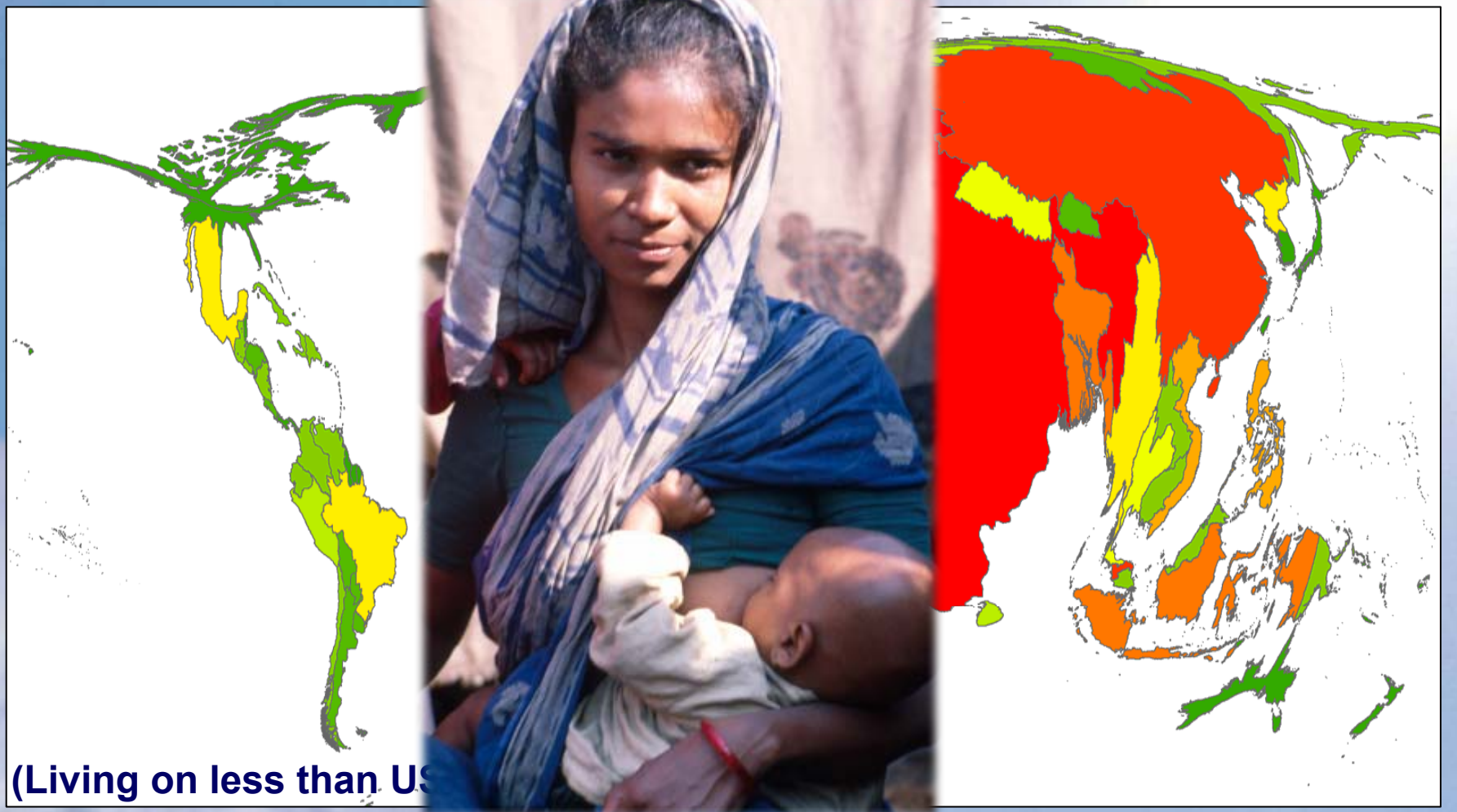
Preparing for the worst: a winning approach

Robert S. Zeigler

on behalf of the

Alliance of the CGIAR Centers

While much better off than 25 years ago, many in the world remain poor…



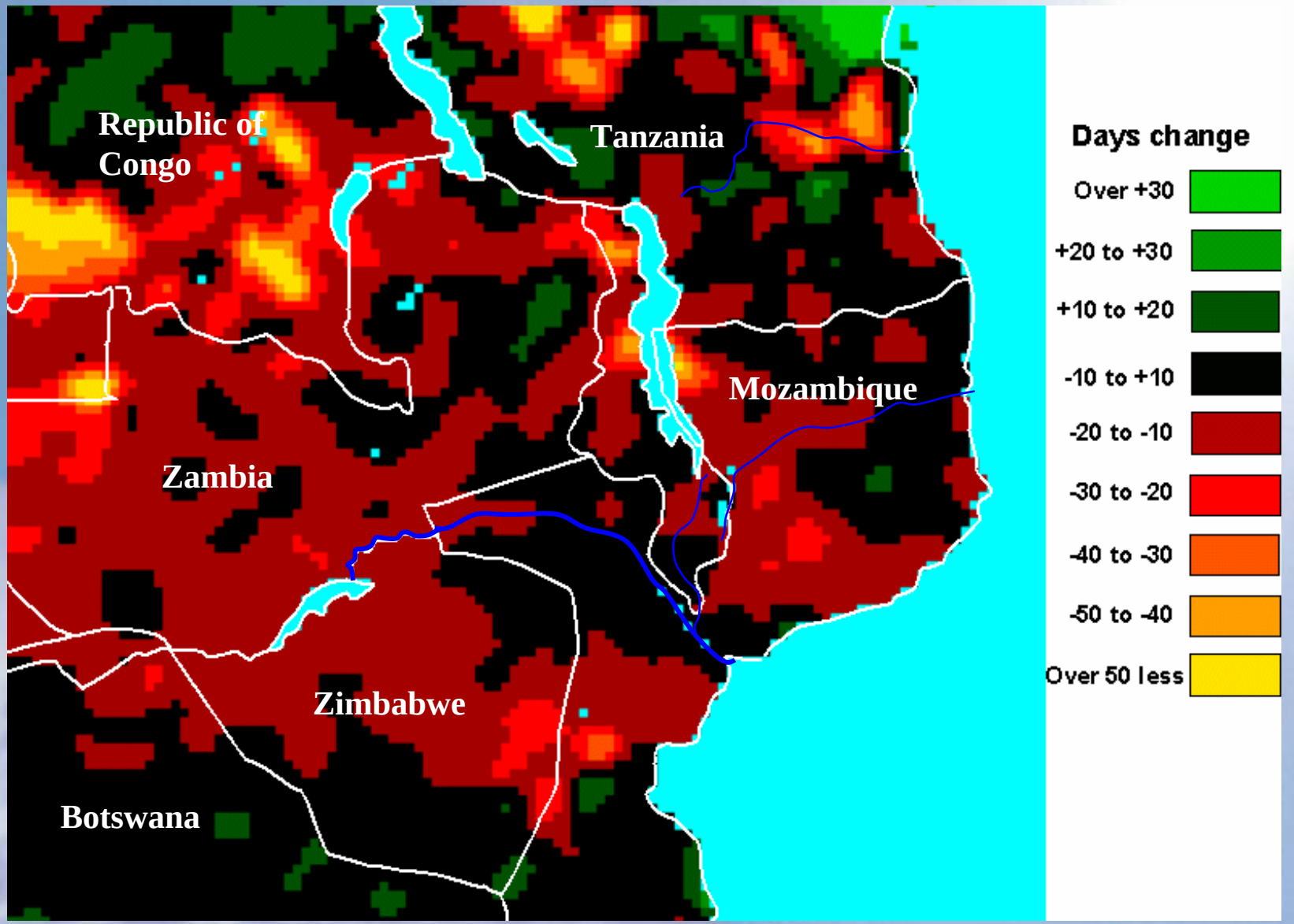
…and, here is where they are - in Asia and Africa

What can we expect from our future climate?

- More CO_2
- Warmer
- Wetter
- Violent storms
- Sea-level rises
- Flooding

Agriculture in the Tropics – where most poor people live – will be affected most

Change in growing season 1975 - 2055



PG Jones, CIAT Land Use Project, March 2004

Two questions:

Why is climate change research relevant to the agriculture development community?

Why is research in agriculture in developing countries relevant to the climate change community?

