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Country Report of Indonesia*

* Submitted by The Geospatial Information Agency (BIG)

COUNTRY REPORT

GEOSPATIAL INFORMATION IN INDONESIA

19th United Nations Regional Cartographic Conference for Asia and the Pacific
18th Permanent Committee on GIS Infrastructure for Asia and the Pacific Meeting

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Submitted by
The Geospatial Information Agency (BIG)
INDONESIA

INTRODUCTION

Indonesia is one of a few countries in the world that has enacted a law on Geospatial Information (Government Act Number 4 Year 2011). This Act aims:

- to ensure availability and access to accountable geospatial information;
- to accomplish efficient and effective implementation of geospatial information through cooperation, coordination, integration and synchronization amongst stakeholders;
- to encourage the use of geospatial information in government and various aspects of daily lives;

In order to achieve the goals, it is very urgent to enforce the use of single reference geospatial data.

One implementation of the Law was the formation of the Geospatial Information Agency (*Badan Informasi Geospatial* in Indonesian or BIG) as a substitute to the National Coordinating Agency for Surveys and Mapping (BAKOSURTANAL). BIG was officially formed through the Presidential Decree Number 94 Year 2011 on 27 December 2011. BIG has a duty to perform governmental tasks relating to geospatial information.

BIG has a broader scope of duty than BAKOSURTANAL, one of which is to provide the basic geospatial information including national geodetic control networks and base maps. The geodetic control networks consist of horizontal, vertical and gravity control networks, while the base maps include topographic maps (up to scale 1:1,000), coastal maps (up to scale 1:10,000) and marine maps (up to scale 1:50,000).

BIG also acts as the coordinator as well as executor of thematic geospatial information development, which are to be produced by one or several institutions depending on the themes. The thematic geospatial information must be created based on the basic geospatial information provided by BIG.

BIG, together with other related government institutions, is also responsible to provide infrastructures for geospatial information. The infrastructures include policies, institutional aspect, technologies, standards and human resources.

STATUS OF BASIC GEOSPATIAL INFORMATION

National Geodetic Control Networks

The National Geodetic Networks consist of Horizontal Control Network, Vertical Control Network, Gravity Control Network, Tide Gauge Stations, GPS Permanent Stations (Indonesia-CORS) and Geodynamic Control Networks. The National Geodetic Networks are presented by the National Geospatial Information Agency to face the need of mapping services and earth science researches and use adequate technology from optic-mechanical instruments to satellite-digital instruments.

Horizontal Control Networks (HCN)

The existing HCN developed consists of 700 of 1000 planned stations. All stations are distributed all over Indonesia covering at least one station in city level. The HCN was initially designed as representation of horizontal coordinate at the surface which is used as reference in the mapping activity. The first and second order HCN were distributed at entire national territory covering every 50 Km2 and maintained by BIG. The lower order of HCN is under responsibility of National Land Agency (BPN) and consists of 27.682 points. The spatial distribution of the zero and first order HCN are illustrated in figure 1.

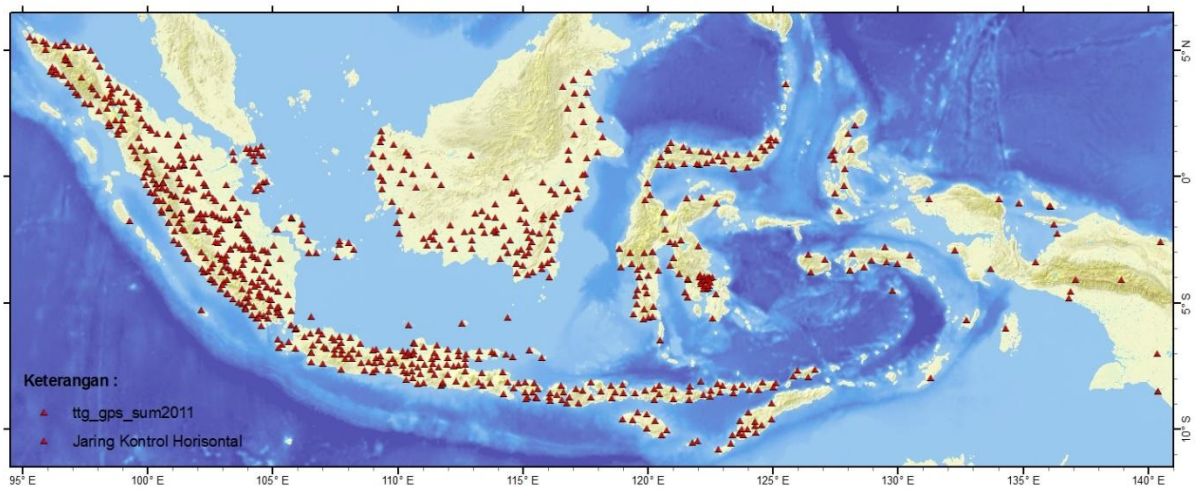

Figure 1. Distribution of HCN in Indonesia

HCN is very useful for single reference both in activity of Base Geospatial information and Thematic Geospatial Information. Recently GPS permanent station (CORS Station) are developed, however the establishment of HCN still needed by user for fulfilling the gap area which is unreached by CORS Station.

Vertical Control Network (VCN)

The Vertical Control Network (VCN) is a vertical reference for national mapping in Indonesia. At this moment 5.911 point of VCN were built and maintained by BIG. VCN is distributed along the national or provincial roads across Java, Sumatera, Bali, Lombok, some part of Sulawesi, some part of Kalimantan and some part of Maluku Islands.

