



# **Reflections on Science, Poverty & Inequality**

**Ismail Serageldin**

**2019**



# Outline

- **Prologue: Science & the SDGs**
- **Diagnosing Poverty**
- **Measuring Income & Wealth**
- **Measuring Poverty**
- **Measuring Inequality**
- **Extreme Poverty and Hunger**
- **Climate Change & its Impacts**
- **Conflicts**
- **Assessing the Challenge**
- **What Science can do**
- **Science and the transformation of Agriculture**
- **On Building Resilience**
- **Conclusions**
- **Envoi**



# **Prologue: Science and the SDGs**





**Science  
Can Feed  
The  
Hungry...**



# Heal the Sick





# Protect the Environment





# Ensure the Dignity of Work





# Connect the World





# The Joy of Self Expression





**Science and Technology (S&T)  
Can Do So Much...**











# SUSTAINABLE DEVELOPMENT GOALS






Our World  
in Data

 = Indicators for which recent global official metrics are available, or for which alternative good-quality cross-country source are available (e.g. estimates from independent research institutes).

 = Indicators that do have official metrics, but for which available data is very incomplete or outdated. Yellow boxes also mark Indicators for which there are no official metrics, but for which closely related estimates are available that allow informative but imperfect monitoring.

 = Indicators for which – to the best of our knowledge – global monitoring is not currently possible.



Licensed under CC-BY-SA to the authors.



1

NO  
POVERTY





# 2 NO HUNGER







**Hunger is  
associated  
with  
extreme  
poverty**



# 10 REDUCED INEQUALITIES





# Diagnosing Poverty



# Diagnosing Poverty

- **On Absolute And Relative Poverty**
- **Deprivation, Dispossession, And Societal Marginalization**
- **Rural And Urban Poverty**
- **Problems Of The Ultra Poor**
- **Social Versus Economic Policies, Programs And Projects**



# Diagnosing Poverty

- **On Absolute And Relative Poverty**
- **Deprivation, Dispossession, And Societal Marginalization**
- **Rural And Urban Poverty**
- **Problems Of The Ultra Poor**
- **Social Versus Economic Policies, Programs And Projects**



# **Absolute and Relative Poverty**

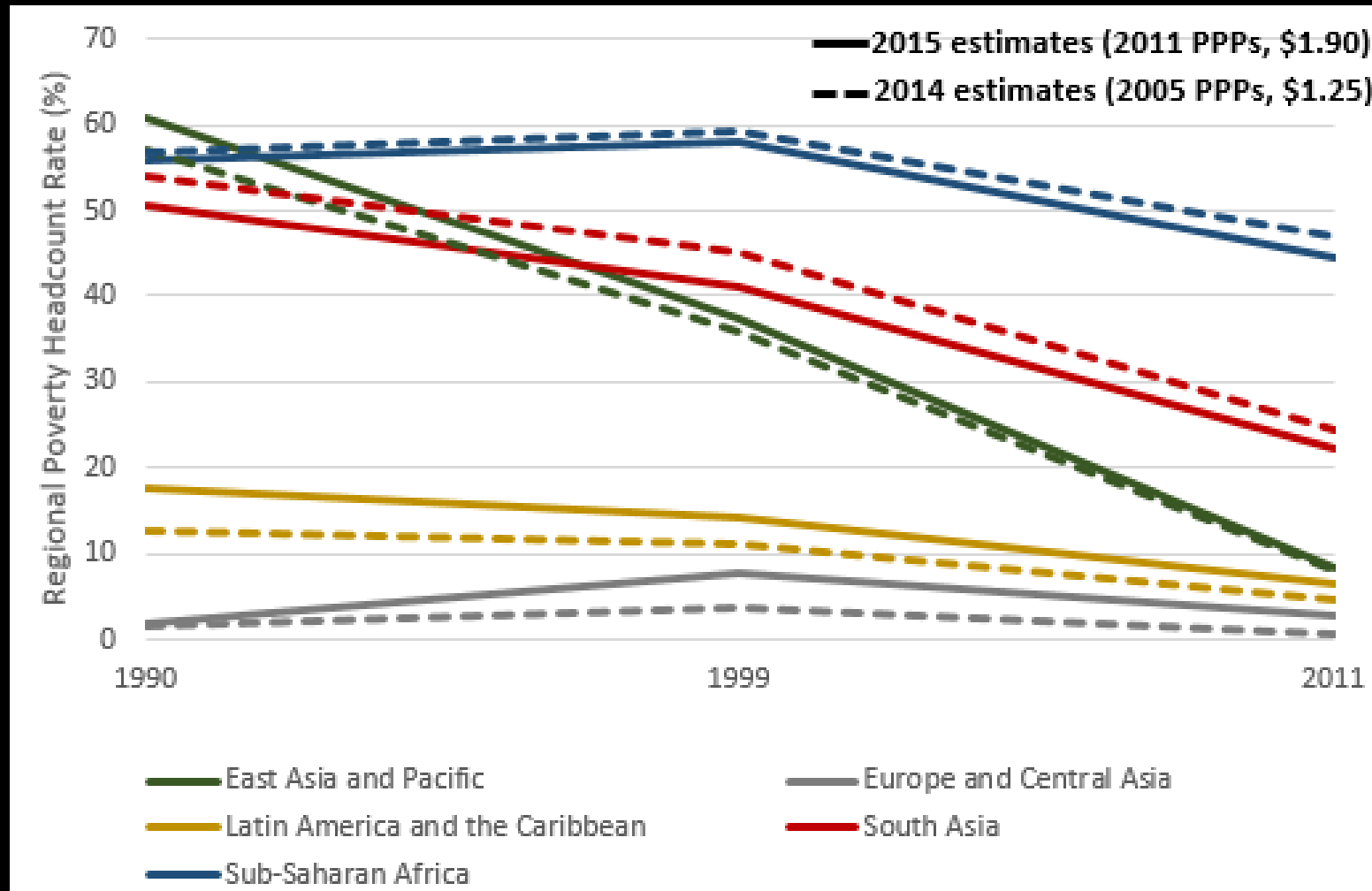


# Absolute Poverty

- **Absolute Poverty** is defined as having income less than the minimum amount needed by a person or household to obtain the basic necessities for living.
- **\$1/day per person** was the benchmark for international comparisons as of 1990.
- It became \$1.25 / day per person in 2005.
- Now it is **\$1.90 /day per person**



# Percent of Population below Regional Poverty Lines





# Relative Poverty

- Varies from society to society
- Sometimes taken as **the lowest 40% of the income distribution** in that country
- Sometimes defined as someone receiving below **60% of the median income**



**But poverty is not just about income or money...**  
**It is more...**



# Diagnosing Poverty

- On Absolute And Relative Poverty
- **Deprivation, Dispossession, And Societal Marginalization**
- Rural And Urban Poverty
- Problems Of The Ultra Poor
- Social Versus Economic Policies, Programs And Projects





