

Urban Monitoring using Former Japanese Army Maps and Remote Sensing : The 100 Years of Urban Change of Jakarta City

J. Tetuko S. S.¹, I. Indreswari S.², and R. TATEISHI¹

¹ Center for Environmental Remote Sensing, Chiba University, 1-33, Yayoi, Inage, Chiba 263-8522 Japan, Tel +81(0)43 290 3840 Fax +81(0)43 290 3857, Email jtetukoss@faculty.chiba-u.jp or tateishi@faculty.chiba-u.jp

² Department of Architecture, School of Graduate Study, Institute of Technology Bandung, Jalan Ganesha 10, Bandung 40132 Indonesia, Tel +62(0)22 250 1214 Fax +62(0)22-250 8059 Email innes@bdg.centrin.net.id

I. Introduction : a brief history of Jakarta city

From prehistoric time to Muslim and Hindu-Javanese kingdoms, the Jakarta area (now the capital of Republic of Indonesia) was a small village called Sunda Kalapa In the twelfth century¹⁾ it appears to have been a harbour for a Hindu-Javanese kingdom called Padjajaran, the capital of which was near the present mountain resort of Bogor, south of Jakarta. A port on the Ciliwung river (see Figure 1) emerged as an important part of Indonesian trade. The importance of Sunda Kalapa was similarly affected as the port of Malacca on the west coast of Malaya that was conquered by the Portuguese in 1511. The Sunda Kalapa was renamed to Jayakarta (Victorious and Prosperous) by the sultanate of Banten

Then this area was started to develop by building of Dutch East India Company (VOC) fort on west bank of the River Ciliwung in 1619²⁾. Then this area was familiar by calling 'Batavia' and about ten thousands people were living in this small city. Traders from India, China, England, Holland and other islands of the archipelago are recorded continuing to visit the port for spices trading.

Total population of Jakarta (inside the wall or fort Batavia) in 1673 was recorded 27,068 people. By the end of the eighteenth century, the VOC was bankrupt that affected the total population would be 35,000 peoples in 1730. This economic situation was

worse; hence the population of city had dropped to 12,131, with 160,986 living in the environs, a large area extending south to the mountains (Bogor area or former Buitenzorg city). In 1815, although the power of VOC declined, the population increased slowly to be 47,000. The city was sprawling by the installing of modern public transport, therefore the population increased to be 70,000 in 1850, and 116,000 in 1900. The city was strung out over 10 to 12 km from north to south. By the 1930, the population of the city of Batavia had grown to 435,000 where the immigration caused it to expand. Most of the road network had been asphalted and public services (electricity and telephone) were established in 1940. In 1942, Japanese occupied the archipelago and divided it into regions, and changing the capital's name to Jakarta that was treated as the capital of one such region, Java. 1942 to 1949 periods is the struggle period of Indonesian for Independence of Indonesia from Dutch, and Jakarta assumed as the capital of an independent Indonesian nation-state in December 1949. Van des Plas reported the population was 844,000 in September 1945. After the independence Jakarta was decided as the capital of Republic of Indonesia, the urbanization made increasing the population that recorded 1,050,000 in 1948, almost double the figure for 1930. President Soekarno's visions had little relevance to the dominant fact of Jakartan life in the period, official figures

