

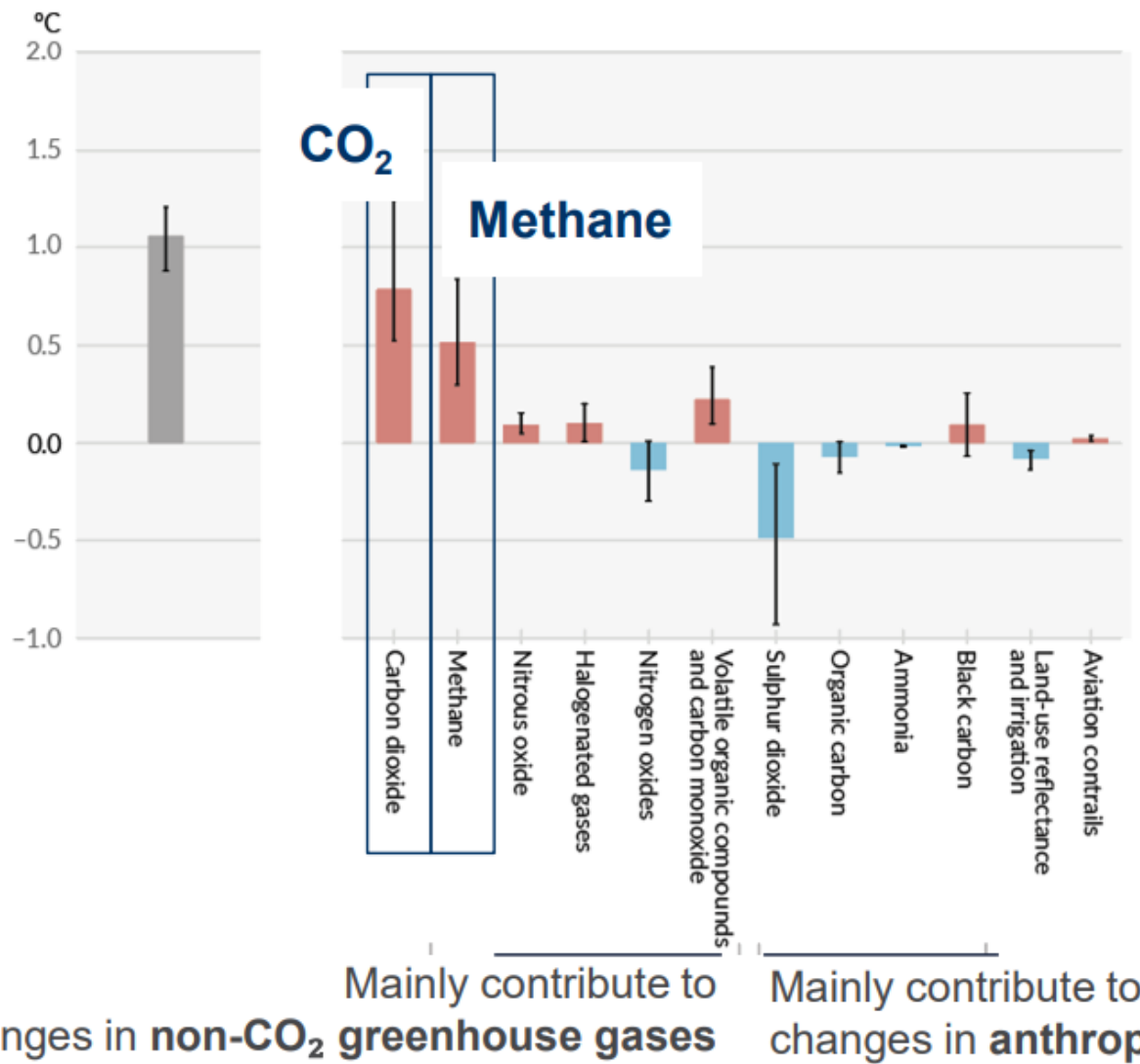
Scene setting- Physical Science Basis of Addressing Short Lived Climate Pollutants and Non-CO₂ emissions in Africa

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University of York, UK



Substances that warm and cool the atmosphere – radiative forcers

Evidence from radiative forcing and climate sensitivity studies



Long-lived Climate Forcers (decades to centuries):