**It is not just the absence of income that defines poverty**





**It is marginalization, deprivation and social exclusion**





**Loss of dignity**





**Social Exclusion**

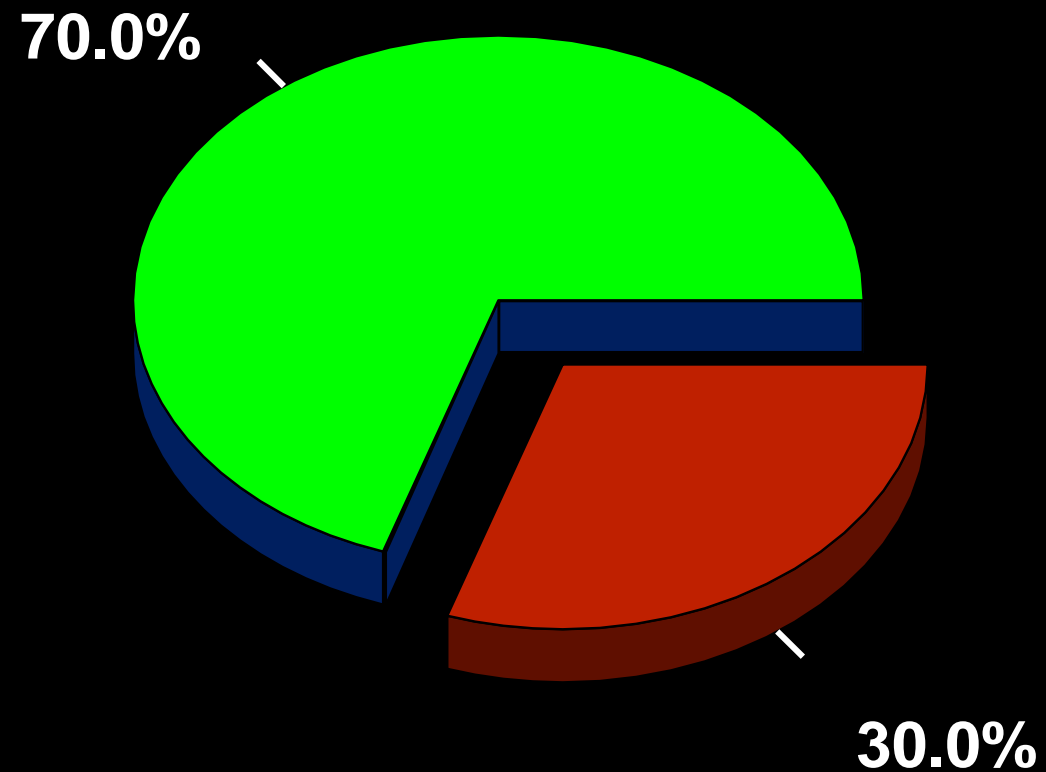


# Diagnosing Poverty

- On Absolute And Relative Poverty
- Deprivation, Dispossession, And Societal Marginalization
- **Rural And Urban Poverty**
- Problems Of The Ultra Poor
- Social Versus Economic Policies, Programs And Projects



# Rural and Urban Poverty in Developing Countries (Income measures)



Source: IFPRI estimate from World Bank data.



# **85% of the Poor live in the Rural Areas**

- The **Multidimensional Poverty Index (MPI)** is applied by Oxford to study the conditions of the world.
- According to the MPI 2014, **85%** of multidimensionally poor people live in rural areas. The MPI suggests that the rural share of poverty is **higher than income poverty estimates of 70 to 75%.**



# Diagnosing Poverty

- On Absolute And Relative Poverty
- Deprivation, Dispossession, And Societal Marginalization
- Rural And Urban Poverty
- **Problems Of The Ultra Poor**
- Social Versus Economic Policies, Programs And Projects



# The Ultra Poor require special help









Copyrighted Material

AN  
INQUIRY INTO  
*Well-Being*  
AND  
*Destitution*

Partha Dasgupta

Copyrighted Material



**PARTHA DASGUPTA**

PROFESSOR OF ECONOMICS, UNIVERSITY OF CAMBRIDGE



**Hunger!**  
**Is associated with extreme poverty**





# Diagnosing Poverty

- On Absolute And Relative Poverty
- Deprivation, Dispossession, And Societal Marginalization
- Rural And Urban Poverty
- Problems Of The Ultra Poor
- **Social Versus Economic Policies, Programs And Projects**







# **The Need for Social Inputs Into Development Decisions**

- **Social policy is more than the social impacts and consequences of economic policies**
- **Social goals and policies complement economic ones**
- **Economic Analysis by itself is insufficient: Social, cultural, political and ethical dimensions must be introduced**



# Elements of a Social Policy - I

- To maintain **social cohesion**
- To foster **equity**
- To reach the **ultra poor** and other marginalized groups
- To uphold **cultural identity** (shared universal values and solidarity, not divisive micro-identities)



# Elements of a Social Policy - II

- To promote **participation** (voice, choice and empowerment through access to knowledge and resources)
- To facilitate social **mobility** (inter-generational, geographic and occupational)
- To support **institutional development**
- To enable participatory **social research**



# Diagnosing Poverty

- **On Absolute And Relative Poverty**
- **Deprivation, Dispossession, And Societal Marginalization**
- **Rural And Urban Poverty**
- **Problems Of The Ultra Poor**
- **Social Versus Economic Policies, Programs And Projects**



# Measuring Income & Wealth



**There are many kinds of poverty**



**But in the final analysis,  
we almost always go back to  
income  
to measure poverty**



# Defining Poverty

- Although we all recognize the multi-dimensional character of poverty, we almost always go back to defining poverty in terms of income
- We have much improved by using Household Surveys; but
- Despite our reservations on income as GDP/Capita, it is still widely used.



**The most common measure of income  
is GNP / Capita**



**But GNP is a measure of production  
and not of well-being...  
It is also flawed**



## **Some flaws of GDP measures:**

- **Production and GDP vs. GNP**
- **How to capture changes in quality, quantity and relative prices**



# **GDP vs. GNP**

## **Production, Yes, ...but who benefits?**

- **Production is still important – it is linked to employment**
- **GDP vs GNP:**
  - **privatizing resource extraction tended to generate some employment locally (hence some GDP increases) but the profits all accrue to foreign companies (seen only in GNP).**
  - **When you add resource depletion and environmental effects, the citizens of the county could be actually worse off...**



# Quality, Quantity and Relative Prices

- It is very complex to capture quality changes and price changes : e.g. electronics, computers, cars...
- Capturing change in quality as compared to quantity is a tremendous challenge:
- Example: Your mobile phone price has gone down but it can do so much more than the old phone... thus the number of units produced (where) and sold (at a particular price) is not really measuring the same thing over time.



# Case Study: Mobile phones:

- Your mobile phone price has gone down but it can do so much more than the old phone... thus the number of units produced (where) and sold (at a particular price) is not really measuring the same thing over time.







**The Modern smart  
mobile phone:  
All of that fits in  
your pocket!**

**20 Years later and all of these  
things fits in you pocket.**





# **The problem of services**

- **The share of services in GDP is growing in every country**
- **It is very difficult to measure services:**
  - **The problems of quality, quantity and pricing of services: medical services, ICT, educational services...**
  - **Public vs. private provision of services**
  - **Unpriced services that do not show up in accounts**



## How to value services?

To the extent that you have a market clearing mechanism, you can say that the amounts paid by the public for the services reflect its true worth in that society.





# Measuring Services

- **The mix between public and private** provision of services (education and health, housing, public sports facilities) are all valued positively by citizens.



# Measuring Services

- **Inputs vs. Outputs:** Valued outputs are traditionally measured by the inputs used to produce them (e.g. number of doctors, number of hospital beds), rather than outputs (e.g. number of (successful) procedures undertaken, or number of patients treated).



