



# Lecture 2- Planetary Health Dimensions

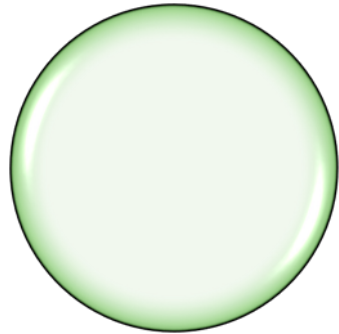
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2<sup>nd</sup> December, 2020

## Climate Change: Health Impact Pathways

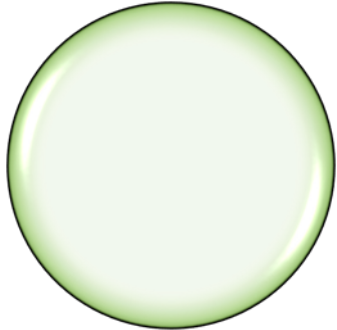


# LECTURE FOCUS-

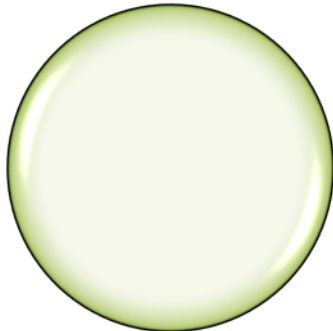
## Link between human activities and Health



Malaria dilemma- Present benefits vs discounted costs



Legacy of Lead Poisoning?



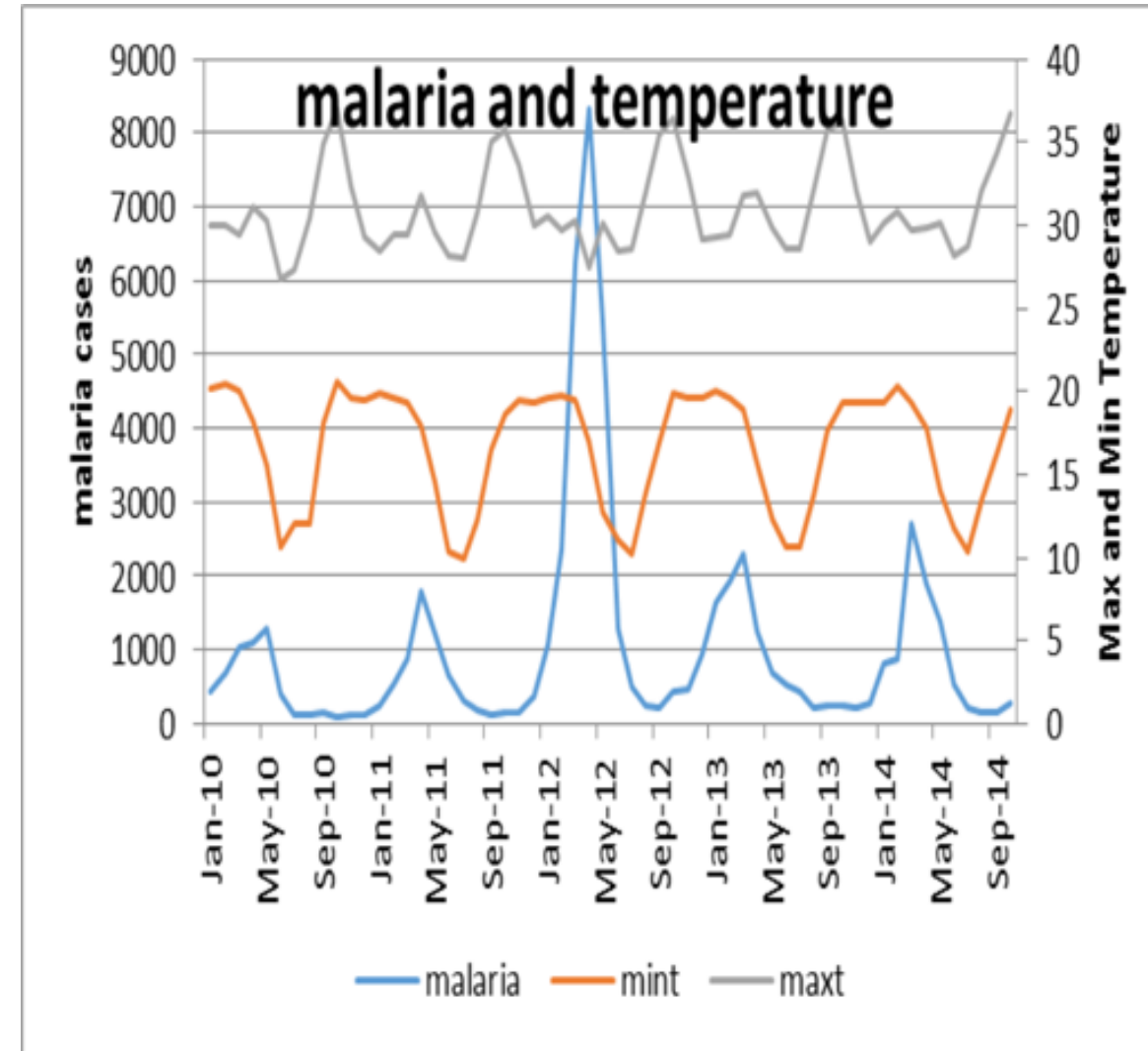
Energy Crisis, Air Pollution and Health outcomes!

# Malaria burden

The sensitivity of the vector borne diseases like malaria, to climate change continues to raise considerable concerns over the implications of climate change on future disease dynamics.

Malaria resurgence and changes in the mosquito behaviour being reported in the country and also in the Southern Africa sub-region could be attributed to changes in the climate among other factors.

- A study was done using health data from the HMIS and Climatic data of high malaria transmission areas.
- Results showed that the incidence of confirmed malaria cases in Zambia increased by 0.2 % with every 1 mm increase in rainfall ( $P = .028$ ).
- Correlations with humidity indicated that malaria incidence increased by 2 % for every 10 % increase in humidity ( $P = .294$ ).
- The correlation between rainfall and all malaria cases was positive and highly significant ( $r = 0.197$ ;  $P = .0006$ ).



# MALARIA DILEMMA- Background

2020/12/03



Malaria is still a leading cause of death and hospital admissions in Zambia;



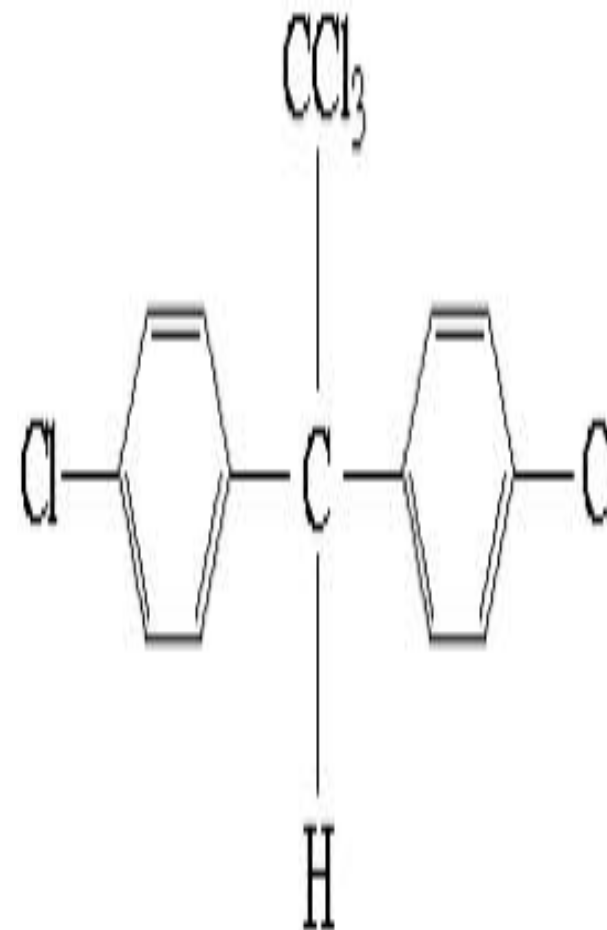
Mostly affected are pregnant women and children;



To address this, the Ministry of Health in Zambia put into place an Integrated Vector Management (IVM) strategy which includes Indoor Residual House Spray with DDT among other chemicals.

