We are all in the same boat: Food production and food security under threat by climate change

Climate-Smart Agriculture Conference
Montpellier, France
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Sir Gordon Conway
Professor of International Development,
Agriculture for Impact,
Imperial College
The Crises all Around Us

- Financial
- Civil Strife
- Food security
- Energy Supply
- Water
- Ecosystem Functions
- Climate Change

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What we have to achieve

A Key role for agriculture, food & nutrition security in the international climate change negotiations.

- Agricultural adaptation: agree on the principles and practices.
- Agricultural mitigation: agree the potential practical role of agriculture in mitigating climate change.
- National strategies that reflect targets for achieving climate smart agriculture.
- Public and private financing mechanisms to make this happen.

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Increasing food prices and recurring food price spikes

About 1 billion people
(1 in 6 of the world’s population)
are chronically hungry

We have to increase food production by 60-100% by 2050

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Source: IMF, Primary Commodity Price System.

1A weighted average of wheat, corn, rice, and barley.

2A weighted average of beef, lamb, pork, and poultry.
Child malnutrition

Globally 1 in 3
Under age 5

In Africa it is
over 40%

They are under height for their age and suffer from stunted development and possible blindness and death

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Feeding the World by 2050

Demand

• Population Growth
• Changing Diets
• Biofuel Demand

Supply

• Rising fuel and fertiliser prices
• Land degradation
• Water scarcity

CLIMATE CHANGE MAKES ALL OF THIS MORE DIFFICULT

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Emissions continue to rise over next century, leading to about 4°C above preindustrial levels.

IPPC, 2014. Summary for Policy Makers

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The Impacts of Climate Change on Agriculture
Crop Plants and Livestock are inherently affected by:

- Too much or too little water
- Too high or too low temperatures
- The length of growing season
- Seasonal variation
- Other climatic extremes

Agriculture is especially vulnerable

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Length of Growing Period

Rwanda and neighbours

Source: ILRI, 2006, Mapping climate vulnerability and poverty.

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More than 5% reduction in length of growing period.

Over next 100 years?

Source: Ericksen et al Mapping hotspots of climate change and food insecurity in the global tropics
Growing Season Temperature
1980 -2008

Climate Change in the UK

Variation in farm income induced by climate change under high emissions

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High temperatures

Average Annual Max Temp > 30°C by 2050

Source: Ericksen et al Mapping hotspots of climate change and food insecurity in the global tropics

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Each degree day spent above 30 °C reduced the final yield by 1% under optimal rain-fed conditions by 1.7% under drought conditions.


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Maize is highly vulnerable

Grain-filling stage

Risk of drought
- High
- Low
- Medium
- Very High
- Very Low
- Default

High Inputs

CIMMYT. Atlas of Maize in Africa. CIMMYT, Mexico
www.ifpri.org/sites/default/files/publications/atlasafricanag_all.pdf

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Drought and Almonds in California, 2014/15

Over 80% Global Production, Value over $4bn

Groundwater Depletion and Aquifer collapse

Sources: Almond Board of California, USDA

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Russia

• Severe heatwave in 2010
• 30% of grain crops lost to burning
• $15bn total loss

Pakistan

• Worst floods in 80 years
• Submerged 1/5th of the country,
• Including 14% of Pakistan’s cultivated land
Farmers are especially vulnerable

- **Millions of Farmers in developing countries:**
  - are small smallholders with <1ha
  - are poor <$1 a day
  - cannot feed their families
  - are highly vulnerable to extreme climatic events

- **In developed countries, many farmers:**
  - struggle to make a living
  - depend on subsidies and insurance payouts
  - and are also highly vulnerable to extreme climatic events

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• 80% of population in sub-Saharan Africa is rural

• 70% of these depend on food production (crops or livestock) for most of their livelihoods.

• In SSA rural poverty accounts for 90% of total poverty

• Small-scale farming provides most of the food produced in Africa

Employs 60 – 70% of working people.