# Government Services

- **Growing everywhere: Government services in OECD countries have gone from about 25% of GDP to ca. 45% in the last 50 years (p.xxii)**
- **Generally set to approximately The wage bill of government employees**
  - Absurdity of that definition
  - Consequences not followed (e.g. doubling the salaries of the civil servants)



# Unremunerated labor

- **Huge problem: Unremunerated labor, especially for women in the home**
- **Example: the Housewife vs. cook, maid, baby-sitter, housekeeper**



# **National Income Accounts**

- **Measure flows not stocks**
- **Accordingly can count a depletion of natural capital as a positive contribution**
- **Need to add environmental dimension**
- **UN agreed to add environmental accounts as satellite accounts**









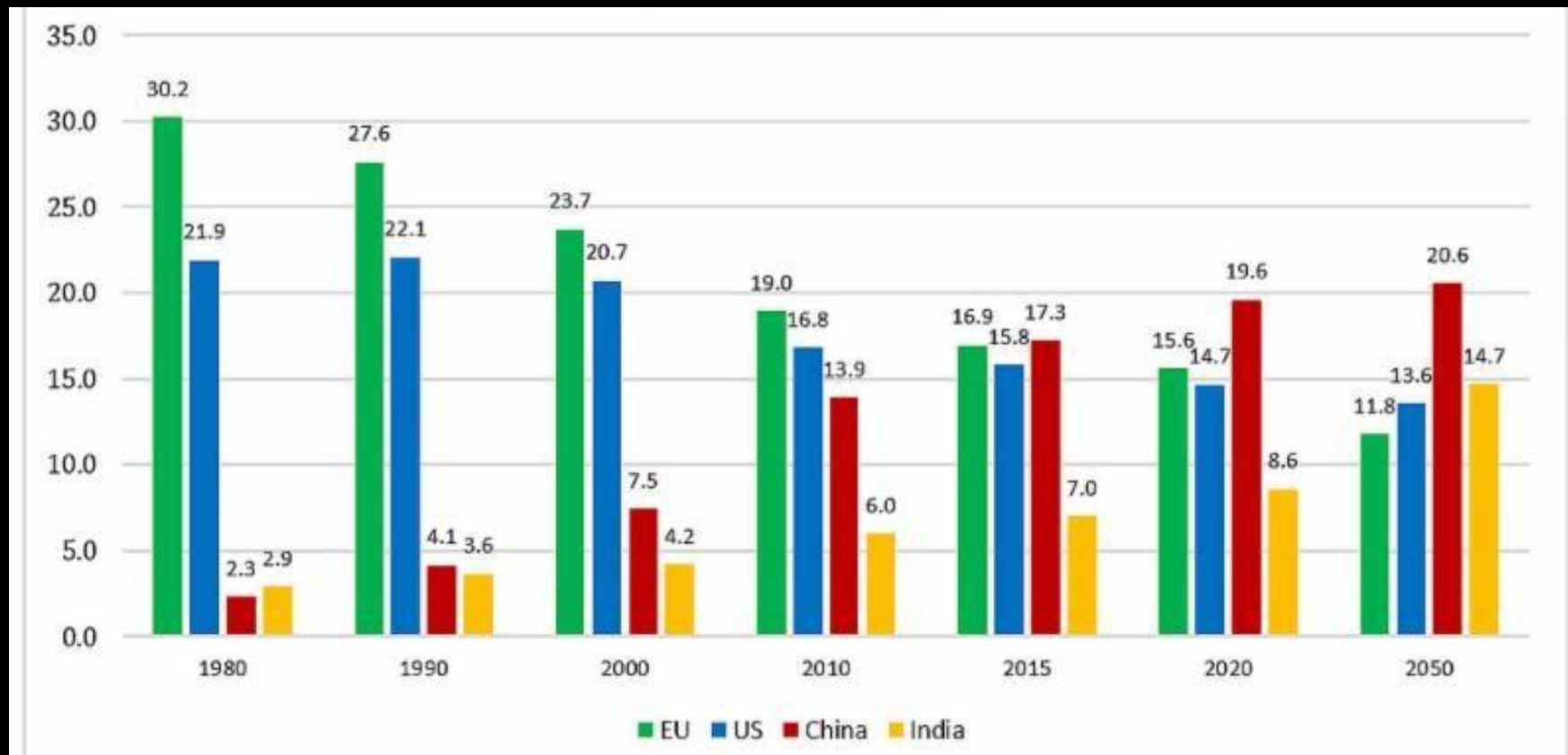


# Country Comparisons

- **GNP/GDP is used to rank size of economies and also when in per capita terms to rank by how rich the citizens are.**
- **But it makes a lot of difference if you use exchange rate measures or PPP.**



# Percentage share of global GDP (in PPP terms)





# From Production to Well-being

- **More generally: It is time to shift from measuring economic production to measuring people's well-being.**
- **But because no single measure can capture well-being of people we will need a whole range of measures.**



# MIS- MEASURING OUR LIVES



Why the GDP Doesn't Add Up

Joseph E. Stiglitz,  
Amartya Sen,  
and Jean-Paul Fitoussi

THE REPORT BY THE COMMISSION ON THE MEASUREMENT  
OF ECONOMIC PERFORMANCE AND SOCIAL PROGRESS

**A Truly Thoughtful  
Critique of  
GNP/GDP  
Measures**



# Many valuable recommendations for GDP, e.g.

- When measuring material well-being, look at income and consumption rather than production.
- Emphasize the household perspective
- Consider income and consumption jointly with **wealth**—look at the four kinds of wealth.

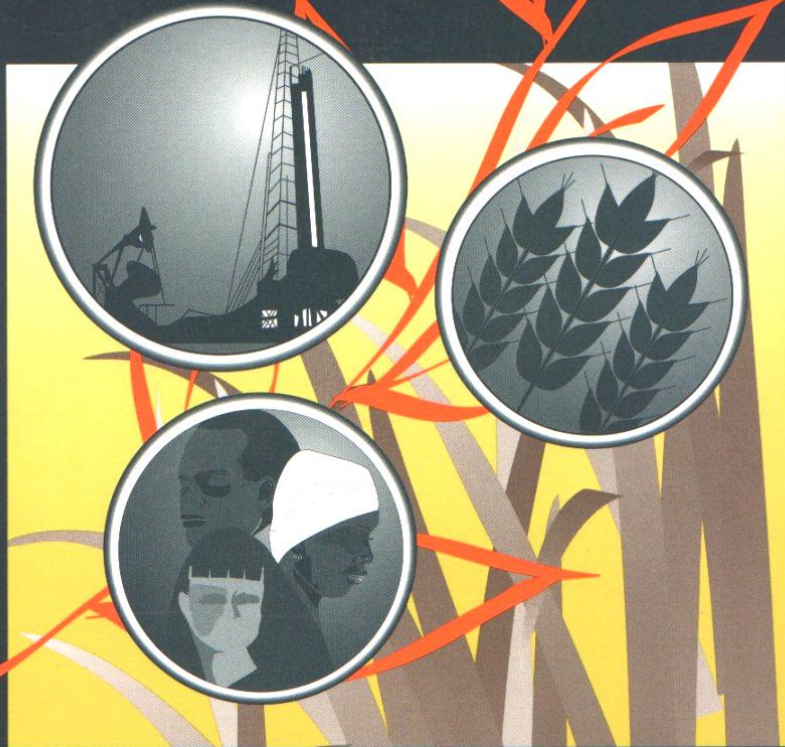
Source: Joseph E. Stiglitz, Amartya Sen and Jean-Paul Fitoussi, *Mis-Measuring Our Lives: Why GDP Doesn't Add Up* The New Press, New York, 2010, pp. xx