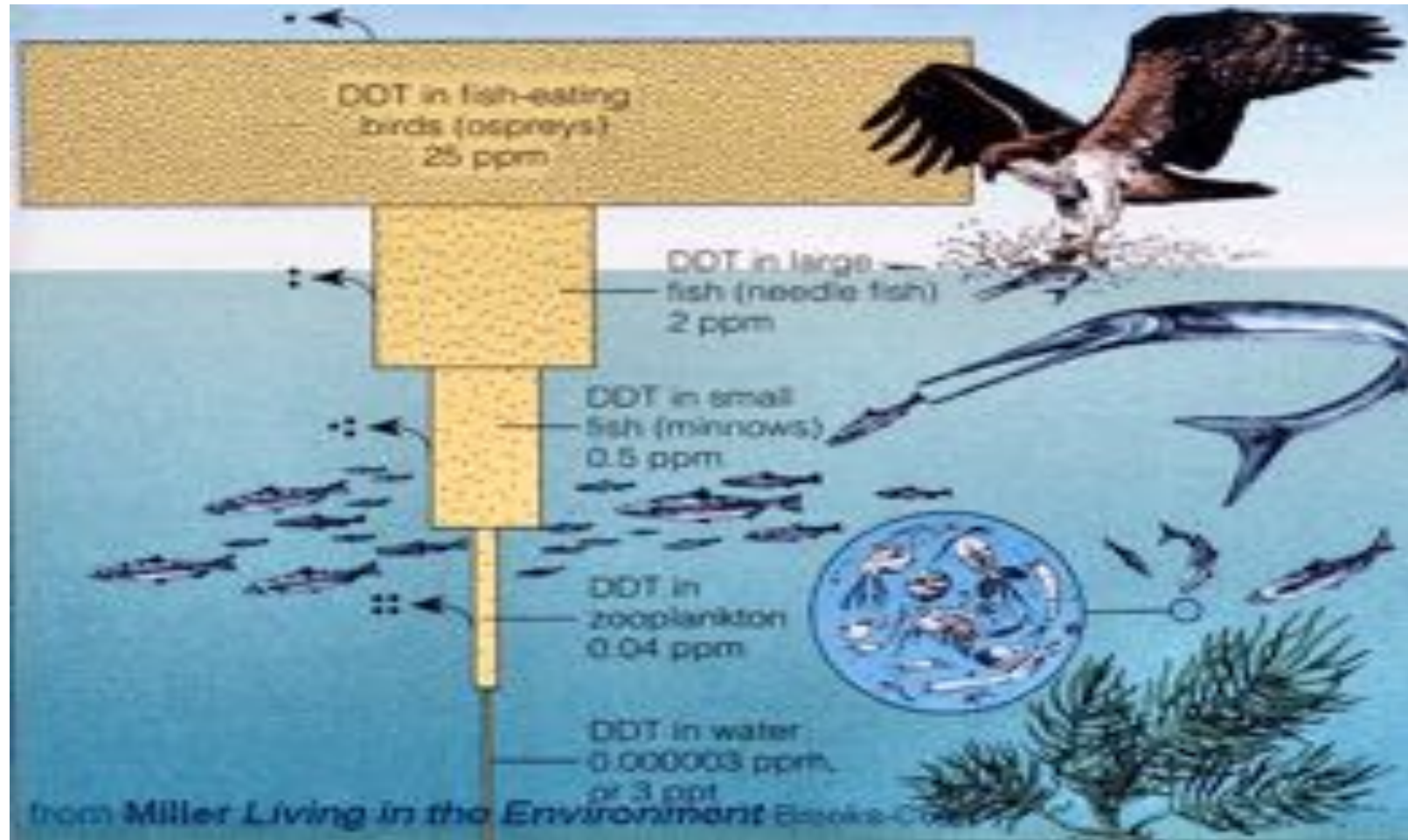
# What is DDT?

- Dichloro Diphenyl Trichloroethane
  - **Persistent Organic Pollutant (POP)**
    - unique combination of physical & chemical properties:
    - resist degradation in environment, breakdown products- DDE, DDD and DDA also stable (i.e. persistent)
    - low, but significant, vapor pressure (“semi-volatile”) leads to distribution in all environmental media
  - **Banned under the Stockholm Convention but allowed for Public Health use in some countries.**





# DDT Bioaccumulation and Magnification





# What is the problem?

- Several studies have shown that DDT causes thinning of bird egg shells and finds its way into the food chain if improperly handled.
- DDT is an endocrine disruptor and has been shown to cause human health effects.



## Evidence of Carcinogenicity and Cancer in Humans-

**Two studies done on occupationally exposed men in the US and Australia found a 7.4 fold higher risk of pancreatic cancer deaths.**

- Rated as “a possible carcinogen” Group 2b by the International Agency for Research on Cancer (IARC).
- Liver cancer- Mc Glynn et al, 2000- the risk of liver cancer was elevated in Chinese men with the highest blood levels of DDT- OR= 3.8; 95% CI, 1.7- 8.0.

## Evidence of Consequences to the fetus

- increased risk of fetal loss in previous pregnancies; \*
- high breast milk DDE concentrations were associated with shorter lactation duration. \*\*

\*Longnecker et al, 2005.

\*\* Gladen and Rogan, 1995 and Rogan et al, 1987.

## Evidence of Reproductive consequences

- Reduced Male fertility-
  - low semen volume,
  - impaired sperm motion parameters including % of motile sperm.
  - Low sperm quality and count.
- Reduced female fertility-
  - long menstrual cycles,
  - earlier age of menopause,
  - delays in conception.

Anneck-Hann et al, 2007. Dalvie et al, 2009.

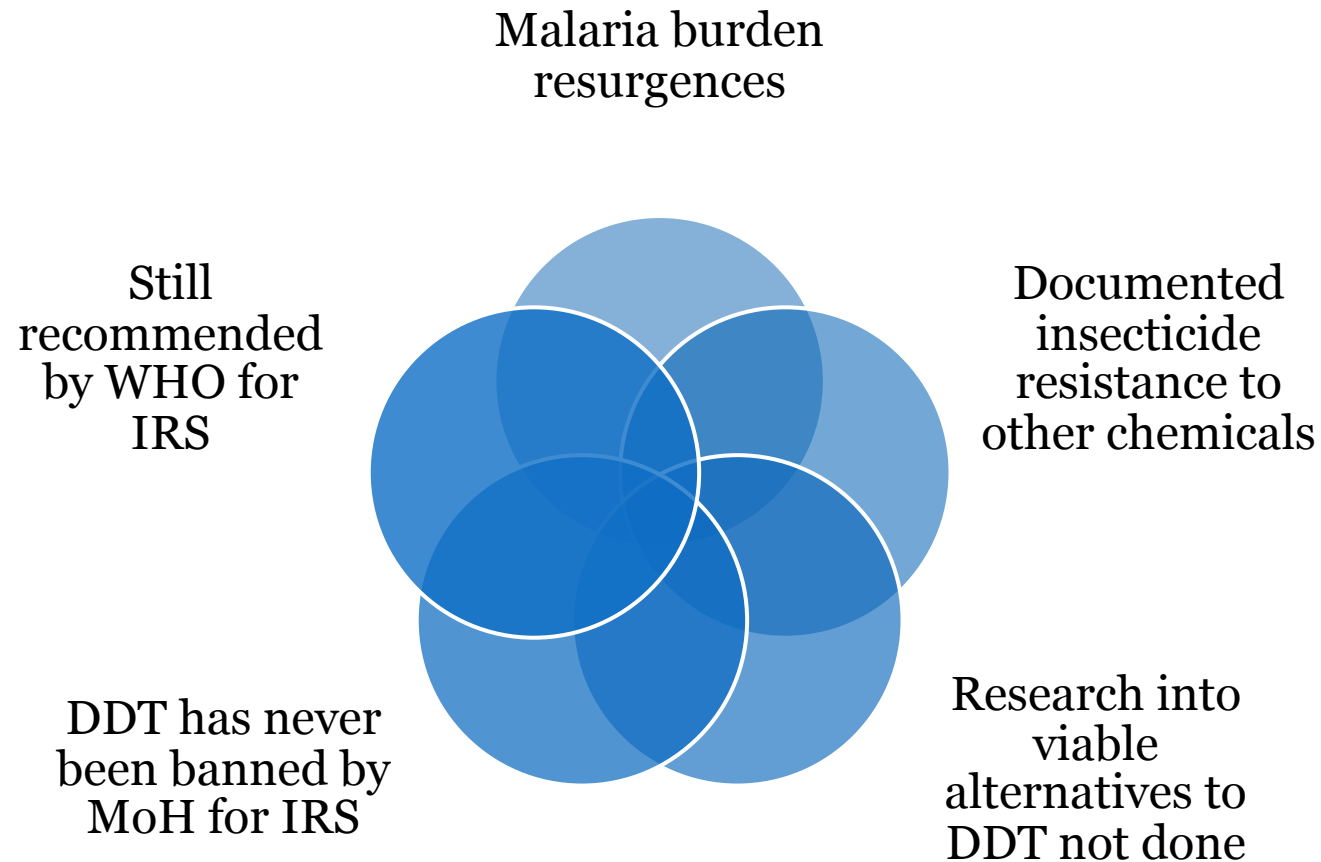
Toft et al, 2008. Akkina et al, 2004.

