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Determination of global fundamental geospatial data themes

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Note by the Secretariat

Summary

The present paper contains the report of the Secretariat on determining global fundamental geospatial data themes for consideration by the Committee of Experts on Global Geospatial Information Management.

At its second session, held in August 2012, the Committee of Experts considered an inventory of issues gathered by Member States that should be addressed in the coming years. Among the key issues was that of agreement to and implementation of core global reference data sets by specific themes. It was considered that a continuing gap in the successful unification of a national, regional and global geospatial information management capability is the lack of an agreed set of readily available and authoritative global reference data sets by specific themes. In furtherance of the topic, the second High Level Forum on Global Geospatial Information Management, held in Doha from 4 to 6 February 2013, dedicated a session to challenges in developing core global reference data sets. The Doha Declaration on Advancing Global Geospatial Information Management, the outcome document of the Forum, affirmed the importance of an agreed set of authoritative core global reference data sets that are needed to support global sustainable development activities and to work jointly towards the preparation, improvement and maintenance of these core global reference data sets. The report describes the background to and the need for global fundamental geospatial data themes and provides national and regional examples that help to inform and guide the way forward.

I. Introduction

1. At its second session, held in August 2012, the Committee of Experts considered an inventory of issues gathered by the Member States that should be addressed in the coming years (E/C.20/2012/5/Add.1). At the request of the Committee, considerations were given to identifying a selection of immediate and prioritized ‘key issues’ that were seen as being the most relevant and important, and that could be considered realistic to make tangible progress within the next few years. At the same time the Committee requested to be action orientated in its approach to its work programme so that tangible outcomes may be seen and leveraged by the Member States.

2. The key issues included “agreement to and implementation of core global reference datasets by specific themes”. It was considered that a continuing gap in the successful unification of a national, regional and global geospatial information management capability is the lack of an agreed set of readily available and authoritative global reference datasets by specific themes. The importance and value of authoritative geospatial information, and the core fundamental reference geographies upon which all other information is based, is recognized by all Member States. These datasets by themes, required to be anchored to an improved global geodetic reference framework, would be developed and maintained by the national geospatial information authorities as an inherent responsibility of the Member States. Where appropriate, they should be readily accessed and shared amongst countries to meet operational objectives, and be adopted by international organizations including the UN agencies. Examples of datasets by themes may include; administrative boundaries, elevation, water, transport, vegetation, human settlement, major features (infrastructure), and other socioeconomic and environmental indicators. Concerted efforts should also be made to bring the developing countries to a base level of capability with respect to their framework datasets.

3. At the Second High Level Forum on Global Geospatial Information Management, held in Doha, Qatar, in February 2013, a session was dedicated to “Challenges in Developing Core Global Reference Datasets”. As an outcome of a number of presentations and interactive discussions, in his Summary, the Chair of the Forum noted the importance of establishing fundamental datasets at national and international levels to help in the standardization and improvement of quality. The custodian and stewardship of these datasets should be clearly spelt out and the role of the geospatial information authority be identified within a network of producers and users. Accountability and governance issues should be addressed. Common data themes that have been widely used included geocoded addressing, boundaries, positioning, place names, elevation, land cover, transport, water and land parcel. The Forum recognized that existing international initiatives, such as the Infrastructure for Spatial Information in Europe (INSPIRE), the Global Earth Observation System of Systems (GEOSS) and the Multinational Geospatial Co-Production Program (MGCP), provide a valuable blueprint on the specifications of fundamental datasets. They illustrated cooperation across countries in the production of standardized datasets and served as good examples to build global platforms for fundamental datasets.

4. In the Doha Declaration, issued 6 February 2013, at the conclusion of the High Level Forum, participants resolved to affirm the importance of an agreed set of authoritative core global reference datasets that are needed to support global

sustainable development activities and to work jointly towards the preparation, improvement and maintenance of these core global reference datasets.

5. Amongst the global geospatial community, there are those who use the terminology “fundamental data” whilst others use “core data” or “framework data”. Often these three terminologies are used interchangeably and synonymously. In this report, the terminology “fundamental” is used to emphasise the concept of geospatial data being fundamental baseline data and information to contribute to the overarching vision of the Committee to contribute to the post-2015 development agenda and sustainable development.

