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Measuring hazardous events and disasters

Recommendations on the role of official statistics in measuring hazardous events and disasters

Note by the Task Force on measuring extreme events and disasters

Summary

The document presents an extract of the *Recommendations on the role of official statistics in measuring hazardous events and disaster* prepared by the Task Force on measuring extreme events and disasters. The Recommendations clarify the role of official statistics in providing data related to hazardous events and disasters, and identify practical steps on how national statistical offices, in coordination with national agencies responsible for disaster management, can support disaster management and risk reduction.

The current short version of the Recommendations is prepared for translation purposes. This version does not include, among others, the case studies referred to throughout the text, which can be found in the full version. The full text of the Recommendations has been sent to all members of the Conference of European Statisticians (CES) for electronic consultation. Subject to a positive outcome of the consultation, the CES plenary session will be invited to endorse the Recommendations.

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I. Introduction

A. Objective

1. The main aim of this report is to clarify the role of national statistical offices (NSOs, and, to a lesser extent, their partners from the national statistical system (NSS)) in providing information related to hazardous events and disasters (HED), and to identify practical steps needed for them, in coordination with national agencies responsible for disaster risk management (DRM), to better support the DRM efforts.

B. Policy interest in measuring hazardous events and disasters

2. The increased policy interest in measuring hazardous events and disasters is addressed in three high-level policy frameworks: the Sendai Framework for Disaster Risk Reduction[1], the 2030 Agenda on Sustainable Development[2], and the Paris Agreement on climate change[3]. All three frameworks require statistics and indicators to measure progress towards the achievement of their goals and targets. The international reporting for these policy frameworks is often carried out or coordinated by the NSOs.

3. The Sendai Framework for Disaster Risk Reduction (Sendai Framework) adopted in 2015 aims to achieve substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural, and environmental assets of persons, businesses, communities, and countries over the next 15 years. It aims to drive better governance and understanding of risk, greater investment in resilience, and enhanced preparedness for effective response, recovery, rehabilitation and reconstruction. The Sendai Framework includes seven global targets, aiming at substantial reductions in disaster mortality, numbers of people affected, economic losses, and damage to critical infrastructure.

4. As the overarching goal of the 2030 Agenda on Sustainable Development is eradicating poverty, the 2030 Agenda is also linked with disaster risk management because disasters often disproportionally affect poor people. The 2030 Agenda includes issues of disaster preparedness and risk in its 17 Sustainable Development Goals (SDGs). Several of these goals are relevant in this context, in particular, Goal 1 on ending poverty, Goal 11 on cities and human settlements, and Goal 13 on climate change. The global SDG indicator framework includes a number of HED indicators in common with those found in the Sendai Framework.

5. The Paris Agreement on climate change (Paris Agreement) will also include HED-related information reporting requirements because many hazardous events and disasters are closely linked with this subject. These requirements are currently being discussed and have not yet been identified in detail.

C. Why the national statistical system should be involved in the work related to hazardous events and disasters

6. The national statistical system of a given country can contribute to HED-related work to the benefit of both national disaster risk management efforts and NSS itself. There are a number of reasons why it is important for NSS to be involved.

1. Improving the use and relevance of existing official statistics

7. NSS already provides much of the basic statistics on population, businesses, environment and other topics that are needed in different phases of disaster risk management. The relevance of the official statistics is at risk if the agencies dealing with hazardous events

[1] See https://www.unisdr.org/we/coordinate/sendai-framework (accessed April 10, 2019).
[2] See https://sustainabledevelopment.un.org/sdgs (accessed April 10, 2019).
[3] See https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement (accessed April 10, 2019).

and disasters are looking for alternative information sources, possibly of lower quality, rather than using these statistics.

8. The increased use of existing official statistics for managing disaster risk and climate change also creates an opportunity to make these statistics more visible and accessible to other networks and establish partnerships. This additional incentive to improve accessibility of information (for example, by establishing multi-purpose databases, geo-coding, integrating information from different sources and subject matter areas, and improving timeliness) will benefit the whole statistical system.

2. Reflecting impacts of hazardous events and disasters in official statistics

9. The impacts of disasters on people, economy, and environment should be visible in traditional economic, social, and environment statistics. Involvement of NSS in measuring the impact of HED will help to ensure that statistics on losses related to these events are consistent with other official statistics. It will also improve the quality of official statistics.

10. The 2030 Agenda notes the linkages between disasters, poverty, and economic and environmental sustainability. To ensure complete understanding of these linkages, which have the potential for major societal impacts, NSS should be involved.

3. Meeting information needs related to hazardous events and disasters on a systematic basis

11. Historically, information needs related to disasters were often addressed on an ad hoc basis due to the requirement for immediate response. Policy action is shifting from immediate disaster response to risk management, which includes preparedness and avoidance. Information for this kind of analysis will be needed on a continuous and systematic basis. NSS is well placed to meet such demands because of its involvement in producing high-quality, comparable data, statistics and indicators over long periods.

4. Strengthening the role of NSOs

12. NSOs are often seen solely as providers of statistics. However, they also have other unique strengths and competencies that would be useful in measuring hazardous events and disasters and their impacts. As coordinators of NSS, NSOs have a strong network and experience in coordinating multiple information producers, including ensuring the use of common standards, classifications, and terminology. They have a mandate to provide information based on professional independence, strict quality criteria, use of sound, transparent, and commonly agreed methodologies, and a commitment to accessibility. NSOs also have established procedures for communicating and disseminating information and are well suited to providing a platform for regular dissemination of HED-related information.

5. Hazardous events happen in all countries and are not rare

13. Various types of hazardous events and disasters happen regularly in all countries. The aim is to prevent small-scale instances of extreme temperatures, drought, floods, storms and forest fires, from escalating into disasters. Globally, the cumulative impact of such small-scale disasters is nearly as high as that of larger and rarer disasters that are mostly concentrated in certain geographic regions (see UNISDR, 2013). Therefore, hazardous events and disasters should be seen as a regular part of life, economy, and environment where NSS should be involved, rather than as rarely occurring phenomena whose relevance to NSS is minimal because of their irregular nature.

