistics covered forestry, fisheries, coastal zone, biodiversity, water resources, land degradation, solid waste, mobile source pollution, toxic contamination, atmosphere-climate change, ozone depletion, and air pollution from stationary sources. These early reports noted significant challenges regarding a harmonized approach to data across the 6 countries, notably in the areas of water quality, air quality, and forestry. The main challenges noted were (i) data availability, fitting the spatial and temporal requirements; (ii) data quality (insufficient data and methodological standardization and inadequate technical quality); and (iii) data documentation (lack of metadata, lack of transparent data showing criteria and routine collection, and lack of willingness to disclose information). Indicative of the Pressure-State-Response methodology, Table 1.8 shows the suggested indicators for the Mekong River based on its various functions (UNEP RRC.AP 2007).

Table 1.8 Recommended Indicators for the Mekong River

Function under investigation	Potential State indicators	Potential Pressure Indicators	Potential Response indicators
Hydrological	1. Minimum monthly natural flow in the Mekong River during each month of the dry season 2. Wet season flow in the Mekong River at Kratie 3. Total suspended solids concentrations in selected locations	1. Area of irrigated crops in GMS countries	1. Irrigation water storage capacity in the Basin 2. Budget contributions to National Mekong Secretariats
Irrigation	1. Area under irrigated crops in the Basin 2. Area under irrigated paddy in the Basin	1. Area of irrigated land per capita	1. Irrigation water storage capacity in the Basin 2. Expenditure on improved irrigation efficiency
Hydropower	1. Hydroelectricity output 2. Percent of hydropower consumed in total energy consumption	1. Energy consumption per capita. 2. Ratio of highest to lowest average energy consumption per capita among GMS countries	1. Installed and approved hydropower generating capacity
Navigation	1. Total volume of cargo and passenger traffic on the Mekong River in the GMS 2. Volume of cargo traffic in selected locations	1. Ratio of road to river cargo volume (without Viet Nam)	1. Installed cargo handling capacity on the Mekong River 2. Length of river navigable to vessels of x tons 3. Expenditures on improving the navigability of the Mekong River
Fisheries	1. Total output of capture fisheries 2. Total output of capture fisheries in Cambodia and Mekong delta 3. Percentage of large fish in the total capture fisheries output in selected locations	1. Quality of Mekong water (e.g., nitrogen concentrations in selected locations) 2. Irrigation water storage capacity in the Basin 3. Total basin population 4. Forest cover 5. Agrochemical consumption	1. Total output of culture fisheries 2. Total area of protected wetlands in the Basin 3. Combined size of MRC and other donor funding of fisheries conservation in the Basin
Tourism	1. Number of foreign tourist visitors 2. Share of first two leading foreign tourist arrival countries in GMS tourist arrivals total	1. Quality of Mekong water (pollution readings) 2. Forest cover	1. Protected areas as percent of total area 2. Expenditure on forest protection

Subsequent assessments reverted to the more commonly used "Drivers-Pressure-State-Impact-Responses" framework, which is routinely used for UNEP's Global Environment Outlook (ADB and GMS Environment Operations Center 2018)[3]. In the environmental performance assessment 2006-2016, the environmental issues covered air quality, biodiversity and habitats, climate change, fish, forests, land degradation, solid waste

---

[3] Refer to (OECD 1993) for more details.

management, and water resources. Data quality issues continued to challenge these assessments. For example, increasing forest cover was based on a 10% canopy cover standard and included plantation forests, thus overlooking the continuing loss of primary forest cover so important for biodiversity. Harmonization of monitoring approaches also continues to make national comparisons difficult. For example, for air quality, Myanmar compares air quality against WHO guidelines. Thailand uses an air quality index based on selected pollutants, while Viet Nam has a national air quality standard. A contrary example of good practice is for GMS countries with established water quality monitoring networks such as Cambodia, Lao PDR, Thailand, and Viet Nam (all participating in the Mekong River Commission Water Quality Monitoring Network) providing annual reports on water quality using common indices for protection of human health and aquatic life.

The report also noted the importance of the MDGs in countries using the same response indicators (e.g., for safe drinking water) and expressed the hope that the SDGs would provide a similar impetus. The report concludes however that "despite improvements, key data needed for tracking SDG progress and for environmental performance assessment reporting are still lacking. Poor data availability and quality can undermine country efforts to track future SDG progress and to assess the success of decisions and actions regarding natural resources and environmental management" (ADB and GMS Environment Operations Center 2018).

1.5 ASEAN Environmental Data Management and Gaps

1.5.1 ASOEN and Environmental Working Groups

The ASEAN Senior Officials on Environment (ASOEN) have created seven environmental working groups:

(i)   ASEAN Working Group on Climate Change (AWGCC);
(ii)   ASEAN Working Group on Chemicals and Waste (AWGCW);
(iii)   ASEAN Working Group on Coastal and Marine Environment (AWGCME);
(iv)   ASEAN Working Group on Environmental Education (AWGEE);
(v)   ASEAN Working Group on Environmentally Sustainable Cities (AWGESC);
(vi)   ASEAN Working Group on Natural Resources and Biodiversity (AWGNCB); and
(vii)   ASEAN Working Group on Water Resources Management (AWGWRM).

ASOEN and its working groups meet once every year to oversee the implementation of ASPEN and the ASCC Blueprint 2025. It should also be noted that environmental issues are addressed by other ASEAN sectoral bodies such as forestry and agriculture, transport and energy, tourism, education, youth, health, social welfare, and disaster management.

1.5.2 ASEAN Strategic Plan on Environment (ASPEN) (2016-2025)

ASPEN (2016-2025) is organized with the same priorities as the seven ASEAN environmental working groups (Table 1.9). The possible indicator sets would need greater specificity in accordance with each AMS's national and sub-national contexts but are included here to illustrate the range of indicators that may be needed.