This VCN is a representation of height reference at the surface which measured from tide bench mark (BM) using mean sea level data. VCN is already implemented as height reference for national mapping. In the future VCN is still erected at nearby tide station for fitting the geoid because the national geoid mapping have been carried out and used as national height reference.

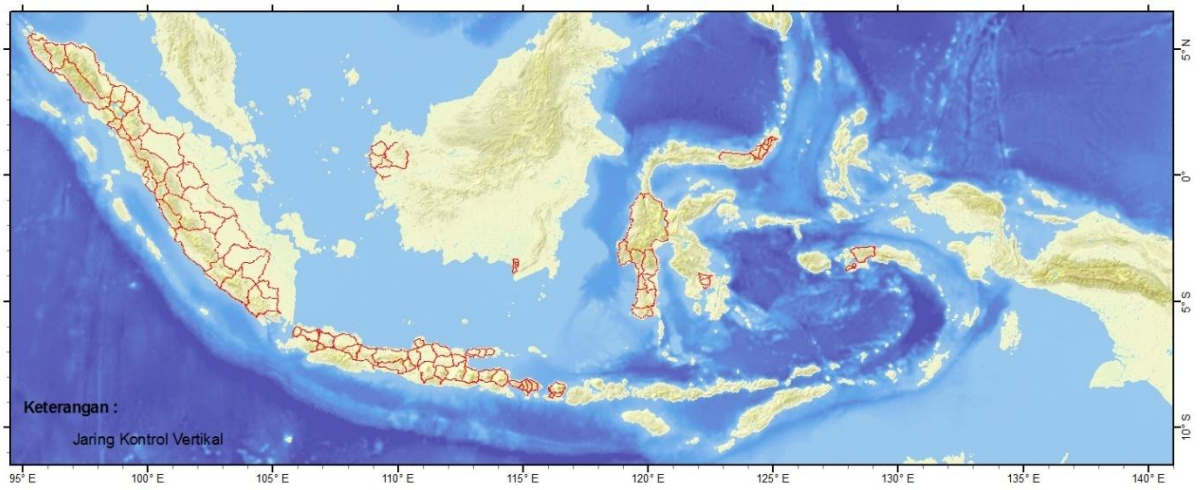

Figure 2. Distribution of VCN in Indonesia

Gravity Control Network (GCN)

The Gravity Control Network (GCN) consists of First Order and Second Order GCN:

- The First Order GCN is distributed in the entire of Indonesia area, mostly represented as a monument of Primary Gravity as depicted in figure 3. The majority of those points are placed at Indonesian airport area. The maintenance of these monuments is carried out through activities such as inventory, repairment and reoccupation every 1 or 2 years. In addition BIG has the absolute gravity measurement at Cibinong using the superconducting gravimeter.
- Second order GCN is established at all Indonesian territory with total of 5.911 points (as shown in figure 2). Almost all of these points are represented as Vertical Control Network or Geodesy Height Mark monument, standard gravity monument and also other points without monument. The maintenance of this Second order GCN is similar to the First Order GCN above.

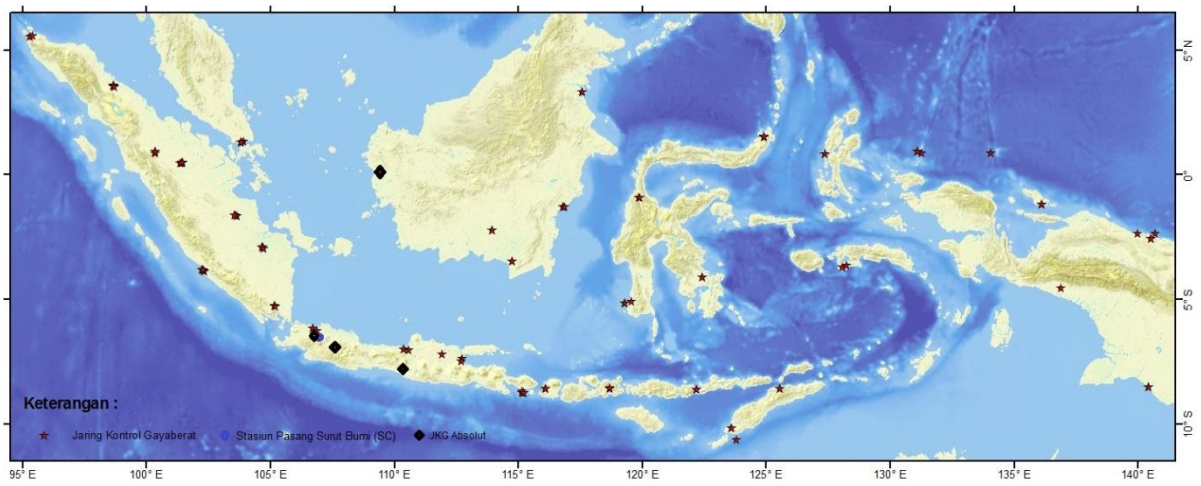

Figure 3. Distribution of First Order GCN, Earth Tide Station and Absolute Gravity Station in Indonesia

The acquisition of gravity data is conducted using the following methods:

1. Terrestrial Gravity survey from 1986 to 2007 which produce 5780 points of First, Second and Third Order of Gravity Control Network and 110 points of Absolute Gravity Control Network
2. Airborne Gravity survey is done with collaboration between BIG and DTU Denmark for area of Sulawesi, Kalimantan and West Papua. In 2012 BIG will launch precision geoid derived from airborne gravity for Sulawesi area.

