

## Jakarta, Indonesia



<https://www.cia.gov/librarY/publications/the-world-factbook/geos/id.html>

Indonesia is a southeast Asian country located between the Indian and the Pacific Ocean. Jakarta is the Capital and the biggest city in Indonesia. Jakarta sits on swampy land with 13 rivers running through it. Jakarta also sits in the “Ring of fire”, causing settling and sinking of the crust up to seven inches a year,” (FMI’s Bruce Allen). Therefore, flooding is frequent in Jakarta.

Climate change have caused the Java Sea to rise and is responsible for the weather patterns to become more extreme. According to some scientists, “Jakarta is sinking faster than any other big city on the planet — so surreally fast that rivers sometimes flow upstream, ordinary rains regularly swamp neighborhoods, and buildings slowly disappear underground, swallowed by the earth.” In its entirety, the city is sinking an average of 3 inches a year, far outpacing the one-third inch annual rise in mean sea level in the area. The coastal areas near Jakarta is sinking at a much greater average of six inches a year – and in some places as much as 11 inches - according to a 10-year study by a team of geodynamics experts

from the Institute of Technology Bandung. Every year the tide gets about 5cm higher. Coastal districts, like Muara Baru, have already sunk as much as 14 feet in recent years. Currently, 40 percent of the city is below sea level.

For instance, a strong monsoon storm accompanied with a high tide in February of 2007, for the first time, pushed a wall of water from the Jakarta Bay into the capital, flooding the city. Nearly half of Jakarta was covered by as much as 13 feet of muddy water. At least 76 people were killed, and 590,000 were left homeless. Damage reached \$544 million.

But global warming is not the only culprit behind the historic floods in Jakarta. The problem is that **the city itself is sinking**. The problem is exacerbated by the fact that Jakarta's land is sinking up to 6.7 inches per year. In recent years, floods have devastated homes, vehicles, and local businesses, particularly in Jakarta's poorer neighborhoods.

A mix of human-induced activities have compounded the situation in Jakarta:

- ✓ excessive groundwater pumping
- ✓ run-way development
- ✓ a near-total lack of planning
- ✓ lack of sewers
- ✓ limited network of reliable piped-in drinking water

In addition to the above-mentioned conditions, Jakarta also inherits several other deep-rooted problems such as,

- ✓ Sinking Buildings
- ✓ Rapid and uncontrollable urban sprawl
- ✓ polluted air and water
- ✓ some of the worst traffic bottle necks in the world
- ✓ Burning of rain forests to make way for palm oil producers and textile factories causing air pollution to spike, contributing to climate change.

- ✓ distrust of government leading to conflicts between Islamic extremists and secular Indonesians, and Muslims and ethnic Chinese who have historically blocked progress, helped bring down reform-minded leaders, and complicated the matter at hand.

### **Near-Permanent Traffic Bottle Neck**

Jakarta is the second-largest metropolitan region in the world, and hence forms the economic center of Indonesia. According to the Reuters Report, more than 10 million people live in Jakarta and has a metropolitan area of more than three times that. The United Nations stated in 2016 that Jakarta was the world's 27th most populous city. The country's road coverage is much lower than that of other big cities, creating a near-permanent traffic jam and encounters drastic congestion problems.



Jakarta's streets are some of the most congested in the world. [Harismoyo/shutterstock](#)

<https://www.businessinsider.com/indonesia-jakarta-sinking-flooding-2019-5#jakarta-currently-rests-on-swampy-land-in-a-low-lying-basin-along-the-java-sea-3>

According to the British lubricant producer Castrol's Stop -Start Index, Jakarta had the worst traffic in the world in 2015. The cost of this congestion has been estimated to be \$11 billion by the Jakarta Transportation Agency. The country spends \$23 billion a year on infrastructure,

which the Asian Development Bank said in 2017, is \$51 billion less than it needs to be investing annually if it is to, “Maintain its growth momentum and eradicate poverty.

### **Rapid Urbanization, Industrialization, and a Crisis of Waste in Jakarta**

Over three decades of **urbanization and industrialization** has caused the rivers, channels, canals and artificial reservoirs to become highly polluted. Degradation and deforestation of the mountainous areas led to soil erosion and a corresponding increase in silt in streams, worsening flooding in lower lying areas. Population growth and intensive farming meant added to the cause by draining fertilizers, and animal and household waste into the river system. Professor Etty Riani, from the Department of Water Resources Management at Bogor Agricultural University, in West Java analyzed the quality of water in various parts of the Citarum, as well as the health of fish and other aquatic animals, including those farmed commercially. According to her research, “The ecosystem in the reservoirs is damaged and heavily polluted.” Furthermore, she and her team of researchers found mercury and other heavy metals in the tissues of fish, and deformations among fish larvae.

Factories dump tons of waste and chemicals into waterways, contaminating the city’s drinking water supply. By law, such factories are required to clean up their wastewater before flushing it back into the river, but due to mismanagement and widespread corruption, the factories continue to dump toxic and hazardous chemicals into the rivers and adjoining canals. According to recent data from the Coordinating Ministry of Maritime Affairs, some 2,800 factories now rely on the Citarum, the longest river in West Java, for their supply and for the disposal of wastewater. A study conducted by America’s University of Georgia, Indonesia revealed that, when it comes to plastic waste, the second greatest ocean polluter, trailing only China.

Secondly, the aquaculture in the reservoirs – which provides fish for many tables in Jakarta – also creates pollution, says Burhanuddin, through fish food and associated waste.