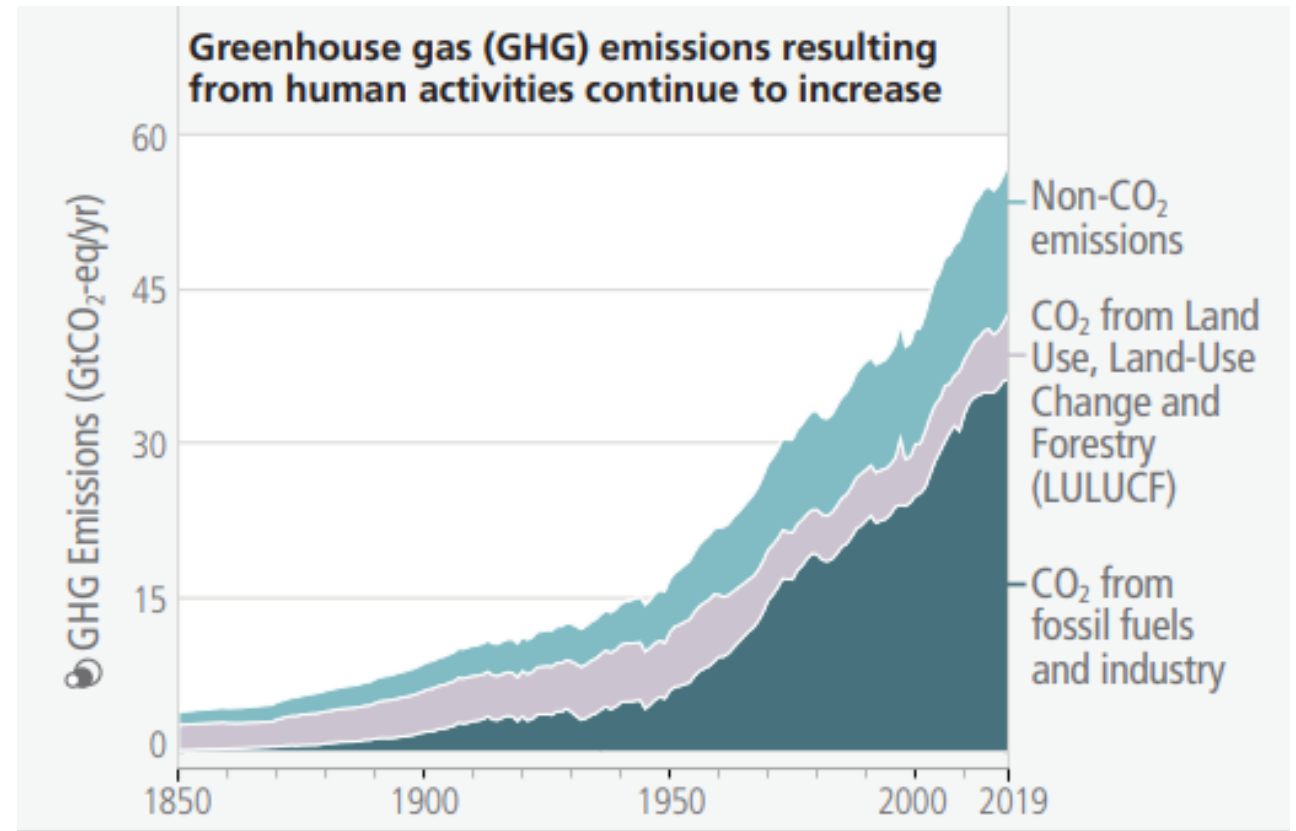
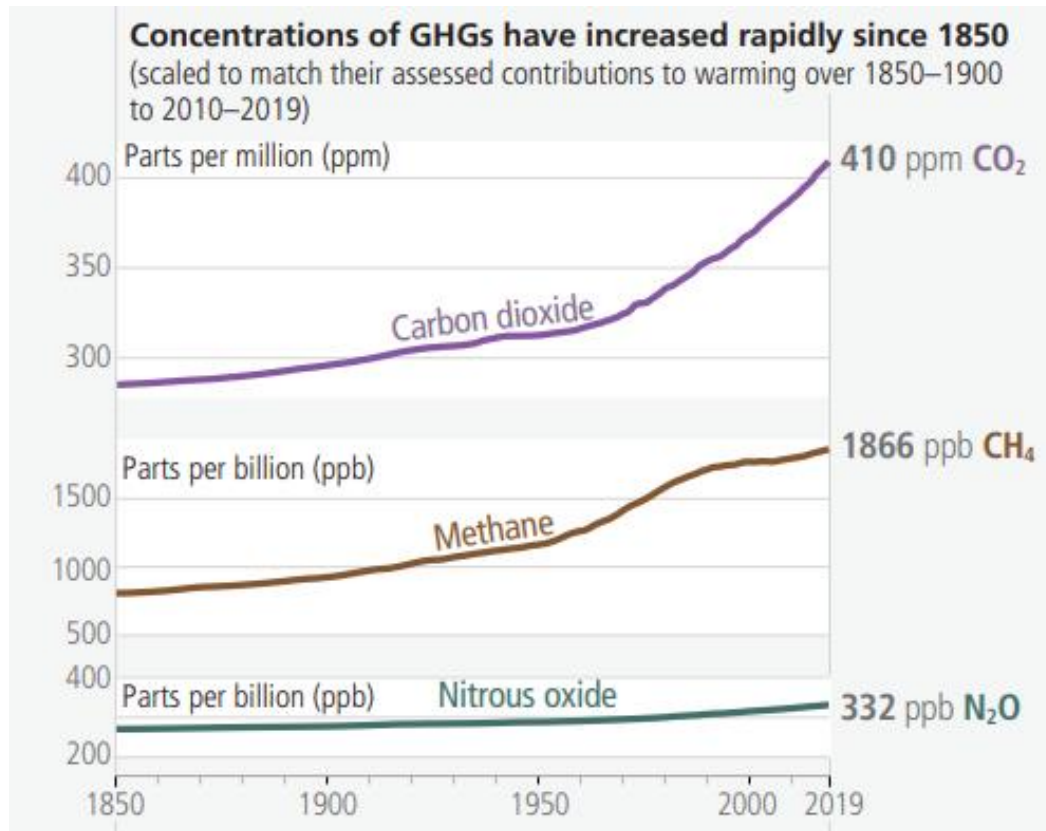
- CO₂, N₂O and some Hydrofluorocarbons (HFCs)