6. The Committee of Experts is invited to take note of the report and to express its views on the way forward in addressing the issues relating to global fundamental geospatial data themes. Points for discussion and decision are provided in paragraph 42.

II. What constitutes global fundamental geospatial data themes?

7. Fundamental geospatial data themes provide a means of organizing and managing fundamental geospatial datasets, based on similarities between datasets. Themes support the development of communities of interest and may include any number of specific data sets. A key aspect of fundamental data themes is that they should be a reference frame, foundation, or base for the development and integration of geospatial data sets within these frameworks at a national, regional and global level. Such a collection of essential data themes would constitute the building blocks for the planning and design of spatial data infrastructures (SDI). For this to be accomplished it is necessary for the data to be available, standardized and widely accessible, to permit new geospatial data sets to be developed through the cooperation of users.

8. In its 2007 report “Determination of Fundamental Datasets for Africa: Geoinformation in Socio-Economic Development”¹ the UN Economic Commission for Africa determined that fundamental data sets are: “the minimum primary sets of data that cannot be derived from other data sets, and that are required to spatially represent phenomena, objects, or themes important for the realization of economic, social, and environmental benefits consistently across Africa at the local, national, sub-regional and regional levels”. The New Zealand Geospatial Office in Land Information New Zealand states that “fundamental geospatial datasets are nationally-significant data that are critical to the effective running of the country, and work together to help support growth in the economy”².

9. Other criteria and guidelines for identifying fundamental data themes should include: complete coverage over the area of interest; they should be needed consistently; must have sufficient detail; and a diversity of users from different sectors must derive significant benefit from their use. Fundamental data themes should also have acceptable standards and validation processes that ensure consistency, reliability, quality, continuity and accuracy. The functional uses of the fundamental data themes, in terms of their use as a geographic reference frame, as

¹ http://www.uneca.org/sites/default/files/publications/geoinformation_socio_economic_dev-en.pdf

² <http://www.linz.govt.nz/geospatial-office/fundamental-geospatial-data>

base geography and as a geo-coding scheme, are to provide non-spatial data a geographical reference.

III. The need for global fundamental geospatial data themes

10. As described earlier in this report, the Committee of Experts has previously determined that a continuing gap in the successful unification of a national, regional and global geospatial information management capability is the lack of an agreed set of readily available and authoritative global reference datasets by specific themes. The Doha Declaration affirmed the importance of an agreed set of authoritative core global reference data themes that are needed to support global sustainable development activities and to work jointly towards the preparation, improvement and maintenance of these core global reference themes. This comes as many Member States recognize the importance of having available core sets of data to support national development and economic growth, and which are being implemented as the core building blocks of national spatial data infrastructures (SDI). The need for these core data themes to be integrated and harmonized across borders from national to global levels, especially in the context of global challenges such as sustainable development, is growing significantly.

11. As described in more detail in the report on activities related to sustainable development and the post-2015 development agenda (E/C.20/2014/13/Add.1 of this session) it is not possible to consistently measure and monitor sustainable development without geography, place, time and location. The Sustainable Development Goals will depend on human and physical geography data and geospatial information to measure and monitor change and progress. There will be a need to create a network of global data and information that is supported by the tools and technology to create maps and detect and monitor change over time in a consistent and standardized manner. This requires global fundamental geospatial data themes to be available to underpin all other data.

12. The 2012 report to the UN Secretary-General ‘Realizing the Future We Want For All’³ stated that global environmental sustainability requires “improving access to geographical information and geospatial data, and building capacities to use scientific information in areas such as climate monitoring, land use planning, water management, disaster risk reduction, health and food security, will allow for more accurate environmental and social impact assessments and more informed decision-making at all levels”

13. The 2014 report of the African Union ‘Common African Position on the post-2015 development agenda’⁴ noted that a key enabler for sustainable development to be effective, Africa must “invest in and strengthen national statistical capacities and geospatial information systems for the collection, analysis, production and dissemination of disaggregated data to measure and evaluate policy effectiveness; and promote a culture of evidence-based decision making”.

³ http://www.un.org/millenniumgoals/pdf/Post_2015_UNTTreport.pdf

⁴ <http://www.africa.undp.org/content/dam/rba/docs/Reports/RBA-common-position.pdf>

IV. National and regional examples of fundamental data theme initiatives

14. This section outlines some of the examples of regional and national initiatives with regards to fundamental data themes. These examples are by no means exhaustive and conclusive, but provide an indication of trends, commonalities, or uniqueness due to geospatial and/or institutional arrangements.