Thirdly, for many of the informal developments (kampungs) that cluster along canals, the waterways underneath them serve as **default sewers**. All the sewage and garbage from these homes jam pumping stations that the city has had to build because gravity no longer drains the rivers and canals naturally. **This further aids in flooding.**

Some of the channels drain into floodwater retention lakes, a magnet for new migrants from outlying provinces who squat illegally around their perimeters. Pumping stations then spew the highly polluted water from these lakes the last few hundred yards into Jakarta Bay.

More and bigger such lakes will soon be needed to discharge the water of all other rivers and canals, including the large flood canals, according to the NCICD Master Plan. “You’re talking about pumping lakes up to 100 square kilometres,” said Victor Coenen, Indonesia chief representative for Dutch engineering and consulting firm Witteven+Bos, who was part of the government’s Dutch consulting team. “Where do you find room for that in a densely populated city?” Then as now, “stagnant canals” functioned as open sewers and exhaled “an intolerable stench.” In the wet season, “those reservoirs of corrupted water overflow their banks in the lower part of town, and fill the lower stories of the houses where they leave behind an inconceivable quantity of slime and earth.”

Today, the city has just one small wastewater treatment plant that serves the central business district. Almost everyone uses septic tanks or dumps waste into neighbourhood sewers that flow into the canal system.

The slime has mounted over the centuries in the canals, and their embankments have risen in a failing effort to contain the flood waters. The canals that flow to the sea or into the coastal retention ponds have lost up to 75 percent of their capacity, said Brinkman at Deltares.

There are serious **health risks** attached to the polluted rivers. According to an ongoing study by the World Bank, poor sanitation and hygiene cause 50,000 deaths annually in Indonesia, with untreated sewage resulting in over six million tons of human waste being released into inland water bodies. Due to a poor sewage system and open defecation, 90 percent of ground water in Jakarta is contaminated by E. coli bacteria, which is the cause of many infant deaths. The World Health Organization (WHO) estimates

that nationwide more than 20,000 children in this age group die every year from diarrhea. Dengue fever and malaria, both spread by mosquitoes that thrive in stagnant water, account for an additional three percent of overall child deaths.

Ibu Sutria, 53, lives in a wooden shack on the banks of West Java's Krukut River, which runs approximately 20 kilometers south from the capital, Jakarta, to the city of Depok. Sutria suffers from regular bouts of stomach-ache and diarrhea, and says the river is constantly flooded. "People use the river for a toilet and children play in it because they have nowhere else to swim." She and others in her community use nearby ground water to wash themselves because they think it is cleaner than river water.



Ibu Sutria along West Java's Krukut River in Indonesia, along which millions live and depend on the polluted river

(Photo: Mark Wilson/IRIN). Read more from Asian Scientist Magazine at:

<https://www.asianscientist.com/2012/04/health/indonesia-west-java-river-pollution-2012/>

Pak Jumari, 35, is a leader of a community group living along the Ciliwung River, which runs north for 97 km from the West Java city of Bogor. "We find many detergents and soaps in the river," he said. "We no longer use it for washing or drinking." Fishermen on the Ciliwung use "Blast fishing" – bombs made of kerosene and fertilizer to kill fish, so they are easier to catch – which has worsened pollution.

43-year-old Bambang Wiharsa, a rice farmer in Majalaya, a district that is home to numerous textile-manufacturing businesses. Majalaya's residential houses are dilapidated, the streets are prone to flooding

and farmers plough forlorn patches of land that sit between roads and factories, the air thick with smoke from nearby coal furnaces. Little of the wealth created by the textile businesses, it seems, remains in the area. Sitting on a couch at a friend's house, Bambang points to his feet and arms. Rashes have broken out on the parts of his body that come into contact with the water, when he wades through paddy fields and bends down to tend the rice saplings.



Farmer Bambang Wiharsa's skin is damaged from contact with contaminated water. Picture: James Wendlinger

Besides flooding and health risks, rapid urbanization and industrialization in Jakarta have also increased the risk of **human displacement**. Several large cities, including Jakarta are expanding in areas that are exposed to hazards, such as the tropical cyclone belt, the Pacific Ring of Fire, pollution, and waste. Urbanization of these cities add another dimension to the persistent issue by exposing the already vulnerable people to the risk of **secondary displacement** in the form of evictions.

What complicates the incidence of pollution is that the river system in Indonesia is spread over many administrative districts. While the river itself falls under the control of the central government, the land management, waste management, and the policing of communities and small to medium-sized businesses are the responsibilities of individual districts, or sometimes overseen at provincial level. Furthermore, Asep Kusumah, the director of Bandung's Natural Resources Conservation Agency, says his office is understaffed and that there is insufficient manpower to closely supervise the industries. When a factory is suspected of

dumping contaminated water, they change the point at which their pipes empty into canals. Thus, making a case against them extremely difficult.



Rubbish on the banks of the Citarum. Picture: James Wendlinger



A bridge across the Ciliwung. The waterways under Jakarta's kampungs have become default sewers.



Indonesia is wrestling with an acute plastic waste problem – David Shukman



The concentrations were so thick they blocked a major tributary – David Shukman



Investment is needed for public education on waste, activists argue - KATE STEPHENS

<https://www.bbc.com/news/science-environment-43823883>



Dredging along the Karang river in North Jakarta.



Cleaning up garbage in the Ciliwung, one of Jakarta's main rivers.



