

# **Climate change and African agriculture: Adaptation options**

**Rashid M. Hassan**

Centre for Environmental Economics and Policy  
Analysis in Africa (CEEPA), University of Pretoria

**EuropeAid**

**European Commission**

**Brussels**

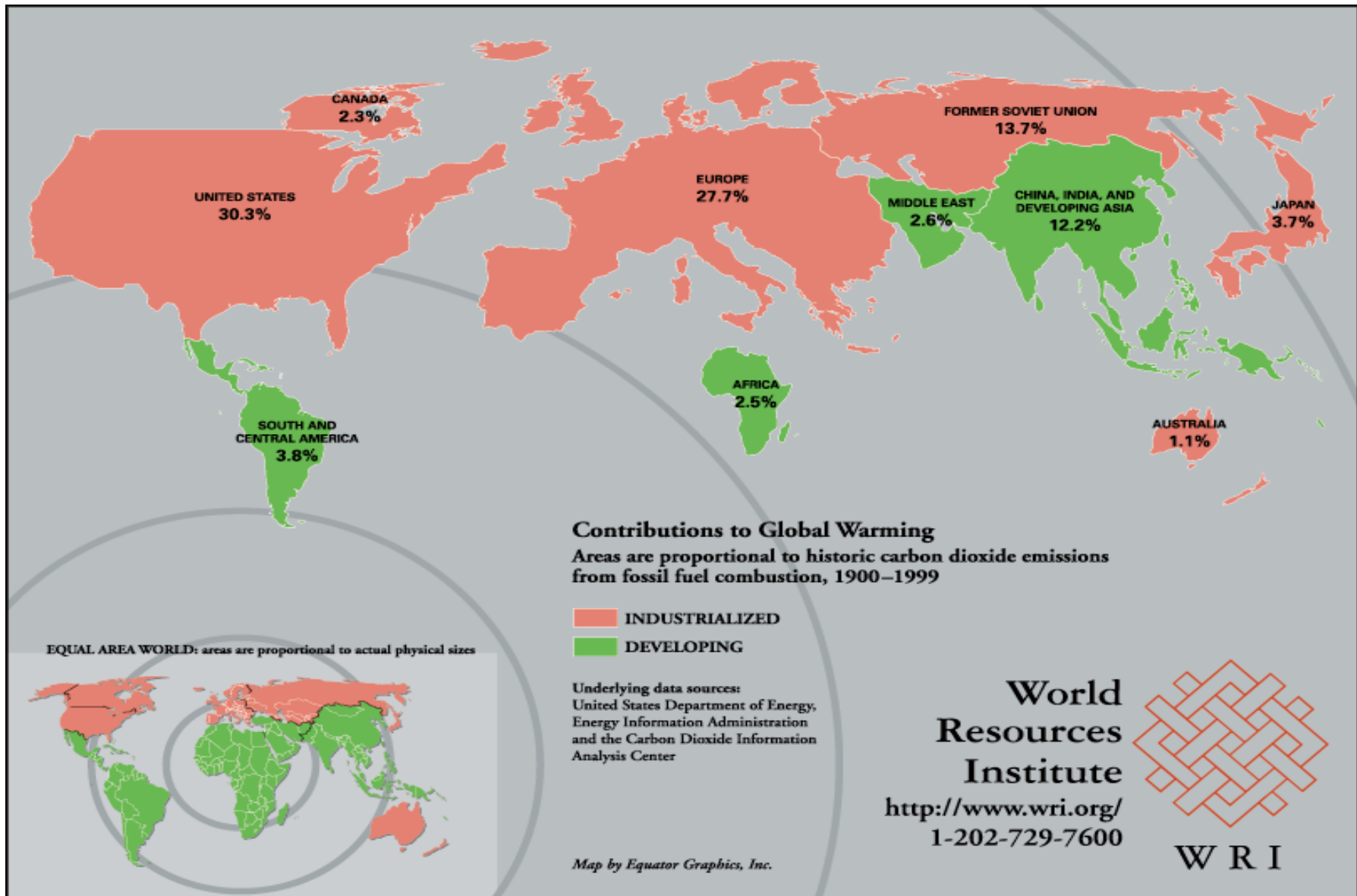
**Friday 28 November, 2008**

# Background & motivation

- **Little dispute over the reality of CC**
  - Global move to action now – precautionary approach
  - Cost & risks of delayed action high (economics of mitigation)
  - Building up to COP15 – Copenhagen 2009
    - Future (post 2012) agreement on strategies and policy framework for country obligations and commitments
- **Consensus on the need for mitigation and adaptation actions – both necessary**
- **Disagreement on responsibilities and roles**
  - Relative significance and distribution among regions of the world (who should do what?)
  - Important differences between industrialized and developing countries in responsibility and abilities