Short-lived Climate Forcers (hours to a decade):

- Methane, some HFCs
- Nitrogen oxides, sulphur dioxide, organic carbon and ammonia emissions form aerosols that are cooling
- Black carbon emissions absorb heat and warm the atmosphere

Adapted from Figure SPM.2

Importance of Non-CO₂ emissions



What are Short-Lived Climate Pollutants?

Table 1.1 Short-lived climate pollutants (SLCPs): Methane, Ozone, HFCs and Black Carbon, their source type, atmospheric lifetime, indirect effect, other effects on the atmosphere or ecosystems, and whether they are covered by the WHO's Air Quality Guidelines.

COMPOUNDS	SOURCE TYPE ²	LIFETIME	OTHER EFFECTS	WHO AIR QUALITY GUIDELINES
Methane (CH ₄)	Primary	~12 years	N/A	No ¹
Ozone (O ₃)	Secondary	Hours to weeks	Ecosystems/crops	100 µg m ⁻³ 8-hour mean
HFC	Primary	Days to years	N/A	No ¹
Black Carbon (soot)	Primary	Minutes to weeks	Cryosphere, Clouds Ecosystems	as part of PM _{2.5} - 5µg m ⁻³ annual mean or 15 µg m ⁻³ 24- hour mean more than 3 - 4 days per year

1. Regulated through Kyoto/Montreal protocols.

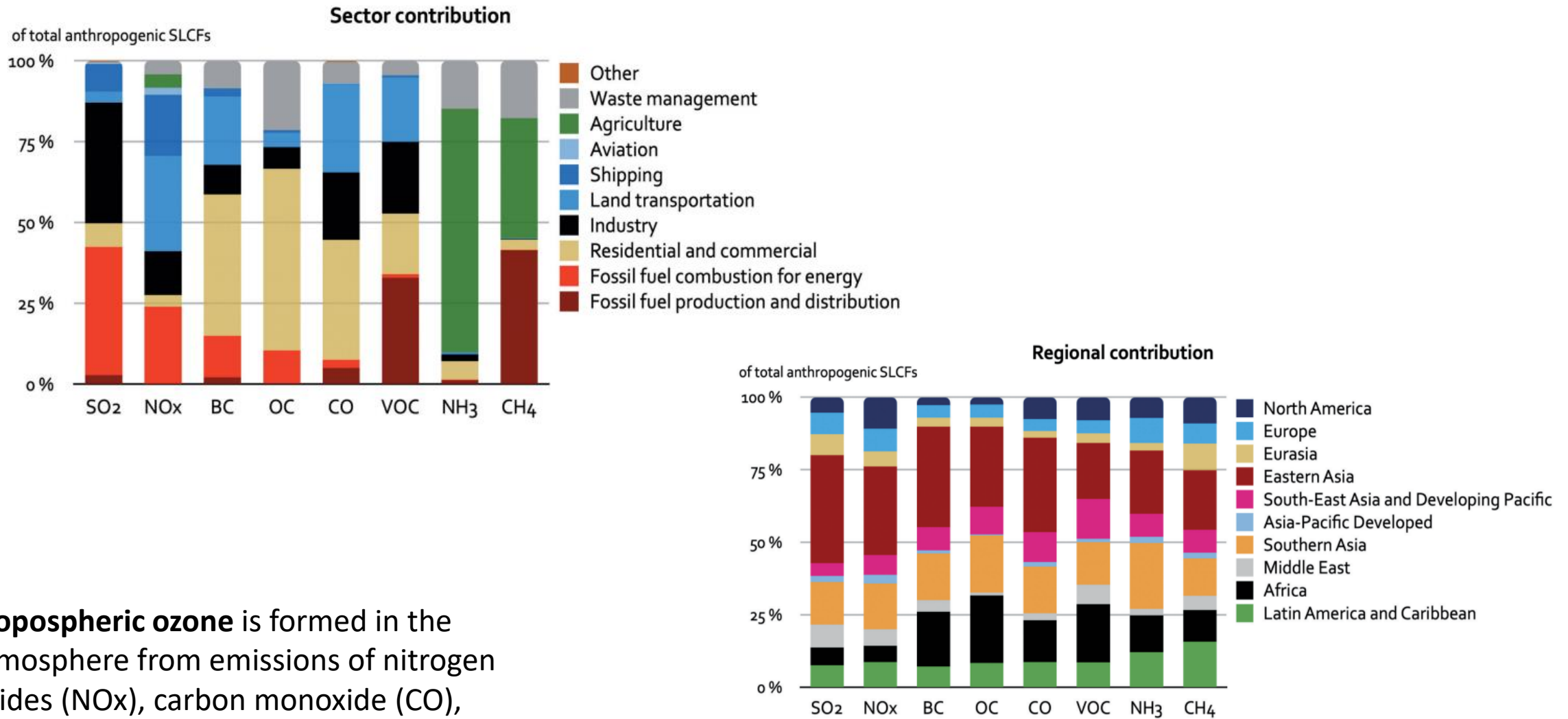
2. Source type can be primary (emitted) and/or secondary (formed through multiple atmospheric mechanisms).

