Research Achievement Report

Taikichi Mori Memorial Research Fund

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Research Title:

Making Smallest Administrative Unit Base Map from Village Sketch Maps of Indonesian Population Census 2010.

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Introduction

Integrating Public Administrative Data for Geoenvironmental Research and Analysis requires appropriate base maps. A small administrative unit base map is better for more accurate analysis. Unfortunately, such base maps are not available in Indonesia. Develop such base maps is therefore important. This research will develop base maps for integrating PAD in Indonesia using smallest administrative units approach. Smallest administrative unit in Indonesia is called Rukun Tetangga (RT)/the neighborhood association which comes from the Japanese system Tonarigumi (隣組). This system was actually first introduced by Japanese Military Administration in Indonesia in 1944 and is still applied until of today. One of possible opportunity for developing such base maps is using village sketch maps generated by Indonesia Statistics prior to national Population Census 2010 in which block census maps may contain smallest administrative units in the generation. If this base map can be developed it will be very important for enriching Indonesia National Spatial Data Infrastructure (NSDI).

Smallest administrative unit is the lowest hierarchy of government machinery. It is in consequence becomes the smallest unit in which government data can be aggregated. Therefore it is the highest resolution can be achieved to represent the data into spatial analysis. However, not every country has yet developed base map of the smallest

administrative unit. Particularly in a form of geo database which is essential for Geographical Information System analysis.

There are many challenges contributing to the lack of smallest administrative unit base map. One of them is the complicated nature of smallest administrative unit delineation. For instance, in Indonesia smallest administrative unit boundary is very uncertain. In most cases, only locals know well the boundaries. On the other hand with the delegation of authority to governing the administrative systems from central government to local government, establishment and amalgamation are not uncommon.

Despite the complexity, it is important to develop a base map of smallest administrative unit so that further analysis of spatial dimensions of government data can be done.

Research Site

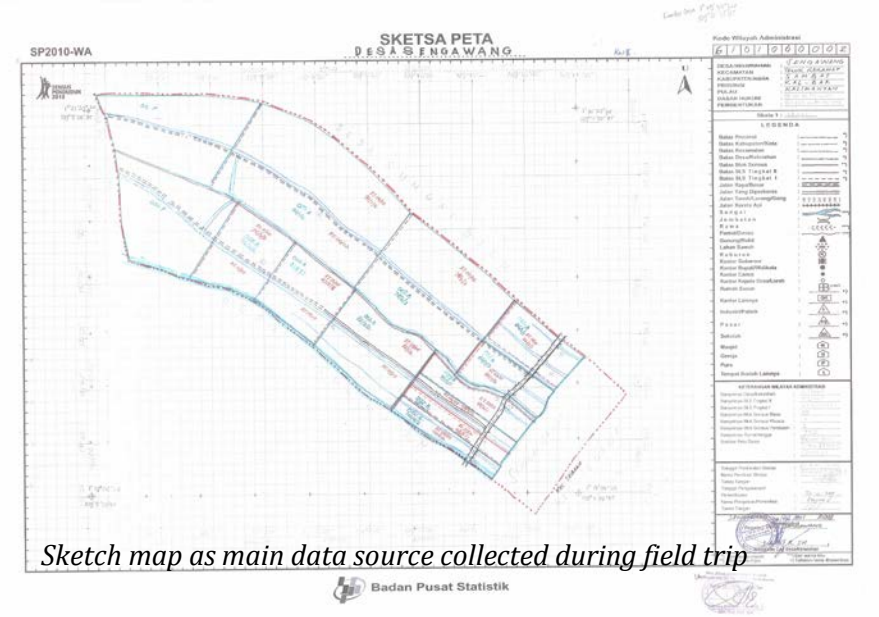
Sambas Regency in West Kalimantan Province of Indonesia has several tropical peatland ecosystems. Those areas experience regular wild fire events that cost much of economic and social losses. One of the tropical peatland ecosystems which has increasing experience of wild fire is Sebubus Forest.

Sebubus Forest consists of an area around 14.100 hectares. It lies between Natuna sea on its west side and Sambas River on its East Side. It is legally stated as *production forest*/ Hutan Produksi (HP) based on Indonesia regulation (Ministry of Forestry, 2014). Around 5.000 ha of the forest area is categorized as deep peat soil (more than 6-meter depth) [9]. It is unique peatland area, since it is surrounded by paddy fields and local agriculture land. According to administrative map of Sambas Regency, Sebubus Peat Forest is situated within 21 villages in four subdistricts namely Kecamatan Tekarang, Kecamatan Teluk Keramat, Kecamatan Jawai, and Kecamatan Tangaran.