Axmon et al, 2006.

Reference	Study Population	Setting	Evidence of effects
<b>1. Rogan et al, 1986</b>	Neonates	USA	Yes
<b>2. Sagiv et al, 2008</b>	Neonates	USA	Yes-irritability
<b>3. Gladden et al, 1988</b>	6-24 MONTHS	USA	No
<b>4. Darvell et al, 2000</b>	6-12 months	USA	No
<b>5. Ribas-Fito et al, 2003</b>	13 months	Spain	Yes-cognitive, motor and social development
<b>6. Eskananzi et al, 2006</b>	6 and 12 24 months	Mexican-American children (USA)	Yes and No
<b>7. Ribas-Fito et al, 2006</b>	4 and 5 years	Spain	Yes-general cognitive, memory etc
<b>8. Torres-Sanchez et al, 2007</b>	3, 6 and 12 months	Mexico	Yes- psychomotor

- **Review of Selected Studies on Neurodevelopmental Effects of DDT on Children**

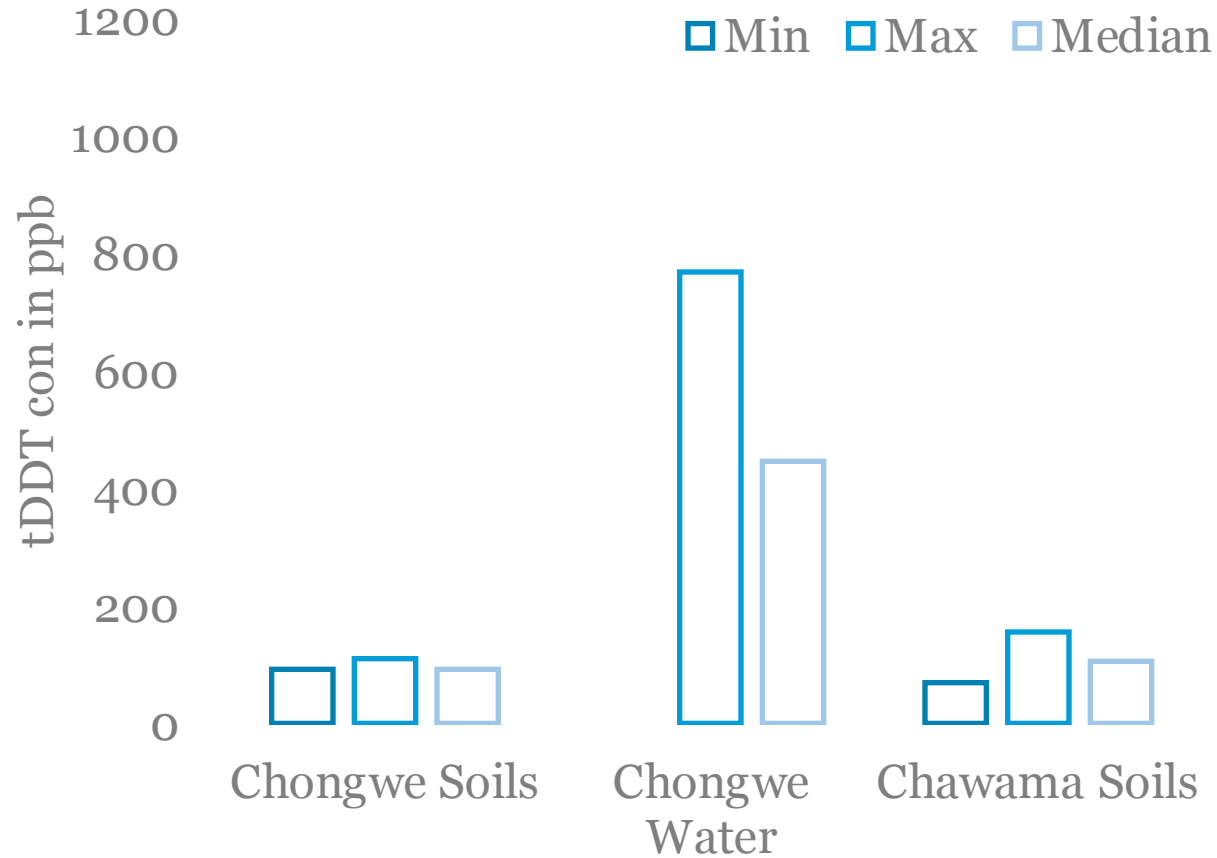
# Why is DDT still in use for malaria control?





## tDDT Conc in Soils and Water of selected areas in Zambia

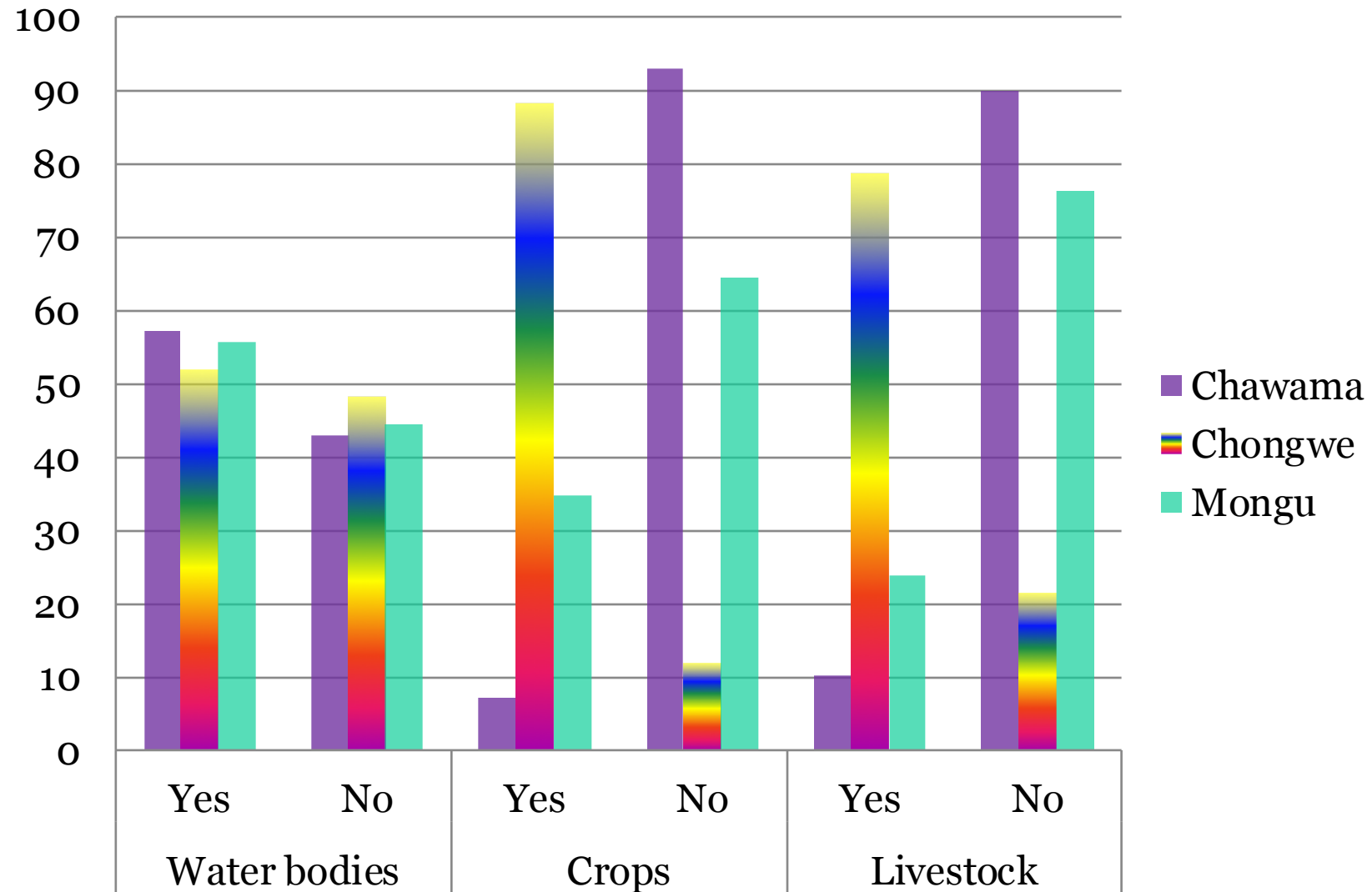
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There were no significant differences in concentrations by the areas.

