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Climate change statistics

Report of the Secretary-General

Summary

In accordance with Economic and Social Council decision 2015/216 and past practice, the present report was prepared by the Statistics Division of the Department of Economic and Social Affairs, in its capacity as secretariat of the Statistical Commission, in collaboration with the Economic Commission for Europe (ECE). It contains a discussion of climate change statistics and highlights their relevance and the need for them. It builds upon the programme review on climate change and official statistics, undertaken at its fortieth session in 2009, and upon the outcome of two related conferences on climate change and official statistics organized by the Division. The present report elaborates on the demand and supply of climate change statistics, describing the situation around the world, with particular emphasis on the constraints that developing countries face. Responding to increasing demand from countries, the present report summarizes the work of the Division on climate change statistics, including methodological guidance, technical assistance and training, as it pertains to three key statistical domains relevant to climate change, namely, environment statistics, geospatial statistics and environmental-economic accounts. Complementarily, it describes the progress made in the work of ECE on climate change-related statistics and indicators. The Statistical Commission is invited to express its views on the report and discuss the way forward.

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I. Introduction

1. Climate change affects all countries and remains one of the most important development challenges facing humanity. It disrupts national economies and affects lives, with significant current and future costs to people, communities and countries. The main impacts of climate change are observed through both slow-onset events, such as sea level rise, increasing temperatures, ocean acidification, forest degradation, biodiversity loss and desertification, and sudden extreme weather events.[1]

2. Building on the United Nations Framework Convention on Climate Change and the Kyoto Protocol, countries and the United Nations reached a new universal agreement in Paris, in 2015, to reduce emissions, keep global warming below 2°C compared with the preindustrial era (about 1850) and mobilize resources to finance adaptation, as societies move towards a low-carbon economy base. The twenty-first session of the Conference of the Parties to the Convention was hosted by the Government of France, in Paris, from 30 November to 11 December 2015. The session and its outcome, the Paris Agreement, were of critical importance, given that it was the first time that humanity had reached a landmark universal agreement on the climate, as the Secretary-General himself noted.

3. Climate change is addressed in Goal 13, to take urgent action to combat climate change and its impacts, of the Sustainable Development Goals, contained in the 2030 Agenda for Sustainable Development. The Goal has five targets that will be monitored through indicators that require statistics for their measurement.

4. Climate change is a cross-cutting issue involving complex dynamics, which include economic, social and environmental factors that affect each other and pose a considerable challenge with regard to statistical measurement at both the country and agency levels. The statistical community around the world will undoubtedly face increasing demands for data from diverse stakeholders. Preparations need to be made to properly inform societies about climate change in terms of emissions, occurrence, impacts, mitigation and adaptation, so that policymaking and monitoring can be more robust and evidence-based.

II. Statistical Commission programme review on climate change

5. In its multi-year programme of work for the period 2015-2019 (E/CN.3/2015/39), the Statistical Commission agreed that climate change statistics should be on the agenda of the Commission approximately every five years, with 2016 the next occasion.

6. The Commission, at its fortieth session, in 2009, launched a programme review on climate change and official statistics carried out by the Australian Bureau of Statistics (see E/CN.3/2009/2). The objective of the review was to specify how official statistics may be used for climate change measurement and analysis and to identify recommendations and actions to mainstream the climate change aspect in official statistics, thus strengthening the role of official statistics and national statistical offices in this area.

[1] See the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.

7. The Commission, in its decision 40/101, welcomed the high-quality programme review, recognized that climate change was an important global issue with social, economic and environmental impacts, acknowledged that climate change was a new area of official statistics, noted that there was a need to understand the data needs of various stakeholders, recognized that many of the statistics needed were already being produced by national statistical systems, noted the interest of countries to develop a framework of environment statistics to facilitate the understanding of the phenomenon of environmental and climate change and stressed the importance of training and capacity-building, in particular for developing countries.

8. The Commission took into consideration the recommendations of the two conferences organized by the Statistics Division of the Department of Economic and Social Affairs on climate change and official statistics, held in Oslo, from 14 to 16 April 2008, and in Seoul, on 11 and 12 December 2008.

