



Potential climate-change related vulnerabilities in Jakarta: Challenges and current status[☆]

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A B S T R A C T

Keywords:
Climate change
Jakarta
Vulnerabilities

The City of Jakarta is considered as one of the most vulnerable cities to climate-related disaster, including flooding, sea-level rise, and storm surge. Various climate risks in Jakarta have been assessed. However, the assessments are limited to the physical aspects of climate-change impacts, whereas risks related to the impacts on socio-economic condition have been neglected. Meanwhile, the climate risks campaign is still limited to the government circle and academics. The current Geographic Information System have spatial data and information on the physical aspects of climate-change related vulnerability, but it has not been integrated with data of the socio-economic vulnerability. The local government has not been fully aware of the implications of climate change, and there is a need to strengthen local government agencies responsible for disaster management in Jakarta.

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Coastal megacities in Asia are facing adverse impacts of climate change, including flooding, sea-level rise, intensified storms, and storm surges, which in turn may result in large losses of life and infrastructure, as well as damage to national and regional economies (Fuchs, 2010, p. 10; see also Bigio, 2003; De Sherbinin, Schiller, & Pulsipher, 2009; Nicholls, 1995; Li, 2003). As Fuchs further argues that 'The risks posed by climate change and sea-level rise will continue to grow into the next century, even if a dramatic reduction in green house gas emissions is achieved' (p. 2). According to Satterthwaite (2008) 'climate change has the potential to intensify flooding risks in cities in three ways: first, from the sea, i.e., higher sea levels and storm surges; second, from rainfall, especially by heavier rainfall and rainfall which is more prolonged than in the past; and third, from changes that increase rivers flows, for example due to glacial melt (p. 5).

Jakarta is not an exception. The city is vulnerable to floods, rising sea water and other natural disasters as well as manmade calamity

such as pollution and excessive extraction of groundwater. In fact, Yusuf and Fransisco (2009) listed Jakarta as one of the most vulnerable coastal city to climate change in Southeast Asia.

Jakarta which occupies the total land area of 662 square kilometer and total population of 9.6 million in 2010 plus about 2.5 million daily commuters from the adjacent areas is also a magnet for migrants who seek for better living conditions, mostly poor migrants. The annual rate of population growth reached 1.39 per cent over the period of 2000–2010, whereas the population density reached more than 1300 person per square kilometer in 2010 (Central Board of Statistics – BPS, 2010), making Jakarta as one of the most densely populated city in the world. Based on the 2008 poverty data released by the Central Board of Statistics (BPS), at present Jakarta has approximately 400,000 poor population and around 300,000 near poor population whom are vulnerable to any external shocks, including climate change. Most of the poor live in slum areas in several parts of Jakarta, which are greatly susceptible to flood. The poor are likely to be the most vulnerable group to the climate-change related impacts (Moser & Satterthwaite, 2009; Satterthwaite, Dodman, & Bicknell, 2009; see also Adger, Huq, Bodron, & Conway, 2003; McGranahan, Balk, & Anderson, 2008).

Although there is no clear evidence that climate change or global warming is the cause of heavy rain and the sea-level rise in Jakarta, obviously the city has been suffering from climate-related disasters, most notably more frequent heavy rainy floods, both in

[☆] An earlier version of this article was presented to the International Workshop on 'Climate Change Vulnerability Assessment and Urban Development Planning for Asian Coastal Cities', organized by Asia–Pacific Network for Global Change Research, Southeast Asia START Regional Center, and the East–West Center, held in Nakorn Pathom, Thailand, 22–28 August 2010.

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the upper region of Jakarta Metropolitan Area and in the city itself, and tidal floods. According to Hadi, Susandi, Radjawane, Asmi, and Widiratih (2005), the sea-level in Jakarta Bay has increased as much as 0.57 cm per year.

The worst flood in Jakarta was in 2002 and 2007 which paralyzed some parts of the city. The 2002 flood inundated almost 90 locations in the city covering more than 16 thousand hectares, or nearly one-fifth of the Jakarta total area. Jakarta needs an adaptive plan to cope with the imminence of climate change. Other local factors may also have affected the flood are land subsidence in several locations and the failure of land use control and infrastructure maintenance. In fact, some locations in the city which have been designated as water recharge areas have been largely converted into wealthier residential areas and other urban land uses.

This article will review and discuss the problems and challenges related to potentially climate-related vulnerabilities in Jakarta, especially the sea-level rise and constant flooding including readiness of the local government to cope those problems. It will also outline what need to be done to deal with the vulnerabilities in the city. Only few studies and research have been conducted on the potential impacts of climate change on urban development in Jakarta in an integrated manner, therefore this study is expected to make a contribution in it. The study is meant to be an overview and a general survey of several aspects related to climate change in the city.

