

# The GLOCEPS

— Daily Influential Brief —  
Research and Analysis in Development

## Dilemma of sinking cities and implications on the future of Nairobi

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*Environmental degradation continues to impact negatively on sustainable development with some of the consequences being the silent but painful subsidence of a number of cities worldwide. Our Research Fellow for Development, Michael Owuor, explores the possibility of land subsidence in Nairobi City within the context of uncontrolled excavation activities.*

*Dr. K.O. Asembo, Editor-in-Chief*



Photo Credit: The Jakarta Post

### Introduction

The unmitigated extraction of underground water is increasingly getting popular in satisfying water needs across urban centres worldwide. It is estimated that more than 2 billion people rely on the acquirable underground water for domestic and industrial use. However, an expanding global population coupled with climate change challenges and the prevalence of cheap well drilling and pumping technologies engenders a silent revolution of sinking cities. Nairobi city is a plausible entrant into this league. Consequently, the unmitigated exploita-

tion of this valuable resource threatens the delicate equilibrium between the city's stability and water security. This brief acknowledges that land subsidence due to groundwater extraction poses an existential threat to Nairobi city. Apathy among policymakers and local communities on the subsequent impact reiterates the need for the renewal of interest and support of the water sector. Policy action that stop or slows groundwater extractions like investing in alternative and sustainable water security projects should be prioritized.





## The context

A rising number of metropolises around the global are exposed to the threat of land subsidence. Geology studies indicate that large groundwater extraction is increasingly being associated with ground subsidence regardless of geological structural formations. Though the land subsidence phenomenon was initially associated with coastal cities and those along waterways like Venice in Italy and Jakarta in Indonesia, the trend is moving inwards and across continents. Examples of sinking cities that are many metres above sea level are Mexico City (Mexico), Tehran (Iran), Bogota (Colombia), Delhi (India), Sao Paulo (Brazil), Las Vegas and Houston (USA) and Riyadh (Saudi Arabia). The common

problem among them is the significant groundwater extraction. There are fears that Nairobi, which sits atop the indiscriminately extracted Nairobi aquifer, is on a similar path. The city has a growing population of more than 4.3 million, with more than half lacking access to water. This has made the unmitigated drilling of more than 3,000 boreholes hugely attractive. The situation is attributed to poor regulation by the apathetical and under resourced water regulation agencies resulting into emergence of cartels profiting from a run-down water infrastructure. This brief explores the dilemma of sinking cities and advances actionable prospects for policymakers and the citizenry.





## Land subsidence and over-extraction of groundwater

The trend of cities sinking under their own weight is a grave though often ignored concern. Realities in cities like Jakarta and Mexico City have engendered discussions around this growing threat, associated with climate change and unmitigated groundwater. Land sinkage in Jakarta presents enormous social and economic challenges. It is estimated that 95% of North Jakarta will be lost by 2050. Already 40% of the city is below sea level. Consequently, Indonesia is constructing a new capital city where she will start relocating government functions starting 2024. Likewise, other sinking cities are recording increased flooding during rainy seasons, destruction of business facilities and homes, and loss of livelihoods.

Evidence from sinking cities highlight association between underground water extractions and the lack of access to piped water. The situation is exacerbated by an increase in water demands by a growing population and expanding commercial base. The Nairobi metropolitan area is already experiencing consistent water deficits from its main water source, Ndakaini

dam. This informs the growing dependence on underground water from the Nairobi Aquifer System. Even though Nairobi is thought to be a long way to experiencing the fate of other sinking cities, the city's path is firmly set. There is an increasing construction of residential buildings and commercial spaces like shopping malls and skyscrapers. It is becoming increasingly attractive to exploit underground water in order to improve the commercial viability of real estate. However, heavy load of the heavy buildings and tectonic activities due to underground vacuums left after water has been extracted highlight a precariously developing situation.

Data about sinking cities highlight striking similarities of underground water extraction and a large number of registered and unregistered wells. A higher number of wells is associated with higher rates of land sinkage. The highlights in Table 1, argues that even though there is dearth of data about Nairobi's annual land subsidence rates, the city's population of wells is worrying. Once land subsidence sets in, mitigating the impacts has proved largely inexorable.