- **Industrialized north**
  - High energy & carbon growth - historic concentration of GHG
  - Accumulation of economic & technological wealth – capacity
  - High per capita emissions – high potential gains from mitigation
  - Regions benefiting from global warming—most in temperate north
- **The developing world**
  - Low energy & emission levels—low potential gains from mitigation
  - Low economic and technological wealth – low ability to invest in expensive mitigation actions (need assistance)
  - High poverty – higher energy & emissions inevitable for economic growth necessary for poverty reduction
  - Already warm & vulnerable – biggest CC damages
  - Claim compensation to adapt to CC risks caused by rich north
- **DCs soon to contribute more than 50% of GHG – mitigation measures are necessary – middle income**

# Who is responsible for global warming (historic)?



# Where does SSA currently stand?

Table 1. Contribution to GHG and CO2 emissions by region and selected countries in million metric tons CO2 equivalent (CO2e) for 2000

	Total GHG emissions		Carbon dioxide emissions	
	Amounts	% of total	Amounts	% of total
World	33,309		23895.7	
Developed Countries	18,102	54.35	14679.5	61.43
Developing countries	15285	45.89	9268.5	38.79
Asia	11471	34.44	7837	32.80
Europe	7638	22.93	6071	25.41
North America	7599	22.81	6283.5	26.30
Central America & Caribbean	725	2.18	507.5	2.12
South America	1812	5.44	796.9	3.33
Oceania	578	1.74	369.1	1.54
Middle East & North Africa	2163	6.49	1531.5	6.41
Sub-Saharan Africa	1323	3.97	492.1	2.06
	Amounts	% in Africa	Amounts	% in Africa
<b>Africa's biggest emitters</b>	1323		492.1	
Congo, DRC	53	4.01	2.5	0.51
Ethiopia	59	4.46	3.6	0.73
Kenya	53	4.01	10.2	2.07
<b>Nigeria</b>	<b>163</b>	<b>12.32</b>	48.1	<b>9.77</b>
<b>South Africa</b>	<b>413</b>	<b>31.22</b>	344.6	<b>70.03</b>
Sudan	96	7.26	5.9	1.20
Tanzania	59	4.46	2.7	0.55
Zimbabwe	33	2.49	14.1	2.87
Source: World Resource Institute, International Energy Agency, <a href="http://earthtrends.wri.org">http://earthtrends.wri.org</a>				

# Which are the dirty economic activities?

	Electricity& heat production	Other energy ind.	Manufacturing & construction	Internal transportation	Residential	Agric. & other
World	37.2	4.7	16.8	18.4	7.8	5.6
Developed Countries	41.0	4.5	15	23.6	8.6	6.1
Developing countries	37.6	6.6	24.5	16.4	7.4	5.8
Asia	41.2	4.6	24.4	13.5	6.9	6.3
Europe	40.2	4.2	16.9	19.2	12.1	6
North America	40.9	5.2	12	30.2	6.4	5.2
Central America & Caribbean	33.3	10.7	17	27	5.6	3.4
South America	14.1	9.8	26.1	35.7	7.2	5.4
Oceania	56.7	4.9	16	22.6	2	2.5
Middle East & North Africa	32.4	11	20.8	18.6	9.8	11.3
Sub-Saharan Africa	47.1	2.7	17.2	18.4	3.4	2.7
<b>African biggest emitters</b>						
Congo, DRC	1.1	1.1	35.4	26.3	15.4	38.3
Ethiopia	0.6	0	27.6	54.5	16.4	0
Kenya	23.1	6.5	16.7	45.5	10.9	4.1
Nigeria	12	11.5	11	41.6	9.3	0
South Africa	57.7	1.3	17.8	10.5	1.6	1.7
Sudan	20.8	1.7	15.3	53.6	2.7	4.3
Tanzania	11.2	0	15.9	56.2	13.4	3.3
Zimbabwe	53.8	0.5	15.4	15.8	1.4	12

Source: World Resource Institute, International Energy Agency, <http://earthtrends.wri.org>

Table 2. Carbon Dioxide emissions by economic activity as percent of total (2000)

# Energy consumption & economic wellbeing

Table 3. Energy consumption (million toe), GDP (1000 \$) and emissions (million ton CO<sub>2</sub>e) in 2002