Africa

15. The mapping of the African continent has been at best patchy for a number of historical and institutional reasons. Practitioners from across the continent have in various forums voiced concerns regarding the lack of fundamental geospatial datasets. They have also raised the concern about the non-availability of base maps, maps being out of date or of too coarse a scale, incomplete geoinformation, and not being in digital format. As such, the 2007 report by the United Nations Economic Commission for Africa “Determination of Fundamental Datasets for Africa: Geoinformation in Socio-Economic Development” is the product of a study commissioned to consolidate inputs from different perspectives and makes recommendations on “candidate” fundamental data sets for Africa.

16. The premise was that, as geospatial data and geoinformation are widely accepted as essential components of the body of knowledge that informs national development strategies, then a pan-continental and common definition of what constitutes a minimally necessary core of geospatial data and information products is required. Therefore the purpose of the report was to identify and enumerate those core or fundamental geospatial data sets required to support Africa’s development agenda.

17. The report identified the following as constituting the fundamental data themes for Africa: Geodetic control network; Imagery; Hypsography; Hydrography; Boundaries; Geographic names; Land management units/areas; Transportation; Utilities and services; and Natural environment.

18. The report was seen as the starting point on the long journey to comprehensively map Africa. However, in recent times, there has been little progress, mainly due to capacity and leadership constraints, on the development of the fundamental geospatial datasets, and making them available for decision making on the continent to address the many development and policy imperatives.

Europe

19. The Infrastructure for Spatial Information in Europe (INSPIRE) Directive⁵ aims to create a European Union (EU) spatial data infrastructure to assist policy-making across boundaries, and is a legislative framework that came into force on 15 May 2007, and will be implemented in various stages, with full implementation required by 2019.

20. INSPIRE is based on a number of common principles:

- Data should be collected only once and kept where it can be maintained most effectively;

⁵ <http://inspire.ec.europa.eu/index.cfm>

- It should be possible to combine seamless spatial information from different sources across Europe and share it with many users and applications;
- It should be possible for information collected at one level/scale to be shared with all levels/scales; detailed for thorough investigations, general for strategic purposes;
- Geographic information needed for good governance at all levels should be readily and transparently available; and
- Easy to find what geographic information is available, how it can be used to meet a particular need, and under which conditions it can be acquired and used.

21. INSPIRE introduced 34 reference geographies and environmental datasets, containing the nine core reference geographies which provide a framework for linking and integrating other geo-referenced information, as well as providing key contextual information. The core reference geographies are key datasets that form common information frameworks which are defined, endorsed and used by all data holders in both the public and private sector, and should be collected and maintained once and used many times.

22. The nine core reference geographies of INSPIRE are: Coordinate reference systems; Geographical grid systems; Geographical names; Administrative units; Addresses; Cadastral parcels; Transport networks; Hydrography; and Protected sites.

Australia and New Zealand

23. Australia and New Zealand, through ANZLIC – the Spatial Information Council, is developing an agreed ‘One ANZ Foundation Spatial Data Framework’⁶ that will provide easy access to authoritative government spatial data over the geographic extents of Australia and New Zealand. ANZLIC has recognized that spatial information users, and locally-maintained information systems and applications across almost every discipline, have a recurring need for a defined number of spatial datasets – or foundation data.

24. The Framework will provide a common reference for the assembly and maintenance of Australian and New Zealand foundation level spatial data in order to serve the widest possible variety of users. It will deliver a national coverage of the best available, most current, authoritative source of foundation spatial data which is standardised and quality controlled. The initial focus is to define an agreed set of user-validated data themes and the data specifications for each theme. The Framework will become an important part of the spatial information infrastructure and will be the preferred regional foundation spatial data source upon which any organisation or user can build upon, by integrating other thematic or application datasets and information sources.

25. The ten agreed foundation spatial data themes are, in no particular order: Geocoded addressing; Administrative boundaries; Positioning; Place names; Land parcel and property; Imagery; Transport; Water; Elevation and depth; and Land cover.