Tide Gauge Station Network

BIG has 113 tide gauge stations located at all part of Indonesia, as presented in figure 5, and will increase to 120 stations and 125 stations in 2013 and 2014 respectively. However, the ideal tide gauge station for Indonesia is actually around 400 stations.

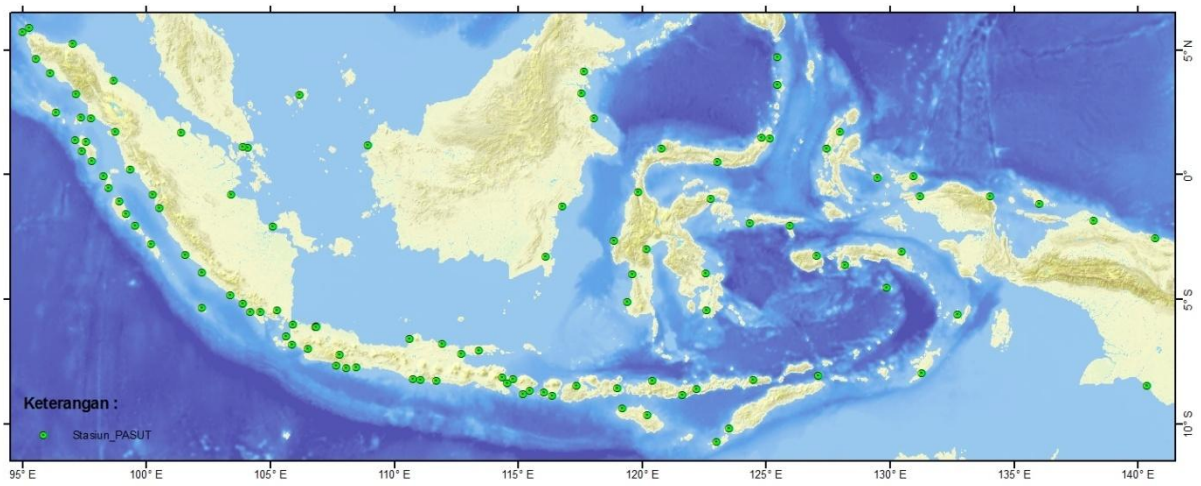

Figure 5. Distribution of Tide Station Network in Indonesia

The tide gauge data are mainly used for mapping. Tide data is important for height reference in Vertical Control Network and furthermore is needed for fitting geoid especially from airborne gravity. Tide data is not just for mapping purpose but also useful for modeling of the ocean model. The tide gauge heading to Indian and pacific oceans area are parts of Indonesia Tsunami Early Warning System.

Tide data owned by BIG is kept in the database system and is connected to Indonesia Tsunami Early warning System (Ina-TEWS) at BMKG to some stations and also to other international institutions.

Indonesia permanent GNSS Stations Network (Ina-CORS)

The establishment of GPS Permanent Station network was initiated in 1996 and consisted of 3 continuously operating GPS reference system (CORS). By supports from the National and Hazard Mitigation Program, BIG succeeded to develop GPS permanent stations with online system up to 118 stations as illustrated in figure

6. These networks contain 100 stations funded from National Budget and 18 stations funded from Indonesia-German Cooperation (GITEWS).

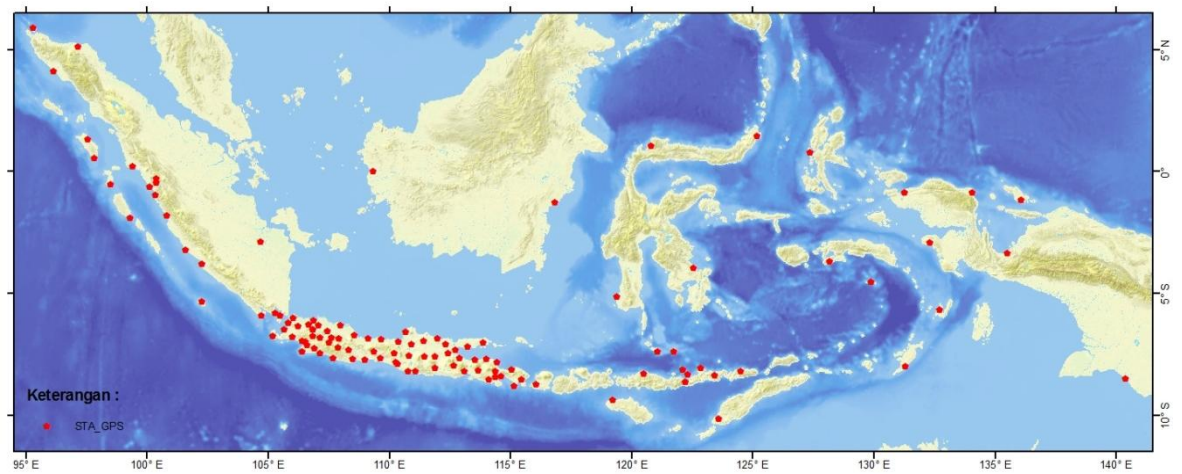

Figure 6. Distribution of GPS Permanent Station or CORS managed by BIG

The objectives maintenance of the permanent GNSS stations network is described as follows:

- To maintain national geodetic reference frame in active seismic zones for survey and mapping purposes,
- Mitigation and crustal deformation monitoring for geological hazard mitigation
- Sea level change monitoring with continuous GPS and Tide Gauge stations
- Collocation and GPS Meteorology to determine PW in the troposphere and TEC in the ionosphere,
- GPS for safety navigation.
- Permanent GPS station is part of the Ina-TEWS (Indonesian Tsunami Early Warning System)
- Maintenance of a national geodetic reference frame, which refers to the global geodetic reference frame (ITRF).
- Service the instantaneous correction positioning with GPS (references in real-time positioning (DGPS/RTK)) for surveying, mapping, navigation and transportation.
- Study geodynamics in Indonesian.
- Mitigation of earthquake disasters

Indonesian Geoid

The distribution and quality of gravity data for Indonesia is not adequate. Most of the gravity data was collected by terrestrial survey and could not cover all the Indonesian territories with complex geology structure. Therefore the geoid was not enough to be used as replacement of vertical references control network that measured from spirit leveling. Hence, the air borne gravity was introduced to improve the national geoid data.