III. Demand and supply of climate change statistics

A. Current situation

9. Currently, demand for data on climate change is greater than its supply, particularly with regard to the environment. If the statistical community does not take decisive action, this gap will increase. The gap is evidently deeper in developing and least developed countries that face critical resource constraints, limited technical capacities, institutional weakness and lack of coordination among national institutions. The systematic production of basic statistics is important yet difficult in the developing world, where prioritization and flexibility are essential.

10. Available official data and statistics pertaining to the more pertinent aspects of both climate change and sustainable development are insufficient, thus requiring the development of spatially relevant statistics and indicators in order to produce quantitative evidence at the national level.

11. Depending on the productive structure and the environmental dynamics of each country, the data needed to gain information about climate change varies among countries. Greenhouse gas emissions are a major driver of climate change. The most significant activities responsible for these emissions are agriculture, land use changes, forestry, energy, manufacturing and transportation. The relative significance of each activity varies among countries, and that should be reflected in the relevance of the corresponding statistics. Whereas manufacturing and energy are the most significant sources of emissions of industrialized countries, agriculture and forestry are more significant in developing countries. Impact and adaptation statistics are also essential in developing countries. In addition, statistics are needed for reporting on climate-related conventions. Such conventions require baseline data for emission projections and statistics on national circumstances, measures taken in climate change adaptation and mitigation, technology exchange, financial resources and education.

12. With the increase in the frequency and intensity of extreme climate-related meteorological events and natural disasters, there are emerging data needs. Increased data will also be needed for the implementation of the Sendai Framework

for Disaster Risk Reduction 2015-2030. Cumulative changes in climate, precipitation, ice cover, drought and sea level are already affecting such areas as agriculture, human health, water availability, conditions in human settlements and natural resources. Adaptation and mitigation measures are needed and are now becoming key aspects of national policy. Consequently, there is a need to develop basic statistics on these aspects to inform stakeholders.

13. The current availability of relevant climate change statistics varies depending on the stage of the climate change process. Bearing in mind the gap in the availability of statistics between developed and developing countries, data on drivers of climate change and on climate change evidence are relatively more available. Socioeconomic and environmental data should be made more easily available to facilitate the analysis of the impacts of climate change. Mitigation statistics are produced less often and are more difficult to capture statistically because of the insufficient resources invested in their measurement and the lack of methodological guidance. Furthermore, their importance notwithstanding, statistics on vulnerability and adaptation, as well as resilience, are still in development and require investment in terms of methodology and capacity development. The outcomes of the twentieth and twenty-first sessions of the Conference of the Parties to the United Nations Framework Convention on Climate Change, held in Lima in 2014 and in Paris in 2015, stressed the importance of mitigation and adaptation actions with regard to climate change.

B. Methodological guidance

14. Strengthening statistics by using international recommendations on statistics in agriculture, energy, industry and the environment, including on extreme natural events and disasters, is conducive to the compilation and dissemination of improved climate change statistics and indicators. Relevant basic statistics are essential for developing indicators, compiling environmental-economic accounts and producing reports and assessments.

15. To guide the production of basic statistics relevant to climate change in different domains, the Statistics Division has produced internationally agreed-upon recommendations, such as the Framework for the Development of Environment Statistics, the International Recommendations for Energy Statistics and the International Recommendations for Industrial Statistics, as well as various hands-on guidance manuals. The Economic Commission for Europe (ECE) has produced the Conference of European Statisticians recommendations on climate change-related statistics, which aims at improving existing official statistics to support climate change analysis and reporting on greenhouse gas emissions under the Convention on Climate Change and focused on statistics that are relevant for analysing climate change, its causes and impacts, rather than on scientific or meteorological data describing changes in weather and climate (see sect. V below).