The short answers:

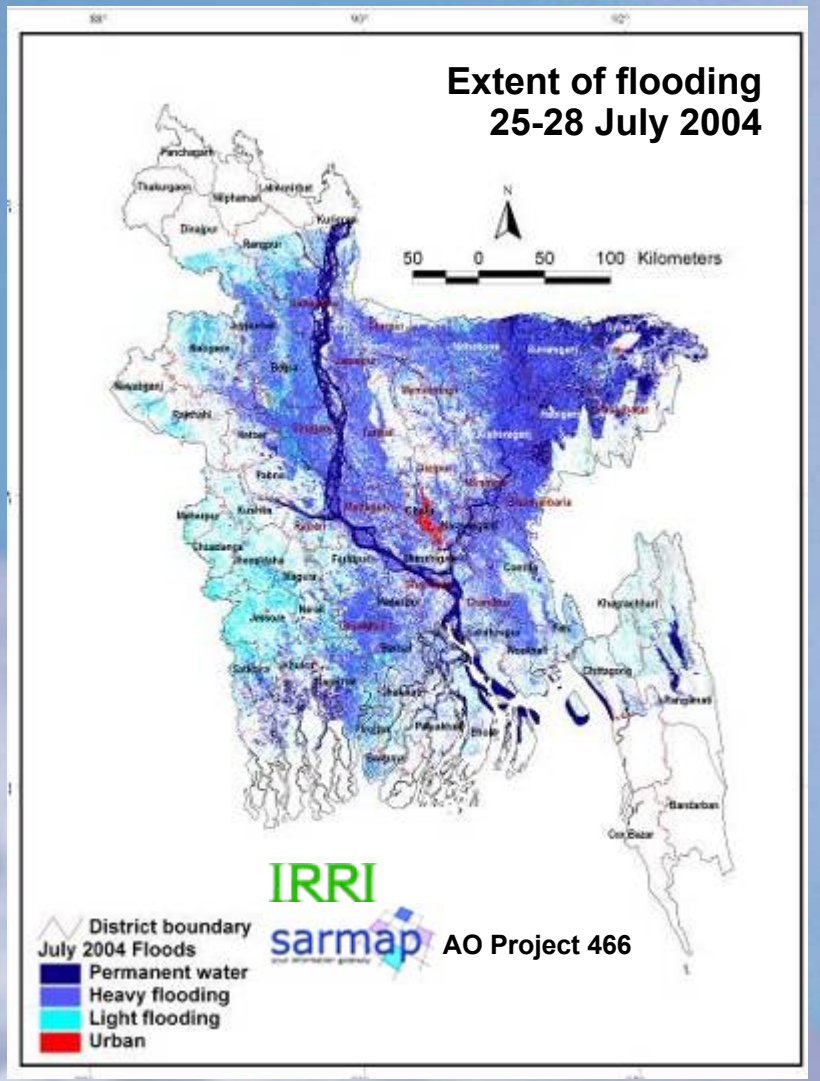
- **Climate change relevance to agriculture and development?**
  - poor, especially the rural poor, are the most vulnerable…coastal and monsoonal Asia, continental Africa…food prices
- **Agriculture and development relevance to climate change?**
  - massive changes in land use, drivers of urbanization, consumption patterns…GHG emissions, particulates

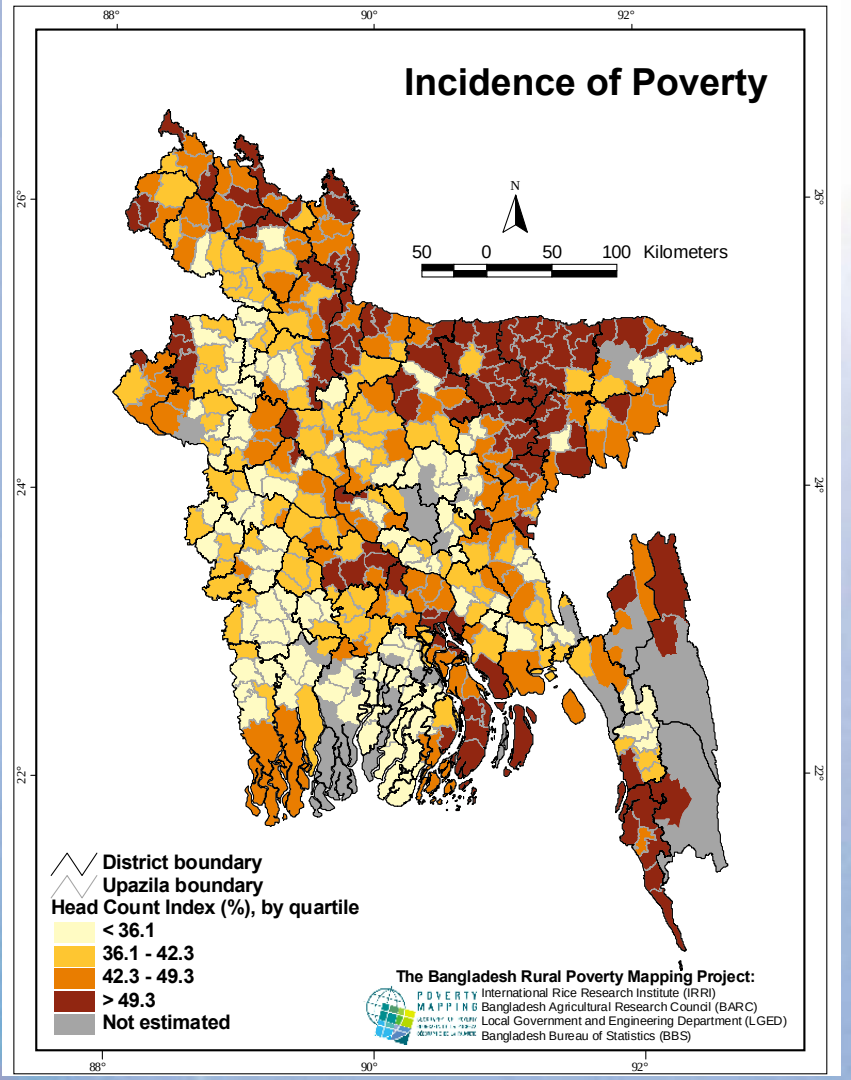
Is a focus on climate change a distraction from our core mission?

- Adequate and affordable food supplies will have to be produced by crops compatible with future climate and weather
- The poorest people in the world live in areas most likely to be hardest hit by extreme weather
- Changes in farming practices in developing countries will have an important impact on greenhouse emissions

NO!

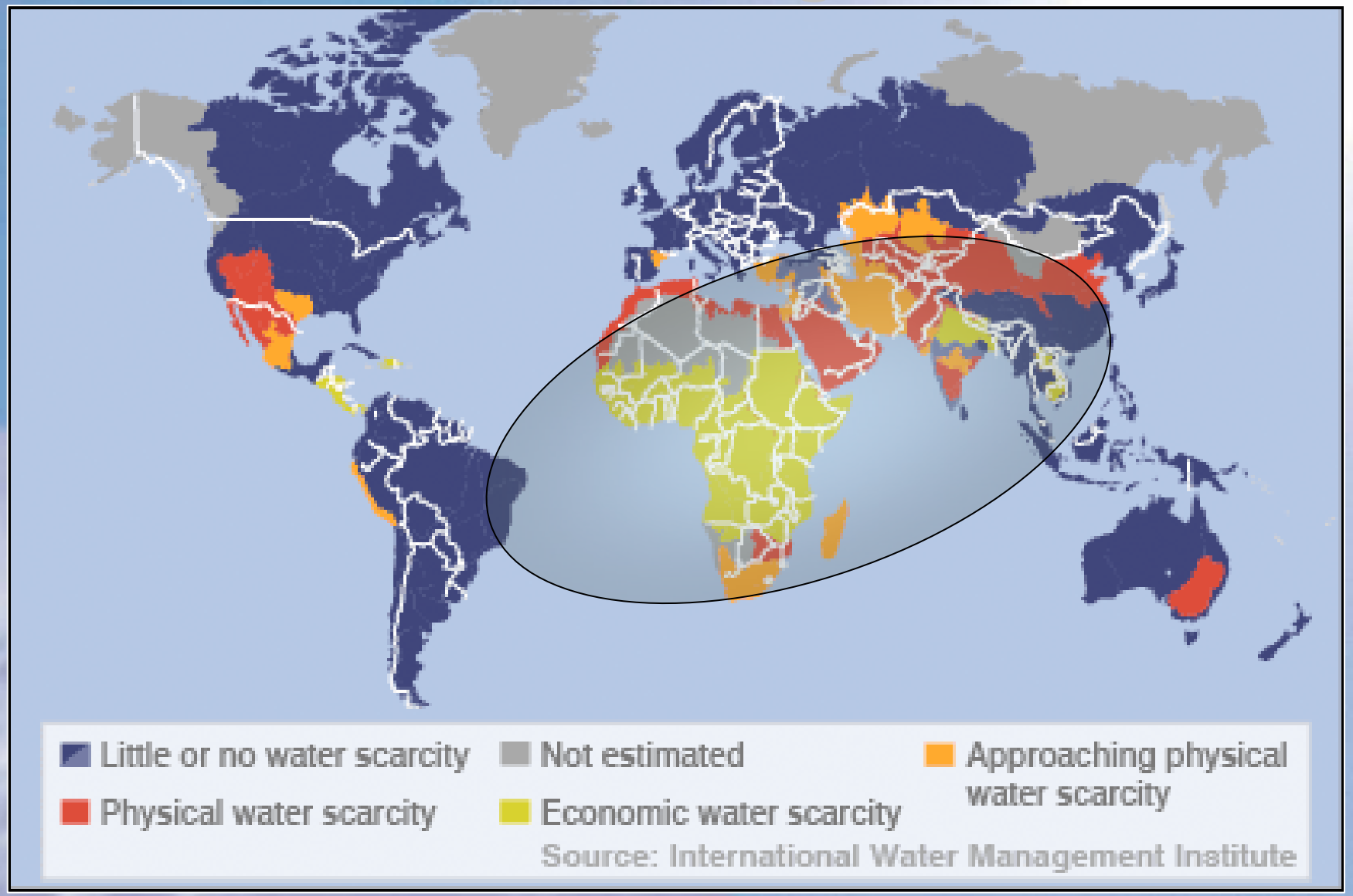
Flood-affected areas and poverty (Bangladesh 2004)