Activities:

Activity 1: collecting and Understanding the data

One of possible data can be used to develop such base map is village sketch maps of population census 2010 in which maps were used to help surveyors on tally the population. The maps were generated using methods uniformly applied for whole country. Thus, it can be assumed that, despite this research is only a case study it can be applied in some extent to whole the country.



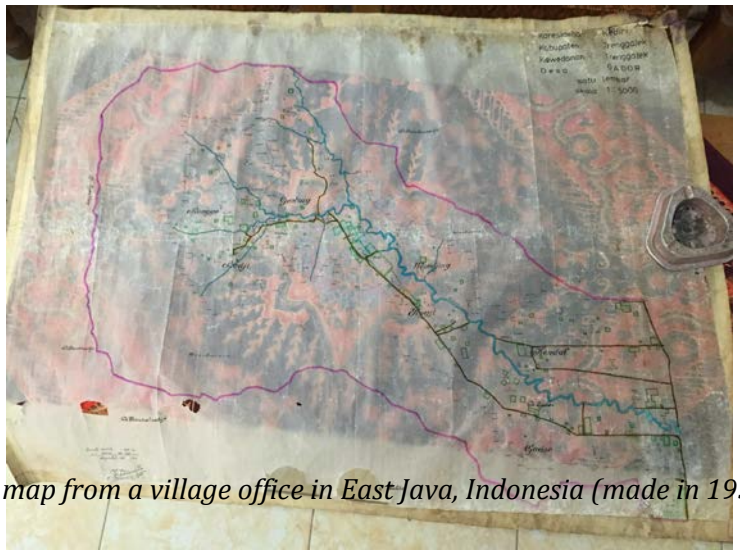
Sketch map as main data source collected during field trip

The maps are sketch maps depict some critical elements essential for population census purposes. Among the elements are administrative boundaries drawn in specific features. The other important elements are landmarks scattered within administrative areas. Those landmarks can help us in determining the position of administrative units.

Sketch map is a product of cognitive process. Spatial inaccuracies are nature of the products.

Therefore, developing a metric base map based on the product can be very challenging. Yet this research is attempt to do that with two expectations:

First, developing a scheme to metricized the sketch maps. Hopefully, this can be a contribution to the national spatial data infrastructure.



Old map from a village office in East Java, Indonesia (made in 1953)

Second, assessing the accuracy of the base map. This can be a contribution to the theoretical development of the sketch mapping.

The data collection was carried out in two places. First, the data was collected in Sambas regency of West Kalimantan, Indonesia. The data was obtained from Indonesia Statistics Sambas Regency Office. The second place is in East Java. However, the data collected in this area is not as expected. The purpose of collecting data in East Java is to find comparative data.

Activity 2: Digitization

Collected Data were digitized using developed scheme. Quantum GIS application was used in the digitization. Sketch maps of 30 villages around Sebubus forest were geo-referenced using a plugin in the application. Several tests were conducted to figure out a best geo-reference method. Later the sketch maps were digitized village by village and then mosaicked as picture below.

This digitized sketch map is very raw and inaccuracies apparently exist. For example, overlap among villages area are common problems. Some overlap seems to be resulted from geo referencing process. This type of overlap is acceptable since geo reference process always has residual, which resulted in inaccuracies. However, it is also found in this case that some overlap may resulted from non technical aspects. Territorial conflict is one of possible cause.

The other cause of inaccuracy is related to the current base map in which

the data were projected. The base map used was geo database obtained from local government (Sambas Regency). The geo database is developed since long time ago. Yet the base map has never been assessed of its accuracy.

However, the most important issue in the digitization of sketch map into metric base map is the nature of the sketch map itself. As afore mentioned, sketch maps is product of cognitive process. In this case, despite the mapping process was guided with a uniformed guideline, mappers' individual cognitive process unavoidably influence the accuracy of the sketch map. Moreover, sketch map is something very schematic. Information drawn on the paper is usually information in limited aspects.

Therefore, an alignment method is required to fixed the problems. The alignment is required to improve the accuracy of the metric base map.

Activity 3: Accuracy Assessment

After the digitization of the sketch maps, an assessment is required to understand the accuracy of the new developed base map. The assessment was done by collecting sample points in the ground. More than 150 sample points has been collected using GPS device. For the purpose, some locals who knew the area well were employed because the location is remote area with challenging transportation routes.

