Climate Change and Disaster Risk Reduction Statistics and Indicators

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Statistical note 23:

Climate Change and Disaster Risk Reduction[1]

Main policy issues, potential goals and targets

23.1 The impacts of climate change on SD are observed through both slow-onset events (e.g. sea level rise, increasing temperatures, ocean acidification, glacial retreat and related impacts, salinization, land and forest degradation, loss of biodiversity and desertification) and extreme weather events. Climate change impacts are already disrupting livelihoods in many parts of the world, particularly those that are dependent on predictable temperature and rainfall, clean water availability, and arable land. Sea level rise will also increasingly affect coastal communities by exacerbating erosion and leading to loss of land and coastal industries.

23.2 The report by the HLP suggests that risk sensitive development must be at the heart of the post-2015 development agenda and that the next SD framework would effectively address disaster and climate risk if it includes a goal/target on overall loss of life and economic losses as well as related targets under the main potential sectorial goals that contribute to risk reduction (i.e. related to water, education, environment and health). Lessons from the Hyogo Framework for Action (HFA)[2] can provide guidance on goals and targets. The HFA Mid-Term Review and the third session of the Global Platform for Disaster Risk Reduction[3] (2011) recognized that targets encourage more accelerated implementation, as well as greater accountability of action. Its fourth session (May 2013) in Geneva called for an immediate start of work to be led by the United Nations International Strategy for Disaster Reduction (UNISDR)[4] to develop targets and indicators to monitor the reduction of risk and the implementation of the future international framework for disaster risk reduction (HFA2).

23.3 As seen, the main policy issues to be included in the SDGs goals and targets involve a sequence of drivers of climate change, greenhouse gas (GHG) emissions, impacts of both slow on-set events and extreme events, mitigation and adaptation, as well as disaster risk and its management for reduction. This sequence is also useful to organize the selection of feasible statistics and indicators to inform stakeholders adequately at the different levels.

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1 The following countries and organizations contributed to the drafting and review of this statistical note: the Netherlands, United Kingdom, FAO, UNECE and UNISDR.

[2] The Hyogo Framework for Action (HFA) is a ten year plan of action adopted in 205 by 168 governments to protect the lives and livelihoods against disasters. It is the key instrument and global blueprint for implementing disaster risk reduction. Its overarching goal is to build the resilience of nations and communities to disasters by achieving substantive reduction of disaster losses by 2015.

[3] The Global Platform for Disaster Risk Reduction was established in 2007 as a biennial forum for information exchange, with the goal to improve implementation of disaster risk reduction through better communication and coordination amongst stakeholders. The Global Platform is organized by UNISDR. The Global Platform for Disaster Risk Reduction is the world's foremost gathering of stakeholders committed to reducing disaster risk and building the resilience of communities and nations.

[4] The International Strategy for Disaster Reduction (ISDR) is a strategic framework adopted by United Nations Member States in 2000. The ISDR guide and coordinates the efforts of a wide range of partners to achieve a substantive reduction in disaster losses. It aims to build resilient nations and communities as an essential condition for sustainable development. The United Nations Office for Disaster Risk Reduction (UNISDR) is the secretariat of the International Strategy of Disaster Reduction and disaster risk reduction community, which comprises numerous organizations, States, intergovernmental and non-governmental organizations, financial institutions, technical bodies and civil society. UNISDR serves as the focal point for the implementation of the Hyogo Framework for Action (HFA).

While a well-established reporting process, guided by the United Nations Framework Convention on Climate Change (UNFCCC), exists for greenhouse gas emissions, comparable statistics on other issues related to climate change are not easily available.

Conceptual and methodological tools

23.4 Given the complexity of climate change and disaster risk reduction, producing statistics to inform about them requires the organization of a wide range of statistical topics and statistical information collected and produced by different national and international institutions.

23.5 There is a demand for reliable statistics that can support the measurement and analysis of the drivers and the social and economic consequences of climate change and the related mitigation (and adaptation) measures. The statistics required to provide the evidence for policy development and research cover a very wide range of scientific, economic and social data. No one statistical framework can hope to embrace such a range of information needs. There are a number of different frameworks created for different purposes that can be used to organize these statistics, as acknowledged in the UN Economic Commission for Europe (UNECE) Task Force on Climate Change Related Statistics. These are the first recommendations that represent useful steps for national statistical offices to enhance their contribution to analysing issues related to climate change and to improve their support to greenhouse gas inventories with official statistical data.[5]

