

Air Pollution and Air Quality Monitoring in Ghana

Presentation by:
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Afri-SET: The Air Sensor Evaluation
and Training centre for West Africa

Objectives of Afri-SET

1. To establish a low-cost air sensors evaluation and training hub in Ghana.
2. To facilitate capacity building of students and air quality practitioners in Africa.
3. To promote long-term sustainability and replication of the center.

Reference Grade Instruments at Afri-SET



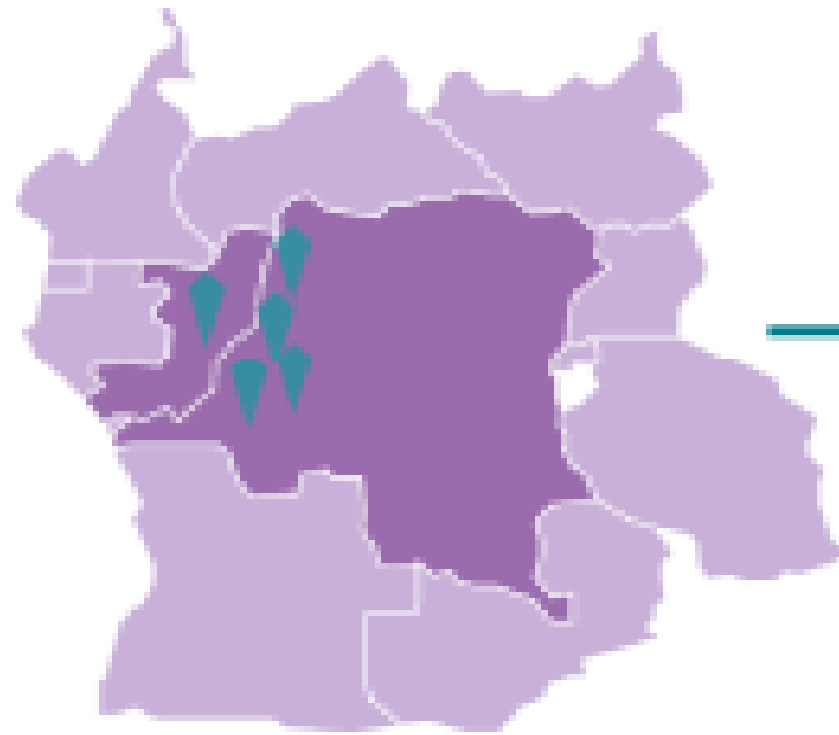
Objectives of Afri-SET



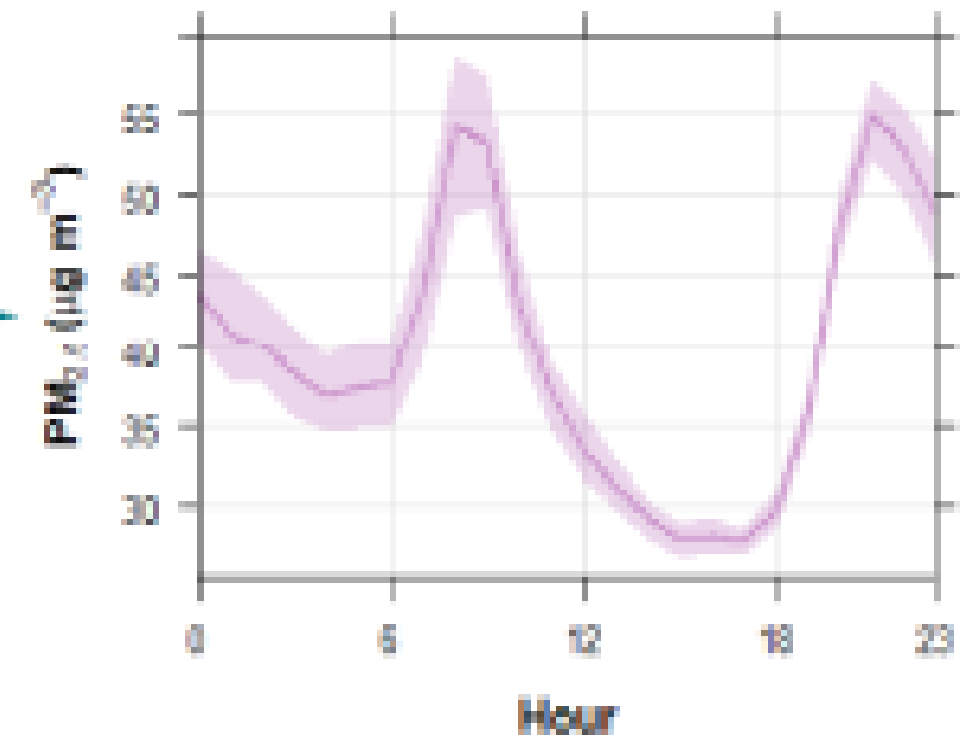
+



CALIBRATE



SAMPLE



ANALYZE

Afri-SET Facility

November 2022



October 2023



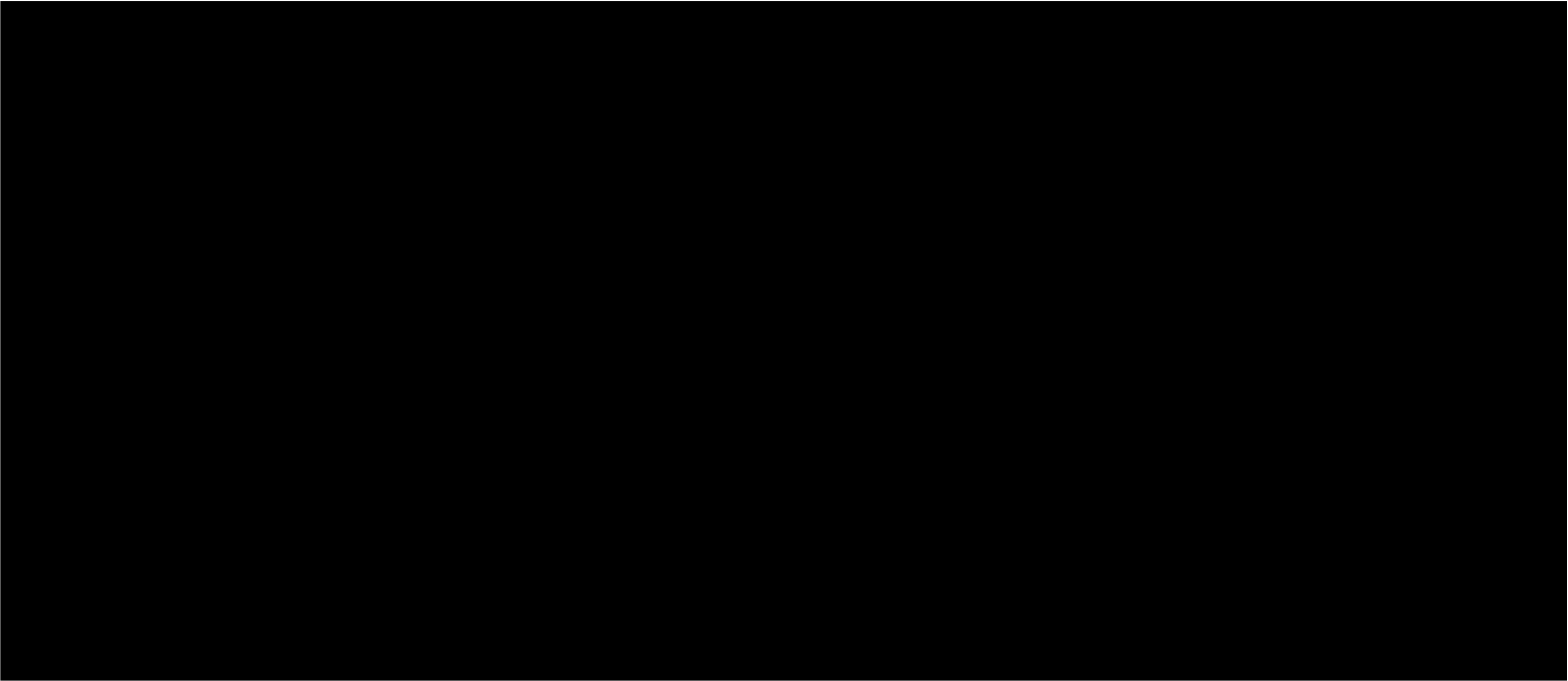
Introduction – What is poor air quality?

