MESTI

COUNCIL FOR SCIENTIFIC & INDUSTRIAL RESEARCH (CSIR – Ghana)

Climate Change Mitigation and Adaptation in Ghana: The Role of the CSIR

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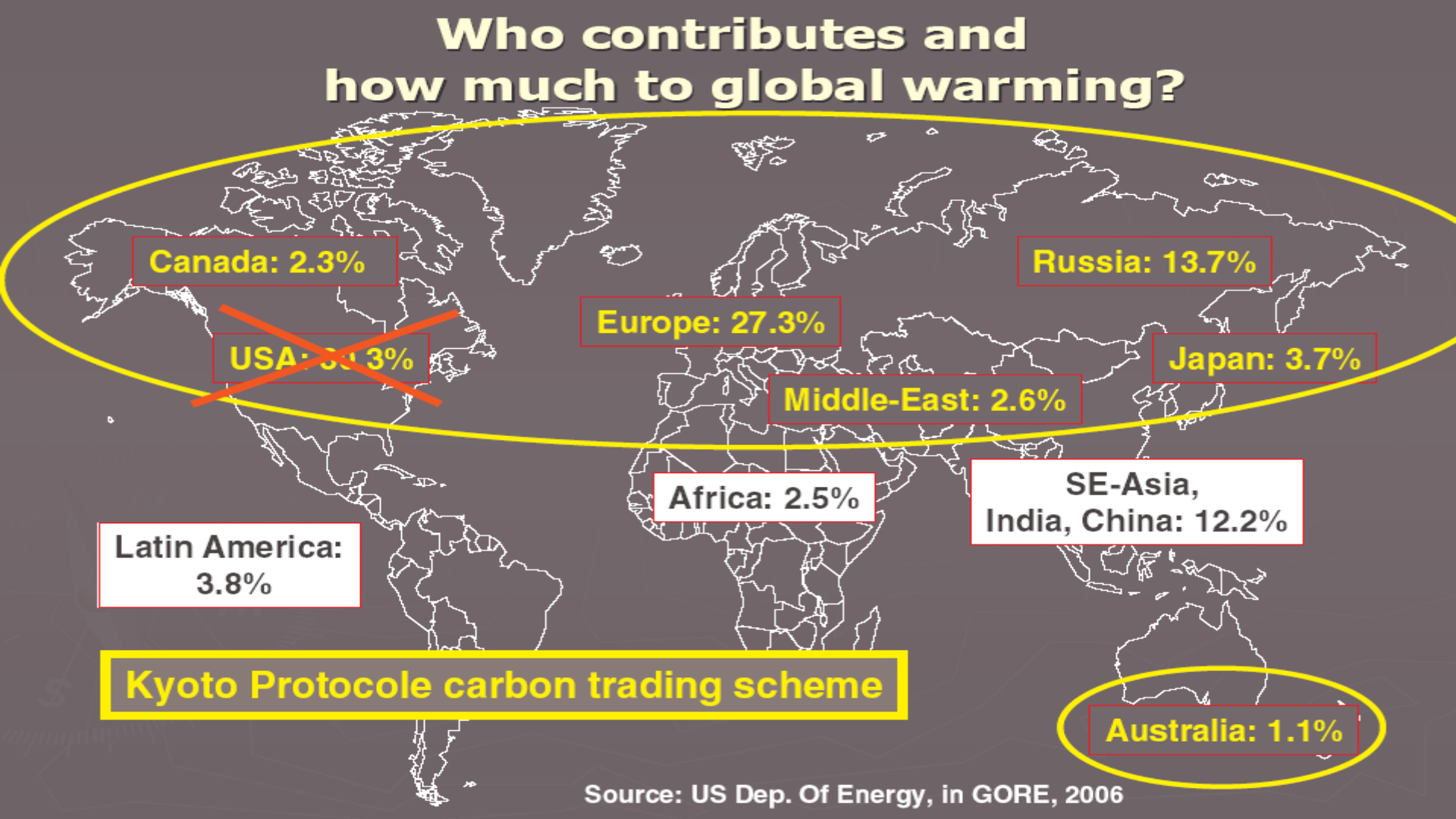
INTRODUCTION

- Climate Change can be attributed directly or indirectly to human activities (e.g. through burning fossil fuels, deforestation, reforestation, urbanization, desertification) that alters the composition of the global atmosphere.
- Ghana is highly vulnerable to climate change, variability and uncertainty as a result of its location in the world's hydro-climate zone.
- Ghana's climatic conditions have changed in the past four decades.
  - *Ghana recorded temperature increase of 1°C.*
  - *Rainfall and runoff declined by about 20% and 30% respectively*
- Events have devastating consequences for Ghana's socio-economic development, food security, water resources, health and livelihoods.

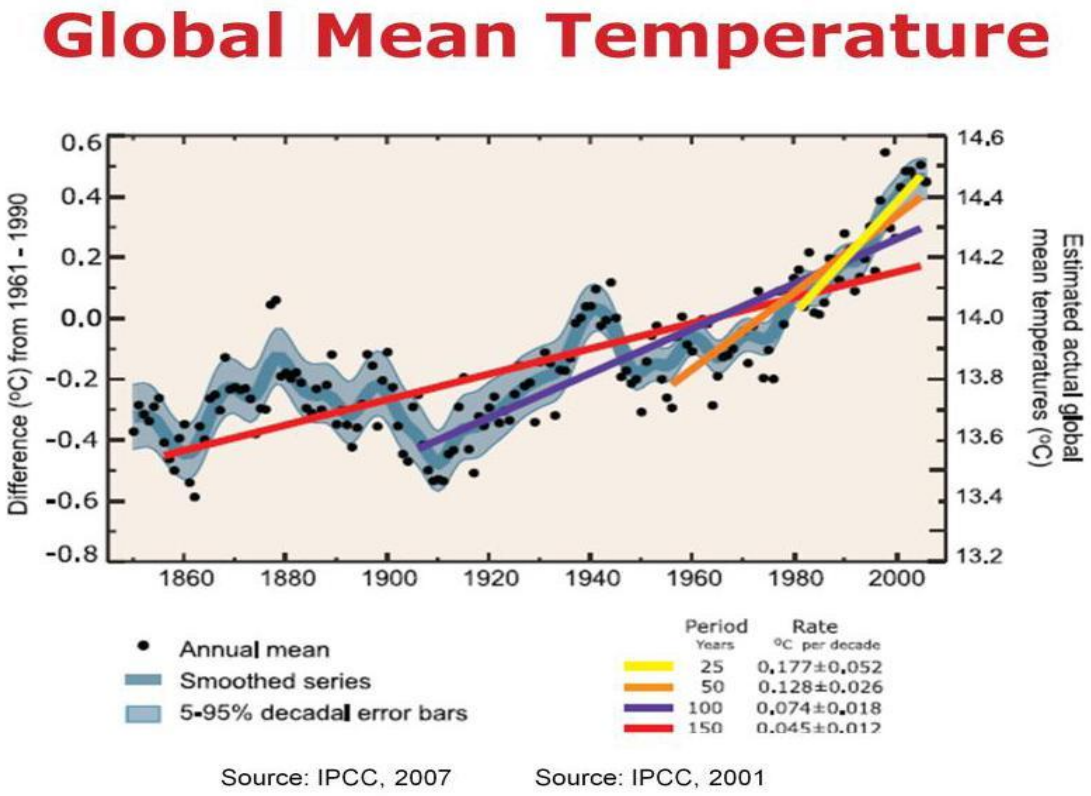
Who contributes and how much to global warming?