# Sustainability and the Wealth of Nations

## First Steps in an Ongoing Journey

*Ismail Serageldin*



# Wealth Accounting And Sustainability as Opportunity



Environmentally Sustainable Development Studies and Monographs Series No. 5





**Man-made Capital  
(Produced Assets)**



# Natural Capital



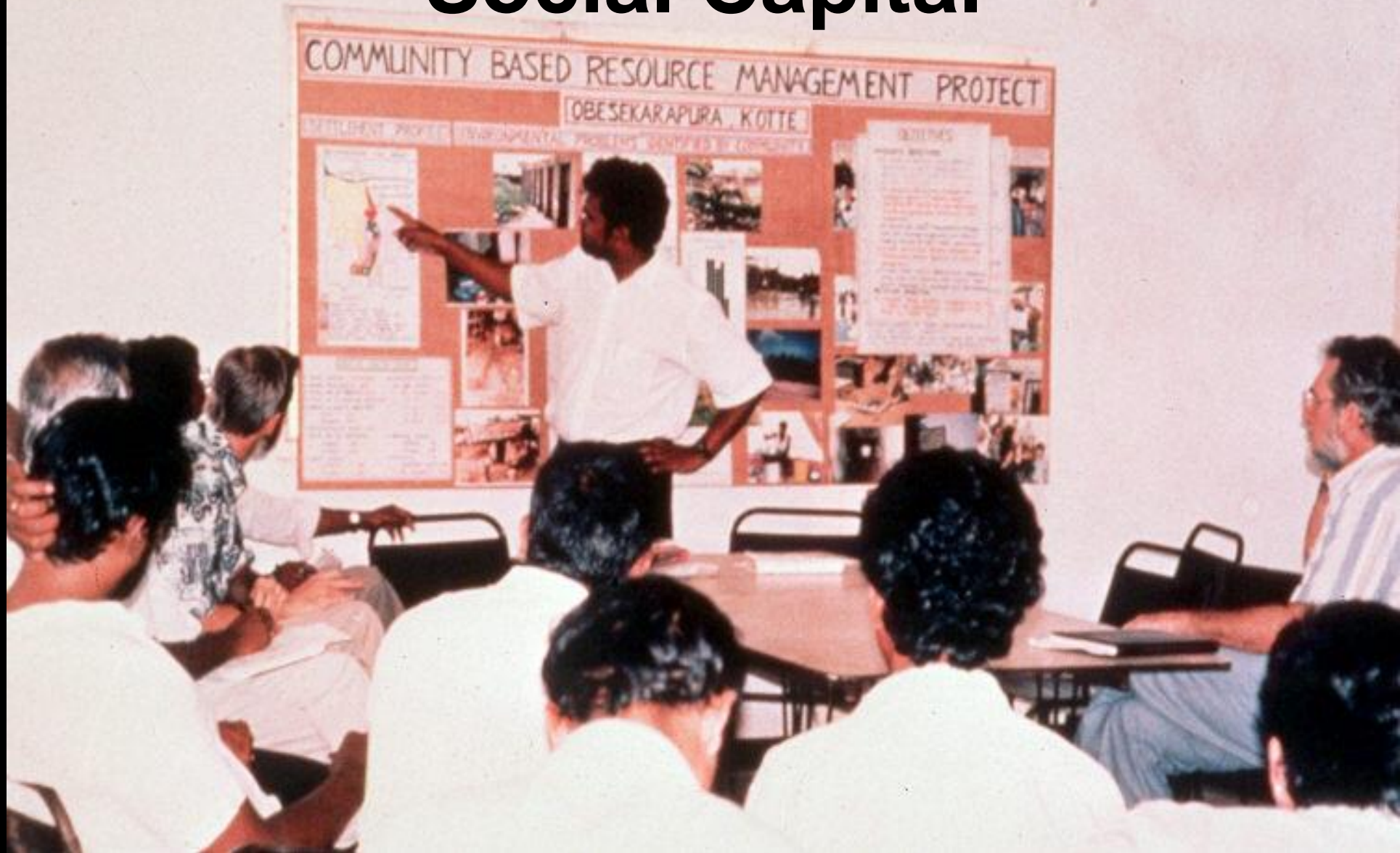


# Human Capital





# Social Capital



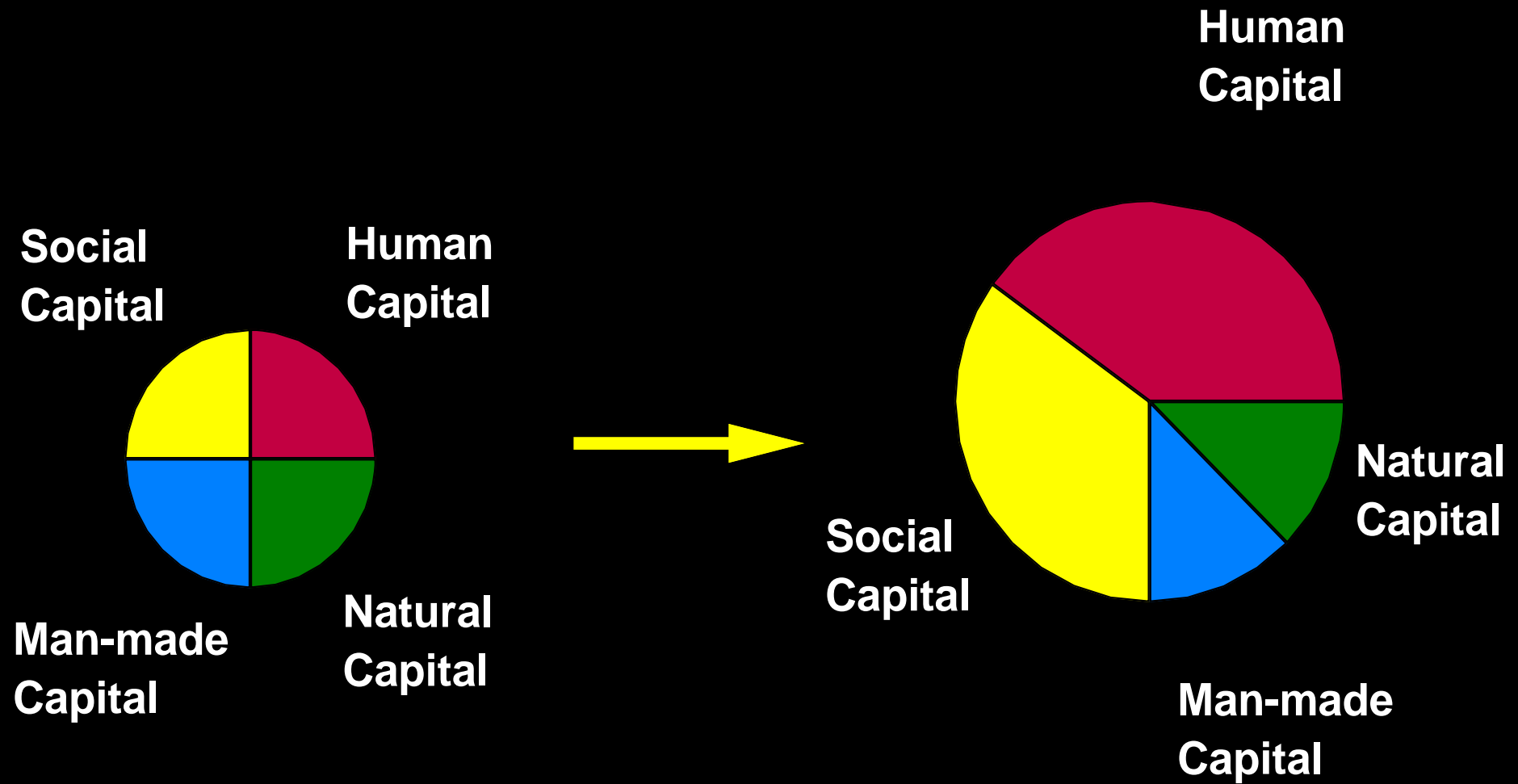


# Capital per person

**Comprises four kinds of capital:**

- **Man-made  
(produced assets)**
- **Natural**
- **Human**
- **Social**







- **The four kinds of capital are partially substitutes and partially complements**
- **Therefore, mix can change over time but critical boundaries must be respected for each type of capital separately**



# Measuring Poverty



# Measuring Poverty

- Headcount Index