- ❑ Poor air quality can be defined as particulates (aerosols) either in the form of solid, liquid or gas exceeding required levels in ambient air.
- ❑ Their presence in the atmosphere has a huge impact on climate by changing the solar energy of the Earth system due to their ability to form other chemical species

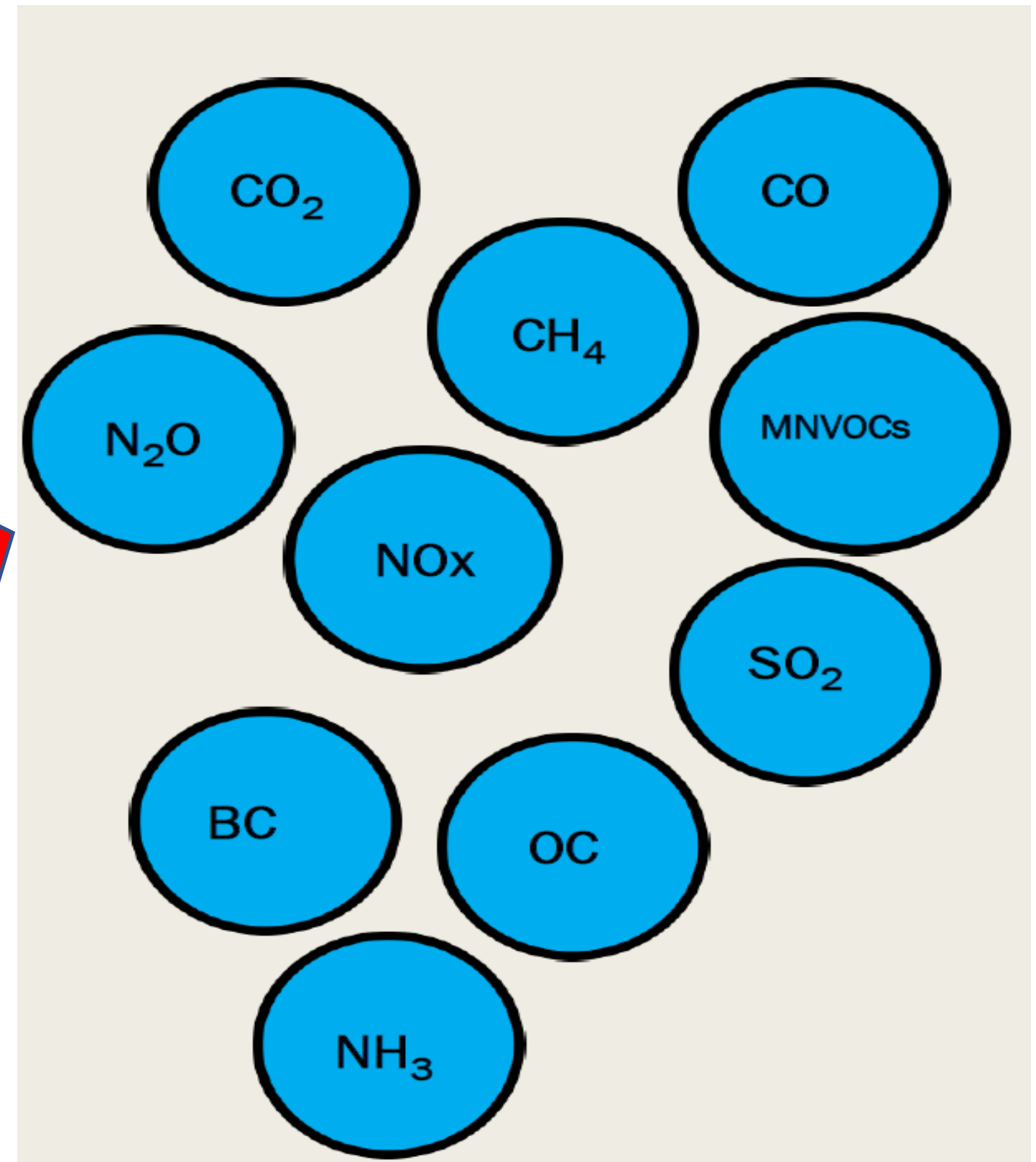


Source : <https://www.ecohubmap.com/hot-spot/air-pollution-in-accra-ghana/hqoiml9l27pbw>

