

**CLIMATE CHANGE AND THE ENVIRONMENT:  
ISSUES AND GEOINFORMATION  
CHALLENGES**

BY

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**SUMMARY**

- **Global Warming**
- Causes, & Impacts of Global Warming
- Effect on Human life & Environment
- Response to Global Warming
- **Environment Issues Nigerian**
- Effects of Global Warming
- State of Nigerian Environment & Sustainability
- Monitoring & Managing Nigerian Environment
- **Way Forward:**
- Baseline Survey; Geoinformation Needs; Environmental Statistics
- Environmental Challenges: Government; Geoscientist

## INTRODUCTION

- **Environment:** all physical, social and cultural factors which support the existence and development of humans and other organism.
- **Human as part of the ecosystem** is
  - the most powerful force .
  - the most precious within the biosphere,
  - but the most dangerous as human activities produce potentially adverse effects on the immediate surroundings and the ecosystem.
- **Remove human from the environment** and nature will take care of the balance of the ecosystem
- Must exploit the environment in a SUSTAINABLE manner

## WHAT IS GLOBAL WARMING?

- The increase in the average temperature of the Earth's near-surface air and the oceans since the mid-twentieth century and its projected continuation.
- Global surface temperature increased  $0.74 \pm 0.18$  °C ( $1.33 \pm 0.32$  °F) during the 100 years ending in 2005; 2005 the warmest ever.
- Intergovernmental Panel on Climate Change (IPCC) indicates that global surface temperature will likely rise a further 1.1°C to 6.4°C (2.0 to 11.5°F) during the 21<sup>st</sup> century.

## CAUSES OF GLOBAL WARMING AND CLIMATE CHANGE

### TWO MAIN CAUSES

- Human induced (anthropogenic) greenhouse gases concentration (in the atmosphere) via the green house effect
- External forcing (climate change) caused by change in the global energy balance owing to fluctuations in the Earth's orbit, ocean circulation and atmospheric composition.

## Greenhouse Effect

- Process by which radiative energy leaving a planetary surface is absorbed by some atmospheric gases, called **greenhouse gases**.
- 50% of energy radiated by the sun reaches the Earth
- Energy reflected back to the atmosphere.
- Reflected long-wave energy trapped by atmospheric gases, just like the artificial greenhouse
- The greenhouse gases transfers the trapped energy back to lower atmosphere, and makes the temperature to rise

## Two Types of “Greenhouse Gases”

### ❑ Earth’s Natural Greenhouse Gases

- Water Vapour; Carbon Dioxide; Methane, Ozone
- Do not constitute any danger to the environment
- Natural warming effect of about 33°C. **Makes Earth habitable**

### ❑ Anthropogenic Human-Induced Greenhouse Gases

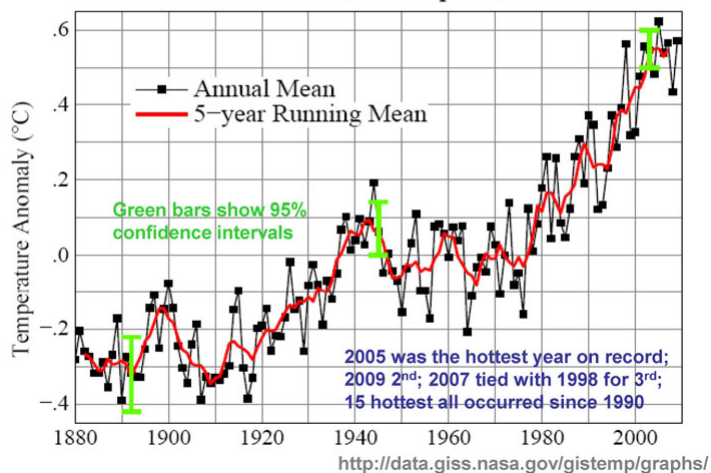
- Increased concentration of CO<sub>2</sub> since industrial revolution
- Main cause of global warming and climate change
- **SOURCES:** Fossil fuel combustion, deforestation & cement production are the major causes of CO<sub>2</sub>.
- Contribution of Ozone depletion & Solar variation are negligible

