signals. In some communities the imaging of building facades has met resistance by some members of the population, which did not wish to show them to the public on the web. Nevertheless Google has pursued street mapping for the sole reason to update the Google Maps content as an internal operation.

In this manner Google Street Map has proved to be an effective tool to quickly update the Google Maps content for buildings and roads. The update of these features can generally be done much faster than by the regular update intervals for authoritative mapping without a reporting system in operation and without a multitude of fast survey options, rather than by a centralized mapping procedure. For coverage see Fig. 41.

Fig. 41: Google Street Map Coverage

5.1.4 Google Ground Truth

In the attempt not only to update the map content, but also to maintain a high level of geometric accuracy, the Google Ground Truth project has been launched for a number of countries in North America, Europe, Australia and South Africa, in which authoritative cartography has been merged with the results of high tech operations, such as Google Street Map, see Fig. 42.

Fig. 42: Google Ground Truth

As Google regards the progress of these projects as a confidential matter, it is not possible to make a more detailed account of the progress made.

5.2 Microsoft Bingmaps

Microsoft considered Google to be their strongest competitor, while Bingmaps has the same objectives as the Google efforts. Therefore care has been taken to achieve a higher resolution and a more accurate geometry than Google Earth.

This was possible by limiting the area of interest to the continental USA and to Western Europe, where there were no flight restrictions. Furthermore, the imagery used for Bingmaps consisted solely of digital aerial imagery flown by the company owned Vexcel Ultracam cameras.

The coverage of the countryside for the USA and for Western Europe was completed at 30cm GSD, and the urban areas were imaged at 15cm GSD. Whether the originally forseen updates of every 3 years can be achieved as planned, is still an open issue. See Fig. 43 (a,b,c,d).

There has been a recent announcement that Microsoft turned over Bing Maps technology to UBER.
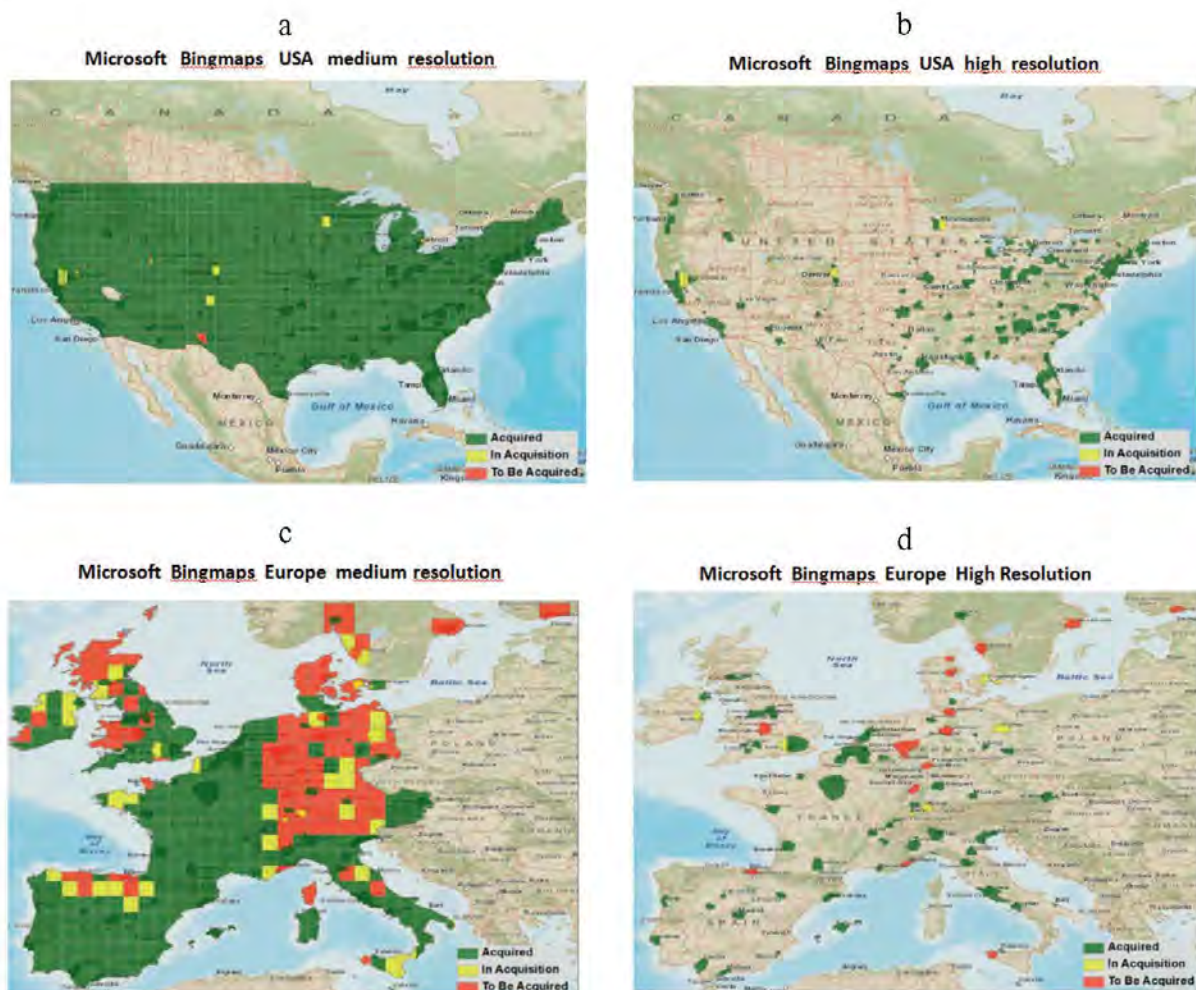
a

Microsoft Bingmaps USA medium resolution

b

Microsoft Bingmaps USA high resolution

c

Microsoft Bingmaps Europe medium resolution

d

Microsoft Bingmaps Europe High Resolution

Fig. 43: a,b,c,d Bingmaps

5.3 Yandex

Another approach has been undertaken by Yandex in the Russian Federation, which was also applied in Turkey by the company Yandex.