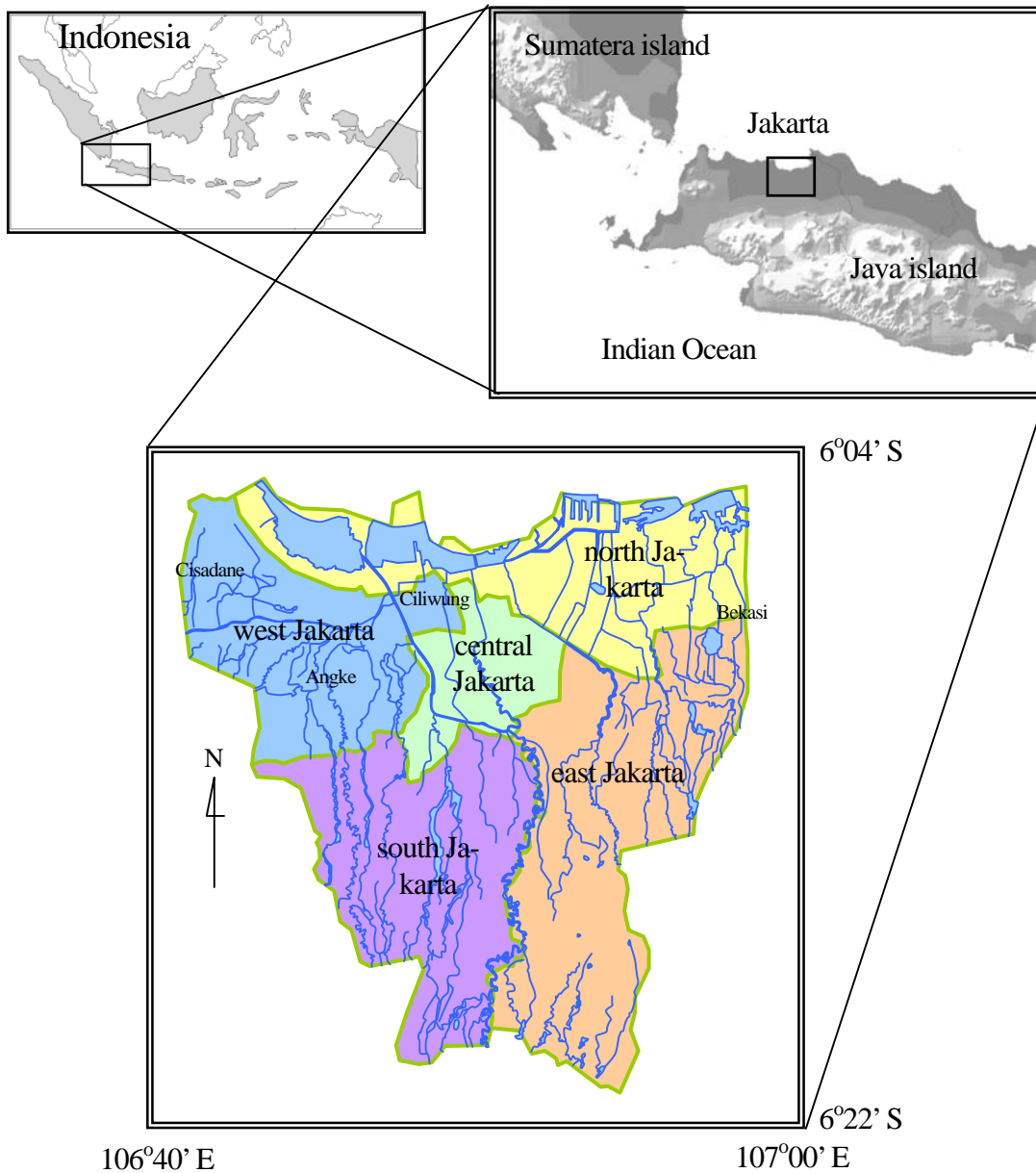


Figure 1. Study site : Jakarta city, Indonesia and its environment

show the the population was increasing drastically 1,782,000, 2,973,000 and 3,813,000 in 1952, 1961 and 1965, respectively. According to the census report of Indonesian Governmental Statistics³⁾, the population in 1971, 1980, 1990, 1995, 2000 and 2004 are 4,579,303; 6,503,449; 8,259,266; 9,112,652; 8,389,443; and 9,792,000, respectively. The population in 2000 decreased comparing to 1995, it is assumed the impact of Asian economic crisis in 1997. The population in 2004 was increasing again by the recovery from the economic crisis. The population

trend of Jakarta city from 1815 to 2004 can be seen in Table 1.

The Statistics shows that the urbanized area coverage of Jakarta 93,7% in 1980, and 100% after 1990s (see Table 2), where total area is 661 km². The data show the lack of information of urbanized area coverage before 1980. Therefore, in this research, old maps and satellite images were employed to obtain the urbanized area coverage before 1980. The detail analysis will be explained next.