Kyoto Protocole carbon trading scheme

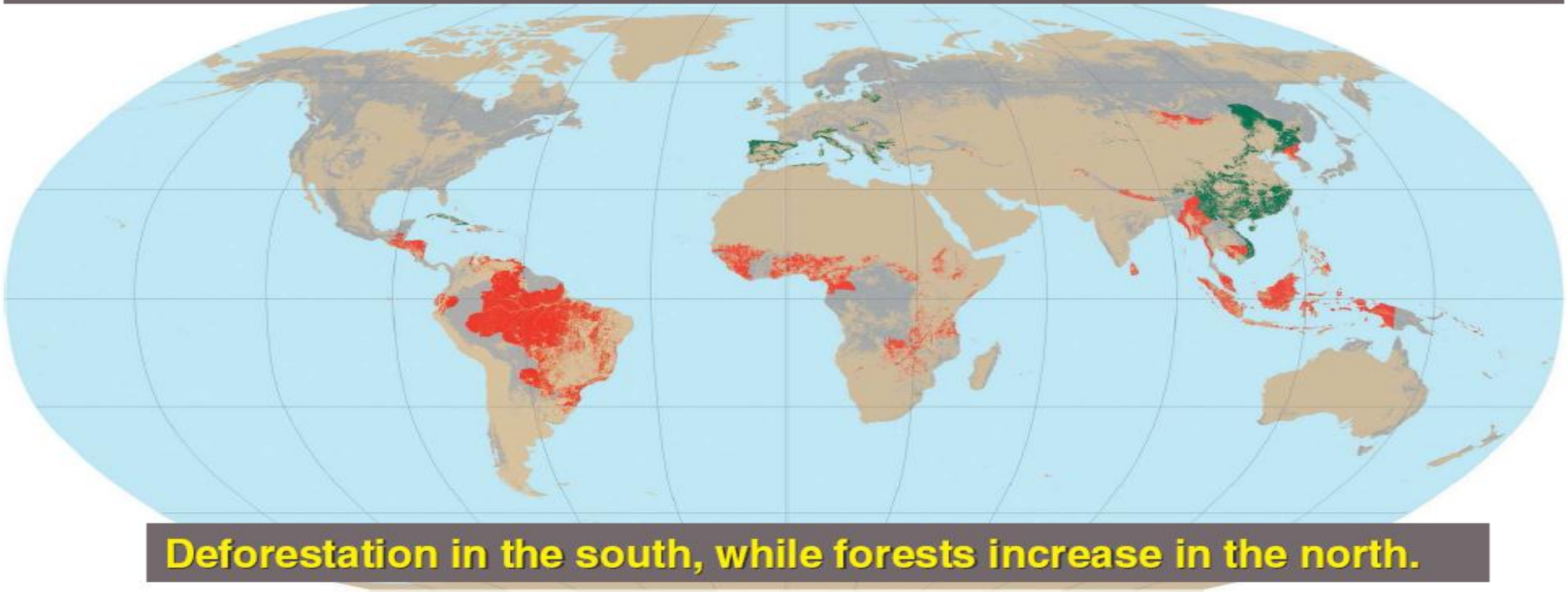
Source: US Dep. Of Energy, in GORE, 2006

Evidence of global warming



The evolution of global temperature for 150 years, from 1850 to 2000. The trend lines show how global temperature has been increasing steadily since 1850.

Dynamic in forested areas 2000-2005: Deforestation and forestation

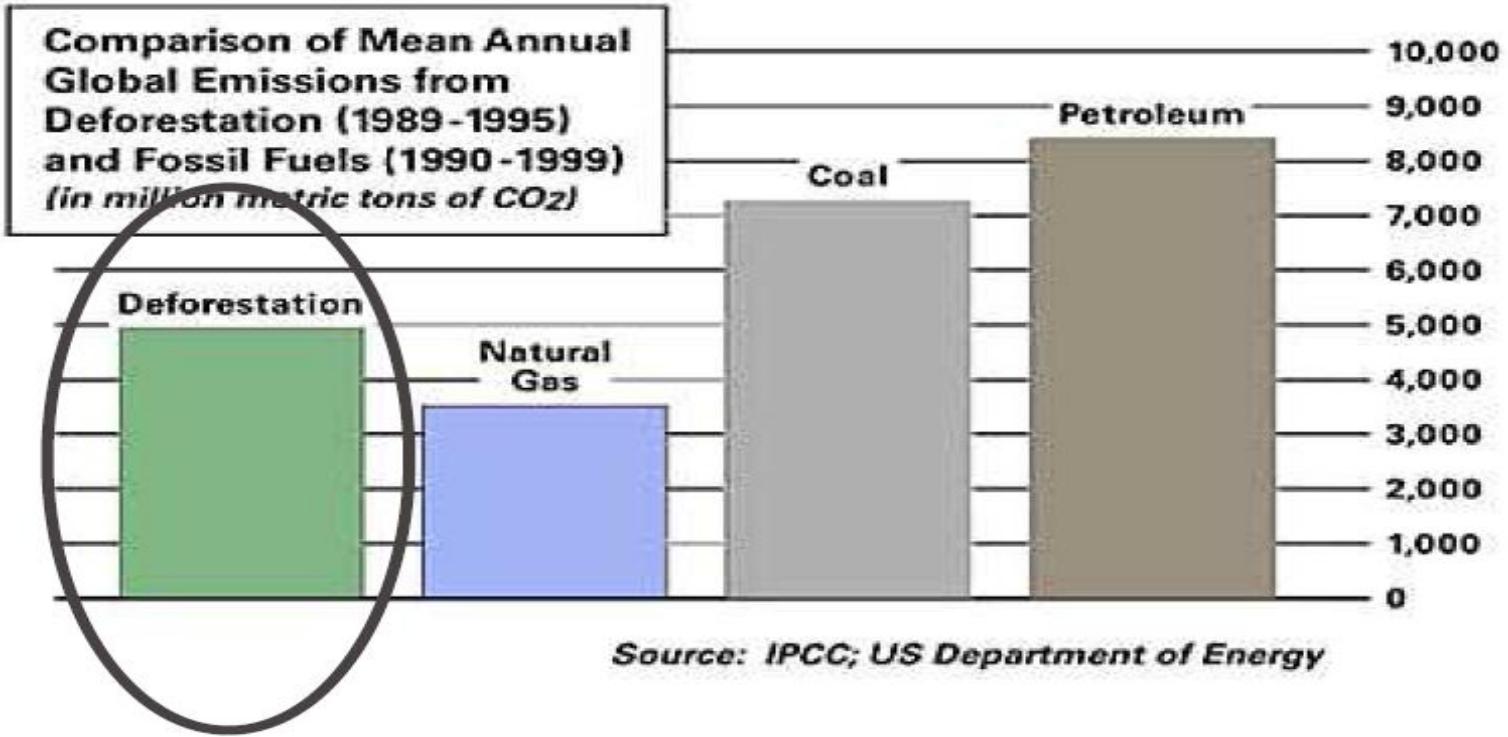


Deforestation in the south, while forests increase in the north.

- > 0.5 % Decrease per year
- > 0.5 % Increase per year
- Change rate below 0.5 % per year