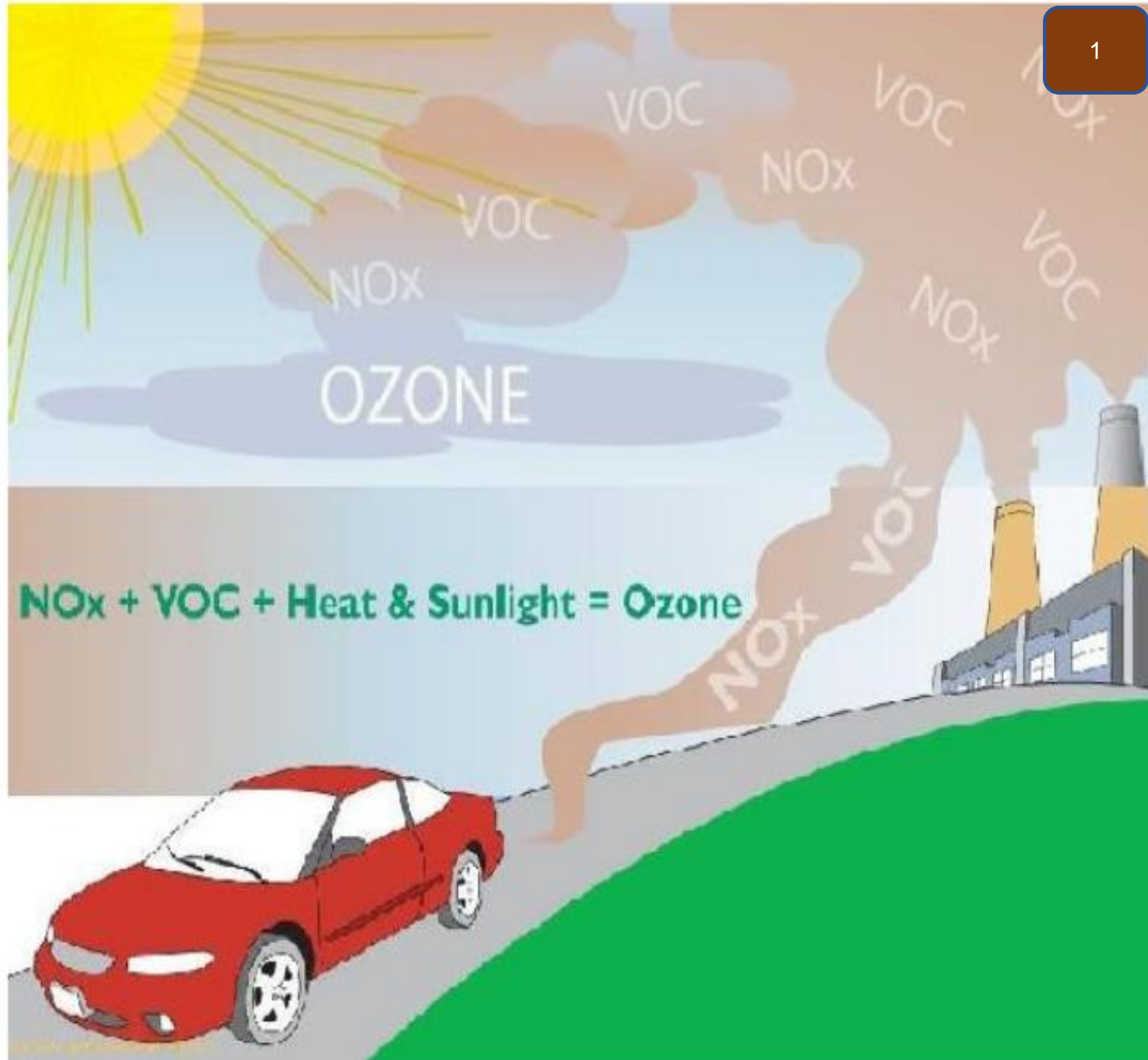
Previous state of Agboglobloshie



Sources of poor air quality



Sources of poor air quality



Landfill fire



Road dust



Old truck



Automobile exhaust



Solid waste burning



Agricultural burning



Metal industry

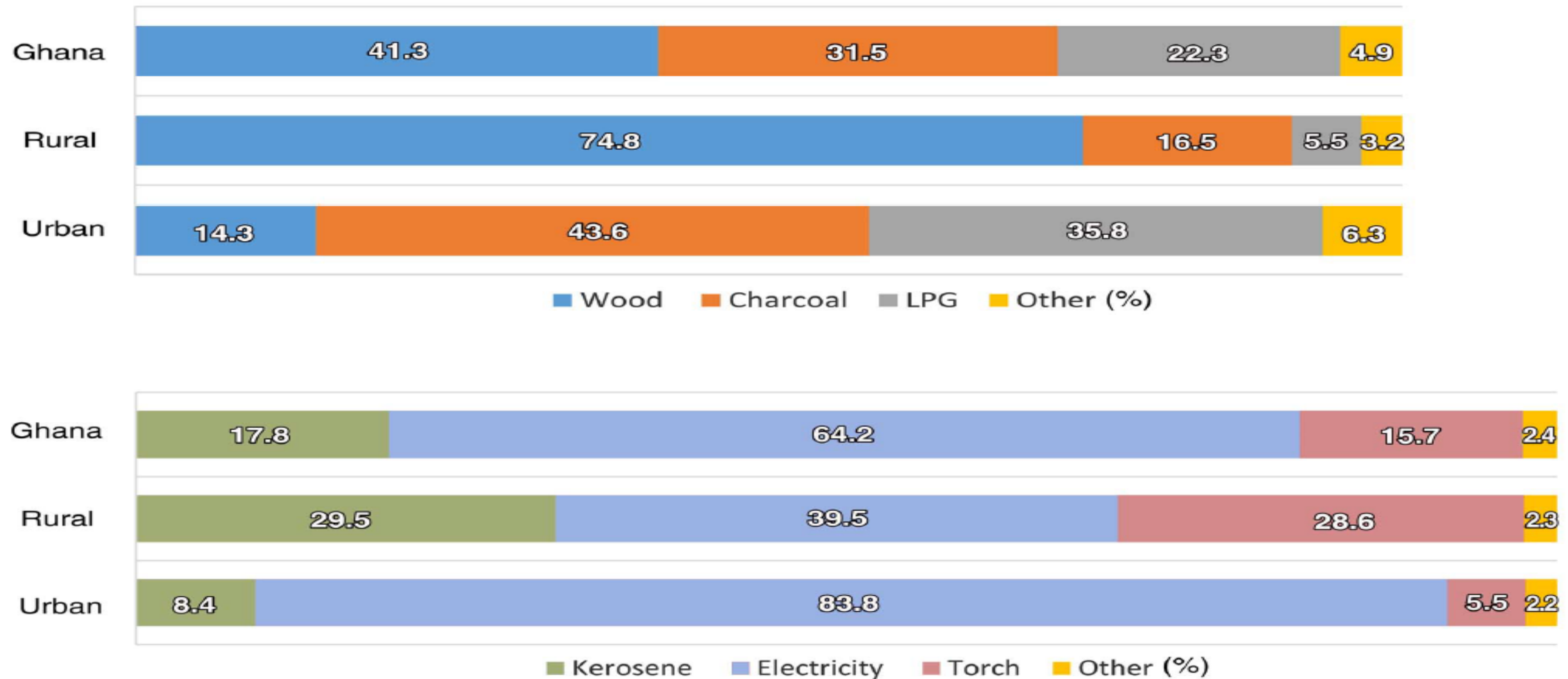


Household cooking

Sources of poor air quality

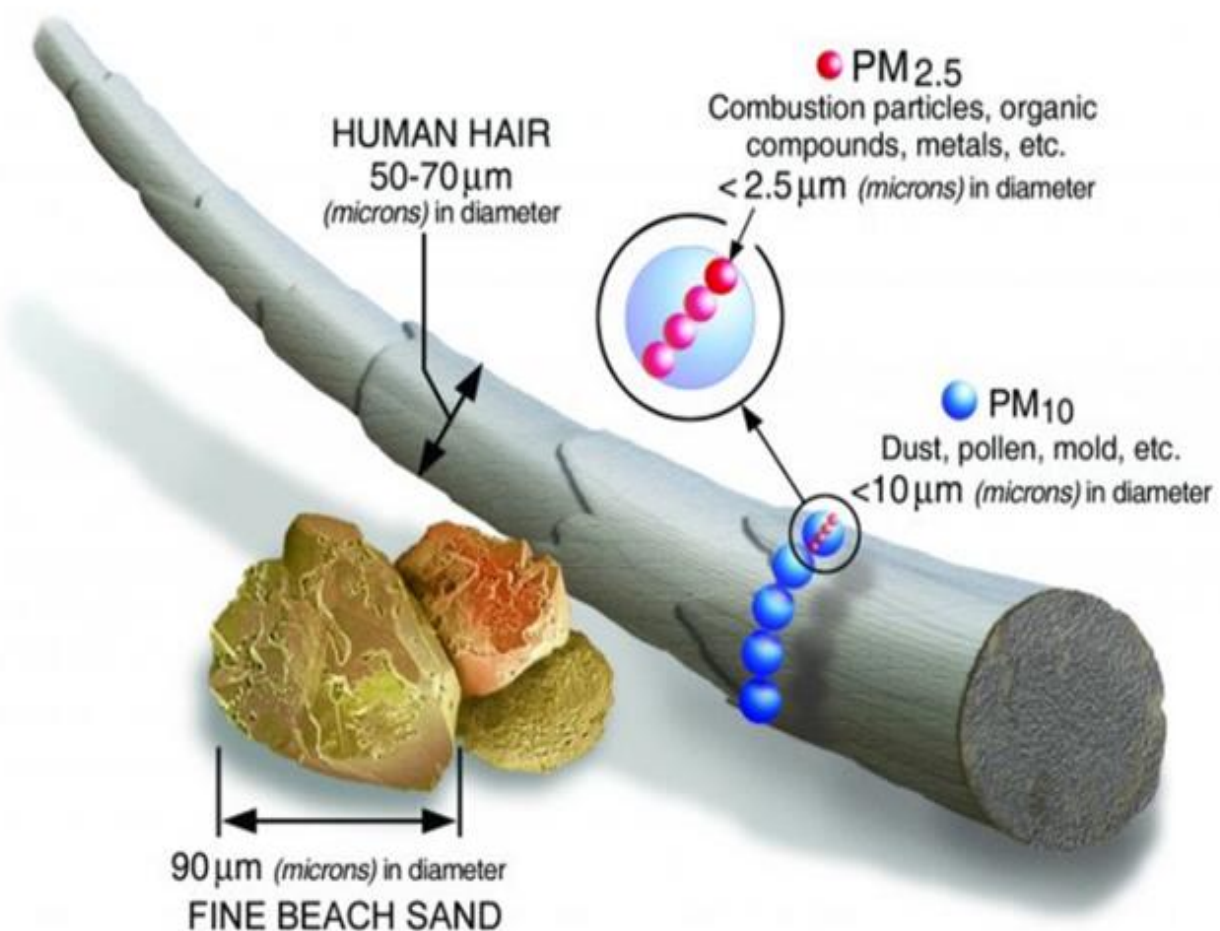


Common sources of poor air quality in Ghana

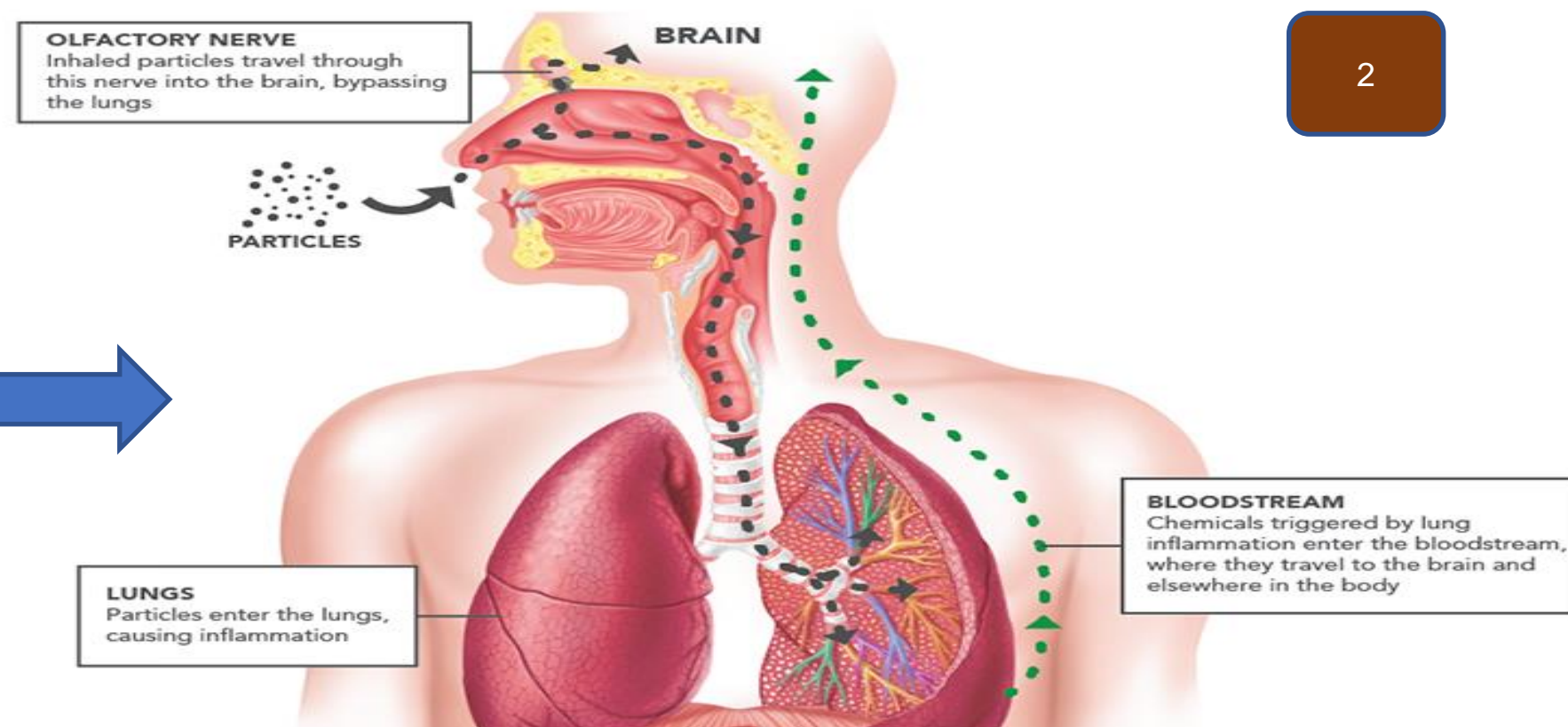


Textbox Figure. Fuel use statistics for Ghana: (A) cooking and (B) lighting. (Based on Ghana Living Standards Survey, 2014 [World Health Organization 2018].)

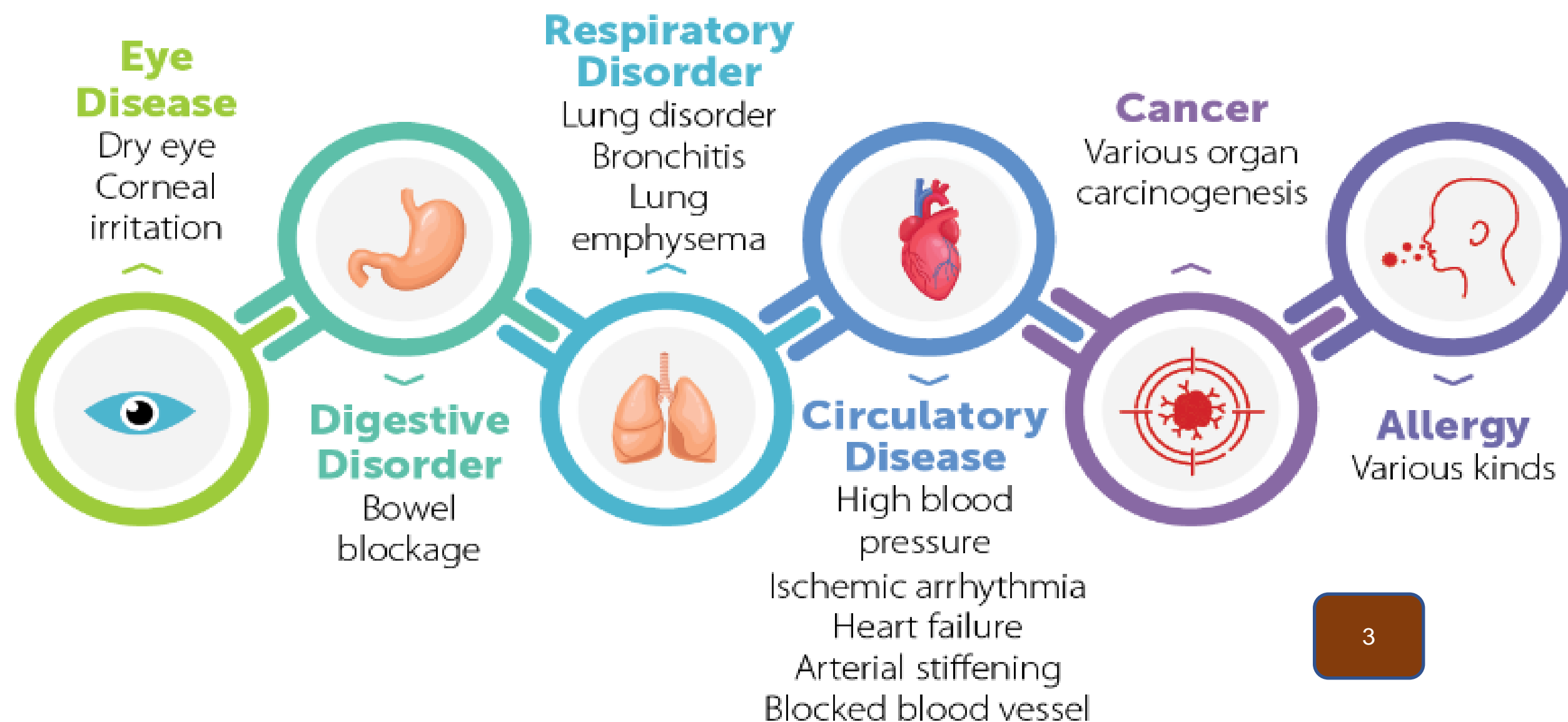
Introduction – Effects of poor air quality



1



2



3

Introduction – Effects of poor air quality

1

Deaths attributable to air pollution
(95% uncertainty interval)

Proportion of global
deaths in Africa

Africa

Global

All air pollution	1.1 million (932 000–1.3 million)	6.7 million (5.9 million–7.5 million)	16.3%
Ambient PM _{2.5} pollution	383 419 (288 615–491 042)	4.1 million (3.4 million–4.8 million)	9.3%
Household air pollution	697 000 (526 000–879 000)	2.3 million (1.6 million–3.1 million)	30.3%
Ambient ozone pollution	11 230 (4 800–18 300)	365 000 (175 000–564 000)	3.1%

Data are from the 2019 Global Burden of Disease Study. PM=particulate matter.