D. Challenges for the national statistical system in measuring hazardous events and disasters

14. Although NSS has information at its disposal that can be used in disaster risk management, this information is often not sufficiently used. NSOs are often not aware of the related requirements, and disaster risk management agencies (DRMAs) are frequently not aware that this information is available.

15. NSS is involved in producing HED-related statistics in a number of countries, but not in many. In a survey carried out by the Task Force in 2016[4], NSOs and other NSS organisations were responsible for producing HED-related statistics in one third of the responding countries. NSOs had a non-production role in about two thirds of the responding countries; sometimes this was merely publishing statistics produced by others. Three quarters of respondents considered that the role of NSOs in this area should be enhanced.

16. HED-related information needs are complex. Addressing these needs typically involves many different agencies. While some of the needs can be met by NSS, others require very different types of information which cannot be provided by it. Therefore, it is important to clarify the roles of NSO and the other organisations within NSS when HED-related information is provided. Issues such as institutional cooperation, integration of statistical and geographical information, and statistical confidentiality should be addressed.

17. In many countries the role of NSS in disaster risk management is not clear. Use and improvement of official statistics for DRM purposes is often uncertain due to lack of clear mandate, legislation, specific protocols or funding. Internal responsibility for this type of information remains unclear.

18. Official statistics are often not fit for measuring HED-related issues. For example, the time lag may be too long, or the required spatial disaggregation may not be available. Special approaches are needed to provide more timely statistics and to deal with confidentiality issues in cases of emergency. As production of these types of statistics often is of low priority, there is lack of funding to make existing official statistics more suitable for disaster risk management and to develop new statistics in this area.

II. Scope and measurement framework for statistics on hazardous events and disasters

19. The scope of statistics on hazardous events and disasters is defined by user needs, which can be summarised as:

- Operational needs; for example, baseline population data for disaster risk management and emergency response
- Summary and time-series statistics needs; for example, for post-disaster assessment, monitoring of climate change impacts, or international reporting, and
- Integrated sustainable development policy needs; for example, land use planning and infrastructure development.

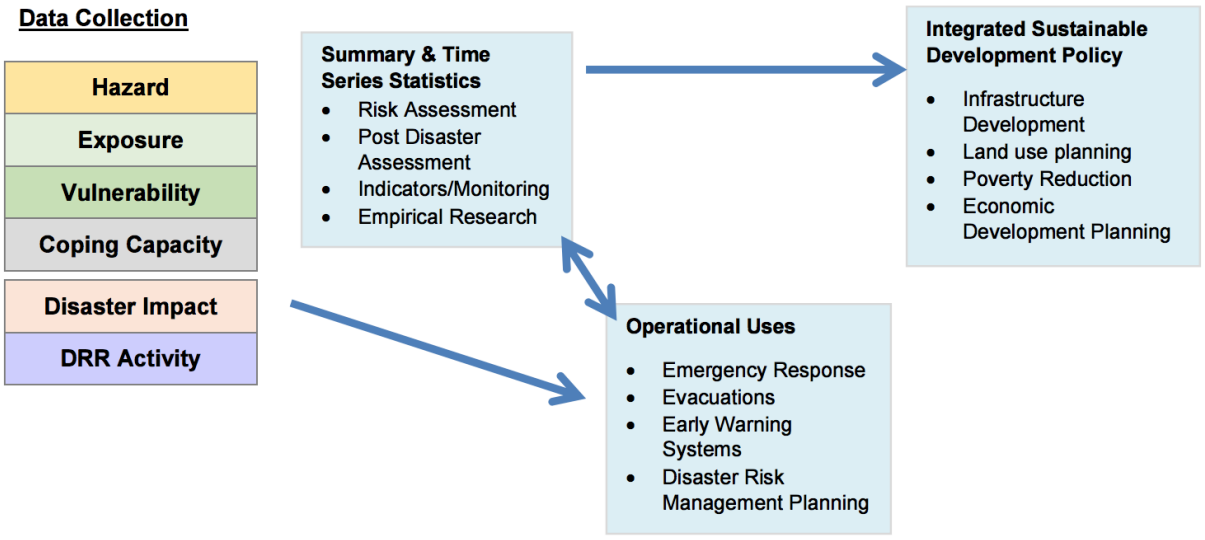
20. The purpose of the information drives the form of measurement, and often the source and provider. Accordingly, the information needs for national DRM differ from those necessary for global reporting. At the national level, the establishment of policies and definition of the needs for HED-related information is often triggered by devastating events. For example the NSOs of Brazil and Italy became engaged in supporting national DRM after devastating events (see case studies in the full version of the document).

21. The Disaster-Related Statistics Framework (DRSF; ESCAP Expert Group, 2018) defines a scope of demands for a basic range of disaster-related statistics and indicators based on these statistics for a) operational purposes; b) summary and time-series statistics, and c) integrated sustainable development policy. The scope of data collection covers hazards, exposure, vulnerability, coping capacity[5], disaster impact, and disaster-risk-related activities.

[4] Forty countries from the UNECE region and beyond responded to the survey. For summary results, see: https://www.unece.org/fileadmin/DAM/stats/documents/ece/ces/2016/mtg/Sess5_extreme_events_UNECE_TF.pdf (accessed April 10, 2019).

[5] Referred to as “resilience” in this report.

Figure 1
Scope of demands for disaster-related statistics



Source: ESCAP Expert Group, 2018.

22. Considering the above, the scope of HED-related statistics includes:

> *Statistics on the occurrence and magnitude of hazardous events and disasters, exposure to hazards, vulnerability, coping capacity, the impact of hazardous events and disasters on human and natural systems as well as on the efforts to reduce disaster risk.*

23. The selection of statistics and indicators on hazardous events and disasters may differ in countries, depending on national priorities and information needs. However, these national statistics should allow aggregation of national information for global reporting and comparison. The case studies from Armenia (see case studies in the full version of the document) demonstrate how national disaster-related indicators may differ in terms of coverage and level of detail.