Source: FAO, 2006

Main sources of GHG emissions, global

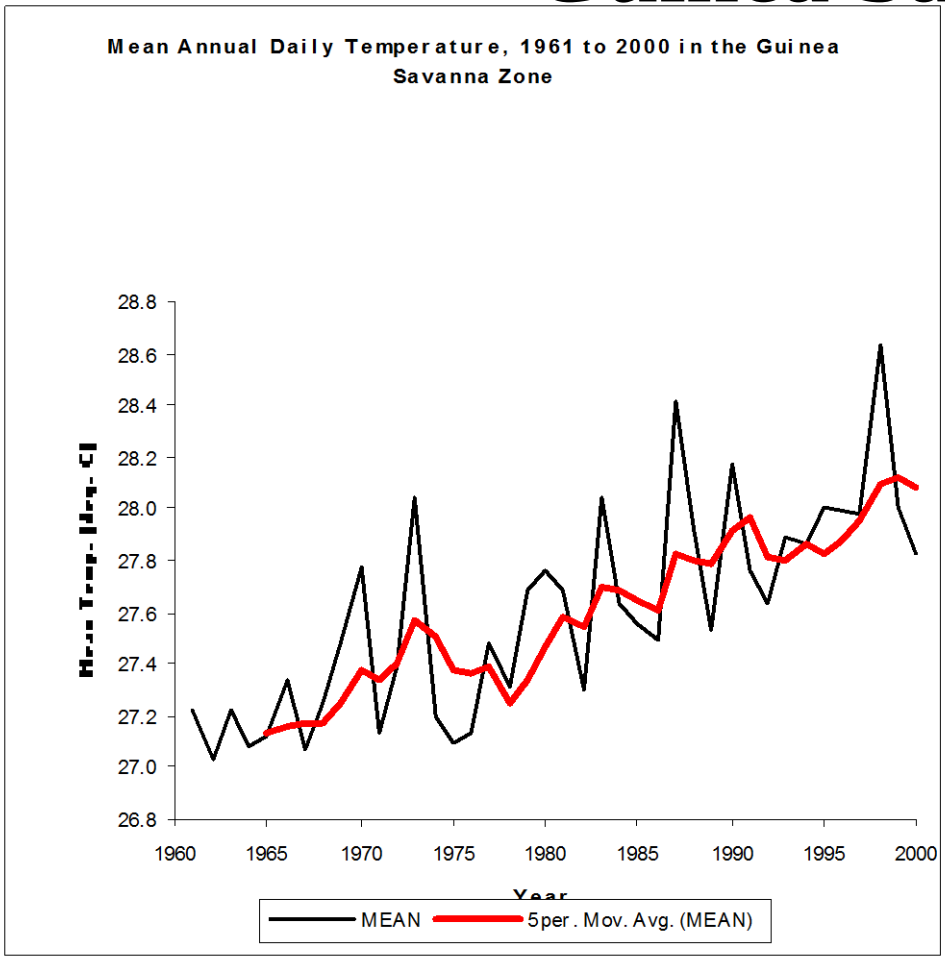


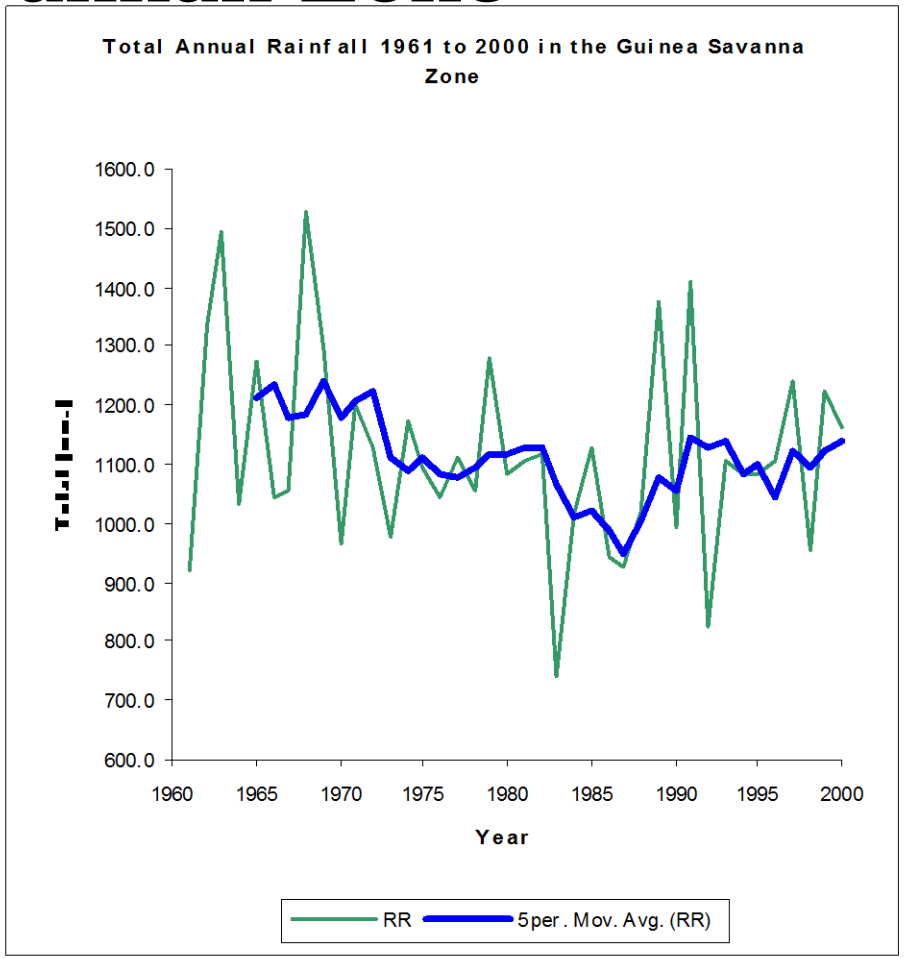
CURRENT AND FUTURE PROJECTIONS OF CLIMATE CHANGE IMPACTS

CLIMATE CHANGE IMPACTS IN GHANA

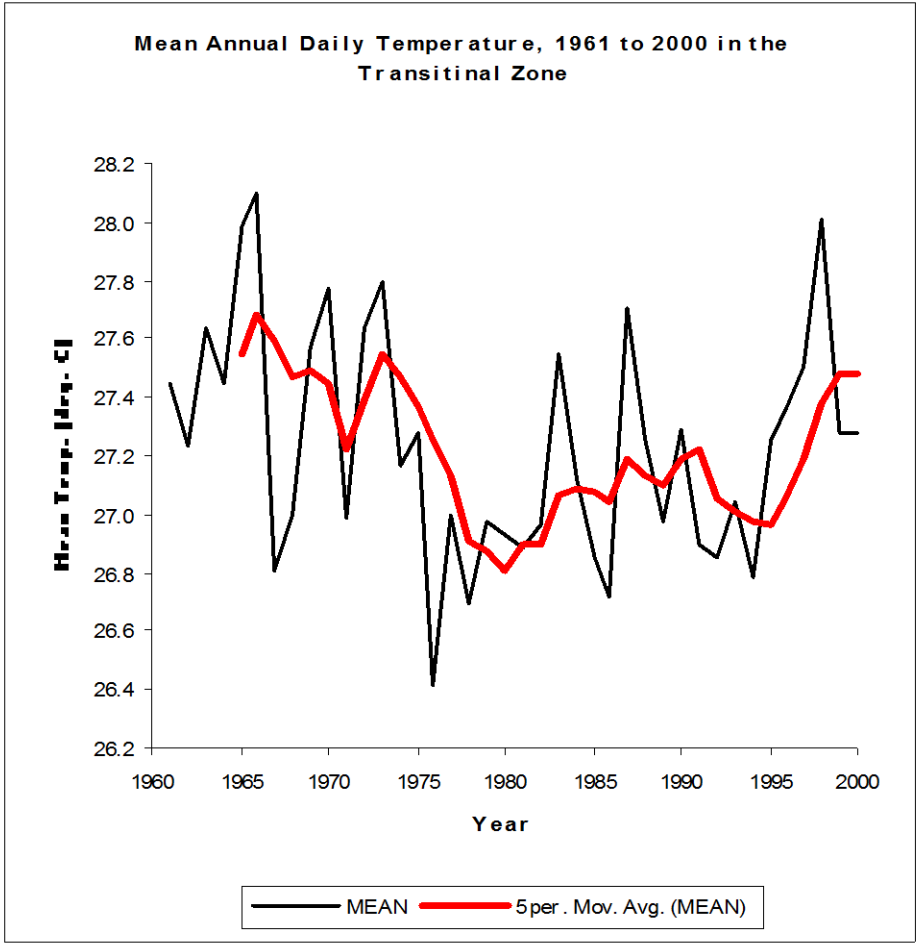
- Average annual temperatures have been rising steadily in 5 of the 6 agro-ecological zones of Ghana.
- The Rainforest Zone (Wet Evergreen Forest Type) a temperature rise of 1°C over a period of 40 years has led to a decrease in total rainfall amount by 500mm over the period.
- In the Forest Zone (Moist Semi-Deciduous Forest Type and Transition Zone) the study also noted a decrease in total rainfall of 300mm over a 40 year period.
- The impacts of the rising temperatures and variable rainfall pattern include:
  - transformation of perennial rivers into seasonal rivers,
  - intensive rainfall,
  - frequent flood and drought events.