Table 1.9 ASPEN Priorities, Objectives and Possible Indicators

Strategic Priority	Objectives	Possible Indicator Sets
1. Nature conservation and biodiversity	1. By 2025, ensure that ASEAN's biodiversity is valued, conserved, restored, wisely used and delivers benefits essential for its people. 2. Promote natural resiliency and use of integrated ecosystem-based approaches (to climate change adaptation and disaster risk reduction).	1. Economic value of biodiversity 2. Protected areas 3. Ecosystem restoration 4. Benefit sharing 5. Species protection 6. Invasive alien species 7. Health and biodiversity 8. Ecosystem-based adaptation 9. Disaster risk reduction 10. Awareness and knowledge management
2. Coastal and marine environment	1. Ensure ASEAN's coastal and marine environment are sustainably managed; representative ecosystems, pristine areas and species are protected; economic activities are sustainably managed; and public awareness of the coastal and marine environment instilled. 2. Conserve clean and healthy coastal and marine environments for ASEAN's sustainable development by reducing anthropogenic threats to coastal and marine ecosystems. 3. Enhance inter-agency and inter-sectoral coordination at the regional and international levels for achieving sustainable management of coastal and marine environment and responding to transboundary issues through good management practices and strengthened policies.	1. Coastal and marine ecosystem management 2. Protected areas and endangered species 3. Invasive alien species 4. Sustainable use of the coastal and marine resources 5. Public awareness campaigns 6. Coastal and marine environmental quality, including marine debris 7. Anthropogenic threats to the coastal and marine environment 8. Trade in marine life 9. Climate change impacts and carbon sequestration 10. Inter-agency coordination 11. Transboundary cooperation
3. Water resources management	1. Promote Integrated Water Resource Management for sustainability of water resources, equitable accessibility, and sufficient water quantity of acceptable quality to meet the needs of the people, economy and environment. 2. Manage water resources efficiently and effectively in order to provide adequate and affordable water services. 3. Reduce the number of people without sustainable access to safe drinking water and improved sanitation. 4. Reduce risks and impacts of water-related disasters (flood, drought, storm, etc.) and strengthen resilience of social and ecosystem.	1. Application of IWRM 2. Accessibility and equity 3. Water quality standards 4. Water quality monitoring and reporting 5. Water resource conservation, management efficiency and demand management 6. Sustainable access to safe drinking water 7. Sustainable access to improved sanitation 8. Water-related disasters 9. Resilient communities and public awareness
4. Environmentally sustainable cities	1. Ensure that cities/urban areas in ASEAN are environmentally sustainable, while meeting the social and economic needs of the people. 2. Promote sustainable urbanization and climate resilient cities in ASEAN towards a clean and green ASEAN.	1. Environmentally sustainable cities 2. Urban air, water, noise and land quality 3. Urban environmental plans and management 4. Urban biodiversity and open space 5. Urban waste management 6. Climate resilient, low-carbon cities 7. Urban disaster management
5. Climate change	1. Enhance regional and international cooperation to address climate change and its impacts on socio-economic development, health and the environment in ASEAN Member States through supporting mitigation, adaptation, technology transfer, capacity building, finance, cross sectoral coordination and global partnerships. 2. Contribute actively to the climate related global framework, such as the Paris Agreement and SDGs. 3. Coordinate activities within ASEAN Member States on climate change to share best practices and lessons learned as well as to facilitate access to climate finance.	1. Climate change adaptation 2. Climate change strategies and plans 3. Loss and damage 4. Capacity assessment and training 5. GHG inventory 6. Mitigation measures 7. Economic approaches (e.g., cap and trade, carbon tax, subsidies etc.) 8. Mainstreaming into sector plans 9. Technology transfer 10. Climate finance

		11. Partnerships and coordination 12. Public awareness
6. Chemicals and waste	1. Further strengthen regional coordination and cooperation in addressing wastes and chemicals- related issues including controlling transboundary movement of hazardous waste under relevant multilateral environmental agreements, such as Basel, Rotterdam, Stockholm, and Minamata conventions, and Montreal Protocol as well as internationally agreed-upon systems, such as the Globally Harmonised System of Classification and Labelling of Chemicals (GHS). 2. Achieve environmentally sound management of hazardous chemicals and wastes throughout their life cycle, in accordance with agreed international frameworks. 3. Reduce the growing threats of hazardous chemicals and wastes to human health and environment through, among others, enhancing the regional cooperation in preventing the illegal traffic of transboundary movement of hazardous chemicals and waste, and capacity building related to good management practice in handling chemicals and wastes.	1. Hazardous waste management, including transboundary movement of hazardous waste 2. Chemicals management 3. Green industries and environmentally sound technologies (cleaner production) 4. Accident prevention and management 5. Contaminated sites remediation 6. Chemicals and health 7. Capacity enhancement and training
7. Environmental education (and sustainable consumption and production)	1. Promote environmental protection through effective environmental education and awareness programmes that enhance capacity and capability to adapt and respond to current and emerging environmental threats and challenges, so as to create a dynamic, sustainable, resilient ASEAN Community that will proactively contribute to the achievement of global sustainable development goals	1. Eco-schools and sustainable university campuses 2. Environmental curricula 3. Public awareness 4. Environmental media 5. Sustainable consumption and lifestyle changes 6. Environmental activism and advocacy

1.5.3 ASEAN Socio-Cultural Blueprint 2025

The ASEAN Socio-Cultural Community (ASCC) Blueprint 2025 has developed a monitoring and evaluation framework for attaining the objectives of the 18 key result areas and achievement of the 109 strategic measures. Key performance indicators for ASPEN will align with these indicators as well as environment-related measures under the ASEAN Political-Security Community (APSC) and ASEAN Economic Community (AEC).

The ASCC Blueprint 2025 monitoring and evaluation system was intended to build on the ASCC Scorecard, which comprises 208 indicators (136 quantitative and 72 qualitative). The ASCC characteristic of "ensuring environmental sustainability" has 28 indicators (16 quantitative and 12 qualitative) in the Scorecard.

While the detailed assessment of the 2015 Scorecard is held internally, some of the key environmental indicators were:

- Ratification of key multilateral environment agreements
- Cases of illegal transboundary movement of hazardous wastes
- Consumption of persistent organic pollutants
- Phase out of ozone-depleting chlorofluorocarbons
- Signatories to the ASEAN Agreement on Transboundary Haze
- Air quality standards and monitoring programmes
- Particulate matter less than 10 microns (PM_{10}) exceeding national standards
- Forest fire hotspots reduction
- Eco-school programmes and environmental education
- Environmental awareness activities
- Environmental certification programmes
- Eco-labelling
- Environmentally sustainable city awards
- Protection of representative coastal and marine ecosystems, pristine areas, and species

- Sustainable management of economic activities in coastal and marine areas
- Promotion of public awareness on the coastal and marine environment
- Marine water quality monitoring and integrated coastal management strategies
- Terrestrial protected area coverage and biodiversity corridors
- Biosafety regulations
- Access to improved water sources
- Improved sanitation facilities
- GHG inventories and National Communications to the UNFCCC

The Scorecard also noted that "a number of environmental indicators have been harmonized across AMS in 2009, i.e., Key Indicators for Clean Air, Clean Land and Clean Water, ASEAN Marine Water Quality Criteria, ASEAN Criteria for Marine Heritage Areas, Criteria for Nomination of ASEAN Heritage Parks, and Millennium Development Goals (MDG) Indicators on Ensuring Environmental Sustainability". Nevertheless, there is clearly much more that needs to be done in relation to harmonization.

The main environment-related strategic measures of the Blueprint 2025 and possible indicator sets are shown in Table 1.10. Note that an "indicator set" would need to be translated into specific indicators according to national contexts.