A clogged section of the Citarum. Picture: James Wendlinger

<https://www.nytimes.com/interactive/2017/12/21/world/asia/jakarta-sinking-climate.html>

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A flooded factory in North Jakarta, an area with some of the world's most polluted canals and rivers.

### **Flooding and Land Subsidence in Jakarta**

According to a source only a quarter of Jakarta's residents have access to piped water, which leave the rest to depend on drilling underground for water. The constant drilling of new wells to source fresh water is causing the city to sink at an alarming rate (approximately 10 inches per year), with some predicting that the metropolis only has two years left above water. **Jakartans are digging illegal wells, draining the underground aquifers on which the city rests.** About 40 % of Jakarta lies below sea level and coastal districts, like Muara Baru have sunk as much as 14 feet in recent years. Hydrologists say the city has only a decade to halt its sinking. The most serious problems however could be found in North Jakarta and if nothing is done to prevent the happenings, it will soon end up underwater. "Jakarta won't be able to build walls high enough to hold back the rivers, canals and the rising Java Sea. **If this goes unchecked, parts of the megacity could be entirely submerged by 2050**" (Asian Development Bank).

The situation is exacerbated by lax regulation allowing anyone from individual homeowners to massive shopping mall operators to carry out their own groundwater extractions. In May 2018, the Jakarta city

authority inspected 80 buildings in Central Jakarta's Jalan Thamrin and found 33 of the 80 buildings were extracting water illegally.



An inspection of buildings in Jalan Thamrin, central Jakarta found many operators pumping groundwater without a permit

<https://www.bbc.com/news/world-asia-44636934>

The Water Management Authorities can only meet 40% of Jakarta's demand for water. Water is piped to less than half the population at exorbitantly high rates by private companies who are awarded government concessions - Therefore, city residents who could have access to piped water prefer to use groundwater because the connection fees is more expensive than a backyard well. Additionally, piped water is undesirable to most people because it is often dirty and unfit for human consumption, as half of Jakarta's water supply comes from the basin of the Citarum River, which was considered to be, "The world's dirtiest river," by the Asia Development Bank. Locals complain by saying that they are left with no choice, but to dig wells for sustenance.

**The sinking situation in Jakarta often portrays a case of social inequality.** The pumping of water by the wealthy communities causes subsidence in the low-lying coastal areas, where the poorer people live.

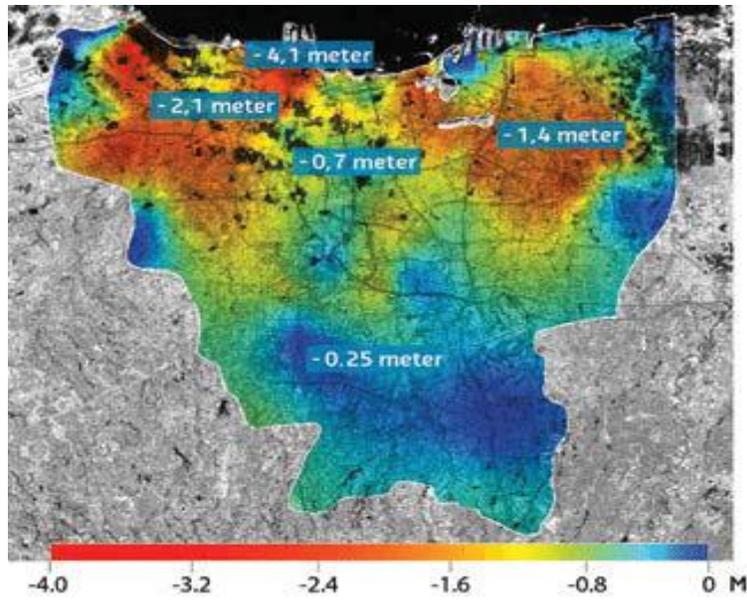
Only those who own a residency card may be eligible to get an apartment in new high-rise public housing projects.

“Everyone has a right, from residents to industries to use groundwater as long as this is regulated, but the problem is that they take more than what is allowed,” says Heri Andreas, a researcher and lecturer on Earth Science at the Bandung Institute of Technology. The ongoing construction projects (luxury apartments and retail stores add to the weight) combined with the extensive draining of the aquifers, is causing the rock and sediment on which Jakarta rests to subside. The aquifers are unable to replenish, despite heavy rains and the abundance of rivers, because more than 97 percent of Jakarta is now throttled by concrete and asphalt. Open fields that once absorbed rain have been paved over and shores of mangroves that used to help relieve swollen rivers and canals during monsoons have been overtaken by shanty towns and apartment towers. Construction of buildings, - as with other besieged coasts around the world facing rising sea levels - only worsen the problem.

**The relation between groundwater extraction, massive urbanization and land subsidence has been explained with the help of the following connectors:**