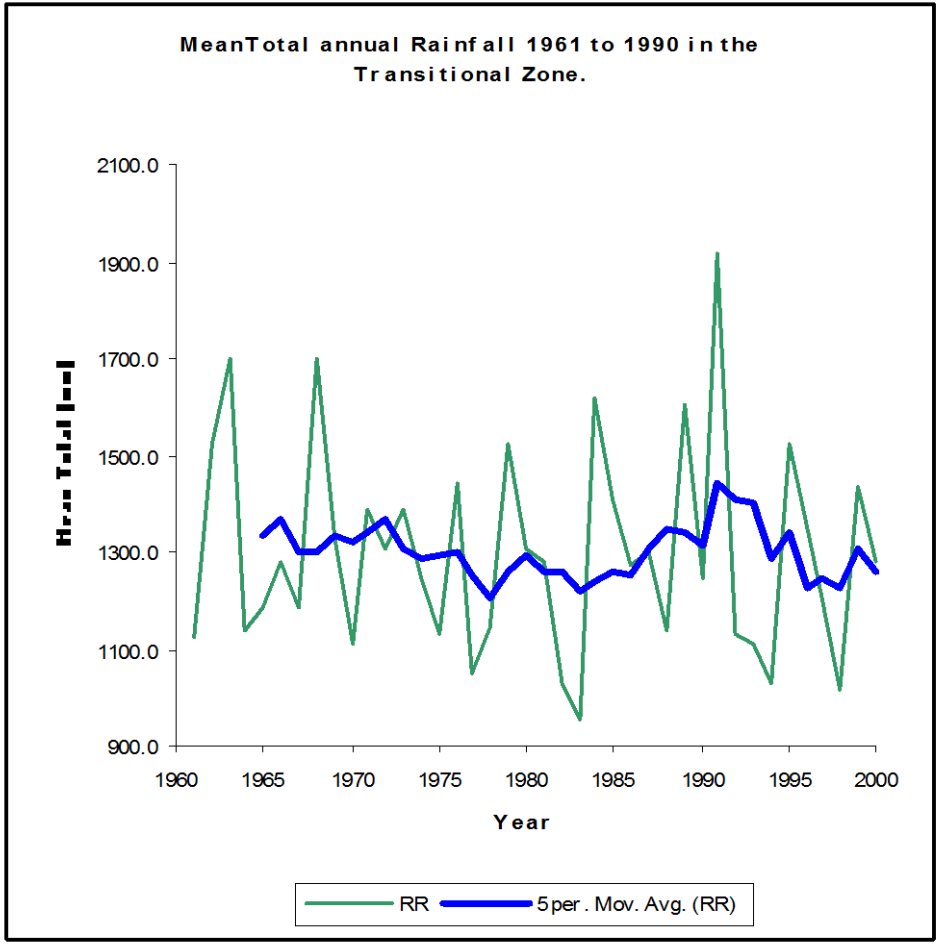
Guinea Savannah Zone



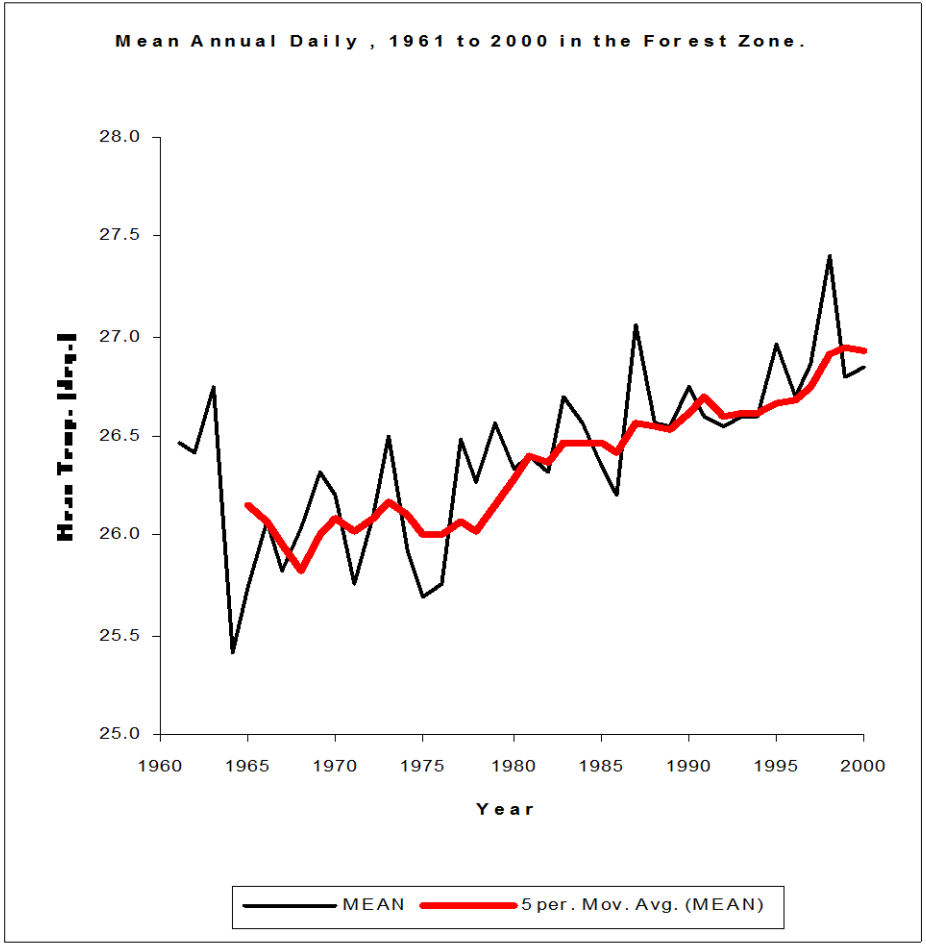


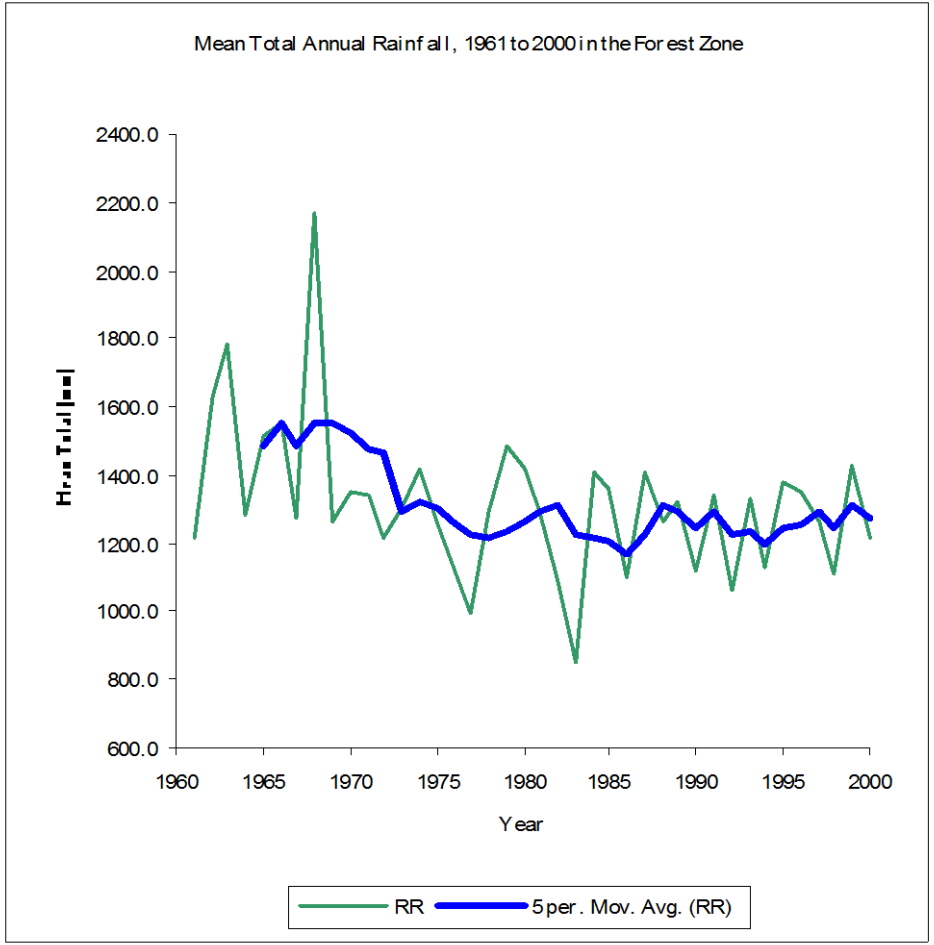
Transitional Zone



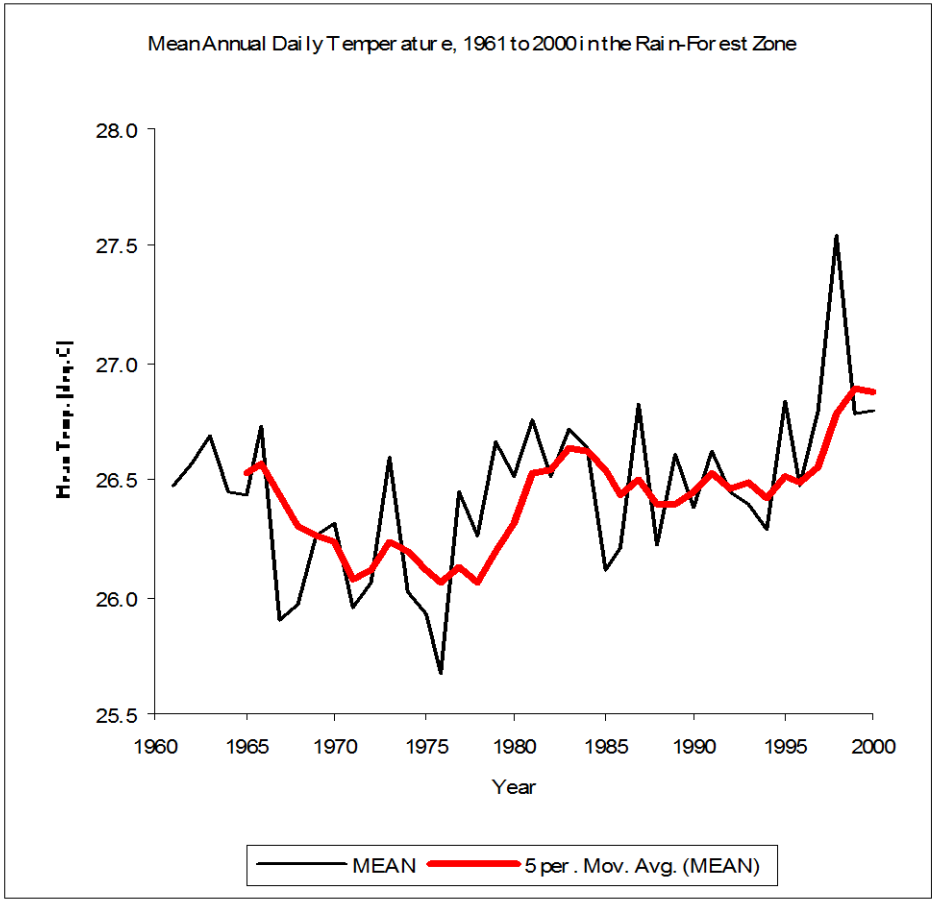


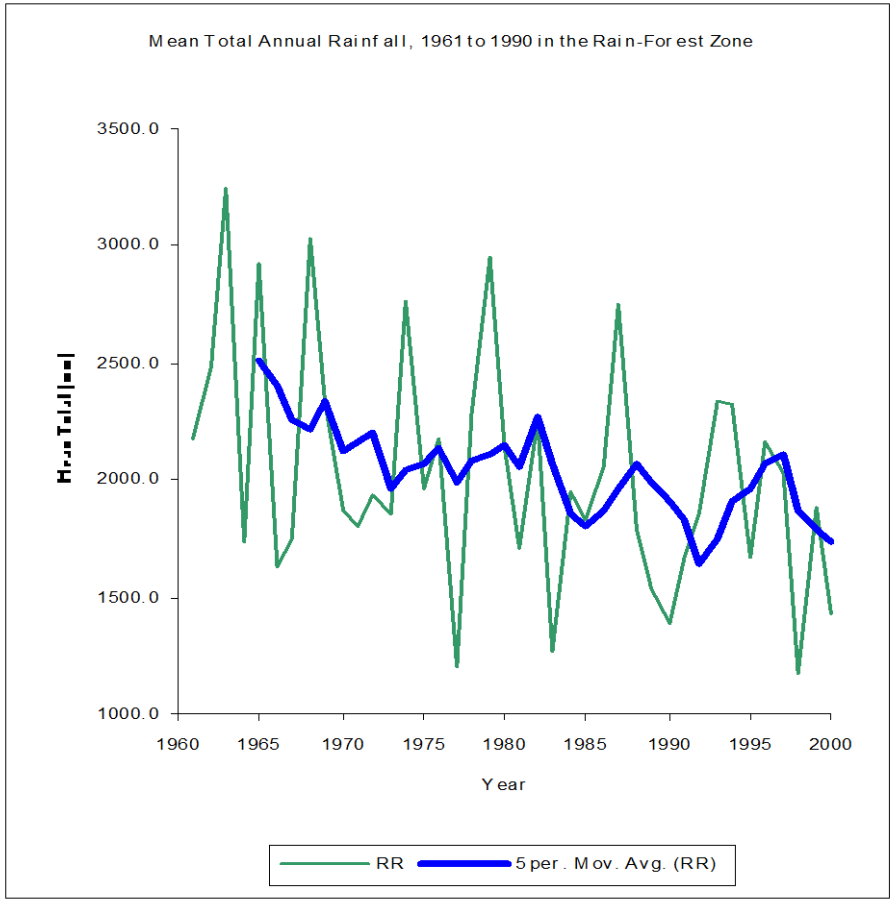