⁶ http://spatial.gov.au/system/files/public/resources/anzlic/ANZ_FoundationSpatialDataFramework_%28FinalWeb%29.pdf

V. Considering global fundamental geospatial data themes

26. In context of the United Nations, the United Nations Geographic Information Working Group (UNGIWG) determined that there was a need to collect seamless sub-national administrative level boundary information at a global level to provide cohesive geospatial data to present and analyse geospatial issues on sustainable development, humanitarian, peacekeeping, environmental, health and food crisis for United Nations operations. Since 2000, the Second Administrative Level Boundaries (SALB) project has been providing global seamless sub-national administrative level boundary data under the leadership of the World Health Organisation (WHO). As of 2011, the management of SALB has been transferred to the United Nations Secretariat, namely, the Department of Economic and Social Affairs for coordination and Department of Field Support for technical coordination. As of 2014, the Economic Commission for Africa is also participating in the work of SALB.

27. In the 1990s, the National Imagery and Mapping Agency (NIMA) of the United States produced Vector Map (VMAP) or Vector Smart Map, global geospatial data at various scales such as VMAP-0 at 1:1,000,000 scale, VMAP-1 at 1:250,000 and VMAP-2 at 1:50,000 scale. An example of another grouping of global data is the Multinational Geospatial Co-production Program (MGCP), which was initiated by the defence community in 2003 to establish co-operation in creating large scale geodatabases at 1:50,000 or 1:100,000 scale. To date, 29 member nations participate in building a unified global production of global geodatabases, with a standard methodology and schema, derived from remote sensed information, extracted and processed into a vector-based geodatabase. Whilst the geospatial information and data is limited to the participating Member States, increasingly this information are also shared with other nations in times of operational demands of the United Nations peacekeeping operations through the United Nations Cartographic Section.

28. The Ministry of Economy, Trade, and Industry (METI) of Japan and the United States National Aeronautics and Space Administration (NASA) jointly produced the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Global Digital Elevation Model (DEM), which is publicly accessible as a global dataset. The newest version of the global DEM was released in October 2011 at a resolution of 70 meters.

29. A core theme that contributes to the global fundamental geospatial data themes is the place or geographical names theme. Perhaps with the exception of imagery, it has a direct relationship with all other data layers constituting fundamental themes. However, its value is not well recognized, perhaps because place/geographical names are easily taken for granted, being frequently used in daily conversation when referring to where an event occurred or a destination. It is therefore plausible that place/geographical names are common reference frameworks, used in the same way throughout the general community globally.

30. Geographical names serve as a location identifier. They may be used, together with appropriate information like maps and gazetteers as well as respective services. Gazetteers and gazetteer services associate the names with corresponding features – or locations – by means of coordinates, feature types and other attributes.

31. The United Nations Group of Experts on Geographical Names (UNGEGN) notes that unless countries have a program in place to process place/geographical

names towards a common understanding of spelling, application, feature extent type, and freely disseminate this information, there is a distinct possibility of multiple names or forms being used. Simultaneously misunderstandings of the application of the name to the landscape can occur. UNGEGN can assist with support, training programs, and general advice for any country wishing to implement or improve its place names standardization program, leading to a significant improvement in this portion of the spatial data framework.

32. Land cover is a specific global fundamental geospatial data theme with direct and critical application to sustainable development. Representing the observed physical cover on the earth's surface, typically captured from remotely sensed satellite imagery, land cover is effective in measuring and monitoring sustainable development. Determining and understanding land cover changes over time, particularly from local to global scales, comprehensively reflects the impacts of climate change, energy resources, land use, urbanisation, ecology, and human activities upon the natural environment.

33. It has been widely acknowledged that the present spatial resolution of global land cover data (typically 300m or lower) will not meet the future needs of global change studies and sustainable development applications. Therefore, the National Administration of Surveying, Mapping and Geoinformation of China (NASG), has developed and produced the world's first global land cover datasets at 30m resolution. The Global 30m Land Cover Mapping Project (GlobalLand30) utilised remotely sensed imagery to create datasets covering the globe for the years 2000 and 2010, and containing 10 major land cover classes. The datasets intuitively present land cover pattern and change information, as well as the area of land cover elements and their change amount and rate through spatial statistics. This brings quantitative understanding to the extent of human activities influencing the natural environment.

34. NASG will soon complete its development of GlobalLand30 and stands ready to contribute these important global datasets to the United Nations, Member States and the international community as tangible support, including scientific decision-making, for Member States to measure and monitor critical environmental components of the SDGs and post-2015 development agenda.