Unless otherwise noted, the stated lifetime refers to tropospheric lifetime.

Source: Szopa et al. (2021); WHO (2021)

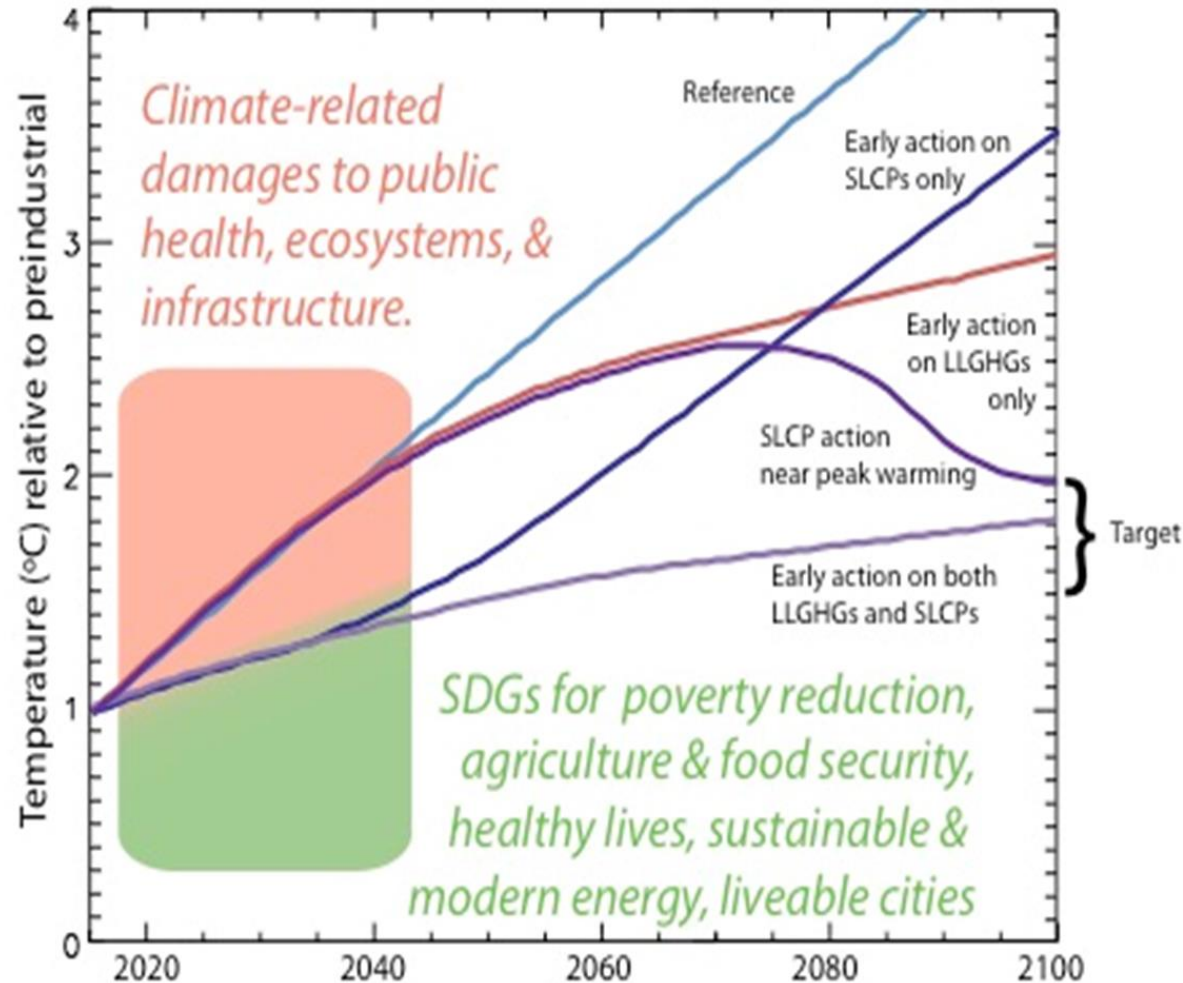
Removing SLCPs from the atmosphere gives climate, environment/crop and human health benefits

Global emission source sectors and regions of SLCFs



Tropospheric ozone is formed in the atmosphere from emissions of nitrogen oxides (NO_x), carbon monoxide (CO), volatile organic compounds (VOCs) and methane (CH₄)

Why are Short-Lived Climate Pollutants Important?