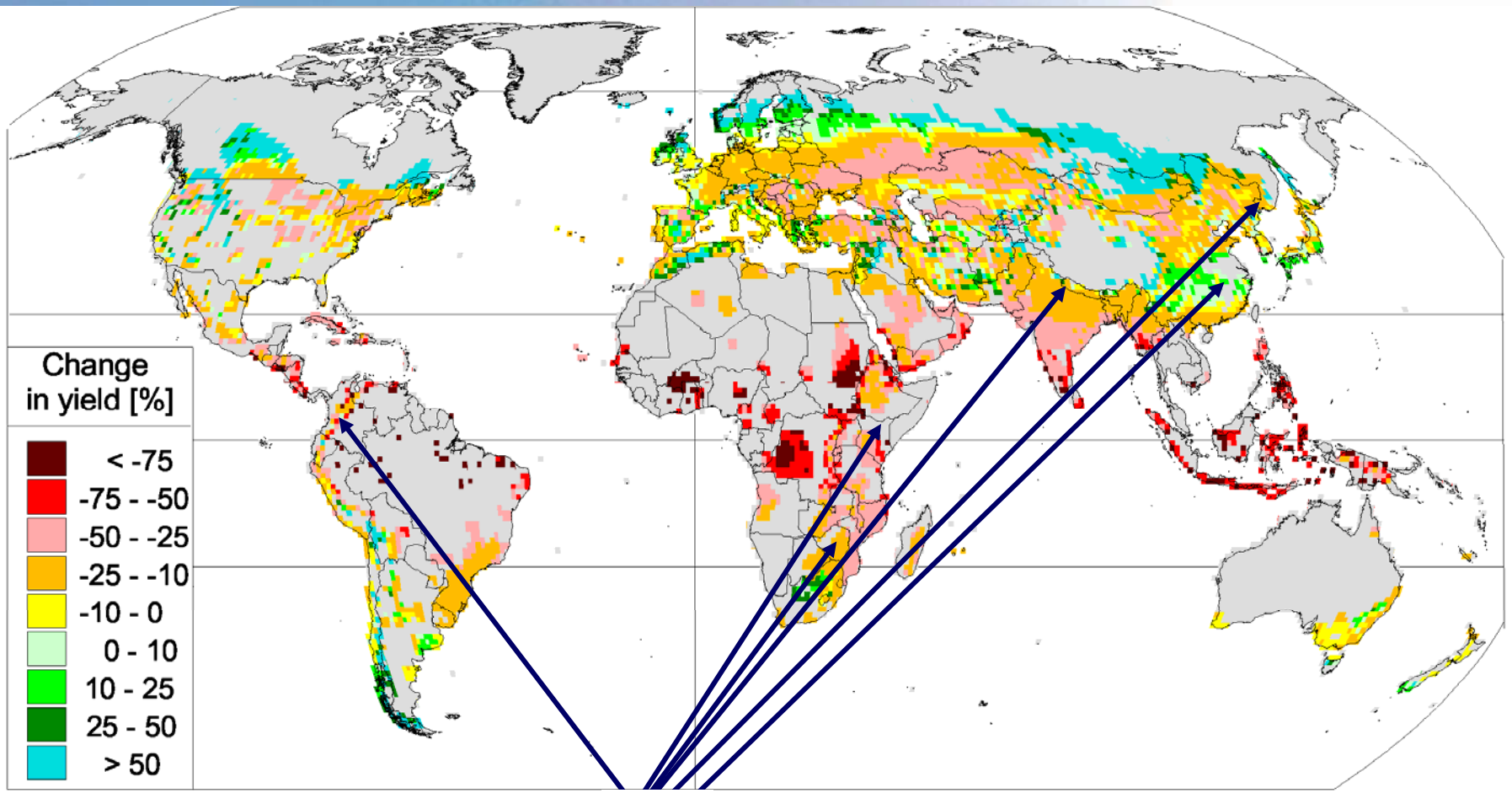


Data source: own estimates

Water scarcity… poverty… climate change



Predicted effect of climate change on potato yields by 2050

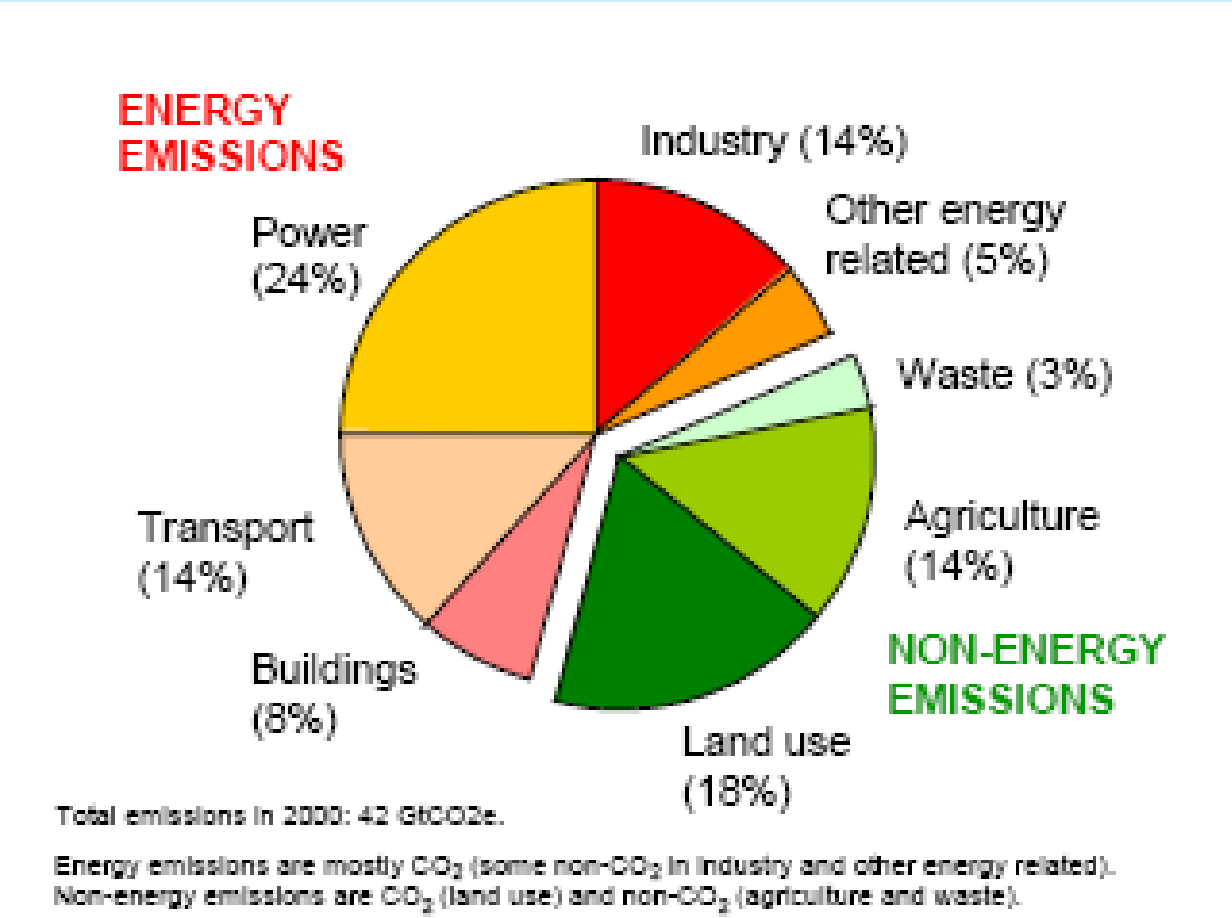


Negative where it is a staple for the poor

CIP / R. Hijmans

Agriculture and land use account for one-third of GHG emissions

Figure 1 Greenhouse-gas emissions in 2000, by source



Source: Prepared by Stern Review, from data drawn from World Resources Institute Climate Analysis Indicators Tool (CAIT) on-line database version 3.0.





Land use patterns changing dramatically

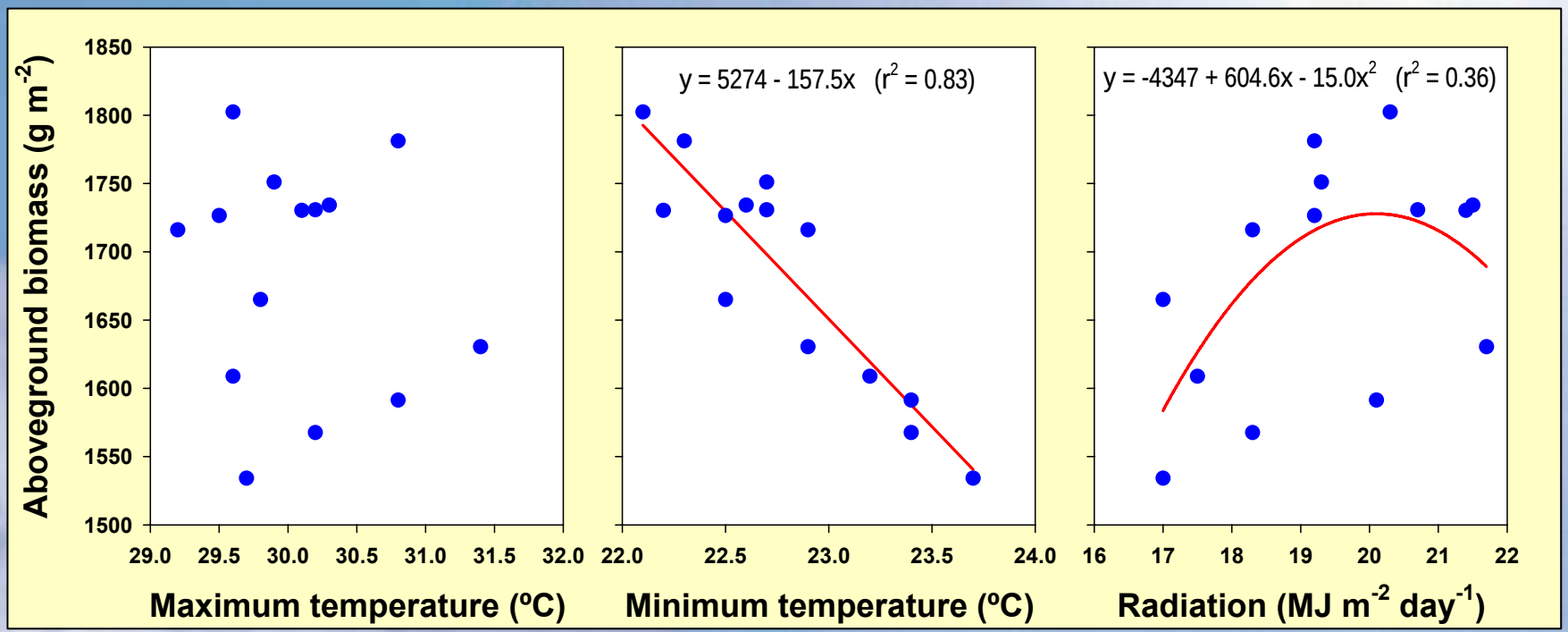
- Urbanization
- Economic growth
- Deforestation
- Water shortages and competing priorities
- Changes in dietary preferences
- Competition for biofuels

What needs to be done?

- **MITIGATION** = monitor, predict and reduce impact of systems changes on GHG emissions
  - *Evaluate increasing practices on GHG emissions*
