Moringa SASUF Event

Research on Moringa: Current trends & impact of climate change

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1-Trends in climate change

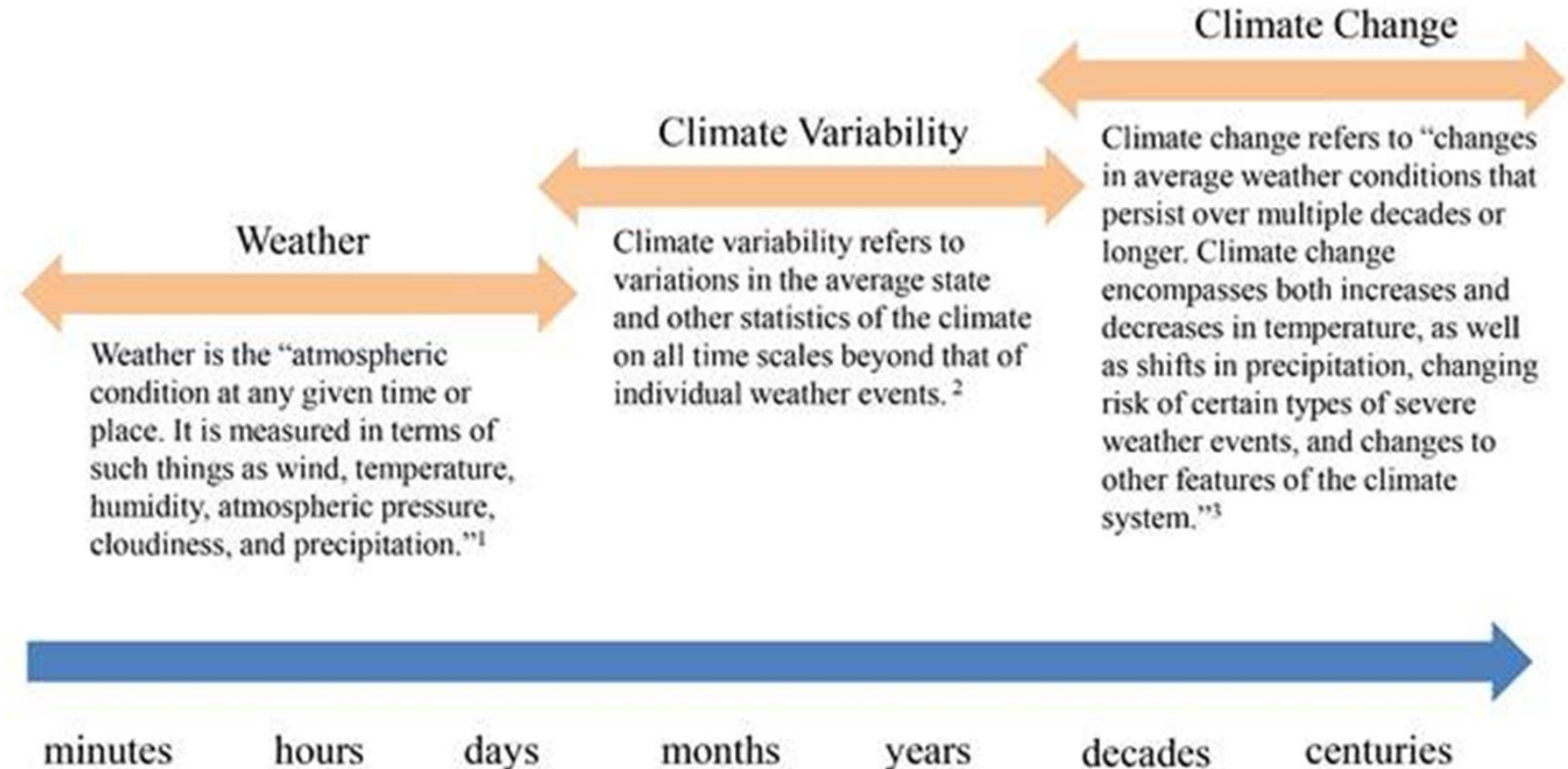-Understanding past climate trends and their impacts is fundamental for climate change (CC):
- ✓ Adaptation
- ✓ Mitigation

-Trends are expressed:
- ✓ Weather
- ✓ Climate variability
- ✓ Climate change

-Indicators:
- ✓ Temperature
- ✓ Precipitation
- ✓ Humidity
- ✓ Cloudiness
- ✓ Pressure
- ✓ Wind

Climate Change
Climate change refers to "changes in average weather conditions that persist over multiple decades or longer. Climate change encompasses both increases and decreases in temperature, as well as shifts in precipitation, changing risk of certain types of severe weather events, and changes to other features of the climate system."[3]

Climate Variability
Climate variability refers to variations in the average state and other statistics of the climate on all time scales beyond that of individual weather events.[2]

Weather
Weather is the "atmospheric condition at any given time or place. It is measured in terms of such things as wind, temperature, humidity, atmospheric pressure, cloudiness, and precipitation."[1]

minutes hours days months years decades centuries

Indicators: temperature, precipitation, humidity, cloudiness, and wind

-1800s➔human-produced CO_2 & other gases that collect in atmosphere & insulate Earth

-1950s➔ CO_2 readings would offer some of 1st data to agree global warming theory