Yandex has procured high resolution satellite imagery from Digital Globe for the entire territory of the Russian Federation at 0.5m GSD and at 1m GSD. The objects of interest were building blocks, single buildings, roads, creeks. They could be identified and mapped from the images. The geocoding of the mapped information was done by accuracy augmented GNSS code receivers with 2 to 3m accuracy on the ground. In this way Yandex succeeded to generate digital maps for about 300 urban conglomerations in Russia and Turkey.

Yandex, like international car navigation system suppliers, was also interested in car traffic routing, providing real time traffic congestion options for the agglomeration of Moscow.

5.4 HERE

When the Finish company Nokia bought Navteq, the global car navigation system efforts were continued by the subsidiary HERE.

HERE makes car navigation systems based on their own maps for 196 countries of the world, 116 countries of which have voice guided navigation and 44 countries of which with live traffic services.

Of interest are roads and points of interest. This also includes unidirectional restrictions of traffic flows.

In Europe 15% of the map´s content is updated every year, modifying or adding 1.1M km of roads, creating 700 000 new points of interest and adding 600 000 speed cameras.

In the Russian Federation 800 000 km of roads change after 6 months, ans so do 120 000 street names, 22 000 turn restrictions, 3400 one way streets, 38 000 speed limits and 8700 directional street signs. See Fig. 44:

Fig. 44: HERE (formerly Navteq) Global Coverage

5.5 TomTom

TomTom has a road navigation coverage for 118 countries extending over North America, Brazil, Argentina, Europe, the Russian Federation, India, Indonesia, Thailand, Australia, New Zealand, West and South Africa. See Fig. 45:

Fig. 45: TomTom Global Coverage

6 Mapping by Military Organizations

Like it happened during the cold war period, when the US and the USSR military organizations considered it their goal to conduct mapping operations in what they considered to be crisis areas, this practice was recently revived by about 30 nations from Europe, North America, Australia, New Zealand, Japan, Rep.of Korea and South Africa, when they launched the Multinational Geospatial Co-Production Program MGCP. The goal of this program is to generate up-to-date 1:50 000 digital maps for potential crisis areas of the globe in Asia, Africa, the Middle East, the West Indies and the Pacific Ocean. Benefitting from this activity are the UN cartographic section, which utilizes these maps to create information for crisis mitigation.
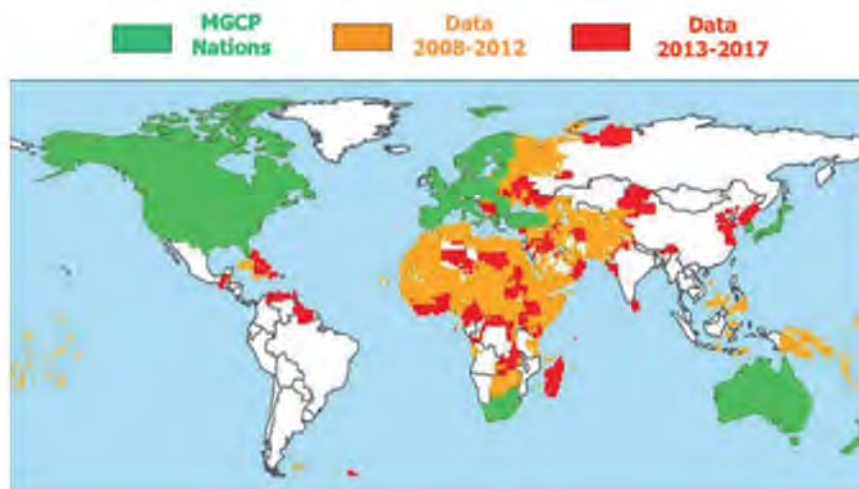

Fig. 46: MGCP Mapping Coverage

7　Summary of Results

- 115 UN Member countries have responded to the 2012-2015 UNGGIM-ISPRS Survey. It has been shown, that nearly all reporting countries have modernized their facilities to adopt modern GNSS, digital imaging and GIS technology in their operations, which are still handicapped by lack of funding and staff shortages.

- While in 1986 the world was basically covered by 1:250 000 maps, progress in technology has now made it possible to state that topographic mapping of the globe at 1:50 000 scale, relevant to sustainable development, has been reached.

- There are still gaps in providing updated information in developing countries. These need to be closed with a goal of no data to be older than 5 years.

- New technologies, such as those used by Google and by Yandex could help to reach this goal in priority areas.

8　Future Activities

- ISPRS has created working group IV-2 to accompany the UNGGIM-ISPRS project.

- This working group has successfully provided the needed discussion forum for the task.

- It will be the future goal of this group to assure that the data collection and analysis will be sustainable by cooperating with UNGGIM and UN-GEO

- A near goal will be the expansion of the work to include global land cover mapping as a task.