## EFFECTS OF CLIMATE CHANGE AND GLOBAL WARMING

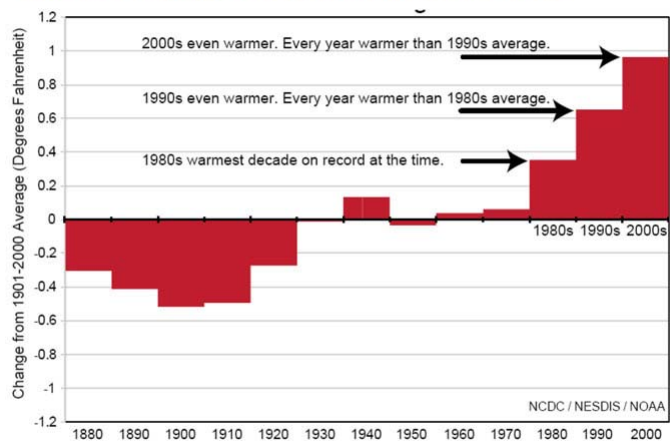
- Increase in global temperature
- Rising sea levels,
- Changes in climate patterns,
- High precipitation, Floods, Coastal Erosion
- More severe weather including stronger storms, droughts, and heat waves
- Possible expanse of the subtropical desert regions.
- Arctic shrinkage and resulting Arctic methane release,
- Shrinkage of the world’s rainforest,
- Changes in agricultural yields, Shortage of food,
- Species extinctions & changes in the ranges of disease vectors

### The Earth is getting hotter

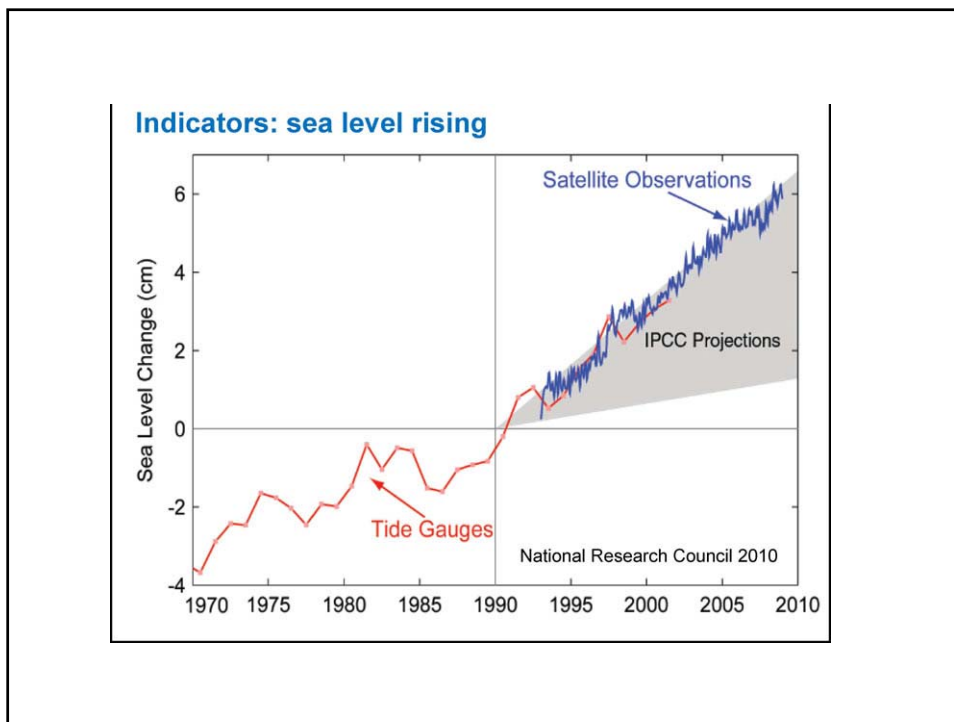
Global Land–Ocean Temperature Index





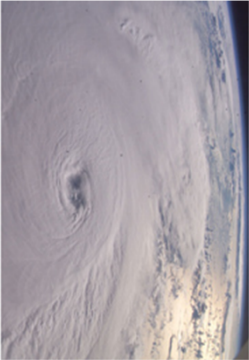
### The Earth is getting hotter (continued)