Annual CO₂ emissions
Carbon dioxide (CO₂) emissions from fossil fuels and industry¹. Land-use change is not included.
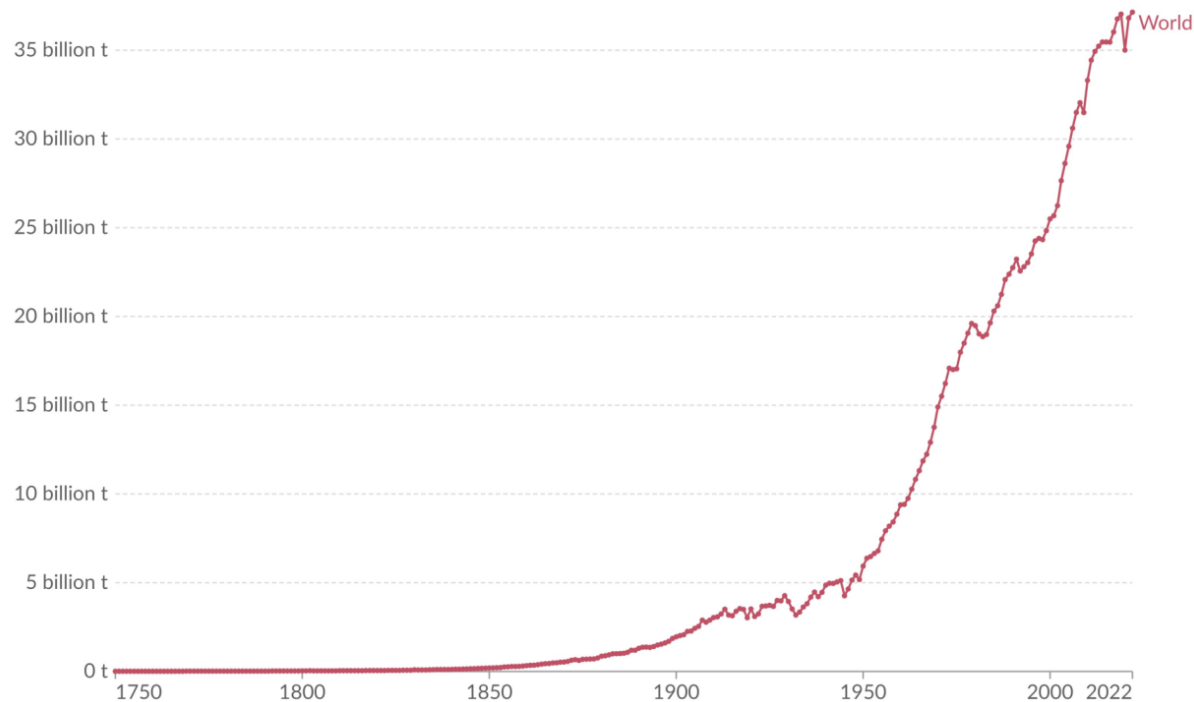
Data source: Global Carbon Budget (2023)   OurWorldInData.org/co2-and-greenhouse-gas-emissions | CC B