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Farmer Associations are a source of strength

Farmer Associations
Cooperatives
Cereal Banks
Contract Farms
Outgrowers
Sustainable Intensification
We have to Intensify

- Agricultural land is becoming severely degraded
- Water for agriculture is becoming scarce
- We have to produce More with Less
- Greater productivity but minimised environmental footprint

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But it has to be sustainable

- With efficient and prudent use of inputs
  - Pesticides, herbicides, fertilisers

- Adapting to Climate Change
  - Ecological, genetic, Socio-economic approaches

- Minimising emissions of Greenhouse Gases
  - Methane, nitrous oxide, CO₂

- While increasing natural capital and environmental services
  - Soil moisture, natural enemies of pests

- Strengthening Resilience

- Reducing environmental impact

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Adaptation
Multiple Potential Approaches to Adaptation

- Sustainable Agro-ecological Intensification
- Sustainable Genetic Intensification
- Sustainable Socio-economic Intensification
- Sustainable Integration
- Use ecological principles to design adaptive agricultural practices
  
  e.g.
  - Agroforestry
  - Integrated Pest Management
  - Organic farming

Intercropping maize and legume
Benefits

- 8.75 to 10 ton/ha wheat
- Crop establishment cost £245 down to £36/ha
- Fuel use 96 to 43 l/ha
- No wind erosion
- No moisture stress
- Elimination of black grass
Conservation Farming
Zambia

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• **Plants more nutritious**
  – carbohydrate and protein
  – micronutrients (Vit A, iron, zinc)

• **Plants more resilient to**
  – pests and diseases
  – climate change

• **Plants more efficient at**
  – converting sunlight to food
  – taking up nitrogen from the atmosphere
  – using water
Orange Fleshed Sweet Potatoes

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Drought Tolerant Maize

An attendant displays KDV1 drought-tolerant seed at the Dryland Seed Company shop in Machakos, Kenya.

Florence Sipalla, CIMMYT
Sustainably Intensifying the links between farmers and markets

Kenya

Sussex

Tanzania

Ethiopia

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URBAN LIVELIHOODS

NATIONAL MARKETS

REGIONAL MARKETS

INTERNATIONAL MARKETS

ASSUMED RISK

ADAPTATION & RESILIENCE

MITIGATION

ADDED VALUE

NUTRITION

WASTE

LAND TENURE

FOOD PRODUCTION

RURAL LIVELIHOODS

RURAL DEVELOPMENT

RESEARCH & DEVELOPMENT

Value Chains

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• Contingency plans and adaptive measures need to be taken.
• Anticipatory, proactive approaches are better than reactive approaches.
• There is need for large-scale publically funded and supported adaptation initiatives.
• But we need to build on local initiatives
Increasingly frequent and severe droughts, floods, and storms

Fertile lowlands good crops but can be destroyed during flood

Highlands good crops of maize and cassava during flood years, but less productive otherwise

http://www.geog.ox.ac.uk/research/landscape/projects/adapтив... Imperial College, London
The Dynamics of Resilience

[Diagram showing the stages of development in response to stress or shock: Anticipate, Prevent, Tolerate, Recover, Restore, Learn.]
How do we build Resilient Livelihoods?

Farmer Innovation in the Sunderbans India

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Integrated Approaches
Integrated Approaches

• **Integrated Pest Management (IPM)**
  Combines modern technology, the application of synthetic, yet selective, pesticides, and the engineering of pest resistance with natural methods of control.

• **Integrated Soil Management (ISM)**
  Combines organic approaches with a prudent use of necessary inputs, through microdosing water and fertiliser.

    **On Africa’s depleted soils,**
    production cannot be increased and maintained without bringing nutrients in from the outside, either through livestock manure, mineral fertiliser or cultivation of legumes.

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Global Soils are Degrading Rapidly

Land degradation hot spots cover about 29% of global land area, inhabited by 3.2 billion people.