- Depth of Poverty (Poverty Gap)
- Foster-Greer-Thorbecke Index ( $P_{\alpha}$ )



# Headcount Index

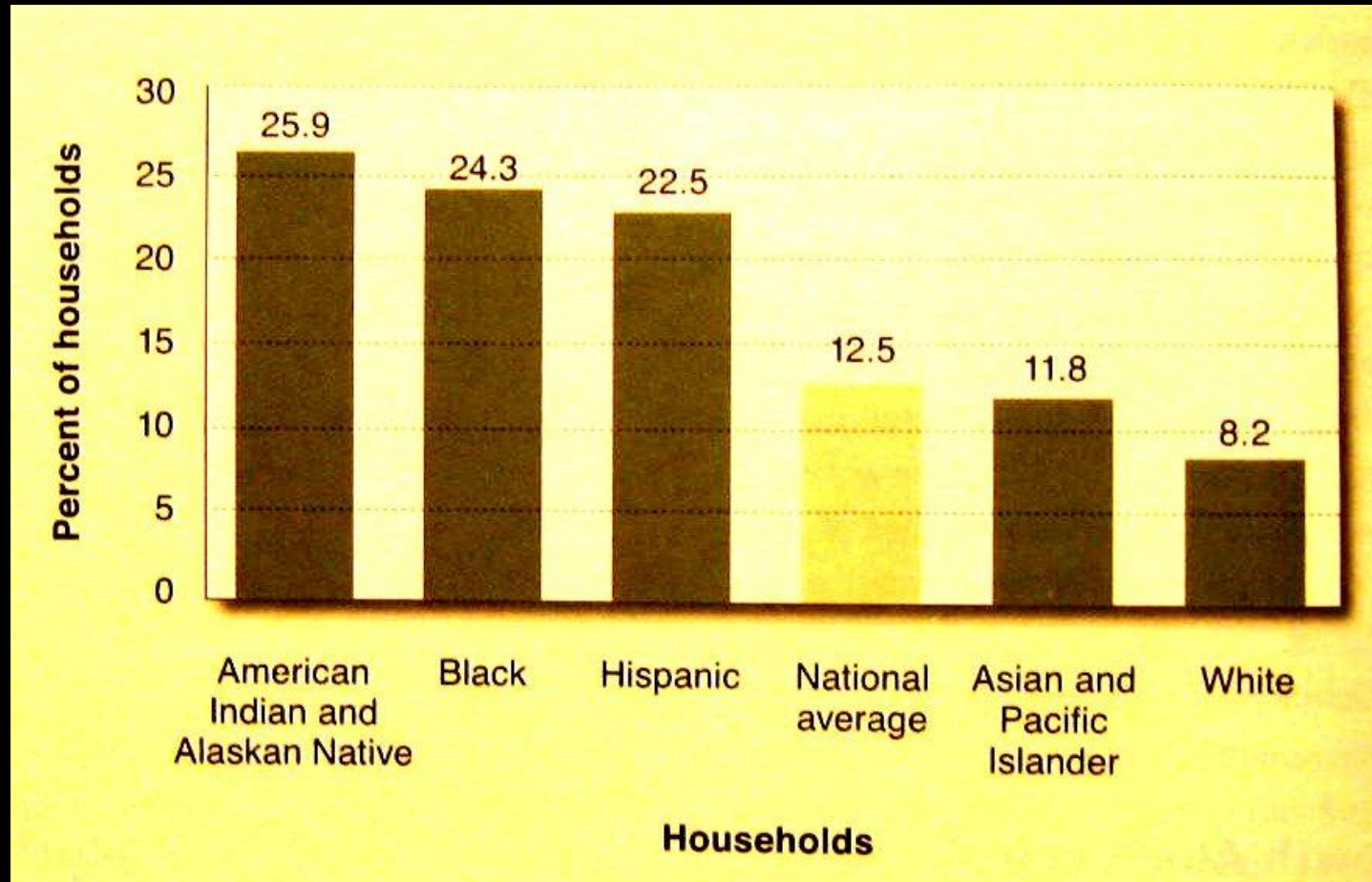
The Headcount Index is the proportion of people below the poverty line:

$$H = \frac{q}{n}$$

where  $n$  is total population and  $q$  is population whose  $Y < z$  and  $z$  is the  $Y$  at Poverty Line



## USA % Households below the poverty line (2003)





# Depth of Poverty (Poverty Gap)

Measures how far the average poor person is below the poverty line and multiplies that by the headcount Index

$$P_G = \frac{1}{n} \sum_{i=1}^q \left[ \frac{z - y_i}{z} \right]$$

$$\therefore P_G = I.H \quad \text{where} \quad I = \frac{Z - y^i}{Z}$$

and  $I$  = mean depth of poverty as a proportion of the poverty Line

$P_G$  = Cost of eliminating poverty by Y- transfer to the poor.



