Projecting the air quality, toxic and health impacts of the Lamu coal-fired power plant

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Air pollution: largest environmental health risk in the world

- Air pollution the biggest environmental killer in the world
- WHO: Air pollution is officially classified as a carcinogen and labeled “a leading environmental cause of cancer deaths”

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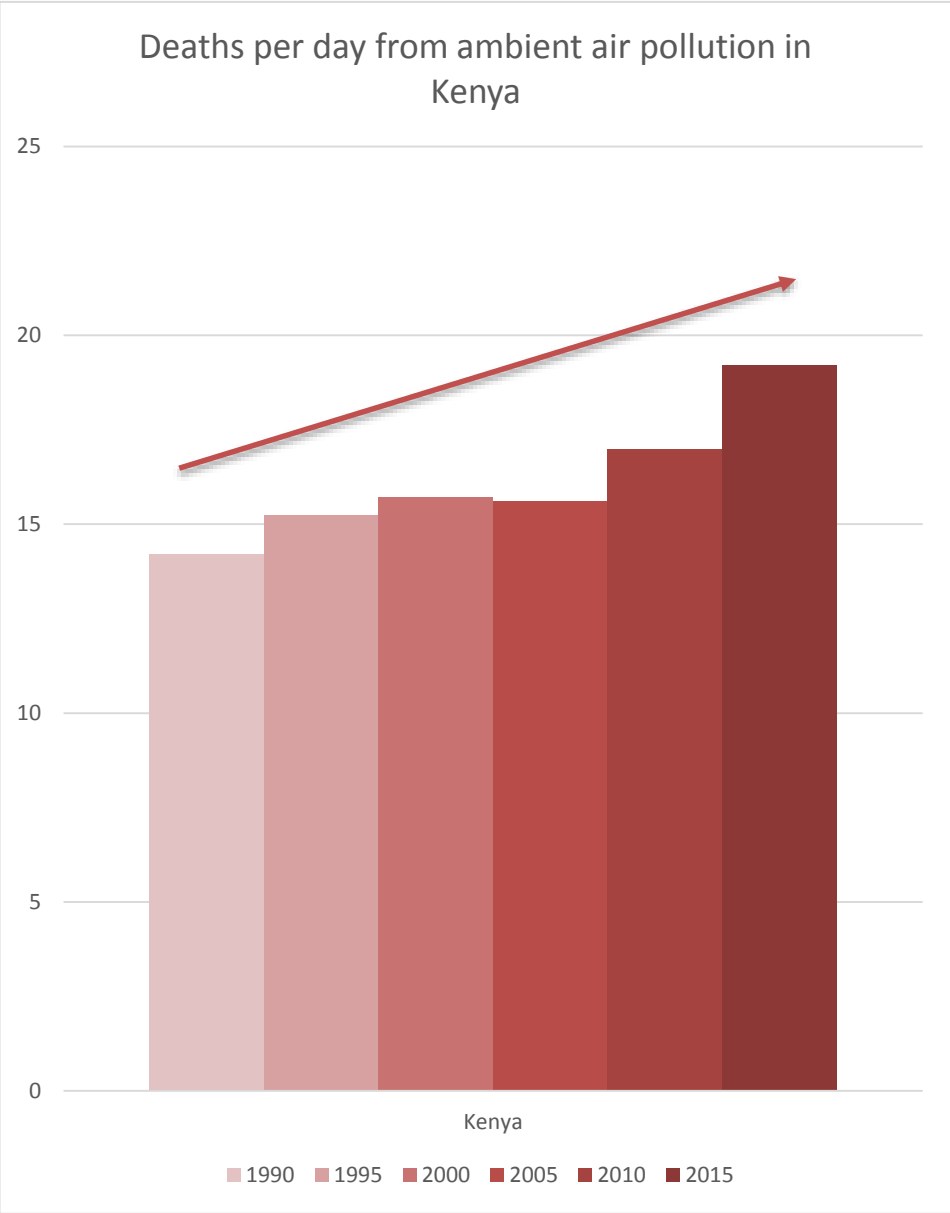
Alarming rise in air pollution deaths



Source: Global Burden of Disease 2015

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PM2.5: tiny, toxic particles that enter deep into lungs and into the bloodstream

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Health impacts of coal power plant emissions

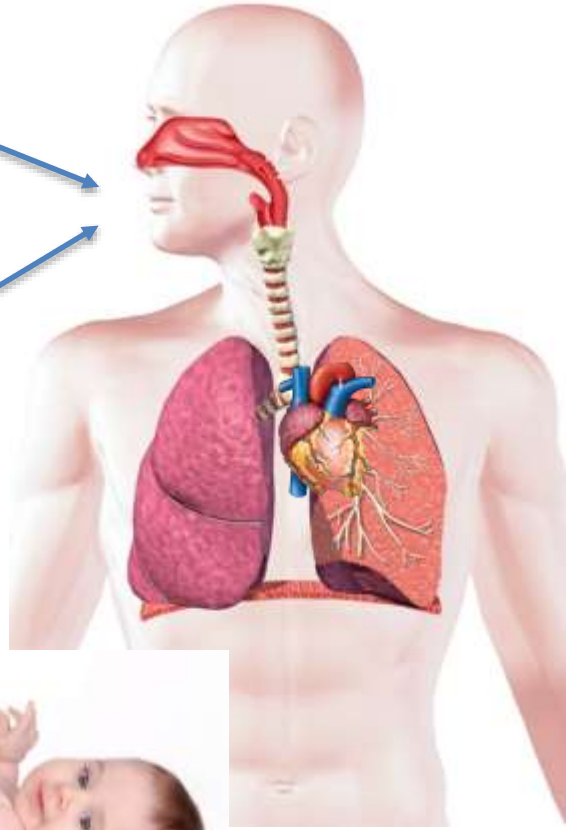
SO2

Dust

NOx

PM2.5

NO2



Low birth weight

Lung cancer
Stroke
Heart disease
Respiratory disease
Asthma symptoms

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Mercury health risks

- Mercury is a potent neurotoxin that can cause severe health problems even at very low doses, and is a serious risk to children's cognitive and neurological development
- Coal-burning is a key source of mercury releases into the environment globally
- Emissions from coal-fired power plants can create significant local hotspots of mercury deposition