9　References

1. UN Secretariat document E/CONF78/BP7 1986, prepared by A. J. Brandenberger & S.K. Ghosh, published in World Cartography XiX, 1990
2. UN Secretariat document E/CONF78/BP8 1986, prepared by G. Konecny, published in World Cartography XIX, 1990
3. Global Geospatial Information and High Resolution Global Land Cover/Land Use Mapping. Proceedings of ISPRS WG IV/2 Workshop, April 2015, Novosibirsk
   - The Global Status of Topographic Mapping, Gottfried Konecny, pp. 4 - 20
   - The Global Status of Topographic Mapping: Technical Background, Uwe Breitkopf, p. 21
   - The Current Status of Mapping in the World - Spotlight on Pacific Islands, John Trinder, pp. 22 - 32
   - High Resolution Global Land Cover/Land Use Mapping. Current Status, Klaus U. Komp, pp. 33 - 47

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Appendix I   Original Questionnaire

QUESTIONNAIRE
ON
THE CURRENT STATUS OF MAPPING IN THE WORLD

The questionnaire is intended to take stock of the current status of mapping in the world. The information collected will eventually be used to develop country profiles, good practices and lessons learned in the dissemination and use of geospatial data. The results of this questionnaire will be collated and disseminated to countries.

Please submit the completed questionnaire and any attachments in electronic format to Mr. Amor Laaribi (E-mail: Laaribi@un.org) or to Ms Vilma Frani (Frani@un.org) by **1 June 2012** at the latest. You may also submit additional material by fax at +1-212-963-9851.

Thank you in advance for your input.

Steps to follow in checking a box:
1. Left double-click on the box
2. Select "Checked" for default value
3. Click "OK".

PART A: BACKGROUND INFORMATION

Please provide the following information on the person filling the questionnaire:

Name of person filling the questionnaire:	
Functional title:	
Institution, department or unit:	
Country:	
E-mail:	
Persons/Institutions consulted:	

1

PART B: National Topographic Mapping Coverage

1. At what scales are topographic digital data and/or map products (or series) produced and maintained? Choose the categories closest to your scales if they are different to those suggested below.

Category:		
I	1:1000 or greater	☐
II	1: 5000	☐
III	1: 25 000	☐
IV	1: 50 000	☐
V	1:100 000	☐
VI	1:250 000	☐
VII	1:500 000	☐
VIII	1:1 million or smaller	☐

   In each case indicate the reference datum used.

2. If possible, provide indexes that show the coverage of these data and/or maps by category in graphic form.

3. If possible, distinguish between the age of available maps and/or data (e.g. 1yr, 2yrs, 3yrs, 4 to 7yrs, 8 to 15yrs, over 15 yrs), state the year of publication[1]

   Do the maps and/or data have restricted access or limited circulation?

   Yes ☐   No ☐

   If so, can you indicate why and to whom?

4. Are the maps and/or digital data sold to the public?

   Yes ☐   No ☐

   Or are the maps and/or digital data free of charge?

   Yes ☐   No ☐

   Are they free of charge to governmental institutions or certain stakeholders?

   Yes ☐   No ☐

   What maps or data are available on the web, and are they free?

---
[1] Even if we know that this may be difficult to do so for the digital data.

2

If applicable, could you indicate what pricing model is being applied to the map products and the digital data?

5. Is there a cycle of map and data revision by:
☐ Complete mapping ie. revision of a national series
☐ Mapping of changed features or themes across the national series
☐ Mapping of changed features as they are detected on an ad-hoc basis

Is the data revision reflected across all map/data scales indicated in Question 1?

Yes ☐   No ☐

If not, state the revision cycle for each map and/or data scale

6. By what methods is national data revision and map updating undertaken (if multiple methods, please indicate):
☐ Field surveys
☐ Aerial photography
☐ Photogrammetric
☐ Satellite imagery
☐ Third party data and/or sources
☐ Crowd sourcing by volunteers and/or other means

If there is a prevalent method of mapping by category 1 to VIII for each map scale, please indicate for each.

7. Is mapping and map updating done in-house or by outsourcing?

In-house ☐   Outsourcing ☐

Where applicable, can you describe the activities, processes and mechanisms by which the outsourcing is conducted?

PART C: National Imagery Acquisition

8. Does a national aerial photography acquisition program exist? Yes ☐ No ☐
Do you have a domestic aerial imagery capability? Yes ☐ No ☐
Or is it obtained internationally? Yes ☐ No ☐
Is imagery flown at regular time intervals? Yes ☐ No ☐
Is analogue or digital photography used? Analog ☐ Digital ☐

9. Does a national satellite imagery acquisition program exist?
Do you have a domestic satellite imagery capability? Yes ☐ No ☐
Or is it obtained internationally? Yes ☐ No ☐
Is satellite imagery acquired systematically at regular time intervals? Yes ☐ No ☐
Or is satellite imagery acquired on an 'as needs' basis? Yes ☐ No ☐

10. Do you acquire and/or use other imagery types (such as LiDAR, Radar, IFSAR, etc.)?

Yes ☐   No ☐

If so, can you please indicate coverage and resolution? (For example: LiDAR along the coastal strip at 15cm pixel resolution).

11. Are any of these new imagery acquisition types (such as LiDAR) being used for the generation of digital elevation models (DEMs), digital terrain models (DTMs), and/or digital surface models (DSMs)? State pts/m² and the coverage in km² if possible.

12. Are orthophotos and orthophotomaps produced?

Yes ☐   No ☐

At what scale?

If possible, show coverage and age at different scales in graphical form.

13. Is there a national digital elevation model (DEM) available?

Yes ☐   No ☐

If applicable, show the resolution and coverage of any sub-national DEM, DTM and DSM data and/or products.

14. Do you produce, or is there the intention to produce, 3D urban and rural landscape models and/or product visualization?