Table 1.10 ASCC Blueprint 2025 Key Result Areas, Strategic Measures and Possible Indicator Sets

Key Result Area	Strategic Measures	Possible Indicator Sets
Engaged stakeholders in ASEAN processes	Integration of impact assessment into policy development, programme development, implementation, and monitoring	1.Strategic environmental impact assessment mainstreamed into policies, plans and programmes.
	Promote partnership frameworks and guidelines in engaging stakeholders for effective implementation of ASEAN initiatives and promotion of public awareness of ASCC programmes and accomplishments.	1. Number of partnerships in ASEAN environmental initiatives. 2. Promotional campaigns on ASEAN environmental initiatives.
Empowered people and strengthened institutions	Increase competencies and resilience of stakeholders with advanced technological and managerial skills to improve institutional capacity to address current challenges and emerging trends, such as disasters, pandemics, and climate change.	1. Capacity enhancement programmes on disasters, pandemics, and climate change.
Reducing barriers	Provide regional mechanisms to promote access to information and communication technologies for all.	1. Regional mechanisms promoting environmental information for all.
Equitable access for all	Provide mechanisms and enhance institutional capacity to promote greater access to basic social services for all, such as health services and education including early childhood education and vocational education, skills training, and promotion of skills recognition	1. Inclusion of environmental knowledge into capacity building programmes and school curricula. 2. Effectiveness studies of environmental capacity enhancement.
	Promote inclusive growth through appropriate measures at the national level to ensure that the poor and vulnerable have equitable access to economic and other opportunities.	1. Equitable access to environmental management measures. 2. Environmental justice programmes.
	Promote equitable opportunities to quality education and access to information with priority given to the advancement of universal access to education.	1. Environmental education programmes. 2. Equitable access to environmental information.
	Promote a community that is healthy, caring, sustainable and productive, and one that practices healthy lifestyle resilient to health threats and has universal access to healthcare	1. Incidence of health problems due to poor environmental quality. 2. Promotion of healthy nature-based lifestyle campaigns.
Promotion and protection of human rights	Promote regional inter-sectoral mechanisms towards a holistic and multi-disciplinary approach in enhancing quality care, wellbeing, gender equality,	1. Protection of vulnerable groups from environment-related risks/ threats and hazards.

	social justice, human rights and fundamental freedoms, especially vulnerable groups, in response to all hazards and emerging social and economic risks/threats.	2. Promotion of environmental justice.
	Promote sustainable financing mechanism for social protection, particularly universal health coverage, early childhood care and development, financial risk protection for disaster risk reduction and climate change adaptation, and social pension, through strategic partnerships with private sector and other relevant stakeholders.	1. Sustainable financing for disaster risk reduction and climate change. 2. Mobilization of environment-related financing from the private sector.
Conservation and sustainable management of biodiversity and natural resources	Strengthen regional cooperation to protect, restore and promote sustainable use of terrestrial ecosystems resources, combat desertification, halt biodiversity loss, and halt and reverse land degradation	1. Regional cooperation on all environment-related issues and concerns.
	Strengthen regional cooperation on sustainable forest management in the context of forest fire prevention and control, including through the implementation of the ASEAN Agreement on Transboundary Haze Pollution, to effectively address transboundary haze pollution.	1. Regional cooperation on sustainable forest management. 2. Implementation progress on the ASEAN Agreement on Transboundary Haze Pollution.
	Promote cooperation for the protection, restoration, and sustainable use of coastal and marine environment, respond and deal with the risk of pollution and threats to marine ecosystems and coastal environment, in particular in respect of ecologically sensitive areas.	1. State and trends of the coastal and marine environment. 2. Annual investment in coastal and marine environmental protection. 3. Protected area status of ecologically sensitive coastal and marine habitats.
	Adopt good management practices and strengthen policies to address the impact of development projects on coastal and international waters and transboundary environmental issues, including pollution, illegal movement and disposal of hazardous substances and waste.	1. Strategic environmental assessments and EIAs for development projects in the marine environment. 2. Environmental policies dealing with international waters and transboundary environmental issues.
	Enhance policy and capacity development and best practices to conserve, develop and sustainably manage marine, wetlands, peatlands, biodiversity, and land and water resources.	1. Capacity enhancement programmes for improved environmental management of natural resources.
	Promote capacity building in a continuous effort to have sustainable management of ecosystems and natural resources.	1. Capacity enhancement programmes for improved environmental management of ecosystems and natural resources.
	Promote cooperation on environmental management towards sustainable use of ecosystems and natural resources through environmental education, community engagement and public outreach.	1. Environmental education programmes on sustainable management of ecosystems. 2. Public awareness campaigns on sustainable use of ecosystems.
	Strengthen global and regional partnerships and support the implementation of relevant international agreements and frameworks.	1. Global and regional partnerships for implementation of MEAs.
	Promote the role of the ASEAN Centre for Biodiversity as the centre of excellence in conservation and sustainable use of biodiversity.	1. Core funding of the ASEAN Centre for Biodiversity.
	Support the full implementation of the Strategic Plan for Biodiversity 2011-2020 and the Aichi Targets.	1. Adoption of the post-2020 biodiversity framework following COP15 in Kunming, China.
Environmentally sustainable cities	Enhance participatory and integrated approaches in urban planning and management for sustainable urbanization towards a clean and green ASEAN.	1. Cities with clean and green urban plans.
	Strengthen the capacity of national and local institutions to implement strategies and programmes towards liveable cities.	1. Institutional capacity for liveable cities.
	Promote coordination among relevant sectors to provide access to clean land, green public space, clean air, clean and safe water, and sanitation.	1. Sectoral coordination on urban services.

