



*Strengthening local capacity
in the economic analysis
of environmental issues*

The Economy and Environment Program for Southeast Asia (EEPSEA) was established in May 1993 to support training and research in environmental and resource economics across its 10 member countries (i.e., Cambodia, China, Indonesia, Lao PDR, Malaysia, Myanmar, Papua New Guinea, the Philippines, Thailand, and Vietnam.) It aims to strengthen local capacity for the economic analysis of environmental issues so that researchers can provide sound advice to policy makers.

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The Cost of Flooding in Jakarta

Jakarta, the capital city of Indonesia, is badly affected by flooding every year. Flooding is responsible for massive damage to property and people's livelihoods and causes significant injury and loss of life. The government has responded to this challenge by implementing a number of initiatives to protect the city from floods and to help people adapt to flooding. Despite this, the economic research that has been carried out on flooding in the city has been inadequate. This has made it difficult for policymakers to assess the true costs and benefits of any flood mitigation project.

To help provide this much-needed information, a new EEPSEA study has looked at the cost of the flood damage caused by one of Jakarta's major rivers. The study is the work of researchers from Bogor Agricultural University. Their findings show that during a three-day flood in January 2013, total damages in the residential and business sectors amounted to USD 1.2 million for the six villages covered by the study. In light of their findings, the researchers recommend that the government should accelerate its anti-flood river normalization program and put in place other measures such as the implementation of an early warning system.



A summary of EEPSEA Research Report No. 2015-RR3: 'Estimation of River Flood Damage in Jakarta: The Case of Pesanggrahan River' by Pini Wijayanti, Tono, Hastuti, and Danang Pramudita, Bogor Agricultural University. Comments should be sent to: Pini Wijayanti, Department of Environmental Economics and Resources, Faculty of Economics and Management, Bogor Agricultural University, Bogor, Indonesia.
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Flooding in Jakarta

Flooding in Jakarta occurs when there is excessive rain in the surrounding locality and floodwater cannot easily flow down the city's rivers into the Java Sea. Although Jakarta's geography and climate contribute to the problem, human factors are considered to be the main cause of flooding. For example, land conversion reduces the landscape's water retention capacity, while sedimentation causes the narrowing of rivers.

There have been three exceptionally large floods in the city in the last thirty years (in 1996, 2002 and 2007). Of these, the 2007 flood caused the most damage (a total loss of USD 516 million) and was regarded as a national disaster. The most recent major flooding in Jakarta was on 17-19 January 2013. This flood submerged 98,444 houses, killed 20 people, and caused total damage worth USD 755 million. It also led to the implementation of various flood mitigation projects and adaptation measures, such as the development of new flood canals and social awareness programs.



Vendors trying to save their products while a 60cm flood inundates their kiosks in South Jakarta in January 2013 as a result of heavy rains causing the Pesanggrahan River to overflow. (Photo credit: Afriadi Hikmal under creative commons license at flickr.com)

Assessing flood damage along the Pesanggrahan River

To help policymakers respond to the flood challenge, the researchers set out to estimate the extent of river flood damage caused by Jakarta's Pesanggrahan River during the January 2013 flood event. They focused on direct damage to the residential and business sectors. They also assessed what factors affected the impact of flooding on households and businesses, investigated the ability of households and