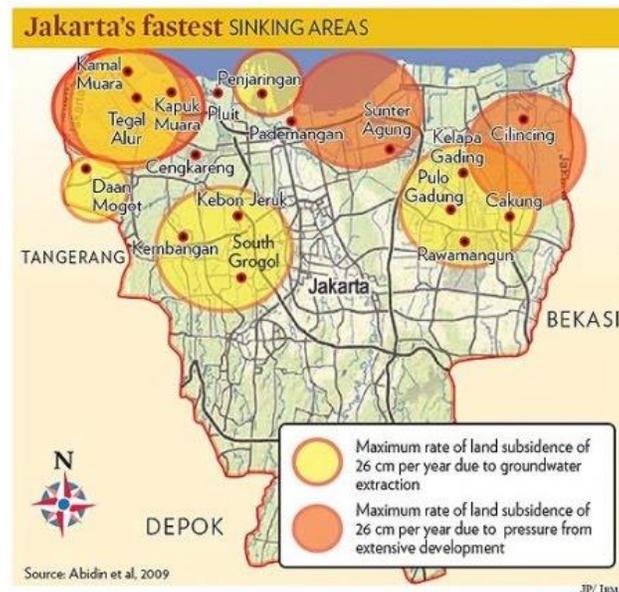
**Over Population > Increase in Water Demand > Increase Utilization of Groundwater resources > Uncontrolled Well Excavation > Over-Pumping > Volume of Groundwater Decreased > The level of land surface above the aquifer will be influenced + de-compaction of the soil layers > Land Subsidence.**

*Source:* Nicola Colbran, ‘Will Jakarta be the Next Atlantis? Excessive Groundwater Use Resulting from a Failing Piped Water Network’, *5/1 Law, Environment and Development Journal* (2009), p. 28, available at <http://www.lead-journal.org/content/09018.pdf>



Land subsidence in Jakarta during the period 1974-2010, based on PSI (ERS-2 1996-1998, Envisat 2007-2009 and ALOS PALSAR 2007-2010), levelling, GPS, extensometers and groundwater level measurements. Source: Deltares 2011.

[https://www.researchgate.net/figure/Land-subsidence-in-Jakarta-during-the-period-1974-2010-based-on-PSI-ERS-2-1996-1998\\_fig25\\_235779260](https://www.researchgate.net/figure/Land-subsidence-in-Jakarta-during-the-period-1974-2010-based-on-PSI-ERS-2-1996-1998_fig25_235779260)



<http://mumtaza-tj.blogspot.com/2010/11/science-fact-jakarta-land-subsidence.html>

Source: Wardany, I. (2010, April 24). *Jakarta Sinking Up to 10 cm Per Year*. Retrieved October 6, 2010, from The Jakarta Post: <http://www.thejakartapost.com/news/2010/04/24/akarta-sinking-10-cm-year.html>



Subsidence data courtesy of Irwan Gumilar of Geodesy Research Group of ITB | Satellite images via Landsat 5 and Landsat 8

### **Flooding in Jakarta**



PHOTO: AGENCE FRANCE-PRESSE

A man sitting outside his house in a flooded area of Jakarta on April 26, 2019.

Jakarta has been prone to flooding ever since its establishment, naturally, due to its geographical location in the tropics and its proximity to the sea – generating heavy rainfall. For instance, the torrential rain in Jakarta on April 26, 2019, triggered flooding in some parts, forcing the evacuation of several residents. Heavy rains caused the Ciliwung River to burst its banks and cause flash floods in at least 17 communities.

Even though entire Jakarta has been historically always prone to flooding, most flooding occurs in the areas with **relatively large subsidence rates**. The largest incidence of subsidence can be found in areas along the coast mainly due to **natural consolidation of alluvial, excessive groundwater extraction, and load of constructions**.

The **sea level rise** in Java sea and **high sedimentation rates in 13 rivers** that flow through Jakarta have compounded the phenomenon of coastal flooding in Jakarta, where naturally these areas used to experience flooding only during the high tide. Coastal flooding in Jakarta have caused enormous economic losses, because besides **causing coastal erosion, the frequent and severe coastal flooding is deteriorating the function of building and infrastructures and decreasing the quality of living environment and life (e.g. health and sanitation condition) in the affected areas**. For example, in the district of Muara Baru, an entire office building lies abandoned. It once housed a fishing company, but the first-floor veranda is the only functional part left... The submerged ground floor is full of stagnant floodwater. The land around it is higher so the water has nowhere to go.

The World Bank warned in a 2012 report that catastrophic floods would soon become routine in Jakarta, “resulting in severe socio-economic damage.” In January 2013, parts of the Jakarta was submerged under 6 feet of water after a heavy monsoon storm.

### **Personal Testimonies**

Mahardi, a local fisherman said, “Every year the tide gets about 2 inches.” But, “None of this has deterred the property developers.” New and more lavish apartments are being constructed, despite the risks. The head of the advisory council for Indonesia's Association of Housing Development, Eddy Ganefo, says he has urged the government to halt further development here [since the weight of these buildings just adds to the problem]. But, he says, “so long as we can sell apartments, development will continue.”

For one kiosk owner who works and lives in Muara Baru, she has seen the tides drag away shoes left outside homes and has lost an entire refrigerator herself. For a street vendor, losing a fridge can be fatal for your livelihood.

For another, a man named Edi Junaedi, a flood in 2007 washed his car away. “It was the worst one to ever come,” he said.

Ideally speaking, the local rivers could help alleviate flooding issues if their width could be expanded to 20m wide, but that is not the case. The rivers are currently only 7m wide, due to housing conflicts and illegal kiosks set up along the shore.

A study published by the United Nations Environment Program (2010 and 2013) established an intriguing link between deforestation and flood frequency in Indonesia. The study showed that the increased deforestation where land that hasn't been deemed worth protecting is given away to industrial logging

companies by the Indonesian government, despite the Agricultural Ministry decree from 1980 that sought to increase watershed protection.