Complementary action on Long-lived and Short-lived GHGs can bring short-term and long-term benefits

(Source: Shindell et al., *Science*, 2017)

Two reports from UNEP.....



Integrated Assessment of Black Carbon



Near-term Climate Protection and Clean Air Benefits: Actions for Controlling Short-Lived Climate Forcers

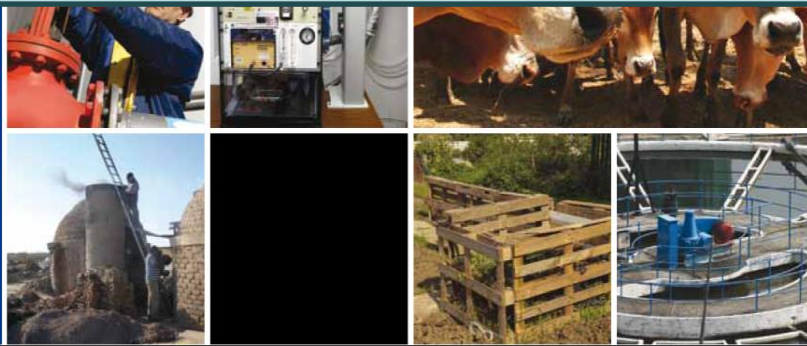
"If someone proposed that you could save close to 2.5 million lives annually, cut global crop losses by around 30 million tonnes a year and curb climate change by around half a degree Celsius, what would you do?"

Act of course"

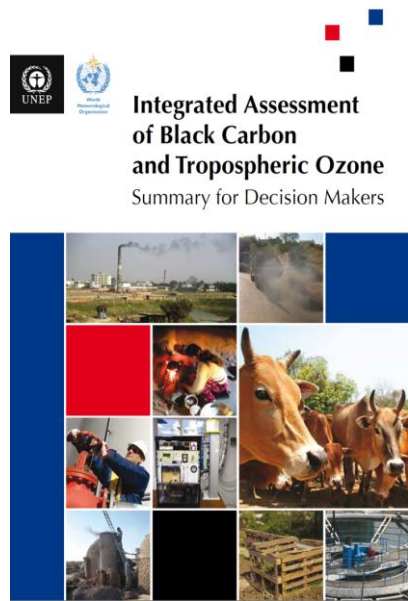
Achim Steiner, Executive Director, United Nations
Environment Programme (UNEP)



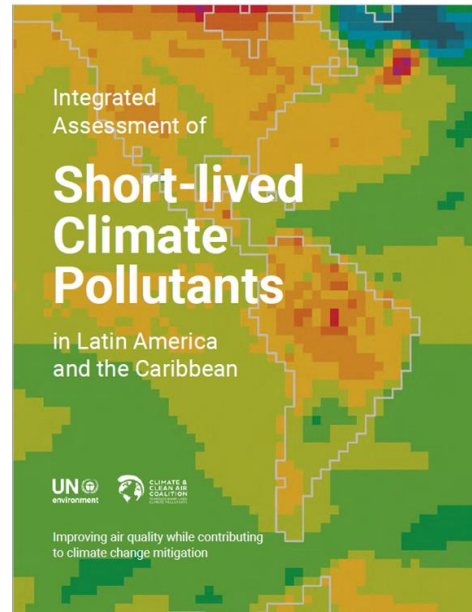
<http://www.unep.org/ccac/Publications/Publications/TimeToAct/tabid/133392/Default.aspx#sthash.g4wcVmgh.dpuf>



There have been several assessments at regional and global scale on short-lived climate pollutants (SLCPs), that give near-term health, crop and climate benefits



2010.....



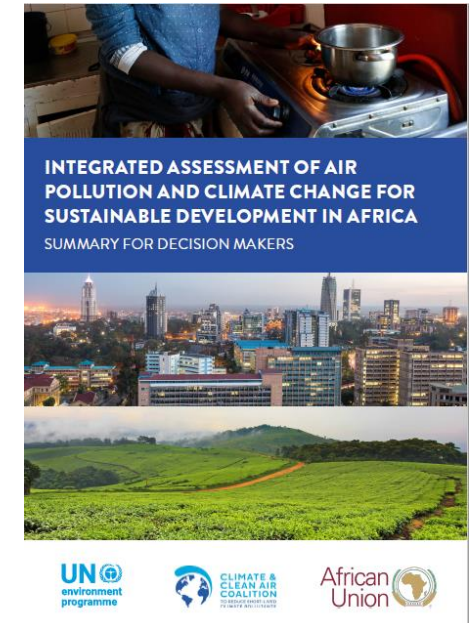
2014.....