Yes ☐   No ☐

PART D: National Surveying and Cadastral Coverage

15. Are there licensed surveyors operating in the country?

    Yes ☐ No ☐

16. Is there national coverage of cadastral maps and/or data available?

    Yes ☐ No ☐

    Is the National Mapping Agency (NMA) responsible for surveying and/or land titles and cadastre?

    Yes ☐ No ☐

    If the NMA is not responsible for these, please indicate the relevant agency/s that are responsible.

    _____

17. What are the cadastral maps and data used for:

    ☐ Land registration
    ☐ Titles
    ☐ Conveyancing
    ☐ Taxation
    ☐ Other

18. Are the cadastral maps based on geodetic control?

    Yes ☐ No ☐

    If so which reference system is being used?

19. Are the property boundaries monumented in the field?

    Yes ☐ No ☐

20. How are the property maps and/or data updated?

    _____

21. Could you list the number of government officials and private surveyors active in cadastral surveys?

    _____

PART E: Organization

22. Are the national topographic mapping, imagery acquisition, surveying and cadastral programs funded by your national Government?

23. Are you able to provide the annual mapping budget of the National Mapping Organization?

    Yes ☐ No ☐

24. What is the number of mapping staff in the Organization, and what is the technical/administration mix?

    _____

25. Are there any regulatory or institutional arrangements in place that mandates your organization to fulfil the role as the lead mapping agency in your country?

    Yes ☐ No ☐

    If so, could you briefly describe them?

    _____

26. In terms of approximate percentages (%) how are all of the different map and data products mentioned above delivered? Consider the following channels:

    Percentage (%)

    _____ ☐ Hard copy paper maps
    _____ ☐ Digital data
    _____ ☐ Data and products downloaded online
    _____ ☐ Via web services

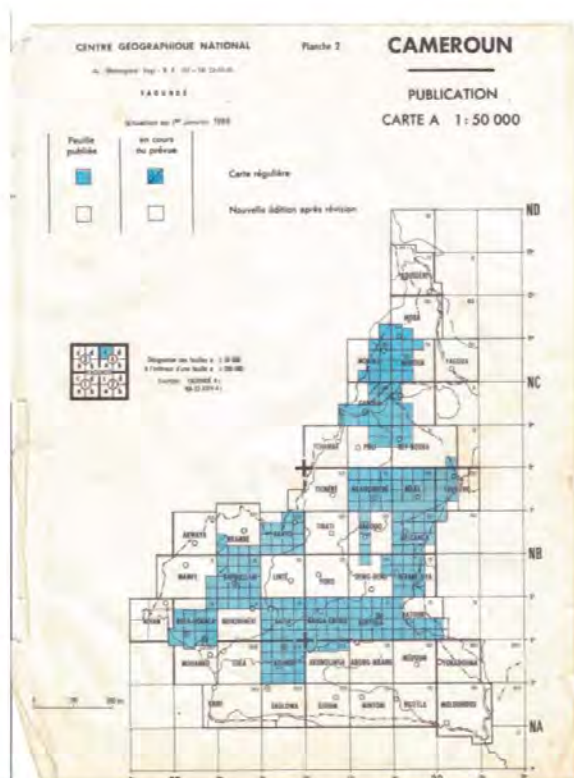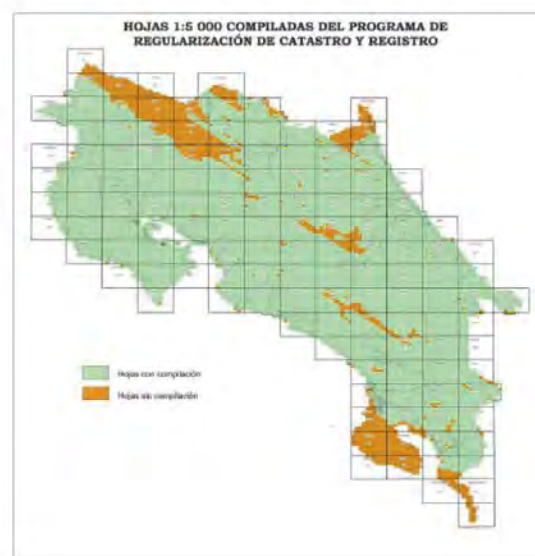27. What is the method of archival for the national data sets?