16. The Intergovernmental Panel on Climate Change conceptual and analytical framework was developed to describe the sequence of events, including climate process drivers, climate change, impacts and vulnerability, mitigation and adaptation. In addition, the internationally agreed methodology for estimating greenhouse gas emissions is provided by the Panel guidelines for national greenhouse gas inventories. The agencies that compile the emission inventories vary

in most developed countries, annex I countries under the Convention on Climate Change and the Kyoto Protocol, and in some developing countries.

17. The System of Environmental-Economic Accounting (SEEA), integrating economic and environment statistics using the System of National Accounts accounting framework, guides the production of accounts that can be used to provide information about the intersection of the environment, the economy and climate change. In particular, it offers guidance on constructing air emission accounts (see sect. IV.C below).

18. A key framework that identifies and organizes a wide range of environment statistics, which is also needed for climate change statistics, is the Framework for the Development of Environment Statistics, endorsed by the Statistical Commission in 2013.[2] It is a multipurpose, conceptual and statistical framework to guide practitioners in organizing and structuring environment statistics, including those needed for climate change statistics (see sect. IV.A below).

19. The existence of methodological guidance notwithstanding, developing countries with many competing needs for scarce resources find it difficult to sustain the regular production of key climate change statistics.

C. Need for environment statistics

20. Climate change statistics span a great proportion of the scope of environment statistics. Insufficiently developed environment statistics pose a critical challenge to providing information about climate change, particularly in developing countries. In turn, this insufficiency negatively affects the compilation of environmental sustainability and sustainable development indicators, as well as environmental-economic accounts.

21. The environmental pillar of sustainable development is the weakest in terms of monitoring and measurement, when compared with the economic and social pillars. This is due to the relative novelty of this statistical domain and the general insufficiency of dedicated regular resources invested in developing and strengthening environment statistics programmes at the national, regional and global levels. Environment statistics often compete with social and economic statistics for limited resources. Certain countries do not yet have an established environment statistics programme. Furthermore, the production of environment statistics is often scattered across various agencies.

22. The key environment statistics needed to provide information about climate change include those relating to greenhouse gas emissions; atmospheric conditions and change; the use of environmental resources; forest cover; land use change; energy production and use, intensity, efficiency and renewability; biodiversity; water availability and quality; waste; and the occurrence and impact of extreme natural events. The necessary statistics are identified in the Framework for the Development of Environment Statistics (see sect. IV.A below).

[2] For relevant topics and individual statistics, see *Framework for the Development of Environment Statistics (FDES) 2013* (United Nations publication, Sales No. 14.XVII.9), chap. 5, sect. 5.3, figures 5.8 and 5.9.

IV. Statistical work on climate change in the Statistics Division

A. Environment statistics

23. In 2008, the Statistics Division organized two conferences on climate change and official statistics, in Oslo and in Seoul, at which the statistical implications of the emergence of climate change in the policy realm, the related challenges and the road ahead were discussed.

24. In subsequent meetings and workshops, the Statistics Division has produced documentation and training materials describing the interlinkages between climate change and environment statistics, using the Framework for the Development of Environment Statistics and other relevant sources. Chapter 5.3 of the Framework contains statistical information to guide countries; it identifies and describes the many environment statistics needed to provide information about climate change, organized in the sequence of climate change events on the basis of the Intergovernmental Panel on Climate Change framework. Countries can use these documents as a reference when adapting and selecting their most relevant statistics and underlying data sets to work towards the development of climate change statistics. The stages defined in the sequence of climate change events and its corresponding statistical topics are as follows: (a) climate process drivers, which include greenhouse gas emissions and the use of ozone depleting substances; (b) climate change evidence, including atmosphere, climate and weather and hydrographical characteristics and the occurrence of extreme natural events; (c) climate change impacts and vulnerability, including the impact of extreme natural events and disasters, environmental problems, human settlements, changes in land cover, biodiversity and marine and terrestrial ecosystems; and (d) mitigation and adaptation, including energy renewability, carbon intensity, environmental protection expenditure, regulation, policy instruments and disaster preparedness. Each group of statistics can be used as numerators and denominators in the calculation of various climate change indicators.