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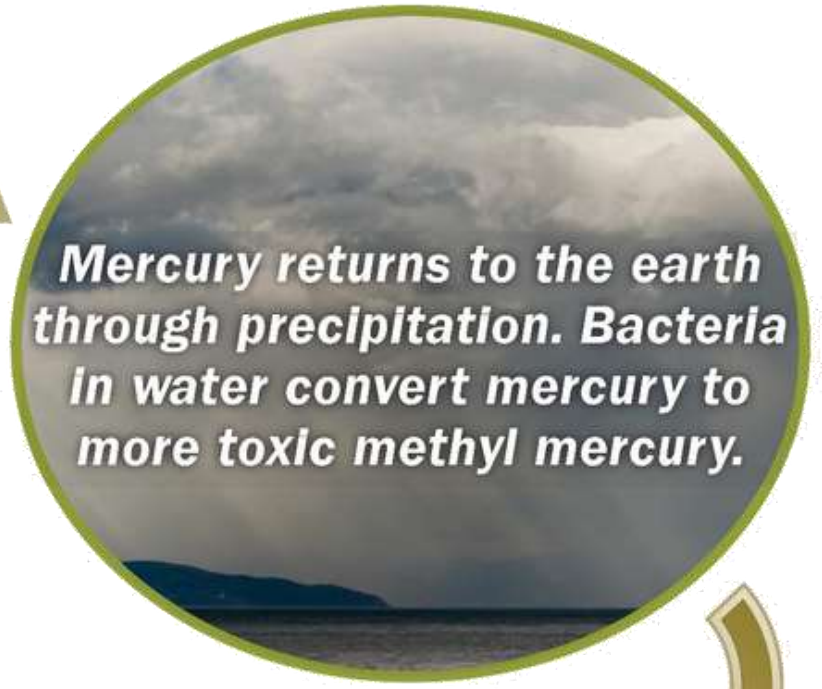
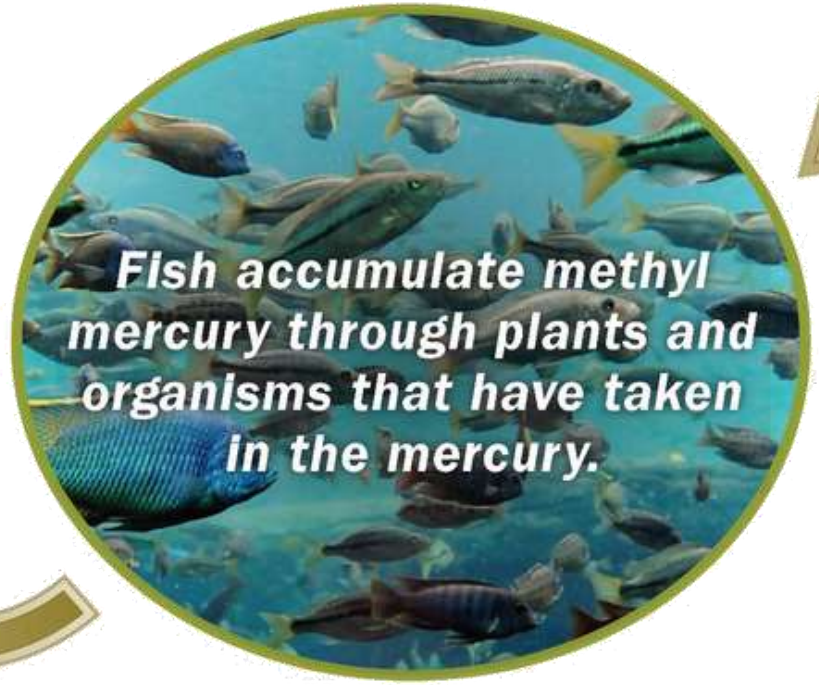
Coal-fired power
plants emit mercury


Mercury returns to the earth
through precipitation. Bacteria
in water convert mercury to
more toxic methyl mercury.


Fish accumulate methyl
mercury through plants and
organisms that have taken
in the mercury.


People accumulate mercury
through fish consumption

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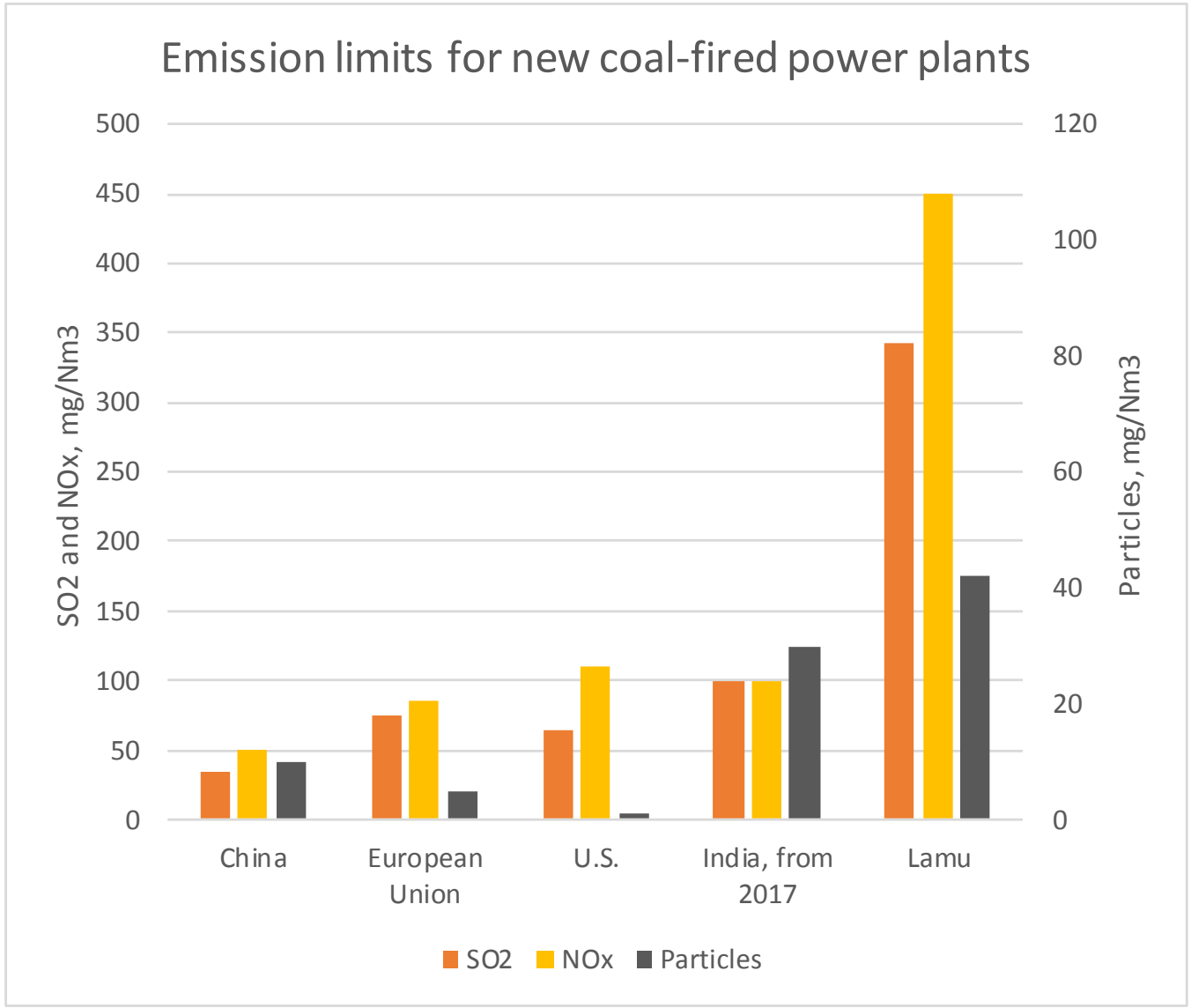
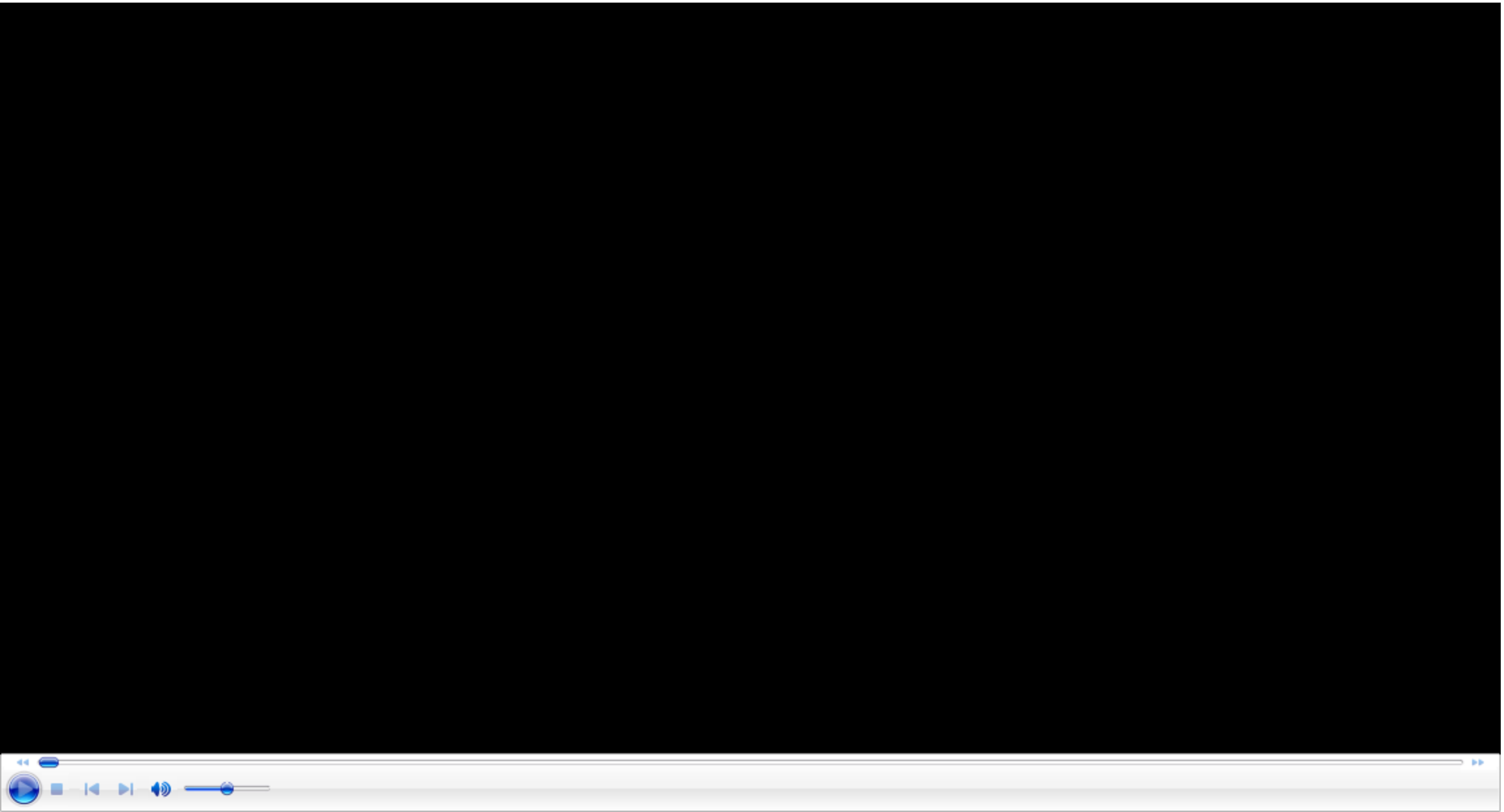
Lamu coal-fired power plant project