Forest Zone

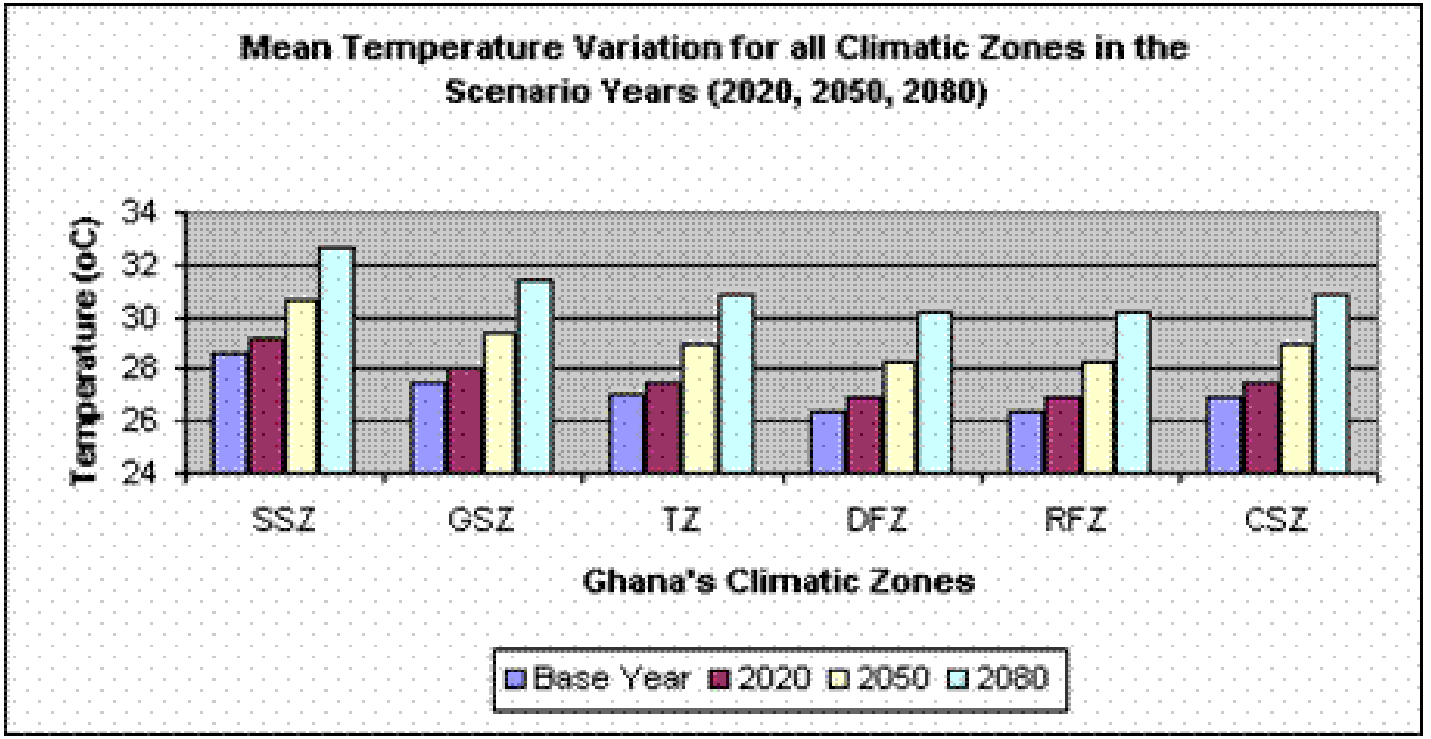

Mean Annual Daily , 1961 to 2000 in the Forest Zone.
28.0
27.5
27.0
26.5
26.0
25.5
25.0
1960
1965
1970
1975
1980
1985
1990
1995
2000
Year
MEAN
5 per. Mov. Avg. (MEAN)