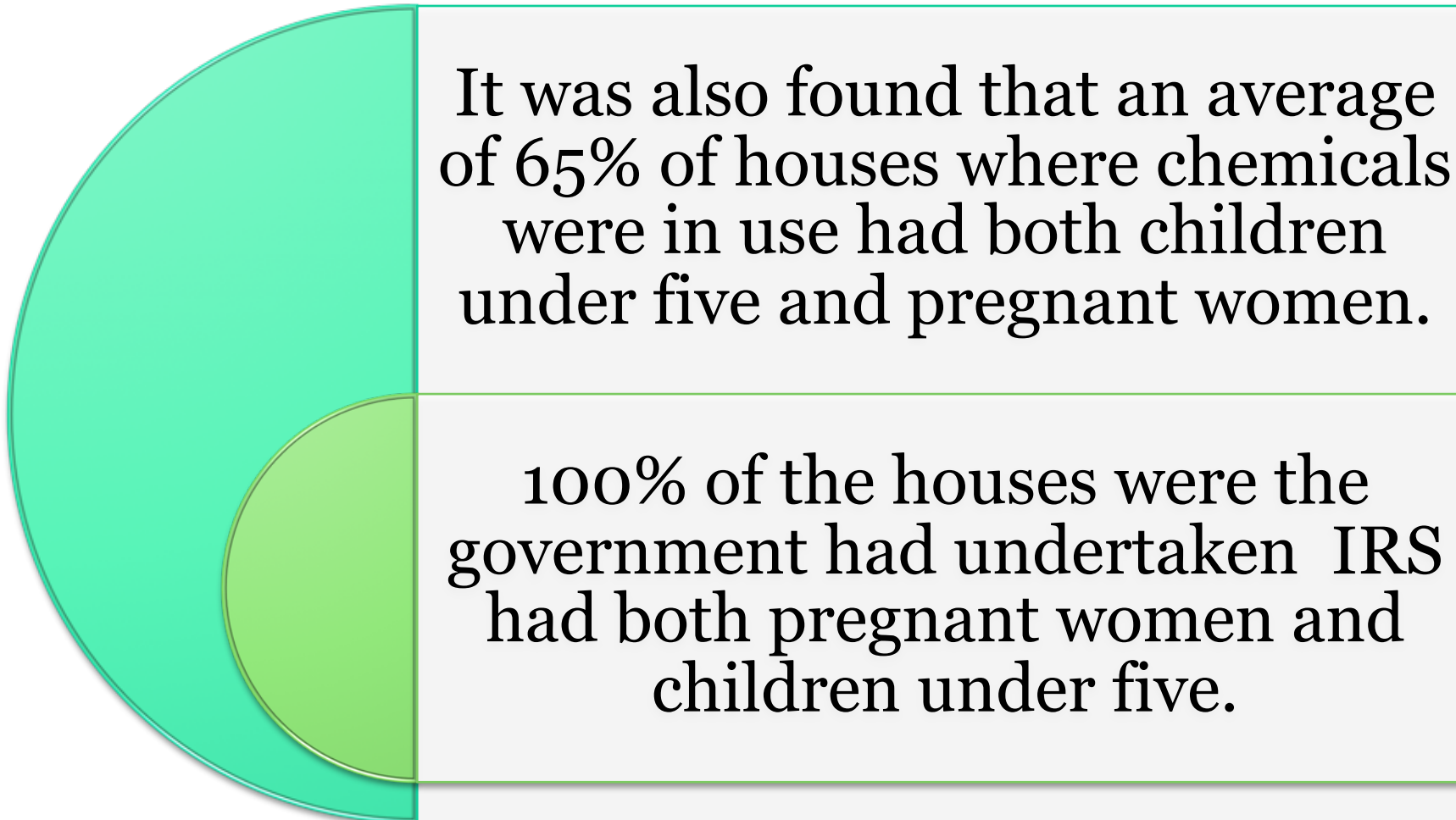
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## Environmental parameters



Location	Where?	Sampling year	DDTs (ng/g d.w.)
			Median
<b>Spain</b>	Top soil ~5 cm	1990	14.7
<b>Mexico</b>	Top soils ~10 cm	2006	66.5
<b>Uganda</b>	Top soils ~15 cm.	2004/05	59
<b>China</b>	Top soils ~10 cm	2007	45
<b>Czech Republic</b>	Top soils ~25 cm	1992–2009	34.2
<b>Zambia</b>	Top Soils 5 cms	2012	<b>106.71</b>

# Summary of Survey results



Pb

Lead

Atomic Number: 82

Atomic Mass: 207.20

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**We made it to the top 10!!!**



# What is Lead?

Lead is a bluish gray metallic element which occurs naturally (in small amounts) in the earth's crust.

It is dense, hence its use as a ballast, ammunition, or radiation shield.

Lead is insoluble in water, but some salts are soluble.