III. The role of the national statistical system

24. Official statistics can be used to measure hazardous events and disasters in many ways. NSS provides important socio-demographic, economic, and environmental statistics needed in each phase of disaster risk management. Currently the involvement of NSS in this area varies across countries due to differences in national priorities and institutional settings.

A. Traditional roles and responsibilities of national statistical offices

25. Formally, official statistics comprise those statistics produced by government agencies or other public bodies within NSS following the *United Nations Fundamental Principles of Official Statistics* (United Nations, 2014).

26. NSS produces official statistics, as defined in national statistical programmes, based on transparent and documented processes. It adheres to the following criteria:

- Producers of official statistics affirm their capability and willingness to comply with the provisions of the national statistical law and of the *UN Fundamental Principles of Official Statistics* (described further below), and
- The deliveries and activities shall not duplicate those conducted by other producers nor result in an excessive burden on respondents.

27. The adherence to the *UN Fundamental Principles of Official Statistics* (Fundamental Principles) is important as a guarantee of good quality, including impartiality and professionalism (UNECE, 2018b). Official statistics are free from political or commercial influence. The members of NSS who compile the statistics have no vested interests and are bound by a strict professional duty of impartiality. Official statistics, to ensure their international comparability, interoperability, and exchange, must be generated based on open methodologies and produced to internationally recognized standards. They are produced transparently so that users can assess their accuracy and reliability. Official statistics are firmly based on evidence: they are generally based on surveys and/or administrative data sources which are larger in scale than most non-official statistics and are provided according to national need rather than commercial expediency. A global network of experts develops official statistics sharing methods and practices internationally.

28. One fundamental principle that has a specific influence on HED-related work is that related to confidentiality (Principle 5): "Individual data collected by statistical agencies for statistical compilation, whether they refer to natural or legal persons, are to be strictly confidential and used exclusively for statistical purposes." This means that statistical system cannot release any information that would allow identification of an individual (either a physical or legal person). This principle can present a challenge when providing statistics on specific small areas or groups of population (for example, in the context of emergency response). This issue should be explored further to maintain confidentiality while allowing use of available information for saving lives and reducing damage.

29. Ultimately, the potential contributions of NSOs should be reflected in national statistical law, national statistical policy, and annual statistical work programmes. This would secure a mandate for NSS to contribute to disaster risk statistics in coordination with other government agencies and international partners. It would thereby facilitate access to resources necessary to build and sustain statistical capacity in this area, and to initiate agreements and protocols among the different partners.

30. At the global level, the importance of linking statistical and geographical information to respond to policy-driven information demands has been well demonstrated by the work of *United Nations Initiative on Global Geospatial Information Management* (UN-GGIM, 2017) and others. The extent to which geospatial data providers have been integrated within NSS as producers of official statistics varies across countries, however, and this affects access to information for the production of HED risk statistics as discussed further below.

B. Competencies of the national statistical system that can be helpful in the work on hazardous events and disasters

31. The strict adherence of NSS to the Fundamental Principles provides important characteristics to official statistics that can be useful in the work on hazardous events and disasters. As coordinator of the statistical systems, the country's NSO has a particular responsibility to uphold and promote the Fundamental Principles across the statistical system.

32. The Fundamental Principles include professional independence, strict conditions and quality criteria, use of sound, transparent and commonly agreed methodologies and a commitment to data accessibility.

33. NSOs are continuously reviewing and improving the availability and quality of statistics as new methods and data sources emerge in order to maintain the relevance of official statistics. This responsibility applies not only to current statistics, but also to the development of new statistics. Existing work streams can be tapped to ensure that disaster risk management related statistics are optimized for a defined purpose.

34. Perhaps the most essential characteristic of NSOs is their commitment to objectivity in the production and dissemination of official statistics. Professional independence is a strength that benefits all aspects of the production and dissemination of statistics on hazardous events and disasters.

35. Official statistics often also include a link to the geographic region and, in some countries, exact co-ordinates are already attributed to statistics through geo-referencing. The

demand for geo-referenced information is increasing, and this is an essential feature for HED-related statistics.

36. Development of long, consistent time series is a core competency of the statistical system. Official statistics include well developed methods to adjust data, so changes are made comparable over time; for example, changes in prices, and temperature are made comparable by accounting for seasonal variation. When such adjustments are made, the effect of a known source of influence on the variation in the data is eliminated so that only the changes caused by unknown sources of influence and natural variation are left. The availability of coherent time series and clear, well-structured statistical compilations is very important for disaster related statistics in order to identify authentic trends rather than random fluctuations of extreme values.

37. The statistical system also has routines for developing statistics that are internationally comparable. This is done through a global institutional infrastructure to ensure that the definitions, classifications, and data collection are harmonised across countries.

38. Furthermore, a core goal of the statistical system is the production of timely statistics. NSS has developed methods and data collection processes to improve timeliness.

39. Recently, the focus of official statistics on environmental and climate issues has broadened, with many NSOs compiling environmental accounts to measure natural resource assets, energy, waste, water and air emissions, as well as environmental protection expenditures. The *System of Environmental-Economic Accounting Central Framework* (SEEA-CF; United Nations et al., 2014) is a statistical standard valid at the global level. SEEA-CF contains internationally agreed concepts, definitions, classifications, accounting rules, and tables for producing comparable statistics on the environment and its relationship with the economy.

40. At the same time, some long-standing challenges may limit the role of NSOs in measuring hazardous events and disasters. The strong emphasis on quality can reduce timeliness. There is a preference for well-established time series rather than production of specialised data files in a variety of formats fit for different uses; inclusion of administrative borders and geo-referencing, for example. Highly detailed information collection poses risks to confidentiality that are traditionally addressed either by limiting access or systematically reducing precision or accuracy in publicly released information.

41. Most of these weaknesses can be overcome. National statistical laws, programmes, and emergency protocols can be updated to reflect data sharing arrangements that maintain confidentiality protection. Data collection and processing can incorporate new sampling techniques and geo-references to improve timeliness and utility.

C. Potential contributions of the national statistical system at each phase of disaster risk management

42. The potential role of NSS varies at each phase of disaster risk management. This is outlined in more detail in the following sections.