Since 2007, BIG has collaborated with Denmark Technology University (DTU) space and has conducted the air borne gravity survey. The airborne gravity survey has been conducted since year 2008 and has yielded a set of GPS kinematics position and Free-air gravity anomaly data along the flight strips. This set of data then be gridded into 6' interval data. Covered survey area is depicted in Figure 7. Detail of the air borne gravity survey periods are described as follows:

2008 : Sulawesi (44,000 line km)
2009 : South and East Kalimantan (45,000 line km)
2010 : Western Kalimantan and Western Papua (56,000 line km)
2011 : Western Papua.

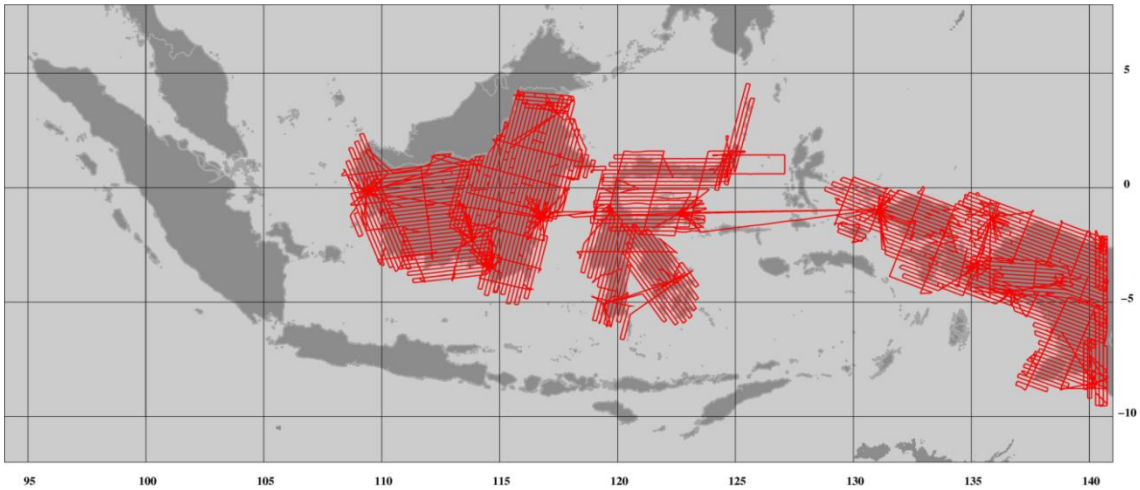

Figure 7. Indonesian Airborne Gravity Survey A joint BIG, NGA and DTU project

Sample of the geoid map that produced form airborne gravity data is illustrated in figure 8.

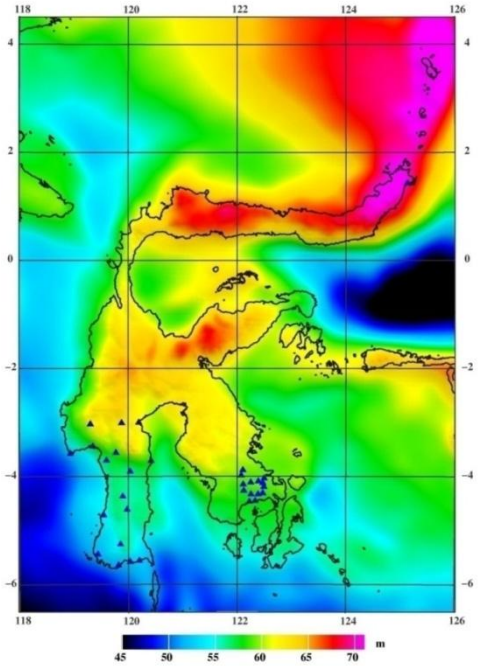

Figure 8. Geoid of Sulawesi

Topographic Maps of Indonesia

Although the Law about Geospatial Information has mandated BIG to provide topographic maps up to scale of 1:1,000, currently the availability is as follows:

- 306 map sheets of scale 1:250,000 covering the whole Indonesia

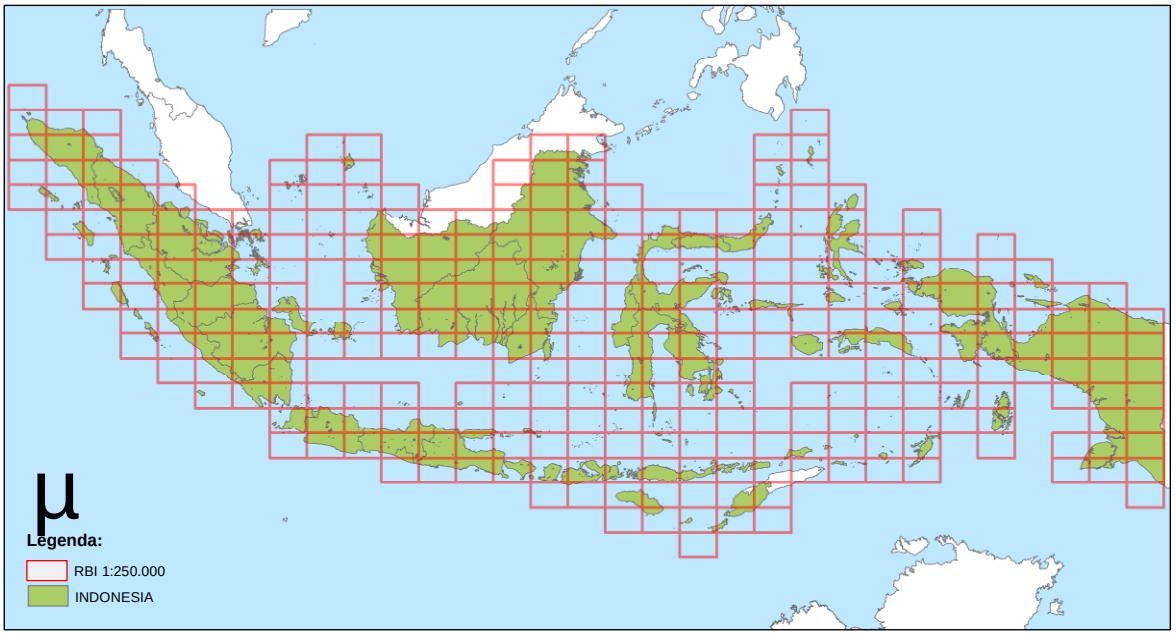

Figure 9. Map index scale 1:250,000

- 2536 map sheets of scale 1:50,000 covering part of Sumatera, whole Kalimantan, Maluku, Papua and Sulawesi Islands.

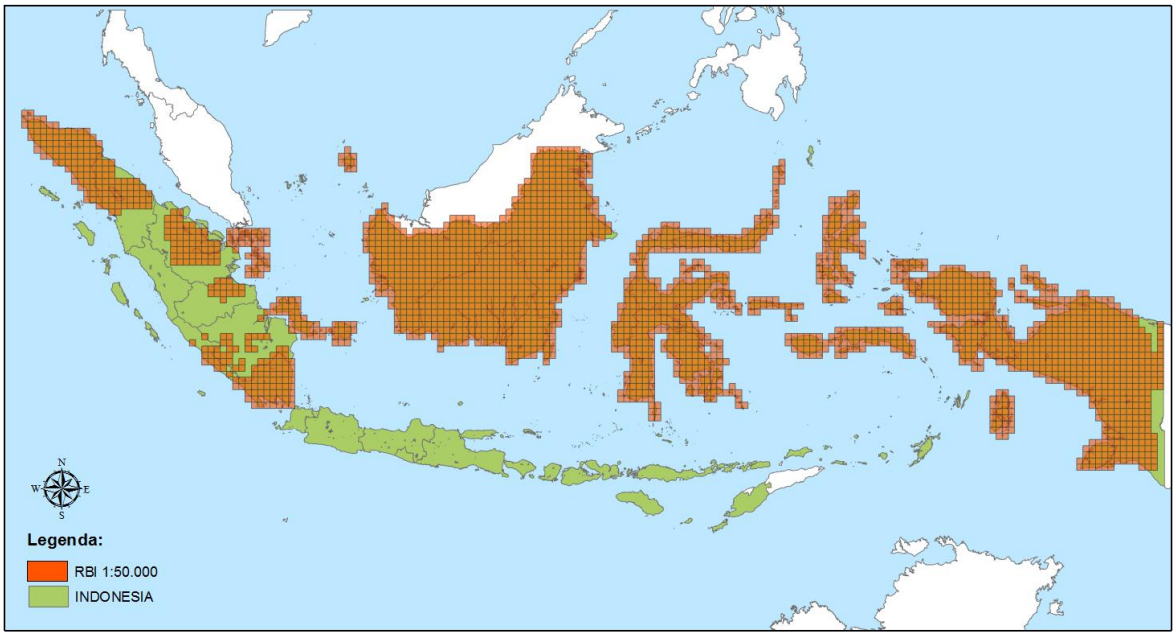

Figure 10. Map index scale 1:50,000

- 2119 map sheets of scale 1:25,000 covering whole Java, Bali and Nusa Tenggara, and part of Maluku, Papua, Sumatera and Sulawesi Islands.