<https://www.youtube.com/watch?v=rLuoyONhYAE>



The ground floor of this abandoned office building is now underground



Stagnant water on the ground floor



People are stranded by floodwaters in Jakarta's central business district in January 2013. Ed

Wray/Getty Images



Residents walk through floodwaters in Jakarta on April 26, 2019. Dasril Roszandi/NurPhoto/Getty Images

**Nearly half of the city sits below sea level, making it extremely vulnerable to floods.**



A young boy stands in flood water after heavy rain in Jakarta in February 2016. Agoes Rudianto/Anadolu Agency/Getty Images



A sinking mosque in North Jakarta on May 18, 2017. Anton Raharjo/NurPhoto/Getty Images



A man wades through a flooded street in a residential area near Jakarta on April 22, 2016. Agoes Rudianto/Anadolu Agency/Getty Images



A February 2019 flood was made worse by the city's poor drainage system. Donal Husni/NurPhoto/Getty

Images



Residents evacuate their goods during a massive flood in February 2018. Edi Ismail/NurPhoto via Getty

Images

## **Humanitarian Crisis – Politics and Human Displacement**

Jakarta's former governor, Basuki Tjahaja Purnama, (an ethnic Chinese, a geological engineer by training) ordered the eviction of several Kampung dwellers when he assembled a sanitation crew, called the **Orange Army, to remove sediment and garbage from rivers and canals**. In the process, some of the kampungs that obstructed waterways also had to be cleared. Consequently, many people lost their homes. Several amongst them resisted the move and were convinced that the evictions were really intended to enrich developers, not improve drainage. "The government said the eviction was about cleaning the river, but I believe it was about politics and development," stated a person who was evicted.

The anti-pollution campaign was politicized hardline Islamic Defenders, who capitalizing on residents' resistance and the piety of the urban poor, teamed with some of the governor's political rivals and religious conservatives to tap into a vein of anti-Chinese populism. The matter turned from being a conflict over the displacement of a fishing community, into an argument about whether a non-Muslim should lead a Muslim-majority city.

The governor was regularly attacked at Friday prayers. He lost his re-election bid, and the Islamists, who exploited anger against him, had him arrested on charges of blasphemy, and is serving a two-year sentence in the prison.

The newly elected governor of Jakarta, Anies Baswedan was supported by the residents of the Kampung and promised them to rebuild some of the shelters. Residents of Bukit Duri province of Jakarta filed a class-action lawsuit against the government to protest the evictions. Recently, a district court judge ruled in their favor. "It's not that nobody should move," argues Elisa Sutanudjaja, a kampung advocate and the executive director at the Rujak Center for Urban Studies. "These poor communities don't all want to stay in place, but they do want to stay together and near their jobs, and they want legal status." They also want to show, where possible, that moving isn't the only solution.

## Personal stories

Topaz a 31-year-old event organizer is a third-generation resident of informal neighborhood (Kampung), named Aquarium. He got evicted and his house bulldozed to the ground. “The government said the eviction was about cleaning the river, but I believe it was about politics and development,” noted Topaz. He now lives in a tattered, windswept tent which he shares with a dozen other squatters not far from where his family home used to be. Over his shoulder, several luxury waterfront apartment towers were under construction. “I saw promotions for those towers that showed Aquarium turned into a park,” Topaz said.

Even though the efforts made by Jakarta’s former governor, Basuki Tjahaja Purnama (Ahok), started to make a difference in terms of cleaning the rivers and canals and controlling floods, many Jakartans like Topaz who were forcefully evicted resisted the moves, convinced that the evictions were really intended to enrich developers, not improve drainage. Aquarium became a hotbed of protest against the governor.

Agus Fadila a 34-year-old motorbike-taxi driver, is another person who was evicted from a settlement called **Bukit Duri**, whose house now lays in rubbles. Agus states, “Several other kampungs had already been cleared, the river widened, its banks lined with concrete and surrounded by high concrete walls, now tagged with graffiti. The river there looks imprisoned, but water flows more easily.” He further states, “I was raised here, my job was here.” Now his family (wife and two young children) had been relocated to a new apartment building, hours away. “I know why they did this,” adds Agus. “It had to do with the river. I know this was not legally our land. But it was my home.”

Residents of Bukit Duri filed a class-action lawsuit against the government to protest the evictions. Recently, a district court judge ruled in their favor. “It’s not that nobody should move,” argues Elisa Sutanudjaja, a kampung advocate and the executive director at the Rujak Center for Urban Studies. “These poor communities don’t all want to stay in place, but they do want to stay together and near their jobs, and they want legal status.

“We want to demonstrate to the government that kampungs can actually be beneficial to the river,” Kamil told me as we looked over the river from the roof deck. Below, banana and star fruit trees shaded a riverside promenade of colorful facades and vegetable gardens.

JanJaap Brinkman, a hydrologist who for decades has been studying Jakarta for the Dutch water research institute Deltares sympathizes with residents of communities like Aquarium and Tongkol. Eviction isn't a cure-all, or even possible, he said, considering how many countless thousands of Jakartans now live atop the canals and rivers in informal developments. At the same time, Mr. Brinkman stressed, moving people is necessary, and bungled evictions squander a meager reservoir of good will and precious time.

### **Proposed Solution to Tackle Flooding**

The following measures should be taken in order to alleviate flooding in Jakarta and surrounding regions in Indonesia.

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- ✓ Building more dams or more flood reservoirs would help, until trash and other things clogged up the channels and stopped the effectiveness of it.
- ✓ Adding more water pumps would help, until the publicly owned electric company shuts the electricity to pumps hooked up to the grid and makes the flooding worse. Not that the pumps would ever be enough, as long as landowners continue to issue land grants to replace wetlands, lakes, and ponds with concrete and business centers.
- ✓ With the surrounding areas in Jakarta made up of asphalt and businesses, the rainwater has nowhere to go except the lower, poorer, sections of the city, before flooding the over-taxed Ciliwung river. The Limnology Research Center at the Indonesian Institute of Sciences showed that of the over 200 lakes in Jakarta and the land around it in 1990, only 25% remain today.

