IPCC- Side Event
– CCDA-V, Victoria Falls

IPCC AR5-Africa Chapter
Impacts and Vulnerability

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The distribution of Least Developed Countries (LDCs):

Poverty in sub-Saharan Africa rural areas - double the prevailing average in developing countries of other regions despite the recorded decline: 64.9% in 1998 to 61.6% in 2008
Meeting MDGs – remains a challenge despite noted progress

- Progress skewed in favor of higher-income groups and urban populations
- Use of improved sanitation low - 41% in 2010 compared to 36% in 1990
- Highly depended on rainfed agriculture
African Cities and Towns: Highly vulnerable to impacts of climate change and variability

- Urban population projected to triple by 2050
- Evolving unplanned cities - informal settlements, inadequate services - urban poverty

- Cities on mega-deltas and coastal areas – expose large population to flood risk and sea level rise
Some of the Projected Vulnerability in Cities

• **Kenya:** by 2030, 10,000 to 86,000 people would be affected
  – Losses ranging US$ 7 million to US$ 58 million (SEI, 2009).

• **Tanzania- Dar-es-Salaam:** By 2030 population at risk of 1 in 100-year return period extreme water levels ~ 30,300 and 110,000 inhabitants
  – Potential losses of US$ 35.6 million to US$ 404.1 million

• **High levels of vulnerability and low adaptive capacity in African cities:** due to structural factors, e.g. incapacitated local governments
Water:

• **Already at risk:** Increasing demand, pollution, etc.
• Climate change will amplify these stress

• Regions projected to become drier - e.g. northern Africa and parts of southern Africa & are already water-stressed - will be most affected.
Ground Water

• Areas receiving between 200 and 500 mm rainfall per year - Sahel, Horn of Africa & Southern Africa - likely to experience a decline in groundwater recharge with climate change

• Coastal aquifers with high rates of groundwater extraction - saltwater intrusion, coupled with increased saltwater ingression from SLR are vulnerable

Ground water data in Africa are extremely limited
Terrestrial Ecosystems

• Under extensive pressure, e.g. fire, deforestation

Observed changes:

• A small expansion of desert conditions (LC).
• A large increase in human disturbances & decrease in the extent of natural vegetation \((HC)\)
• Complex shifts in vegetation types:
  – A net decrease in woody vegetation in western Africa
  – A net increase in woody vegetation in central, eastern, and southern Africa \((HC)\)