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Africa’s Soils are Degrading Rapidly

For SSA land degradation hotspots affect 26% of the land area

The economic loss is about $68 billion a year affecting 180 million people

A Healthy Soil is strong in Structure
With an optimal mix of large and small particle sizes
Providing good permeability and water holding capacity.
It is highly fertile with rich humus and sufficient nutrients for high yields
It is also rich in soil biota and contains no pollutants.

REPAIR, RESTORE, ENHANCE AND CARE
CLIMATE SMART AGRICULTURE

- Provides adaptation and resilience to shocks
- Generates adaptation and mitigation as co-benefits
- Is a location-specific and knowledge-intensive approach
- Provides integrated options that create synergies and reduce trade-offs
- Identifies barriers to adoption and provides appropriate solutions
- Strengthens livelihoods by improving access to services, knowledge and resources
- Integrates climate financing with traditional sources of agricultural investment

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Soil Pit
Chimoio, Mozambique

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Targeted Fertilisers
Mozambique

Blended N, P, K, Zn, Mo, Bo, S
Plus Lime

4-6 tons / ha

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Precision Farming

Phosphorus Deficiency

http://www.willingtoncropservices.co.uk/

Harper Adams University

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Combining Conservation Agriculture with Microdosing

Conservation Agriculture

Microdosing

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Mitigation
Agriculture is a Significant Emitter of GreenHouse Gases

- Agriculture emits nitrous oxide, methane and carbon dioxide.
- Nitrous oxide and methane are 300 times and 35 times respectively as powerful in contributing to global warming as carbon dioxide.
- Cultivation of the soil can reduce the carbon containing humus.
- The cumulative historical loss of carbon dioxide from agriculture is between 50 and 78 Gt of carbon dioxide.

AGRICULTURE HAS A POTENTIAL ROLE IN MITIGATION

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GHGs and Agriculture

GLOBAL WARMING

GREENHOUSE GASES

CARBON DIOXIDE +VE

CARBON DIOXIDE -VE

NITROUS OXIDE

METHANE

BURNING

ALL CROPS

RICE

LIVESTOCK

CROP STRAW

FORESTS

GRASSLANDS

NITROGEN-FIXING CROPS AND TREES

INTEGRATED SOIL MANAGEMENT

FERTILISER AND SOIL NITROGEN

NITROGEN

SOIL CARBON SEQUESTRATION

Agriculture’s impact on climate change

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• Key is Soil Organic Carbon (SOC)
• SOC lost due to agricultural practices
• Can be put back
  – Conservation farming
  – Agroforestry

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Incentives
• Despite the considerable potential gains
• Uptake of ISM in Africa remains low
• Many factors affect farmers decisions
• Too often the choice is made to forgo better land management practices in lieu of more affordable, less labour intensive or alternative uses of resources
• We need stronger incentives and better information
There is a need to scale-up funding

- Development organisations, governments and the private sector need to devise new financial and programming instruments to address these challenges.

A good example is IFAD’s ASAP programme:

- World's largest climate change adaptation programme focused explicitly on smallholder farmers;
- More than USD 300 million channelled to at least 8 million smallholder farmers to build their resilience to climate-related shocks and stresses;
- Financed by IFAD and the governments of Belgium, Canada, Finland, Netherlands, Norway, Sweden, Switzerland and United Kingdom.
Countries have agreed to publicly outline in their INDCs what actions they intend to take under a global agreement well before the Paris Summit.

Their form and rigor will largely determine whether an ambitious 2015 agreement will be achieved.

It is crucial that INDCs address both options for adaptation and mitigation in agriculture.
**Intended Nationally Determined Contributions (NDCs)**

- Eg

- Country X will agree to plant ???mha of Faidherbia agroforestry.

- They will be rewarded on the basis of estimates of:

  1. The adaptation contribution
  2. The reduction in methane and nitrous oxide emissions
  3. The carbon sequestered

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Political Leadership and People
It Is All About People

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Thank you

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