    _____

Appendix II   Maps from Reports
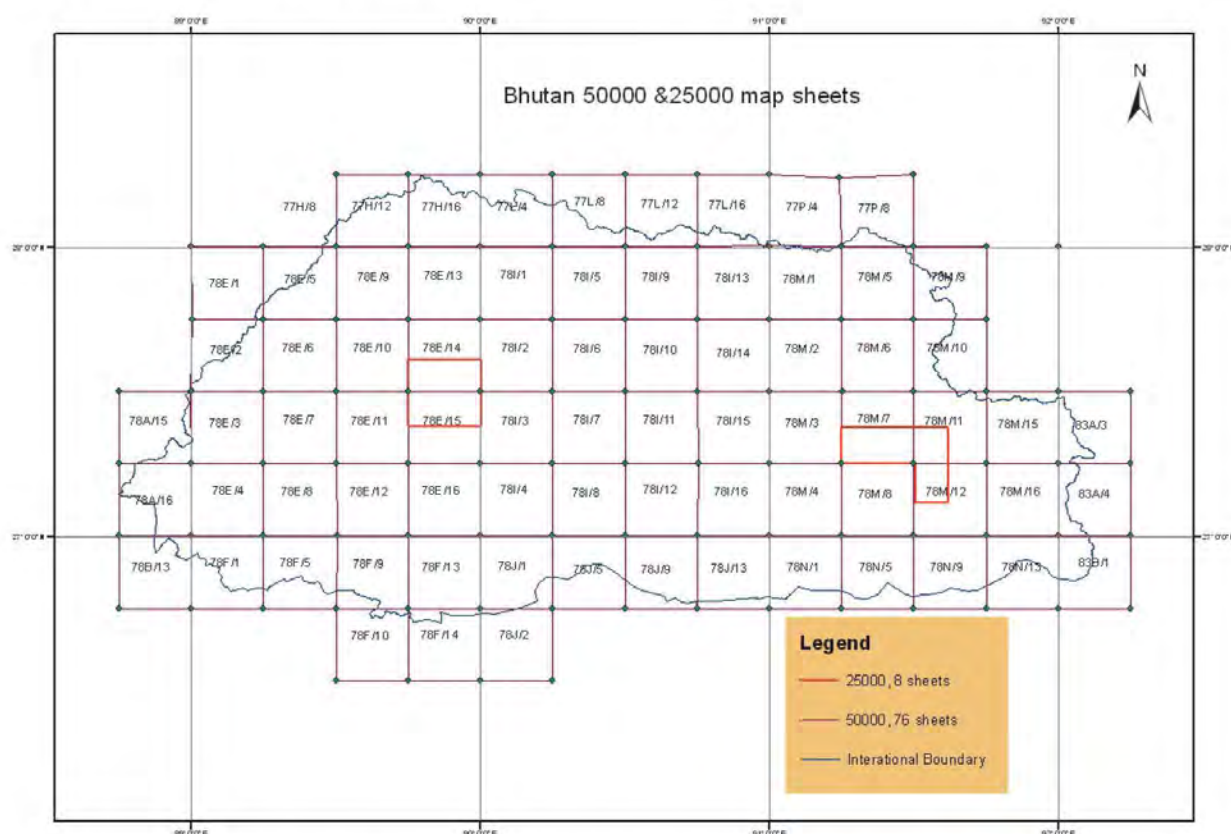
Appendix II-1: Bhutan - 1:50 000 map grid of Bhutan in black, 76 sheets and 1:25 000 map grid of Bhutan in red, 8 sheets
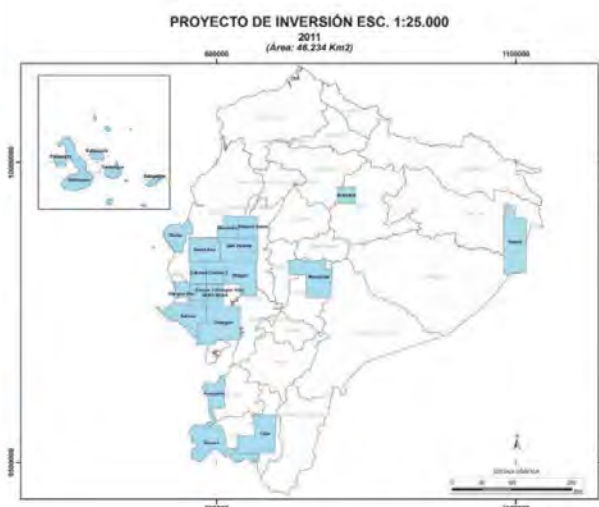

Appendix II-2: Cameroun - 1:50 000 mapping, completed sheets in blue (left) and 1:200 000 mapping, completed sheets in blue (right)

Appendix II-3: Costa Rica - 1:50 000 mapping, completed sheets (left) and 1:5 000 cadastre maps; completed sheets in green, not completed sheets in brown (right)
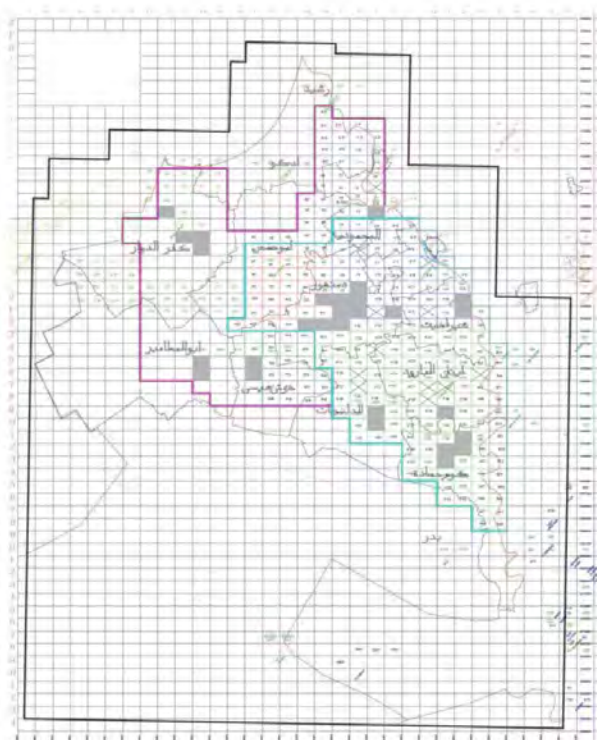

Appendix II-4: Cote d' Ivoire - 1:50 000 mapping; white: not available, yellow: in colour, grey: in black and white

Appendix II-5: Ecuador - 1:25 000

Appendix II-6: Egypt - 1:25 000 mapping of
agricultural areas (Nile Delta) as example