43. While NSS has a lot to offer, not all DRM information requirements could or should be met by official statistics. The role of each institution involved in this process should be clearly identified, including its individual responsibilities regarding information provision. This is especially critical in emergency response to save lives and reduce damage.

1. Risk assessment

44. NSS regularly produces information that can contribute to risk assessment, including baseline data describing the exposed population, its resiliencies, vulnerabilities, and coping capacity.

45. Exposure to hazards is defined as the set and situation of people, infrastructure, housing, production capacities, and other tangible human assets. These can be combined with the specific vulnerability and capacity of the exposed elements to any particular event to

estimate the quantitative risks associated in the area of interest. For this purpose, NSS can provide statistics on:

- Population
- Housing and dwellings
- Infrastructure
- Businesses
- Other assets (for example, cultural and natural heritage).

46. These statistics are also needed as a baseline for evaluating the impact of hazardous events and disasters after the event. It is important to be able to provide the statistics with detailed spatial breakdown, preferably in a geocoded format, for areas that can be prone to natural disasters (for example, river basins, coastal areas and areas near volcanoes) as well as those susceptible to industrial disasters (for example, areas near factories handling hazardous substances).

47. Vulnerability is the condition determined by physical, social, economic, and environmental factors or processes which increases the susceptibility of an individual, a community, assets, or systems to the impacts of hazards. There are two main components of vulnerability: geographical and socio-economic.

48. Examples of statistics related to vulnerabilities include:

- Median household disposable income
- Education enrolment, by age group and level of achievement
- Information on assets of households, such as type of dwelling
- Other human development statistics, such as nutrition and childhood health
- Type of employment, such as engagement in agriculture or fishing
- Urbanisation of affected or exposed areas.

49. In addition to providing information on exposed populations and their vulnerability, NSOs may also be able to provide information on hazards in some cases; for example:

- Location and extent of hazards for geographical analysis
- Frequency and duration of hazards for temporal analysis.

50. In cooperation with other agencies and research, NSOs may also be able to provide information on:

- Scale and intensity of hazards, and
- Probability of occurrence of hazards (European Commission, 2010).

2. Prevention and mitigation

51. Important statistics to be made available by NSOs could include those relating to:

- Scale, location, and other characteristics of investments in disaster risk reduction (technical infrastructure investments, for example)
- Signals of slowly developing risks that are approaching thresholds to a potential disaster (land-use changes in disaster-prone areas, for example)
- Factors that cause or exacerbate disaster risks (environmental degradation, highly vulnerable infrastructure, or extreme poverty, for example).

3. Preparedness

52. As stated in the *Framework for the Development of Environment Statistics* (Subcomponent 6.3: Extreme Event Preparedness and Disaster Management), measures of disaster preparedness vary according to community and location characteristics and the historical profile of hazardous events and disasters. Relevant information may include:

- Existence and description of national disaster plans
- Type and number of shelters in place
- Type and number of internationally certified emergency and recovery management specialists
- Number of volunteers
- Quantity of first aid, emergency supplies, and equipment stockpiles.

4. Disaster impact

53. Examples of statistics on disaster impacts (Below et al., 2009) include those covering:

- Magnitude of events
- Human casualties and injuries
- Number of permanently or temporarily displaced people
- Number of directly and indirectly affected persons
- Number of structures damaged or destroyed
- Cultural heritage damaged or destroyed
- Infrastructure and lifelines
- Ecosystem services
- Crops and agricultural systems
- Disease vectors
- Psychological wellbeing and sense of security
- Financial or economic loss (including insurance loss)
- Coping capacity and need for external assistance.

54. Perhaps the most important challenge is the fact that many disaster impacts are not observed directly. Establishing causality is difficult because other factors can affect outcomes besides the disaster. Some assumptions and very clear measurement rules are required to calculate figures for recovery. United Nations Office for disaster Risk Reduction (UNISDR) has developed practical recommendations for these issues in the form of *Technical Guidance for Monitoring and Reporting on Progress in Achieving the Global Targets of the Sendai Framework for Disaster Risk Reduction 2015 – 2030* (UNISDR, 2018).

5. Response

55. Clear identification of the roles of all institutions involved in HED-related work is especially critical in emergency response to save lives and avoid and reduce loss and damage during a disaster. Emergency protocols are essential for an orderly and effective response. Several countries, such as Armenia, have emergency protocols which, once triggered, have an immediate impact on the concerned institutions and their roles in reducing the disaster impact.

56. The main task for NSOs during a disaster is to quickly provide the required statistics for the affected area. These are the same statistics that were listed under exposure, vulnerabilities, and resilience that cover the area particularly affected by a specific hazardous event or disaster. It is essential that they are geo-coded or available as grid-data (high resolution) and easily accessible in order to be fit for use in disaster response.

57. Basic statistics for different types of hazardous events and disasters should be identified in advance and made available in an “emergency data-kit” when needed. This data-kit could include the most recent information on:

- Population
- Dwellings

- Businesses
- Buildings
- Historical and natural heritage areas
- Critical infrastructure; for example, health and education facilities, roads, highways, power grids, pipelines, water supply
- Potential hazards that could increase disaster impacts; for example, waste storage sites.

6. Recovery

58. Disaster recovery requires the same kind of information as disaster response. Since recovery is also a long-term issue, NSOs may have a role in providing updated information to support recovery efforts by governments and other institutions. This information is also important for international reporting.

59. The United Nations Development Group, the World Bank, and the European Union developed the Post-Disaster Needs Assessment (PDNA) framework[6] to assess the full extent of a disaster's impact, define the needs for recovery, and serve as the basis for designing a recovery strategy and guiding funding. The framework quantifies physical damages and economic losses and identifies socio-economic recovery needs based on information obtained from the affected population.[7]

60. NSOs can provide information on the assessment of disaster impacts that can serve as an input to PDNAs. In addition, NSOs can provide information on demographic, social, cultural, economic, and environmental issues relevant to restoration and rehabilitation processes. This information will aid the post-disaster calculation of vulnerability to future incidents, in turn benefiting updated preparedness and mitigation strategies.