	Strengthen positive economic, social and environmental linkages among urban, peri-urban and rural areas.	1. Rural-urban environmental linkages.
Sustainable climate	Strengthen human and institutional capacity in implementing climate change adaptation and mitigation, especially on vulnerable and marginalised communities.	1. Institutional capacity for addressing climate change.
	Facilitate the development of comprehensive and coherent responses to climate change challenges, such as but not limited to multi-stakeholder and multi-sectoral approaches.	1. Effectiveness of climate change responses.
	Leverage on private sector and community to have access to new and innovative financing mechanisms to address climate change.	1. Innovative climate financing mechanisms.
	Strengthen the capacity of sectoral institutions and local governments in conducting Greenhouse Gas (GHG) inventory, and vulnerability assessments and adaptation needs.	1. Improved capacity for GHG inventories and climate change adaptation.
	Strengthen the effort of government, private sector and community in reducing GHG emission from main activities of development.	1. Climate change mitigation measures.
	Mainstream climate change risk management and GHG emission reduction on sectoral planning.	1. Climate change mainstreamed into sectoral plans.
	Strengthen global partnerships and support the implementation of relevant international agreements and frameworks.	1. Partnerships supporting implementation of MEAs.
A Climate adaptive ASEAN with enhanced institutional and human capacities to adapt to the impacts of climate change	Expand regional cross-sectoral platforms and establish shared strategies to respond to the impacts of climate change.	1. Cross-sectoral plans to combat climate change.
	Promote sound scientific and evidence-based policies on climate change adaptation.	1. Science-based climate policies.
	Promote and consider indigenous and traditional knowledge and practices in responding and adapting to the impacts of climate change.	1. Indigenous and traditional knowledge mainstreamed into climate change strategies and plans.
Sustainable consumption and production (SCP)	Strengthen public-private partnerships to promote the adoption of environmentally sound technologies for maximizing resource efficiency.	1. Public-private partnerships for environmental technologies.
	Promote environmental education (including eco-school practice), awareness, and capacity to adopt sustainable consumption and green lifestyle at all levels.	1. Green lifestyles incorporated into school curricula.
	Enhance capacity of relevant stakeholders to implement sound waste management and energy efficiency.	1. Capacity enhancement for urban utility services.
	Promote the integration of SCP strategy and best practices into national and regional policies or as part of CSR activities.	1. Integration of SCP in national and regional policies.
A disaster resilient ASEAN that is able to anticipate, respond, cope, adapt, and build back better, smarter, and faster	Enhance regional mechanisms and capacities to enable ASEAN to respond together to disasters within and outside the region.	1. Enhanced regional capacity for disaster management.
	Promote regional standards, including methodologies and tools to assess, record, calculate the disaster losses and damages, and share non-sensitive data and create common information system, to enhance interoperability, ensure unity of action, and strengthen resilience.	1. Availability of regional standards and standard operating procedures for disaster prevention, management, and recovery.
	Promote local communities' resilience by integrating principles of resilience in risk reduction, preparedness, response, recovery, and rehabilitation measures.	1. Enhanced community resilience.
	Promote policy coherence and interlinkages, and synergize initiatives on disaster risk reduction, climate change adaptation and mitigation, humanitarian actions and sustainable development.	1. Extent of environmental policy coherence and effectiveness.
	Harness local wisdom and traditional knowledge to foster a culture of resilience.	1. Indigenous and traditional knowledge mainstreamed into resilience planning.

A safer ASEAN that is able to respond to all health-related hazards including biological, chemical, and radiological-nuclear, and emerging threats	Strengthen health systems to be resilient in preparedness for effective response to health-related hazards, including biological, chemical, radiological-nuclear hazards and emerging threats.	1. Health system preparedness for environmental hazards and emerging threats.
	Promote regional standards to enhance interoperability, ensure unity of action and strengthen collective resilience.	1. Availability of regional standards for health-related hazards.
	Enhance institutional and human capacities and approaches to support the effective implementation of policies, strategies and programmes in preparing and responding to all health-related hazards and emerging threats.	1. Enhanced capacity to respond to health-related hazards and emerging threats.

The institutional challenges of the 2015 ASCC Scorecard included (i) lack of agreed indicators necessitating more qualitative approaches; (ii) incomplete data sets for all AMS; (iii) lack of updating and verification of data; (iv) comparable data was not available for the baseline (2009) and year of reporting (2015); (v) most data sets were only up to 2012; and (vi) inconsistent data formats. The Yale University Environmental Performance Index (EPI) was used as the overall indicator of progress. The 2020 EPI shows AMS ranging from 58.1 (Singapore ranked 39 out of 180) to 25.1 (Myanmar ranked 179 out of 180)[4]. For the 10-year change Viet Nam (+5.4) was highest among AMS, while Singapore (-8.4) was the lowest.

The mid-term review (MTR) of the ASCC Blueprint 2025 showed limited improvement in addressing these shortfalls. The MTR was partly based on outcome-level monitoring tracking 32 key performance indicators (KPIs) for the Blueprint's Results Framework and Baseline Report, plus other qualitative and quantitative inputs to illustrate the impacts of the Blueprint to date. The Blueprint was translated into 964 ongoing activities in the workplans of 15 sectoral bodies, with the vast majority conducted under ASOEN. One important observation was that of the 45 KPIs and sub-KPIs intended to measure the outcomes of the Blueprint, 19 lacked sufficient data against the 2016 baseline. For the other 26 KPIs, 21 show evidence of progress.

Under Characteristic C "sustainable", there have been 362 activities since 2016, of which 11.6% have been completed. Progress was noted in relation to (i) increased regional initiatives on conservation and sustainable use of biodiversity; (ii) environmentally sustainable cities; (iii) enhanced capacity for Nationally Determined Contributions on climate change; and (iv) sustainable consumption and production activities.

Recommended improvements for the remainder of the ASCC Blueprint 2025 term, relevant to the environmental data monitoring and management framework, include (i) addressing the incomplete data for 19 outcome indicators; and (ii) for Characteristic C, formulating "indicators and measuring methods that can demonstrate the quality of outcomes, in addition to the number of projects".

1.5.4 ASEAN Community Progress Monitoring System 2017

Measuring progress in the ASEAN Community is complicated because of the interlocking aspects of the ASEAN Political-Security Community (APSC) Blueprint, ASEAN Economic Community (AEC) Blueprint, ASEAN Socio-Cultural Community (ASCC) Blueprint, Initiative for ASEAN Integration Work Plan III, and the Master Plan for ASEAN Connectivity 2025. The 2017 monitoring report attempted to take stock of where the ASEAN Community was in relation to wide-ranging outcome-level key performance indicators over the period 2005-2015.

Under the ASCC Blueprint Characteristic C "sustainable" three indicators were chosen as shown in Table 1.11.

---

[4] Denmark was ranked first in 2020, with a score of 82.5 (Yale University 2020).

Table 1.11 ASCC Blueprint 2025 Characteristic C "sustainable" progress 2005-2015

ASCC Indicator	2005-2015 trends	Notes
C.I. Carbon dioxide emissions (metric tons per capita)	AMS averaged a 30% increase in 2013 over 2005 levels. Brunei Darussalam has close to 20 tCO_2/cap, while Cambodia, Lao PDR, and Myanmar report less than 1 tCO_2/cap.	Data came from the UN Millennium Development Goals database (http://mdgs.un.org).
C.II. Proportion of urban population living in slums, informal settlements or inadequate housing facilities (%).	The proportion of the population living in slums has been decreasing across most AMS, with the most significant improvements in Cambodia and Lao PDR since 2005.	Indicator is the same as 11.1.1 for SDG 11 (Make cities and human settlements inclusive, safe, resilient and sustainable). "AMS were not able to submit data on the number of people living in slums, informal settlements or inadequate housing".
C.III. Ratio of protected area to total area and forest cover to total land area.	For forest cover to total land area, Lao PDR, Brunei Darussalam and Malaysia greater than 65%, with Thailand, Philippines, Singapore and Indonesia less than 35%. For protected area, Brunei Darussalam has almost 45%, while Viet Nam, Myanmar, Malaysia and Singapore have less than 10%.	Relates to SDG indicators 15.1.1 and 15.2.1. "Forest area is land under natural or planted stands of trees of at least 5 meters, whether productive or not, and excludes tree stands in agricultural production and trees in urban parks and gardens.
Supporting SDG indicator 15.1.2: coverage of protected areas for important sites of terrestrial and freshwater biodiversity.	Thailand, Brunei Darussalam and Philippines have more than 40% coverage, while Lao PDR, Malaysia, Indonesia, and Viet Nam had less than 10%.	Other related indicators covered access to safe drinking water and the World Risk Index.