25. A new web-based knowledge platform dedicated to climate change statistics is being developed by the Environment Statistics Section of the Division.[3] It includes various documents, tools and resources, such as: (a) a fact sheet on climate change statistics developed on the basis of the Framework for the Development of Environment Statistics and the Intergovernmental Panel on Climate Change framework; (b) detailed lists of the environment statistics of the Basic Set of Environment Statistics of the Framework that are needed to provide information about climate change, organized in the sequence of climate change events of the Framework and the Panel; (c) the statistical note prepared for the Open Working Group of the General Assembly on Sustainable Development Goals on climate change and disaster risk reduction; (d) relevant links to climate change indicators; (e) a fact sheet about Goal 13 and environment statistics; (f) a set of methodological guidance tools about climate change statistics, including methodology sheets for the Basic Set of Environment Statistics related to climate change and explanations and links to the emission methodologies of the Panel and of the Food and Agriculture Organization of the United Nations (FAO); (g) the Conference of European Statisticians recommendations on climate change-related statistics; (h) presentations

[3] Available at http://unstats.un.org/unsd/environment/climatechange.html.

identifying the environment statistics needed to gain information about climate change; (i) links to the two international climate change and statistics conferences; and (j) an inventory of current related work on climate change statistics by partner organizations.

B. Geospatial work and the Committee of Experts on Global Geospatial Information Management

26. The Committee of Experts on Global Geospatial Information Management, for which the Statistics Division is the secretariat, is the leading intergovernmental mechanism for making joint decisions and setting the direction with regard to the production and use of geospatial information within national and global policy frameworks. Geospatial information is an essential tool for supporting national development, economic growth, improved decision-making and policy formulation. It has enhanced the capability of Governments, international organizations and researchers to analyse, model, monitor and report on sustainable development, climate change, disasters and other global development challenges. As geospatial information is so integrative and cross-cutting across many sectors of industry and government, as well as all three pillars of sustainable development, the Committee of Experts does not focus specifically on climate change issues in isolation but takes a more holistic approach to data and geospatial frameworks in order to build decision-making and policymaking capacity and capability for Governments. This includes national spatial data infrastructure and the provision of reliable and authoritative fundamental geospatial data themes, such as geodetic positioning, elevation, water and oceans, land use and cover, transport, infrastructure, administrative areas, population and imagery, as means to support and inform national development.

27. The national spatial data infrastructure, supported by the consistent and best available fundamental geospatial data, provides the means to organize and deliver core geographies with regard to many outcomes, from the local to the global levels, including measuring and monitoring climate change. For example, when assessing the impacts of climate change owing to sea level rise or more severe meteorological events in the coastal zones of many island States, the use of geospatial information allows for the integration and modelling of many data inputs across many scenarios. The types of geospatial data inputs include: (a) profiles of the land: topography, bathymetry, river systems, coastline shape, geomorphology; (b) hazard: characteristics, frequency, intensity, extent, including of flood and storm events, and Intergovernmental Panel on Climate Change scenarios; (c) exposure: location of people and community elements that are exposed, location of homes, buildings, critical facilities and infrastructure, such as roads, schools and hospitals and systems of power, gas and water; and (d) vulnerability: spatially located demographic information on where and who are the most vulnerable in the community, such as children, older persons and persons with disabilities.

28. Using geospatial information to integrate the many disparate data sets allows for the risk or impact from climate change scenarios to be modelled, visualized and understood, thus enabling policymakers and decision makers to make better, more informed decisions. Such methods and approaches are being directly applied in countries to support more rigorous climate change data analysis.

C. Environmental-economic accounts

29. In its report on climate change and official statistics, the Australian Bureau of Statistics recognized SEEA as an important statistical framework for climate change statistics and analysis, with considerable potential to add value in many areas of environmental-economic analysis, and a most practical way forward (see E/CN.3/2009/2, para. 40). It recommended that the mandate of the Committee of Experts on Environmental-Economic Accounting be expanded to include climate change and that the Committee of Experts begin consultation with the secretariat of the Convention on Climate Change. As a result of that recommendation, the Committee of Experts amended its mandate to include climate change statistics as part of its area of work with regard to the formulation of a statistical response on emerging policy issues, an amendment which was endorsed by the Statistical Commission at its forty-first session (see E/2010/24).