Table 1: Deaths attributable to air pollution, in Africa and globally, in 2019

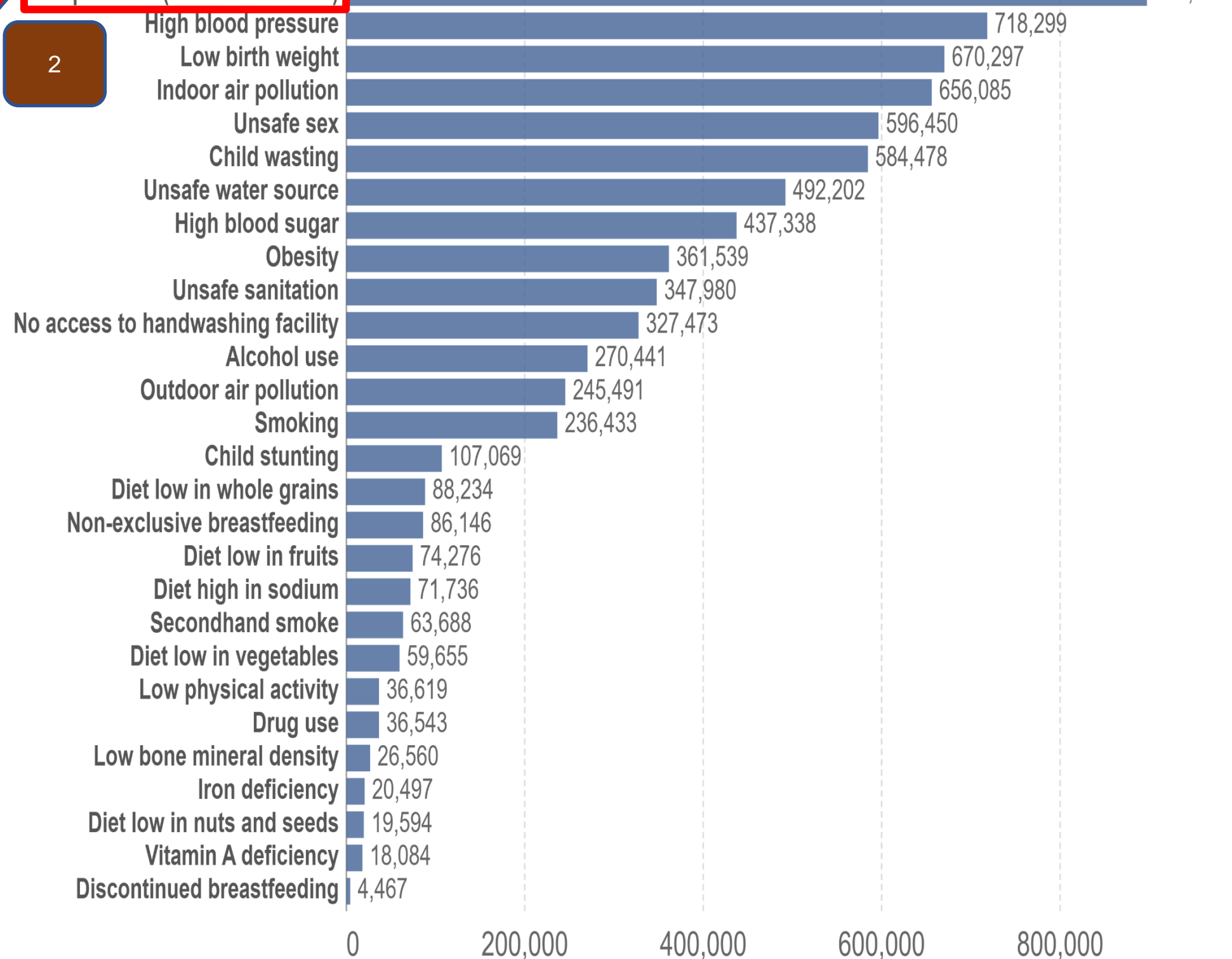
Number of deaths by risk factor, African Region (WHO), 2019

Total annual number of deaths by risk factor, measured across all age groups and both sexes.

Our World
in Data

Air pollution (outdoor & indoor)

2



Source: IHME, Global Burden of Disease (2019)

OurWorldInData.org/causes-of-death • CC BY

Past Studies on Air quality in Ghana

- ❑ There were no known continuous reference grade air quality instruments in Ghana.
- ❑ Most air quality studies focused on quantifying sources in the capital city – Accra.
- ❑ Few air quality instruments were available.

Zhou et al. 2014

Accra ^a	November 2006– August 2007	Pollutants	Ambient and cooking area PM _{2.5}
		Sample duration	48 hr
		Samples (N)	80
		Speciation	Elements (EDXRF), BC (smoke stain reflectometer)
		Model	PMF

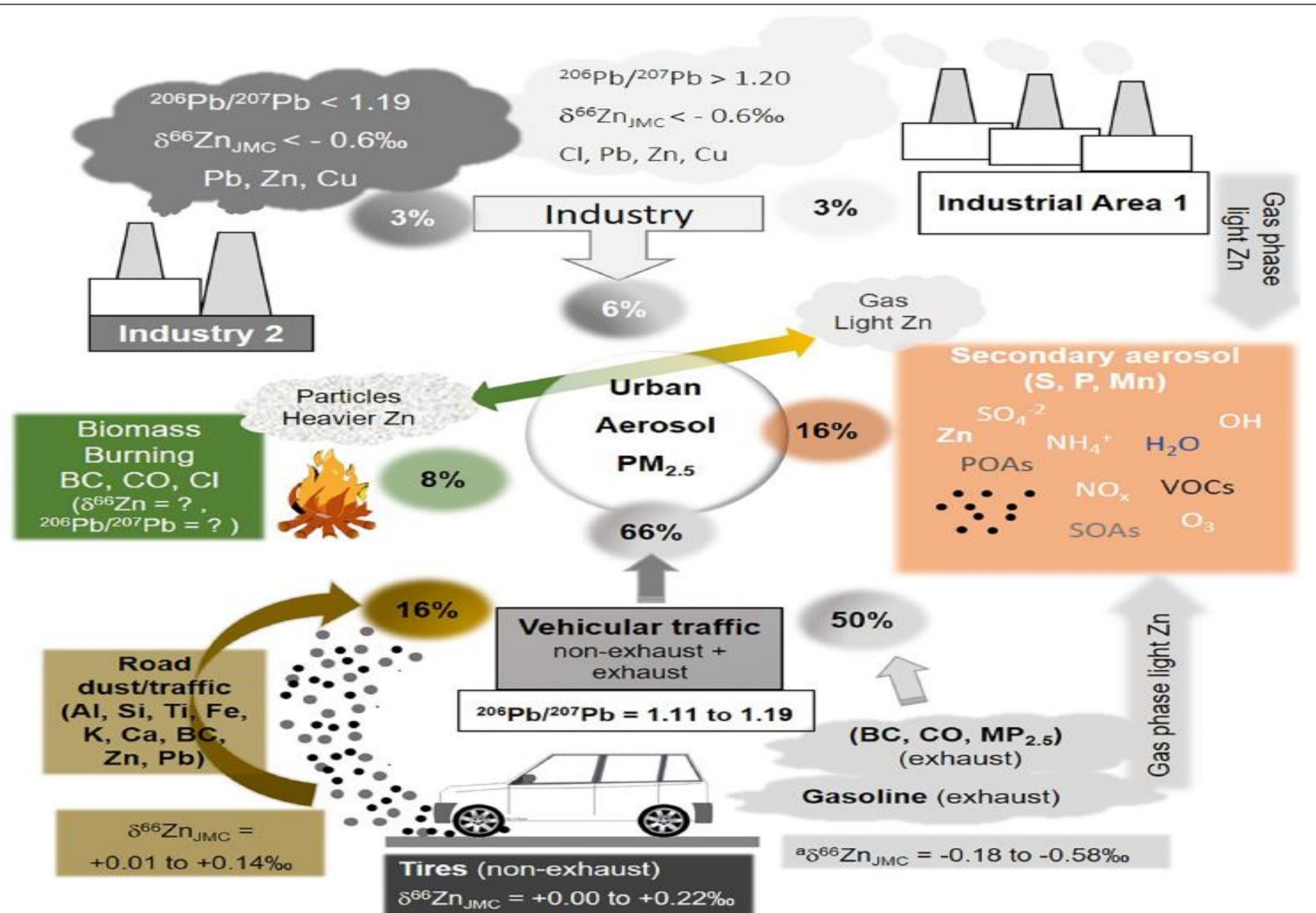
Piedrahita et al. 2017

Kassena-Nankana (northern Ghana)	November 2013– September 2014	Pollutants	Ambient PM _{2.5}
		Sample duration	One week
		Samples (N)	50; 25 for organics — used for source apportionment
		Speciation	Carbon speciation (NIOSH TOT); organics (subset of samples, GC-MS)
		Model	PMF ₂