1.5.5 Gaps in the current environmental data management system in ASEAN

Contrary to an abiding myth in ASEAN that there are very few environmental data, the above assessment shows that AMS are struggling to keep up with the ever-increasing global, regional, and national reporting requirements, but there are possibly hundreds of environmental indicators for which some data are available. For example:

- SDG reporting requires 231 unique indicators to be considered, of which at least 92 are environment-related, and at least 35% of those are available in AMS;
- Indonesia's 2021 VNR covered 64% (59) of the 92 SDG environment-related indicators;
- The MEAs listed on InforMEA cover 289 goals, requiring hundreds of indicators for often obligatory reporting;
- As an example, the 20 Aichi targets of the Convention on Biodiversity were assigned 78 generic and 145 specific indicators, while the Sendai Framework for Disaster Risk Reduction has 7 targets and 38 indicators; and
- The UN Framework Convention on Climate Change currently has 134 indicators, although this may change if countries are able to reach an agreement on adaptation metrics, with regular reporting required under the transparency framework.

Accordingly, the main concerns are not so much about the availability of environmental data but rather its systematic organization, validation, and accessibility. For the ASEAN Strategic Plan on Environment (2016-2025) the intention is to align the environmental indicators with those of the ASEAN Socio-Cultural Community Blueprint 2025 and the ASCC Scorecard, which has a minimum of 28 environmental indicators (out of 208) but potentially could have closer to 60 environmental indicators (Table 1.9, (AFD 2020))

2. Conclusions and Recommendations

With the possible exception of the biodiversity topic, the ASEAN region does not have a coherent, harmonized set of environmental indicators, despite a number of regional strategic plans and agreements and global reporting obligations that would benefit from more rigorous establishment of baseline conditions and a well-funded monitoring and evaluation programme.

Recommendation 1 – All existing and future regional plans and agreements should have a consistent structure that consists of vision, objectives (or goals), time-bound targets, indicators, a monitoring and evaluation plan, and means of implementation, among others.

For the current draft ASPEN and possible subsequent plans, the following structure could be considered (Table 1.12). The proposed set of indicators should be reviewed, amended, and endorsed by ASOEN, as ASPEN is being finalised. Based on this review, a simplified baseline and fewer key indicators can be identified as a minimal set of data for future SOERs.

Table 1.12 ASPEN Priorities, Objectives, and Interim Indicators

Strategic Priority	Objectives	Possible Indicator Sets	Interim Indicators
1. Nature conservation and biodiversity	1. By 2025, ensure that ASEAN"s biodiversity is valued, conserved, restored, wisely used and delivers benefits essential for its people. 2. Promote natural resiliency and use of integrated ecosystem-based approaches (to climate change adaptation and disaster risk reduction).	1. Economic value of biodiversity 2. Protected areas 3. Ecosystem restoration 4. Benefit sharing 5. Species protection 6. Invasive alien species 7. Health and biodiversity 8. Ecosystem-based adaptation 9. Disaster risk reduction 10. Awareness and knowledge management	1. Total number and area of protected areas (ha) 2. Annual increase or reduction of forested area (ha).
2. Coastal and marine environment	1. Ensure ASEAN"s coastal and marine environment are sustainably managed; representative ecosystems, pristine areas and species are protected; economic activities are sustainably managed; and public awareness of the coastal and marine environment instilled. 2. Conserve clean and healthy coastal and marine environments for ASEAN"s sustainable development by reducing anthropogenic threats to coastal and marine ecosystems. 3. Enhance inter-agency and inter-sectoral coordination at the regional and international levels for achieving sustainable management of coastal and marine environment and responding to transboundary issues through good management practices and strengthened policies.	1. Coastal and marine ecosystem management 2. Protected areas and endangered species 3. Invasive alien species 4. Sustainable use of the coastal and marine resources 5. Public awareness campaigns 6. Coastal and marine environmental quality, including marine debris 7. Anthropogenic threats to the coastal and marine environment 8. Trade in marine life 9. Climate change impacts and carbon sequestration 10. Inter-agency coordination 11. Transboundary cooperation	1. Monthly coastal water quality as measured by E. coli counts in selected tourism areas 2. Annual increase or decrease in mangrove forests (ha)
3. Water resources management	1. Promote Integrated Water Resource Management for sustainability of water resources, equitable accessibility, and sufficient water quantity of acceptable quality to meet the needs of the people, economy and environment. 2. Manage water resources efficiently and effectively in order to	1. Application of IWRM 2. Accessibility and equity 3. Water quality standards 4. Water quality monitoring and reporting 5. Water resource conservation, management efficiency and demand management 6. Sustainable access to safe drinking water	1. Monthly change in drinking water quality standards (E. coli, turbidity, salinity) 2. River water quality according to usage standards (e.g., contact vs. non-contact uses) 3. Percentage of the population with access to safe drinking water and sanitation.

	provide adequate and affordable water services. 3. Reduce the number of people without sustainable access to safe drinking water and improved sanitation. 4. Reduce risks and impacts of water-related disasters (flood, drought, storm, etc.) and strengthen resilience of social and ecosystem.	7. Sustainable access to improved sanitation 8. Water-related disasters 9. Resilient communities and public awareness	
4. Environmentally sustainable cities	1. Ensure that cities/urban areas in ASEAN are environmentally sustainable, while meeting the social and economic needs of the people. 2. Promote sustainable urbanization and climate resilient cities in ASEAN towards a clean and green ASEAN.	1. Environmentally sustainable cities 2. Urban air, water, noise and land quality 3. Urban environmental plans and management 4. Urban biodiversity and open space 5. Urban waste management 6. Climate resilient, low-carbon cities 7. Urban disaster management	1. Annual changes in solid waste volume collected and recycled (tonnes) 2. Increase or decrease in urban green spaces (ha)
5. Climate change	1. Enhance regional and international cooperation to address climate change and its impacts on socio- economic development, health and the environment in ASEAN Member States through supporting mitigation, adaptation, technology transfer, capacity building, finance, cross sectoral coordination and global partnerships. 2. Contribute actively to the climate related global framework, such as the Paris Agreement and SDGs. 3. Coordinate activities within ASEAN Member States on climate change to share best practices and lessons learned as well as to facilitate access to climate finance.	1. Climate change adaptation 2. Climate change strategies and plans 3. Loss and damage 4. Capacity assessment and training 5. GHG inventory 6. Mitigation measures 7. Economic approaches (e.g., cap and trade, carbon tax, subsidies etc.) 8. Mainstreaming into sector plans 9. Technology transfer 10. Climate finance 11. Partnerships and coordination 12. Public awareness	1. Annual change in greenhouse gas emissions by sector (tonnes CO_2 equivalent) 2. Annual government expenditure on climate change as % of GDP (%)
6. Chemicals and waste	1. Further strengthen regional coordination and cooperation in addressing wastes and chemicals-related issues including controlling transboundary movement of hazardous waste under relevant multilateral environmental agreements, such as Basel, Rotterdam, Stockholm, and Minamata conventions, and Montreal Protocol as well as internationally agreed-upon systems, such as the Globally Harmonised System of Classification and Labelling of Chemicals (GHS). 2. Achieve environmentally sound management of hazardous chemicals and wastes throughout their life cycle, in accordance with agreed international frameworks. 3. Reduce the growing threats of hazardous chemicals and wastes to human health and environment through, among others, enhancing the regional cooperation in	1. Hazardous waste management, including transboundary movement of hazardous waste 2. Chemicals management 3. Green industries and environmentally sound technologies (cleaner production) 4. Accident prevention and management 5. Contaminated sites remediation 6. Chemicals and health 7. Capacity enhancement and training	1. Annual number of accidents involving chemicals 2. Number and area of contaminated sites remediated annually.