- The proposed Lamu power plant would be among the largest point sources of air pollution and mercury in all of Kenya
- Yet the toxic emissions and health impacts of the projects have not even been analysed in the EIA or elsewhere
- This study is the first attempt at plugging this gap

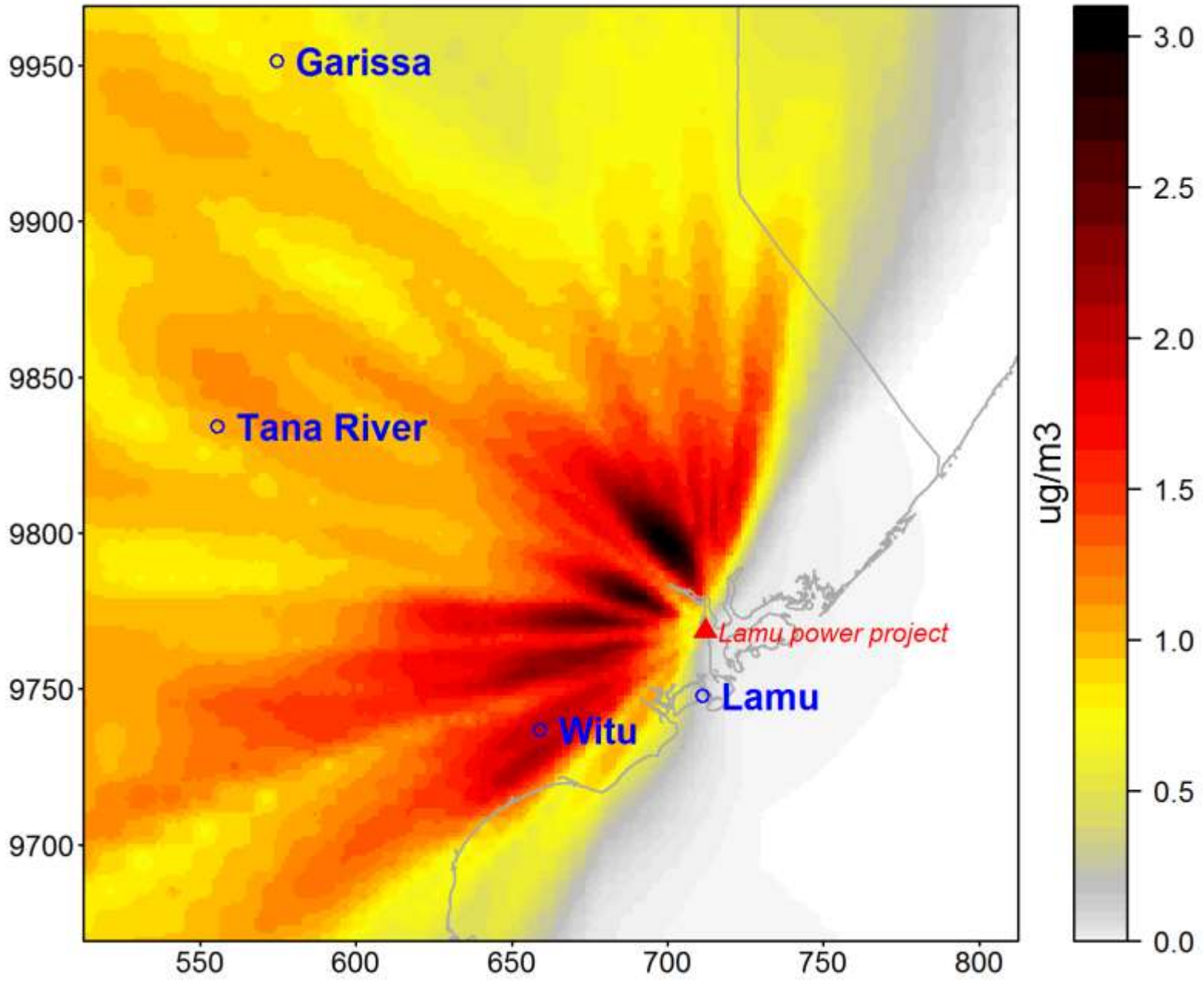
Highly polluting technology makes impacts worse



Model results – increases in daily pollutant levels



Maximum 24-hour PM2.5 concentration from Lamu power plant



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Projected health impacts – cases per year

	Outcome	Present day population		2030 population	
PM2.5, premature deaths	Chronic diseases in adults	22	(14-29)	38	(24-50)
	Lower Respiratory Infections in children	3	(1-8)	3	(1-7)
NO2, premature deaths	All causes	1	(0-1)	1	(1-2)
Premature deaths	Total	26	(15-38)	41	(26-58)
PM2.5	Low birth weight births	20	(6-35)		

- Approximately 1,600 premature deaths and 800 low birth weight births over an operating life of 40 years