2018.....



2021.....



2022

Various levels of successful moving science to policy but how to move to next stage of action to implement the measures recommended in these assessments and reduce emissions?

Find them all at: <https://www.ccacoalition.org>

Activity and Emission Modelling Overview

- **Africa-wide** model developed in LEAP with data for all nations.
- **Time Period:** Historical Period: 2000 – 2018, Projections: 2019-2063. Annual results but with particular focus on 2030 (SDG target year), 2050, and 2063.
- **Geography:** Whole continent with national-scale resolution of key variables. Results can be shown for Africa as a whole, for individual countries or for various country groupings.
- **Sectors:** Modeling of all energy consuming and producing sectors and key non-energy sectors
 - Energy: Including Industrial, households, transport
 - Non-energy: Including waste and agriculture
- **Pollutants:** All long-lived GHGs and short-lived climate pollutants (SLCPs), and all major local air pollutants.

The model is freely available for use by countries for national planning

<https://leap.sei.org/>

Africa Assessment : MITIGATION MEASURES

Other Energy Sector Measures

- E1. Efficient Charcoal Making
- E2. Post-Combustion Emission Controls in Industry
- E3. Coal Methane Capture
- E4. Oil and Gas Methane Emissions.
- P1. Industrial processes and product use (IPPU)
- E5. Transmission and Distribution Loss Reduction
- E6. Industrial Energy Efficiency
- E7. Service Sector Energy Efficiency
- E8. Reduce Demand for Cement
- E9. CCS in Carbon Intensive Industries and Electric Generation
- E10. Renewable Electric Generation: Solar, Wind, Geothermal and Hydropower



Agriculture

- A1. Livestock - Reduce enteric fermentation by increasing productivity
- A2. Livestock - Reduce enteric fermentation via digestibility of feed
- A3. Livestock - Manure Management
- A4. Crops - Rice
- A5. Biomass burning
- A6. Food Waste
- A7. Diet - Protein source



Transport Measures

- T1. Passenger Electric Vehicles
- T2. Advanced Emissions Controls for Road Vehicles
- T3. Hybrid Vehicles
- T4. Public Transport
- T5. Non-Motorized Transport
- T6. Switch Freight from Road to Rail
- T.7. Rail Electrification
- T.8. Road Freight Electrification



Residential Measures

- H1. Clean Lighting
- H2. Clean Cooking
- H3. Efficient Air Conditioning
- H4. Efficient Refrigeration
- H5. Other household energy efficiency