	preventing the illegal traffic of transboundary movement of hazardous chemicals and waste, and capacity building related to good management practice in handling chemicals and wastes.		
7. Environmental education (and sustainable consumption and production)	1. Promote environmental protection through effective environmental education and awareness programmes that enhance capacity and capability to adapt and respond to current and emerging environmental threats and challenges, so as to create a dynamic, sustainable, resilient ASEAN Community that will proactively contribute to the achievement of global sustainable development goals	1. Eco-schools and sustainable university campuses 2. Environmental curricula 3. Public awareness 4. Environmental media 5. Sustainable consumption and lifestyle changes 6. Environmental activism and advocacy	1. Number of eco-schools and sustainable university campuses 2. Number of companies involved in recycling and/or re-purposing waste materials.

Recommendation 2 – To enable AMS and the ASEAN Secretariat to report on the SDGs as required by the High-Level Political Forum, the 92 environmental indicators identified by UNEP should be incorporated into future versions of ASPEN as a minimal set of indicators and incorporated in the corresponding national monitoring plans and statistics systems and subsequent Voluntary National Reports (including Local VNRs). Data collection mechanisms should be developed to collect this information routinely, with annual reports at least until 2030.

Recommendation 3 – The structure of FDES (i.e., environmental conditions and quality; environmental resources and their uses; residuals; extreme events and disasters; human settlements and environmental health; and environmental protection and resource management expenditure, plus the 21 sub-components) should be adopted by national environment, resource management and disaster management agencies. In addition, the 458 environmental statistics should be reviewed by the ASEAN Senior Officials on Environment (ASOEN) to determine which of them should be common across all AMS, but with emphasis on the initial Core Set in Annex 1.

Recommendation 4 – One or more AMS should trial the SEAA-EA, with a view to adding an additional responsibility to the ASEAN Centre for Biodiversity to provide capacity strengthening support on adopting the ecosystem accounting procedures across all AMS.

Recommendation 5 – Under the "sustainable cities" initiative, ASEAN municipalities should consider adopting the Singapore Index on Cities' Biodiversity for all medium to large cities and repeat the assessment every three to five years.

Recommendation 6 – Recognizing that data collection is a time consuming and expensive activity, AMS should not waste resources by collecting the same information by multiple agencies or by failing to store the collected data in a central database. That database should be managed and maintained by the relevant Statistics Department at the national level, which should also be responsible for developing and maintaining the meta-data that will ensure accuracy and consistency of the collected data over time. Through this attention to accuracy and consistency, greater confidence can be achieved in environmental quality trend analysis.

Recommendation 7 – Under ASOEN guidance, a separate task force or ASEAN working group should be given the mandate to work on development of an ASEAN Manual on Environmental Assessment, which would include the agreed indicators, metadata, and methods of data collection.

Recommendation 8 – Environmental data are being collected by national sectoral agencies, environment agencies, local government bodies, city administrations, private sector companies, and consultants (e.g., for environmental impact assessments) but these remain scattered. Governments should mandate that any environmental data collected is automatically submitted to a central database maintained by the national Statistics Office.

Annex 1 Framework for the Development of Environment Statistics (FDES)

The FDES provides guidance on a core set of environmental indicators designed to assist all countries in their environment statistics programmes by: "(i) delineating the scope of environment statistics and identifying its constituents; (ii) contributing to the assessment of data requirements, sources, availability and gaps; (iii) guiding the development of multipurpose data collection processes and databases; and (iv) assisting in coordination and organization across institutions".

The FDES covers measurement of (i) state and trends of the environment; (ii) human dependence on the environment; (iii) anthropogenic impact on the environment; (iv) positive and negative impacts on social and economic systems; and (v) how the environment is currently protected and managed.

The Basic Set of Environment Statistics consists of 458 individual statistics organized by components, sub-components, and topics. The Basic Set is divided into three tiers, based on the level of relevance, availability, and methodological development of the statistics:

- Tier 1, corresponding to the Core Set of Environment Statistics, includes **100** statistics which are of high priority and relevance to most countries and have a sound methodological foundation.
- Tier 2 includes **200** environment statistics which are of priority and relevance to most countries but require greater investment of time, resources, or methodological development.
- Tier 3 includes **158** environment statistics which are either of lower priority or require significant methodological development.

The UN Statistics Division, in collaboration with the Expert Group on Environment Statistics, has developed and Environment Statistics Self-Assessment Tool (ESSAT) to assist countries

in: (i) developing an environment statistics programme; (ii) collecting data on the environment; and (iii) assessing the current state of environment statistics and the need for further development at the national level.

A1.1.1 Key concepts from the FDES 2013

<u>Environmental information</u> includes quantitative and qualitative facts describing the state of the environment and its changes. Quantitative environmental information is generally produced in the form of data, statistics, and indicators, and is generally disseminated through databases, spreadsheets, compendia, and yearbooks. Qualitative environmental information consists of descriptions (e.g., textual or pictorial) of the environment or its constituent parts that cannot be adequately represented by accurate quantitative descriptors.

<u>Environmental data</u> are large amounts of unprocessed observations and measurements about the environment and related processes. They may be collected or compiled via statistical surveys (censuses or sample surveys) by the national statistical system or may originate from administrative records, geographic databases, registers, inventories, monitoring networks, thematic mapping, remote sensing, scientific research, and field studies.

<u>Environment statistics</u> are environmental data that have been structured, synthesized, and aggregated according to statistical methods, standards, and procedures. The role of environment statistics is to process environmental and other data into meaningful statistics that describe the state of and trends in the environment and the main processes affecting them. Not all environmental data are used to produce environment statistics. The FDES provides a framework that identifies environmental and other data that fall within its scope and then contributes to structuring, synthesizing and aggregating the data into statistical series and indicators.