# Lead - Absorption

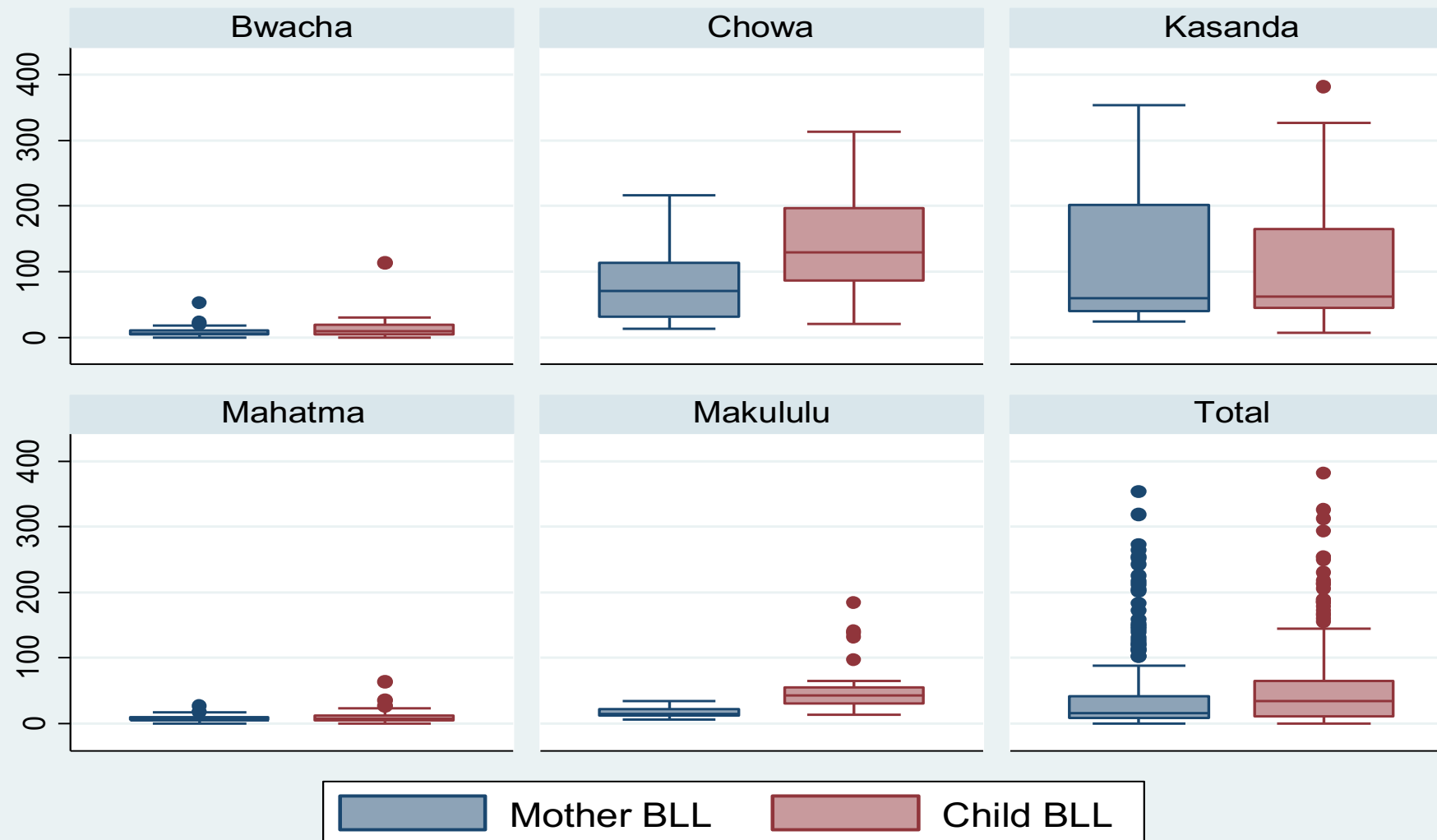
- Inhalation
  - Dermal
  - Orally
- Consumed Lead Absorbed  
In Place of Calcium

CHILDREN – 30-50% OF LEAD

ADULTS – 5-10% OF LEAD

Increased During Pregnancy

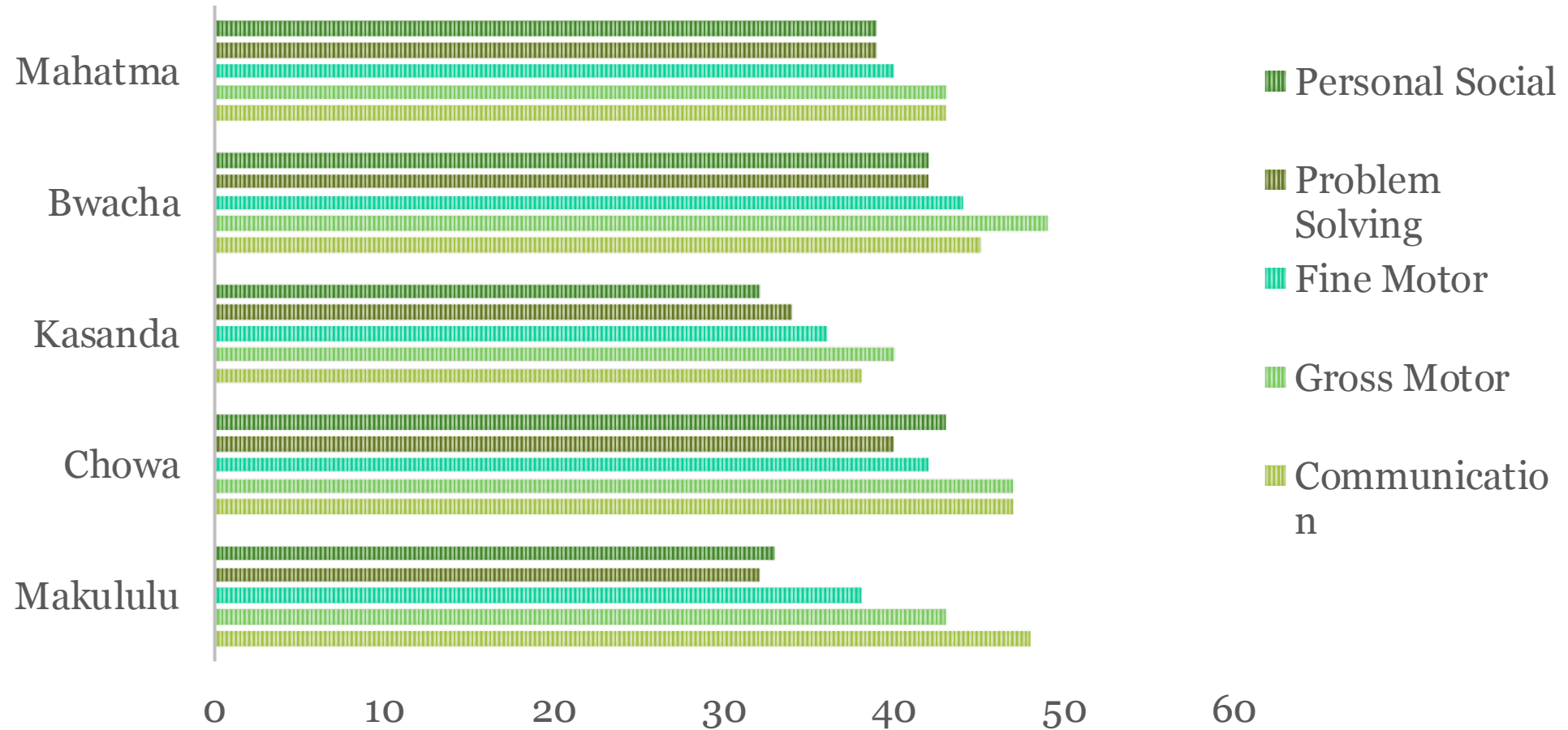
Blood Lead Levels of Mothers and Children of selected areas of Kabwe



There were significant differences in BLL concentrations by the areas.

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## NEURODEVELOPMENTAL SCORES IN SELECTED TOWNSHIPS OF KABWE



There were significant differences in ND scores by the areas.\*except FM domain\*

# Caregiver's Concerns

- Child has a problem with **appetite**, mother had **hearing complications** in childhood
- Child has **eye problems** often and there is a history of **hearing problems** in the family
- Mother is concerned about **child's weight** and **lack of interaction with others**
  - Child has **delayed speech** and was **not feeling well**, child is very **hyperactive**
    - history of **hearing impairment** in older sibling
  - Child had **malaria and anemia**, child fights a lot, child gets sick a lot
    - Child has **delay in speech** and he is **not walking yet**
- Child has **speech problem**, child walked for three days of which after she stopped
- Child has **delayed in speaking**, the child's paternal uncle has a **hearing problems**
- Child is **too much quite**, the aunt has **hearing problem**, the child had fever

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# ENERGY CRISIS!!!!





# Background

- The shortage of electricity has been increasing –this has been attributed to reduced water levels at Kariba North Bank, Kafue Gorge and Victoria falls (Banda, 2006; CSO 2010).
- Unsustainable harvesting of trees and use of charcoal has adverse effects both on human health and the environment.
- Respiratory infections have been ranked among the top two causes of mortality in Zambia since 2013.
- These illnesses can be acute or chronic in their manifestation.

## Background ctd

- Climate change affects respiratory health in a variety of ways and pathways.
- This is both directly through Greenhouse Gas emissions and indirectly by exacerbating already existing conditions including asthma and bronchitis.
- Coping mechanisms to the energy crises has seen households resorting to using cooking fuels that have harmful levels of indoor pollutants.
- Scientists also predict rising incidence of allergies and respiratory diseases as warmer air grows more charged with pollutants, mould spores and pollens.