The sample points were the locations on the ground in which the landmark can be identified with high degree of certainty as locations belong to particular neighborhood association.

The coordinate of the location and the name were recorded. They are later brought into computer analysis.

The other sample points are exact border of neighborhood associations and villages. Similar to the procedure for area based sampling, border line base sampling also looking for landmarks on the ground as identification.

Activity 4: Workshop

A workshop was held at Japan Space System. This workshop is a workshop attended by Indonesian President's Special Envoy for Climate Change and Environment.

Summary of discussion as follows:

"Workshop on Carbon Management of Peatland-Coastal Ecosystems"
Date/Time: 20th December 2017, Time: 13:00-16:15 Venue: Meet
Systems, Tokyo, Japan
Objective: To understand peatland-coastal ecosystems with chemical property of humic substances, mangrove reforestation-conservation and advanced remote sensing technology; "SHIMADA" model, InSAR and hyper spectral "HISUI"

Picture Courtesy of Japan Space System

Comments:

Peatland ecosystem

1. We had a good seminar today: peatland modeling, chemical properties and boundary estimation. Indonesia needs such information especially peatland boundary. Many stakeholders are behind.
2. Capacity building for peatland management is important in not only central governments, but also for local stakeholders; local governments, local universities, farmers and private sectors.
3. We have to consider about how to bring information to local communities. Also awareness is necessary for them to raise the importance of peatland wise-use.

4. HyperspectralHISUIcouldbeusefulsensorforpeatlandassessment,suchas peat forest classification, biomass estimation and DOC estimation from terrestrial carbon discharge from peatland to coastal-ocean regions.
5. Peat depth estimation model shown by Dr.Shimada is a good approach. It is important model to improve current peat depth estimation. Because so far there is no relevant approach to provide peat depth based on scientific model.
6. Rewettingbydamsfordegradedpeatlandareimportantenvironmentallyand politically.

7. There are many methods to try to map the peatland extent. Most reliable and low-cost approach is drill hole survey based on the satellite image- GIS analysis. Japan Space Systems conducted 66 drill hole survey funded by the Ministry of Environment Japan in FY2016. About 40,000 hectares of peatland was newly discovered in Central Kalimantan.
8. Indonesia is wide, and it has rich forests. Private companies can be stakeholders for considering about good peatland management and sustainable use (wise-use).
9. The importance of humic acid was recognized in discussing Peatland-Costal Ecosystem. The peatland produces and retains a fair amount of humic substances which can not only improve soil properties, but can also enhance/accelerate the growth of the plants, similarly to growth hormones and enzymatic action. The humic substances in peatland are considered to migrates to coastal area and basically controls the ecosystem of coastal area.

Coastal ecosystem

10. Mangrove forest is one of big issues in Indonesia. Coordinating Minister for Economic Affairs issued regulation No.4/2017 (1) wants to know how to expand good mangrove forest for double targeting to 2045.
11. Sea grass is also one of issues. At World Carbon Conference on September 2017, they discussed carbon stock links to economy as well. Restoring mangrove is also a key to save CO2 emission.
12. Blue carbon was a hot topic at COP 23, Bonn, 2017. In general, accessibility to mangrove areas are difficult. Remote sensing is one of good technique to monitor mangrove forest. Ground survey and remote sensing are good approach to know how much carbon stocked in mangrove areas. Regulation No.4/2017 of Coordinating Minister for Economic Affairs: regarding strategy, progress and indicators for mangrove reforestation targeting to doubling a good mangrove area from 1.7 million hectares in 2017 to 3.0 million hectares in 2045.
13. Mangrove is source of income to local communities because of the good habitats for fish, crab and others.
14. Methodology is one of Indonesian problems. Indonesians do not have skills even they have had ODAs. Achieving skills is now important for sustaining. Their definitions and recognitions are different.
15. Private companies invest to environmental activities such as reforestation of mangrove not only CSR but also ESG investment. For instance, Tokyo Marine Insurance cooperation support Mr.Kogo's activities on mangrove reforestation in Myanmar.

16. Sagu is very important commodity in peatland. It is only one sustainable agricultural product in acid and poor nutrient conditions such as peatland. we would like to learn plants or species that can grow sustainably in peatland.
17. Remote sensing technique is advanced, but researchers need field data. Central and local governments have to open data, and they have to make data access simple and easy. Field data are required to improve monitoring and modeling.

(Summarized by Hirose Kazuyo; Japan Space System)

Pictures during sample points collection.