1. **Fossil emissions**: Fossil emissions measure the quantity of carbon dioxide (CO₂) emitted from the burning of fossil fuels, and directly from industrial processes such as cement and steel production. Fossil CO₂ includes emissions from coal, oil, gas, flaring, cement, steel, and other industrial processes. Fossil emissions do not include land use change, deforestation, soils, or vegetation.
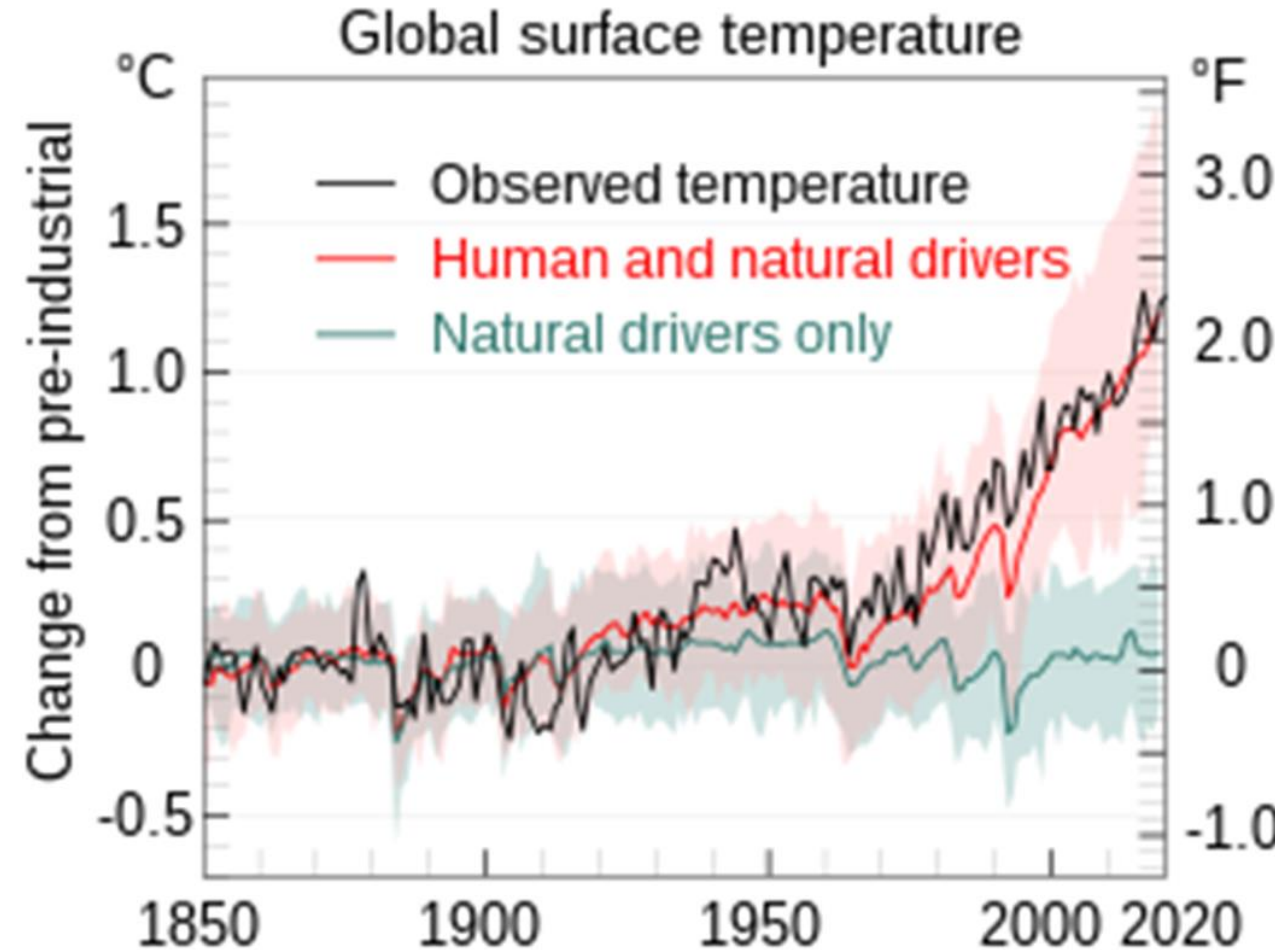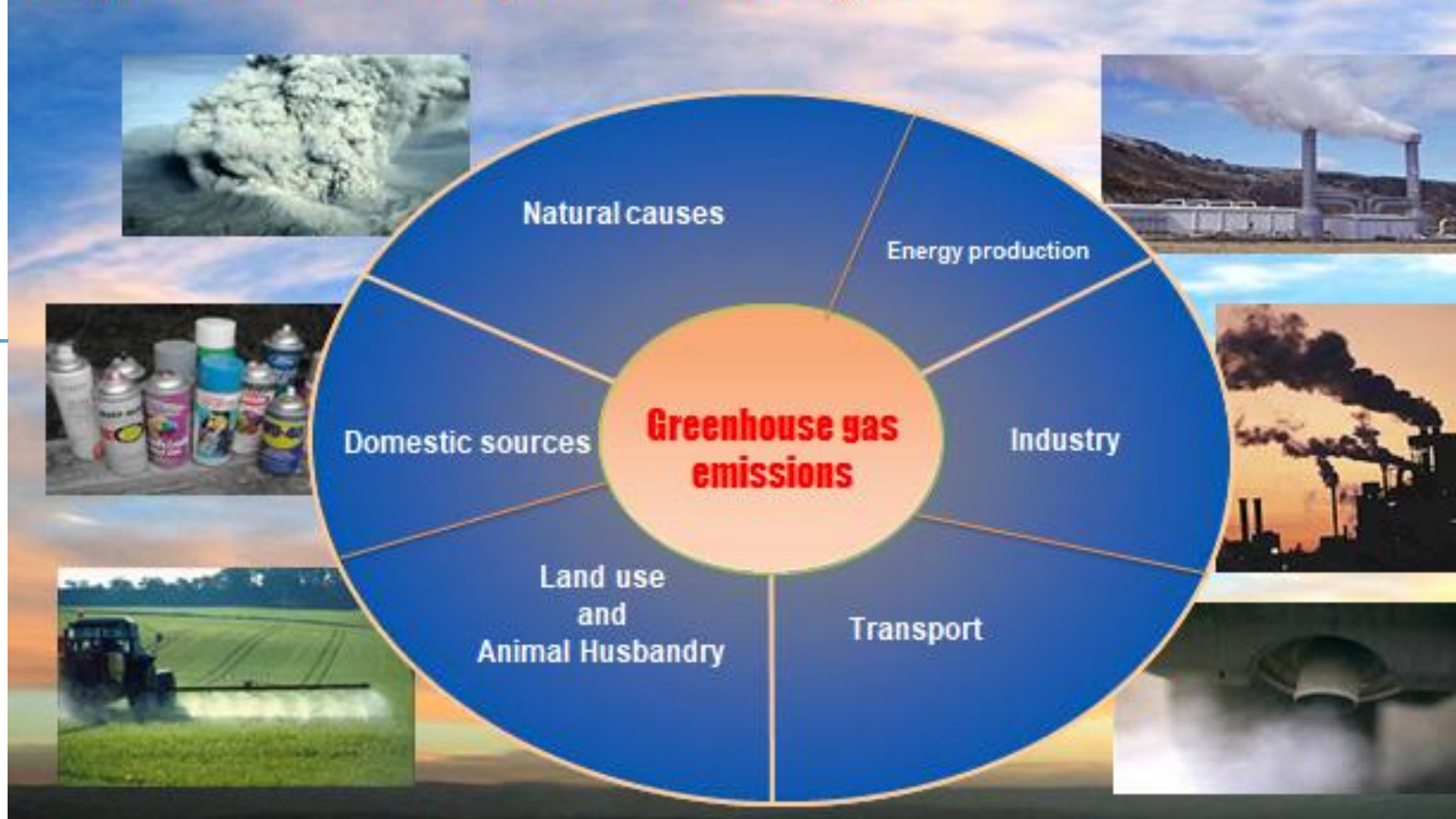
-Burning fossil fuels are major source of producing Greenhouse gas (GHG)
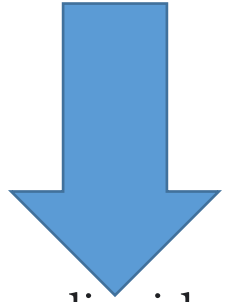
✓ Carbon dioxide (CO_2)

✓ Methane (CH_4)

✓ Nitrous oxide (N_2O)

✓ Hydrofluorocarbons (HFCs)

✓ Perfluorocarbons (PFCs)

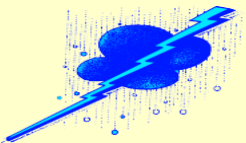✓ Sulphur hexafluoride (SF_6)

Major sources of greenhouse gases

Natural causes

Energy production

Domestic sources

Greenhouse gas emissions

Industry

Land use and Animal Husbandry

Transport

Climate change impacts

Climate Changes
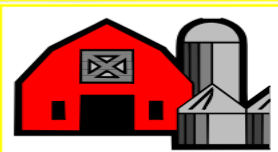
Temperature

Precipitation

Sea Level Rise

Health Impacts

Weather-related Mortality Infectious Diseases Air Quality-Respiratory Illnesses

Agriculture Impacts

Crop yields Irrigation demands

Forest Impacts

Change in forest composition Shift geographic range of forests Forest Health and Productivity

Water Resource Impacts

-Changes in water supply
-Water quality
-Increased competition for water

Impacts on Coastal Areas

Erosion of beaches Inundate coastal lands
Costs to defend coastal communities

Species and Natural Areas

Shift in ecological zones
Loss of habitat and species

-Relationship b/n CC/variability & crop failures is not a new phenomenon especially in rural areas