### **Adaptation**

#### **1. Relocation of the Country's Capital**

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In order to address the issue of sea level rise, sinking land, crippling floods, traffic, world's most polluted canals, and over-crowding. The Indonesian President, Joko Widodo, in 2017 commissioned a survey from the National Development Planning Agency, or BAPPENAS, to look into sites in Central Kalimantan province on Borneo island. The chief candidate for a new capital is Palangkaraya, a Kalimantan city that even founding president Sukarno once hoped could replace Jakarta as the capital. Although Indonesia is on the so-called "Ring of Fire" its Borneo provinces are further from volatile tectonic plates and are thus less susceptible to volcanoes and earthquakes that are a regular feature of life in Indonesia. In addition, Central Kalimantan also has very low sea access for the seat of a nation comprised entirely of islands. The governor of Central Kalimantan, Sugianto Sabran said that his province is preparing 1235.53 acres of land in Palangkaraya, Gunung Mas Regency, and Katingan in the event that the government moves the needle on relocation in 2018. Planning Minister Bambang Brodjonegoro said that the move could take as long as 10 years, but said the government was using "visionary" thinking.

The relocation of the Indonesian capital will be accompanied with great economic and geopolitical costs to. For one thing, Borneo is already shared between Indonesia, Malaysia, and Brunei, a fraught balance that would be affected if one of those countries decided to govern from there. Moreover, "political parties would have to move out. Courts and Supreme Courts would also have to move, aside from the president. Military bases would also have to move. There would be hundreds of thousands who would need housing and offices," as Indonesia's Vice President Yusuf Kalla said last year. And finally, developing Palangkaraya or a nearby city to house a new capital would aggravate environmental degradation on Borneo. The biodiverse island has been particularly hard-hit by deforestation due to palm oil and other industries, and it is home to dozens of critically endangered species like the Borneo orangutan. The Indonesian government estimates a total expenditure of about thirty-three million United States Dollars.

## **2. Building a Sea Wall to Prevent Flooding and Sinking**

In 2014, the National Capital Integrated Coastal Development (NCICD) in Jakarta, had undertaken the construction of a fifteen-mile sea wall from the city of Tangerang in the west of Jakarta to Jakarta's Tanjung Priok harbor, as a measure of protecting the capital city against flooding. The estimated cost of the project is

going to be \$40 million USD and is estimated to take 10 to 15 years, before construction of this wall is realized. In the meantime, existing dikes will be strengthened. The NCID masterplan is being supported by the Dutch and South Korean governments.

The sea wall is a quasi-temporary barrier to hold back the rising sea and compensate for subsidence — built extra high because, like the rest of North Jakarta, it is expected to sink, too. With subsidence at the current rate, the Coastal Wall itself may be underwater by 2030. The plan includes the creation of a large artificial lagoon inside the wall in order to buffer outflow from the 13 rivers in Jakarta. It will help with the flooding which is an issue when the rains come. The masterplan of this project intends on converting the surface of the sea wall into a center for urban development. This will include the construction of upmarket offices and housing, as well as low-cost housing, green areas, and beaches. The new integrated city will also involve 17 artificial islands, complete with toll roads, a railway, and seaport, and should be able to absorb approximately two million people.

Even though many believe that building of the sea wall would solve Jakarta's problem of sinking, many others oppose to it on the grounds that its construction would destroy the local fishing communities. Even more alarming is the spot along the waterfront where the wall ends and all that holds back the sea is a low, crumbling concrete rampart. The water was only a couple of feet below the top when we peered over the embankment. "If this wall breaks, there's simply no holding back the Java Sea," said Mr. Brinkman (a hydrologist who for decades has been studying Jakarta for the Dutch water research institute Deltares), gesturing from the rampart toward the city. "Jakarta will flood all the way to the center of town, six kilometers from here. JanJaap Brinkman, a hydrologist with the Dutch research institute Deltares, told the *Guardian*, that the city only had two options: "retreat or advance". "We either abandon and evacuate north Jakarta, which is a non-starter, or we advance out into the bay with the seawall," a \$40 billion waterfront city project designed to keep the city from sinking.

Three Dutch non-profit groups released a report in 2017 which also casts doubt on whether the sea wall and artificial islands could solve Jakarta's subsidence problem. Jan Jaap Brinkman, a hydrologist with the Dutch water research institute Deltares, argues it can only ever be an interim measure. He says it will only buy

Jakarta an extra 20-30 years to stop the long-term subsidence. “There is only one solution, and everybody knows the solution,” he says. That would be to halt all groundwater extraction and solely rely on other sources of water, such as rain or river water or piped water from man-made reservoirs. He says Jakarta must do this by 2050 to avoid major subsidence.

On the contrary, Jakarta’s Governor Anies Baswedan says, people should be able to extract groundwater legally, as long as they replace it using something called the biopori method.

In 2009, the Ministry of Environment came up with a novel idea to restore the water tables - **the Biopore Method**. The method involved digging a hole 10 cm. in diameter and 100 cm. deep, into the ground to allow water to be reabsorbed into the soil. Furthermore, the Ministry issued a decree requiring homeowners and commercial buildings to store rainwater in 3-foot-deep, “Biopore cylinders” on their properties to absorb and store rainwater.