# $P_\alpha$ : The FGT Poverty Index

$$P_\alpha = \frac{1}{n} \sum_{i=1}^q \left[ \frac{z - y_i}{z} \right]^\alpha$$



# $P_\alpha$ : The FGT Poverty Index

$$P_\alpha = \frac{1}{n} \sum_{i=1}^q \left[ \frac{z - y_i}{z} \right]^\alpha$$



$$P_{\alpha}$$

- If  $\alpha = 0$   $\therefore P_0 =$  Headcount Index
- If  $\alpha = 1$   $\therefore P_1 =$  Poverty Gap Measure
- If  $\alpha = 2$   $\therefore P_2 =$  Mean of squared proportionate poverty gaps



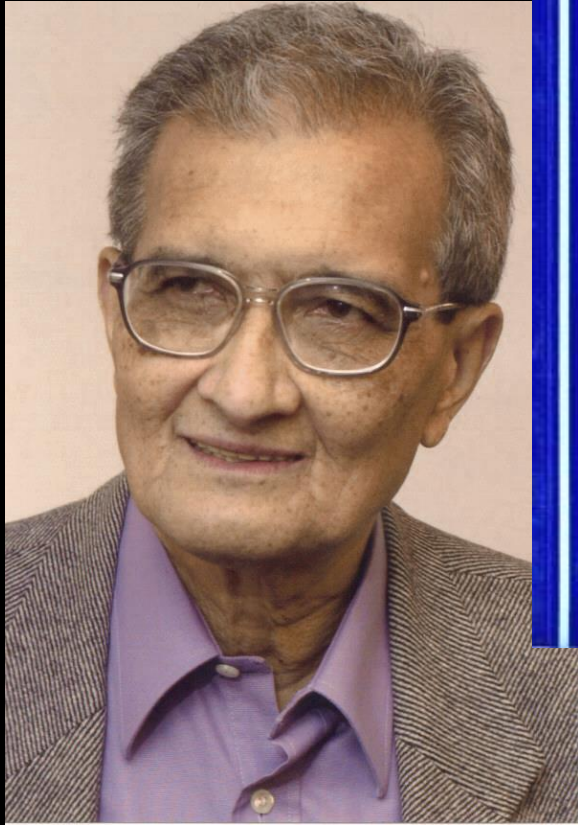
## A better statement about $P_\alpha$

- If  $\alpha = 0$   $\therefore P_0 = \text{Amount of poverty}$
- If  $\alpha = 1$   $\therefore P_1 = \text{Depth of Poverty}$
- If  $\alpha = 2$   $\therefore P_2 = \text{Severity of Poverty}$   
(usually associated with hunger)

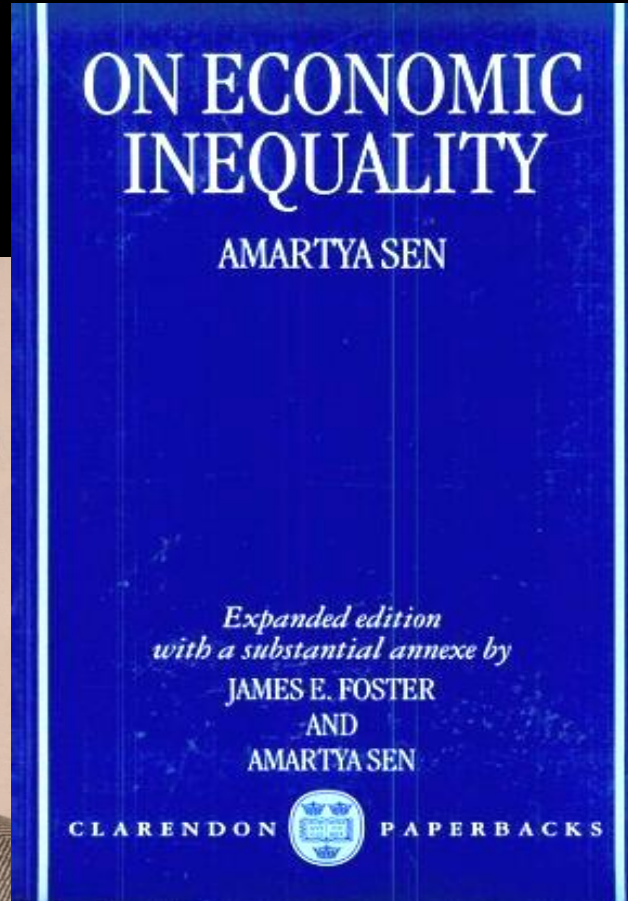


**Ideally, the use of FGT indexes  
should be supplemented by  
inequality indicators.**





**Amartya Sen**



**James Foster**

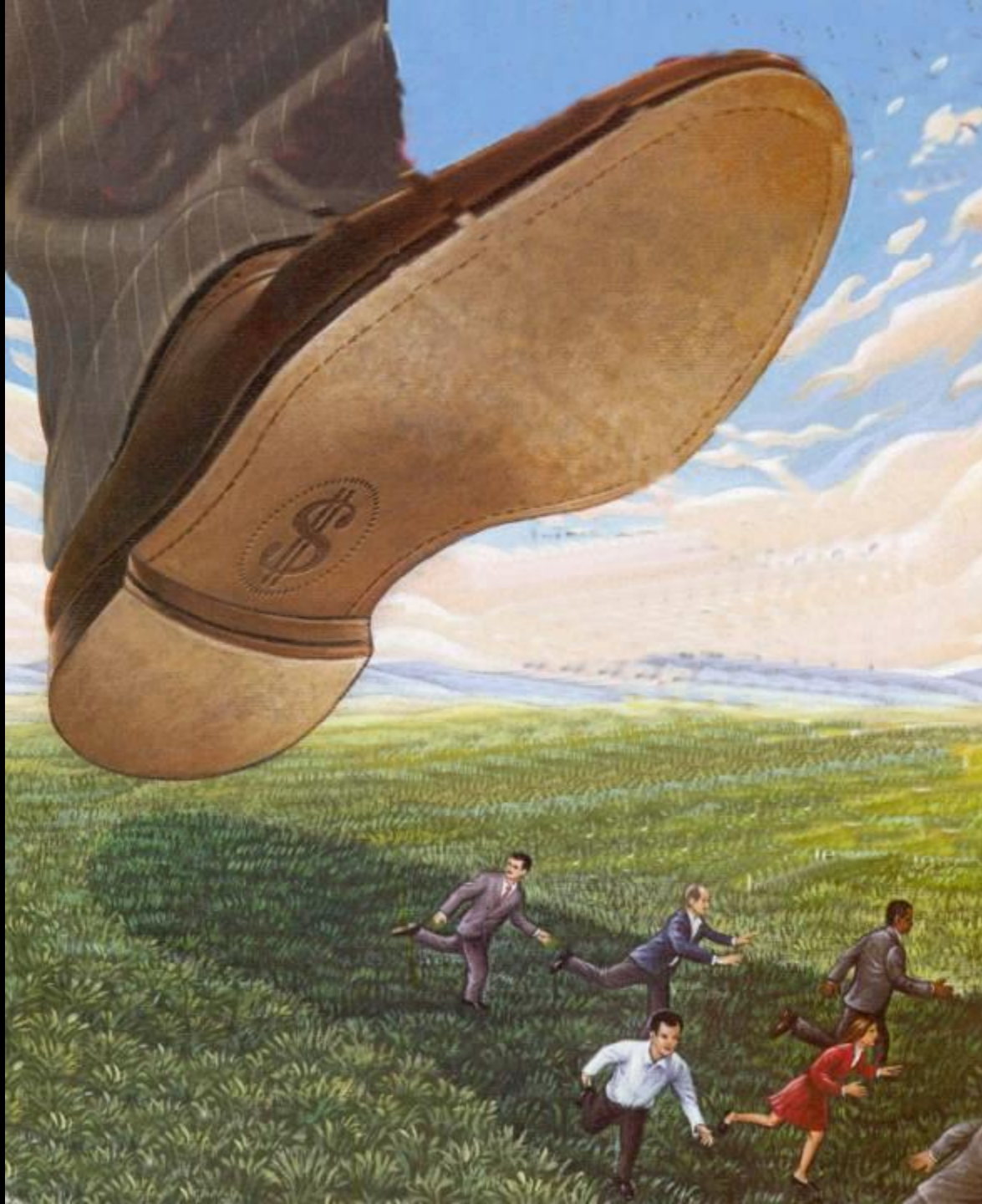


**Links To Inequality...**  
**Which brings in the whole**  
**population, not just the poor...**



# Measuring Inequality







# **Richest Countries: The Share of Total Global Wealth**

- **United States — 41.6%**
- **China — 10.5%**
- **Japan — 8.9%**
- **U.K. — 5.6%**
- **Germany — 3.9%**
- **France — 3.5%**
- **Canada — 3.0%**
- **Italy — 2.9%**
- **Australia — 2.0%**
- **South Korea — 1.6%**