Appendix II-8: El Salvador - 1:25 000
mapping (complete)
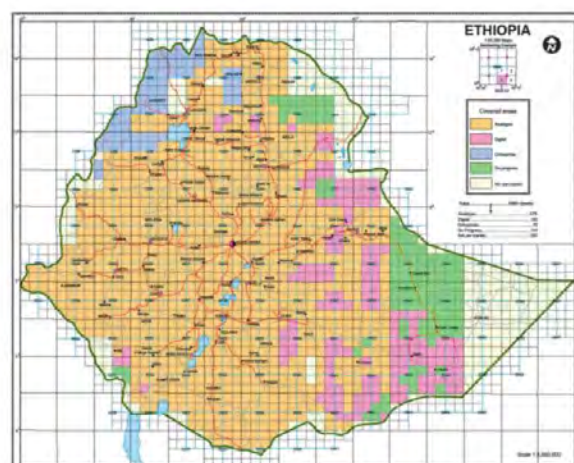
Appendix II-9: Ethiopia 1:50 000
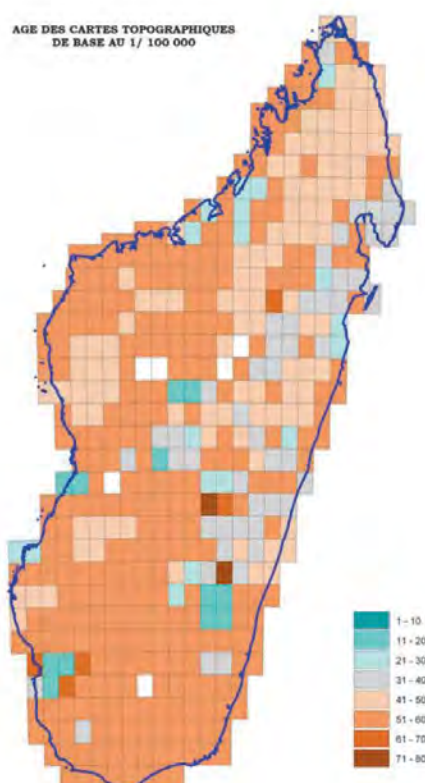
Appendix II-7: Madagascar - 1:100 000 mapping,
age of data: blue: 1-10 year old maps,
dark brown: 71 to 81 years old
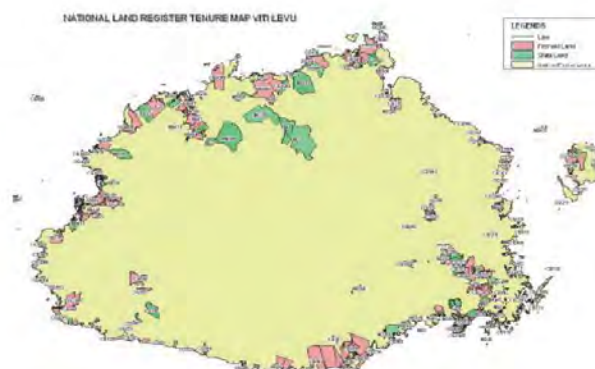
Appendix II-10: Fiji land register
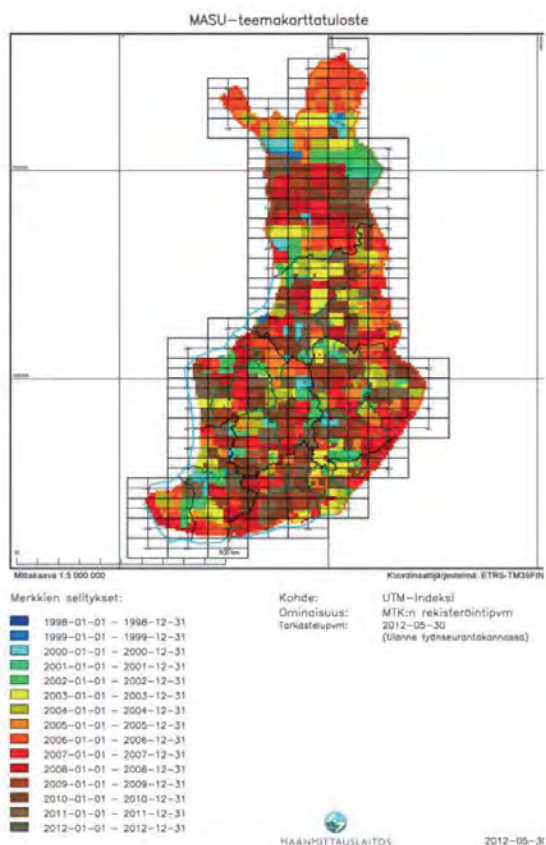
Appendix II-11: Finland - 1:50 000 Thematic
Maps of Finland and their age

Appendix II-12: Finland - 1:50 000 mapping,
age of data between 2005 and 2012
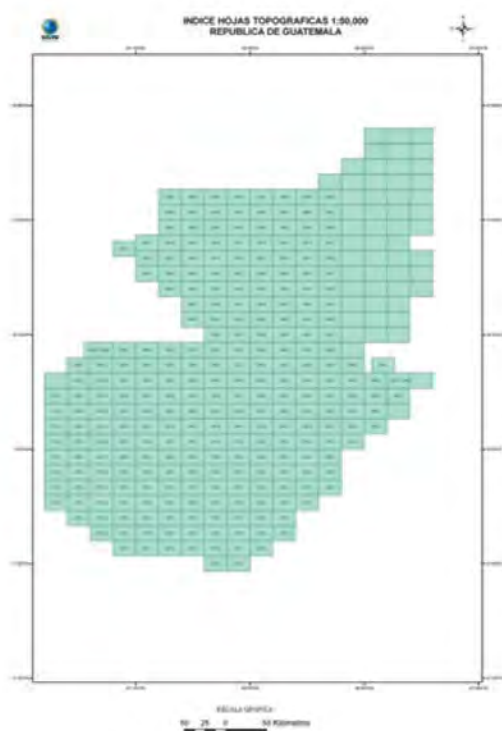
Appendix II-13: Guatemala - 1-50 000