Critics say this scheme would only replace water at a superficial level, whereas in Jakarta water is often pumped out from several hundred meters below ground level. Secondly, the decree had no enforcement mechanism, and the city environment ministry could not say how many cylinders had been installed. Not to mention the fact that groundwater, like piped water, is highly contaminated. According to a study conducted by the city government, **seventy percent of the wells in the city are contaminated by the E. coli bacteria from leaking septic tanks.**

Furthermore, some critics opine that the Great Garuda (Great Seawall) will not be able to restore the flow of some of the sinking city’s 13 rivers and various canals into Jakarta Bay, because some of the channels drain into floodwater retention lakes, a magnet for new migrants from outlying provinces who squat illegally around their perimeters. Pumping stations then spew the highly polluted water from these lakes the last few hundred yards into Jakarta Bay.

Many more such lakes with larger capacity need to be built in order to be able to discharge the water of all other rivers and canals, including the large flood canals, according to the NCICD Master Plan. “You’re talking about pumping lakes up to 100 square kilometres,” said Victor Coenen, Indonesia chief representative

for Dutch engineering and consulting firm Witteven+Bos, who was part of the government's Dutch consulting team. "Where do you find room for that in a densely populated city?"

Coen further noted that the seawall could solve Jakarta's problem if a single large storage lake is built in the Jakarta Bay, enclosed by the inner and outer seawalls and fed by pumping stations onshore. "If it comes to that, I'd prefer to have the one big black lagoon offshore," Coenen said. Moreover, in order to prevent the Great Garuda from looking like a great black lagoon, the city must prioritize providing clean piped water to its citizens and setting up waste treatment facilities so the rivers and canals no longer have to function as open sewers.



The sea wall is meant to mitigate the city's severe flooding



A new concrete seawall built on the old sinking wall in Jakarta. Anton Raharjo/Pacific Press/LightRocket/Getty

Images



The construction of the sea wall is underway



Houses once overlooking the ocean now face a dyke

<https://www.bbc.com/news/world-asia-44636934>



Aseng, 42, bathes behind the old concrete seawall as waves smash into it in 2016. Anton Raharjo/Pacific

Press/LightRocket/Getty Images



Fortifying a North Jakarta sea wall. A giant Coastal Wall protects the city, but may itself be underwater by 2030.



The Citarum has been dubbed the world's "dirtiest river" by the World Bank. Picture: James Wendlinger

### 3. Cleaning Rivers, Canals, and Waterways

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In order to prevent Jakarta from sinking,

- ✓ It is critical for people to **stop digging wells**.
- ✓ Attempt to use the process of **desalination**. However, it is not a simple solution for Jakarta. “You could desalinate until you’re blue in the face and you won’t be able to fill the void,” says Michael Kiparsky, director of the Wheeler Water Institute at UC Berkeley. “The scale of water use in Jakarta is immense, and the cost of the infrastructure and the cost of the energy to desalinate the ocean water would be massive.” “The message here is that technology can’t get us out of this,” Kiparsky adds. “You need something more difficult—you need institutional solution; you need political will to do something radical.”
- ✓ **Clean the canals and rivers**. This can be achieved by regulating the factories and households that dump chemicals and garbage. However, the cleaning effort could potentially create a secondary problem of resettling the informal communities (who would get displaced) into new land and building homes for the internally displaced people.
- ✓ **Recycle plastic products**. Mohamad Bijaksana Junerosano (an activist of Greeneration), opined that the solution has to involve law enforcement, education, and social awareness. Furthermore, according to him, the government should invest more to teach children about waste and recycling and retrain public attitudes towards waste. A small first step towards achieving this goal was witnessed in the Bandung area of Jakarta. In order to encourage recycling, the authorities here are supporting initiatives called, “**Eco-villages**,” where residents can bring old plastic items and earn small amounts of money in exchange. The plastics are then divided by type and recycled.

Rivers and canals in Indonesia are so polluted and clogged by bottles, bags, and other plastic packaging, that in 2018 the President Joko Widodo **initiated a seven-year clean-up campaign**. As part of Widodo’s anti-pollution campaign, the Indonesian Army was called to assist in the clean-up process, who were allowed to seal off factory pipelines they suspect of funneling contaminated water into streams and rivers

without first gathering evidence and issuing warnings. According to the decree, the army was granted the right to, “Improve, revoke, and/or alter existing regulatory provisions.”

**Success Stories:** Colonel Purwadi, who oversees an area with many textile factories, has been successful in installing a new communal waste-water treatment plant in his sector.

In a leafy kampung called Tongkol, residents during the last couple of years have installed their own septic tanks and kept their stretch of the Ciliwung clean.

A young architect named Kamil Muhammad, from Architecture Sans Frontieres-Indonesia, designed a low-cost home made of concrete, bamboo and reused brick. It stacks seven tiny apartments under a covered communal roof deck. The project is a template for cheap, do-it-yourself housing that can free up space along Jakarta’s waterways critical for flood control.

The commander of a military unit in the city of Bandung described it as "our biggest enemy." Dr. Anang Sudarna, head of the West Java Environmental Protection Agency says even though, “The result is a little bit improved... but I am angry, I am sad, I am trying to think how best to solve this... the most difficult thing is the people attitude and the political will.”