30. The SEEA Central Framework was adopted as a statistical standard in February 2012. Together with SEEA Experimental Ecosystem Accounting, it provides the integration framework to monitor and evaluate drivers, impacts, mitigation and adaptation, bringing together basic statistics, including geo-referenced data, through its thematic accounts, statistics and indicators. The SEEA Central Framework is also accompanied by SEEA applications and extensions which describe the application of the SEEA framework for climate change statistics and analysis.

V. Climate change-related statistics work in the Economic Commission for Europe

31. The ECE Conference of European Statisticians launched in 2011 to improve the use of official statistics for providing information on climate change, with regard to drivers, impacts, mitigation and adaptation.

32. National statistical offices and environmental agencies hold a huge variety of information that would be more useful for analysing the various aspects of climate change if correctly combined and evaluated. ECE is leading the work to make those statistics fit for this purpose, in close collaboration with national statistical offices, agencies in charge of emission inventories, international statistical organizations and agencies involved in measuring climate change, including the Convention on Climate Change, the Intergovernmental Panel on Climate Change, the World Meteorological Organization, the Directorate General for Climate Action of the European Commission, the European Environment Agency, the International Energy Agency, the Statistics Division, FAO, the United Nations Office for Disaster Risk Reduction and the United Nations Population Fund.

33. A dedicated ECE task force developed the Conference of European Statisticians recommendations on climate change-related statistics,[4] which the Conference unanimously endorsed at its plenary session in April 2014. In the recommendations, the Conference defines for the first time what is meant by climate change-related statistics and suggests a course of action to make official statistics more useful for analysing the causes and impacts of climate change, as well as its

[4] Available from www.unece.org/publications/ces_climatechange.html.

mitigation and adaptation efforts. The scope of climate change-related statistics is defined to include environmental, social and economic data that measure: (a) emissions: greenhouse gas emissions and their human causes; (b) drivers: human causes of climate change with regard to the sources of emissions; (c) impacts: impacts of climate change on human and natural systems; (d) mitigation: efforts of humans to avoid the consequences of climate change; and (e) adaptation: efforts to adapt to those consequences.

34. In the Conference of European Statisticians recommendations, priorities and practical steps are suggested in three areas: (a) official statistics need to be improved to support greenhouse gas inventories, given that they can provide a substantial part of the activity data needed for greenhouse gas inventory calculation; (b) the availability and usefulness of official statistics should be improved to support the analysis of climate change impacts, mitigation and adaptation efforts; and (c) to complete the above-mentioned steps requires a review of the current statistical infrastructure, including classifications, definitions, data collection, organizational structures, knowledge, products and services, so that statistical offices can provide a suitable context for compiling climate change-related statistics. Statisticians should form new partnerships and exchange knowledge with the relevant data producers at the national and international levels.

35. Currently, the focus of the work of ECE is on the implementation of the Conference of European Statisticians recommendations. An ECE steering group was set up to guide the implementation and promote further harmonization and coherence between the greenhouse gas inventory data and official statistics. Regular ECE expert forums for producers and users of climate change-related statistics will provide a platform for sharing experience, advancing work on conceptual and measurement issues and collaborating with the key organizations involved in the measurement of climate change. The expert forum held in September 2015 brought together experts representing national statistical offices, environment agencies and ministries, meteorological services, agencies specializing in disaster risk management, research institutes and international organizations. Work has begun to collect practical examples and good practices to illustrate ways of implementing the recommendations and to develop a road map that allows countries to prioritize their actions to improve their climate change-related statistics in response to increasing demands from the outcome of the twenty-first session of the Conference of the Parties to the United Nations Framework Convention on Climate Change, the Sustainable Development Goals and the Sendai Framework.