# Justification

Public health linkage to energy use and negative health outcomes are under researched in Zambia.

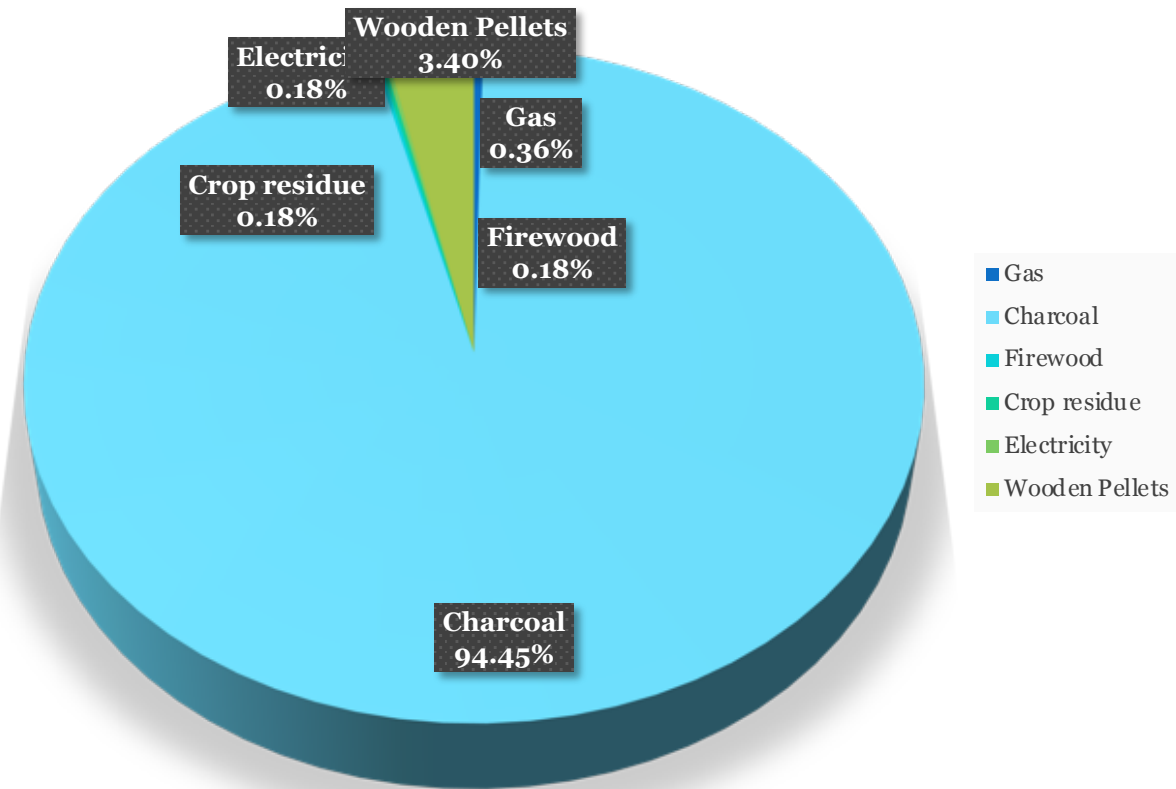
Understanding the dynamics of the energy and health relationship will help develop sustainable energy measures.

Provide policy makers an insight to establish efficient and well rounded measures to safe guard health.

Contribute to the body of knowledge

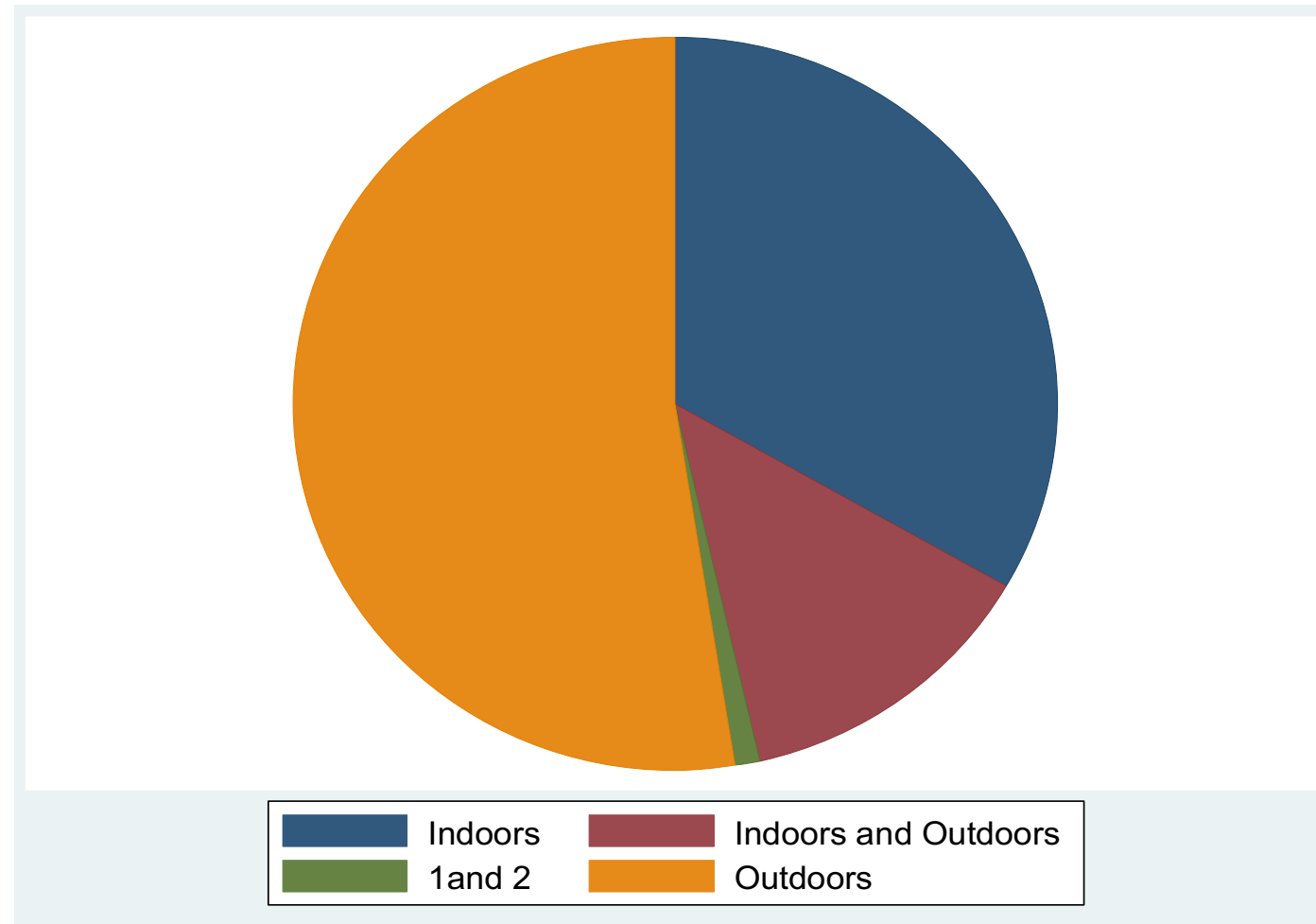
- enhance multi-sectoral collaboration among key energy using organs for well rounded and efficient long term policies
- Enlightenment on importance of formulating and enforcing local indoor air guidelines and regulations.