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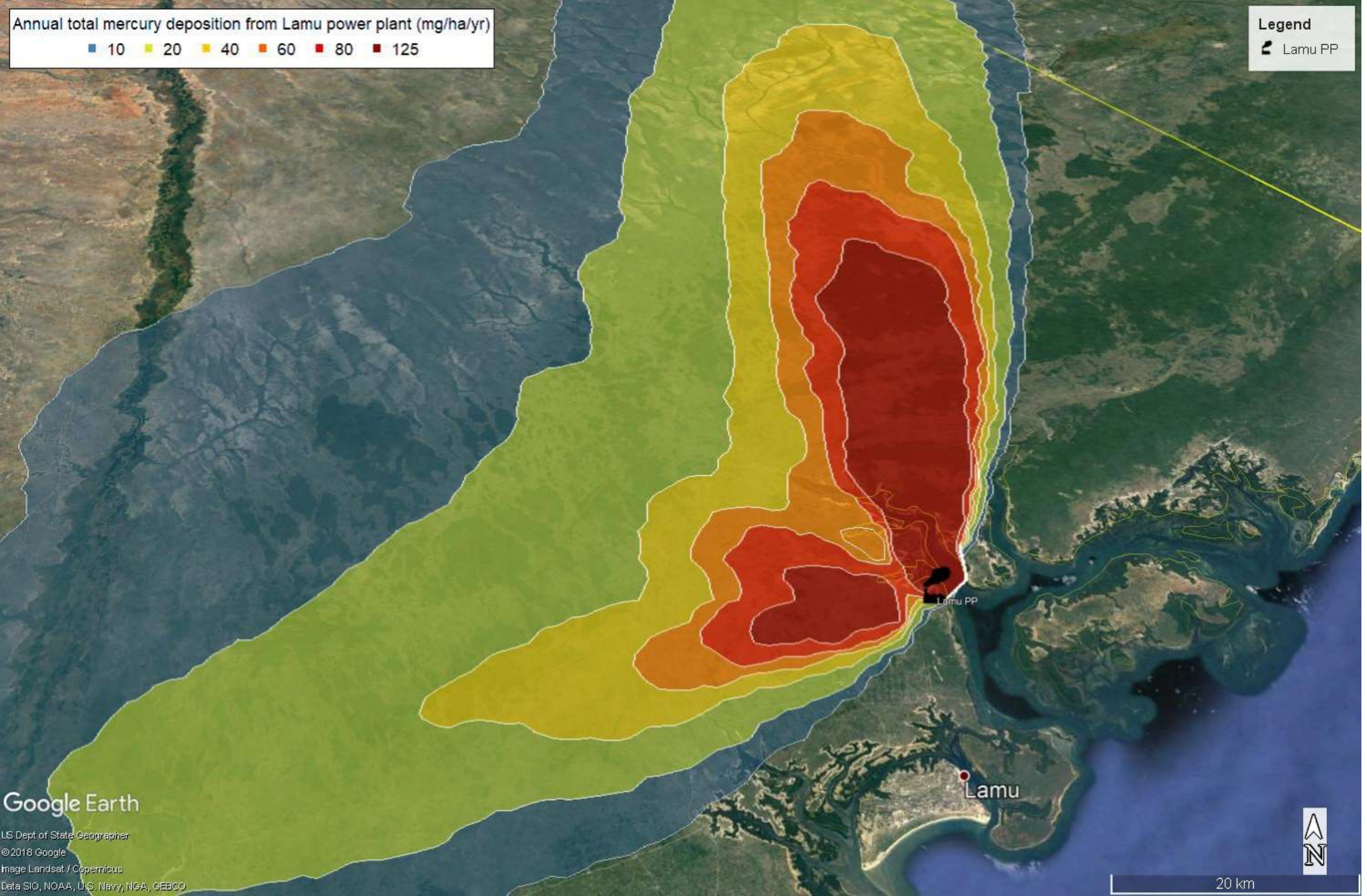
Annual total mercury deposition from Lamu power plant (mg/ha/yr)
10
20
40
60
80
125
Legend
Lamu PP
Lamu PP
Lamu
Google Earth
US Dept of State Geographer
©2018 Google
Image Landsat / Copernicus
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
N
20 km