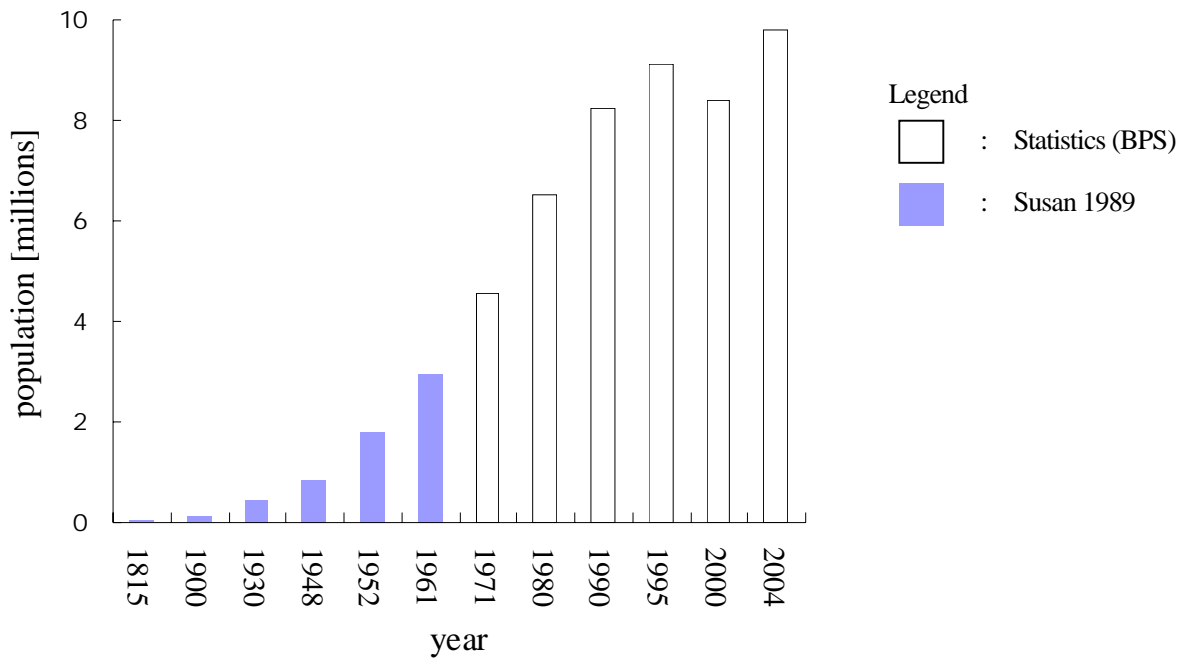


Table 1 Population of Jakarta city

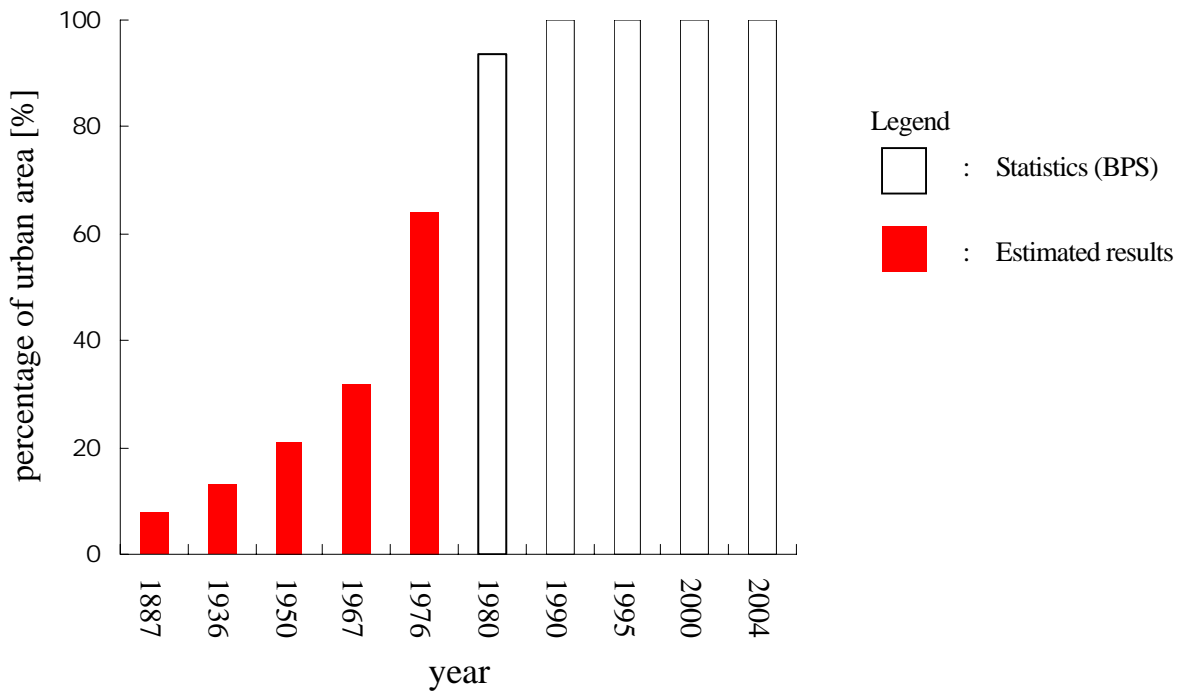


Table 2 Urbanized area of Jakarta in time series

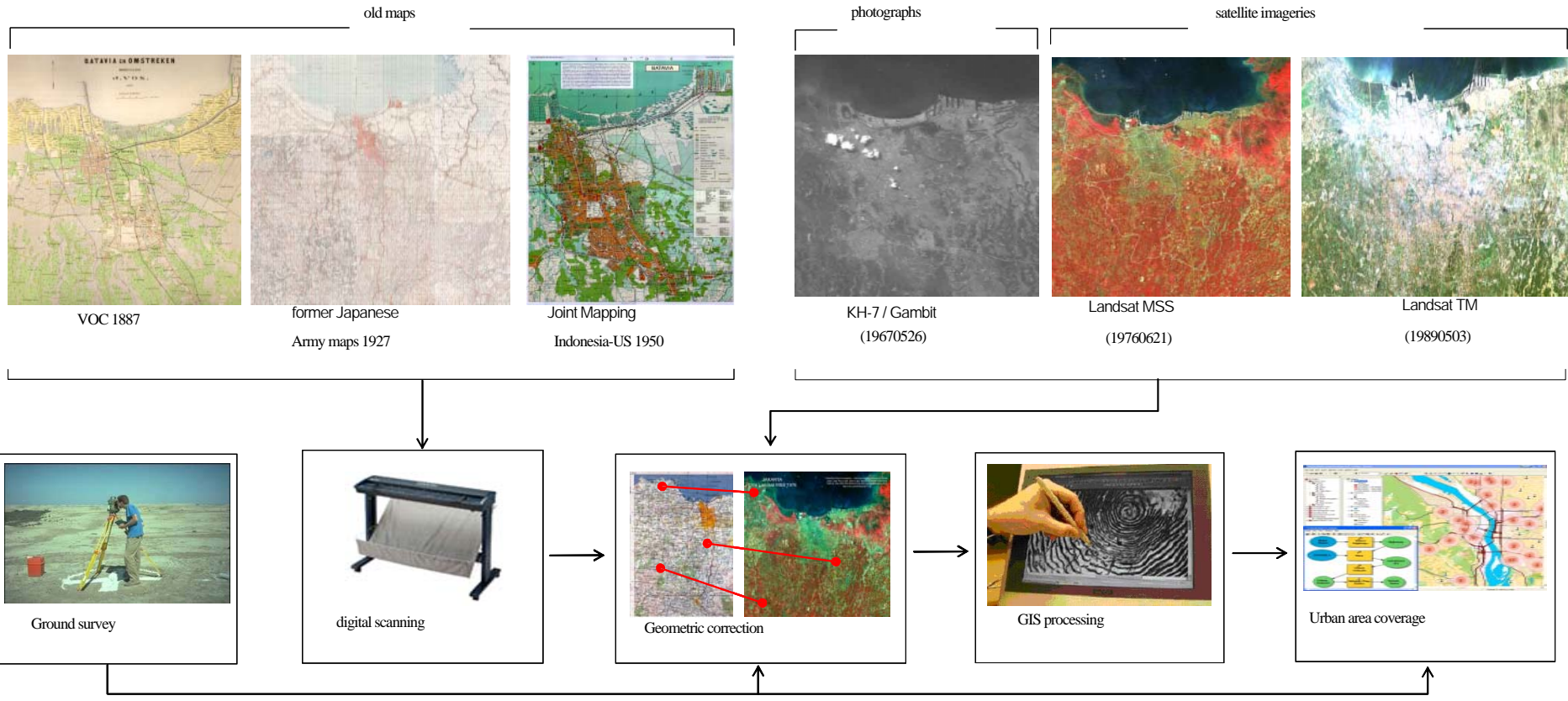


Figure 2 Flowchart of analysis

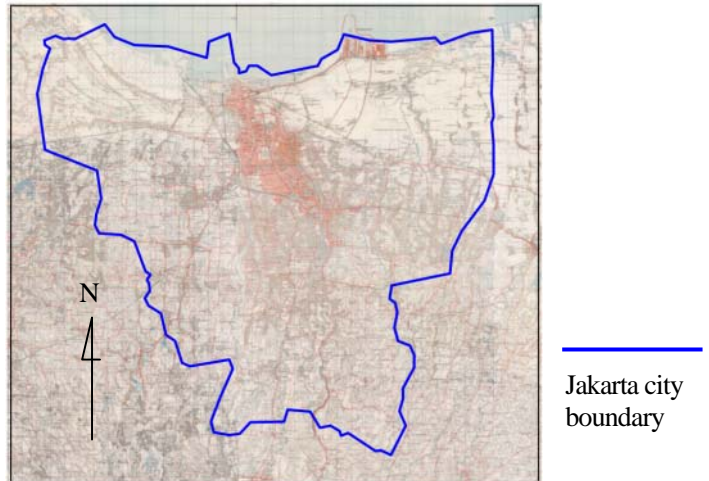


Figure 3 Mosaic maps of the former Japanese Army

II. Study site

Figure 1 shows the study site, Jakarta city (the capital of Republic of Indonesia) that located in $106^{\circ}40'E - 107^{\circ}00'E$, $6^{\circ}04'S - 6^{\circ}22' S$ and covering about 661 km². The area around the mouth of the Ciliwung river in west Java, the site of present-day Jakarta, has known human settlement from pre-historic times. Built up from the silt washed down from the volcanic mountain range to the south, an alluvial plain spreads out in a fan shape traversed by several rivers: Cisadane, Angke, Ciliwung, Bekasi and Citarum.

