

THE SINKING CITY: JAKARTA

WHAT IS LAND SUBSIDENCE?

- Subsidence = the lowering of the earth's surface over time
- A local phenomenon on a global scale
- Mainly human induced
- Steadily more attention towards the topic, as new subsidizing areas occur
- Main Consequences: increased flood risk & structural damaging
 - Especially the flood risk of coastal settlements increases when land subsidence and sea level rise enhance each others effects
- Delayed response of aquitards can lead to additional subsidence



- All over the world, cities are subsiding
- Subsidence is a local problem, but not tied to a specific region
- Examples are often located in coastal regions, but inland cities face subsidence as well e.g. Mexico City
- To develop a resilient city, one of the key requirements is the active management of subsidence



land subsidence and Jakarta's other problems
Questions remain whether:

islands can sustainably adapt to extreme changes like subsidence and sea level rise
capital's relocation won't simply shift the negative effects on to Boracay island

- Deforestation and loss of biodiversity are expected
 - If urban planning fails, traffic jams, air pollution, risk of earthquakes and floods might also occur in the new capital

3. Impoverished inhabitants , who are currently affected most and will be staying in their current location, will be left to live in an unfunctional system, in which they'll have to keep pumping groundwater.

 - Elevation costs for 1 house lie at a minimum of 800 US\$. Only about 13% of households in low-income areas have that much money saved
 - As the problem is ever-present, the risk perception of inhabitants vs. The actual level of exposure is mismatched. Regular floods are normalized and accepted, as education on subsidence is scarce.

DRIVERS OF SUBSIDENCE

Human Induced

- Overextraction of water
 - Rapid Urbanization
 - Fracking & Mining Activities
 - Land Reclamation

Naturally Induced

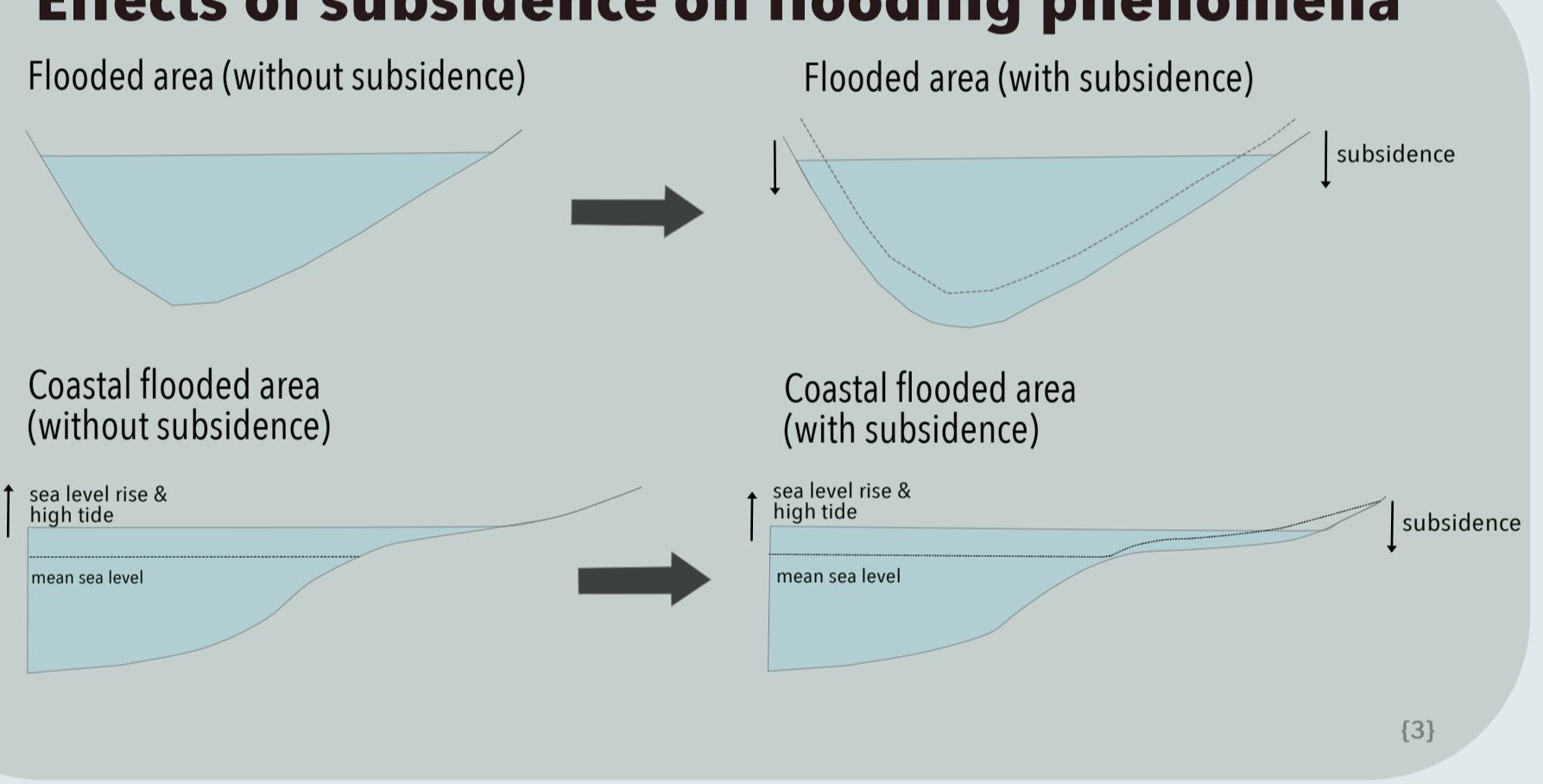
- Oxidation of Organic Material
 - Earthquakes
 - Compaction of unconsolidated-alluvial soils

WHAT MAKES JAKARTA SPECIAL?

- Lowland coastal area
 - Soft alluvium soil
 - 13 rivers & 2 canals flowing through Jakarta
 - Rapid growth - 11 000 000 Inhabitants
 - Excessive groundwater extraction

CONSEQUENCES FOR THE CITY:
-Subsidence rates of up to **20 - 28cm/year**

- Fastest subsiding city worldwide
 - An accumulated subsidence of about **5 Meters**
 - The flooding area expands and the water depth increases



SOLUTION STRATEGIES

SCIENTIFIC APPROACH

on measures & mitigation measures ring of subsidence characteristics

- Continuous monitoring of subsidence characteristics, initiate subsidence adaptive urban development & increasing the surface groundwater supply and resources
 - As there is a strong correlation between floods and subsidence, they should be managed together

ARTA IS ACT GOVERNMENT

INDONESIAN GOVERNMENT APPROACH

In the past years 2 main strategies have been pursued.

1. BUILDING A SEA WALL:

Small concrete dykes have been
be of no use and now have to
dig them up.

disproportionally. These areas lie at a lower elevation and struggle as the walls are sinking and crumbling.

2. THE RELOCATION OF JAKARTA:

As a reaction to Jakarta's dense population, high pollution, extreme road traffic and overall vulnerability regarding natural disasters, president Widodo declared the capital's relocation to East-Kalimantan (Borneo) in 2019. The new location more than 1000 km away was chosen, due to it's central location in Indonesia, to minimize effects of natural disasters and the large area available (40.000 hectares).

- 19% funded
- Includes rel

- Includes relocation of government offices & homes for 1.5 million civil servants
 - Relocation of People planned starting in 2024
 - Estimated costs : 33 Billion US Dollars