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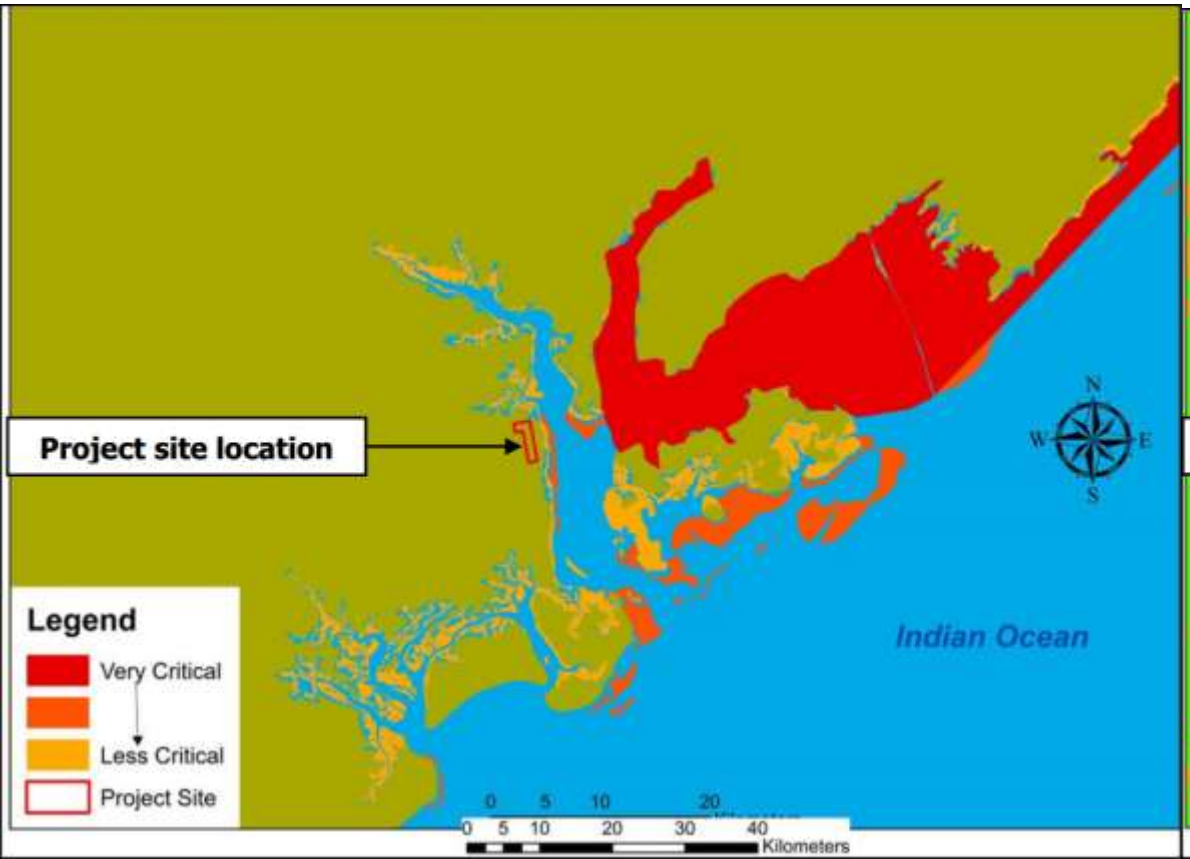
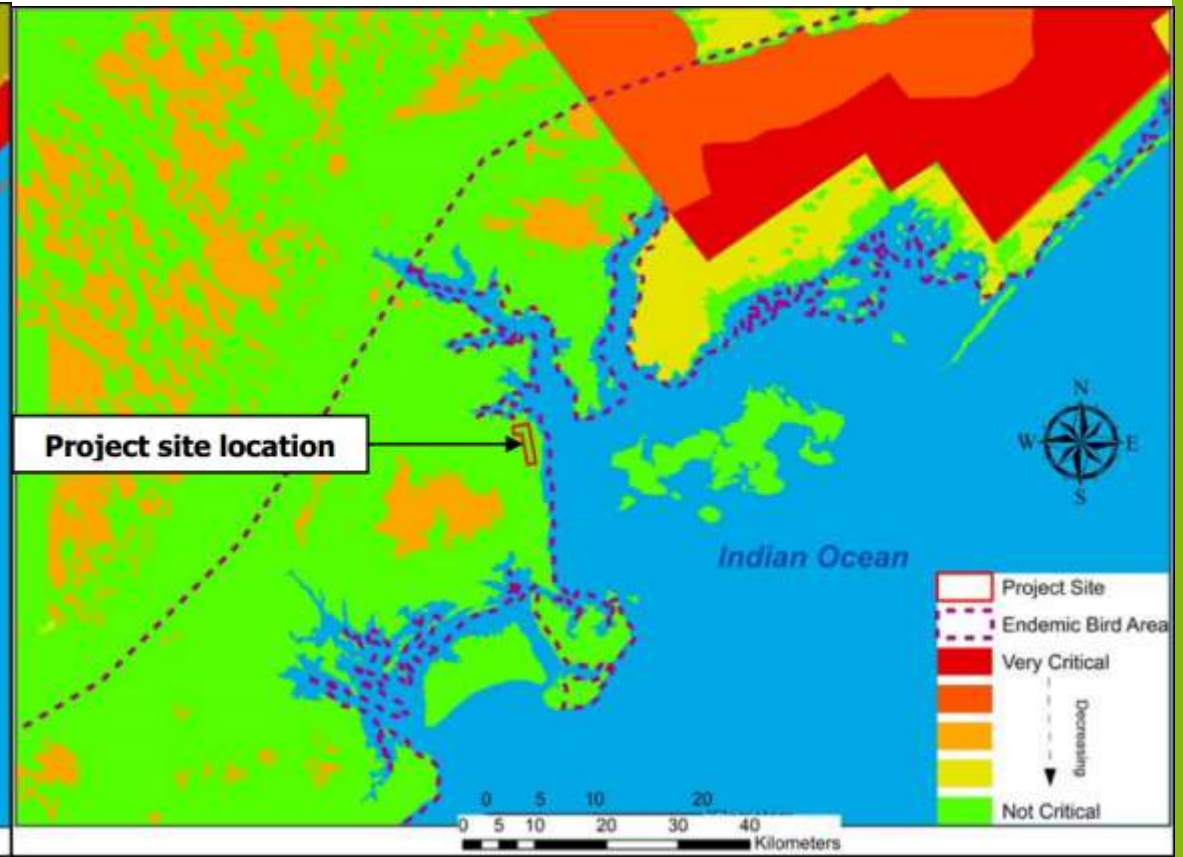
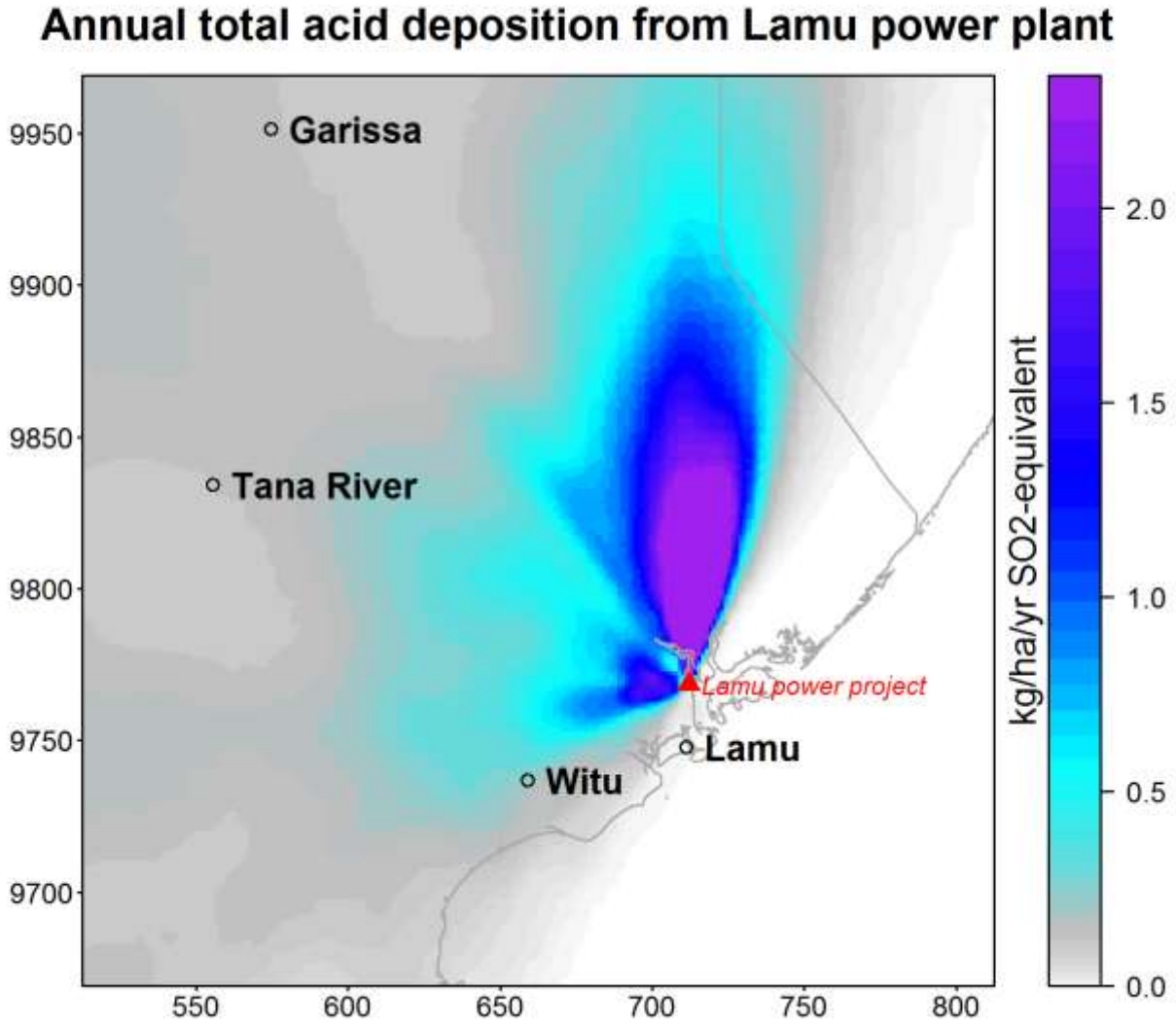
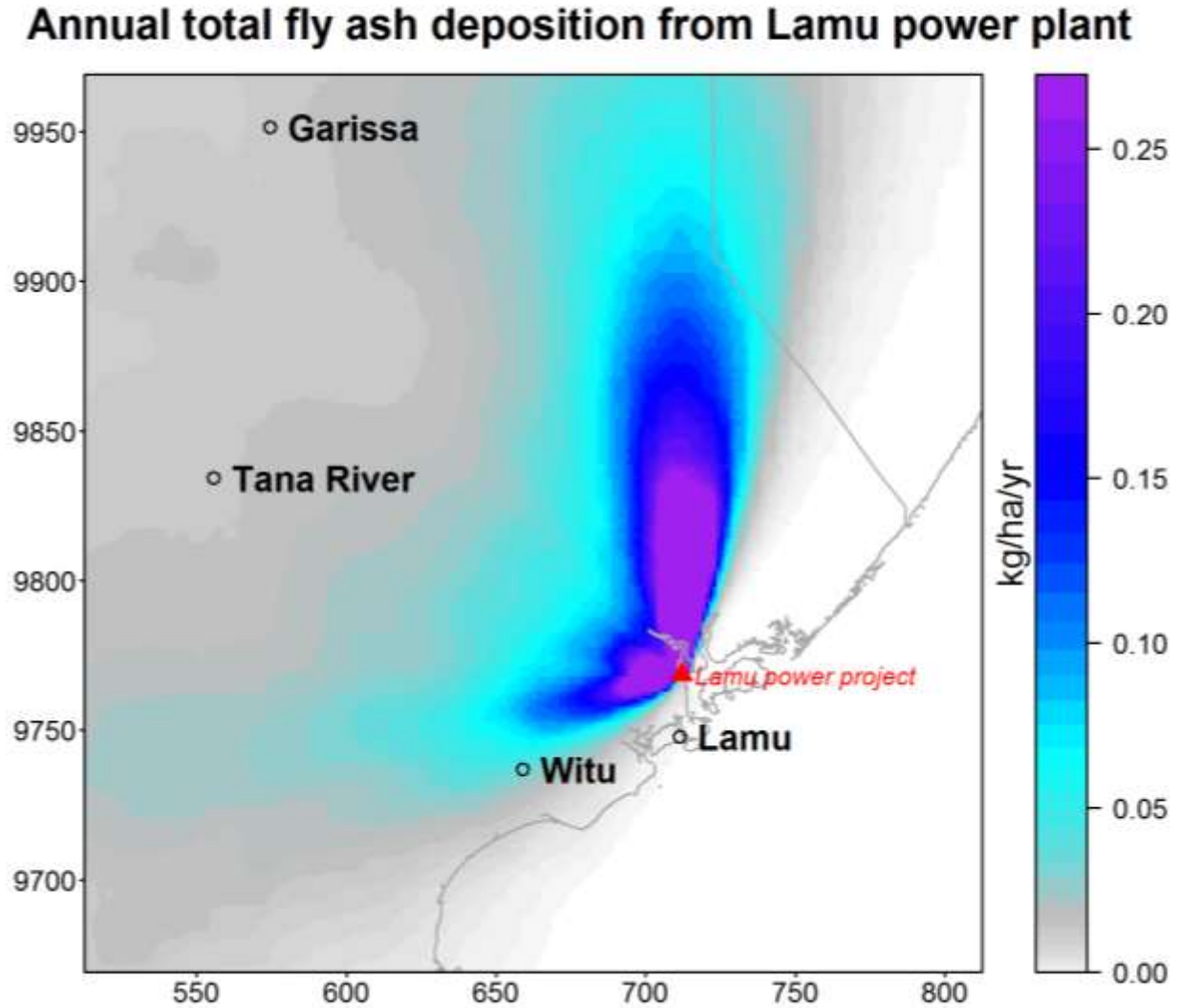
Critical and protected areas around the project site