Source: Allianz Report, cited at: <http://fortune.com/2015/09/30/america-wealth-inequality/>



# Countries With The Highest Wealth Inequality

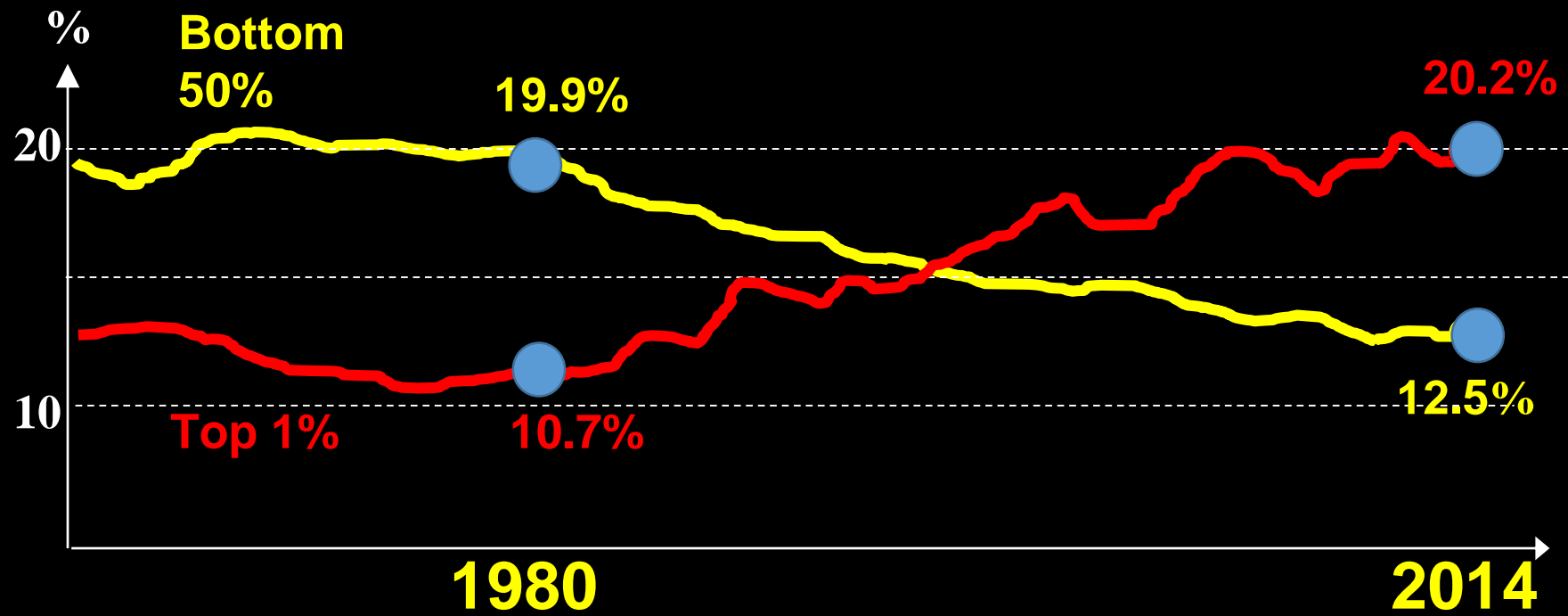
- **U.S.A. — 80.56.**
- **Sweden — 79.90.**
- **U.K. — 75.72.**
- **Indonesia — 73.61.**
- **Austria — 73.59.**
- **Germany — 73.34.**
- **Colombia — 73.18.**
- **Chile — 73.17.**

Source: Allianz Report, cited at:<http://fortune.com/2015/09/30/america-wealth-inequality/>



# Income Inequality

The income gap continues to widen: Since 1980, the share of total income going to the top 1 percent of earners has doubled, while the bottom half's share has narrowed. Stagnant wages for many Americans are a major culprit.



Note: Income figures are for individual adults, incomes within married couples are split equally  
Source: Thomas Piketty, Emmanuel Saez, and Gabriel Zucman cited in NYT 08 december 2016



**An Enormous Gap Exists Between  
the Rich and the Poor...**













## Rich and Poor in Sao Paulo

source: <http://mindblog.dericbownds.net/2007/10/rich-and-poor.html>



**Inequality has been  
rising everywhere**

## Parting company

1

Gini coefficients\*

0=perfect equality, 1=perfect inequality

1985

2013†



Source: OECD

\*Post taxes and transfers †Or latest



# The Most Widely Accepted and Used Measures of Inequality

- The Gini Coefficient and the Lorenz Curve
- Closely interrelated
- Powerfully descriptive



# Max Otto Lorenz (1876 – 1959)

- He developed the Lorenz curve in **1905** to describe income inequalities.
- He published this paper when he was a doctoral student at the University of Wisconsin





# Corrado Gini

(1884-1965)



- Corrado Gini was an Italian statistician, demographer and sociologist
- He developed the Gini coefficient, a measure of the income inequality in a society in 1912.



# Gini Coefficient

- Inequality on the Gini scale is measured between 0, where everybody is equal, and 1, where all the country's income is earned by a single person.
- It allows comparing inequality between countries or within the same country over time.

See inter alia, Sen, A. On Economic Inequality. Oxford, England: Clarendon Press, 1973. Or <http://mathworld.wolfram.com/GiniCoefficient.html> (Accessed 24 01 2018)