23.6 The frameworks for structuring climate change related information assessed in more detail in the report of the UNECE Task Force include the following:

a. The United Nations System of Environmental-Economic Accounting (SEEA) Central Framework provides an integrated set of basic statistics that can be re-grouped into a variety of indicators that are useful for the analysis of climate change.

b. The Framework for the Development of Environmental Statistics (FDES) also facilitates the description of climate change related statistics through its main components and the related variables as it provides a structure for a set of basic and core climate change and disaster related statistics that can guide statistical and indicator work.

c. The IPCC Schematic Framework (Climate Process Drivers, Climate Change Evidence, Impacts and Vulnerability, Mitigation and Adaptation) can be linked to the SEEA-CF and FDES. It was specifically developed for analytical purposes and to understand and manage climate change, but it can also serve to identify relevant statistics and indicators and to asses data availability.

d. Climate change related information could be structured according to the Driving forces – Pressure – State – Impacts – Response (DPSIR) model, which is widely used

[5] www.unece.org/fileadmin/DAM/stats/documents/ece/ces/2014/Recommendations_on_climate_change_related_statistics.pdf

as an analytical tool to describe and structure state of the environment reports and sustainable development indicators.

e. The Natural Capital Approach is one of the frameworks that can help link climate change related information on environmental quality and human well-being through the flows of ecological goods and services from natural assets to humans.

f. Another way for categorizing climate change related statistics is in line with the way climate change policies and discussions typically are structured – Impacts, Mitigation and Adaptation (IMA).

23.7 The SEEA Central Framework, adopted by the UN Statistical Commission as an international statistical standard in 2012, has been recognized as a useful framework for climate change related statistics, as it provides value added in analysing mitigation and adaptation strategies and their trade-offs and provides an integration framework for the derivation of climate change indicators. As a statistical system the SEEA Central Framework is comprehensive in that it encompasses all known aspects of the environment-economy interaction and uses concepts and classifications consistent with System of National Accounts. The SEEA Experimental Ecosystem Accounting looks at these relationships from the point of view of ecosystems. The value of data organized according to the SEEA could be further increased by linking these data with social and demographic statistics to permit their analysis in the context of, for example, vulnerable population groups.

23.8 The Framework for the Development of Environment Statistics (FDES 2013), adopted by the UN Statistical Commission as the framework for strengthening national environment statistics programmes identifies a basic and a core set of statistics related to climate change and disasters and provides an organizing structure that links them together with all other related fields of environment statistics. The FDES 2013 and the SEEA Central Framework are compatible.

Existing and new indicators

23.9 Existing indicators of relevance to climate change and disaster risk reduction include those used or implicit in the UNFCCC and IPCC reporting systems (e.g. national and sectorial GHG emissions, national adaptation and mitigation plans and actions and flows of finance and technology); the UNECE Protocol on Pollutant Release and Transfer Registers (PRTR)[6] with geo-referenced data on industrial pollutants, including greenhouse gas emissions; the Hyogo Framework for Action indicators of progress; and the Aichi biodiversity targets. MDG indicators that are most relevant include MDG7, indicator 7.2 CO_2 emissions, total, per capita and per $1 GDP (PPP). Several other MDG indicators are closely related to the cross-cutting issue of climate change and risk reduction.

[6]For more information on PRTR : www.unece.org/prtr_grt2013.html, www.unece.org/env/pp/welcome.html and prtr.net/

23.10 Indicators on climate change adaptation and mitigation have been proposed, but are often difficult to calculate and disseminate regularly because of considerable data gaps, particularly in developing countries. International agreements in both concepts and methodologies are crucial in order to be able to respond statistically to the new SDG monitoring framework. For example, proposals for integrating resilience into the SDGs framework have been made to date by different institutions (see UNISDR, 2013). The proposals discuss potential indicators and targets for including a specific goal on disaster resilience, as well as considering the opportunities for building disaster resilience into targets and indicators into other sector goals. Overall, disaster resilience is a cross-cutting issue relevant across various sectors, and affecting individuals and institutions at all levels (from local to national, regional and global and vice versa). Clear definitions are necessary to further develop statistical work and possible indicators in this area. The Demographic Explorer for Climate Adaptation (DECA), developed by the UN Population Fund with partners, is an interesting example of combining official statistical data with other information for the purposes of disaster risk analysis and climate change adaptation. The automatic spatial analysis tool is available at the first stage for Indonesia[7]. It assembles available data into detailed categories (e.g., hazard levels, land use type, housing materials, age groups, education levels, infrastructure types) so that the user can combine data categories for specific groups of people or targeted geographic areas.

