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The Use of Population Census Data for Environmental and Climate Change Analysis

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Introduction

Despite their potential uses for environmental studies and climate change analysis, censuses have not been sufficiently exploited as key data sources. This neglect was particularly obvious at recent specialized conferences (such as the Conference on Climate-Change and Official Statistics held in Oslo, Norway, in April 2008 and the International Conference on Climate Change, Development and Official Statistics in the Asia-Pacific Region, held in Seoul, Korea, in December 2008), where population censuses were rarely mentioned.[2] In one of the most important frameworks for climate-change adaptation in least-developed countries, the National Adaptation Programmes of Action (NAPAs), census data are rarely used. When they are used, it is primarily to report the most basic population statistics without further analysis of impacts across categories of sex, age or specific vulnerabilities.

However, the information required to investigate and analyse the linkages between environmental changes and the socio-economic and demographic conditions of the population have increased significantly in recent years; the increased availability of census data at a smaller scale can thus make a significant contribution. Censuses collect information on all households, which allows for the production of statistics for small areas that can then be analysed for specific objectives using tailored methodologies. The limit for the level of detail depends on the protection of the confidentiality of census data.

The 2010 Census round could become one of the most important sources of data for environmental analysis[3] and, in particular, will provide additional information that can aid in the calculation of emissions and in the identification of those populations vulnerable to the environmental disasters caused by climate change, thus providing an evidence base for both mitigation and adaptation policies. Three main challenges need to be addressed: 1) what needs to be done to ensure that relevant questions are included in the censuses and that those that are usually included are adequate to meet current needs; 2) what needs to be done to ensure that census data are collected and processed to facilitate detailed analysis of very small areas (preferably environmentally homogeneous areas); and 3) what needs to be done to ensure

that census data are made available, disseminated, analysed and used for national mitigation and adaptation policies.

This chapter will present an overview of the potential uses of census data, provide examples of the use of census data in particular countries and highlight the potential of such data to provide evidence in still unexplored areas. It aims to call attention to the need to act now in order to better position environmental statistics in censuses, through the inclusion of questions and the development of methods for processing and analysing geo-referencing population data.

The 2010 Round of Censuses

Most of the countries of the world expect to conduct their censuses around 2010. In addition to providing data on the characteristics of households and dwellings, population and housing censuses will provide information on the size, composition and characteristics of the population, as well as on many other areas, such as the spatial distribution of population, occupation, education, sex, household composition and environment, among others. The 2010 Census round will also be the main source for updates of current population estimates and projections.

The potential of population and housing censuses is indisputable. However, their use will largely be affected by the availability of the data, the degree of their dissemination, the extent of the analysis based on the information collected, the quality of the data and, most important, the relevance that is given to the census data as key inputs for policy design.

In the particular case of environmental analysis, in addition to the areas mentioned above, use of the data will depend on the availability of geo-referenced maps as well as on having census enumeration areas that are small enough to allow for linking population data to environmental-geographic data. It will also depend on the types of questions included and the categories of responses related to environmental issues. For example, to date, gender analysis of climate change issues has been notably lacking.

Limitations exist, inter alia, because censuses are conducted, in the best case, every ten years, so the data become outdated the longer the time from the date of the most recent census. In addition, the potential use of information derived from the inclusion of specific questions related to the environment can be limited due to the characteristics of the census questionnaire which only allow for the inclusion of a selected number of questions and easily identifiable categories.

The following section provides an analysis of some common questions that are included in censuses and that can be used for environment and climate-change studies (see Tables 12.1 and 12.2).

The Use of Census Data based on the Specific Questions Included

Most of the information obtained in a census can be useful for climate-change analysis. Data on the characteristics of the population (sex, age, household

composition, etc.) can be used to determine the pattern and level of emissions (see Dalton et al., 2008) and the conditions and assets of a population that can be beneficial for adaptation to climate change. However, there are specific questions that can be included in the household questionnaire which can provide specific details about the anthropogenic impact on climate change. The most commonly used are listed below, mainly because they are considered to be the basic questions in the Principles and Recommendations of the United Nations for Population and Housing Censuses (United Nations, 2008). In some cases, other questions are included based on the specific needs of a country. In the case of Latin America, for example, there has been an increase in the number of countries including these questions (see Table 12.1).