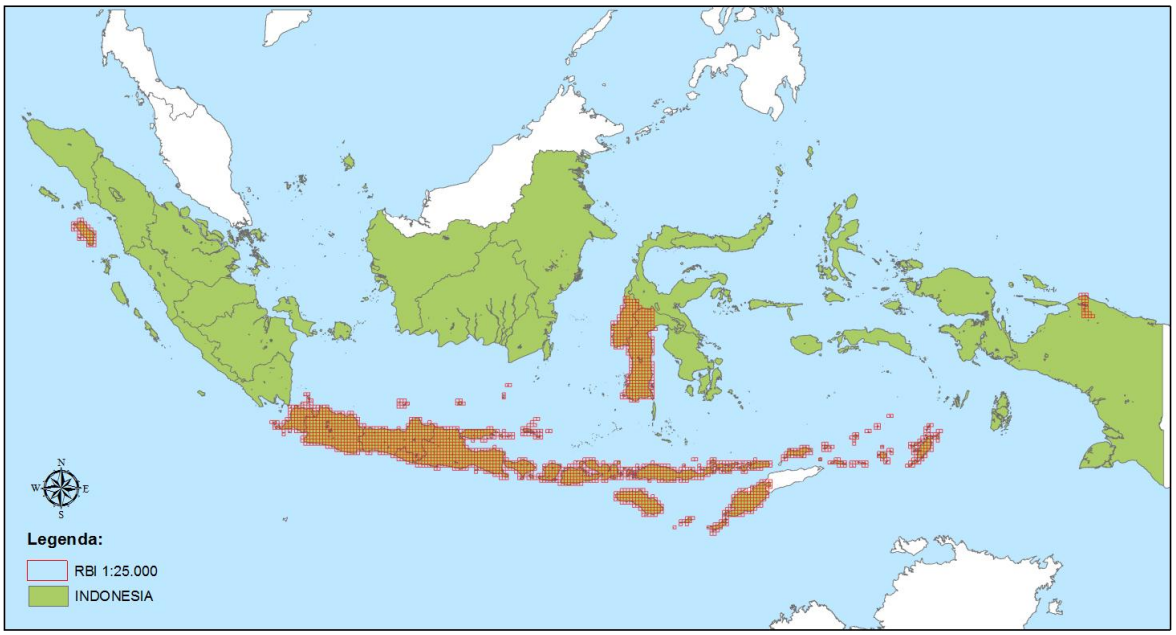

Figure 11. Map index scale 1:25,000

- 790 map sheets of scale 1:10,000 covering some areas in Jakarta, West Java, West Nusa Tenggara, Nangroe Aceh Darussalam, North Sumatera, West Sumatera, Riau, Jambi, Bengkulu, South Sulawesi, Gorontalo and North Sulawesi.

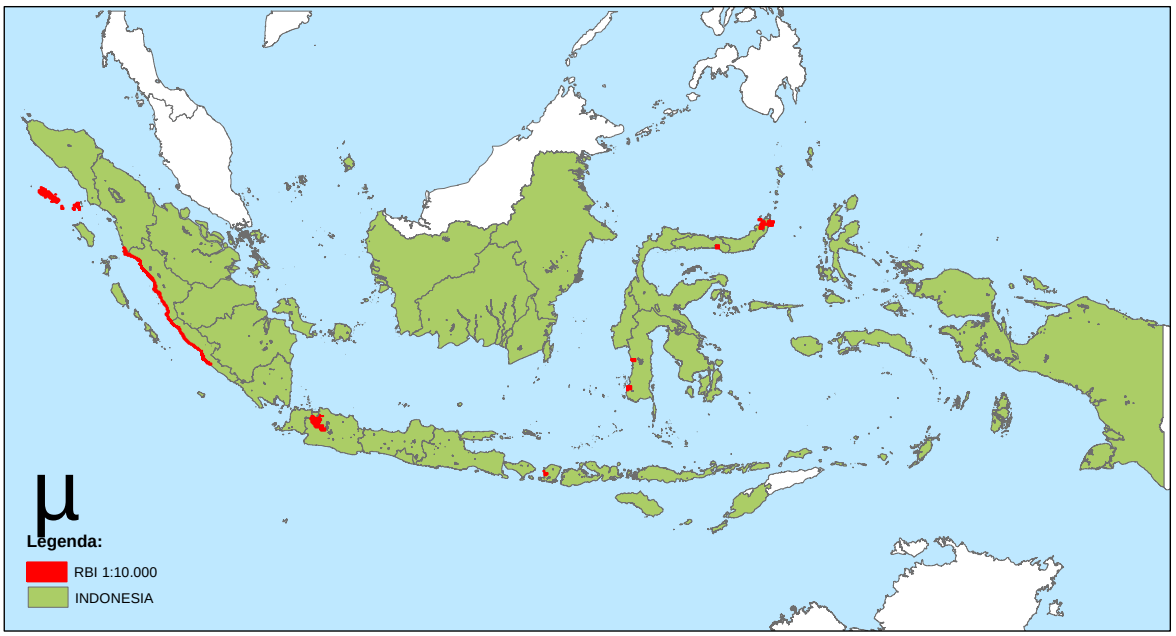

Figure 12. Map index scale 1:10,000

COLLABORATIVE WORKS IN THEMATIC GEOSPATIAL INFORMATION

Revision of Moratorium Indicative Map

Presidential Instruction Number 10 year 2011 on New Permit Moratorium and Improvement of Natural Primary Forest Governance and Peatland was intended to balance and harmonize economic, social, cultural and environmental as efforts to reduce greenhouse gas emissions through reducing emissions from deforestation and forest degradation. The Presidential Instruction was a response to global concerns about the governance of natural resources in Indonesia, particularly related to the use of forests and peatlands.

The Presidential Instruction gives a mandate to the Minister of Forestry, Minister of Interior, Minister of Environment, Head of the Presidential Working Unit for Supervision and Control (UKP4), Head of National Land Agency (BPN), Head of National Spatial Planning Coordinating Board (BKPRN), Head of Geospatial Information Agency (BIG), Head of REDD+ Task Force, the Governors and the Regents/Mayors to take steps required by tasks, functions, and authority of each to support the new licensing delays of primary natural forest and peatland conservation in the forest, protected forest, production forest area and other uses.

The Instruction also gives a mandate to the Head of BIG for renewing maps of forest cover and peatland corresponding Indicative Map of New Permit Moratorium (PIPIB) in the forest and other uses every 6 (six) months. The revision of PIPIB is conducted by BIG, Ministry of Forestry, Ministry of Agriculture, and BPN, coordinated by UKP4. In Technical Team, each institution synergizes to share data and technical support needed to update forest cover/land cover, and land title (HGU) in primary forest and peatlands.