NOAA, State of the Climate 2009, 2010



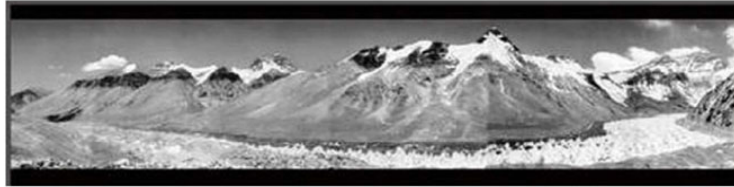
**Table 4: Wild Fire, Intense Drought and Tropical Storm**

Wild Fire	Intense Drought	Tropical Storms
		
<p>The effects of global climate change include more frequent wildfires, longer periods of drought in some regions and an increase in the number, duration and intensity of tropical storms.</p>		

Source: Summary for Policymakers, IPCC Synthesis report, November 2007  
<http://www.ipcc.ch/>

**Table 5: Glaziers Shrinking (Adapted from Holdren 2010)**

**Indicators: mountain glaciers shrinking**



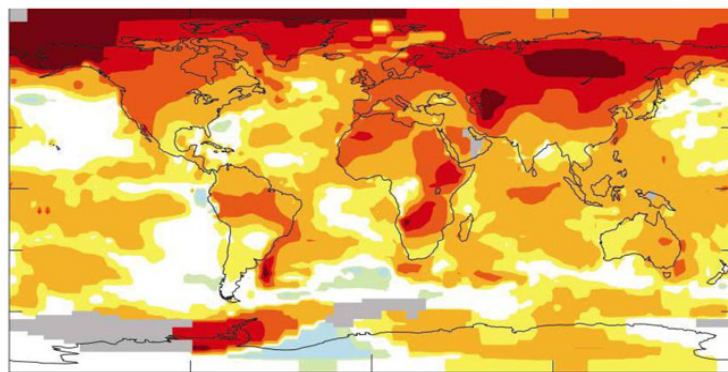
Rongbuk glacier in 1968 (top) and 2007. The largest glacier on Mount Everest's northern slopes feeds Rongbuk River.

National Snow & Ice Data Center 2010

**Table 6: Non-Geographically Uniform Heating (Adapted from Holdren 2010)**

**The heating is not uniform geographically**

Surface T in 2001-2005 vs 1951-80, averaging 0.53°C increase



-2 -1.6 -1.2 -0.8 -0.4 -0.2 .2 .4 .8 1.2 1.6 2.1

J. Hansen et al., *PNAS* 103: 14288-293 (2006)

## RESPONSE TO CLIMATE CHANGE

There are only THREE Options

- ❑ **MITIGATION**: This means measures to reduce the pace & magnitude of the changes in global warming being caused human activities.
- ❑ **ADAPTATION**: Meaning measures to reduce the adverse impacts of global warming on human well-being.
- ❑ **SUFFERING** the adverse impacts that are not avoided by either mitigation or adaptation

## IMPLEMENTING THE OPTIONS

- Suffering not an option. Depends level of adaptation and mitigation
- To minimize human suffering: Do a LOT of mitigation and a LOT of adaptation because:
  - Mitigation alone will not work. Can't stop global warming quickly. Economic factors involved
  - Adaptation alone won't work. It gets costlier and less effective with increase in warming
  - We need enough mitigation to avoid the unmanageable and enough adaptation to manage the unavoidable