7. International reporting

61. Concerning the SDG indicators, CES recommends that the provision of indicators for the global SDG list in countries should be coordinated by NSO. Although the data and statistics required for these indicators are often provided by many different agencies in the country, NSO should coordinate, or at least be aware which agencies are providing them, and should be copied on correspondence in the process.

D. Recommended roles and tasks for national statistical office in disaster risk management information

62. The previous section listed information needs for each stage of DRM and for international reporting. This information can be provided by different governmental and non-governmental entities, using different sources and measurement tools, and produced at different geographic levels. The nature of information and the scale of measurement vary substantially.

63. NSOs are well suited to provide some of the relevant data, statistics and indicators. Others are produced elsewhere within NSS, and by agencies outside it. NSOs must also cooperate with international organizations for regional and global reporting. Therefore, NSOs should coordinate their work with many institutions to ensure efficient and effective disaster risk management and reporting at national and international levels.

64. The particular tasks of an NSO in this process depend upon the national institutional and policy context. Based on current NSO practices and their typical strengths, core tasks can be identified that each NSO could undertake. These are explained in the section 1 on core

[6] See https://www.undp.org/content/undp/en/home/librarypage/crisis-prevention-and-recovery/pdna.html (accessed April 10, 2019).
[7] See http://www.worldbank.org/en/events/2017/06/12/post-disaster-needs-assessment-for-resilient-recovery (accessed April 10, 2019).

role and tasks below. In many countries, NSOs are already implementing these tasks (see Philippines case study in the full version of the document). In addition, in a number of countries NSOs are carrying out additional functions which may not be in the core mandate of NSS. These are explained in section 2 on additional roles and tasks below and illustrated by case studies.

1. Core roles and tasks

65. According to the Task Force's 2016 survey, the most common contribution of NSS to DRM is the provision of the baseline data needed to produce statistics on exposure and impact. NSS is uniquely positioned to provide these data, as they are regularly produced through traditional censuses, surveys, and administrative registers.

66. In addition, NSS can support DRM with its competence and expertise in producing and communicating information. The disaster response emergency data-kit described above (section 5 of chapter III C) is just one example. As lead agencies in NSSs, NSOs have strong networks for coordinating the multiple information producers and flows needed for monitoring progress of the Sendai Framework, SDGs, and the Paris Agreement.

2. Additional roles and tasks

67. The NSO role in DRM could expand beyond the core functions currently carried out. NSOs could assist with the assessment of direct and indirect social, environmental, and economic impacts of hazardous events and disasters. This could include leading work on assessing disaster risk impacts, supporting preventative risk assessments, maintaining the national disaster database, and managing collective information sharing tools. NSOs could also lead coordination of data flows with geographical information services and international databases.

68. For example, INEGI in Mexico manages a Collaborative Site for Disaster Attention (see case study in the full version of the document). This site allows different government agencies involved in disaster management to provide statistical and geographic information through the full cycle of emergency response to ensure informed decision making in each phase.

69. In Brazil, the Institute of Geography and Statistics (IBGE) has developed a methodology to integrate population census information and maps of disaster risk areas (see case study in the full version of the document). These are the areas susceptible to adverse weather and hydrometeorological conditions that can trigger hazardous events such as floods and landslides. These hazards, in turn, generate risk of disasters with significant impacts on society and the environment. IBGE and the National Center for Natural Disaster Monitoring and Alerts (CEMADEN) have constructed a tool for identifying and characterizing population in risk areas.

70. In Italy, NSO is contributing to the initiative *Casa Italia* for maintaining a national risk map of Italian municipalities (see case study in the full version of the document).

IV. Key infrastructure

A. Legislation

71. Following the model of the *Guidance on Modernizing Statistical Legislation* (UNECE, 2018a), the production of statistics on hazardous events and disasters should become part of the multi-year statistical programmes and the annual statistical programmes of NSS. A review of the existing programmes may be necessary to obtain the mandate for the production of these kinds of statistics and to clarify roles and responsibilities within NSS.

B. Statistical confidentiality

72. Disaster risk management typically requires DRMAs to access small-scale statistics, particularly population and economic data. There are several methods to make the necessary data available for public and other uses outside NSS. For example, Statistics Canada provides "public-use microdata files" containing microdata that have been modified to ensure that no individual can be identified in them. Statistics Canada also offers real-time remote access, where users do not view the data but get access to a full range of descriptive statistics, and the operation of research data centres (Dosman and Stobert, no date). In absence of existing mechanisms to give users direct access to anonymised microdata, the analytical departments of NSOs could prepare the required aggregates upon request or following a protocol or agreement with DRMAs that respects rules of confidentiality.

73. Regulations should guarantee the institutional framework and clarify the role of NSOs in the case of emergencies, also considering legal, technical and other barriers for information exchange. For example, the role of NSO of Armenia is clearly defined in the case of an emergency (see case study in the full version of the document).

C. Frameworks, standards, and classifications

1. Framework for the Development of Environment Statistics

74. Framework for the Development of Environment Statistics (FDES) organizes environment statistics in a simple and flexible manner into components, sub-components, statistical topics, and individual statistics, using a multilevel approach. The six components are 1) Environmental conditions and quality; 2) Environmental resources and their use; 3) Residuals; 4) Extreme events and disasters; 5) Human settlements and environmental health; and 6) Environment protection, management and engagement.

75. Component 4 on extreme events and disasters, organizes statistics on the occurrence of hazardous (extreme) events and disasters and their impacts on human well-being and the infrastructure of the human subsystem. It distinguishes between *natural extreme events and disasters* (subcomponent 4.1) and *technological disasters* (subcomponent 4.2). Statistics and related information include, for example, the type of extreme event and disaster, location, magnitude, number of people affected, and economic and physical losses.

76. Captured under component 6, environment protection, management and engagement, sub-component 6.3 on extreme event preparedness and disaster management organises statistics on the preparedness and disaster management of a country. These will differ based on the type of extreme event and disaster that usually occurs or may occur. Disaster management expenditure should also be captured under this sub-component.