  - *Develop alternative resource management practices*
  - *Link to global assessments and modeling efforts*
- **ADAPTATION** = maintain food security and minimize impact on poverty and environment
  - *Breeding crops and animals that can withstand environmental changes and extremes*
  - *Changing/improving crop, pest, systems and resource management*
- **IMPACT ASSESSMENT** = quantify global mitigation alternatives in terms of impact on human well-being in developing countries
  - *Contribute to policy development*

From the beginning…

1961: first experiment on the effect of high temperature on grain filling in rice (IRRI)



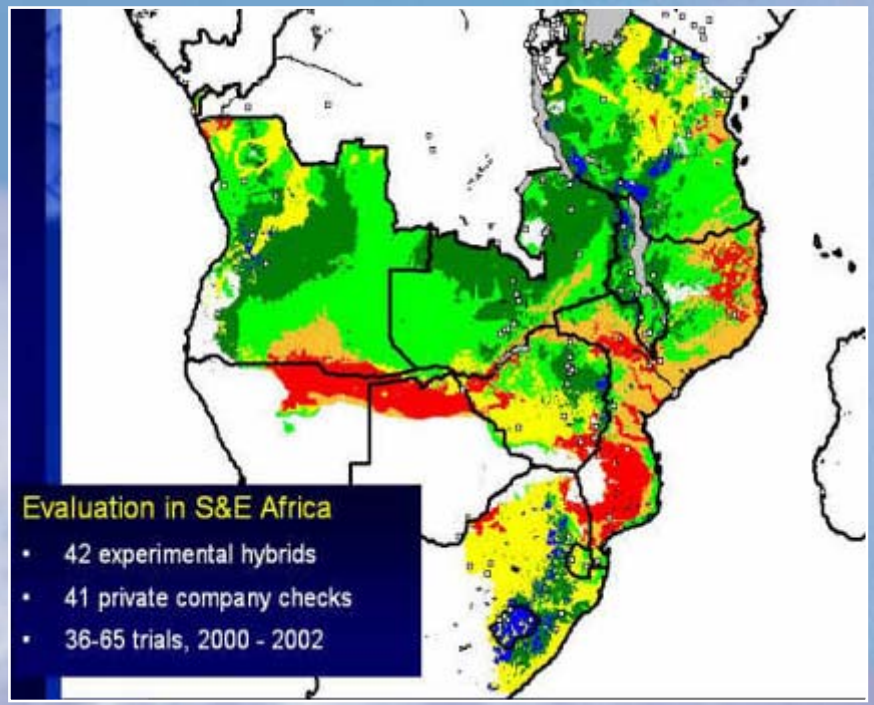
1992 – 2005 decrease in rice yields associated with increasing night temperatures

Developing “climate-ready” crops

- Understanding of crop biology and genetics
- Ability to integrate that understanding into a breeding program
- Capacity and penetration to enable the adoption of the crops