36. An area requiring further work is identifying an internationally comparable set of key climate change-related statistics and indicators using the SEEA Central Framework, the Framework for the Development of Environment Statistics and other statistical frameworks as a source of information. A dedicated task force is developing the set of indicators. The work also takes into account the relevant indicators for the monitoring of progress towards realizing the Sustainable Development Goals. A draft set of statistics and indicators is expected to be completed in 2016.

37. An issue related to climate change is the measurement of extreme natural events and disasters. ECE launched a task force that is working to clarify the role of official statistics in this area and identify practical steps regarding how national statistical offices can support disaster management and risk reduction. The work is

being done in close collaboration with the expert group on disaster-related statistics in Asia and the Pacific of the Economic and Social Commission for Asia and the Pacific. It will feed into the monitoring of progress towards the Sendai Framework. The final report of the task force is expected to be completed in 2017.

38. A background document from ECE provides more detail on the Conference of European Statisticians recommendations on climate change-related statistics and on ECE activities in this area.

VI. The way forward

39. The landmark Paris Agreement sets the path to enable humanity to combat climate change effectively and boost the transition towards resilient, low-carbon societies and economies around the globe. It enhances the implementation of the Convention on Climate Change and aims at strengthening global response to the threat of climate change in the context of sustainable development and the eradication of poverty by: (a) holding the increase in global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit this temperature increase to 1.5°C, recognizing that this would significantly reduce the risks and impacts of climate change; (b) increasing the ability to adapt to the adverse impacts of climate change and fostering climate resilience and low greenhouse gas emissions development; and (c) making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development. There are to be nationally determined ambitious contributions, in terms of decreasing net emissions every five years, in order to collectively achieve the purpose of the Agreement. Countries will need to report on their progress with regard to their committed reductions of greenhouse gas emissions. The agreement includes provisions on mitigation, adaptation and capacity-building that directly relate to the information and statistics requirements going forward and addresses the capacity-building needs of developing countries, least developed countries and small island developing States.

40. Similarly, Sustainable Development Goal 13 and its targets on climate change will undoubtedly require the production of relevant data and statistics covering the sequence of climate change events so that countries can report on the indicators of this Goal in line with the Paris Agreement.

41. To provide better information about climate change, countries and international organizations need to strengthen the production of environment statistics and promote them to the same status as economic and social statistics.

42. Countries have expressed that, in order to produce more and better statistical evidence about the different aspects of both climate change and sustainable development, they need further statistical capacity-building and training, according to their priorities and circumstances. They have called upon the international statistical community to provide more training and technical assistance opportunities at the national level so that they can more actively involve their institutional partners from various national and sub-national agencies. Countries and agencies also need to regularly invest adequate resources to sustain production of these statistics as part of national statistical systems.

43. The Statistics Division, ECE and partner agencies are committed to providing technical assistance to countries, particularly developing countries, to strengthen their capacities to produce statistics on the environment and climate change. Their expertise and guidelines are available to foster these efforts. However, key statistical programmes, such as environment statistics, in international organizations face resource constraints to adequately respond to the increasing demand from countries and provide technical assistance to them. To achieve a substantial improvement in statistics on the environment and climate change, more donor support is needed to benefit Member States, in particular their national statistical offices and national partners.

VII. Points for discussion

44. The Statistical Commission is invited to:

(a) Express its views on the report and discuss the way forward, in particular on the coordination of the various initiatives;

(b) Urge the international statistical community to expand their capacity-building efforts in climate change statistics;

(c) Strongly encourage national statistical systems to invest in the development of climate change statistics, in particular environment, energy, agriculture and industry statistics, in their respective countries;

(d) Urge the donor community to mobilize additional and substantial resources to enable capacity-building in environment and climate change statistics in developing countries;

(e) Express its views on the work being undertaken by the ECE task force on climate change-related statistics and indicators in particular their efforts to develop a set of climate change-related statistics and indicators, and discuss to what extent that work can serve as a basis for developing a global set of climate change statistics and indicators.