Photo Credit: Treehugger





Cities	Estimated number of underground wells (registered and unregistered)	Cities
Mexico City, Mexico	1500	2.4 to 60cm
Jakarta, Indonesia	4500	5- 25cm
Shanghai, China	1700	1 to 9cm
Nairobi	3000	Not available

The problem of sinking cities expose a pertinent challenge of water drilling regulation that promotes unrestricted excavation of water wells. While poor city planning has been identified as critical gap, reports highlight capacity issues at the Ministry of Water, Sanitation and Irrigation and the implementing agencies. Focus is deemed to be around revenue collection from the licensing of the drilling of water wells. Moreover, implementing agencies like the Water

Resources Management Authority (WARMA), National Environmental Management Authority (NEMA), and water boards lack competent personnel as well as technical and financial resources to manage aquifers. They are thus handicapped in enforcing legal provisions that control unmitigated drilling. These challenges need addressing to mitigate the existential threat to Nairobi City.

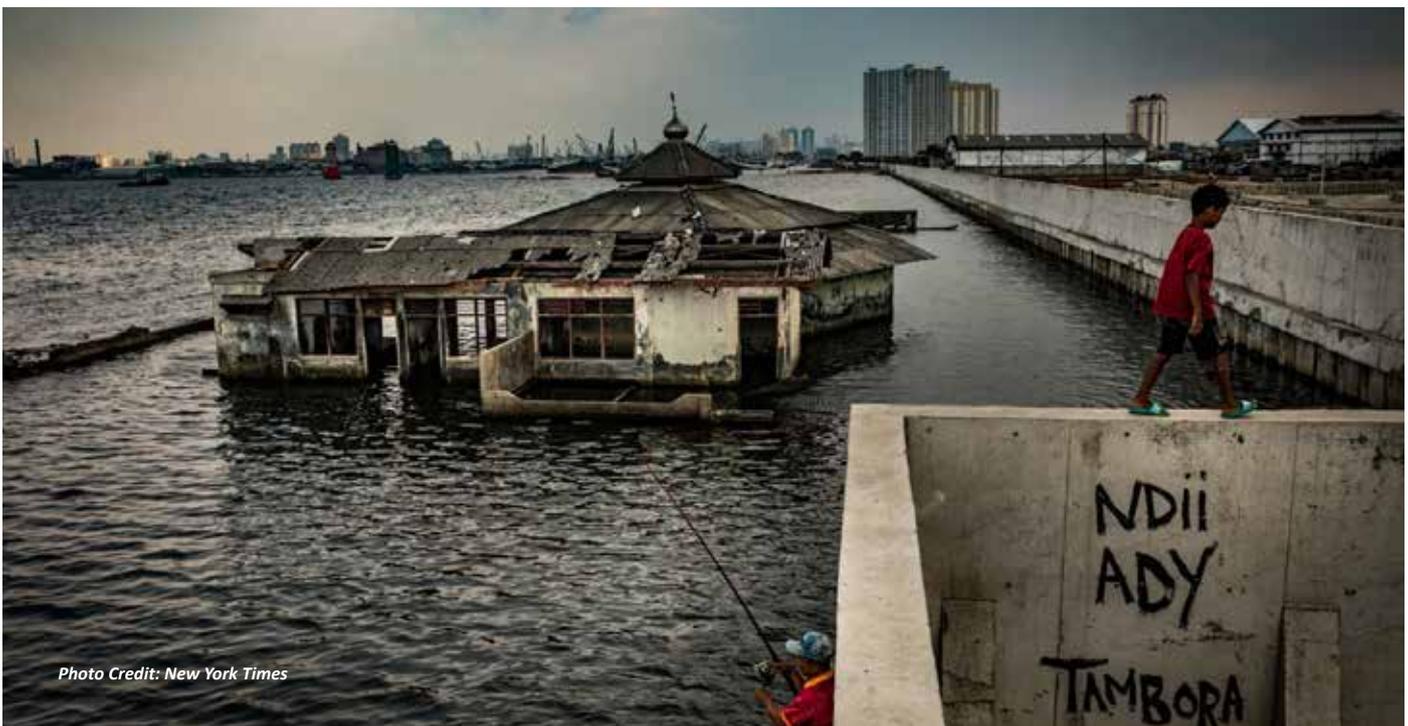


Photo Credit: New York Times





## Prospects

From the development lenses, the consequences on sinking cities range from cracks in transport and subway systems, widespread damage to building and other structures and rupture of water and sewage systems. Through solutions to halt land subsidence are available, they are exorbitant. For instance, Tokyo employed the artificial recharge method to replace groundwater at its source. Therefore, policymakers and water authorities should prioritize and expedite efforts on strategic alternatives that are cost-effective and sustainable. Studies should be undertaken to understand the impact of unmitigated drilling of wells on Nairobi city's geology. Policy action should be targeted at addressing apathetic management of water resources, a fundamental drive by local communities to use their own underground water resources. Since water authorities are deemed unreliable in meeting water demands by individuals and industries, a multi-pronged approach involving financing and monitoring is needed. Equally, policy actions should promote strict regulation on underground drilling of water wells including limiting their numbers per area; promote use of alternative water sources and rain harvesting. Decisive action is required on environmental management and cleaning of rivers, dams and lakes to allow for widespread use of piped water.