## MITIGATION POSSIBILITIES

### CAN DO

- Reduce Emissions of greenhouse gases
- Reduce deforestations
- Modify agricultural practices to reduce emission of greenhouse gases

### FUTURE TECHNOLOGY

- Scrub greenhouse gases from the atmosphere
- Geo-engineering to create cooling effects, offsetting greenhouse heating

## ADAPTATION POSSIBILITIES

- Change the cropping patterns
- Develop new crops resistant to heat, drought, & salt
- Build new water projects for flood control and drought management
- Build dikes & storm-surge barriers against sea-level rise
- Strengthen Public Health and environmental engineering defenses against diseases.
- Avoid further development on flood plains and near sea level (Lagos – Lekki axis!?!?)



## Effects of global warming

- Change in the seasonal patterns, very hot weather conditions and heat waves
- High precipitations leading to flooding, ruined crops in parts of the country creating food scarcity, the latest being Jigawa State;
- Gully erosion has sacked many communities especially in Edo and Anambra States;
- Lake Chad has almost dried up,
- Desert encroachment in the north.
- Rain forest disappearance in the
- Sea-level Rise: Coastal erosion sacking settlement
- Is the country prepared for the impact of global warming?
- The dearth of environmental statistical database: difficult to estimate the impacts of Global Warming in real terms.
- Need to: monitor, collect data systematically, create environmental database.

## Monitoring and Managing the Environment

- Before the environment can be meaningfully monitored and protected, all parameters defining the environment must be relatively and spatially located to create a spatial database.
- Information – statistical data - about the status of these parameters can then be treated as metadata & linked to the database.
- Basic tool for this is geoinformation

### Measuring and Monitoring the Impact of Global Warming & other Environmental Issues

- Global warming has effect on the troposphere and the earth surface.
- To respond, we need to know the effects and magnitude in real terms, on the spatial content of the geographical space of interest: measurement: Spatial data

### Tools for Environmental Monitoring & Management

- **Topographical Maps** to depict main datasets such as: Land Use and Land Cover, Topography, Demographics, Ecology, Hydrology, Soils, Infrastructure, Air Quality, Climatology and Water Quality, Epidemics
- **Remote Sensing** to produce image maps and base-maps quickly and cheaply. Multi-temporal datasets & monitoring
- **GIS**: The ability to integrate spatial data of different themes and resolution as well as non-spatial data makes GIS a powerful tool for the monitoring and management of the environment; as various environmental indicators can be analysed & integrated. [A POWERFUL TOOL FOR ADVOCACY](#)

## GEOINFORMATION CHALLENGES

- Current Basic Maps not Available
- Large Scale Maps not Available
- Production of Geoinformation not adequately coordinated
- Government and Society not Spatially Enabled
- Governments at all levels embark on comprehensive mapping of the country and evolve a policy to make the exercise sustainable

## WHAT SHOULD DONE SHOULD BE PROACTIVE

- The Nigeria and Developing Countries should be proactive in response to the global warming phenomenon & challenges
- Should not wait until much damage is done which will be very costly correct.
- Should not fold their arms and wait for international donor agencies and Research Institutes to provide wholesale solutions her global warming issues.
- Take up the challenge and seek cooperation and collaboration with International Agencies in other to create opportunities for technology transfer.

## ADAPTATION OPTION (RESPONSE)

- Agriculture and Research Institutions should commence research into crops that are resistant to drought and heat.
- The River Basin Authorities should commence the study, design and construction of new water projects for drought management and erosion control.
- The rapid erosion of the nation's sandy coast to be halted by construction of dykes & storm surge barrier.
- House needs and Design studies
- Development on wetlands, flood plains, and close to sea level, especially by the poor who are most vulnerable to disasters, should be stopped.