2. The Disaster-Related Statistics Framework (DRSF)

77. DRSF is a guideline for statistics which includes descriptions for a basic range of disaster-related statistics and methodological guidance and tools for their implementation. It was developed by an Expert Group of the ESCAP region and adopted by ESCAP in May 2018 (ESCAP Expert Group, 2018).

78. DRSF tools include a collection of tables (templates) that provides a visualization of how the current collections of basic data could be compiled into structured tables for presentation of statistics in response to the specific needs in analysis.

3. Report of the open-ended intergovernmental expert working group (OIEWG) on indicators and terminology relating to disaster risk reduction

79. The report of the OIEWG (UNISDR, 2017) outlines the indicators for the seven targets of the Sendai Framework and terminology relating to disaster risk reduction. Furthermore, this report defines important key terms used in disaster risk management and recommends classifications such as the ISIC (International Standard Industrial Classification of All Economic Activities) or the Integrated Research on Disaster Risk (IRDR) peril classification of hazards for the compilation of Sendai Framework indicators.

4. Technical guidance for monitoring and reporting on progress in achieving the global targets of the Sendai Framework for Disaster Risk Reduction

80. This document (UNISDR, 2018) supports the refinement and finalization of technical guidance for countries reporting on the indicators to monitor achievement of the 7 targets of the Sendai Framework.

5. Classifications

81. The most important statistical classifications mentioned in this context are the following:

- International Standard Industrial Classification of All Economic Activities (ISIC rev. 4)
- International Classification of Diseases (ICD-10)
- Other statistical classifications as needed for the assessment of impacts on agriculture, or environmental assets, which can all be found in the International Family of Classifications.[8]

82. No statistical classification exists for categorizing hazards. It is recommended to use the list of hazards in Annex I of the *Technical Guidance for Monitoring and Reporting on Progress in Achieving the Global Targets of the Sendai Framework for Disaster Risk Reduction* (UNISDR, 2017). This classification has been derived from the IRDR Peril Classification and expanded by technological disasters.

D. Organisational structures

83. The relatively few NSOs that are directly involved in the compilation of HED-related statistics do not have a specific organizational unit that has been assigned the related tasks. Instead, the work is spread over different units and coordinated by a focal point within NSO.

84. For example, in Brazil the IBGE's (Brazilian Institute of Geography and Statistics) Department of Geography is involved in the work on identifying and characterizing population at risk in Brazil. The Department of Population and Social Indicators also included in the Municipal Basic Information Survey (MUNIC) questions about disaster risk management in 2013 and 2017 (see case study in the full version of the document).

E. Statistical methods

85. A review of metadata is required so that it can be used to address DRM information needs. This will require the formulation and testing of new methodologies for statistical indicators of disaster risk. An accompanying set of statistical standards will also be required in order to promote interoperability and transparency of DRM information.

86. Geo-referencing is essential for HED-related statistics, particularly at significant disaggregation levels. Although NSOs are already experienced in preparing maps and datasets for various information needs on sub-national phenomena, the lack of spatial disaggregation for areas which are not part of the standard data collection and dissemination products is a current limitation to further contribution to disaster risk statistics.

87. Improving existing data is essential for HED-related statistics, and in particular with regard to the following points.

- Disaggregation should be increased. Details such as location, gender, age, disability, hazard type, and event, are necessary to monitor the Sendai Framework targets.
- Data standardization and data quality should be improved. Standardised and comparable methodology has to be implemented to produce DRM statistics.

[8] See https://unstats.un.org/unsd/classifications/Family (accessed April 10, 2019).

- Existing data collection systems should be reviewed and improved. Simple adjustments to data collections, increasing survey coverage to compile small-area statistics could yield significant benefits.
- Linkages between socio-economic and environmental data should be improved, as should the availability of geo-coded data.
- Financial resources, technology transfer, and capacity building should be increased. These are crucial to filling identified gaps.

88. Expanding the scope of data and statistics has to be considered; in particular, those on:

- Hazards and disasters (frequency, duration, intensity, impact and other dimensions)
- Exposure and vulnerability of critical infrastructure
- Resilience, risks and vulnerability of population groups, and the population at risk from disasters
- Social and economic impacts of HED
- Non-standard geographical areas (such as, coastal areas, flood- and drought-prone areas, slums, and settlements on steep slopes).

89. The following briefly discusses how different statistical tools can be combined and further developed to improve existing data and statistics to fill HED-related information gaps.

1. Census

90. Limitation of census data use in HED-related statistics may be caused by the lack of geocoding, the time lag between data collection and availability, as well as long intervals between data collection periods (commonly 10 years in the case of population census).

91. It is essential that the geographic characteristics of the data are available in order to improve the suitability of census data for small-scale analysis. For example, the *CES Recommendations for the 2020 Censuses of Population and Housing* (UNECE, 2015) recommend to geo-reference the place of usual residence with a pair of precise geographical coordinates of the address point, or in the absence of such coordinates, to a precise and complete postal address.

2. Surveys

92. Very specific surveys are post-disaster surveys (or “first field surveys”) which are carried out right after or shortly before the state of emergency has been finished. Post-disaster surveys help to assess disaster damage and loss in detail. They may also have a major influence on future response activities and on the timing and effectiveness of the early stages of recovery. Their success depends on adequate planning and preparation both before and after the disaster occurs.

3. Statistical registers

93. Statistical registers, and in particular, registers for land use, population, businesses, and agriculture, are important potential sources for HED-related statistics. These registers are a particularly important source for baseline information for risk assessment and for emergency response.

4. Administrative data

94. In addition to traditional administrative sources for official statistics (ministries of finance, agriculture, energy and environment, among others) new administrative data sources need to be explored for producing HED-related statistics. These include:

- Disaster risk management agencies
- National hydrometeorological institutes
- National geological surveys

- Insurance companies.