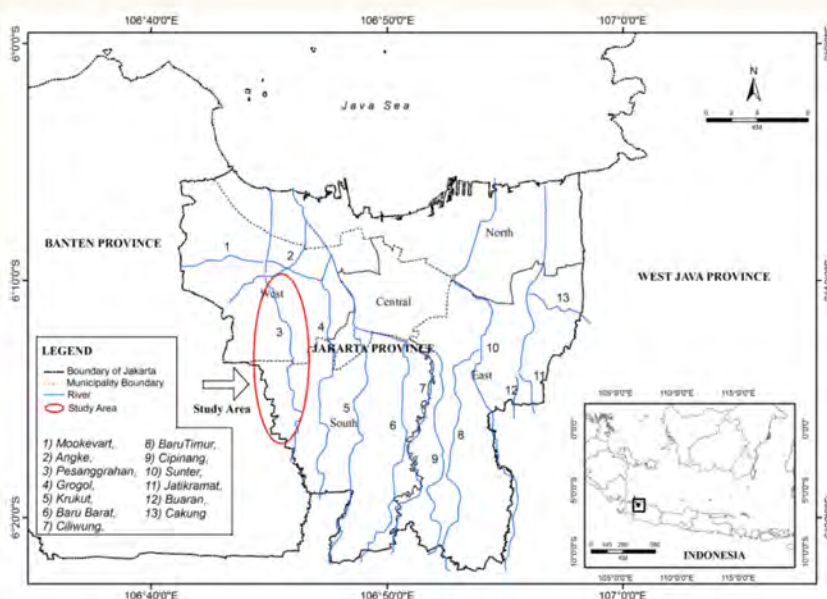
businesses to anticipate and respond to flood events, and looked at the role women played in the response to flooding. The gender issue was investigated because women are particularly vulnerable to floods and are also particularly well placed to help their families to prepare for, cope with, and recover from flooding.

The study was mainly conducted in the residential and business areas along the Pesanggrahan River. It covered six villages in four districts. These areas were selected because they are extremely prone to flooding. In January 2013, 1,706 houses in the study villages were inundated with river water. The districts were also selected because they are among the beneficiaries of the government's 'river normalization' flood mitigation program.

Gathering information from households and businesses

The researchers used primary data that was gathered by surveying households and businesses that had been affected by floods. Household heads and business managers were interviewed. In total, 300 households and 150 businesses were surveyed.

The household questionnaire gathered personal information and



The study areas included the villages of Ulujami in Pesanggrahan district, and Kebayoran Lama Utara and Cipulir in Kebayoran Lama district (in South Jakarta) and the villages of Kedoya Selatan and Sukabumi Selatan in Kebun Jeruk district, and Rawa Buaya in Cengkareng district (in West Jakarta).

data on house conditions, flood emergency responses, the damage caused by floods, households' beliefs and perceptions about flood risks, their willingness to act to reduce the impact of floods or to move to safer locations, and the layout of their homes. The business questionnaire collected commercial information and data on building conditions and layouts, flood emergency responses, and structural damage costs. It also collected information on the businesses' beliefs and perceptions about flood risks.

To get gender-specific information, the study conducted four sessions of focus group discussions with women who had actively helped their communities during floods. Additional information was collected from relevant government agencies.

Costing the damage

The flood damage analysis was conducted in two steps. First, the study looked at the depth and duration of flooding. Second, the cost of direct and indirect damage was estimated in monetary terms. Direct damages included structural and content damages; indirect damages included the loss of income, clean-up cost, evacuation cost, and cost of illness for the households and loss of turnover, labor cost, cost of temporary headquarters, and clean-up cost for businesses.

Statistical analysis was used to assess the factors that affected the impact of flooding on households and businesses and the factors that influenced their ability to anticipate and respond to flooding.

The role that women played was given an economic value by identifying how many hours women worked to help their families and the wider community prepare for, cope with, and recover from floods. It was assumed that this work would be worth the minimum hourly wage.

The impact of the three-day flood

During the three-day flood in January 2013, about 1,706 households and 816 small-to-medium-sized business units were inundated along the Pesanggrahan River in the six villages covered by the study. In the residential sector, the mean inundation depth was 86.6 cm and the mean inundation duration was 97.6 hours. In the business sector, the mean inundation depth was 74.2 cm and the mean inundation duration was 84.5 hours.

In the residential sector, the total damage per house was IDR 2,996,600 (USD 308) and the total damage to the whole population was IDR 5,112,301,960 (USD 0.5 million). In the business sector, the total damage per business unit was IDR 8,147,861 (USD 837) and the total damage to the whole business population was IDR 6,648,654,348 (USD 0.7 million). The total damage in both sectors was IDR 11,760,956,308 (USD 1.2 million) for the six villages covered by the study.