• It is difficult to isolate the role of climate change from other drivers
<table>
<thead>
<tr>
<th>Type of change and nature of evidence</th>
<th>Examples</th>
<th>Time scale of observations</th>
<th>Confidence in the detection of change</th>
<th>Potential climate change driver(s)</th>
<th>Confidence in the role of climate vs. other drivers</th>
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<tbody>
<tr>
<td>Changes in ecosystem types</td>
<td>Across sub-Saharan Africa, 57% increase in agricultural areas and 15% increase in barren (largely desert) areas was accompanied by 16% decrease in total forest cover and 5% decrease in total non-forest cover (Brink and Eva, 2009).</td>
<td>~25 years (1975–2000)</td>
<td>Medium</td>
<td>Increasing CO$_2$, changing precipitation patterns, increasing temperatures</td>
<td>Low</td>
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<td></td>
<td>On Mt. Kilimanjaro, increased vulnerability to anthropogenic fires has driven 9% decreases in montane forest and 83% decreases in subalpine forest (Hemp, 2009).</td>
<td>~25 years (1976–2000)</td>
<td>High</td>
<td>Increasing temperatures, decreasing precipitation</td>
<td>Low</td>
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<td>In the Democratic Republic of Congo, total forest cover declined by 2.3%, with most losses in secondary humid forest (Potapov et al., 2012).</td>
<td>~10 years (2000–2010)</td>
<td>High</td>
<td>None proposed</td>
<td>Low</td>
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<td>Dieback of seaward edge of mangroves in Cameroon at rates up to 3 m yr$^{-1}$ (Ellison and Zouh, 2012)</td>
<td>~35 years (1975–2010)</td>
<td>High</td>
<td>Sea level rise</td>
<td>Medium</td>
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<td>Across western Africa, central Africa, and Madagascar, net deforestation was 0.28% yr$^{-1}$ for 1990–2000 and 0.14% yr$^{-1}$ for 2000–2010 (Mayaux et al., 2013).</td>
<td>~20 years (1990–2010)</td>
<td>High</td>
<td>None proposed</td>
<td>Low</td>
</tr>
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<td>Changes in ecosystem structure</td>
<td>Surveys of coral reefs in northern Tanzania indicate relative stability in the abundance and diversity of species, despite climate and non-climate stressors (McClanahan et al., 2009).</td>
<td>~9 years (1996–2005)</td>
<td>High</td>
<td>None proposed</td>
<td>Low</td>
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<td>Analysis of sediment cores from Lake Victoria indicates current community structure (i.e., dominated by cyanobacteria and invasive fish) was established rapidly, during the 1980s (Hecky et al., 2010).</td>
<td>~100 years (1900–2000)</td>
<td>High</td>
<td>Increasing temperatures</td>
<td>Low</td>
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<td>Long-term declines in density of trees and shrubs in the Sahel zone of Senegal (Vincette et al., 2010) and Mali (Ruelland et al., 2011)</td>
<td>~20–50 years (Senegal, 1976–1995; Mali, 1952–2003)</td>
<td>High</td>
<td>Drought stress induced by decreasing precipitation</td>
<td>Low</td>
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<td>Long-term increase in shrub and tree cover across mesic savanna sites (700–1000 mm mean annual precipitation (MAP)) with contrasting land use histories in South Africa (Wigley et al., 2009; 2010)</td>
<td>~67 years (1937–2004)</td>
<td>High</td>
<td>Increasing CO$_2$</td>
<td>Low</td>
</tr>
</tbody>
</table>
Food production

- High temperatures to have negative effects on major cereal crops across Africa

**Estimated Losses:**

Maize: 18% for southern Africa to 22% aggregated across sub-Saharan Africa

Wheat: 35% by 2050

Sorghum: low- 2% but increases above 2°C will lead to greater losses also affecting millet e.g. West Africa

- A Shift to livestock likely in regions of changing & shortened growing season e.g. W. African Sahel & parts of southeastern Africa
Perennial crops

- Economically valued crops - tea, coffee, and cocoa:
  - Suitable agro-climatic zones estimated to significantly diminish due to rising temperatures.
## Perennial Crop Suitability Estimates

<table>
<thead>
<tr>
<th>Crop</th>
<th>Description</th>
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<tr>
<td>Coffee</td>
<td>KENYA: Increased suitability at high latitudes; decreased suitability at low latitudes</td>
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<tr>
<td>Tea</td>
<td>UGANDA: Increased suitability at high latitudes; KENYA: Decreased suitability at low altitudes</td>
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<tr>
<td>Cocoa</td>
<td>GHANA AND CÔTE D’IVOIRE: Constant or increased suitability at high latitudes but decreased suitability at low latitudes</td>
</tr>
<tr>
<td>Cashew</td>
<td>GHANA AND CÔTE D’IVOIRE: Increased suitability</td>
</tr>
<tr>
<td>Cotton</td>
<td>GHANA: Decreased suitability</td>
</tr>
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</table>
It is not all negative:

- **Maize** production could benefit from warming at high elevation locations (A1FI scenario)

- **Cassava:**
  - Eastern Africa - Cassava yields estimated to moderately increase up to the 2030s
  - Suitability of cassava to increase in Central Africa - Cassava - a potential option – given its hardiness to higher temperatures and sporadic rainfall relative to many cereal crops

- Livestock rearing in highland areas of East Africa - could benefit from increased temperatures
Thank you all for your kind attention!!