There is a recent study on environmental problems and sustainability in Jakarta (Steinberg, 2007). However, the study focuses only the problems of traffic, urban infrastructure, environmental pollution, housing, the rich and the poor, planning and management for the city, but does not specifically address the potential impacts of climate change on Jakarta development. Also, there have been several studies on climate-change related impacts in Indonesia at the national and macro level (see UNDP, 2007; World Bank, 2007), but only very few those at city and local scale (see Kobayashi, 2009).

According to Fuchs (2010) several actions need to be done to reduce climate-change-related risks: (1) Raising awareness; (2) risks and vulnerability assessment analysis; (3) Coastal flooding risk prediction and mapping; (4) Flood protection works; (5) Warning systems and evacuate planning; (6) Land use and spatial planning; (7) Controlling land subsidence; (8) Disaster response and relief; (9) Improvement in governance capacities (pp. 5–9). It is possible to reduce the risk of large disasters, although it is difficult, and there is a need to incorporate climate change management into urban planning and governance (p. 10; see also McGranahan, Balk, & Anderson, 2009). As Satterthwaite, Huq, Reid, Pelling, and Lankau (2009) also argue that 'adaptation is not possible without knowledgeable, accountable, better resourced and technically competent local authorities....' (p. 363).

Currently, the Jakarta Capital City Government does not have a policy which specifically tailored to climate change. In general, the Jakarta City Government is still lacking of adaptation policy or program for climate change. Many have argued that climate change is on the horizon and people have no choice but to adapt to the changes. One of the main problems is that there is difficulty in finding the proper instrument to measure the level of adaptation. Research is still needed to explore the form and mechanism of adaptation policy at micro, mezzo, and macro scale of development in Indonesia.

The Jakarta City government does have policies related to climate change mitigation such a system of rapid mass transportation system which include the Trans Jakarta bus system and MRT system. There is also a policy of conversion from kerosene to gas stove with a target of two million residents in Jakarta and 1 million small enterprises. In addition, Jakarta City Government also plans to increase green open space areas from 14 per cent to 30 per cent by 2030 and reducing carbon emission to around 30 per cent.

Several regulations have been issued by the Jakarta City Government, including air quality control, absorption well, and gas emission control and other, bio-pore absorption hole, smoke free zone, and river/drainage normalization. Moreover, the Jakarta City Planning Department has developed a green building policy and tried to implement it to the real estate development in Jakarta, especially for superblock and mixed land use development.

Following the introduction, this article will be divided into five parts. Part one and two will critically discuss the assessment of climate risk and of socio-economic vulnerability in Jakarta respectively. Part three will examine the extent to which impact of climate change has been incorporated into Jakarta Spatial Plan; Part four will discuss the institutional aspects for climate change coping in Jakarta; and Part five will conclude the discussion.

Assessment of climate risks in Jakarta

Risk is defined as the product of the three vectors: hazards, vulnerability, and adaptive capacity (see Rosenzweig & Solecki, 2001). Climate risks can be understood as risks that variables in the climate/weather system which may affect human life adversely.

Jakarta has experienced a number of natural disasters over the years. The highest number of natural disasters is flood which has occurred every year in almost all the sub-districts in Jakarta. Moreover, the city has to deal with rising sea water, particularly in North Jakarta Municipality and the Thousand Island District where high tides coupled with growing incidence of rising sea water is a growing concern (Table 1). In fact, about 40 per cent of Jakarta land area are located below sea-level, mostly in North Jakarta area.

Other natural disasters which have occurred frequently are twisters or tornadoes and landslides. Jakarta has also experienced the after effect of earthquakes quite a number of times. Fortunately, Jakarta is not closed to the earthquake fault lines, even though the effect of an earthquake elsewhere in the country can sometimes be felt in the capital. Nevertheless, Jakarta is vulnerable to natural and manmade disasters as well as other environmental changes.

A study conducted by Yusuf and Fransisco (2009) showed that Central and North Jakarta are respectively ranked first and second of the most vulnerable places in Southeast Asia. Central Jakarta is the most at risk because of incidences of flooding while Central Jakarta is considered the most adaptive compared to the other districts, whereas North Jakarta has also experienced flooding caused by rainfall. Other districts in Jakarta, i.e. East, West and South Jakarta are also on the top list.

Climate-related hazards that frequently occurred in North Jakarta include flood caused by sea water or high tide. A simulated projection shows that by 2050 some areas in Jakarta will be under water if global warming continuous at the current pace (Susandi, 2009). The sea-level rise is projected to inundate most of Central Jakarta and will likely cause a significantly large adverse socio-economic impacts. Another study (Ward, Marfai, Yulianto, Hizbaron, & Aert, 2010), based on a GIS-flood model simulates inundated area

Table 1

Number of localities where natural disasters occurred in Jakarta by municipality and type of disaster, 2005–2008.

Municipality	Flood	Rising sea water	Twister	Landslide
Thousand islands	–	4	3	–
South Jakarta	42	–	–	–
East Jakarta	43	–	1	1
Central Jakarta	27	–	–	–
West Jakarta	37	–	–	–
North Jakarta	29	3	1	–
Total	178	7	5	1

Source: Central Board of Statistics (BPS), 2009.

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