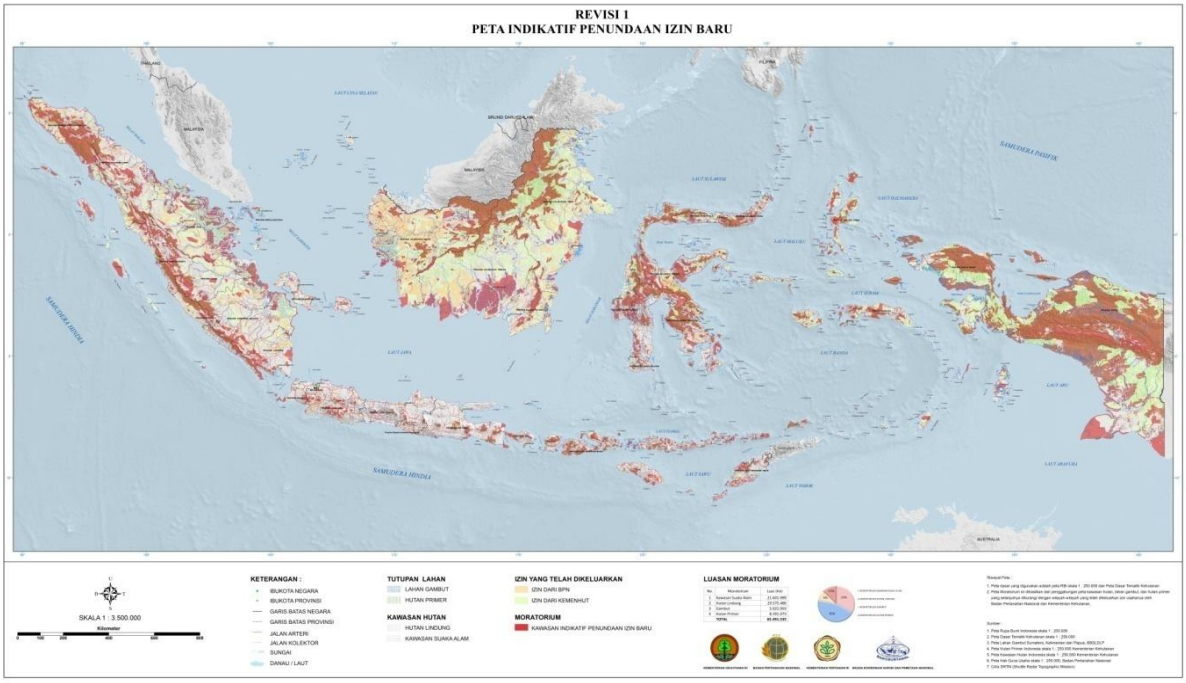

Figure 13. PIPIB Map Revision 1

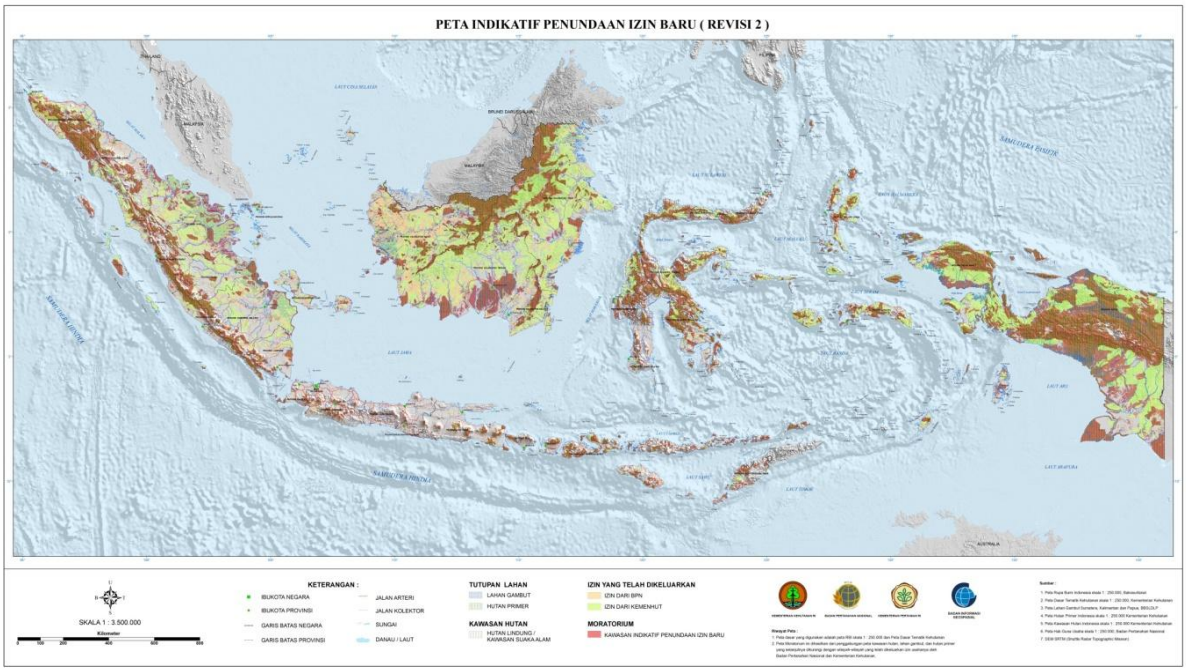

Figure 14. PIPIB Map Revision 2

Natural Resources Inventory

In order to meet the demand for geospatial information on environment and natural resources, BIG performs a variety of activities producing geospatial information of various themes on land and sea, such as:

- Scale 1:1,000,000 (36 sheets) covering the whole Indonesia on themes of mineral resource balance, water resource balance, coastal land form, sea surface temperature, coral reefs distribution, mangrove ecosystem balance, and many more themes
- Scale 1:250.000 of land cover maps covering Sumatera and Kalimantan Islands (102 sheets), water resource balance of Java Island (19 sheets), forest resource balance of Kalimantan Island (52 sheets), and multi hazard vulnerability of Gorontalo Province (52 sheets), coastal demography, mangrove distribution, and more.
- Scale 1:50,000 of flood vulnerability covering regencies/cities that are at risk such as Pekanbaru, Kediri, and Barito Kuala, land form and ecosystem of outermost small islands in North Sulawesi and Kep. Riau Provinces (8 sheets), and more.
- Scale 1:25,000 of Land Cover map covering part of West Java and Banten (307 sheets) and Bali (19 sheets).