Projected fly ash and acid deposition





Projected deposition into critical and protected ecosystems

- Mercury: 170kg/year on land, of which 24kg/year into critical ecosystems ➔ 1000kg over lifetime of 40 years
  - Within 10km of the plant, mercury deposition would more than double from background rates
  - In an area of 1000km2, with population of 6000, average deposition exceeds level that can alone make fish unsafe to eat (125mg/ha/yr)
- Acid deposition: 850 tonnes SO2/year
- Fly ash: 40 tonnes/year
  - Containing around 5-15kg of chromium, 2-5kg of copper, 5-30kg of manganese, 2-10kg of nickel and 1-2kg of lead

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Projected total deposition into protected and critical ecosystems

- Uncertainty around mercury and other heavy metal deposition is very large, as almost no data was provided in EIA.

Conclusion

- The Lamu project is proceeding without meaningful assessment of any of the key pollution impacts
- Proposed emissions control technology is very weak and makes health impacts worse
- The project would significantly worsen air pollution levels in the region, causing an estimated 1,600 premature deaths from air pollution over an operating life of 40 years
- The project would significantly increase heavy metals deposition around the plant site and would entail significant toxic deposition into critical habitats

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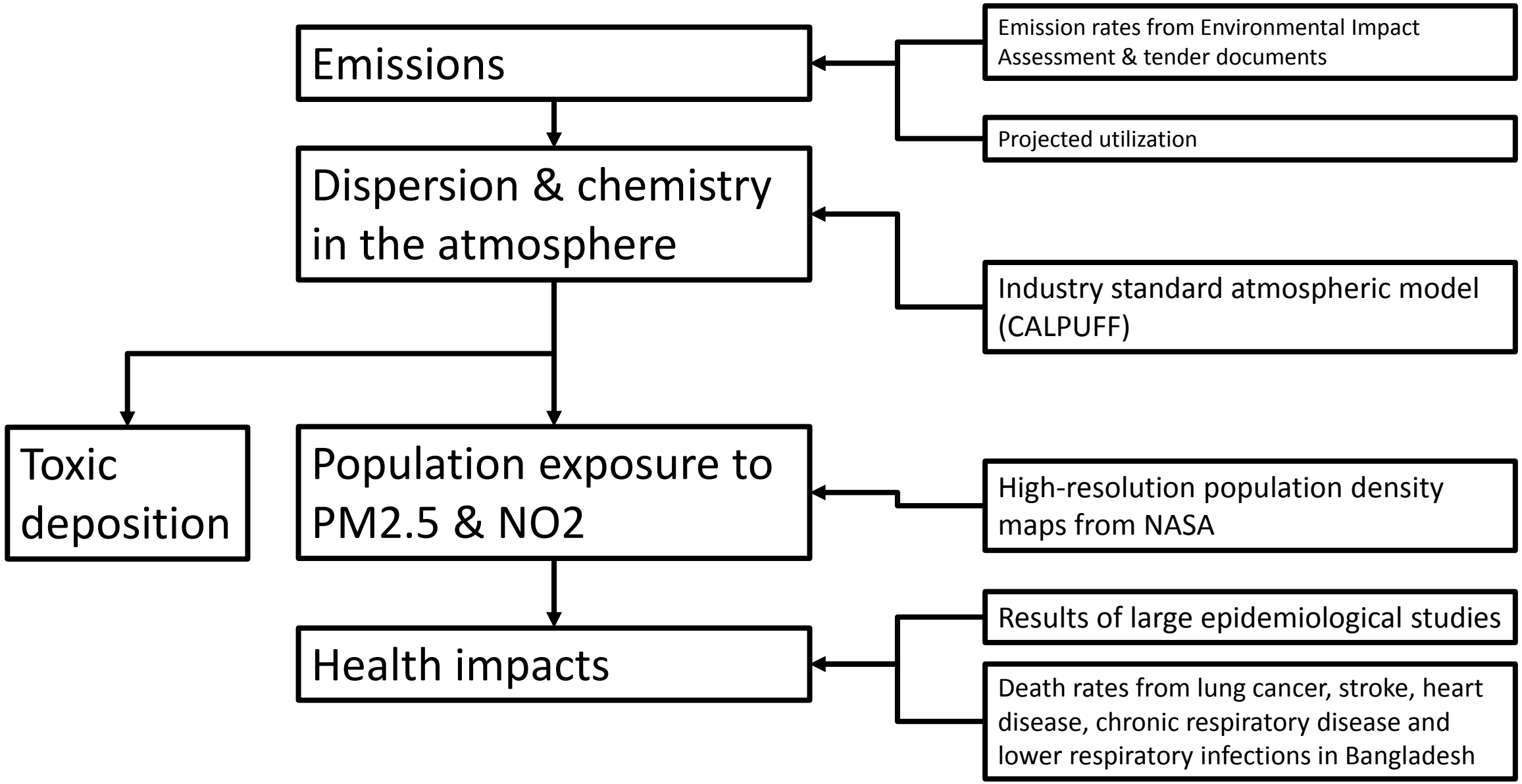
Thank you!