Past Studies on Air quality in Ghana

Study / Location	Year(s)	Sampling and Analysis	
Aboh et al. 2009			
Greater Accra region (Kwabenya)	February 2006–February 2007 (Harmattan and non-Harmattan period)	Pollutants	Ambient PM _{2.5–10} , PM _{2.5}
		Sample duration	24 hr
		Samples (N)	171
		Speciation	Elements (EDXRF); black carbon (BC)
		Model	PCA
Ofosu et al. 2012			
Ashaiman (semi-urban town)	February 2008–August 2008	Pollutants	PM _{2.5}
		Sample duration	24 hr (sampling period was 12 hr or 16 hr due to logistical constraints)
		Samples (N)	Not available
		Speciation	Elements (EDXRF); carbon speciation (IMPROVE TOR)
		Model	PMF
Ofosu et al. 2013			
Navrongo	February 2009–February 2010	Pollutants	PM _{2.5-10} , PM _{2.5}
		Sample duration	24 hr
		Samples (N)	110
		Speciation	Elements (EDXRF); carbon speciation (IMPROVE TOR)
		Model	PMF
Zhou et al. 2013			
Accra	September 2007–August 2008	Pollutants	Ambient PM ₁₀ , PM _{2.5}
		Sample duration	48-hr samples/6 days
		Samples (N)	199 (PM _{2.5}), 197 (PM ₁₀)
		Speciation	Elements (EDXRF); BC (smoke stain reflectometer)
		Model	PMF

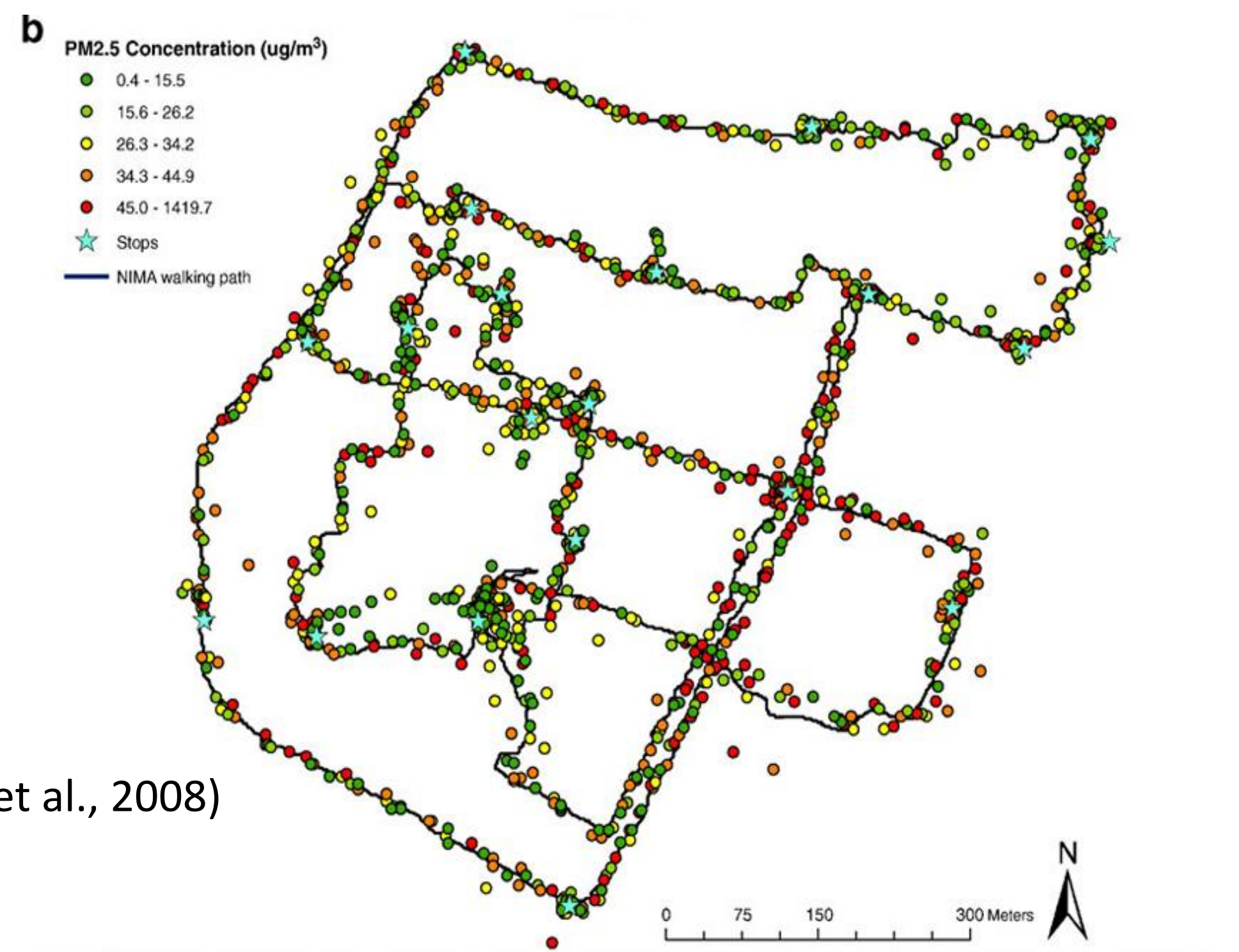
Typical Source Apportionment Study



Past Studies on Air quality in Ghana



(Arku et al., 2008)



□ High variation of PM levels in the neighbourhoods of Nima and Jamestown.