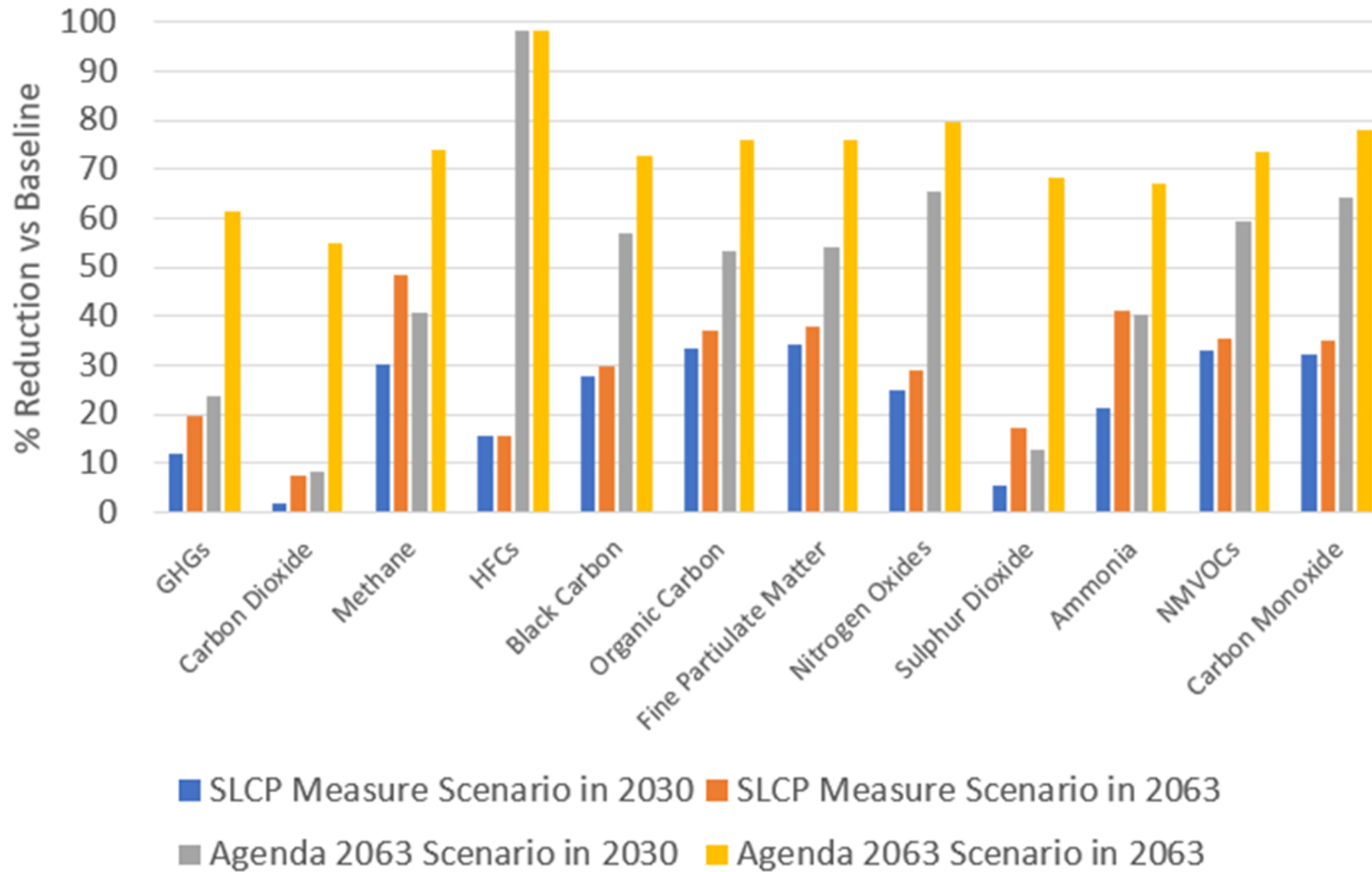
Waste

- W1. Solid Waste Disposal - best practise landfill management to reduce open burning of waste, and methane capture at landfills
- W2. Liquid Waste - Methane capture at wastewater treatment plants
- W3. Solid Waste Disposal - Implement waste collection and development of formal landfill sites
- W4. Solid Waste Disposal - Diversion of organic waste to composting or biogas
- W5. Solid Waste Disposal - Reduce organic waste generation
- W6. Universal access to improved water and sanitation services



Integrated action across 5 key areas as part of National Action Planning on SLCPs for Agenda 2063, SDG and NDC and RECs

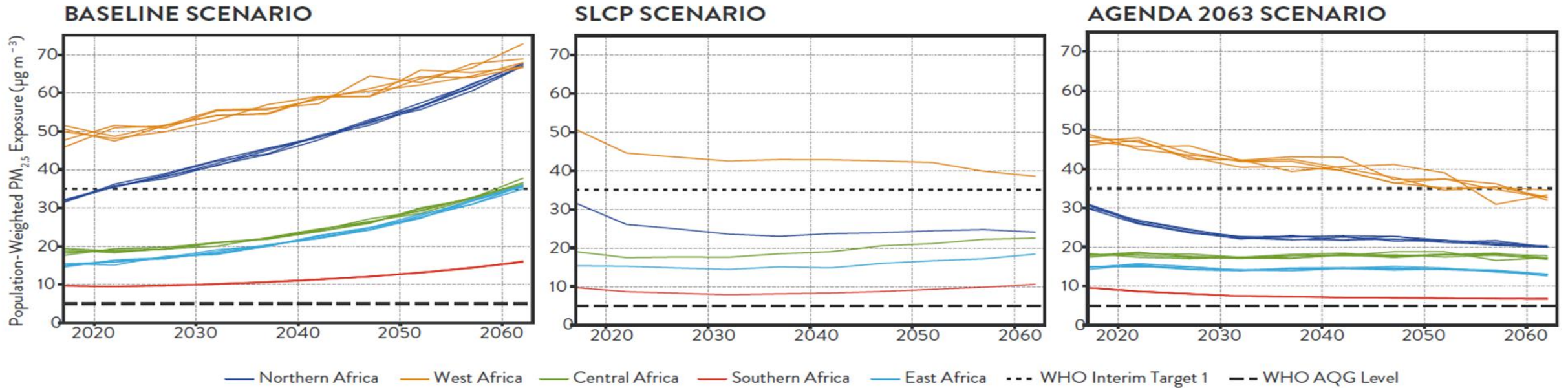
What are Short-Lived Climate Pollutants?



Emission reduction by 2063:

CO₂ - 55%, CH₄ - 74%, N₂O - 40%, Black carbon - 72%, PM_{2.5} - 75%, HFCs - 98%, NO_x - 80%, NMVOCs 72%