Methodology of the study



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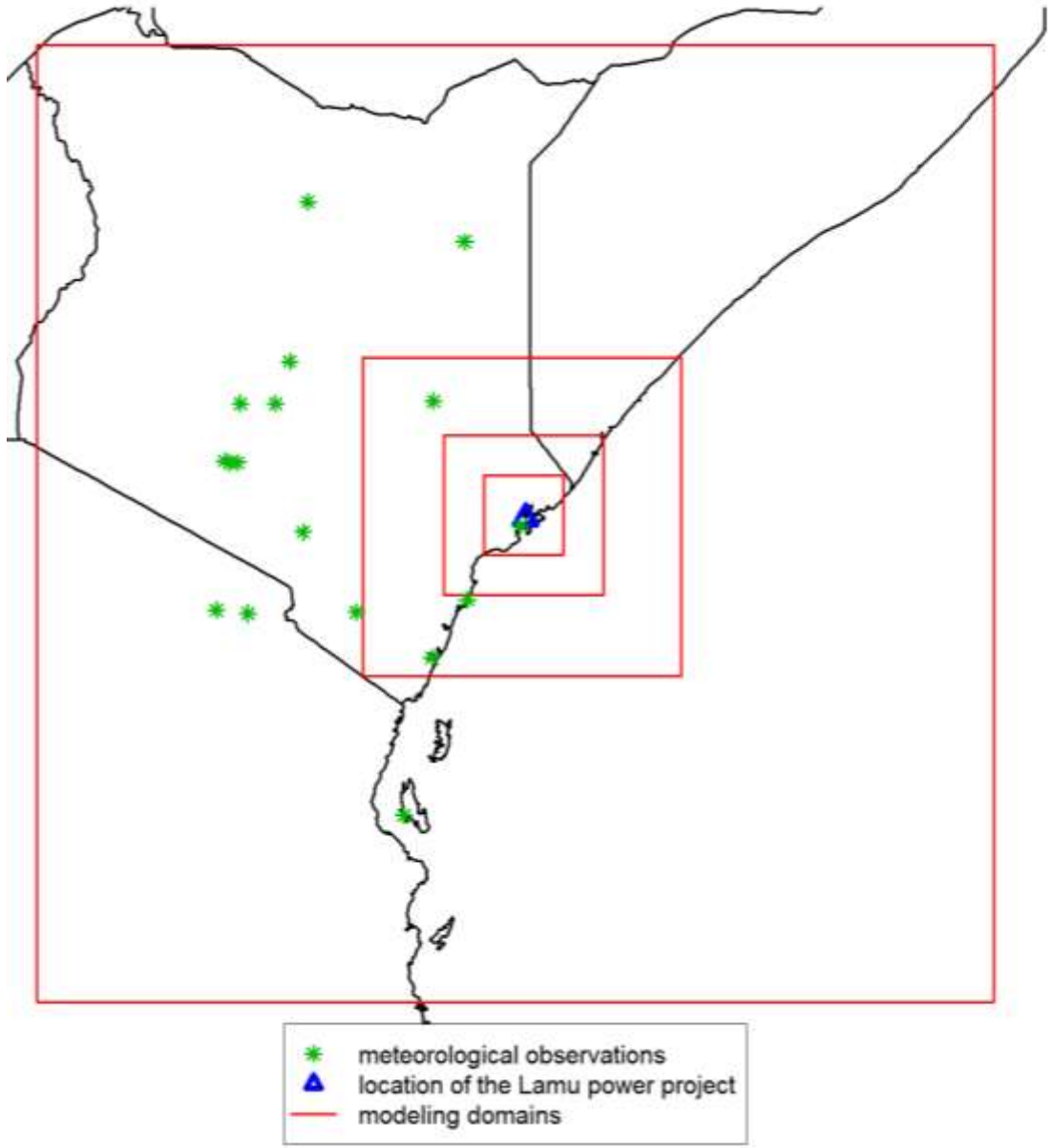
Calmet-Calpuff modeling system

- Recommended by the U.S. EPA for long-range impacts of industrial sources
- Uses detailed hourly atmospheric data for thousands of horizontal locations and 12 vertical layers to predict dispersion, chemical transformation and deposition of air pollution in the atmosphere
- Weather data is generated from local weather observations (30 stations in this study) and global data derived from measurements, satellite observations and weather models
- Atmospheric chemistry is based on air quality measurements and modeled data where not available

Modeling domain



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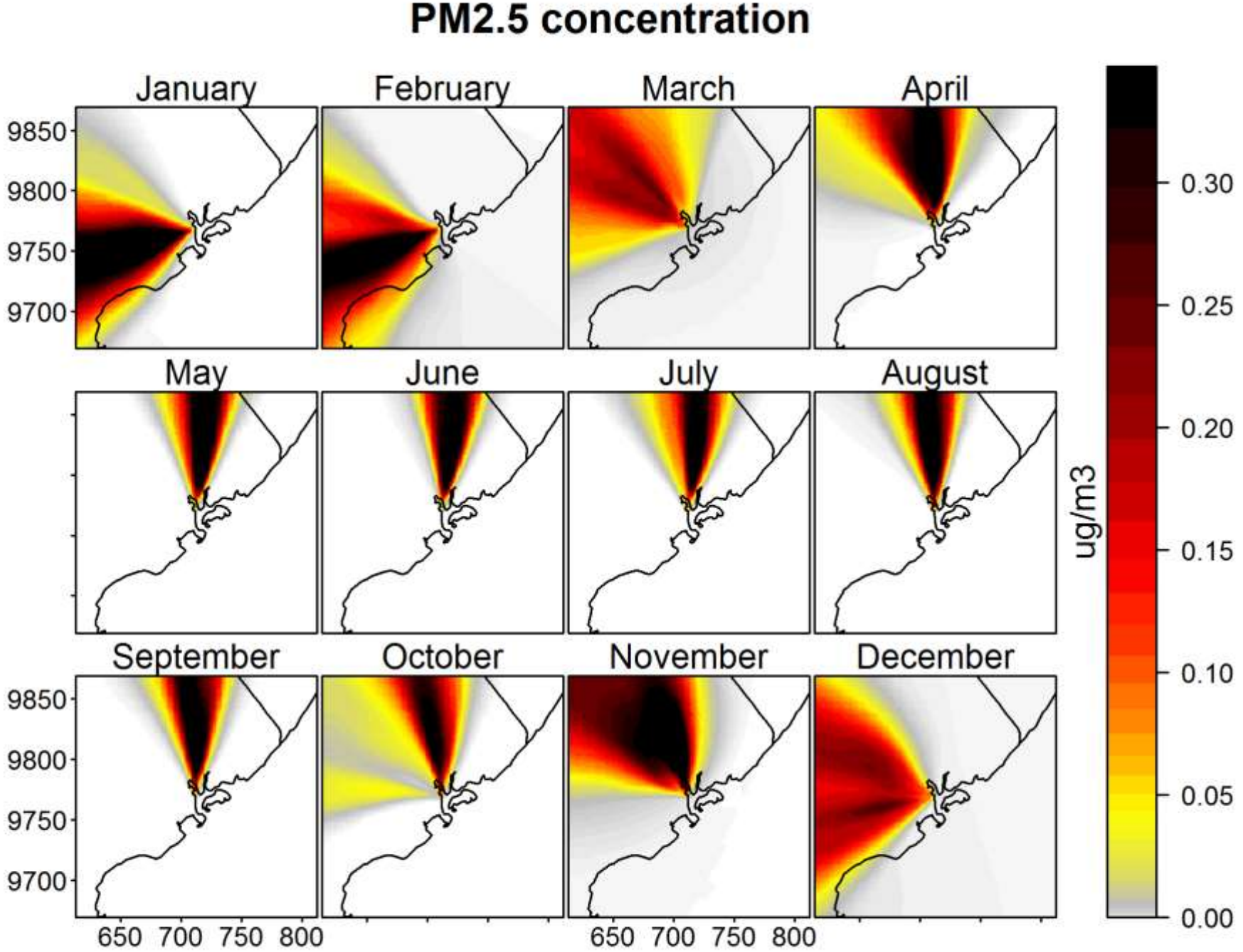
PM2.5 concentration
January
February
March
April
May
June
July
August
September
October
November
December
9850
9800
9750
9700
650 700 750 800
ug/m3
0.30
0.25
0.20
0.15
0.10
0.05
0.00