III. Analysis

The urban area change of Jakarta city is investigated by using old maps and satellite images. The employed old maps are VOC (1887), former Japanese Army map (1927), and Joint Mapping Indonesia - US 1950 maps. Especially, the former Japanese Army map is composed or mosaicked by 11 maps⁴⁾ as shown in Figure 3. Jakarta city boundary in this Figure shows the present boundary of Jakarta. Then the satellite images are KH-7 / Gambit (26 May 1967), Landsat MSS (21 June 1976) and Landsat TM (3 May 1989).

As shown in Figure 2, firstly the old maps are scanned. Secondly, the maps were geometrically corrected before digitizing process (visually) to obtain the urbanized area class. The satellite images are also geometrically corrected, then supervised classification process was employed to acquire the urbanized area class. The topographic maps⁵⁾ with 1:25,000 scale were used in the geometric correction. Then the urbanized area class only was delineated to obtain the urban area distribution more clearly. Basing on the digitalizing or delineation process, the coverage of urbanized area of Jakarta in each date could be acquired as shown in Figure 4. This Figure shows (visually) that the urbanized area was increasing drastically after 1945 or the independence of Republic of Indonesia. Figure 4 shows that the urbanized area coverage is 8%, 13%, 21%, 32% and 64% in 1887, 1927, 1950, 1967 and 1976 respectively. According to the Landsat TM data (3 May 1989), the coverage in 1990s is almost 90% or matches well with the statistics data. Table 1 and Table 2, or the population and urban area change of Jakarta city respectively show the strong relationship. These tables mean the increased population caused the sprawling of urban area.