<u>Environmental indicators</u> are environment statistics that have been selected for their ability to depict important phenomena or dynamics. Environmental indicators are used to synthesize and present complex environment and other statistics in a simple, direct, clear and relevant way. Environmental indicators are generated because environment statistics are usually too numerous and detailed to meet the needs of policy makers and the general public, and often require further processing and interpretation to be meaningful. Environmental indicators may take various forms such as rates, ratios or proportions, and be constructed at different levels of aggregation. The purpose of these indicators is to assess present and future directions with respect to goals and targets, evaluate and determine the impact of specific programmes, monitor progress, measure changes in a specific condition or situation over time, and convey messages. Policy frameworks such as the Millennium Development Goal (MDG) and Sustainable Development Goal (SDG) frameworks, the Driving force – Pressure – State – Impact – Response (DPSIR) framework and national environment/sustainable development indicator sets, are typically used to identify and structure indicators.

Table A2.1 Core set of environmental indicators

Component	Sub-component	Topic	Core set of indicators
Environmental conditions and quality	Physical conditions	Atmosphere, climate and weather	Temperature: monthly average, minimum monthly average, maximum monthly average Precipitation: annual average, long-term annual average
		Hydrographical characteristics	Description of main watersheds
		Geological and geographical information	Area of country or region Coastal waters Length of marine coastline Coastal area
		Soil characteristics	Area by soil types Area affected by soil erosion Area affected by desertification
Environmental conditions and quality	Land cover, ecosystems and biodiversity	Land cover	Area under land cover categories
		Ecosystems and biodiversity	Area of ecosystems Known flora and fauna species Protected terrestrial and marine areas
		Forests	Total forest area
Environmental conditions and quality	Environmental quality	Air quality	Concentration of particulate matter (PM_{10}) Concentration of particulate matter ($PM_{2.5}$) Concentration of tropospheric ozone Concentration of carbon monoxide Concentration of sulphur dioxide Concentration of nitrogen oxides
		Freshwater quality	Concentration level of nitrogen Concentration level of phosphorus Biochemical oxygen demand Concentration level of faecal coliforms
		Marine water quality	Concentration level of nitrogen Concentration level of phosphorus Biochemical oxygen demand Area affected by coral bleaching
		Soil pollution	-
		Noise	-
Environmental resources and their use	Mineral resources	Stocks and changes of mineral resources	Stocks of commercially recoverable resources Extraction (mass, volume)
		Production and trade of minerals	-
Environmental resources and their use	Energy resources	Stocks and changes of energy resources	Stocks of commercially recoverable resources Extraction (mass, volume)
		Production, trade and consumption of energy	Total production Production from non-renewable sources Production from renewable sources Primary energy production Secondary energy production Total energy supply Final consumption of energy
Environmental resources and their use	Land	Land use	Area under land use categories
		Use of forest land	Area deforested
Environmental resources and their use	Soil Resources	Soil resources	-
	Biological resources	Timber resources	Stocks of timber resources

Environmental resources and their use		Aquatic resources	Fish capture production Aquaculture production
		Crops	Area planted Area harvested Amount produced Natural fertilizer use Chemical fertilizers Pesticides
		Livestock	Number of live animals
		Other non-cultivated biological resources	-
Environmental resources and their use	Water resources	Water resources	Precipitation Inflow from neighbouring countries Evapotranspiration
		Abstraction, use and returns of water	Total water abstraction Water abstraction from surface water Water abstraction from renewable groundwater resources Water abstraction from non-renewable groundwater resources
Residuals	Emissions to air	Emissions of GHGs	Carbon dioxide Methane Nitrous oxide Sulphur dioxide Nitrogen oxides
		Consumption of ozone depleting substances	-
		Emissions of other substances	-
Residuals	Generation and management of wastewater	Generation and pollutant content of wastewater	Volume of wastewater generated
		Collection and treatment of wastewater	Volume of wastewater collected Volume of wastewater treated
		Discharge of wastewater to the environment	Total volume of wastewater discharged to the environment after treatment Total volume of wastewater discharged to the environment without treatment
Residuals	Generation and management of waste	Generation of waste	Amount of waste generated by source Amount of hazardous waste generated
		Management of waste	Total municipal waste collected Amount of municipal waste treated by type of treatment and disposal Number of municipal waste treatment and disposal facilities Total hazardous waste collected Amount of hazardous waste treated by type of treatment and disposal Number of hazardous waste treatment and disposal facilities Amount of recycled waste
Residuals	Release of chemical substances	Release of chemical substances	-
Extreme events and disasters	Natural extreme events and disasters	Occurrence of natural extreme events and disasters	Type of natural extreme event and disaster Location
		Impact of natural extreme	Number of people killed

		events and disasters	Economic losses due to natural extreme events and disasters
Extreme events and disasters	Technological disasters	Occurrence of technological disasters	-
		Impact of technological disasters	-
Human settlements and environmental health	Human settlements	Urban and rural population	-
		Access to selected basic services	Population using an improved drinking water source Population using an improved sanitation facility Population served by municipal waste collection Population connected to wastewater treatment Population supplied by water supply industry
		Housing conditions	-
		Exposure to ambient pollution	-
		Environmental concerns specific to urban settlements	Number of private and public vehicles
Human settlements and environmental health	Environmental health	Airborne diseases and conditions	-
		Water-related diseases and conditions	Incidence Prevalence Mortality
		Vector-borne diseases	Incidence Prevalence Mortality
		Health problems associated with excessive UV radiation exposure	-
		Toxic substance and nuclear radiation related diseases and conditions	-
Environmental protection, management and engagement	Environmental protection and resource management expenditure	Government environmental protection and resource management expenditure	Annual government environmental protection expenditure
		Corporate, non-profit institution and household environmental expenditure	-
Environmental protection, management and engagement	Environmental governance and regulation	Institutional strength	-

		Environmental regulation and instruments	List of regulated pollutants and description
		Participation in MEAs and environmental conventions	List and description of MEAs and other global environmental conventions
Environmental protection, management and engagement	Extreme event preparedness and disaster management	Preparedness for natural extreme events and disasters	-
		Preparedness for technological disasters	-
Environmental protection, management and engagement	Environmental information and awareness	Environmental information	-
		Environmental education	-
		Environmental perception and awareness	-
		Environmental engagement	-

References

ADB. 2012. "Environmental Governance and the Courts in Asia: An Asian Judges Network on the Environment."

ADB, and GMS Environment Operations Center. 2018. "Greater Mekong Subregion Environmental Performance Assessment 2006-2016." Manila, Philippines. https://doi.org/10.22617/TCS189527-2.

AFD. 2020. "Data Opportunities and Challenges for Calculating a Global Strong Environmental Sustainability (SES) Index." https://www.afd.fr/en/ressources/data-opportunities-and-challenges-calculating-global-strong-environmental-sustainability-ses-index.