Proliferation of Air Sensors in Ghana



Airbeam 3



Airly



Airnote



Modulair



Airgradient



Praxis



Atmos



IQair



Airqo



SensorAfrica



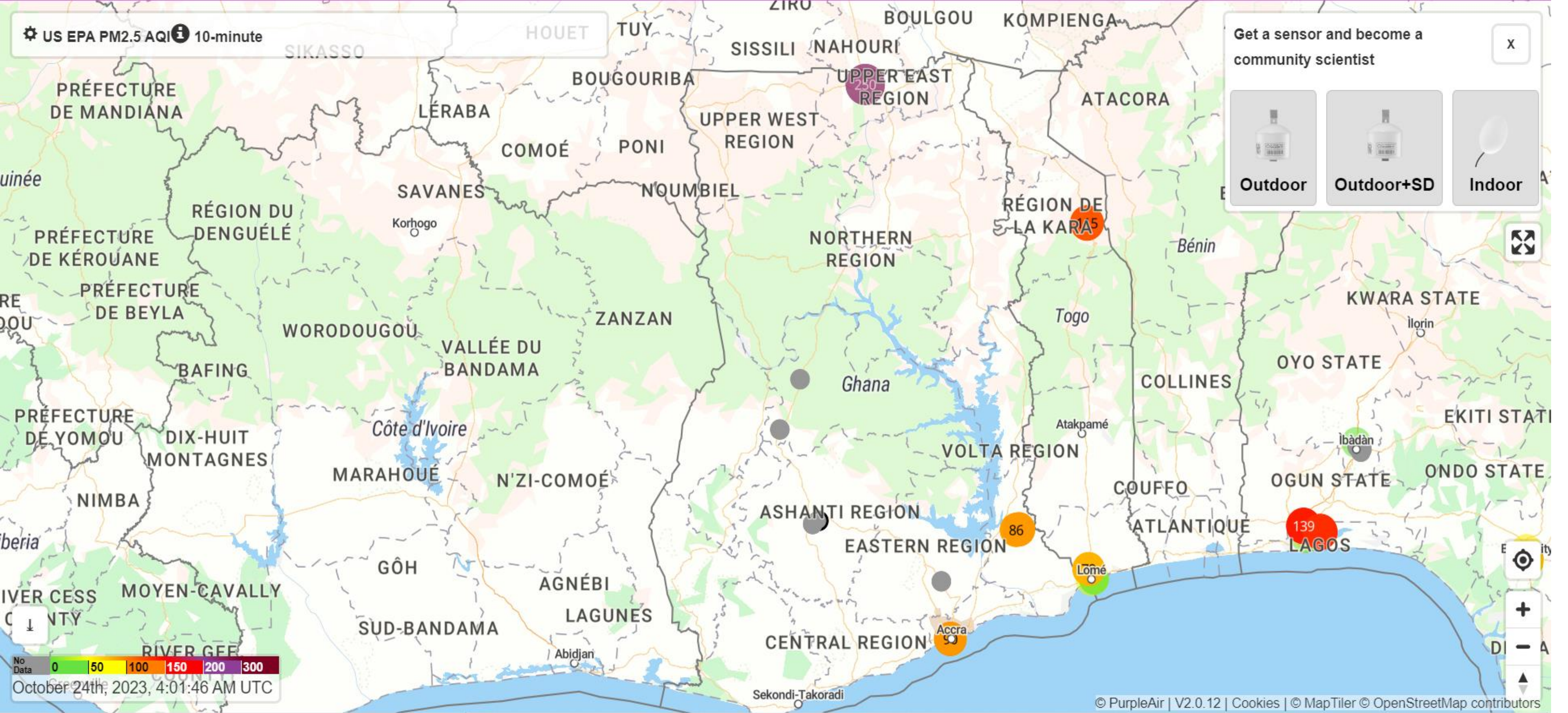
Air Quality EGG

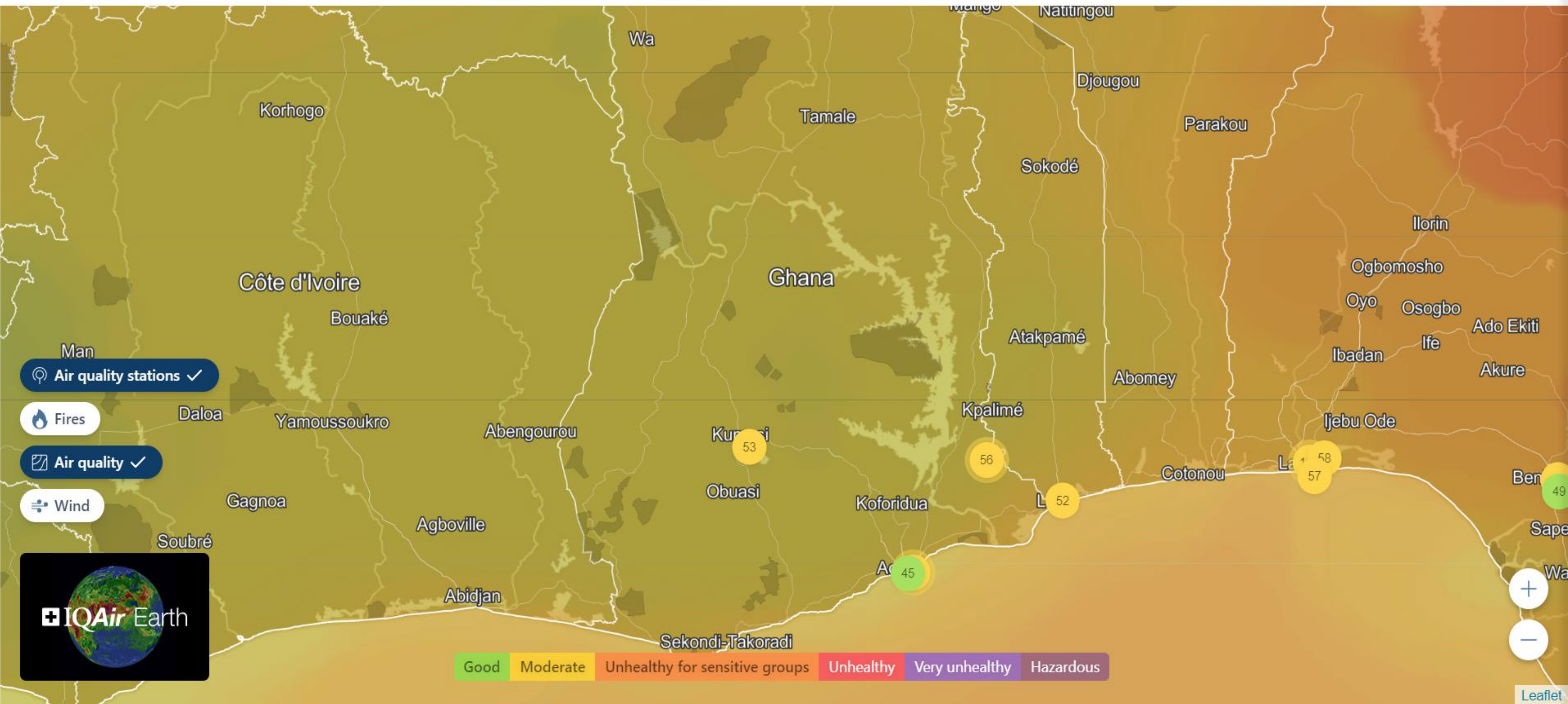
Installed Sensors at Afri-SET



Installed Sensors at Afri-SET

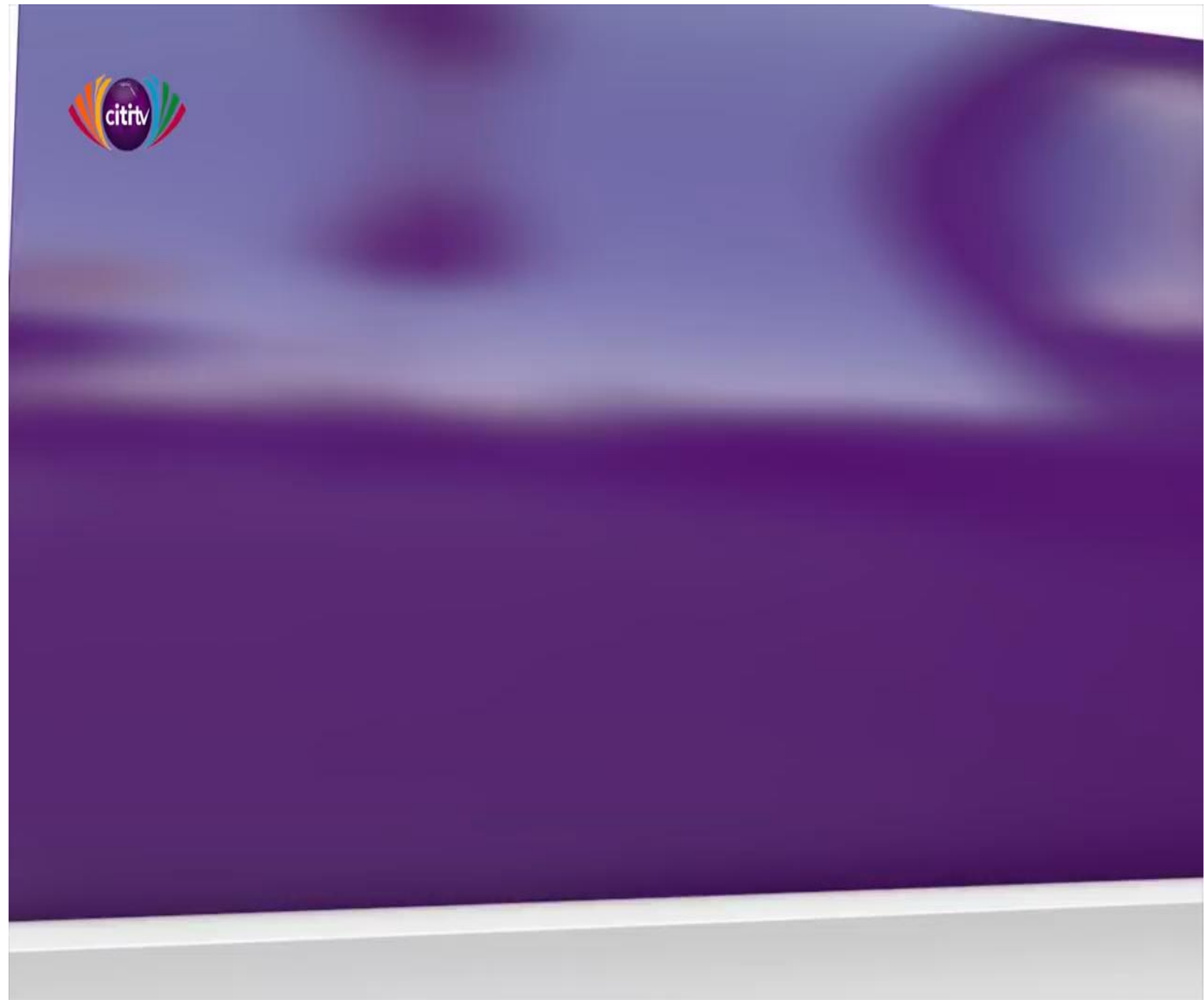






Interventions based on air quality studies

- ☐ The use of clean cook stoves.
- ☐ Awareness of poor air quality in our communities and schools .
- ☐ Proliferation of air quality instruments in Ghana.
- ☐ Increase in training of air quality studies
- ☐ Others