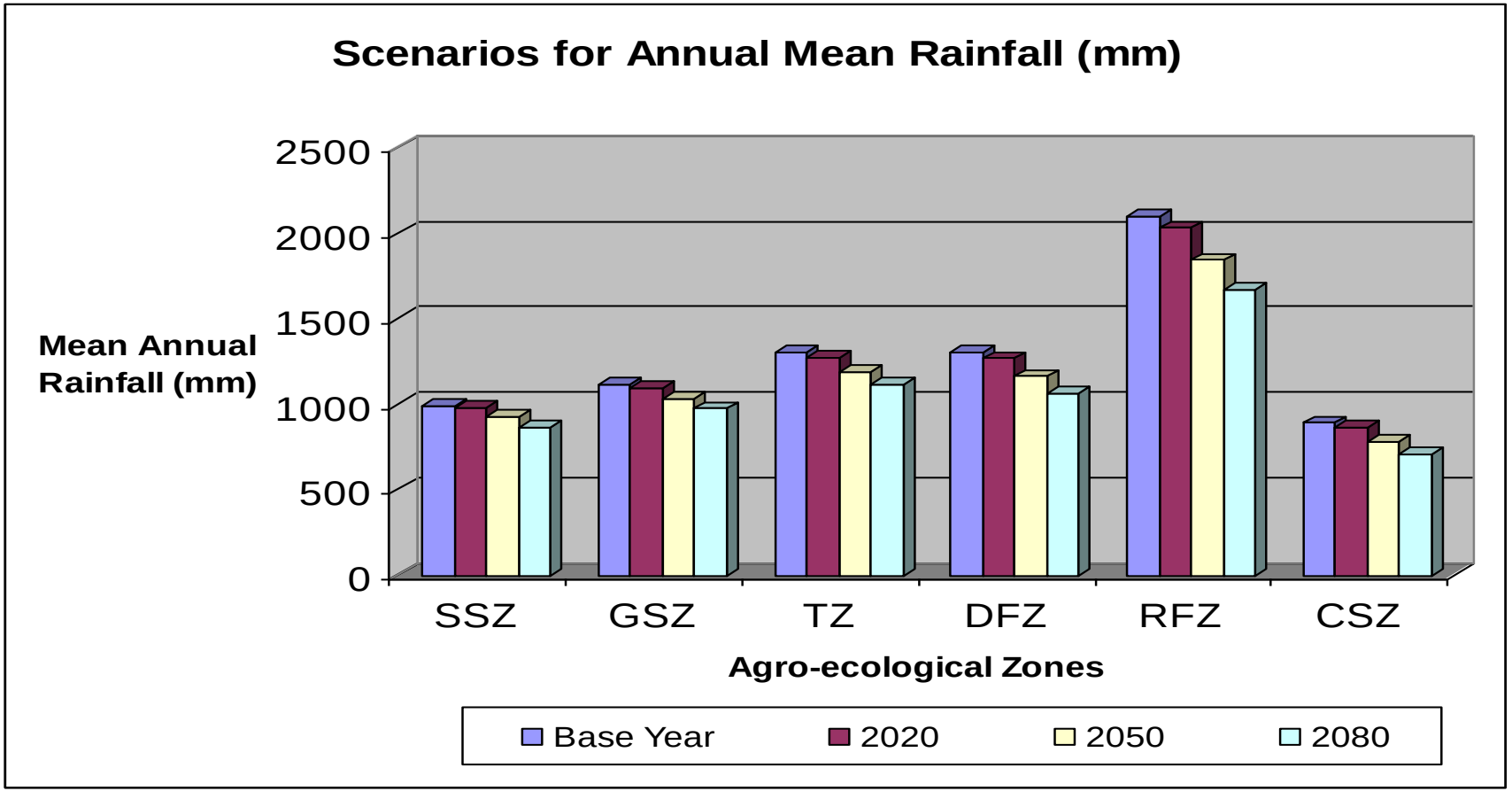

Mean Total Annual Rainfall, 1961 to 2000 in the Forest Zone
2400.0
2200.0
2000.0
1800.0
1600.0
1400.0
1200.0
1000.0
800.0
600.0
1960
1965
1970
1975
1980
1985
1990
1995
2000
Year
RR
5 per. Mov. Avg. (RR)

Rain-Forest Zone






Mean Temperature Variation for all Climatic Zones in the Scenario Years (2020, 2050, 2080)
Temperature (oC)
34
32
30
28
26
24
SSZ
GSZ
TZ
DFZ
RFZ
CSZ
Ghana's Climatic Zones
Base Year
2020
2050
2080


Scenarios for Annual Mean Rainfall (mm)
Mean Annual Rainfall (mm)
2500
2000
1500
1000
500
0
SSZ
GSZ
TZ
DFZ
RFZ
CSZ
Agro-ecological Zones
Base Year
2020
2050
2080

Floods and Variability in Rainfall

- The effects of flooding include :
  - Disruption of economic activities
  - Property loss
  - Ssanitation implication and health risk
  - habitat loss and loss of road networks
- In 2007 floods affected about 332,600 people and caused the death of 56 persons in the Upper East, Upper West and Northern regions and parts of Western region.
- In 2010, over 377,652 people were internally displaced due to the floods,
- In 2010 for the first time in twenty years, the level of the Akosombo Dam Reservoir rose to 274.8ft, close to the maximum of 278 ft in 2010.
- Consequently, areas close to the Volta River were flooded.