Work has been started on a project to help alleviate the flooding issues in Jakarta - The Ciliwung River is being expanded, deepened, and reinforced to prevent the sides from collapsing during heavy rain. Current progress has doubled the depth to 2m from 1m, but the ideal depth would be 5-6m. Additionally, a 32km sea wall is being constructed, due to finish in 2017, to help with the tidal floods. The three-phase project is planned to be finished in 2070. The expansion of waterways including the Ciliwung river and the installation of the 32km sea wall are part of the initiatives to stave off the flooding issue.

A major development scheme began in 2013, whereby islands were being reclaimed from the bay. The development boasted of posh condominiums, yacht marinas, and golf courses. The development scheme was also linked to discredited plans for reclaimed islands inside the bay. Officials in Jakarta believed that

that tax earned from the developers of the islands could help towards the construction of a dike to halt it from sinking.

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The current president, Joko Widodo stated, “I know there have been efforts to mitigate as well as prevent [floods], such as reforestation... Let’s focus so that this problem that has been plaguing us for years is resolved...” Ardhasena Sopalheluwakan is among the climate scientists here who think the best approach was never to construct a giant dike but “to give back part of North Jakarta to nature.” “The idea would be to **“Reintroduce mangroves and rejuvenate some of the dozens of reservoirs that were actually part of old Jakarta.”**



Colonel Purwadi, head of the Citarum Task Force Sector 7. Picture: James Wendlinger

Dadan Ramdan, of Walhi



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The challenge is so vast, different army units are needed to deal with the problem - KATE STEPHENS

## Conclusion

**Mitigation:** In order to tackle the adverse effects of climate change on communities (including the coastal communities, small island states, women, youth, indigenous people, poor people, disabled, and the elderly), the “**Climate Justice**” initiative brought some hope.

The **climate justice** concept with a formal framework first came into light at the United Nations World Summit on Sustainable Development in Bali in June 2002. At the summit, twenty-seven principles of climate justice were developed by a coalition (CorpWatch, 2002).

The main focus of the principles was, to expel the impacts of climate change, reduce the emission of greenhouse gases, influence of the transitional corporations on decision-making, to put a ban on new fossil fuel, nuclear power, and large hydro schemes exploitation and replace it by generating sustainable energy resources, increasing the need for women’s rights, promoting relevant education, consuming resources sensibly and creating a healthy planet for the future generations are required (CorpWatch, 2002).

Principles 7, 8 and 9 of the document call for the recognition of an ecological debt that the industrialized governments and transitional corporations owe the rest of the world, identifies them liable for all past and current life-cycle impacts and affirms the rights of the climate change victims and associated injustices to receive full compensation, restoration and reparation of loss of land, livelihood and other damages (CorpWatch, 2002; Goodman, 2009). This conveys the idea of bringing justice to the ultimate climate victims – **the climate refugees**. One central theme of climate justice is taking responsibility of the climate refugees by the polluting countries, and rehabilitating them properly (Okereke, 2010).

Most strategies designed to reduce hazard vulnerability and/or adapt to climate changes are in early stages of development. However, successful programs such as early warning systems are becoming more widespread. Strategies such as crop insurance and cash-based aid to disaster victims are not widespread. Long term adaptation demands improved planning and regulation in hazard zones, possible population movements and the construction of protective infrastructure (Wisner et al., 2004).

**Table 5: Government Policies Influencing Vulnerability and Resilience**

### Government Policies on Coping Mechanisms

Goals	Strategies	Examples
Increase Resilience	<ul style="list-style-type: none"> <li>• Encourage Rural Development</li> <li>• Micro-credit Improvement of livelihoods</li> <li>• Encourage food security</li> <li>• Build Infrastructure Roads</li> <li>• Relief centers</li> <li>• Watershed management</li> <li>• Land Use and development regulations</li> </ul>	<ul style="list-style-type: none"> <li>• Grameen bank loans Fair Trade programs World Food Program Initiates</li> <li>• United Nations Water and sanitation program (e.g. bore holes).</li> <li>• Tanzania versus Kenya Public Lands</li> </ul>

	<ul style="list-style-type: none"> <li>• Communal versus Private Land</li> <li>• Land reform</li> </ul>	
Reduce Hazard Vulnerability	<ul style="list-style-type: none"> <li>• Early Warning Systems</li> <li>• Replace lost income</li> <li>• Preservation of productive assets</li> <li>• Crop insurance systems</li> <li>• Strict regulation in hazard zones</li> <li>• Secure squatter settlements in urban areas</li> </ul>	<ul style="list-style-type: none"> <li>• Famine Early Warning System (FEWS)</li> <li>• USAID (Somalia)</li> <li>• Botswana Drought Relief Program Multiple cases (See Wisner et al., 2004)</li> </ul>
Adaptation	<ul style="list-style-type: none"> <li>• Sea walls (SLR)</li> <li>• Population movement (SLR)</li> <li>• Neighboring relocation agreements (SLR)</li> <li>• Improved planning for coastal communities (SLR)</li> </ul>	<ul style="list-style-type: none"> <li>• Nigeria Proposed in Maldives e.g. New Zealand/US See Wisner et al., 2004.</li> </ul>

[http://siteresources.worldbank.org/EXTSOCIALDEVELOPMENT/Resources/SDCCWorkingPaper\\_MigrationandConflict.pdf](http://siteresources.worldbank.org/EXTSOCIALDEVELOPMENT/Resources/SDCCWorkingPaper_MigrationandConflict.pdf)

Assessing the Impact of Climate Change on Migration and Conflict Clionadh Raleigh, Lisa Jordan and Idean Salehyan

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