5. Big data options

95. Although these data sources may provide a large potential for improving the quality of official statistics, including HED-related statistics, the manner in which they can complement official statistics still needs to be further explored. The challenges, advantages, and disadvantages were discussed by the UNECE High-Level Group for the Modernisation of Official Statistics.[9]

96. A specific example of big data is geospatial data originating from earth observations. Such information has been widely recognized as an important aspect of disaster risk management. There is growing experience with the integration of geospatial information with traditional statistics. This requires close cooperation between NSOs and national mapping, environment, cadastral, territorial, and urban planning authorities.

97. For example, in Brazil and Mexico (see case studies in the full version of the document), geospatial and statistical activities are closely integrated and supervised by a single organization, the National Geospatial and Statistics Office. Likewise, NSOs of Canada, Colombia, Italy, Netherlands, New Zealand, Norway, and Singapore have a range of internal geospatial capabilities and good collaboration with their national geospatial communities. In the European Union, NSOs provide geospatial data support for the INSPIRE programme (Infrastructure for Spatial Information in the European Community).

6. Other statistical methods and requirements

98. Collaborative sites (such as in Mexico, see case study in the full version of the document) can also promote integration, interoperability, and accessibility of DRM-related statistics. This can include databases of registered disaster damages.

99. Development of HED-related statistics will require enhancements in the capacity and inter-functionality of the IT systems used by NSOs; for example, to allow the linking of different types of data from different sources.

100. Information dissemination via different means (for example, electronic dissemination in form of downloadable interactive tables, reports, maps and graphs, and more traditional printed yearbooks and compendia) will not only address different user needs but also provide information backup in case of emergency.

101. For data security, data backups at different locations are recommended in case the NSO headquarter is also affected by the disaster. This happened, for example, during the earthquake on 14 February 2016 in Christchurch, New Zealand and in the earthquake on 19 September 1985 in Mexico City. In case of Mexico, the NSO (INEGI) headquarters were moved to Aguascalientes, a less disaster-prone location.

F. Quality assurance and guidelines

102. As for all types of statistics, the application of a quality assurance framework is recommended; for example, the *National Quality Assurance Framework*[10], the *European Statistical System Quality Assurance Framework*[11], and the *Eurostat Handbook on Data Quality Assessment Methods and Tools* (Ehling and Körner, 2007).

[9] See http://www.unece.org/stats/mos.html (accessed April 10, 2019)
[10] See https://unstats.un.org/unsd/dnss/qualitynqaf/nqaf.aspx (accessed April 10, 2019)
[11] See https://ec.europa.eu/eurostat/documents/64157/4392716/ESS-QAF-V1-2final.pdf/bbf5970c-1adf-46c8-afc3-58ce177a0646 and https://ec.europa.eu/eurostat/web/quality/overview (accessed April 10, 2019).

G. Knowledge and capacity

103. HED-related knowledge and capacity is spread around numerous agencies, ministries, and research institutes, many of which produce and use statistics outside the statistical system (for example, through meteorological and atmospheric monitoring networks). It could be necessary for NSOs to work together with these institutions to ensure standardisation and good quality.

104. The statistical system often does not put much emphasis on cross-cutting data and measuring interactions between subject areas. New expertise will be required in several areas (for example, small-scale analysis, geospatial information integration, and disaster economic impact monitoring) to develop and incorporate new statistics to support disaster risk management.

V. Recommendations

A. Introduction

105. There is a growing demand for HED-related statistics to respond to international policy frameworks and for all stages of DRM (risk assessment, prevention and mitigation, preparedness, response and recovery). This chapter introduces the Task Force's recommendations for measuring hazardous events and disasters. Though targeted primarily at NSOs, the recommendations are also relevant to other users and producers of HED-related statistics, both inside and outside the statistical system.

B. Recommendation 1: National statistical offices should clarify the main purposes of engaging in the domain of measuring hazardous events and disasters

106. National disaster risk management, often also including climate change adaptation, is a responsibility of DRMAs, line ministries, and other specialized agencies. Monitoring of extreme climate, weather, and hydrological events is performed by hydrometeorological services. NSOs have important contributions to make by providing consistent official statistics at different phases of DRM. National DRMAs, policy makers, researchers and civil society are the users of this information.

107. Potential users are often not aware of the official statistics available to them. There is lack of statistical literacy on the use of official statistics for DRM and climate change policies.

108. Therefore, it is important to identify the national HED-related information needs by engaging with the user community. This will also help clarify the roles of NSOs in providing HED-related information and increase potential users' knowledge of the official statistics available for their purposes.

C. Recommendation 2: National statistical offices should reach out to national agencies responsible for national disaster risk management

109. NSOs should be proactive in reaching out to national agencies responsible for national disaster risk management.

D. Recommendation 3: National statistical offices should review key information needs related to hazardous events and disasters

110. It is important to make optimal use of existing statistics to meet new information demands.

E. Recommendation 4: National statistical offices should improve data and statistics related to hazardous events and disasters

111. NSOs must improve HED-related data and statistics in collaboration with DRMAs.

112. NSOs should draft, together with DRMAs, a prioritized list of national information gaps and prepare a road map on HED-related data and statistics.

F. Recommendation 5: National statistical offices should consider development of new information related to hazardous events and disasters based on a review of the key needs

113. When considering the production of new data and statistics, it is important to recall the key competencies of NSOs and consider the traditional boundaries of their work. For example, NSOs do not usually compile forecasts or make judgements about cause-effect relationships.

G. Recommendation 6: Review statistical infrastructure from the viewpoint of meeting the information needs related to hazardous events and disasters

114. NSOs are recommended to:

- Review existing statistical infrastructure to see how the needs of DRM and related international reporting are being met
- Identify what new capacity, knowledge, skills and partnerships are required
- Consider how current institutional structures support production of HED-related information
- Review existing classification systems, registers, definitions, statistical frameworks, products and services for their coherence with the DRSF and the Sendai Framework
- Gradually develop new partnerships, expertise and capabilities, and
- Identify a focal point and clarify responsibilities within NSO.