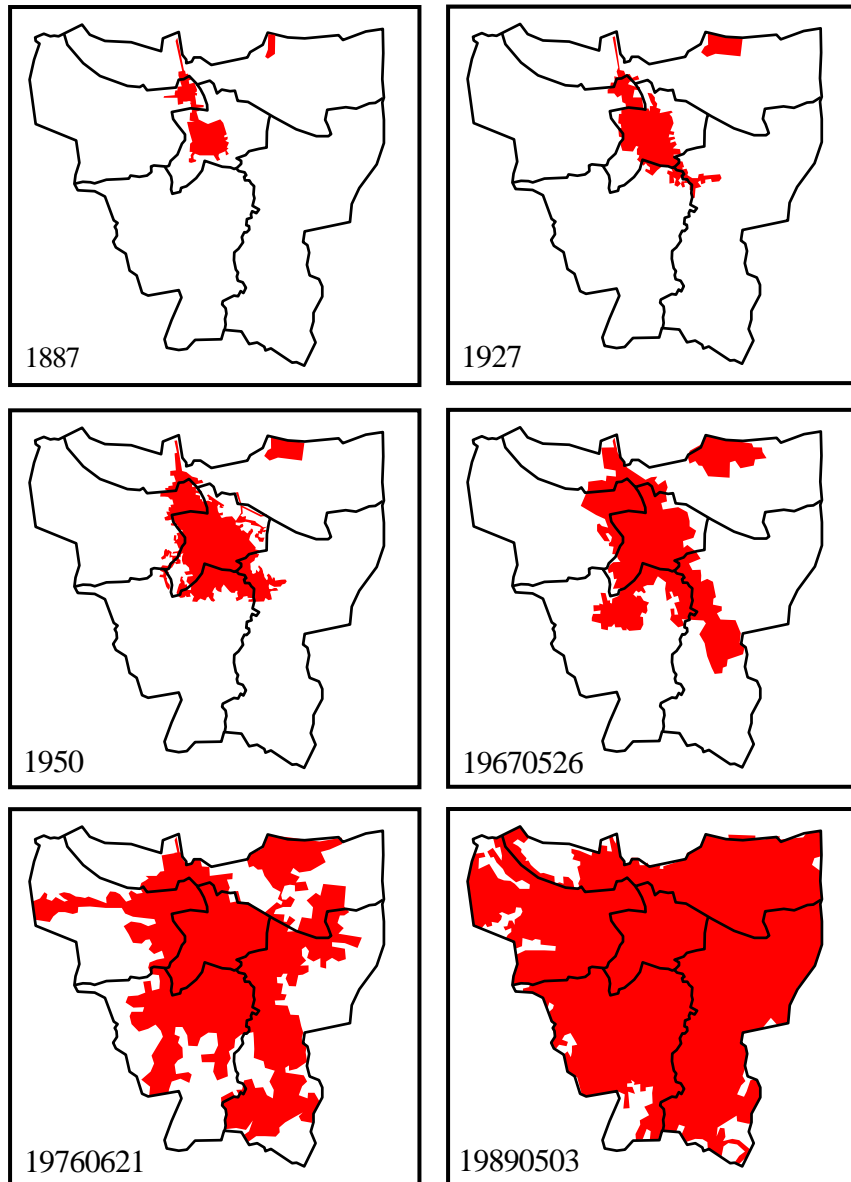


Figure 4. Urbanized area change of Jakarta city in time series

IV. Conclusions

Like many big cities in developing countries, Jakarta city has almost 250 years history and suffers from major urbanization problems. The population has sharply risen after 1960s, and according to the old maps and satellite images, the urbanized area covers whole of city (661 km²) in 40 years after the independence and the declaring of Jakarta as the capital of the Republic of Indonesia. The result shows that the old maps (1887 - 1950) including former Japanese Army maps (Gaihozu), and satellite images (1967 - 1989) can be employed in combi-

nation to monitor the city sprawling and its problems.

In the near future, the authors will employ these data and Geographical Information System (GIS) to retrieve the city spatial information and its change. The information of urbanized area, vegetation, digital elevation model (DEM), annotation, transportation network and hydrologic network will be retrieved from the former Japanese Army maps to obtain the topographic information of 1900s. The high resolution of satellite images also will be employed to monitor the area around Jakarta city or

known as buffer zone of Jakarta (Bekasi, Bogor, Tangerang, and Banten) called Jakarta Megapolitan area.

Acknowledgement

Thank to the Museum of Natural History, Tohoku University for providing the Gaihozu; Pandhito Panji Foundation - Remote Sensing Research Center for old maps; and University of Maryland for Landsat datas.

References

1. Simon Winchester, *Krakatoa - the day the world exploded: August 27, 1883*, Sterling Lord Literary, 2003.
2. Susan Abeyasekera, *Jakarta : A History*, Revised edition. Oxford University Press, 1989.
3. BPS, Indonesian Statistics Report, 2005.

- Gaihozu, Blad 36/XXXVIIA (oud No.17A) Ma-oek, 36/XXXVIIC (oud No.17C) Tangerang, 36/XXXVIII A (oud No.18A) Paroeng Pandjang, 36/XXXVIIB (oud No.17B) Batavia, 36/XXXVIID (oud No.17D) Kebajoran, 36/XXXVIIB (oud No.18B) Paroeng, 37/XXXVIIA (oud No.23A) Tandjoeng Priok, 37/XXXVIIC (oud No.23C) Meester Cornelis, 37/XXXVIII A (oud No.24A) Depok, 37/XXXVIIB (oud No.23B) Moeara Bekasi, 37/XXXVIID (oud No.23D) Bekasi, 24B Tjibaroesa : the Museum of Natural History, Tohoku University, 1927. Bakosurtanal, Jakarta 1209-441, Tangerang 1209-432, Cakung 1209-442,
4. Pasar Minggu 1209-423, Pondok Gede 1209-424, Teluk Naga 1209-434, Ancol 1209-443, Tanjung Priok 1209-444, 2001.