23.11 Indicators on the impact of climate change and disasters have been produced by the relevant international agencies, and also within countries. Emissions by sector of activity are important (i.e. globally, two thirds of GHGs are emitted by the energy sector while 20-30% by agriculture, forestry and other land uses). Most key indicators can be disaggregated to discriminate between the respective contribution by economic activity or by the sector receiving the impact of the extreme event and disasters. A number of other statistics, indicators and thematic areas are currently being used by the IPCC and UNFCCC, as well as other global, regional and national institutions. Some examples of existing indicators sets are mentioned in the report of the UNECE Task Force. There is a lack of information especially on the socio-economic impacts of climate change.

23.12 While generic targets and indicators on disaster management have been developed under the HFA in consultation with countries, challenges have been faced in translating these targets into consistent efforts across countries. These challenges include: difficulty measuring targets given the cross-cutting nature of disaster risk reduction, limited connection with existing goals/targets of development frameworks like the MDGs, lack of access to data collection and monitoring tools; and the lack of recognition of disaster risk reduction as a

[7]The Demographic Explorer for Climate Adaptation (DECA) for Indonesia: nijel.org/un_popclimate/deca

development principle. To date, the achievement of the HFA has been monitored against a set of 22 core indicators across the five Priority Areas[8].

Data requirements, challenges and limitations

23.13 Statistics on the emissions of GHGs to the atmosphere can be found in countries reporting to UNFCCC. GHG emissions, emission reduction and mitigation actions are communicated by parties to the UNFCCC regularly through National Communications (NC). In addition, Annex I parties report their emissions annually. Non-Annex I parties have significant capacity gaps that limit their ability to report regularly. All parties to UNFCCC will need to report biennially, starting at the end of 2014. Such reporting, which will include GHG National Inventories and planned Mitigation actions, including Nationally Appropriate Mitigation Actions (NAMAs) and Reducing Emissions from Deforestation and Degradation (REDD+) activities, are called Biennial Update Reports (BURs). A robust national GHG inventory, including projected emissions in coming decades, is the basis for parties to UNFCCC to highlight emission hotspots, plan efficient national and sub-national action, and document mitigation activities against business-as-usual reference emission levels. NCs from parties are available from UNFCCC; Yearly National Inventory Reports (NIRs) from Annex I countries are available since 1990. Only a few complete time series are available for non-Annex I parties.

23.14 In addition, national communications to the UNFCCC require reporting other information than emissions much of which is available from the statistical system. These include data on socio-economic developments, national circumstances, impact of policies and measures on emissions, basic data used for emission projections, data on vulnerability, financial resources and assistance, transfer of technology, education, training and public awareness. Many gaps exist in these data that should be filled as these requirements will remain the same for a number of years. The availability of data varies a great deal across countries. However, the general issues highlighted by the in-depth reviews of national communications include the following:

- Impacts of climate change on key economic sectors (for example, tourism) and social issues;
- Mitigation: Cost and effect of policies and measures across sectors, financial resources for mitigation, technology transfer;
- Adaptation: Measures taken to minimize adverse impacts of climate change and extreme events, vulnerability assessment (for example, of the health sector and biodiversity), financial resources for adaptation, investment etc.

[8] Through an on-line HFA Monitor progress is benchmarked by countries on a scale of 1 to 5, complemented by means of verification and a qualitative description Although this has generated the most significant global repository of information available on the progress reported by governments in reducing disaster risk, the experience of three biennial review cycles in 2009, 2011 and 2013 has highlighted some of the main challenges8. Recognising these weaknesses, a new system of indicators for risk management could be adopted. The immediate indicator would comprise the level of disaster loss as indicator of success of risk management.

23.15 The measurement methodology[9] to estimate emissions of GHGs guides countries in their reporting to UNFCCC. The Greenhouse Gas Inventory Data of the UNFCCC contains the most recently submitted information, covering the period from 1990 to the latest available year, to the extent the data have been provided by countries. The GHG data contain information on anthropogenic emissions by sources and removals by sinks of the six principal GHGs (carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF_6)) that are not controlled by the Montreal Protocol. The GHG emission statistics are usually presented disaggregated by source category. Linking GHG emissions to other statistics remains a challenge due to differences in classifications. Efforts to connect economic information to climate change related issues, for instance by using the SEEA Central Framework, or by improving possibilities to link GHG emissions and water use to economic activities would facilitate multi-sectorial analyses of the drivers of climate change.

23.16 For non-Annex 1 countries, internationally comparable estimates of CO2 emissions can be found in the Carbon Dioxide Information Analysis Centre (CDIAC) database (see: http://cdiac.ornl.gov/). CDIAC acquires or compiles, quality assures, documents, archives, and distributes data and other information concerning carbon dioxide.