Drought tolerance in maize for southern Africa

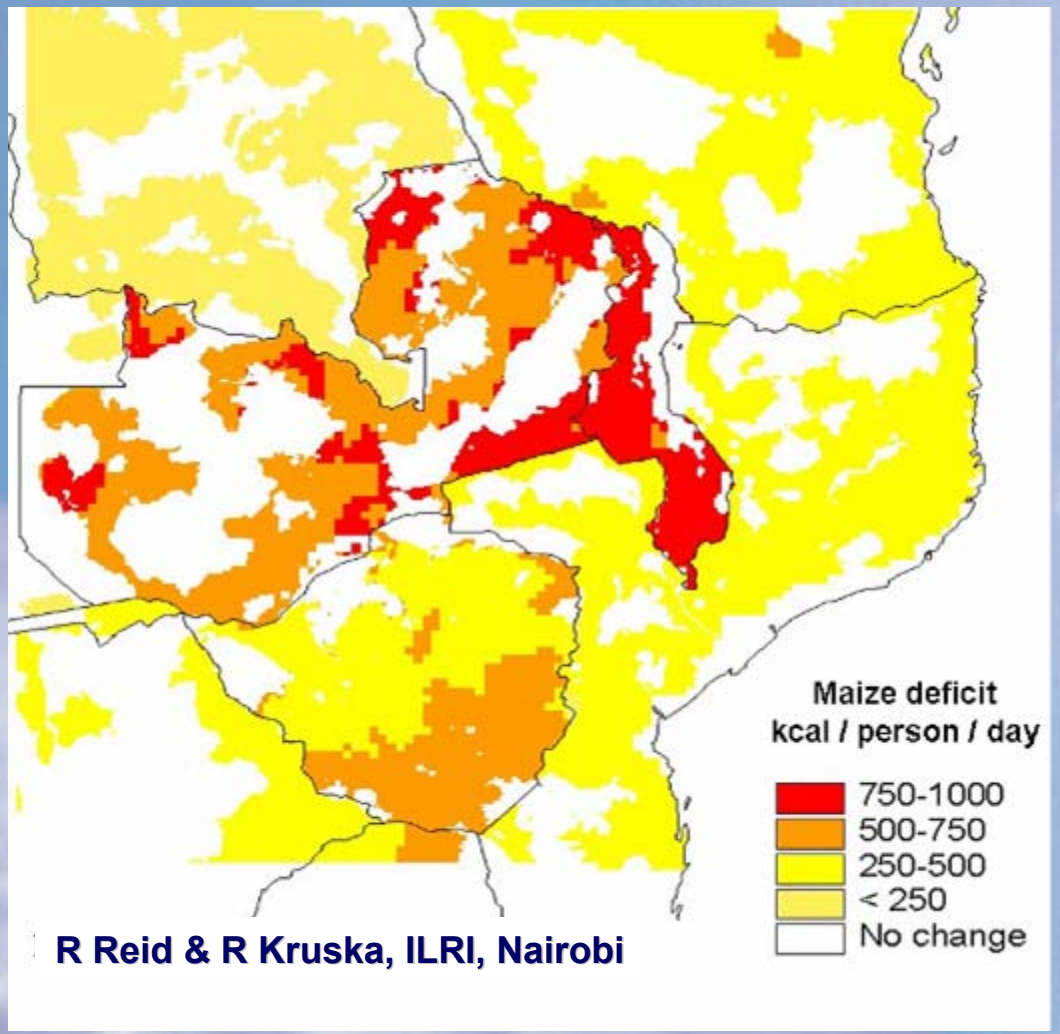
A comprehensive approach…



…can produce climate-ready crops and systems

Courtesy of the Banziger team from CIMMYT in southern Africa

CIAT + ILRI (looking at maize in E & S Africa)



R Reid & R Kruska, ILRI, Nairobi

The combination of climate change and population growth will have markedly different effects both within and between countries:

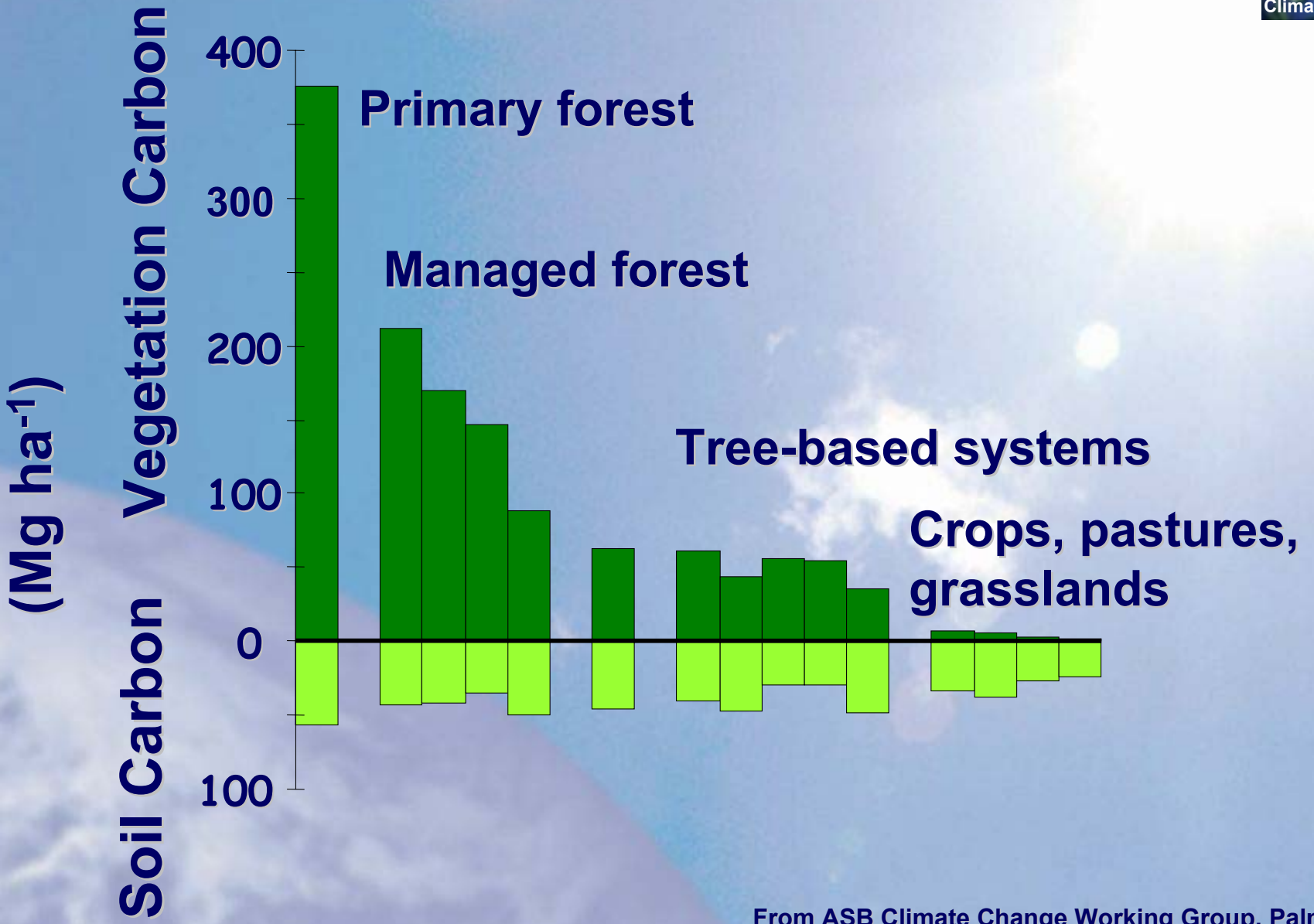
Mozambique and southern Tanzania, partly because of their greater reliance on cassava, show small kcal deficits

Almost all of Malawi and large areas of Zambia could be badly affected

Next steps: model complete crop/livestock systems to elucidate these interactions

P Jones (CIAT) and P Thornton (ILRI)

Agroforestry in the humid tropics and carbon stocks



From ASB Climate Change Working Group, Palm *et al.*

Long-term experiment to assess effect of converting continuous rice to rice–maize