Table 12.1: Number of Countries that included Selected Questions Related to Environment in Latin America, Census Rounds 1980, 1990 and 2000

Question	Number of countries by census round		
	1980	1990	2000
Energy used for cooking	10	10	13
Access to electricity	11	11	13
Waste Disposal	1	6	10

Source: CELADE.

Questions included:

1. Source of energy for cooking and lighting

Target 9 (Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources) of Goal 7 of the Millennium Development Goals (MDGs) (Ensure environmental sustainability) has, as one of its indicators, the proportion of the population using solid fuels. This indicator is important because it provides a link between household solid fuel use, indoor air pollution, deforestation, soil erosion and greenhouse gas emissions (United Nations, 2008). Therefore, this information is very relevant from the point of view of the mitigation of climate change.

Access to electricity is also a relevant indicator for environmental analysis. The need to increase accessibility to and affordability of energy services for the poorest populations in developing countries is considered essential in strategies to alleviate poverty and to contribute to social and economic development (IAEA, 2005).

The environmental impact of sources of energy for cooking and lighting are best demonstrated when combined with information on other factors such as densities, occupational distribution, land-use and tenure patterns and the level of urbanization. The level of pressure on resources can then best be brought into focus.

Table 12.2: Selected indicators of Sustainable Development that can be Obtained Using Census Data and/or a Combination of Census Data and Other Sources

Issue covered	Indicator	Census data that can be used to calculate this indicator	Relevance (extracted from the source document)
Sanitation	% of population using an improved sanitation facility	Type of sanitation facilities	Assess sustainable development, especially human health. Accessibility to adequate excreta disposal facilities is fundamental to decreasing the faecal risk and the frequency of associated diseases.
Drinking water	% of population using an improved water source	Access to drinking water	Access to improved water sources is of fundamental significance to lowering the faecal risk and frequency of associated diseases.
Access to energy	Share of households without electricity or other modern energy services. Additional: % of population using solid fuels for cooking	Type of energy for cooking and lighting	Lack of access to modern energy services contributes to poverty and deprivation and limits economic development. Adequate, affordable and reliable energy services are necessary to guarantee sustainable economic and human development. The use of solid fuels in households is a proxy for indoor air pollution, which is associated with increased mortality from pneumonia and other acute lower respiratory diseases among children, as well as to increased mortality from chronic obstructive pulmonary disease and lung cancer (where coal is used) among adults.
Living conditions	% of urban population living in slums	Data on population and type of materials used for roofs, walls and ceilings combined with other sources	This indicator measures the proportion of urban-dwellers living in inadequate housing conditions. It is a key indicator for measuring the adequacy of dwellings for the basic human need for shelter. An increase in this indicator is a sign of deteriorating living conditions in urban areas.
Vulnerability to natural hazards	% of population living in hazard-prone areas	Data on population combined with other sources, such as elevation maps, etc.	Measures the level of vulnerability in a given country, thus encouraging long-term, sustainable risk reduction programmes to prevent disasters, which are a major threat to national development.
Coastal zone	% of total population living in coastal areas	Data on population combined with other sources, such as elevation maps, etc.	Quantifies an important driver of coastal ecosystem pressure, and it also quantifies an important component of vulnerability to sea level rise and other coastal hazards.

Source: Based on: United Nations, 2007.

2. Waste disposal

The amount of waste generated, its composition and mode of disposal are important variables that are relevant for environmental analysis. Censuses usually only collect information on the method of waste disposal. Where household waste (solid or liquid) is dumped into streets, drains or streams, or burned (therefore creating emissions of carbon dioxide), especially in high density areas, the environmental consequences will be greater than in areas where such waste is either composted or collected through an organized sewerage system. But a collection system is not enough: It must be joined by a 'cleaning' or management system. If it is not, other areas (where the waste is disposed without treatment) will be affected.

This is, therefore, an important component of (local) environmental policies aimed at reducing toxicity and the volume of waste generated by the population at large, as well as increasing the coverage of households with waste collection and helping in the design of appropriate management of waste disposal.[4] The data are reported by municipal authorities, thus the results refer primarily to urban areas and waste collected by municipal trucks. While these components were included in Questionnaire 2008 on Environmental Activities by the United Nations Statistics Division (UNSD) and the United Nations Environment Programme (UNEP), the use of census data for this purpose is not mentioned. However, cross-referencing this information with census data would allow for a better measurement of the population covered by waste collection services.