-The effects of CC are causing the occurrence of droughts more of a norm than an exception

https://www.tegemeo.org/n/news-notices/research-topics-blog/climate-change/climate-change

2-Research on Moringa

-CC and variability has profound effects and threats to agricultural systems and productivity

-There has been time in history humans used several vegetables and cereals→ very few cereals

-After roughly 10,000 years of progressive agricultural civilization(Nierenberg, 2011):

✓ 70%-World's food/calories supply comes from just three grains (maize, wheat and rice)

✓ 80%-Our plant-based food intake comes from just 12 plant species:

*8-cereals (barley, maize, millet, rice, rye, sorghum, sugar cane and wheat)

*4-tubers (cassava, potato, sweet potato and yam)

-Some of reasons why we concentrate on very small plant species has blamed (Nierenberg, 2011)

✓Globalization

✓Intensification

✓Industrialization of agriculture

✓Climate change

-Trees survive when crops fail ➡choose of CC impact mitigation

-There are a lot of plant trees that are both nutritional and herbal in nature
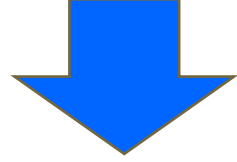
Moringa

-Thakur et al. (2017) describe Moringa as a tree that have key characteristic:

✓Fast growing and short rotation period

✓Deep root system

✓Diversified uses

✓Food security potential

✓Socio-economic benefits

✓CC mitigation and adaptation -

-Moringa is genus consists of 13 species ➔Asia & Africa various uses (Rani et al., 2018)

Moringa species	Country	Trivial name
➢ *M. arborea* Verdcourt	Kenya, Somalia	-
➢ *M. borziana* Mattei	Somalia, Kenya	-
➢ *M. concanensis* Nimmo	India	-
➢ *M drouhardii* Jumelle	Madagascar (Southern)	
➢ *M. hildebrandtii* Engler	Madagascar (Southern)	Hildebrandt's moringa
➢ *M. longituba* Engler	Ethiopia, Somalia, Kenya	Moringa tubiflora
➢ *M. oleifera* Lam	India	Horseradish, Ben-oil, Drumstick, Kelor
➢ *M. ovalifolia* Dinter & Berger	Namibia, Angola	Phantom, Ghost, Arican Moringa
➢ *M. peregrina* (Forssk.) Fiori	Red Sea, Arabia, NE Africa	Wispy-needeled Yasar,Wild drumstick, Yusor
➢ *M. pygmaea* Verdcourt	Somalia	-
➢ *M. rivae* Chiovenda	Kenya, Ethiopia	Swanjehro
➢ *M. ruspoliana* Engler	Ethiopia, Kenya, Somalia	-
➢ *M.stenopetala* (Baker f.) Cufodontis	Ethiopia, Kenya, Somalia	Cabbage tree, Haleko, Shelagda, Shiferaw

Research status of the 13 Moringa species in website

✓ *M.oleifera-~90%*

✓ *M. ruspolina*
✓ *M. stenopetala*
✓ *M. peregrina*
✓ *M. arborea*

        <3% (2.3-1.7%)