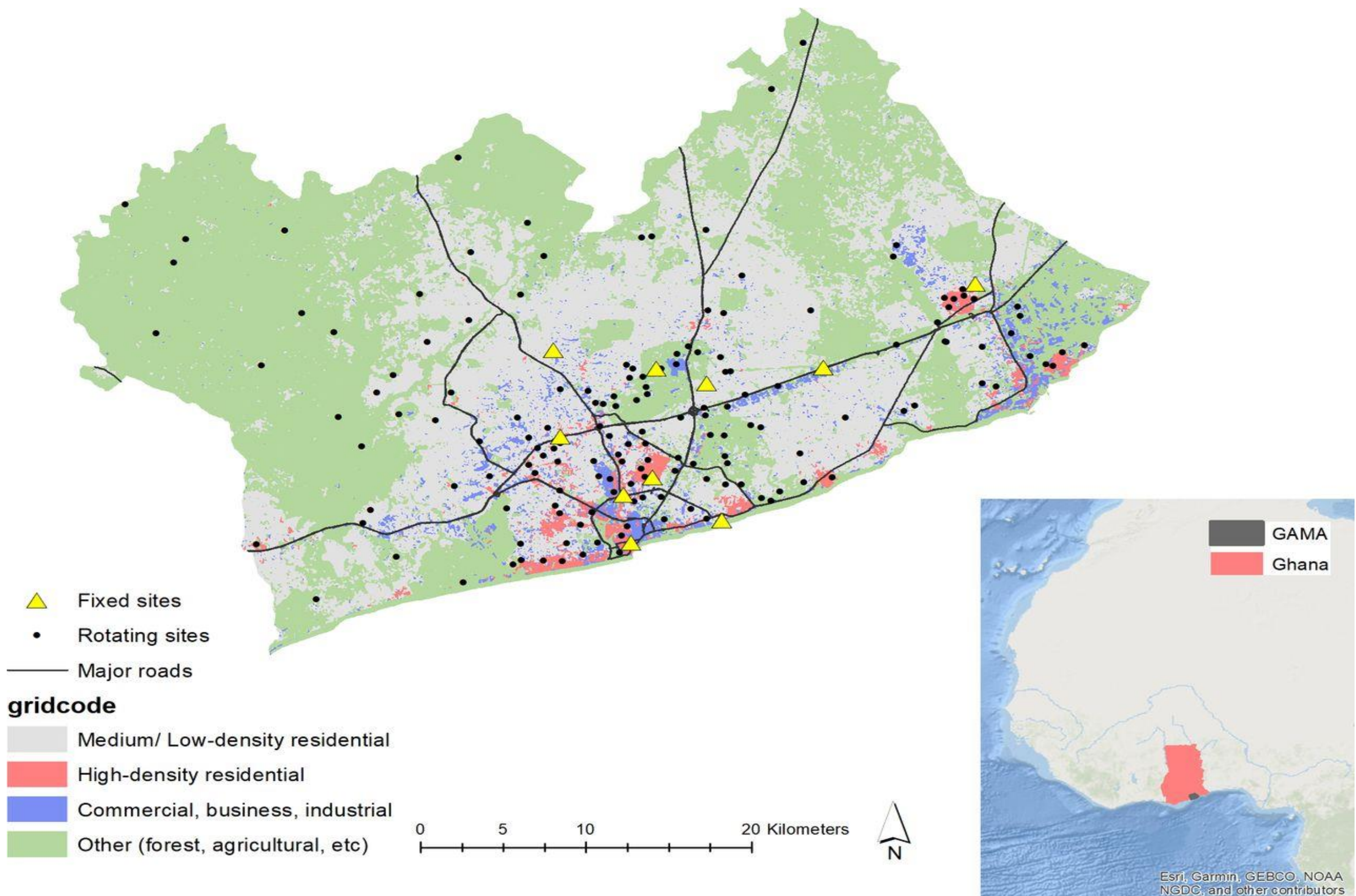


Current state of Agbogbloshie - 2022



An aerial photo taken on 28 March 2022 shows the reclaimed Agbogbloshie scrapyard site with only GIZ's technical training facility and Pure Earth's recycling containers left standing. Old Fadama is across the Korle Lagoon in the distance, where many e-waste and scrap metal practices now take place. Copyright © Muntaka Chasant.

Current studies on air quality in Ghana



Current studies on air quality in Ghana

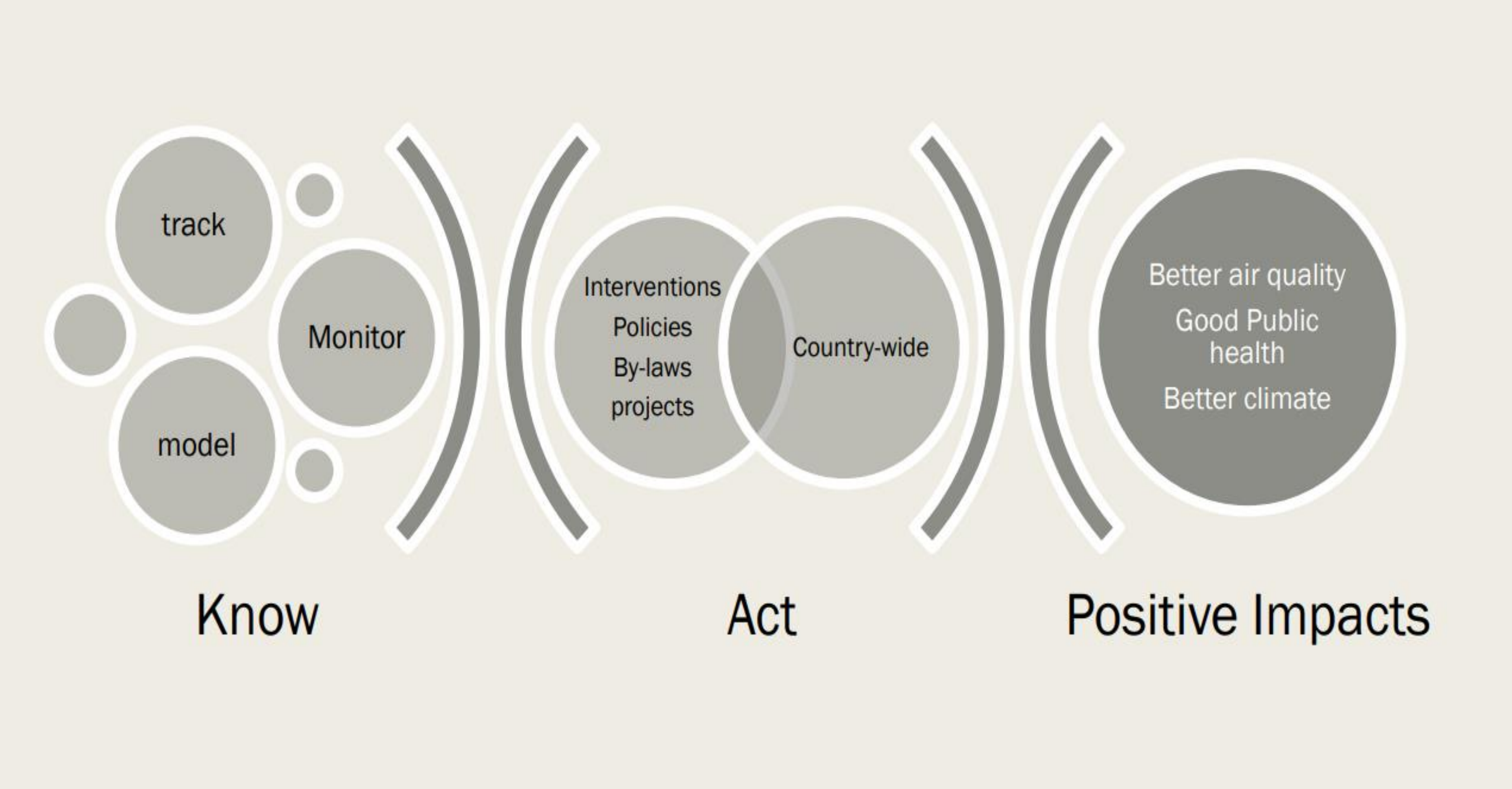


Pathways to
Equitable
Healthy
Cities



BREATHE
ACCRA

Conclusion



<https://afriset.org/>



Thank you

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