## ENERGY OPTIONS



# Location of cooking sites

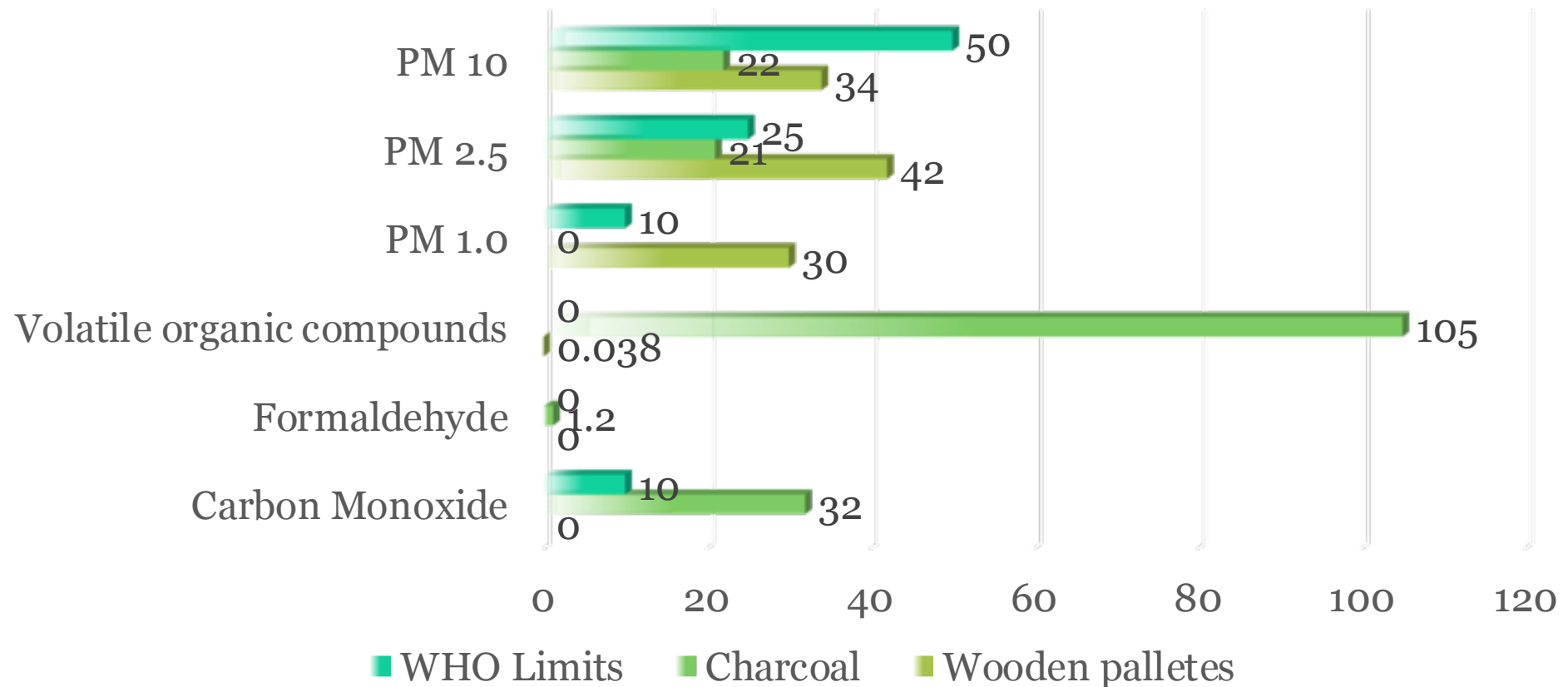
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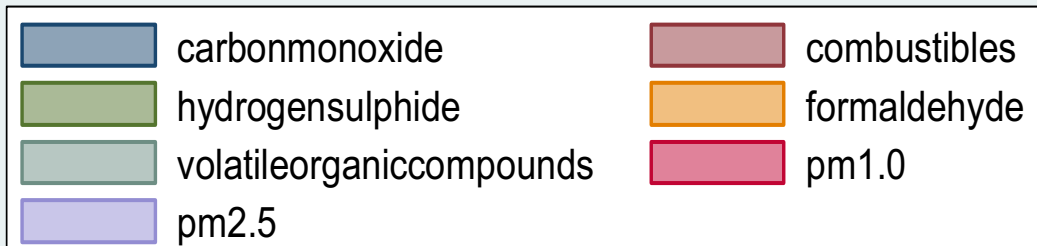
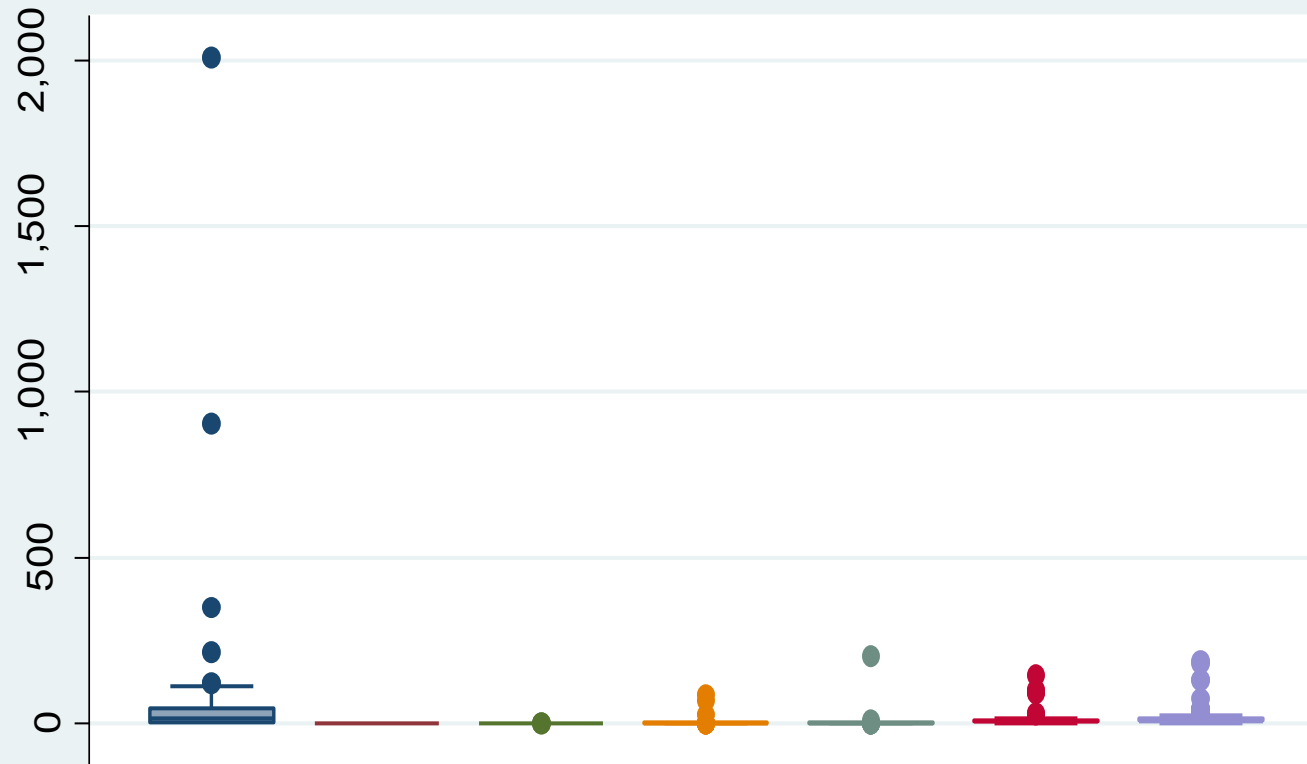
# Air Pollution Measurements in Matero Households