✓ *M. concanensis*
✓ *M. ovalifolia*
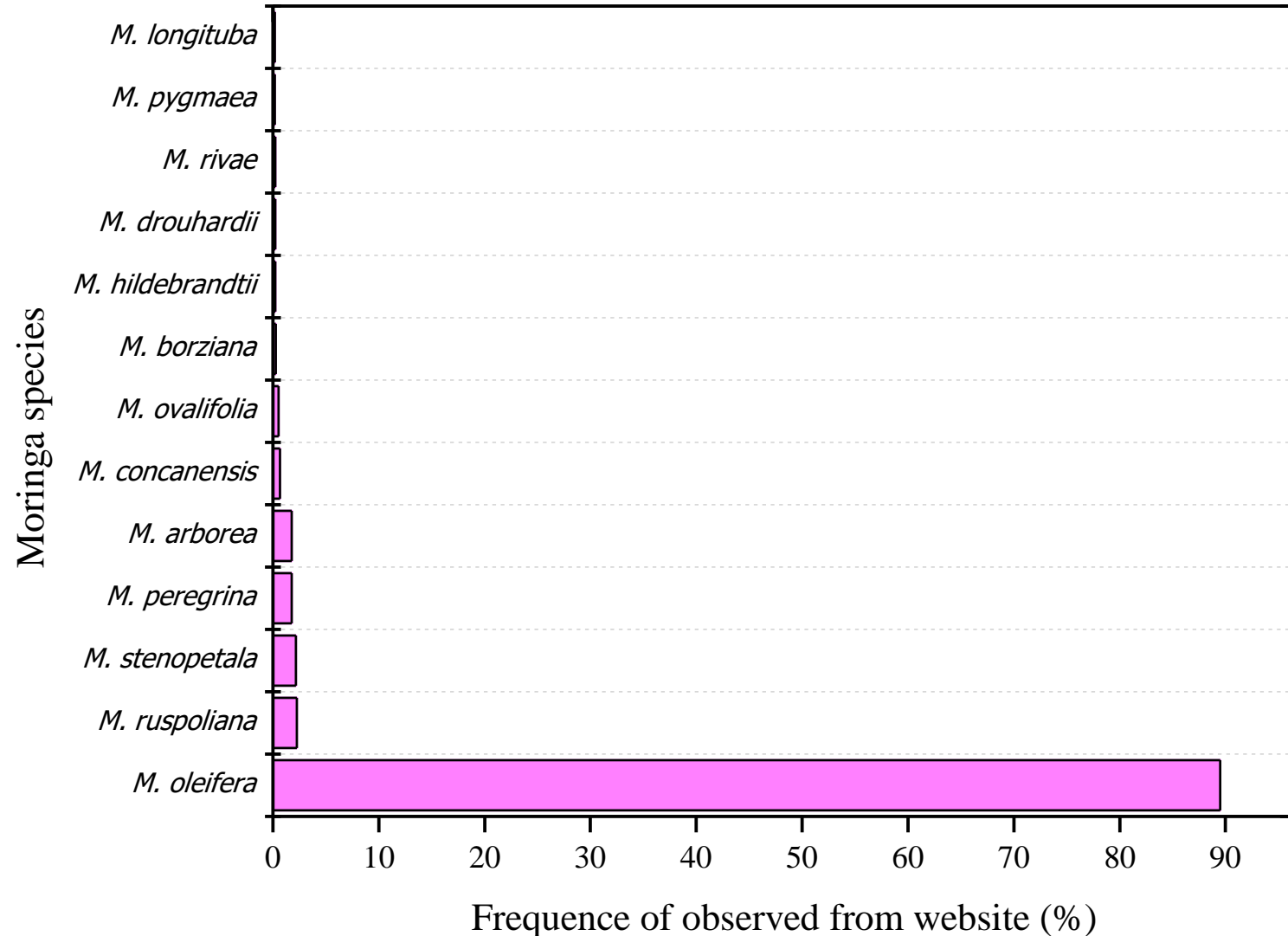✓ *M. borziana*
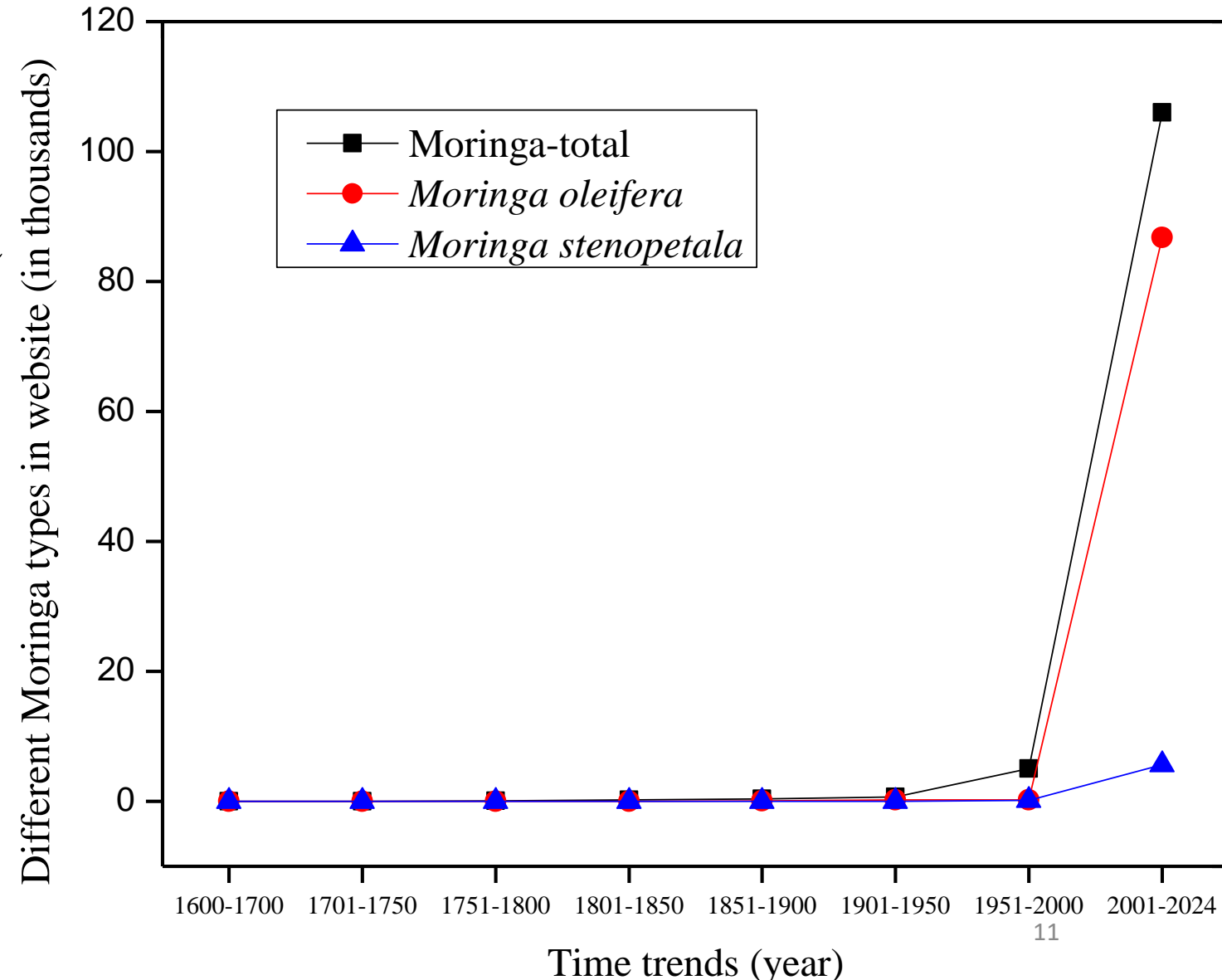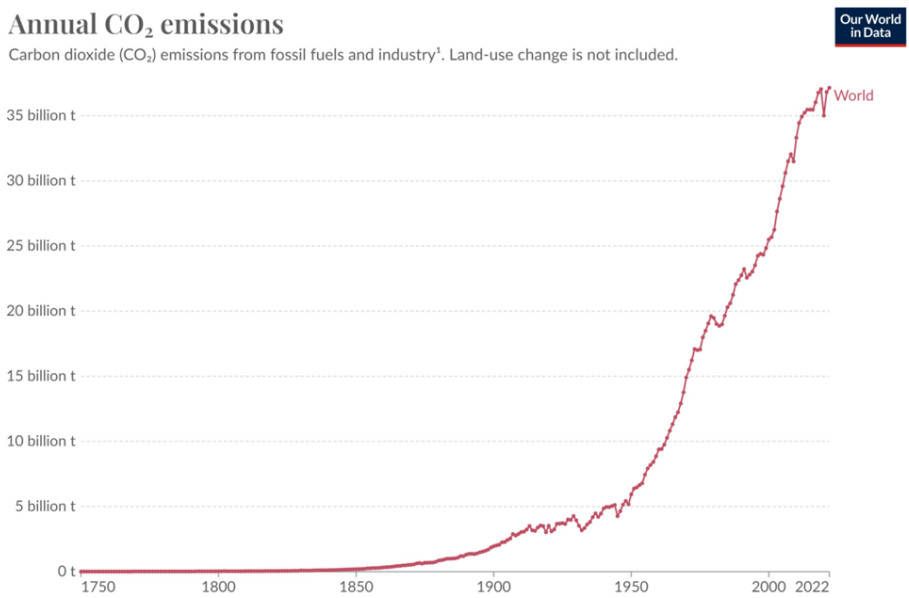✓ *M. hildebrandtii*
✓ *M. drouhardii*
✓ *M. rivae*
✓ *M. pygmaea*
✓ *M. longituba*