Regional Development Planning (RDP)

RDP is one of the usage of spatial data and information that are analyzed together with statistics/textual data using dynamic system and advanced spatial analysis methods to support decision making in relation to the regional development

planning. The National Mid Term Development Planning (RPJMN) has been criticized that it has no spatial sense and it is considered merely a sector based planning. The planning in RPJMN is more driven by market that is intended to gain short term advantages rather than to obtain long term goal in sustainable regional planning based on local potential for development. In 2011 dynamic spatial model was developed to plan the development of some areas in West Nusa Tenggara, North Sulawesi and South Sulawesi based on their potencies in agriculture, livestock and fisheries. This year Kalimantan and Sulawesi Islands were selected as study areas.

Global Mapping

BIG also participates in Global Mapping project driven by the International Steering Committee for Global Mapping (ISCGM) headquartered in Japan. Until 2011 BIG already submit 28 sheets including 4 themes in vector format (population, boundaries, hydrograph and transportation) and 3 themes in raster format (landuse, landcover and elevation).

Spatial Planning

BIG currently plays an important role in guarding the establishment of Regional Spatial Planning. BIG is a member of National Spatial Planning Coordinating Agency (BKPRN), in which BIG has a task to geometrically verify and validate the Regional Spatial Planning maps that have been created by each regional government (province/district/city). BIG already produced and provided base maps of scale 1:250,000 to be used for spatial planning at province level, as well as specification, codification, database and layout standards to be used for spatial planning.

GEO-SPATIAL DATA INFRASTRUCTURE

NSDI Project in Indonesia

Geospatial data and information need to be updated periodically in order to be utilized to support sustainable development planning. Law Number 25 Year 2004 about the National Development Planning already mandated that the planning must be based on accurate and accountable geospatial data and information.

Long before the birth of Government Act Nr 4 about Geospatial Information in 2011, BAKOSURTANAL (the predecessor of BIG) led the way to the birth of Presidential Decree Number 85 Year 2007 about National Spatial Data Network. The Decree was intended to build a system that can facilitate and accommodate any kinds of spatial data generated by various institutions in carrying out their respective functions for the development of National Geo-Spatial Data Infrastructure (NSDI).

In the Decree, a variety of issues related to data sharing among network nodes has been organized and BIG acts as Network Node Connector. Although the Decree only regulated 14 government institutions, up to now BIG has already connected 95 nodes in central and regional level.

Since 2007 there has been an NSDI Development Project in Indonesia and it is scheduled to finish in 2014. The objective of this project is to achieve good governance of central as well as local governments efficient administrative works and evasion of duplicated investments and works in the production of geo-spatial data through (1) acquisition and production of geo-spatial data of Sumatra island, (2) development of National Geo-Spatial Data Infrastructure (NSDI) networking system and (3) utilization of NSDI to support Regional Development Planning for provincial governments, thereby contributing to the appropriate management of natural resources, protection of environment and mitigation of natural hazard, and ultimate contributing to overall economic development of Indonesia.

As a result to the NSDI project, Indonesia has been establishing a National GeoPortal (Ina-GeoPortal) addressed at http://tanahair.indonesia.go.id. Through this portal, the network nodes share their geospatial data to be used by other institutions.

High Resolution Satellite Imagery

Regarding the highly occurrence and experience on natural disasters in Indonesian country, the Central and Local Government Institutions need to manage the post disasters situation and condition, these have to be implemented in order to support and provide better services to the citizen. Based on the previous disaster experiences, many Government Institutions need an access to Current High Resolution Geospatial Data and Information, such like very expensive High Resolution Satellite Imageries (HRSI). Due to the existing End User Licensing Agreement (EULA) condition, costly purchasing duplication on the HRSI at the same area for many purposes cannot be avoided by many Government Institutions, and at the end this will produce duplicated geospatial information which have different accuracy and reliability, consequently it will result in inaccurate planning and decision making management, and also the HRSI cannot be shared among Government Institutions.

Concerning the problems above, the Indonesian President issued the Presidential Instruction Nr. 6 Year 2012 related to the new regulation on purchasing and providing HRSI in internal Government Institutions only. In general, the Presidential Instruction states on the following matters:

1. Provide a single EULA for the Government Institutions uses only;
2. The HRSI is procured and radiometrically processed by the National Institute of Aeronautics and Space (LAPAN);
3. The HRSI is orthorectified, managed, and shared through National GeoPortal (Ina-GeoPortal) by the Geospatial Information Agency (BIG);

4. The orthorectified HRSI is used as the GeoReference Data to produce Large Scale Topographic Maps which is stated in Government Act Nr. 4 Year 2011 regarding Geospatial Information;
5. The HRSI needs are identified through the annual National Coordination Meeting which is organized by BIG and LAPAN.