Appendix II-14: Italy - 1:25 000 and 1:50 000
mapping; age of data between 1965 and 2015
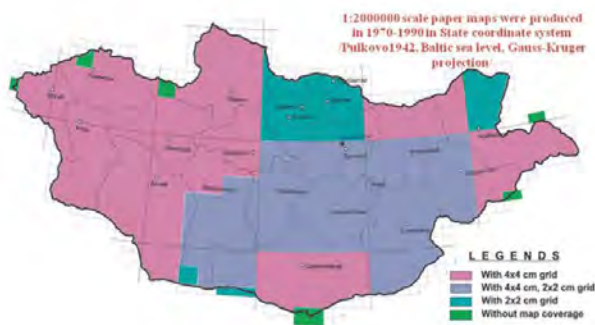
Appendix II-15: Mongolia - 1:200 000, paper map production, 1990

Ulaanbaatar city's 1:1000 scale map covering 100 sq.km of central built up part of city were produced in 2010-2011 funded by Korean KOICA by aerial photography method.

Appendix II-16: Nepal - 1:25 000 and 1:50 000 Mapping of Nepal, 1969 - 2001
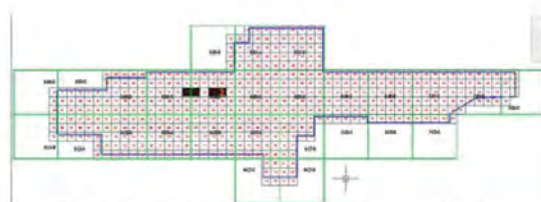
463 sheet maps produced in central part of Ulaanbaatar city covering 100 sq.km.

Appendix II-17: Mongolia - 1:1 000 mapping of Ulaanbaatar, 2010 - 2011

Appendix II-18: Philippines - 1:50 000 Mapping of the Philippines, age of data: yellow: 1947 - 2007, green: 2008 - 2011, violet and red: since 2012
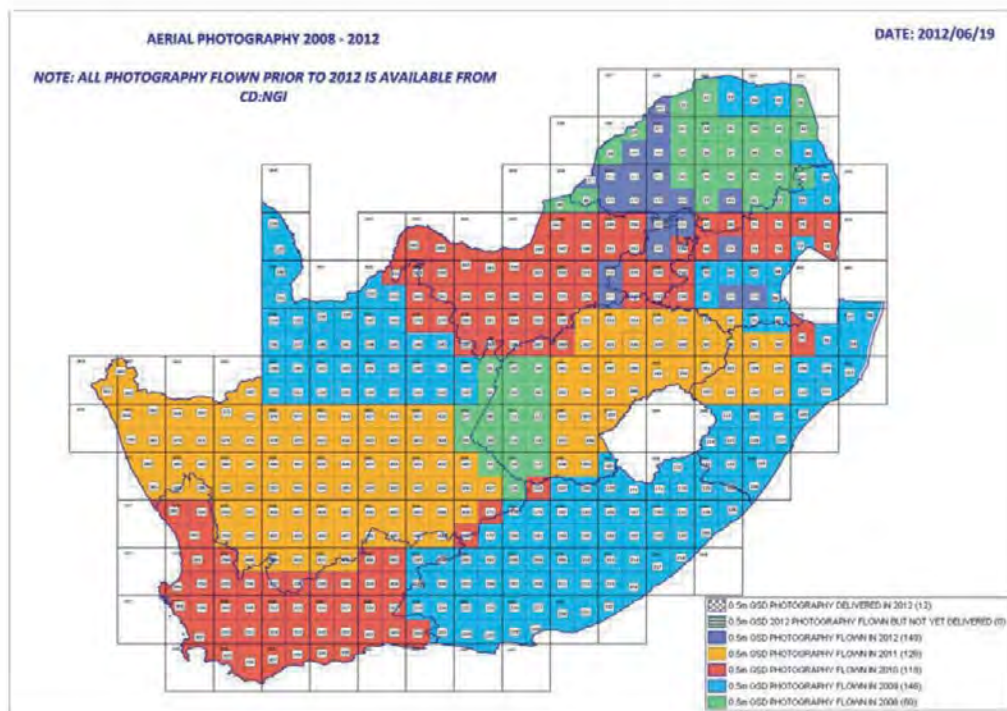

Appendix II-19: Korea (South) - 1: 25 000

43

Appendix II-20: South Africa - 1:50 000 mapping

Appendix II-21: South Africa - 1:10 000 Orthophoto Maps completed 2012

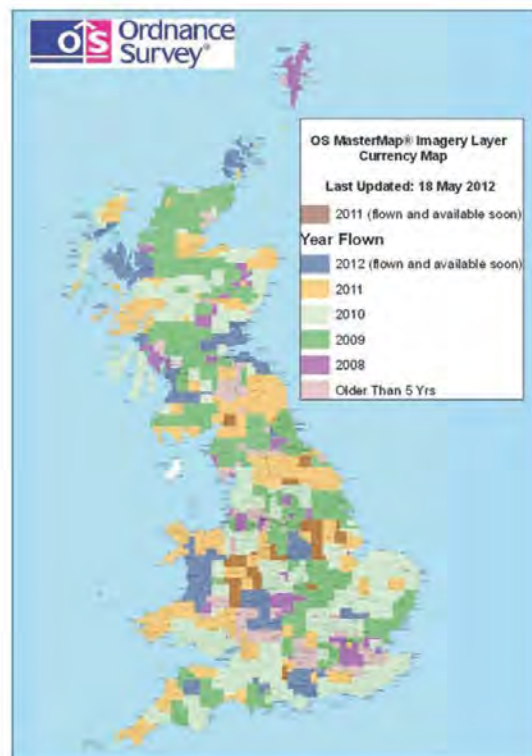Appendix II-22: Uruguay - Map grid for 1:50 000, 1:100 000 and 1:200 000