        <1% (0.6-0.2%)

Trends of research in Moringa (1600-2024)

✓ Before 1700-No a single finding

✓ 1900-Moringa research in progress

✓ 1951-Still more research on Moringa

　*Almost studies are about *M.oleifera*

　*Little for *M. stenopetala*

Annual CO₂ emissions
Carbon dioxide (CO₂) emissions from fossil fuels and industry¹. Land-use change is not included.

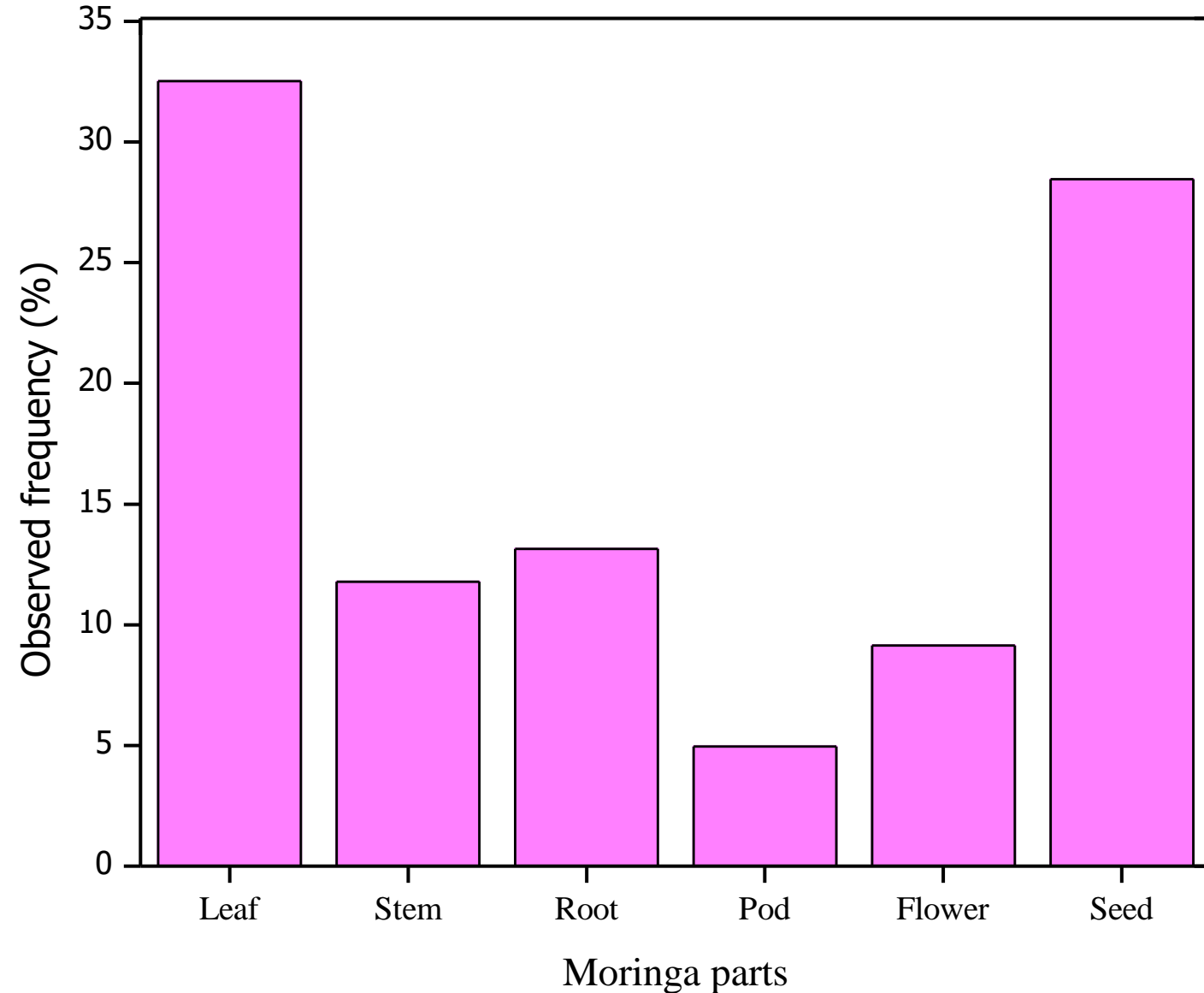# Research trend in Moringa in the last 23 years (2000-2023)