Using these findings, the researchers calculated that a reduction of flood depth and flood duration of up to 50% could reduce flood damage by 26% in the residential sector and by up

to 30% in the business sector (see Table below). They estimated that this would lead to savings of over USD 330,000. It was felt that such a reduction could be brought about by the government's river normalization program. The normalization program along a 26.7-kilometer stretch of Pesanggrahan aims to widen the river to increase water discharge.

The factors that make flooding worse

The researchers found that households that were inundated for more than 72 hours experienced more flood damage than those that were inundated for less time. However, households that were located close to the river suffered less damage than those further away. This was because the households that were further away from the river had lower elevations than those located closer to it.

High-income households suffered more damage than low-income households, and large houses suffered more than smaller ones. This is not surprising as large, high-income houses, generally speaking, have more valuable contents such as furniture and electronic appliances.

Most households did not take any direct action when they first received information about the coming flood, because they did not believe that the flood would occur until they saw the water heading towards their houses. This observation helped explain the finding that flood awareness did not contribute significantly to flood damage reduction.

Table: Estimation of flood damage reduction from the river normalization project

Sector	Number of units	Before normalization		After normalization		Damage reduction (%)
		Damage per unit (USD)	Total damages (USD)	Damage per unit (USD)	Total damages (USD)	
	(1)	(2)	(3) = (1) x (2)	(4)	(5) = (1) x (4)	[(5)-(3)]/(3) x 100%
Residential	1,706	300	511,230	222	373,333	26
Business	816	815	664,869	572	466,962	30

The researchers found that the businesses that suffered most from flooding were those that had been inundated for more than 72 hours, were close to the river, had a large business area, and a high daily turnover. Such businesses had also suffered a high frequency of previous flooding and showed little flood awareness.

Flood awareness and action

When it came to people's awareness of flooding, it was found that households along the Pesanggrahan River knew that they lived in a flood-prone area. Moreover, most households (89.4%) believed that future flood events would have negative consequences for them. More than 50% of the surveyed households reported that they were going to undertake private flood mitigation measures. However, 25.7% households stated that they would not undertake any mitigation measures in the future, either because they had already put such measures in place or because they lacked the financial resources to do so.

People living along Pesanggrahan River also argued that if the government did not come up with any public flood mitigation measures then their private mitigation measures would be useless. About 74% of households considered that it is extremely important for the government to make public flood reduction efforts.

In contrast with the residential sector, many businesses were not interested in undertaking future flood mitigation measures – only 47.4% stated that they were 'likely' or 'very likely' to undertake such work, or that they would definitely do so. This was because many

business units had already put such measures in place.

Generally, business owners said that it was useless to take action to mitigate the impact of floods unless the government put in place public flood mitigation measures. About 97.9% of the business respondents claimed that public flood reduction efforts are important.

The role of women

The researchers found that women had played important roles in supporting their families before, during and after the three-day flood event. Women who had actively helped during the flood spent, on average, 20.5 hours helping their own families and 20.98 hours helping their communities. The community activities that these women performed included: cooking in community kitchens, distributing food and medicine, and helping people at evacuation camps.

During the three-day flooding in January 2013, the value of the work the women did helping their families was IDR 256,500 (USD 26) per person, while the value of the help they gave society was IDR 262,250 (USD 27) per person. The average total value of a woman's contribution to family and society was IDR 518,750 (USD 53) per person during the three-day flood.

Action needed from government, communities and individuals

Overall, it is clear that the people living in the Pesanggrahan River area are vulnerable to flooding and routinely experience high levels of flood damage. Given the scale and value of this damage – and

the views of local households and businesses – the study recommends that the government should accelerate its river normalization program, and other ongoing flood defense measures, and combine these with preparedness programs such as the development of an early warning system. To gain support for this work, the study recommends that the government should provide clear information on the benefits and the costs of its proposed flood mitigation measures.

Due to the complexity of the flood challenge, the study also recommends that there is a need for collaboration between individuals, communities and the government of Jakarta. It suggests that households and businesses should take proactive and reactive adaptation measures and recommends that communities should contribute by managing local emergency responses and by working to effectively spread flood information.

As for the role of women in relation to flooding, the study recommends that there is a need to increase their capabilities by providing them with training in flood preparation, flood evacuation and post-flood clean-up techniques.

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