23.17 In regard to the concentrations of CO_2, NASA and NOAA produce and disseminate long series on carbon dioxide concentrations (http://climate.nasa.gov/key_indicators) in the global atmosphere, based on their basic research on current global concentrations by direct measurement with a global monitoring station network and past to thousands of year indirectly from CO_2 contained in in ice cores from the past. These science based indicators and statistics are further disseminated in numerous international and national website

23.18 As to key statistics and indicators about the evidence of climate change at the global level, there are international agencies that provide them with adequate quality and timeliness. These include long series on carbon dioxide concentrations in the global atmosphere, global surface temperature, Artic sea ice, land ice, sea level and land ice, glacial retreat, extreme events and ocean acidification, etc.

23.19 Regarding the disaster risk, the UNISDR has developed a Global Risk Model for a series of GAR. It measures annual average loss (AAL) and probable maximum loss (PML) based on probabilistic modelling. Currently the data set includes AAL and PML for earthquake, cyclones and floods under the return period of 250 years. The data is open to

[9] GHG emission inventories are developed by Parties to the Convention using scientific and methodological guidance from the Intergovernmental Panel on Climate Change (IPCC), such as Revised Guidelines for National Greenhouse Gas Inventories (1996), IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (2000) and IPCC Good Practice Guidance on Land Use, Land-use Change and Forestry (2003). *IPCC Guidelines for National Greenhouse Gas Inventories* are approved internationally and developed through an international process. The IPCC Guidelines were first accepted in 1994 and published in 1995. UNFCCC COP3 held in 1997 in Kyoto reaffirmed that the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories should be used as "methodologies for estimating anthropogenic emissions by sources and removals by sinks of greenhouse gases" in calculation of legally-binding targets during the first commitment period.

public via UNISDR's website. For GAR 15, the UNISDR will expand the data set by adding Tsunami PML and volcanic ash exposure data and by allowing multiple return periods.

23.20 Occurrence and direct impact of extreme events and disasters is usually recorded by the affected countries authorities and as administrative records and geo-spatial information it can be used to be transformed in statistics and indicators series. Most international databases portraying extreme events, disasters and their impact based their statistics on national information, sometimes complemented by their own. In addition, statistics on hazard prone areas and on the exposure to disasters (i.e., population living in hazard prone areas), are also relevant.

23.21 At the global level, CRED and its Emergency Database[10] provides a series of methodological and conceptual tools for international reference, including the criteria needed to qualify and event as a disaster[11], the definition of disasters[12], their classification and other elements that are useful tools to harmonize the statistical work in this field. Additionally, CRED undertakes data compilation, validation and analysis. It provides open access to its data through its website. In addition to providing information on the human impact of disasters, such as the number of people killed, injured or affected, EM-DAT provides disaster-related economic damage estimates and disaster-specific international aid contributions

23.22 While the scope of CRED database covers relatively intensive disasters, many countries suffer from accumulation of low-severity and high-frequency disasters (extensive disasters). To grasp a whole picture of disaster, the UNISDR promoted the establishment of disaster loss database covering both intensive and extensive disasters. Furthermore, for GAR13, the UNISDR invented a methodology to assign economic value to the loss data and applied the methodology into 56 country's databases. The initiative has been expanding and in 2014 74 countries will develop disaster loss database. The data is open to the public via website.

23.23 Regarding the systematic collection of vulnerability data which influence the disaster risk, many organisations have initiatives, such as the IDB's Indicator of Disaster Risk and Risk Management, JRC's InForm and DARA's Risk Reduction Index. Depending on the objective of database development, the scope and territorial coverage of database is different.

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[10] Since 1988 the WHO Collaborating Centre for Research on the Epidemiology of Disasters (CRED) has been maintaining an Emergency Events Database EM-DAT http://www.emdat.be. It was created with the initial support of the WHO and the Belgian Government. The main objective of the database is to serve the purposes of humanitarian action at national and international levels. It is an initiative aimed to rationalise decision making for disaster preparedness, as well as providing an objective base for vulnerability assessment and priority setting. EM-DAT contains essential core data on the occurrence and effects of over 18,000 mass disasters in the world from 1900 to present. The database is compiled from various sources, including UN agencies, non-governmental organisations, insurance companies, research institutes and press agencies.

[11] A disaster can be categorized using the CRED Emergency Events Database (EMDAT) criteria, that is at least one of the following criteria must be fulfilled: a) Ten (10) or more people reported killed; b) One hundred (100) or more people reported affected; c) Declaration of a state of emergency; or d) Call for international assistance has been made.