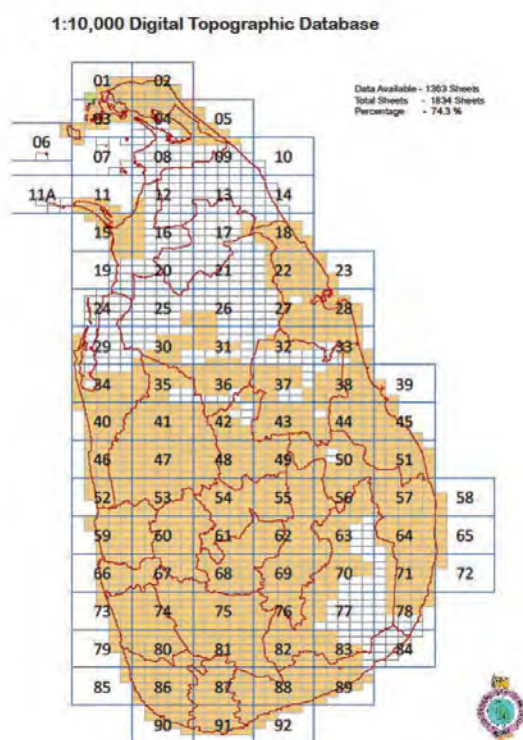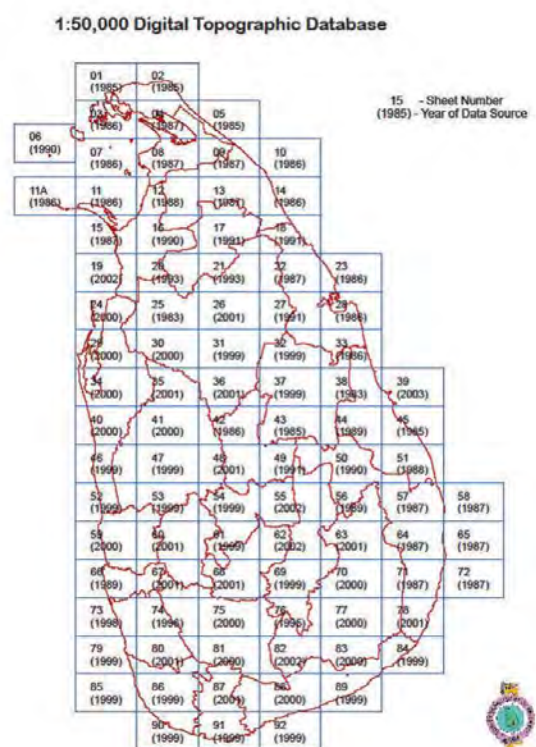Appendix II-23: South Africa - Aerial photographic coverage, 2008 - 2012

Appendix II-24: United Kingdom - content of master map, all updated within 6 months, dark green: 1:1 250, medium green: 1:2 500, light green 1:10 000

Appendix II-25: United Kingdom - Age of Imagery Layer of Master Map, 2008 - 2012
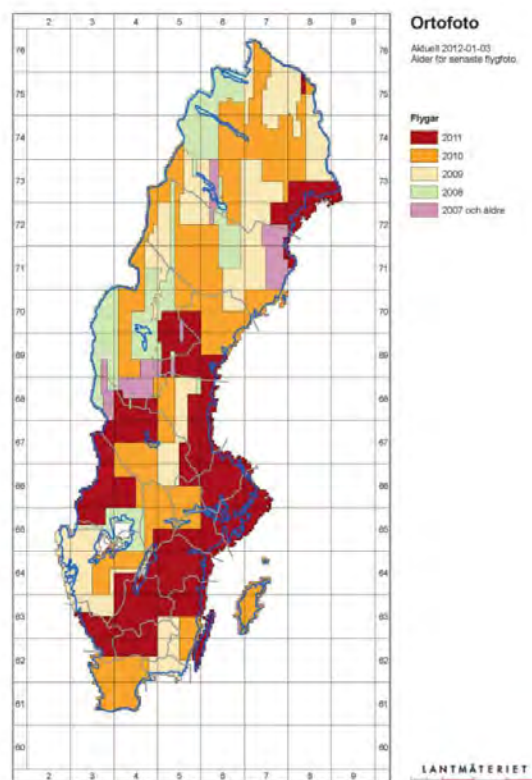

Appendix II-26: Sri Lanka - 1:10 000 mapping, brown: completed

Appendix II-27: Sri Lanka - 1:50 000 mapping completed with year stated

Appendix II-28: Sweden -
Mountain area map 1:100 000

Appendix II-29: Sweden - Age of
orthophotos 1:10 000 (2007-2011)

Appendix II-30: Sweden -
Property map 1:5 000

Appendix II-31: Sweden -
Mapping 1:50 000