FLOODING

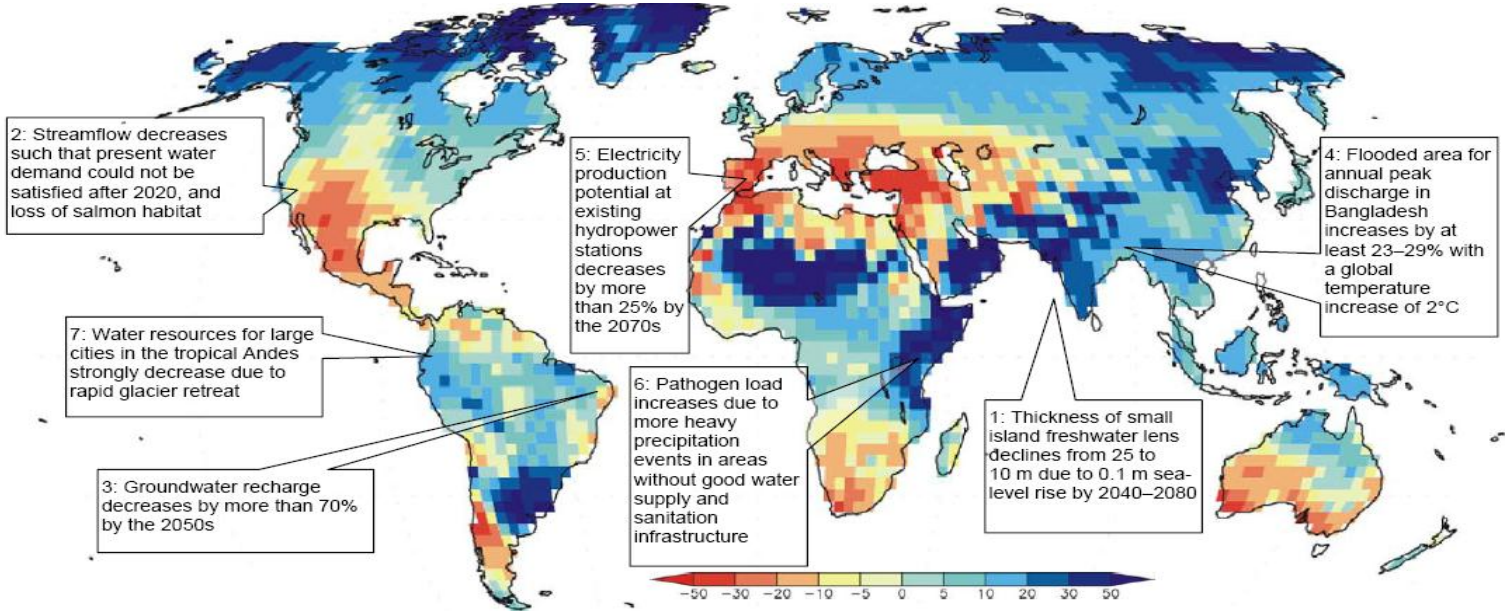
Impact on Agriculture

- Reduction in crop yields and agriculture productivity.
- Increased incidence of pest attacks.
- Limit the availability of water.
- Exacerbation of drought periods.
- Reduction in soil fertility.
- Low livestock productivity and high production cost.
- Reduced labor for agriculture due to health related risks.

Effects on Food Security

- Impacts of climate change are likely to be more severe in the food production sector of the economy.
- The price of rice is projected to increase by 60 % without climate change but with climate change it could go up by as much as 121%.
- Prices of maize are projected to increase by up to 153 % in 2050 with climate change, instead of just more that 60 % without climate change.
- About 70% of the population who depend directly or indirectly on agriculture are particularly vulnerable.
- Key economic assets such as cocoa, seed cotton, maize, coconut and bananas, among others, are subject to shifting climatic trends and unpredictability.

Impact on Global Water Resources



Future climate change impacts on freshwater will be site-specific and will threaten the sustainable development of the affected regions. The effects will be vastly different across the tropical Andes, North-eastern Brazil, East Africa, in small islands, and in Bangladesh.

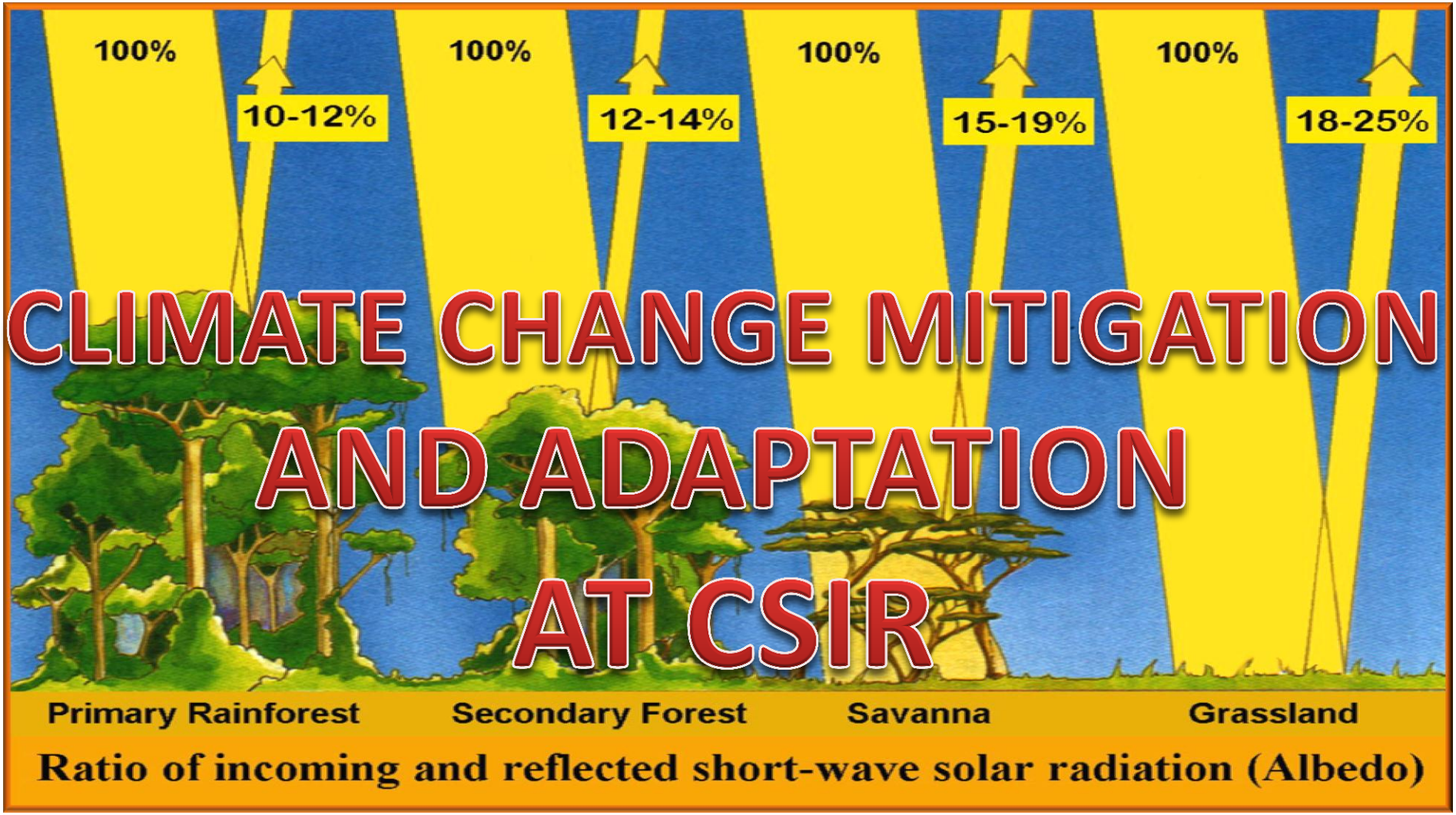
(Sources: Kundzewicz et al. 2008; Parry 2009)

Impact on National Water Resources and Fisheries

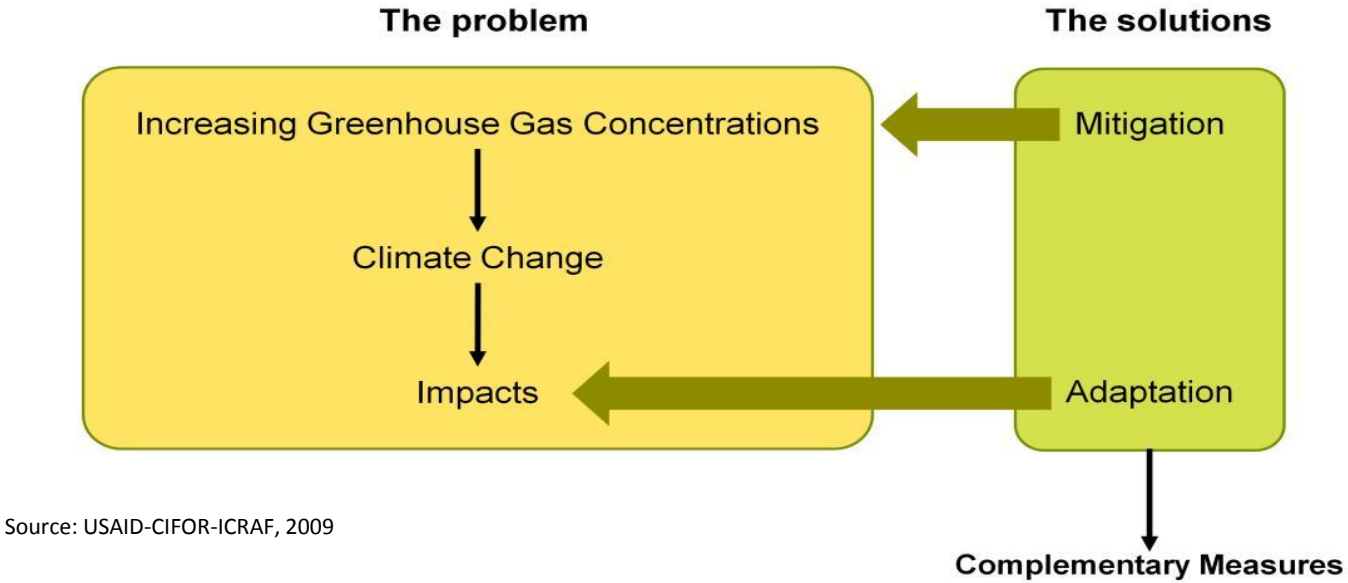
- General reduction in annual river flows in Ghana by 15-20 % for the year 2020 and 30-40 % for the year 2050.
- Reduction in groundwater recharge of 5-22 % for 2020 and 30-40% for 2050.
- Demand for irrigation water is likely to rise by 40-150 % for 2020 and 150-1200 % for 2050.
- If mitigation measures are not pursued by the year 2020, the hydropower generation will experience a reduction of 60 %.
- The unpleasant reality is that by the year 2020, all river basins will be vulnerable and the whole country will face acute water shortage.