## INDOOR POLLUTANT LEVELS AND WHO LIMITS





## Indoor Air Pollutants



## AIR QUALITY INDEX



# Findings related to Children

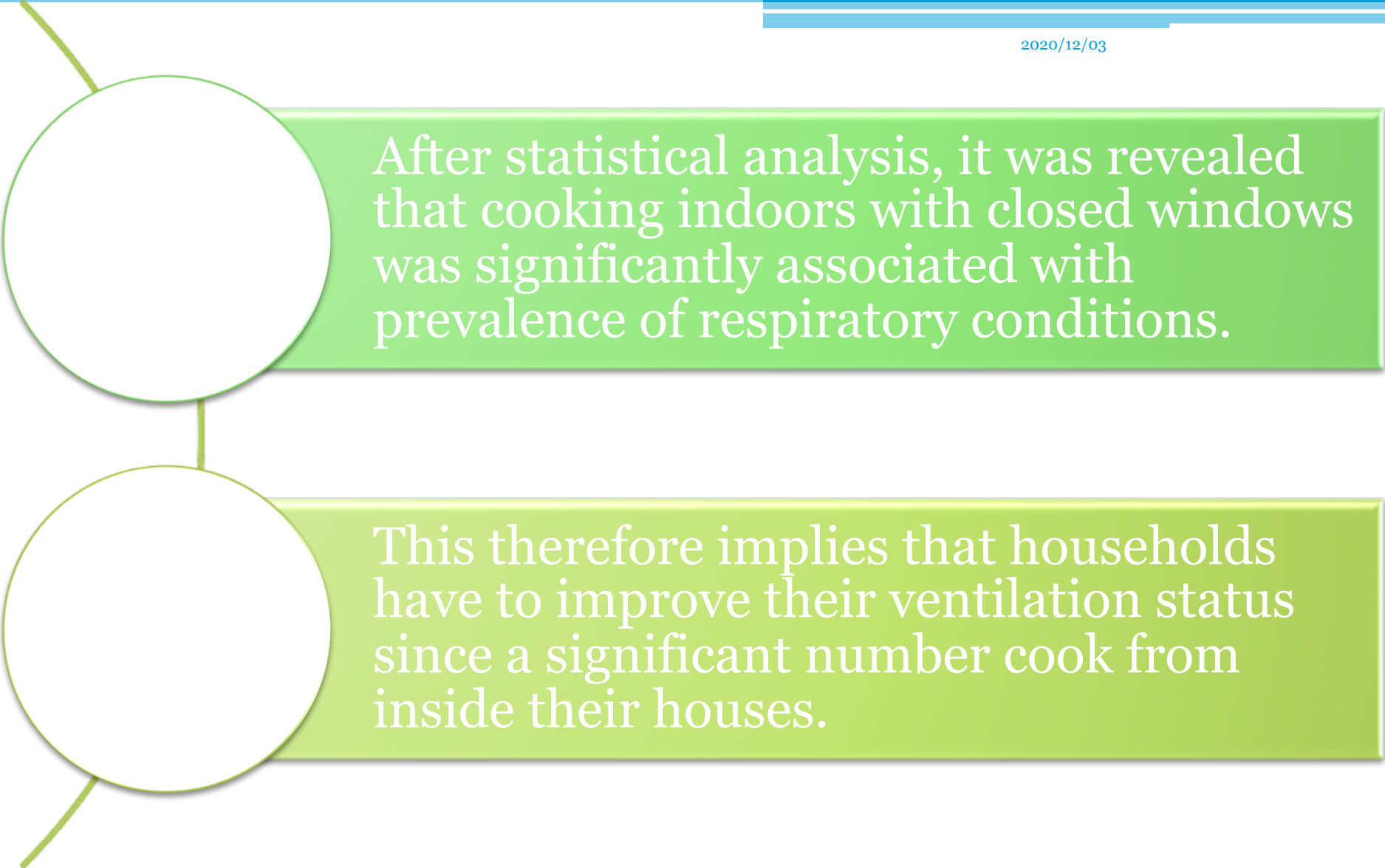
428 (75%) of the sampled households had children living there;

Reported that they cooked with children in the same area.

Burns and fires were reported in 18 households with half of these having children present.

# Reported health effects

- Coughing
  - Sneezing
- Rapid pulse rate
  - Fatigue
- Unconsciousness
  - Dizziness
- Throat dryness
- Tears
- Runny nose
- Headache
- **Chest pain**
- **Red eyes**
- **Swollen eyes**
- **Shortness of breath**



After statistical analysis, it was revealed that cooking indoors with closed windows was significantly associated with prevalence of respiratory conditions.

This therefore implies that households have to improve their ventilation status since a significant number cook from inside their houses.

# Daubed/mud-thatched houses



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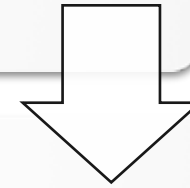
# IS IT ALL DOOM AND GLOOM????

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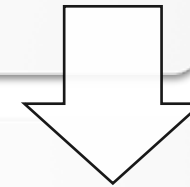


# How do we change the horizon???

Transformation of how we “do” Science!!!



Move from the laboratory like settings where everything is at “STP”;



Translate the knowledge, innovations into packaged interventions that will meet various societal and ecosystem needs.

## PARIS CLIMATE AGREEMENT

Historical document that legally binds the whole World to participate in climate change fight.

**196 countries**

**Adopted the Agreement**

officially recognizing human influence on climate



**Finance**

Rich countries will provide minimum of \$100 billion to developing ones for climate change adaptation by 2020



**Will come into force by 2020**

If signed by **55 countries** covering **55%** of global emissions

**Goal**

Holding the increase in the global average temperature well below

**2°C**

Pursue efforts to limit the temperature increase to

**1.5°C**

**Role of forests**

The Agreement binds saving and increasing forest area in order to capture GHGs from the atmosphere



**5 years**

**Ambitious**

Every 5 years countries shall revise their emissions reduction targets and measures



**Climate neutrality 2050**

The balance between emissions and sinks should be reached in the second half of XXI century



**Climate damage**

For the first time ever the Agreement defines climate loss and damage terms **but** liability and compensation are not mentioned

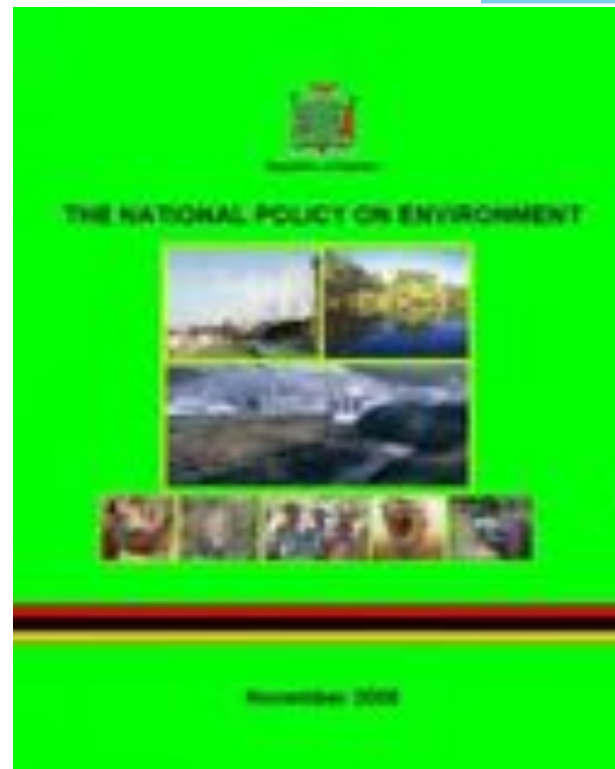


**Clean technologies**

The Agreement urges to speed up clean tech development and international technology transfer

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**NATIONAL HEALTH IN ALL POLICIES STRATEGIC FRAMEWORK 2017-2021**

MINISTRY OF NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION



MINISTRY OF NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION

**NATIONAL POLICY ON CLIMATE CHANGE**

Ministry of Natural Resources and Environmental Protection

April 2016



ARE THESE ENOUGH????

- PLANETARY HEALTH- FROM KNOWLEDGE TO TRANSFORMATIVE CHANGE,  
Local Solutions  
Go back to the communities





We need to make a choice between Present benefits vs discounted costs.



- Conducting Training programs that eliminate geographical barriers;
- Integrating Planetary Health thinking into traditional teaching resources;
- Sharing of resources across the global divide;
- Holistic, transdisciplinary thinking and action.



# Reflections for developing countries

- Housing design, water reticulation systems
  - Rural and urban planning implications
- Integrated vector control that takes into account climatic variations, social determinants and other ecological factors
  - Total homestead environment approach that looks at the entire planet.

*"One of the most alarming aspects of the chemical pollution of water is the fact that here—in river or lake or reservoir, or for that matter in the glass of water served at your dinner table—are mingled chemicals that no responsible chemist would think of combining in his laboratory."*

RACHEL CARSON  
SILENT SPRING



**THE EARTH IS IN OUR HANDS**



Vielen Dank!!!  
Dzikomo Kwambiri!!

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**Questions are welcome**