3. Access to water and sanitation

Two indicators for monitoring progress of Target 10 of MDG Goal 7 (Halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation) merit consideration. While indicator 30 refers to the proportion of the urban and rural populations with sustainable access to an improved water source, indicator 31 asks for an increase in the proportion of the urban and rural populations with access to improved sanitation (United Nations, 2008).

A comparison of average household sizes and the average quantity of water used per person per day with the availablity of water from the sources stated in the census can provide a basis to determine the sustainability of their use over time as the population continues to grow. Population and household projections could be used to demonstrate the imminence of an environmental crisis caused by the increasing need for water for drinking and sanitation. This is a key issue for adaptation to climate change.

4. Other relevant questions at the household level

Some countries may incorporate other questions that can help in identifying vulnerable groups and in the preparation of plans for adaptation to climate change. These may include questions on the type of energy used for heating, the availability of piped gas, the type of dwelling, the year of construction, the materials used in the walls, floors and roof, the availability of cars, trucks and other means of transportation for the household, the accessibility of IT, property tenure, location of toilet facilities, etc.

The use of the results from these questions for environmental and climate-change analysis

Despite the relevance of these questions, they are still used rather infrequently for the purpose of environmental studies.[5] One of the main uses seems to be for calculating the indicators for sustainable development that have been defined by the United Nations Division for Sustainable Development.[6] However, as can be seen in Table 12.2, those indicators are mainly utilized in identifying vulnerabilities and not necessarily for measuring emissions or, at the least, for characterizing subpopulations by their patterns of emissions.

In order to produce a change in this regard, there is a need for more analysis on the limitations as well as on the potential of census data for environmental and climate-change analysis. One of the reasons for the non-utilization of these data is that the number and types of questions included and the possible options for responses are limited. For example, the question on energy used for cooking does not cover how much energy is consumed or consider why there are variations in use between different population groups living in similar environmental settings. In addition, when electricity is used, households do not know how this electricity has been produced (hydro, nuclear, fuel combustion, etc.).

For these reasons, administrative records and household surveys seem to be more useful. Until now, surveys have been the most used source for this kind of analysis. However, censuses do have some main advantages: They cover the total population, including those living in households or collective residences, and they provide information on the whole country and allow for estimations for very small areas. This last characteristic permits a detailed analysis at the local level, which is impossible to do with household surveys. Thus, there is a need for triangulation of information from different sources: censuses, household surveys and administrative statistics. The combination of censuses and surveys is probably the better way to extract the best of both sources (coverage from censuses and better quality and details from surveys).

Finally, these data have also been used for measuring poverty, based on data on household's assets. The poverty indicator can be linked to other indicators, the better to express the vulnerability of different population groups.

Use of Census Data in Environmental and Climate-change Analysis

Population size and spatial distribution

The use of census data for environmental analysis has its starting point in linking population size to geography.[7] The Principles and Recommendations for Population and Housing Censuses of the United Nations (United Nations, 2008) provide a comprehensive overview of the census process, including the suggested questions to be integrated and the tabulations that need to be produced. In relation to environment, it concludes that:

> *. . . Population and housing censuses provide a powerful tool for assessing the impact of population on the environment, for example, on drainage basins and on water resource management systems. The spatial units for such a study may combine a group of local administrative areas. In this situation the availability of census databases with mapping capability (see paras. 1.126–1.128) is of great importance* (United Nations, 2008, p. 241).

In this regard, the use of census data is related to the 'resolution' of the data available (the size of the area in relation to its population). In their 2004 paper, "The Global Distribution of Population: Evaluating the Gains in Resolution Refinement", Balk and Yetman underline the fact that, in recent years, the country-specific average resolution of census data has increased. Significant improvements in access to a higher resolution of administrative data include: 1) the opening of National Statistical Offices (NSOs) and other providers of spatial data, including the fact that many NSOs allow for direct access to microdata;[8] (2) the beginning of awareness of and collaboration among providers of population and spatial data; and 3) the increase in capacity to manage, manipulate and process increasingly large population and geographic data sets. Alongside these developments, new efforts are being made to validate census data quality using satellite information systems. These positive changes do not eliminate the difficulties in comparability between censuses and therefore the difficulties for trend analysis, due to a lack of record keeping of census areas at NSOs.