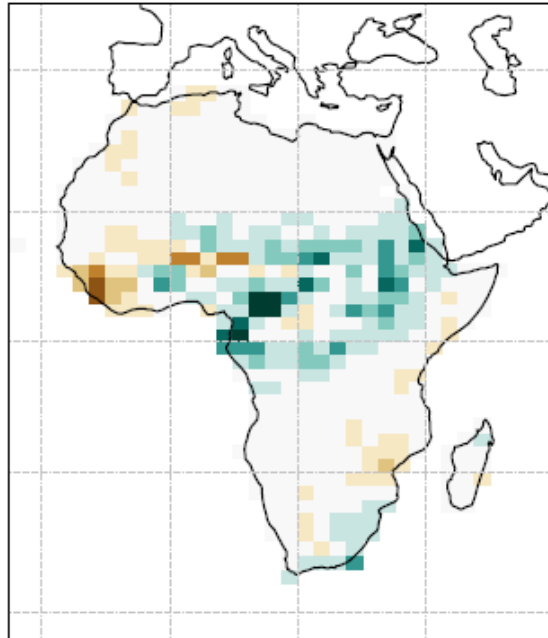
Air quality and health



- **180,000** premature deaths per year due to outdoor air pollution can be avoided in 2030 rising to **800,000** in 2063
- A further 20,000 premature deaths per year could be avoided from indoor air pollution rising to **80,000** avoided premature deaths by 2063

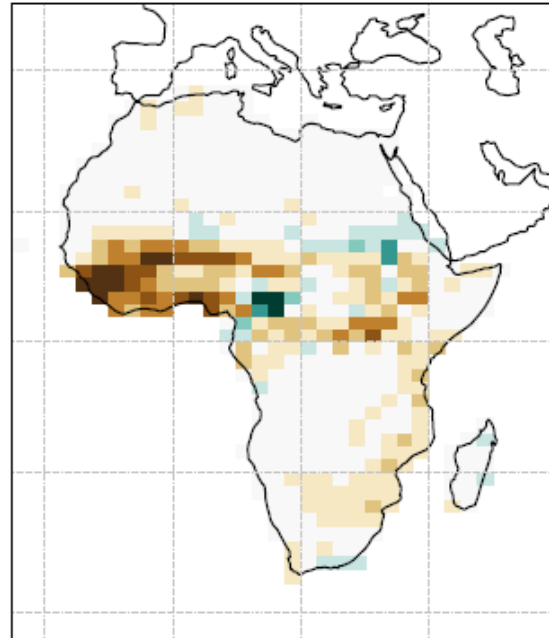
The role of aerosols in influencing African local rainfall patterns

(g) Agenda JJA



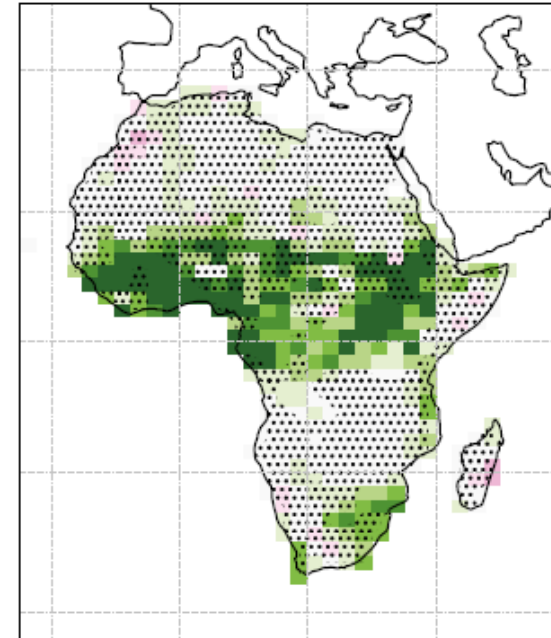
—1.0 —0.5 0.0 0.5 1.0
precipitation change (mm day^{-1})
(2050-59 mean minus 2015-24 mean)

(h) Baseline JJA



—1.0 —0.5 0.0 0.5 1.0
precipitation change (mm day^{-1})
(2050-59 mean minus 2015-24 mean)

(i) Agenda vs Baseline JJA



—0.50 —0.25 0.00 0.25 0.50
precipitation difference (mm day^{-1})
(2050-59 mean)

African policy choices may therefore greatly reduce regional African summer drying, especially in the Sahel region

Main Messages

- ✓ Air pollution and climate change are inextricably linked – the integrated package of long-lived GHGs and SLCP measures can achieve multiple benefits for health, environment and climate
- ✓ A first **Integrated Assessment of Air Pollution and Climate Change for Sustainable Development in Africa** has been conducted and shows the potential benefits of implementing a set of 37 measures across 5 key sectors
- ✓ Data is available for such studies but more data and research is needed to support implementation of measures
- ✓ Most of the recommended measures have already been successfully implemented in different parts of Africa
- ✓ The main benefits of action taken will be in Africa



**INTEGRATED ASSESSMENT OF AIR
POLLUTION AND CLIMATE CHANGE FOR
SUSTAINABLE DEVELOPMENT IN AFRICA**
SUMMARY FOR DECISION MAKERS



Full Technical Report and
Summary for Decision
Makers available for
download at:

[https://www.ccacoalition.org
/resources/full-report-
integrated-assessment-air-
pollution-and-climate-
change-sustainable-
development-africa](https://www.ccacoalition.org/resources/full-report-integrated-assessment-air-pollution-and-climate-change-sustainable-development-africa)



Thank you