H. Recommendation 7: The international statistical community should take an active role in contributing to the global system on measuring hazardous events and disasters

115. Beside the work on SDG indicators, there is demand from the global expert community working on HED-related issues for official statistics. This has been recently addressed by UNFCCC, UNISDR and World Meteorological Organization (WMO). Furthermore, these international organisations have agreed upon certain concepts (including classifications and terminology) in international processes that must be considered in developing the related information. The international statistical community and NSOs are recommended to:

- Seek closer collaboration between the statistical community and international organisations working on these issues
- Actively engage, at the national level, with representatives delegated to report progress on the implementation of the Sendai Framework to assist in information-related issues, comment on methodologies and assist in review processes
- Exchange experience on the contributions of NSOs to improving HED-related information; for example, at expert meetings and through other communication channels.

VI. Implementation

116. This chapter describes practical, incremental approaches NSOs can take. The specific steps outlined are intended to assist NSOs in the production of HED-related information, whether just beginning or already well engaged.

117. Some of the steps described may be pursued concurrently rather than sequentially. The steps might also be taken up in a slightly different order depending on national context and opportunities. However, two key features should be reflected in any HED-related information road map. First, the process should be viewed as incremental, to be undertaken step-by-step, with short-, medium-, and long-term objectives identified. Second, the process should be viewed as iterative, repeating similar evaluation steps with increasing detail as information is gathered and plans are formed.

A. Identify a focal point

118. To strengthen the production HED-related information, senior management should assign responsibility to a focal-point unit within NSO. The first task for this focal point is to identify the main objectives for developing HED-related information given the particular national context, risk management, and international reporting needs. This task involves improvement of knowledge and awareness of the scope of information needed for national DMR purposes and international monitoring by reviewing relevant frameworks.

B. Engage with stakeholders to clarify information needs

119. To assess the adequacy of coverage, quality, timeliness, and accessibility of existing national HED-related data and statistics, the designated focal point should engage with national stakeholders. All producers and users of official statistics and, specifically, representatives of the organizations involved should be consulted. Here, it is especially important to consult with information producers associated with the top disaster risks given the national context.

C. Define the scope of information needs related to hazardous events and disasters relevant to the national context

120. This network can assist in developing a preliminary description of the scope of information needed. Such a review requires detailed identification of the (main) hazard risks faced given the national context. These risks will vary within and across each country because the geography and topography, demographic and population dynamics will differ. Land use and expansion, effects of climate change, and availability of resources will also differ. All these factors, alone and in combination, can influence the type and intensity of risk by affecting the likelihood of a hazardous event, exposure, and vulnerability.

D. Assess available information

121. The initial assessment of available information should:

- Identify the information available, given the preliminary scope defined by the focal point and network
- Reflect consultation with possible information sources in local and national ministries, universities, nongovernmental organizations, international organizations, and neighbouring countries, as relevant
- Be organised into an initial set of available information, along with metadata and data provider contact information; and
- Generate a list of gaps in the availability, quality, transparency and accessibility of data and metadata.

E. Prioritise data gaps

122. When prioritizing among information gaps to be addressed, those most critical to reducing direct risk to the population should be given priority. Vulnerability of populations and timeliness of data and statistics must be considered. Information for national DRM must be timelier than that for international monitoring and reporting purposes. Among the information needed for DRM, that required for an emergency data-kit to assist first responders in the immediate aftermath of a disaster should be prepared in advance so that it is immediately available. A strong understanding of the DRM cycle assists with assessing the timeliness needs for particular data and statistics.

F. Prepare a development plan

123. Once information needs are prioritized, taking account of the use of the information, timeliness requirements, and potential costs, a statistical development plan for HED-related information should be prepared. The plan should address improvements needed for both existing information and that yet to be developed. This plan should formulate short-, medium- and long-term actions.

G. Assign tasks for the national statistical office

124. When assigning tasks for the NSO:

- The current role of NSO and other agencies engaged in DRM should be assessed
- Roles should be assigned to all partners and affirmed by senior management, considering traditional strengths of NSOs, the national context, and institutional framework, and
- Specific tasks and work plans should be defined.

H. Manage and disseminate compiled information

125. HED-related information should be managed in a multi-purpose system comprising microdata, metadata, statistics and indicators in a national database. All relevant information flows from producers should contribute to this system. Although information needs include both that required for national DRM purposes, and for international monitoring and reporting, both can, and should, be efficiently managed within a common system. The frameworks guiding both national management and international monitoring and reporting, and therefore, the types of information needed for both purposes, overlap in many places.

126. Recommended steps:

- Define a plan for dissemination of HED-related information
- Promptly disseminate available information
- Improve accessibility and interpretability of information
- Identify the level of detail needed for different users
- Construct a multipurpose information system serving all needs
- Implement different tools; for example, databases, indicators, risk maps, and geospatial data.

I. Unresolved issues and next steps

127. The Task Force suggests development of guidance on the implementation of these initial recommendations be prepared for countries wishing to move forward in this area. To this end, it is suggested that a new task force comprising 6-8 countries and international

organizations be established to provide guidance on core activities and the road map to be developed.

128. Another goal of any new task force should be to define a set of core HED-related indicators and statistics (including links with climate change adaptation), starting from areas of traditional strengths, such as social and economic data and statistics. Several countries are developing indicator sets for HED policy purposes. This work should be internationally coordinated to ensure availability of comparable statistics and to maximise use official statistics.

129. The Task Force suggests creation of a platform for regular exchange of knowledge and experience on HED-related information similar to the UNECE Expert Forum for Producers and Users of Climate Change Related Statistics.[12]

130. The Task Force also identified a set of unresolved issues should be addressed to further improve HED-related information. Specifically, how to:

- Ensure coherence among WMO and UNISDR frameworks to be used in the definition and production of HED-related information
- Update statistical standards, methods and classifications to better support HED-information
- Identify the information that should be prepared in peace period as an emergency data-kit that will be really useful to the DRM community
- Identify the information that should be prepared to avoid and/or to manage the consequences of HED
- Identify and address the obstacles to linking statistics across domains while preserving respondent confidentiality
- Gradually develop new partnerships, expertise, competence, knowledge, skills and abilities for producing HED-related information.

[12] See http://www.unece.org/statistics/meetings-and-events.html?id=3214#/0/0/0/41189/.