35. Upon provision of the GlobalLand30 datasets to the United Nations, it is anticipated that an international cooperation mechanism will be initiated to enable Member States and relevant participants to conduct data validation/verification, updating and maintenance. Under the overall management of the UN-GGIM Secretariat, NASG will provide access to and services for the data validation/verification via the global land cover information service platform, including flexible technical training. Further, NASG will actively conduct statistical analysis and program development, and conduct research on a more unified and detailed land cover classifications in order to enrich the data content.

VI. Summary

36. The global geospatial professional community, including the Committee of Experts, has repeatedly documented and determined that a continuing gap in the successful unification of a national, regional and global geospatial information management capability is the lack of an agreed set of readily available and authoritative global reference datasets by specific themes. While many Member States and regional entities continue to progress efforts at national and regional

levels, primarily aimed at deploying successful implementations of Spatial Data Infrastructures, global efforts and outcomes are lacking and remain a significant gap. While a number of important attempts are being made globally, the high level ownership and consensus, particularly at the political level, is missing. This has the potential of diminishing the valuable progress being made by the Member States through the Committee of Experts.

37. For example, this session of the Committee will discuss and decide on a number of agenda items that include significant elements of geography, place, and location – and therefore core reference geographies. These are namely, the agenda items related to:

- Global geodetic reference frame, one of the fundamental underpinning data themes to establish and anchor the baseline geospatial framework;
- Global Map for Sustainable Development Working Group and the work by the International Steering Committee for Global Mapping (ISCGM) which rely entirely on core global data themes;
- Implementation and adoption of standards, which refers directly to the suites of SDI standards, and Tier 3: “Spatially enabling the nation” integrating and providing access to geospatial foundation data for a range of application areas;
- Integration of geospatial and statistical data, which requires fundamental geospatial data themes to underpin and locate the statistical data from national to global;
- Activities of the United Nations, especially by UNGIWG which has referenced SALB as a fundamental global geospatial data theme; and
- The need for such data themes to support the geographic approach to the post-15 development agenda.

38. The report of the Preparatory Committee of United Nations Global Geospatial Information for Europe (contained in E/C.20/2014/14/Add.1 of this session) also discusses this topic in some detail and provides valuable context. It expands on the European perspective of core reference geographies and provides views on the challenges in delivering pan-European harmonised geospatial core data to enable the implementation of public policies in a coherent and coordinated way. The report notes that geospatial data remain heterogeneous between countries. Although some pan-European harmonized data is compiled from national data, other datasets are commissioned centrally at European level which may duplicate and be inconsistent with the existing data in use at a national level.

39. In terms of meeting global requirements, the report has proposed to define core data as the authoritative data from UN Member States that satisfy minimal needs at cross-border, European and global level. The rationale of this definition being:

- It is essential from a user perspective that national data and European data are coherent;
- It is essential to meet the requirements from the 2020-2021 round of census for geospatial core data; and
- Core data would facilitate the production and would guarantee the quality and geometrical consistency of other richer, more detailed, more thematic geospatial data, which would rely on core data.

40. The report goes on to state that European UN Member States welcome the introduction of UN-GGIM: Europe as a useful Forum in which to proceed and recommend a process leading to the establishment of core data at European level by identifying “what” is needed and by “whom” interfacing and capturing results from existing requirement definition processes. It also acknowledges that “UN-GGIM could be a unique opportunity to address the issue of ‘core data’ and to persuade UN Member States to do things according to minimum requirements”.

41. While considering the previous issues described in this and other reports of this session, it must be noted that the paradigm of data availability and usefulness is also changing rapidly, and is becoming more real-time. National spatial data infrastructures are evolving and will become more important than previously, but their value must also be viewed in a different manner. SDIs are no longer just a means of storing and delivering data. They now have the real ability to provide the means to “organize” and deliver core geographies from everywhere at any time.

VII. Points for discussion

42. The Committee is invited to:

(a) Take note of the report and express its views on the way forward in addressing the issues relating to global fundamental geospatial data themes;

(b) Consider establishing a working group to build upon this initial work, to determine an initial set of global fundamental geospatial data themes, and to report its findings back to the Committee at a future session;

(c) Consider the continued contribution of authoritative information and data for activities such as SALB, and UNGEGN, which can provide important themes towards the global fundamental data themes.