Linking basic census data, such as population size, to the geographic area allows for the calculation of population density, a classic indicator for environmental study, particularly in urban areas. It also allows for the characterization of urban settlements: slums, sprawl, concentration and dispersion of the population. For adaptation policies, this indicator is still more relevant when it is combined with variables such as the type and quality of housing, source of water, energy, mode of waste disposal, patterns of occupational distribution and land use and tenure. It also helps to define the sustainability of the use of resources in particular locations and to highlight both environmental and related social vulnerabilities. Unfortunately, in most cases, this is the main and only use of population data for environmental analysis.

In urbanization studies, the indicator of density is one of the most relevant and most considered. A study on Chinese and Indian sites, for example, explores an alternative way to measure urbanization through density (Long et al., 2001). It includes the measurement of density (the percentage of the population living above and below a certain level of density and the percentage of occupied land under and above these specific densities) using census data for small areas. However, this methodology is considered to be more useful for making comparative studies. The authors suggest that ". . . the greater detail on the spatial complexity of each area measured at similar levels of spatial disaggregation could begin to supply the comparative data needed for ecological and other studies across many different societies and landscape".

Demographic dynamics, including household composition

The size and growth of population has been used to prepare the main Intergovernmental Panel on Climate Change (IPCC) emissions scenarios. However, there is a growing consensus that this is a very limited use of the information on population dynamics. Some studies (O'Neill et al., 2002; Dalton et al, 2008; Pachauri and Jiang, 2008) have shown the relevance of the composition and distribution of the population by sex, age, household structure and spatial distribution as key to understanding future changes in emissions.

But the importance of the size and growth of the population for adaptation and recovery plans should not be neglected. Specific age-sex categories evidently make varying demands on their immediate environments as they strive to ensure their livelihoods. Adaptation plans therefore need to consider the demographic and socio-economic characteristics of the population that could be affected by climate change.

Census data can be used in formulating these plans, taking care of the limitations of the data, particularly in regard to household composition, which also affects household surveys. De facto censuses can provide biased information on household composition, especially in cases of short-term migration. De jure censuses also have their own constraints. These factors need to be considered when using census data for this kind of analysis.

Identification of environmentally vulnerable populations

Censuses are an essential source for the identification of populations vulnerable to climate change and environmental disasters. This is the case for populations settled in coastal lowlands, which are at particular risk, including from rising sea level and flooding.[9] In addition to the geographic location, vulnerability is further exacerbated by income and other socio-economic and demographic factors, such as whether households are headed by women, men or children. Besides being already at peril from environmental change, dense populations in coastal zones can put a further burden on coastal ecosystems. Although this analysis seems to be an easy task, it is made difficult because censuses publish information by administrative areas that may not coincide with environmental areas (see Balk and Yetman, 2004).

In their article, "The Rising Tide: Assessing the Risks of Climate Change and Human Settlements in Low Elevation Coastal Zones", McGranahan, Balk and Anderson (2007) assessed the distribution of human settlements in Low Elevation Coastal Zones (LECZs) around the world.[10] In order to calculate the population at risk and their international distribution in LECZs, the authors integrated spatially constructed global databases of population distribution, urban extent and elevation data, overlaying gridded geographic data, thus deriving totals of national populations in LECZs.

Linking demographic and socio-economic census data to environmental data

A good example of how census data can be utilized beyond their traditional use is presented in the recent publication, "Mapping a Better Future: How Spatial

Analysis Can Benefit Wetlands and Reduce Poverty in Uganda" (2009), by the Wetlands Management Department, Ministry of Water and Environment, Uganda, and the World Resources Institute. This report provides examples of the development of poverty maps for 2002 and 2005, based on estimations combining data from their 2002 population and housing census with estimations from the 2002–2003 and 2005-2006 household surveys, respectively. "The level of detail obtained at subcounty permits more meaningful spatial overlays of poverty metrics and wetland indicators [and provides] first insights into relationships between poverty, wetland status, and use of wetland resources" (p. 4-5).

Migration data

Censuses provide useful information for the measurement of internal migratory movements, particularly with regard to movements during the five years prior to the census (Rodriguez and Busso, 2009). Some countries have included questions with a shorter reference period, thereby obtaining information on rapid changes that can be linked to sudden recent environmental changes. The information obtained through the census can thus be used to monitor the changes in spatial distribution due to migration.[11] When associated with the environmental changes mapped through other sources, these trends would be of great value. In this regard, census data on internal and international migration can be used not only to measure the impacts on the environment but also as the main instrument to identify emerging new patterns of migration and settlement and land-use patterns in environmentally fragile areas or costal zones. Censuses, by virtue of their full coverage, present unique opportunities for analysis that cannot be matched by sample surveys.