✓ Before 2005-Almost low for Moringa

✓ After 2010-More about *M. oleifera*
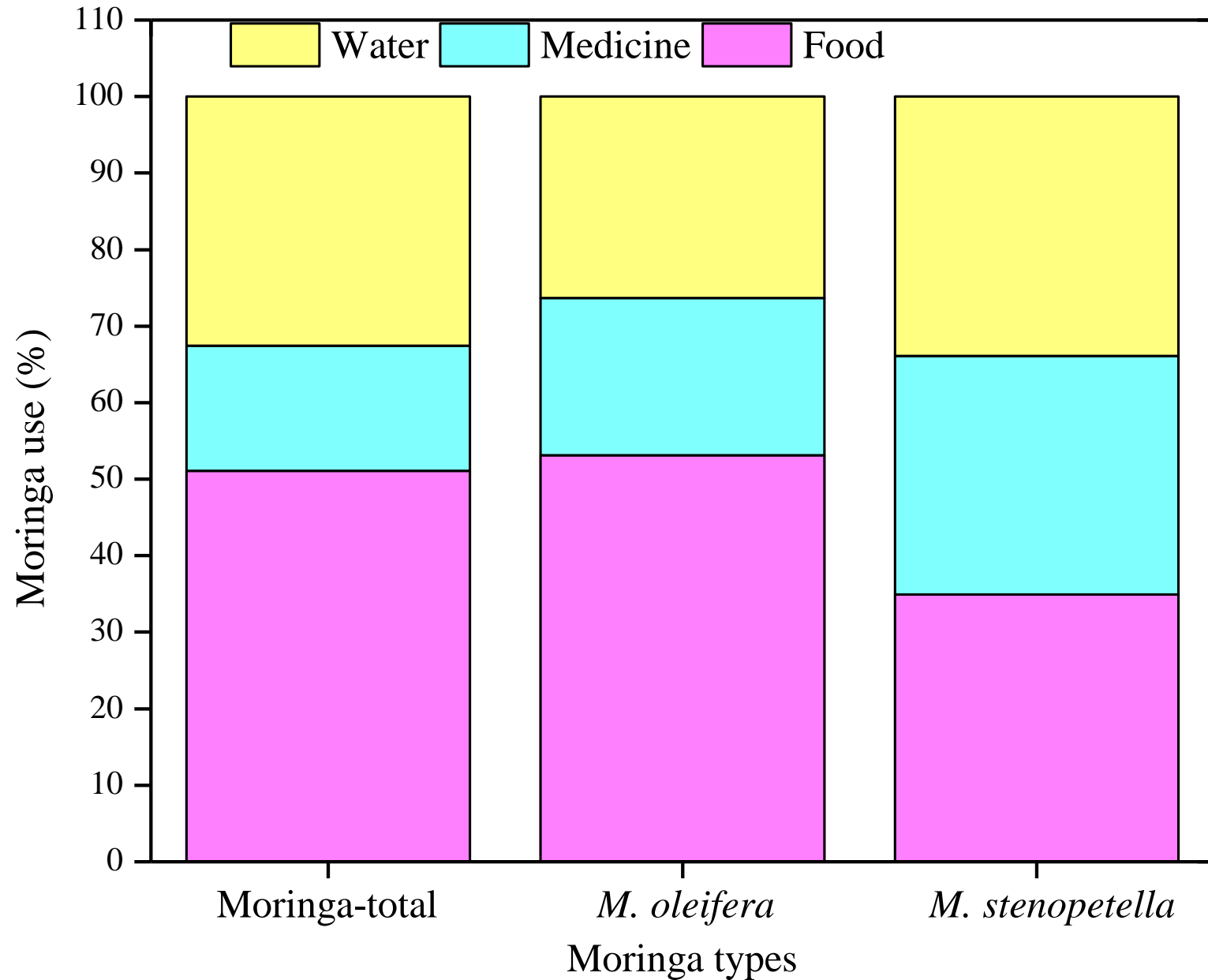
✓ 23 years- Not significant *M. stenopetala*
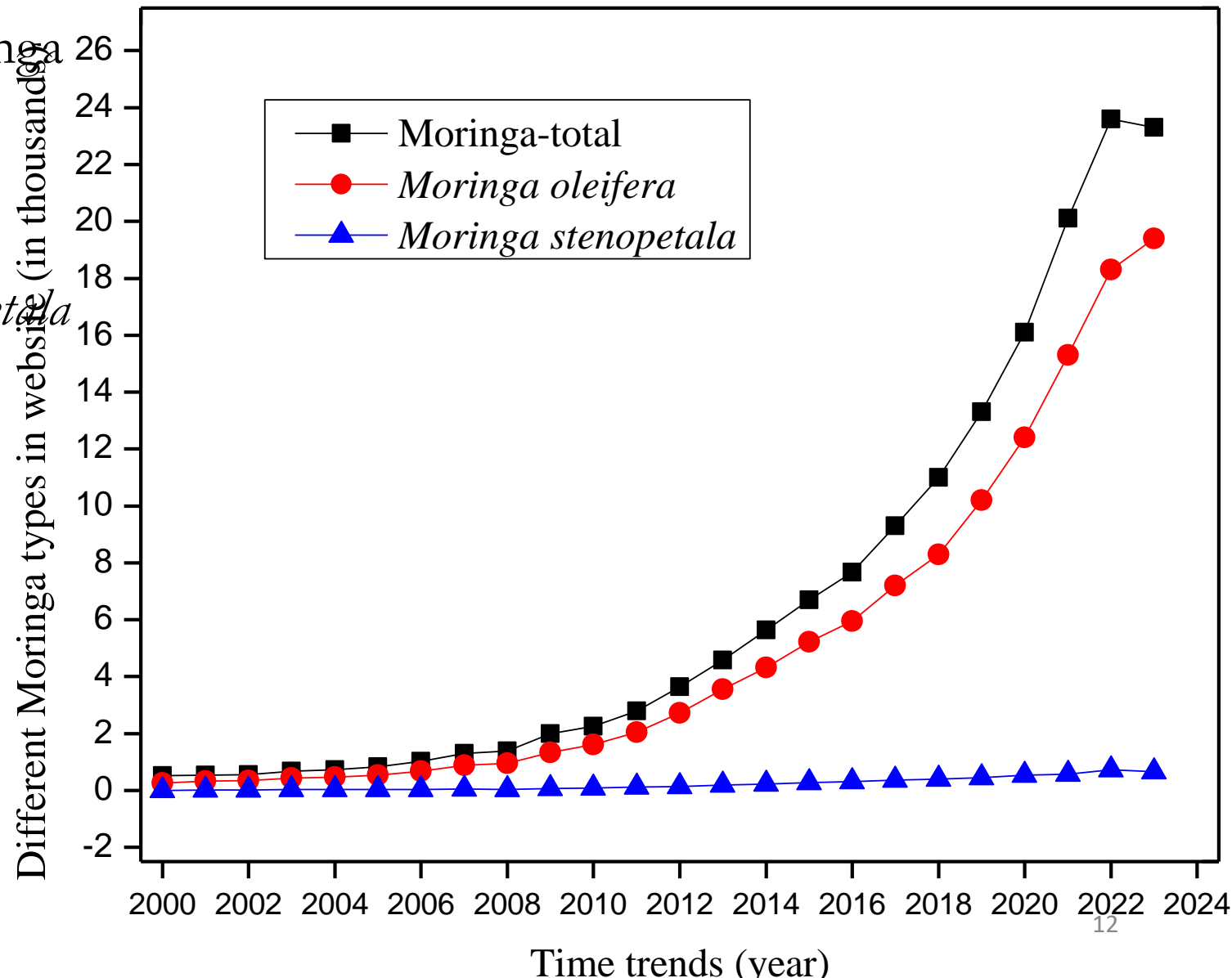
Moring different parts