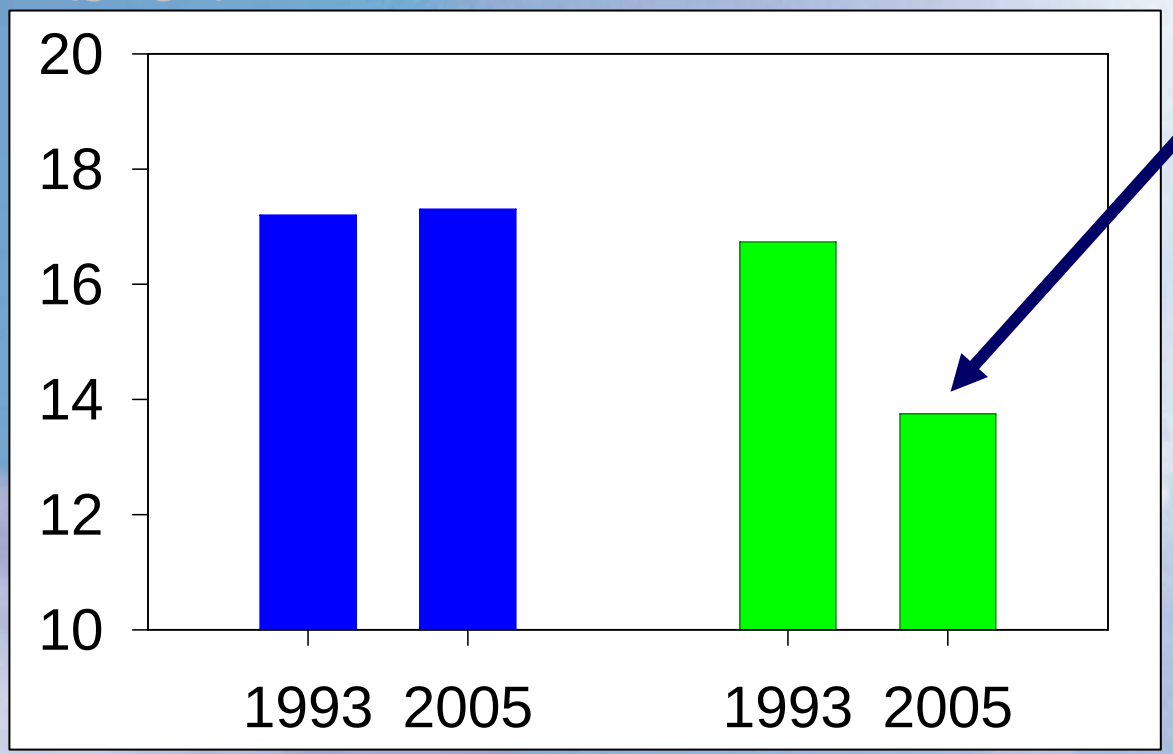
Start: 1993
Design: Split-split plot with 4 reps
Location: IRRI, Los Baños, Philippines

Dry season

Wet season

(IRRI, Los Baños, full fertilization, residue removed, conventional tillage)

Decrease in soil C 12 years after conversion from continuous rice to a rice-maize rotation



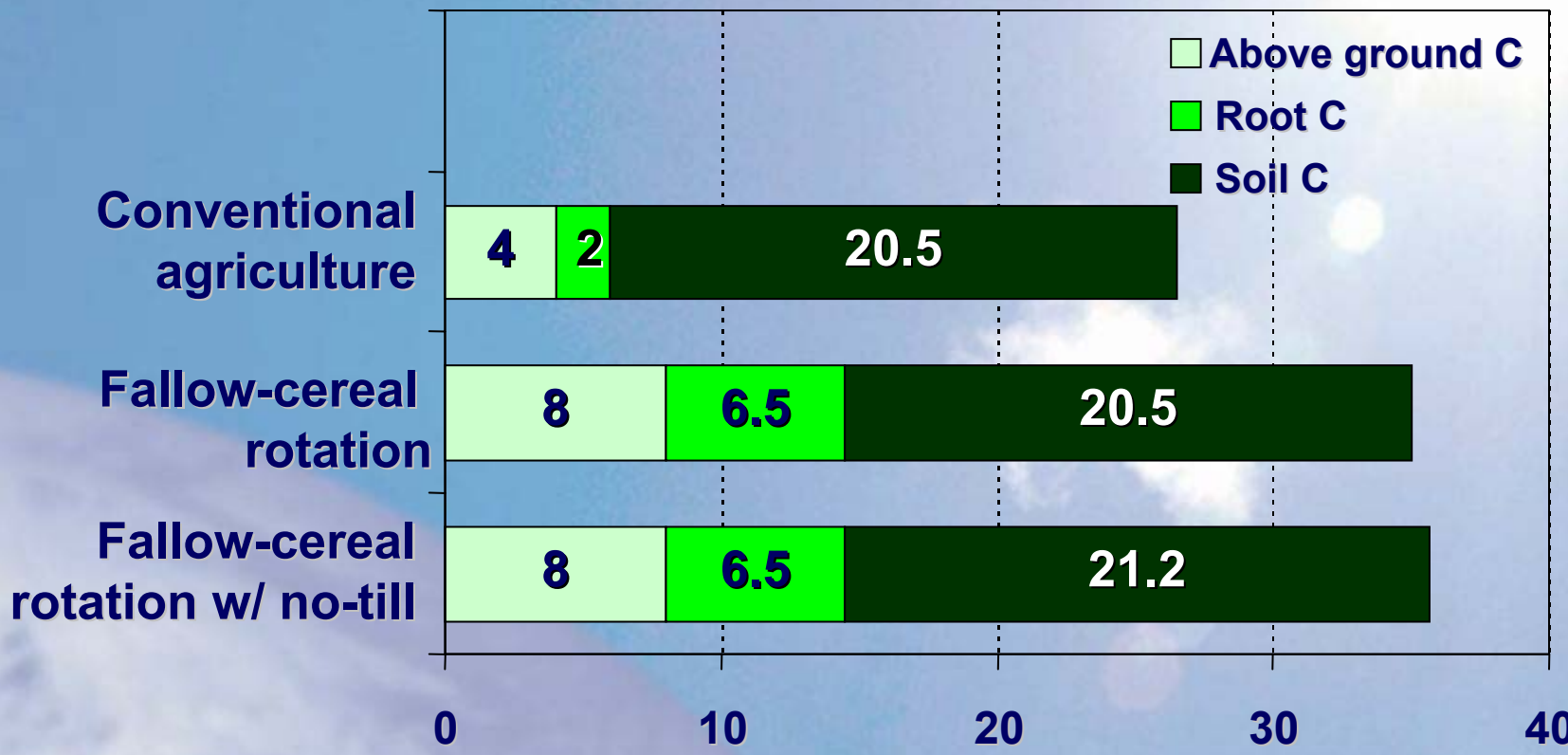
25% of soil carbon to atmosphere

What is happening to nitrogen?

Converting a carbon sink into a carbon source?