Census data on spatial distribution could also be useful to identify emerging patterns of movement of people to new areas due to environmental changes. Bordt and Smith (2008) note that census data could be useful in showing additional settlement in new locations due to increased agricultural and forestry production in areas of currently marginal production.

Censuses can include questions on the reasons for migrating. This presents a great opportunity to show how census data on migration are uniquely suited for the identification of migration flows to and from environmentally fragile areas. In this regard, the census, by virtue of its full coverage, presents unique opportunities for analysis that also cannot be matched by sample surveys.

The use of census data on climate-change-induced disasters for planning, evaluation of impacts and recovery plans

The use of population data in preparing for and responding to natural disasters has been widely recognized. The "Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters" (United Nations, 2005, pp. 6-27) underscores the need for a better understanding of the impact of

hazards and the resulting physical, social, economic and environmental vulnerabilities, as well as their interactions. This requires the development of risk maps and systems of indicators of disaster risk and vulnerability at national and subnational scales.

In situations of humanitarian response, population data are keys to identifying the population in need of aid and where this population is located (National Academies, 2007). The availability of geo-referenced and updated population data is an essential component of timely emergency response, which requires an important investment in capacity building. Censuses provide the basic information to determine the number and characteristics of the "likely population at risk of natural disasters" (p. xi). However, censuses are only conducted every 10 years, at best; therefore, if these data are not complemented and updated with other sources (surveys, administrative records, etc.), their use could be limited. The publication of the National Academies emphasizes these issues in the cases of Haiti, Mali and Mozambique.

Recommendations

1. **What needs to be done to ensure that relevant questions are included in the censuses or that those usually included are adequate for current needs?**
   - The process of design of the questionnaire and the plan of analysis of census data must be gender sensitive and involve researchers and policy-makers working on the mitigation and adaptation plans, in consultation with representative stakeholders.
   - Relevant census questions must eventually be added in order to measure the specific vulnerabilities associated with climate changes. In the case of a recent environmentally-induced disaster, specific questions should be added.
   - The categories for questions that focus specifically on environmental issues can be adapted to the national needs. These questions can be further focused by linking them to sociodemographic variables.

2. **What needs to be done to ensure that census data are collected, processed and made available to facilitate detailed analysis of very small areas (preferably environmentally homogeneous areas)?**
   - NSOs must commit to making census information available with the highest resolution possible. This will allow for a better definition of areas with higher vulnerabilities to climate-change-induced events.
   - NSOs should consider environmental areas in the definition of census areas.
   - NSOs should keep records of census areas to allow for inter-census comparisons.
   - Promotion of collaboration between different ministries and research centres, including professionals from different disciplines, ensuring the participation of gender and social development specialists.
   - Allow for the use of microlevel data and avoid a blockage of data users' access to them.

Box 12.1: Using Population Data for Measuring the Impact of Disasters: The Case of the ECLAC *Handbook for Estimating the Socio-economic and Environmental Effects of Disasters*

The Handbook for Estimating the Socio-economic and Environmental Effects of Disasters, produced by the United Nations Economic Commission for Latin America and the Caribbean (ECLAC) (2003), includes a section on the evaluation of the population affected by different kinds of disasters, including those that are environmentally induced. It presents a detailed methodology on how and when to use population censuses to determine the population that could be affected by disasters. Furthermore, the handbook shows the limitation of censuses and/or the projections derived from them for small areas in cases where censuses are outdated and important population mobility has taken place.

The manual provides methodologies on how to use population data, including censuses, to make an analysis of the human impacts of a disaster, including: 1) determination of the population with greater or lesser risk of being affected, identifying and defining profiles; 2) estimation of the demographic impact of the disaster, i.e., population and households likely to be affected by the event; 3) prevention and planning for action before the event occurs; and 4) generation of plans for evacuation or assistance during a disaster. Additionally, the social characteristics of a population are factors that increase or decrease the risk of harm. The level of education, socio-economic status, age structure and gender composition of the population, access to services, family structure, among other traits, influence the differential impact of the event.