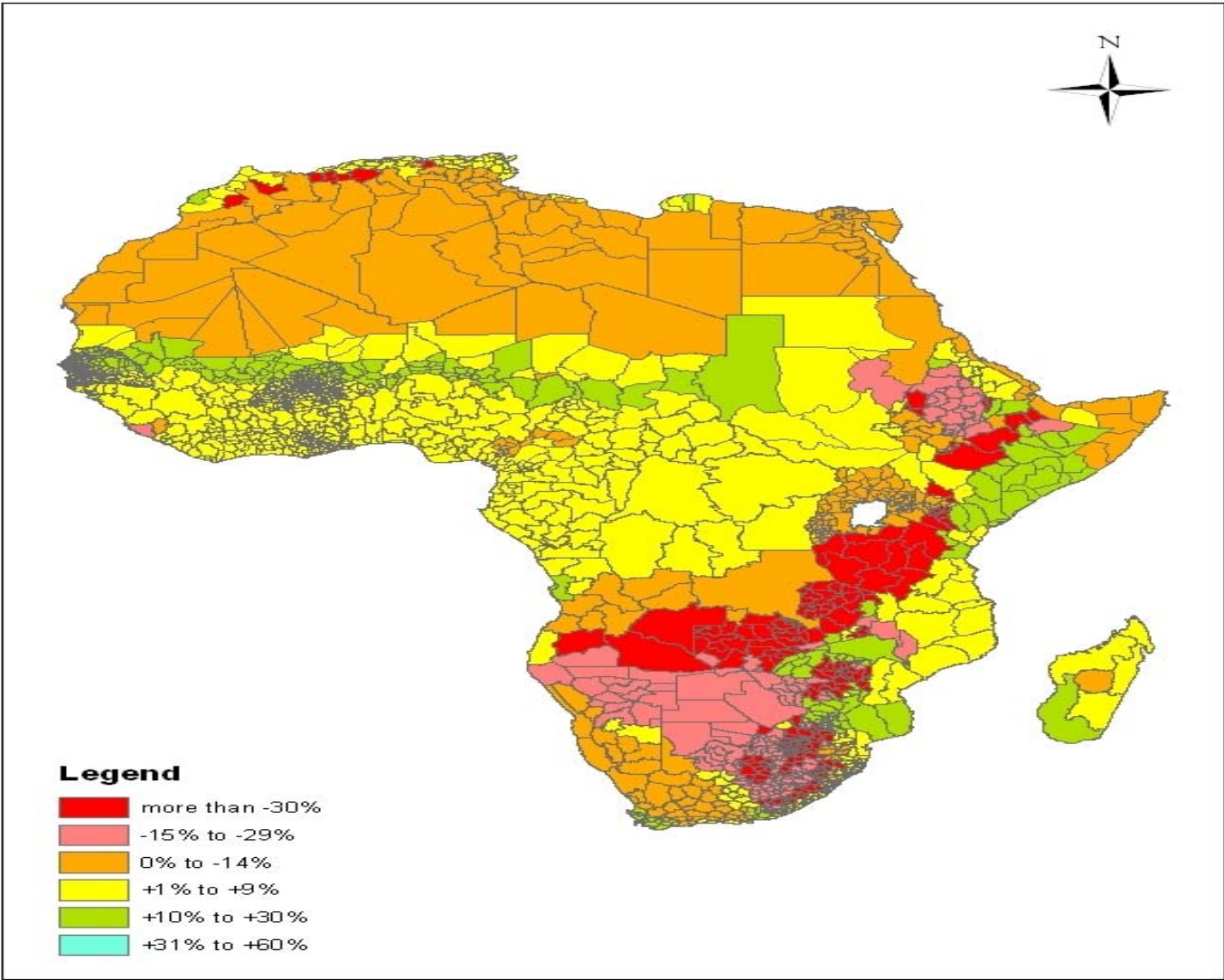
	Total	% of total	toe/capita	GDP/capita	CO <sub>2</sub> e/capita
	Mtoe			000\$	Mt CO <sub>2</sub> e
World	6,975		1.12	7.88	3.85
Developed Countries	4,184	60	3.17		11.11
Developing countries	2791	40	0.57		1.90
Asia	2175.4	31	0.62	4.68	2.24
Europe	1858.7	27	2.56	18.10	8.37
North America	1725.6	25	5.39	35.14	19.64
Central America & Caribbean	138.5	2	0.78	7.35	2.84
South America	304.5	4	0.86	7.33	2.24
Oceania	86.7	1	2.77	21.35	11.80
Middle East & North Africa	408.3	6	0.96	5.99	3.62
Sub-Saharan Africa	259.5	4	0.38	1.78	0.72
<b>African biggest emitters</b>		<b>% of SSA</b>			
Congo, DRC	14.28	6	4.45	0.98	0.78
Ethiopia	18.45	7	0.28	0.75	0.05
Kenya	11.04	4	0.35	1.02	0.32
<b>Nigeria</b>	<b>85.49</b>	<b>33</b>	0.71	0.92	0.40
<b>South Africa</b>	<b>56.43</b>	<b>22</b>	1.28	<b>10.15</b>	<b>7.80</b>
Sudan	9.08	3	0.28	1.94	0.18
Tanzania	12.45	5	0.34	0.06	0.07
Zimbabwe	8.27	3	0.63		1.08