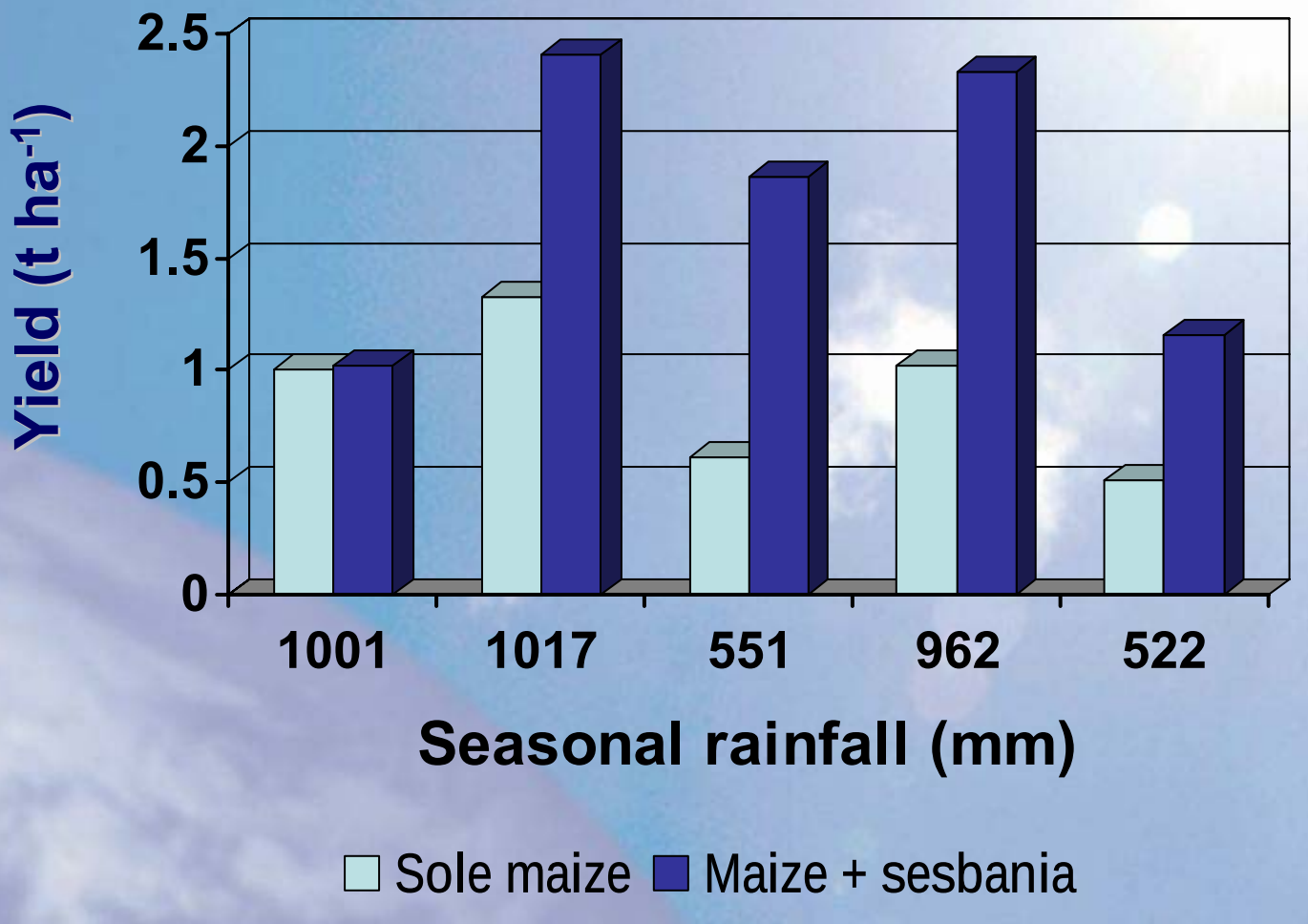
R Buresh / IRRI

Improved C storage through improved fallow systems



A. Albrecht/WAgFor

Fertilizer tree agroforestry increases yield resilience in drier climates

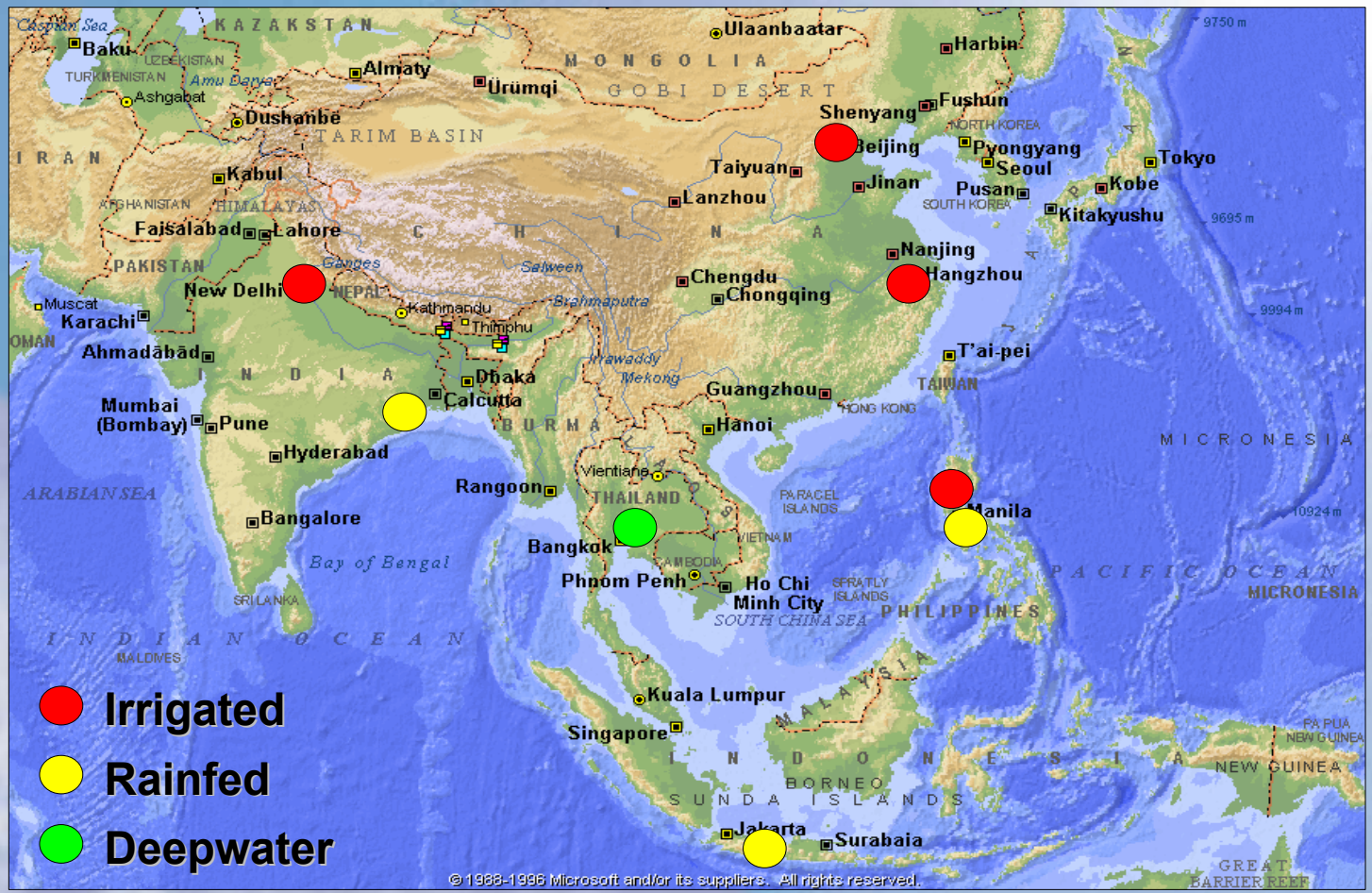


Malawi, WAgFor

Policy support for adaptation and GHG mitigation

If governments are to make policy changes that affect the lives of hundreds of millions of people, they will need solid data and decision tools

IRRI project funded by UNDP/GEF on methane emissions from rice fields (1993-1999)



IRRI project funded by UNDP/GEF on methane emissions from rice fields (1993-1999)

- Early 90s: rice production estimated to be a major source of methane
- IRRI quantified this source and provided better data for GCMs
  - *tropical irrigated rice was far lower a source than assumed in GCMs*
- Important lessons
  - *assumptions must be validated*
  - *there are few sources of data for the tropics*

Who can generate these data for the medium and long term?

CGIAR Climate Change

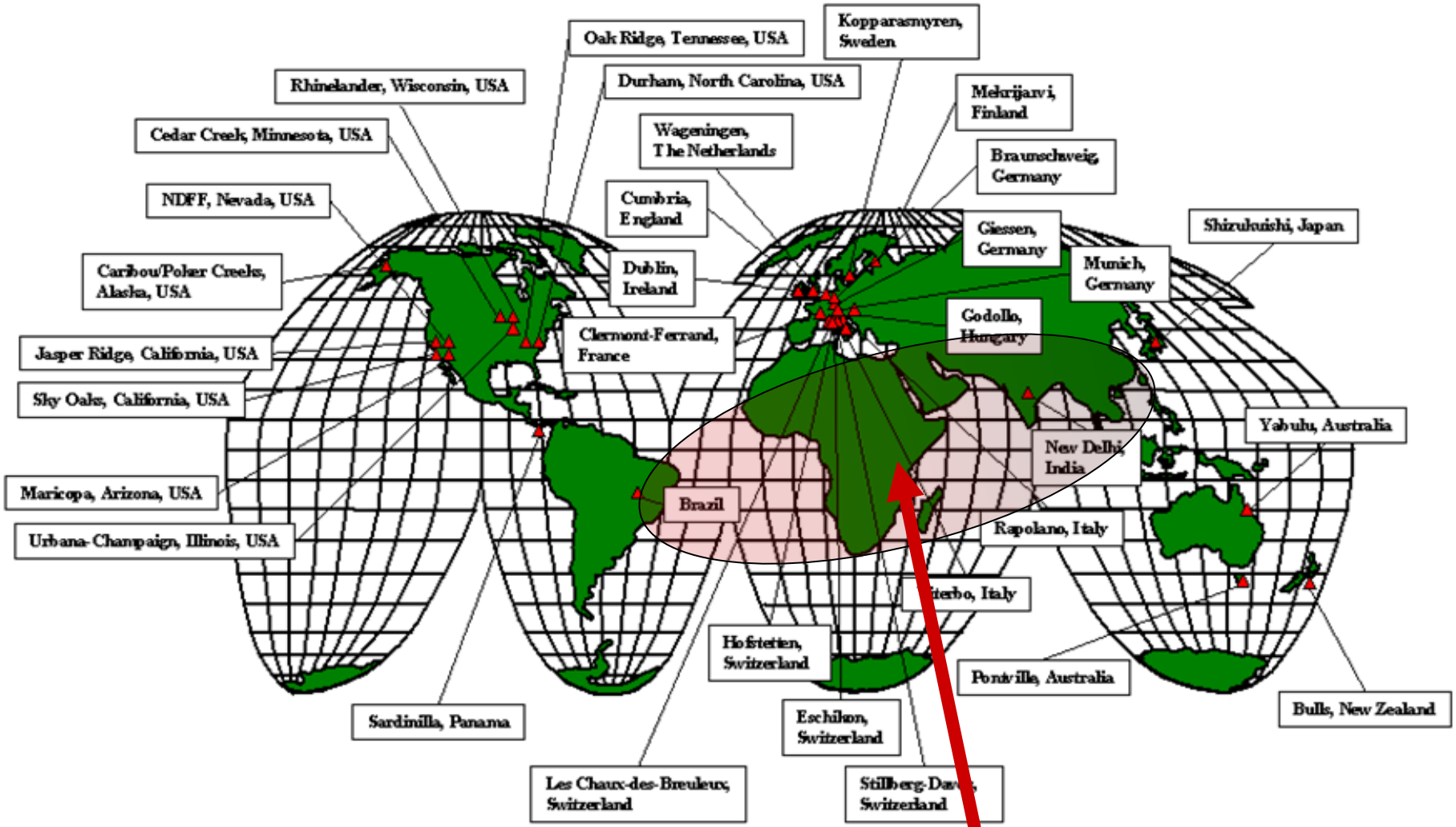
Field set-ups at IRRI for recording:

a) impact of enhanced CO_2 levels in 'Open Top Chambers'

b) impact of UV-B radiation on rice yields

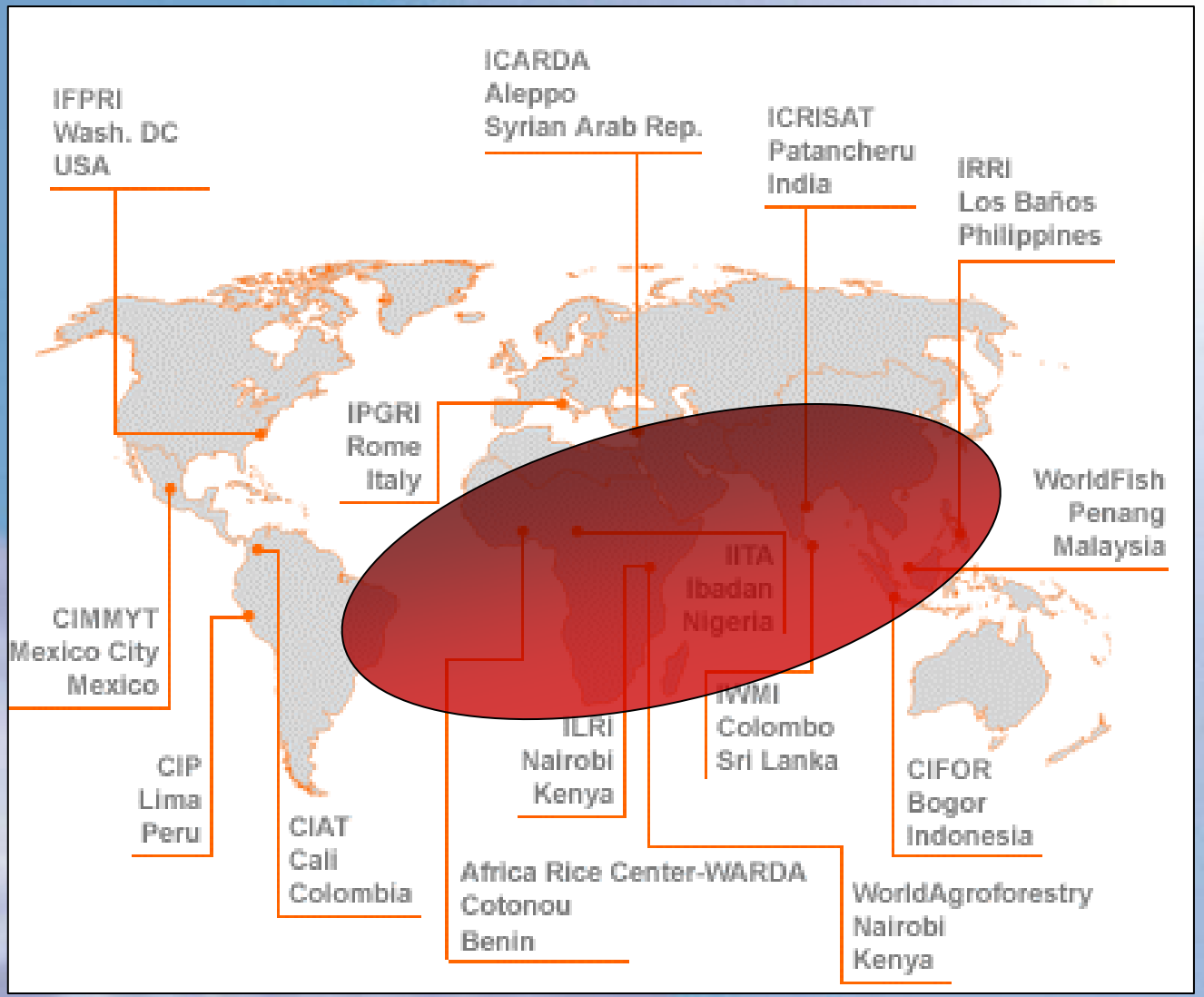
c) methane emissions using an automatic measurement set-up

Distribution of monitoring stations for FACE (Free Air CO_2 Enrichment) projects



Remember our poverty concentrations?

The IARCs and partners are where the action is



Compelling convergence

Required traits for improving productivity in rainfed systems:

drought, submergence, and salt tolerance

For African systems:

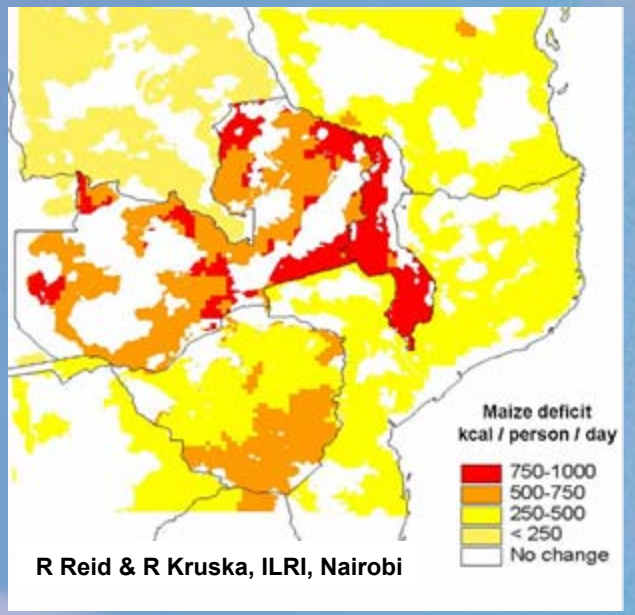
drought, submergence, and salt tolerance

For adaptation to climate change:

drought, submergence, and salt tolerance

A carefully defined research agenda can address a wide variety of globally important issues

What do these examples tell us?



The work of the IARCs is relevant

There is the opportunity to fill a serious gap in the global climate change agenda

HOWEVER

A serious climate change program relevant to development must be:

- long-term
- forward-looking
- securely funded
- focused

Why now?
Urgency of the situation!

- **The global community is demanding action**
  - Compelling reviews, reports, and calls to arms are emanating at an accelerating pace
    - *Stern Review* (October 2006)
    - *UNDP Human Development Report* (November 2006)
      - "…support for adaptation to climate change in developing countries is piecemeal and fragmented. The multilateral response has been woefully inadequate, highlighting wider failures in the way that global governance systems are responding to global problems."
      - "Climate change now poses what may be an unparalleled threat to human development."
- **The longer we wait, the more difficult the situation we will face**

A formal global partnership between the international agricultural research community and the global climate change community

- **Revolutionary**
- **What form should the agenda take?**
  - ***The GCC community and the CGIAR must align goals and priorities***
  - ***To meet in late February***
  - ***Framework for integration***

THANK YOU

Alliance
of the CGIAR Centers