## The mitigation options

- Stop the gas flaring and oil pollution in the Niger Delta with all the force of government and stopped forthwith.
- Deforestation should be reduced by encouraging mechanised farming and use of cooking gas instead of wood fuel, while concerted efforts should be made to address afforestation and reforestation.
- The Ministry of Science and Technology and Universities of Technology should start research into "Clean - Energy Technologies", as an ultimate alternative to fossil fuel burning.
- Solar Energy as alternative to fossil fuel burning
- The Public to be educated on Global Warming and Effects
- Set up National Committee on Global Warming

## WAY FORWARD

- **Carryout Environmental Baseline Survey**
  - Cooperation, sharing of data among all stakeholders: Policy makers, NGOs, Researchers, Institutions etc
  - Carry out systematic environmental data collection to reflect all environmental indices for the creation of a comprehensive environmental database driven by GIS (Show next slide)
- **Produce base-maps of the entire country**
  - Fund surveying and mapping activities
  - Stop project specific mapping
  - Adopt a mapping policy
- **Pay adequate to and fund environmental projects**

Table 3: Framework for an environmental information Database

INPUT			
<b>BIOPHYSICAL ENVIRONMENT</b>			
<b>LAND:</b> Land use Deforestation Land degradation Land desertification Waste disposal	<b>WATER:</b> Inland water pollution Utilization of inland water Marine water pollution	<b>ATMOSPHERE AND CLIMATE:</b> Air pollution Climate change	<b>BIODIVERSITY:</b> Destruction of biodiversity Loss of aquatic fish Wildlife trade Habitat loss Protected areas
<b>SOCIOECONOMIC ENVIRONMENT:</b>			
<b>POPULATION:</b> Characteristics of population Population growth Rural urban migration Health education	<b>HEALTH:</b> Characteristics of health Mortality incidences Noise pollution	<b>AGRICULTURE:</b> Agricultural production Livestock population & production Use of agrochemicals	<p>ENVIRONMENTAL INFORMATION DATABASE</p> <p>↓</p> <p>OUTPUTS</p> <p>TABLES</p> <p>GRAPHS</p> <p>MAPS</p>
<b>POVERTY</b>	<b>TRANSPORTATION</b>	<b>TOURISM</b>	
<b>ENERGY</b> Renewable energy Non-renewable energy	<b>EDUCATION</b>	<b>ECONOMY AND EMPLOYMENT</b>	
<b>INDUSTRY</b>			
<b>NATURAL DISASTERS:</b>			
<b>FLOOD HAZARD</b>	<b>DROUGHT HAZARD</b>	<b>CYCLONE</b>	<b>EARTHQUAKE</b> <b>FOREST FIRES</b>
<b>VOLCANOS</b>	<b>LANDSLIDES</b>		
<b>POLICIES AND INSTITUTIONS</b>			
STATUS OF EIA STATUS OF ENVIRONMENTAL MONITORING AND MANAGEMENT PARTICIPATION IN MAJOR GLOBAL CONVENTIONS			

Source: UNEP/EAP-AP—State of the Environment Data Collection and Reporting Training for South Asia (unpublished).

## CONCLUDING REMARKS

- Global Warming is real.
- Its impacts on socioeconomic activities and human life are palpable.
- Federal Government should take a cue from the Lagos initiative and set into motion global warming response system
- The environment and natural resources are currently not being exploited and managed in a sustainable manner.
- There is dearth of environmental statistics
- Environmental data collection is not coordinated.
- Urgent need to carry out a nationwide baseline survey to create a national environmental information database based on adequate geoinformation.

## CONCLUDING REMARKS CNTD

- Governments and scientific communities must take environmental challenges of our time very seriously
- The world is becoming an information society and “**information infrastructure**” is prerequisite to all developments. The most basic of all information infrastructures is geoinformation, since all other information is location specific. We must map to be able to assess, predict and plan against the impacts of global warming and foreseeable environmental inclemency. Government at levels must therefore pay adequate attention to geoinformation production and put in place a mapping policy to drive surveying and mapping activities.