Source: ECLAC, 2003, elaborated in collaboration with Alejandra Silva, CELADE-CEPAL.

3. What needs to be done to ensure that census data are made available, disseminated, analysed and used for national mitigation and adaptation policies?

- Create awareness: Advocate for a more extensive access to data for detailed analysis at the local level.
- Make census data useful by disseminating examples of good practices.

One of the most important areas of intervention in the implementation of these recommendations is capacity building.[12] A recommendation from the International Conference on Climate Change, Development and Official Statistics in the Asia-Pacific Region, held in Seoul in December 2008,[13] was that "the use of Geographic Information Systems and other spatial data infrastructure for the spatial analysis of official statistics should be improved and promoted" (Harper, 2008). This includes holding workshops on the development of spatial frameworks

and the coding systems that have to be established to support these frameworks and building on existing census-based workshops to cover their use in the analysis of climate change (Harper, 2008).

Notes

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2 The same applies to documents from relevant agencies. See, for example, the presentation of the United Nations Environment Programme (UNEP, 2008).

3 The document, "Indicators of Sustainable Development: Guidelines and Methodologies," 3rd edition (United Nations, 2007), presents a list of 50 core indicators, which are part of a larger set of 96 indicators of sustainable development. Around 40 per cent of these indicators can be calculated (partially or totally) using census data. See a detailed list of these indicators in Table 12.2.

4 See: Questionnaire 2008 on Environment Statistics (United Nations Statistics Division). Website: http://unstats.un.org/unsd/environment/questionnaire2008.htm, last accessed 11 September 2009.

5 An example is the use of census data from Bolivia and Chile to determine the amount of lamps that could be used in a household based on the number of rooms and the lighting needed. This information was used to derive estimates of mercury disposal using different kinds of lamps (Camilla et al., 2009).

6 In other cases, the use of census data is even more limited. As an example of this, the International Atomic Energy Agency (IAEA), in collaboration with other international organizations, elaborated a framework of energy indicators. Despite the fact that some of these indicators could be calculated (or triangulated) with the information obtained from censuses, there is no mention of the possibility of utilizing the census as a credible data source. Among these indicators, the percentage of the population using electricity and using biomass could be calculated using census data, allowing for geographically disaggregated estimation.

7 The new *Handbook on Geospatial Infrastructure in Support of Census Activities* (United Nations, 2009) focuses on how the use and application of geospatial technologies and geo-referenced databases are useful tools at all stages of the census process.

8 If the microdata are available and geo-referenced, it is much easier to define geographic areas that are environmentally homogeneous. See: Balk and Yetman, 2004.

9 These also include those living in slum areas, on steep, eroded slopes, in valleys, in catchment areas, on arid lands, etc. All these present varying challenges in terms of the ways they can be affected by climatic changes and how they impact on the environment.

10 They estimate that 600 million people, of which 360 million are urban settlers, live in LECZs, accounting for 10 per cent of the world's population and 13 per cent of the urban population. LECZs, covering 2 per cent of the world's land area, are defined as the contiguous land area up to 100 kilometres from the coast that is less than ten metres above sea level.

11 See: Balk et al, 2009. In their study, "Mapping the Risks of Climate Change in Developing Countries", presented at the Population Association of America meeting in 2009, the authors use migration data from the 1991 and 2001 Censuses of India to identify migration flows and the fastest growing cities and towns.

12 As mentioned in the conclusions of the work of the Committee on the Effective Use of Data, Methodologies, and Technologies to Estimate Subnational Population at Risk (National Research Council of the National Academies):

> *At present, there are relatively few units, especially in developing countries, with sufficient trained expertise in both demography and geospatial tools and technologies. Improvements in training and commitment by the national statistical office (NSO) and other staff for each country to include both demographic projection methodology in local areas and the use of appropriate spatial administrative units in map form are essential. There are a number of mechanisms for building such capacity, the first of which is recognizing the importance of the skill sets required for disaster preparedness and response. The second is formalized training. Such training programs could be part of overall capacity building and funded by bilateral aid programs, such as USAID, or*

through broader country capacity-building programs, such as those supported by the World Bank or United Nations **(National Academies, 2007, p. 151)**.

13 Organized by the Korea National Statistical Office (KNSO) and the United Nations Statistics Division (UNSD).

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