FUTURE PROJECTIONS OF CLIMATE CHANGE IMPACTS

- Future projections suggest a temperature increase of 1.0 to 3.0°C by the 2060s, and 1.5 to 5.2°C by the 2090s, as well as severe changes in seasonality, rising sea levels and storm surges
- Of all economic activities, agriculture will be among those in greatest need to adapt. Many of the poorer, food-insecure farmers and local communities are particularly vulnerable to the effects of climate change on crop production


100%
10-12%
100%
12-14%
100%
15-19%
100%
18-25%
CLIMATE CHANGE MITIGATION AND ADAPTATION AT CSIR
Primary Rainforest
Secondary Forest
Savanna
Grassland
Ratio of incoming and reflected short-wave solar radiation (Albedo)

Solutions to climate change impacts



Source: USAID-CIFOR-ICRAF, 2009

- Mitigation measures deal with the causes of climate change, e.g., reducing energy consumption and using clean technologies.
- Adaptation measures deal with the impacts of climate change, e.g., managing watersheds for reducing landslides or developing alert systems for extreme events.

Mitigation Research in Forestry (REDD^{+})

- **The principal driver of deforestation and degradation are:**
  - agricultural expansion (50%)
  - wood harvesting (35%)
  - urban sprawl and infrastructure development (10%)
  - mining and mineral exploitation (5%)
- **REDD+ research is focused on:**
  - Plantation development
  - Wildfire-Management
  - Conservation and utilization of medicinal plants in Ghanaian forest fringe communities
  - Reducing Emissions from Deforestation and Forest Degradation through Collaborative Management with Local Communities
  - Reclamation and rehabilitation of degraded areas by artisanal and small scale mining activities
  - Capacity Building for Clean Development Mechanism (CDM

Mitigation Research in Agriculture

- Agricultural biotechnology to produce crops varieties with enhanced carbon sequestration.
- Introduction of leguminous cover crops such as *Mucuna* and cowpea for carbon sequestration.
- Cover crops can reduce artificial fertilizer use and save fossil fuel used in fertilizer manufacture.
- Biochar – a potential technique for soil carbon sequestration.
- Conservation tillage (zero tillage) for CO_2 and methane mitigation.

Adaptation Research at CSIR:
Agriculture and Soil Conservation

- Technologies that increase soil organic matter or the adoption of more agro-forestry-based techniques.
- Irrigation systems that help combat the effects of prolonged droughts.
- Crop diversification
- Planting of drought-resistant and short-season varieties.
- Introduction of practices to enhance soil moisture retention in fields.
- Minimal tillage.
- Agro-ecological zoning with GIS to assess the suitability of regions within Ghana for different crops and farming systems.

Adaptation Research at CSIR: *Livelihood Adaptation Research*

- CSIR's livelihood adaptation research strategies are based on three (3) strategies, namely:
  - **Insurance strategies:** Reducing vulnerability to current climate stress may increase adaptive capacity and increase resilience to future climate change.
  - **Coping strategies:** Planting mixtures of crops and cultivars adapted to different moisture conditions (reducing the risk of complete crop failure)
  - **Livelihood adaptation strategies:** Addresses long-term changes and typically occur when coping strategies are exhausted and individuals are forced to "alter fundamentally the ways in which they subsist".
- Introduction of best practices to rear small stock (chickens, guinea fowl, goats, sheep, and pigs) are also important livelihood adaptation research at CSIR.

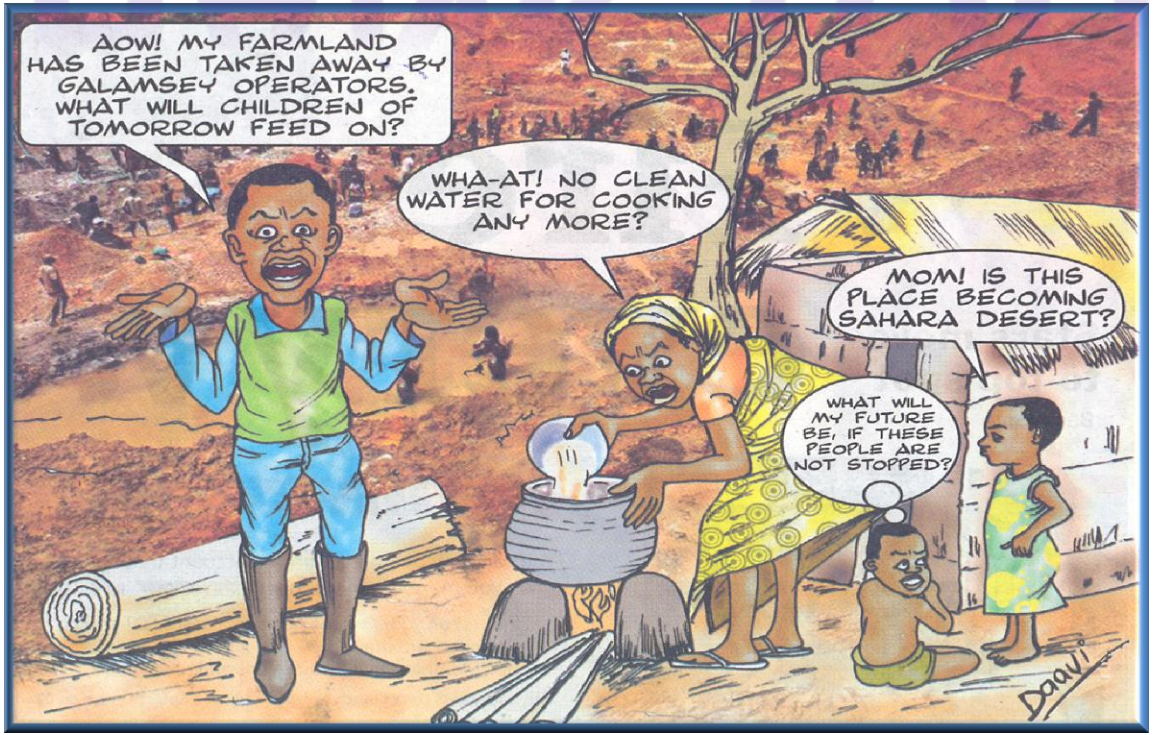
Adaptation Research at CSIR: *Water Resources*

- Document the evidence of hydrologic effects of climate change in Ghana.
- Improve the awareness of policy makers and other stakeholders on the consequences of climate change on water resources.
- Scientifically support the preparation of an action plan on climate change for the country.
- Contribute to adaptation strategies to climate for coping with water stress change.

WAY FORWARD

- Support the private sector to increase uptake of the mitigation and adaptation technologies.
- Establishment of a national climate change research and monitoring centre under the auspices of CSIR to scientifically monitor natural resources at risk for long-term sustainability and resilience of the vegetation, farmers and local communities.
- Need to disseminate information on climate-friendly technologies to shape how and how well farmers mitigate and adapt to climate change.
- The attention of policy-makers and the general public should also be drawn to the need to mitigate and adapt to the impacts of climate change so as to help generate the resources needed to strengthen research on climate change.
- Government should establish a Climate Change Research Fund.

THANK YOU



DAILY GRAPHIC; Monday June 17; 2013