- ✓ Leaf-Most researched
- ✓ Seed-More researched
- ✓ Root
- ✓ Stem
- ✓ Flower
- ✓ Pod

Moringa use

✓Food

✓Medicine

✓Water treatment

-According to Villafuerte & Villafurte-Abonal (2009) rate of **CO_2** absorption by:

✓Moringa > 20x General vegetation

✓Moringa > 50x Japanese cedar tree →Moringa as tool to prevention of global warming

> 50x

Moringa (*Moringa oleifera*)

Japanese Cedar (*Cryptomeria japonica*)

One million hectares Moringa plantation worldwide →5 GT CO_2e sequestered (Villafuerte & Villafurte-Abonal, 2009)

-In addition to CO_2, there are other GHGs listed in the Kyoto Protocol (Pachauri & Reisinger, 2007)

- ✓ Methane (CH_4)

- ✓ Nitrous oxide (N_2O)

- ✓ Hydrofluorocarbons (HFCs)

- ✓ Perfluorocarbons (PFCs)

- ✓ Sulphur hexafluoride (SF_6)

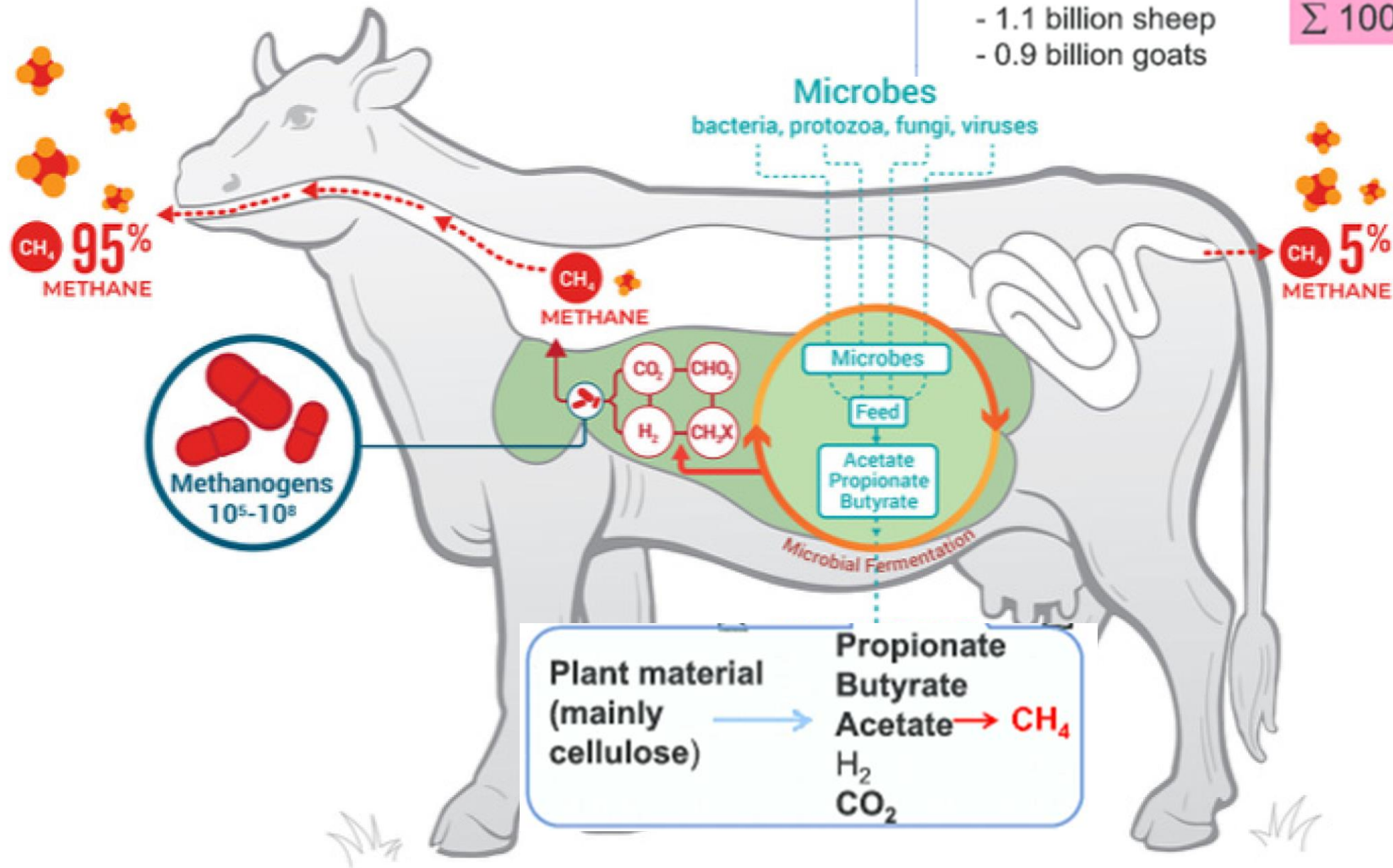-According to EPA (2020), CH_4 gas is a more potent global warming potential (GWP) gas

-Among agricultural activities, ruminant animals produce ➔18-33% CH_4 source of emission

-In ruminants, CH_4 produced ➔under anaerobic microbial fermentation during feed digestion

Source: Palangi and Lackner (2022)-Management of Enteric Methane Emissions in Ruminants Using Feed Additives: A Review

Acknowledgement

➢SASUF organizing committee

➢Moringa plate form project members

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