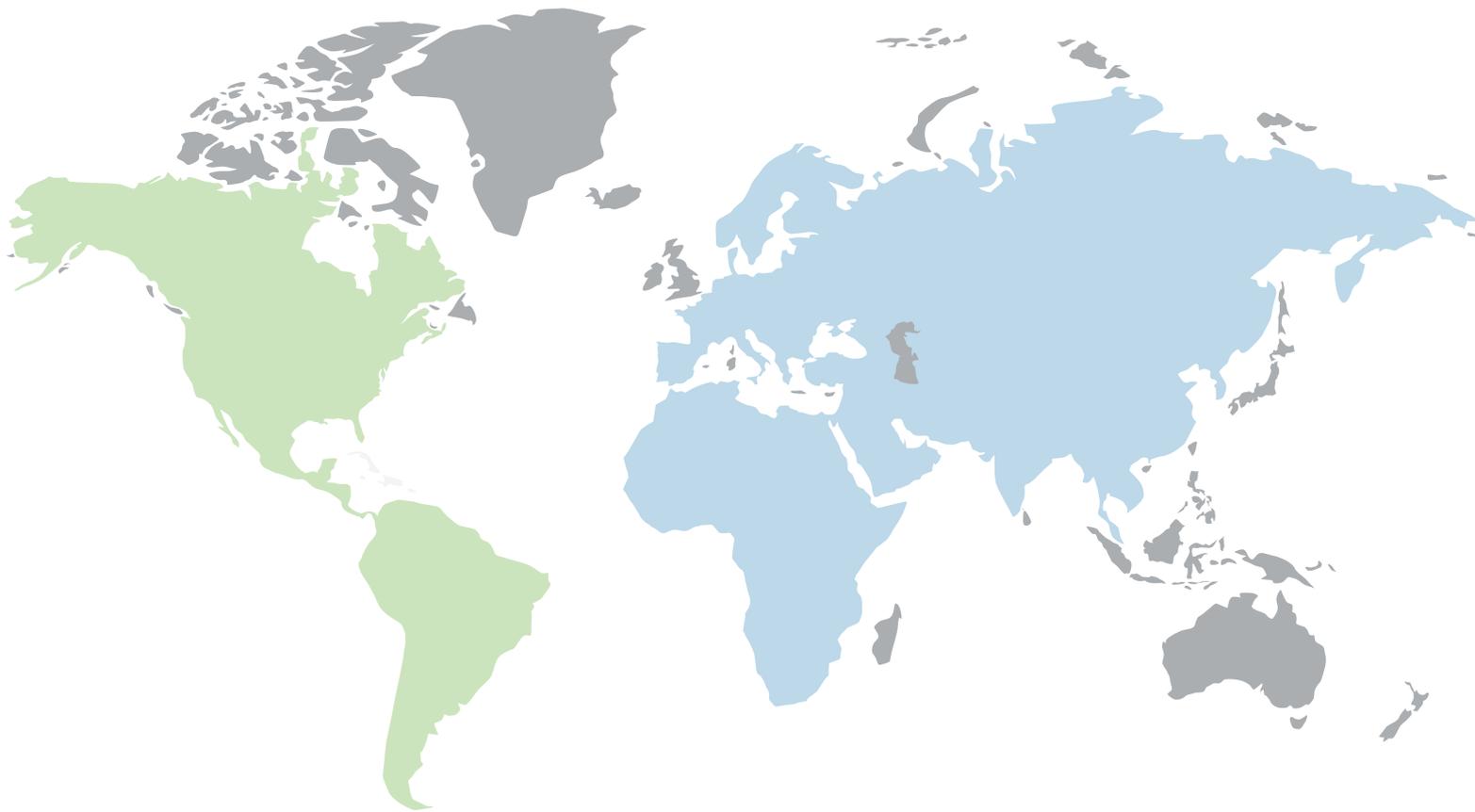
Photo Credit: Devpolicy Blog

**Mr Michael Owuor** is GLOCEPS Research Fellow for Development Pillar. He has over ten years' experience in running multidisciplinary development programs and research with international public benefit organizations, universities and government agencies for policy action. His research priorities include business strategies, economic development and political economy. He holds Bachelor's degree in Business Management; a Master of Business Administration and MSc in Health Systems Management.





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