ASEAN Centre for Biodiversity. n.d. "Indicator Trends." *ASEAN Biodiversity Dashboard*. https://experience.arcgis.com/experience/2ffc8feeafab47c8a6dcf9e88436e37c/page/page_24/.

———. 2015. "THE ASEAN Clearing House Mechanism." ASEAN Centre for Biodiversity. 2015. https://www.aseanbiodiversity.org/the-asean-clearing-house-mechanism/.

———. 2016. "Regional Action Plan for ASEAN Heritage Parks 2016-2020." https://environment.asean.org/wp-content/uploads/2020/02/AHP-RAP-2016-2020-ACB-GB-endorsed.pdf.

———. 2017. "Global Taxonomy Initiative: Regional Action Plan for Southeast Asia (2017-2025)." https://environment.asean.org/wp-content/uploads/2020/02/GTI-RAP-2017-2025_for-website.pdf.

ASEAN Secretariat. 2016. "ASEAN Agreement on Transboundary Haze Pollution." https://asean.org/wp-content/uploads/2016/07/17.-July-2016-ASEAN-Agreement-on-Transboundary-Haze-Pollution.pdf.

———. 2017. "Fifth ASEAN State of the Environment Report." Jakarta: ASEAN Secretariat. https://environment.asean.org/soer5/.

CBD Secretariat. 2022a. *Final text of Kunming-Montreal Global Biodiversity Framework*. Convention on Biological Diversity. https://prod.drupal.www.infra.cbd.int/sites/default/files/2022-12/221222-CBD-PressRelease-COP15-Final.pdf?_gl=1*11drvy*_ga*MTI5Mzk5Mjg0OS4xNjg1NDI4MTY3*_ga_7S1TPRE7F5*MTY4NTQyODE2Ni4xLjAuMTY4NTQyODE3NS41MS4wLjA.

———. 2022b. *Monitoring Framework for the Kunming-Montreal Global Biodiversity Framework*. Convention on Biological Diversity. https://www.cbd.int/doc/c/179e/aecb/592f67904bf07dca7d0971da/cop-15-l-26-en.pdf

Chan, L., O. Hillel, T. Elmqvist, P. Werner, N. Holman, A. Mader, and E. Calcaterra. 2014. "User's Manual on Singapore Index on Cities Biodiversity." https://www.cbd.int/authorities/doc/Singapore-Index-User-Manual-20140730-en.pdf.

Department of Environment Parks and Recreation. 2006. "State of the Environment Report Brunei Darussalam 2006." *Environmental Policy and Law*. https://doi.org/10.1016/S0378-777X(83)80088-2.

Elder, Mark, and Simon Høiberg Olsen. 2019. "The Design of Environmental Priorities in the SDGs." *Global Policy* 10 (S1): 70–82. https://doi.org/10.1111/1758-5899.12596.

Ministry of Natural Resources and Environment. 2012. *Lao Environment Outlook 2012*. Vientiane.

OECD. 1993. "Report of OECD Core Set of Indicators for Environmental Performance Review."

———. 2008. "OECD Key Environmental Indicators 2008." Paris. https://www.oecd.org/env/indicators-modelling-outlooks/37551205.pdf.

———. 2020. *Environment at a Glance 2020*. OECD. https://doi.org/10.1787/4ea7d35f-en.

PEMSEA. 2018. "SDS-SEA Implementation Plan 2018-2022." http://pemsea.org/sites/default/files/PEMSEA_SDS-SEA_IP_2018-2022_20190606.pdf.

UN Statistics Division. 2021. "Global Set of Climate Change Statistics and Indicators." In .
        https://unstats.un.org/unsd/envstats/pubs/Part II.pdf.
———. 2022. "Manual on the Basic Set of Environment Statistics." UN Statistics Division.
        2022. https://unstats.un.org/unsd/envstats/fdes/manual_bses.cshtml.
UNDESA. n.d. "SDG Indicators Metadata Repository." Accessed December 31, 2021.
        https://unstats.un.org/sdgs/metadata/.
———. 2017. "Framework for the Development of Environment Statistics (FDES 2013)."
        https://unstats.un.org/unsd/environment/FDES/FDES-2015-supporting-
        tools/FDES.pdf.
———. 2021a. "Global Indicator Framework for the Sustainable Development Goals and
        Targets of the 2030 Agenda for Sustainable Development."
        https://unstats.un.org/sdgs/indicators/Global Indicator Framework after 2021
        refinement_Eng.pdf.
———. 2021b. "System of Environmental-Economic Accounting— Ecosystem Accounting."
        https://unstats.un.org/unsd/statcom/52nd-session/documents/BG-3f-SEEA-
        EA_Final_draft-E.pdf.
UNEP-WCMC, and IUCN. 2020. "Protected Planet Report 2020: Tracking Progress towards
        Global Targets for Protected Areas." www.unep-wcmc.org.
UNEP-WCMC, IUCN, and NGS. 2018. "Protected Planet Report 2018."
        https://livereport.protectedplanet.net/pdf/Protected_Planet_Report_2018.pdf.
UNEP. 2019. "Minmata Convention on Mercury Text and Annexes."
        www.mercuryconvention.org.
———. 2021. "Measuring Progress: Environment and the SDGs."
        https://www.unep.org/resources/publication/measuring-progress-environment-and-
        sdgs.
UNEP RRC.AP. 2007. "Greater Mekong Environment Outlook 1."
UNESCAP. 2020. "Asia and the Pacific SDG Progress Report 2020."
        https://www.unescap.org/sites/default/d8files/knowledge-
        products/ESCAP_Asia_and_the_Pacific_SDG_Progress_Report_2020.pdf.
UNESCO. n.d. "Education for Sustainable Development for 2030 Toolbox." Accessed June
        21, 2022. https://en.unesco.org/themes/education-sustainable-development/toolbox.
———. 2020. "Education for Sustainable Development: A Roadmap."
        https://unesdoc.unesco.org/ark:/48223/pf0000374802.
United Nations. 2014. "System of Environmental-Economic Accounting 2012 Central
        Framework." https://seea.un.org/sites/seea.un.org/files/seea_cf_final_en.pdf.
Usubiaga-Liaño, Arkaitz, and Paul Ekins. 2021. "Monitoring the Environmental Sustainability
        of Countries through the Strong Environmental Sustainability Index." Ecological
        Indicators 132: 1470–160. https://doi.org/10.1016/j.ecolind.2021.108281.
Yale University. 2020. "Results Overview." Environmental Performance Index. 2020.
        https://epi.yale.edu/epi-results/2020/component/epi.

Acknowledgments

Institute for Global Environmental Strategies (IGES)

2108-11 Kamiyamaguchi, Hayama, Kanagawa, 240-0115, Japan
Tel: 046-826-9592   Fax: 046-855-3809   E-mail: iges@iges.or.jp
www.iges.or.jp