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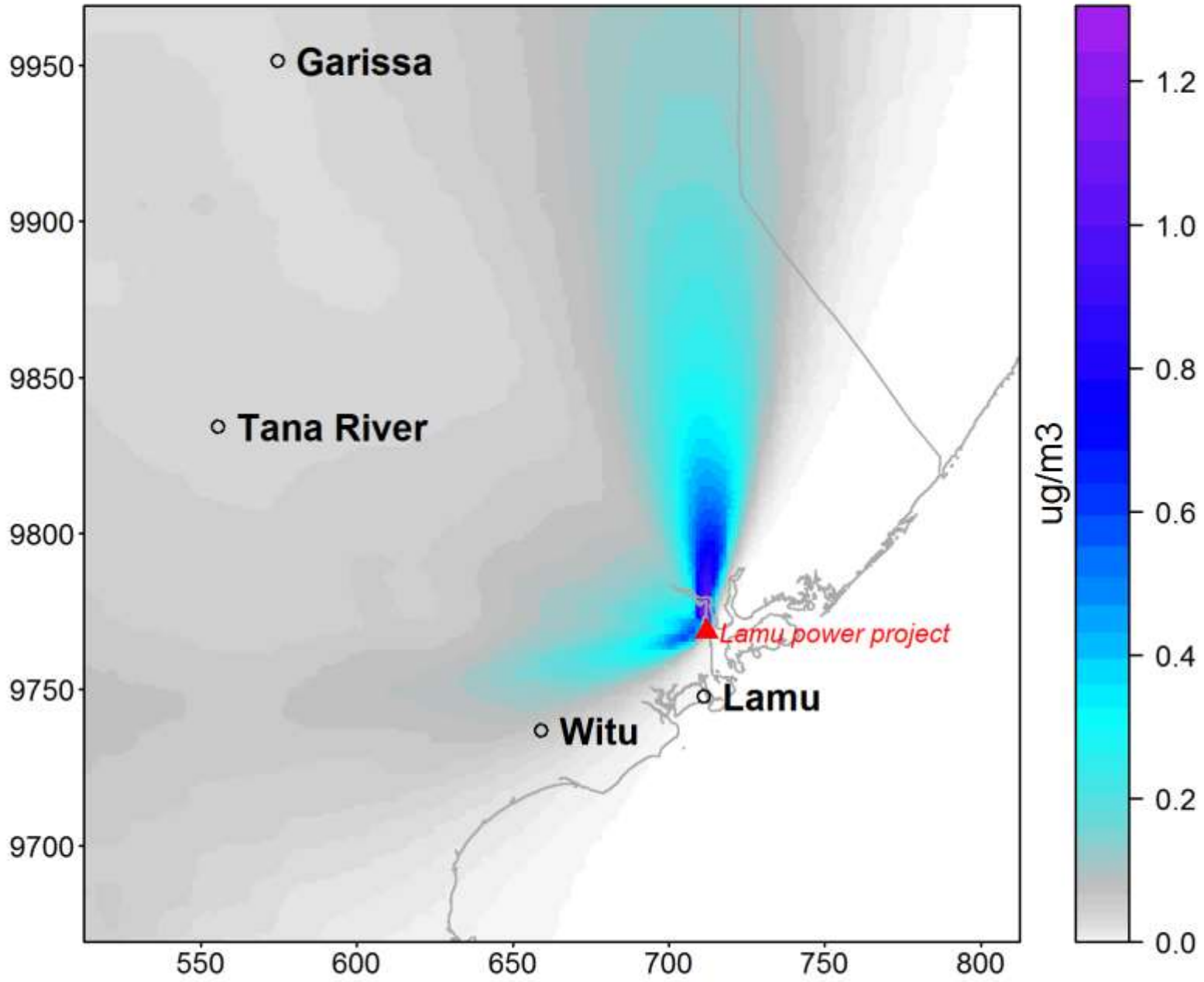
Annual mean NO2 concentration from Lamu power plant



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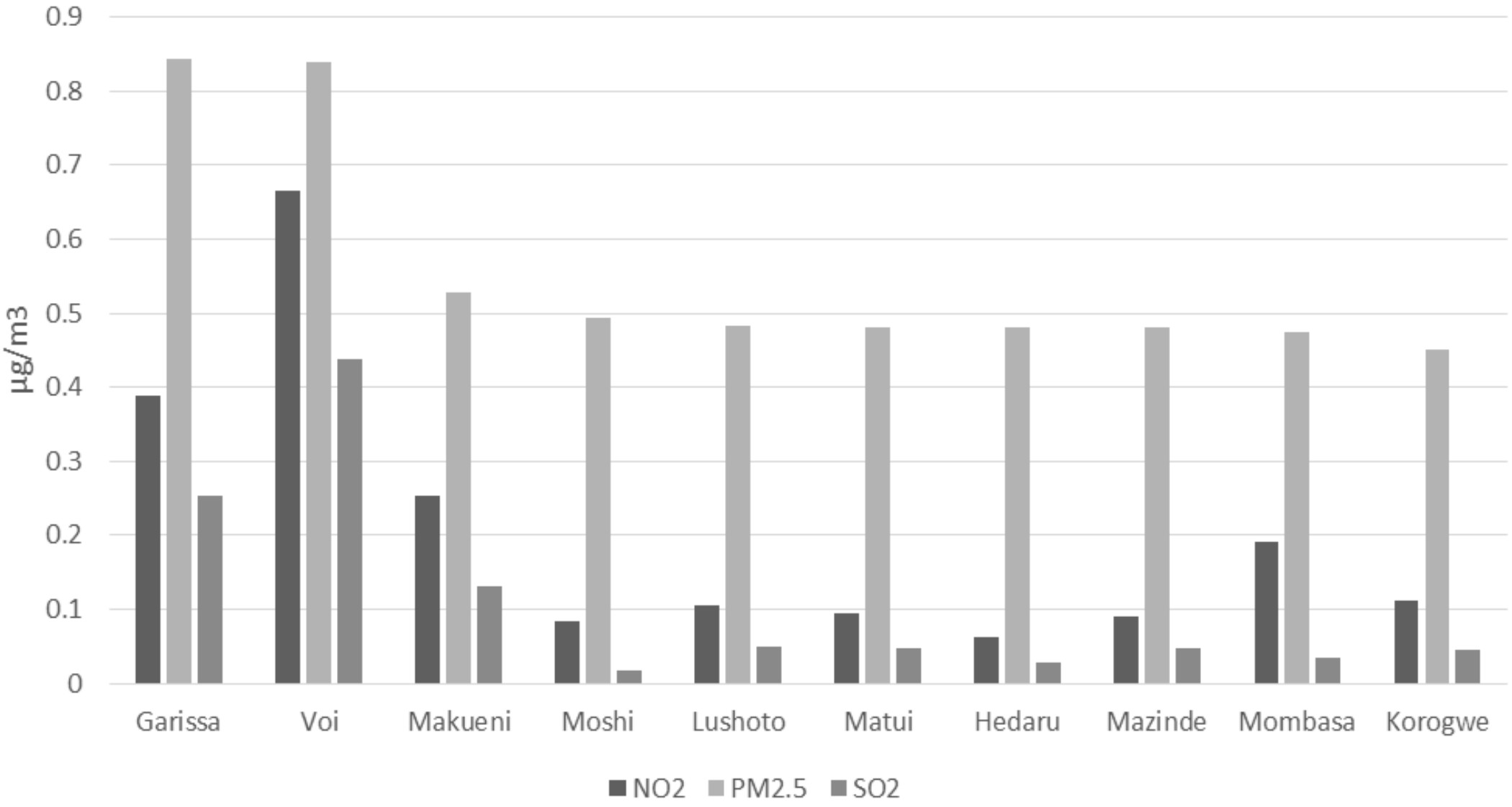
Most affected cities and towns

Maximum 24-hour pollutant concentration attributed to the Lamu power plant



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Evidence of health risks

- “American Cancer Society study”: The largest and most well-known study on particulate air pollution and risk of death.
- 500,000 adults in 50 U.S. states with different air pollution levels were followed between 1982 and 1998.
- People living in more polluted environments have a significantly higher risk of fatal heart and lung disease and lung cancer.