[12] The Centre for Research on the Epidemiology of Disasters (CRED) defines a disaster as an "unforeseen and often sudden event that causes great damage, destruction and human suffering."12 It often surpasses local capacities to respond to it and requires external assistance at the national or international level. A disaster is often described as a result of exposure to an extreme event.

23.24 Systematic collection and analysis of these data can provide key information to governments and agencies in charge of disaster risk management activities including relief and recovery activities. It also aids the incorporation of health issues into development and poverty alleviation programmes. However, there is a lack of international consensus regarding best practices for collecting these data. Together with the complexity of collecting reliable information, there remains huge variability in definitions, methodologies, tools and sourcing.

23.25 As a regional initiative, the United Nations Economic Commission for Latin America and the Caribbean (UNECLAC) has developed a handbook which may be useful to other countries and regions, "UNECLAC: Handbook for Estimating the Socio-economic and Environmental Effects of Disasters". It evaluates the overall impact of disasters associated with natural events and includes a methodology for evaluating this impact. This analysis of disaster impact in terms of damage and losses makes it possible to estimate the impact of disasters on economic growth, on the population's living conditions and on environmental conditions in the region.

23.26 Within countries, the most common data sources are administrative records and in some cases maps, aerial photography and satellite imaging produced by national and sub-national authorities responsible for disaster management and assistance, emergency management and response agencies, insurance companies, optical and radar satellite operators for satellite information, as well as seismic monitoring and research centres.

23.27 Although the connections between urban planning, poverty, location of human settlements in risk areas, social and environmental vulnerability and disasters impact is in general well understood, constructing statistics to inform in these relations capturing the complexity of the phenomena is fairly difficult and require significant investment in capacity building and statistical development in the affected countries. Considerable statistical progress is required in these two areas in the upcoming years.

Conclusions

23.28 The UNECE Task Force on Climate Change Related Statistics recommendations state that national statistical offices should work more closely with greenhouse gas inventory producers to ensure that official statistics meet the needs of greenhouse gas inventories. Moreover, official statistical data should be developed in light of the needs of climate change analysis and policy making; and the existing statistics produced by various institutions be organised to improve access to the information. Existing environmental, social and economic statistics should be better organised for the purposes of climate change analysis. Also, the usefulness of the existing statistics for climate change analysis should be improved by reviewing existing data collection systems and geo-referencing the data. Improvements in data and statistics are needed: improved timeliness, regularity in collection, longer time series, greater detail both with regard to economic activities and geographic breakdown,

linking data across statistical domains for integrated analysis, requiring datasets using consistent structures and scopes, improved accessibility to data currently scattered across organizations, and improved interpretability, especially for complex scientific data.

23.29 The recommendations by the UNECE Task Force present a good starting point for improving the contribution of official statistics to climate change analysis and greenhouse gas inventories. Progress in the area will require action by national statistical offices as the coordinators of national statistical systems both nationally and internationally. The need for underlying data and regular statistics to inform the policy aspects of climate change and disaster risk reduction remains a pressing requirement and a great challenge for developing countries. Climate change and disaster risk reduction statistics are spread over a large proportion of the domain of environment, social and economic statistics in all countries. Statistics pertaining to the different steps of the described sequence are necessary to monitor climate change and to observe how it is affecting different countries and regions, particularly in relation to disaster occurrence and risk reduction.

23.30 The statistics to calculate potential SDG indicators in this issue are more developed at national and international levels for the climate change drivers including emissions of GHGs and sectorial activity statistics identifying the economic activities responsible for those emissions. Scientific data and monitoring data are available for climate change evidence statistics. While disaster loss and risk data have been improving and expanding in coverage, their development still needs support from the international community. Developing and least developed countries, SIDS, among others, still encounter important challenges when producing statistics about the impact of the disasters and other long term effects of climate change. Statistics and indicators about mitigation and adaptation of climate change and also about disaster risk reduction are less developed and require worldwide investment in statistical capacities for producing them and making them available for monitoring and decision making. Furthermore, as related information is scattered across databases of a variety of producers, it is largely unstructured and often not harmonised across countries, data and statistics should be analysed under an established conceptual framework to contribute to better decision making.

23.31 Recent conceptual and methodological developments, such as the SEEA Central Framework and the SEEA Experimental Ecosystem Accounting provide tools to link environmental and economic data in a consistent manner and thus will facilitate the derivation of many robust indicators relevant to climate change and disaster risk reduction.