Source: World Resource Institute, International Energy Agency, <http://earthtrends.wri.org>

# How CC damages burden SSA agriculture?

Percentage change in

farm net revenue with CCC 2100 Scenario



0 3 6 12 Decimal Degrees

# What needs to be done? Response options

- Mitigation necessary—precautionary approach
  - Atmospheric GHG concentrations stabilization (below 2.5 °C)

Stabilization targets (by 2050)	450 ppm CO <sub>2</sub> e	550 ppm CO <sub>2</sub> e
Likely associated warming (50% probability)	2 °C	4 °C
Marginal cost of mitigation (US\$ per ton CO <sub>2</sub> )	> 200	50
Required annual investments (% of global GDP)	1.1% (High)	0.4% (Low)
Adaptation efforts needed	Low	High
Current world average per capita emission (ton)	7	7
Target per capita emission achieved by 2050	2	5
Required % reduction in current emission levels:		
North America	90%	80%
Other OECD	80%	60%
China at current emission of 5 ton/capita	60%	Freeze at current
SSA & other at currently < 1 ton	Little growth	Room for growth
Source: Adapted from IEA (2008)		

# Mitigation is whose responsibility?

- Potential gain and capacity higher in rich industrialized
- At less than 1 ton no commitments expected for SS
  - Developing countries soon reach 50% global emissions
- Does this mean no mitigation for SSA?
- Mitigation opportunities include:
  - Reforming carbon trading – deforestation & land use change
  - Reward energy use efficiency in carbon intensive sectors
  - Advantage of low carbon technology transfers
  - Information and financial assistance
- Adaptation most important for SSA

# SSA agric adaptation challenges

- African farmers have always coped with climate adversities
  - Never new
- Short-term coping responses of government & policy
  - Disaster relief, food assistance, droughts, floods, etc.
- Low investment in science, technology, information for long-term changes
- Weak economic infrastructure (access to markets) , poor technology, institutions, poverty, etc.
- High dependence on dryland farming (< 4% under irrigation compared to about 30% in Asia – high vulnerability to climate risk)
- Low awareness and supply & use of relevant information

# Adaptation opportunities for SSA agric

- capacity to adapt is context-specific
  - Varies among countries, communities, social groups and individuals, and over time
  - Determined by a range of factors:
    - Range of available technological options,
    - Resources and their distribution
    - Structure of critical institutions
    - Stock of human capital
    - Property rights
    - Access to risk spreading processes
    - Ability of policy makers to manage information and make effective decisions
    - Public's perception of attribution

# Priority areas

- Climate science – ability to predict well climate damages at regional/local scale

Model		Current averages	2020	2100
CCC	<b>Temperature (0C)</b>	23.29	24.9 (+1.6%)	29.96 (+6.7%)
PCM		23.29	23.9 (+0.6%)	25.79 (+2.5%)
CCC	<b>Precipitation (mm)</b>	79.75	78.8 (-3.7%)	65.08 (-18.4%)
PCM		79.75	89.8 (+12.5%)	83.18 (+4.3%)

- Map the distribution & rank vulnerabilities of regions, systems and communities – where is the highest risk
  - Priority targeting
- Identify & evaluate observed & potential adaptation mechanisms / options
  - Merit (economic, social & environmental goals-cost efficiency, equity, sustainability, etc.
  - Adaptation economics & policy research - evaluation

- Better communication between providers and users of climate information
  - Providers understand better needs of users
  - Make info relevant to needs of users & easy to interpret
  - Users ability to understand & interpret
  - Facilitating platforms/institutions
- Farmers education & effective extension
- Shift focus of decision making and public policy from short to long-term goals

- Observed vulnerabilities of current agricultural practices and strategies:
  - Mono-cropping
  - Specialized farming – plantations / beef & diary cattle
  - Reliance on dryland – irrigation
  - Stress tolerance (water, nutrients, heat)
- Access to markets & non-farm income and employment opportunities
- Access to energy (rural electrification)

- Mainstreaming climate sensitivity as an integral component of all agricultural & broader economic development planning & policy design
- National poverty reduction plans, adaptation action plans & general development strategies to be consistently sensitive to impacts of CC
- External assistance critical for effective implementation of adaptation mechanisms
- Developed world to channel substantial funding, information & technological assistance to reduce negative impacts on poor countries of the global environmental externality they have created
- External funding and other assistance to be tied to some new conditionality requiring reasonable commitment from recipient countries to adaptation, energy efficiency and poverty alleviation targets
- Major reforms and radical changes in existing donor funding mechanisms urgently needed to be effective in assisting development, adaptation and poverty reduction effort
  - Most critical is speeding the delivery of promised obligations
  - Assistance received by SSA in 2005 was almost the same as what reached the region in 1985
  - Currently very small percentage of total funds pledged for achieving the Millennium Development Goals have reached target countries