**The classical definition of G appears in the notation of the theory of relative mean difference:**

$$G = \frac{\sum_{i=1}^n \sum_{j=1}^n |x_i - x_j|}{2n^2 \bar{x}}$$

**Where:**

**x is an observed value**

**n is the number of values observed**

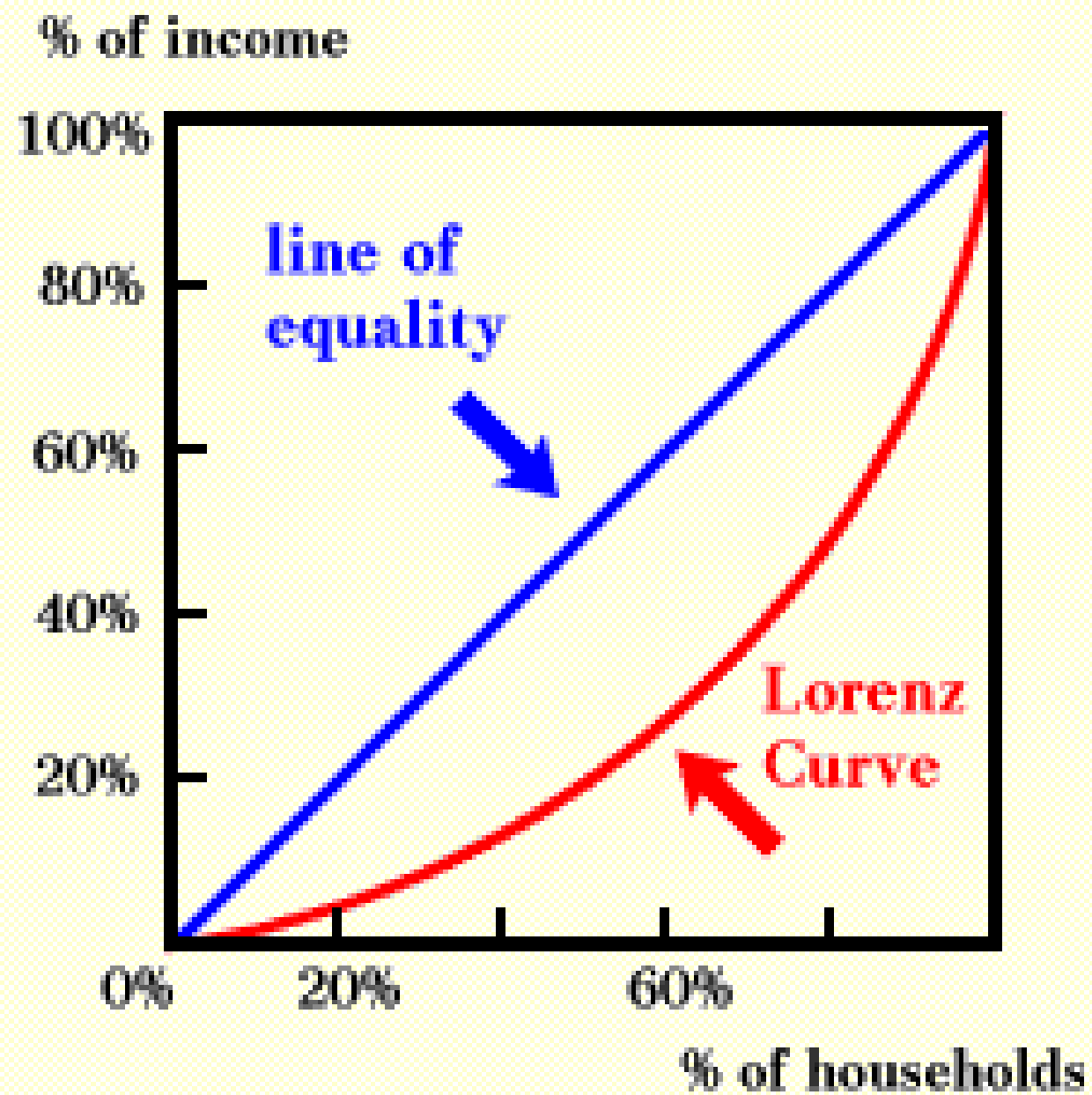
**$\bar{x}$  is the mean value**



# Measuring Inequality: The Lorenz Curve and the Gini Coefficient

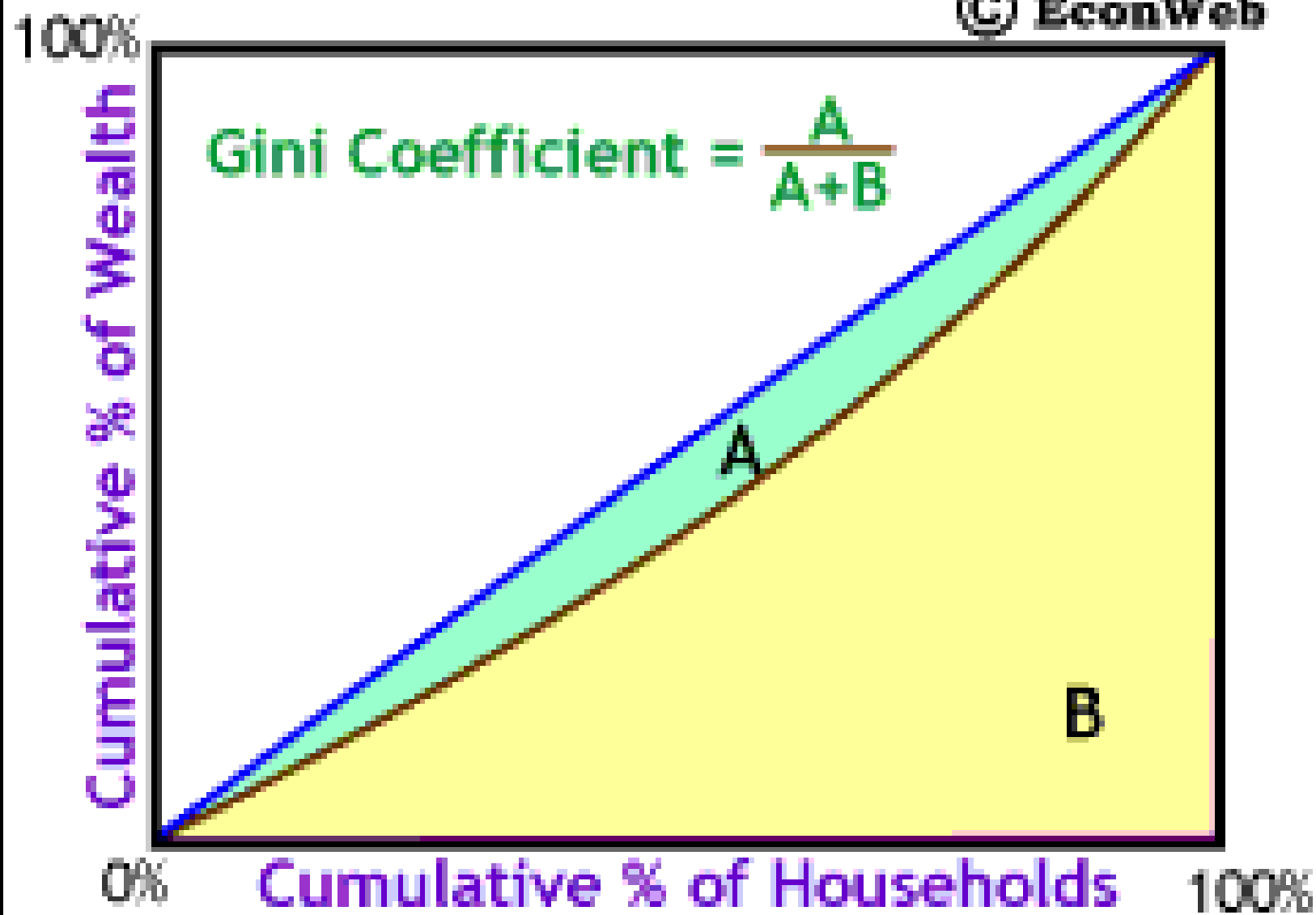
- The Gini coefficient (or Gini ratio) is a summary statistic of the Lorenz curve and a measure of inequality in a population.
- The Gini coefficient is most easily calculated from unordered size data as the "relative mean difference," i.e., the mean of the difference between every possible pair of individuals, divided by the mean size ...





**A Lorenz Curve illustrates inequality**





Increasing Gini Coefficient  
Due to Increasing Inequality



**But index numbers allow  
shorthand indications of status,  
trends and inter-country  
comparisons  
(all with due caution!)**

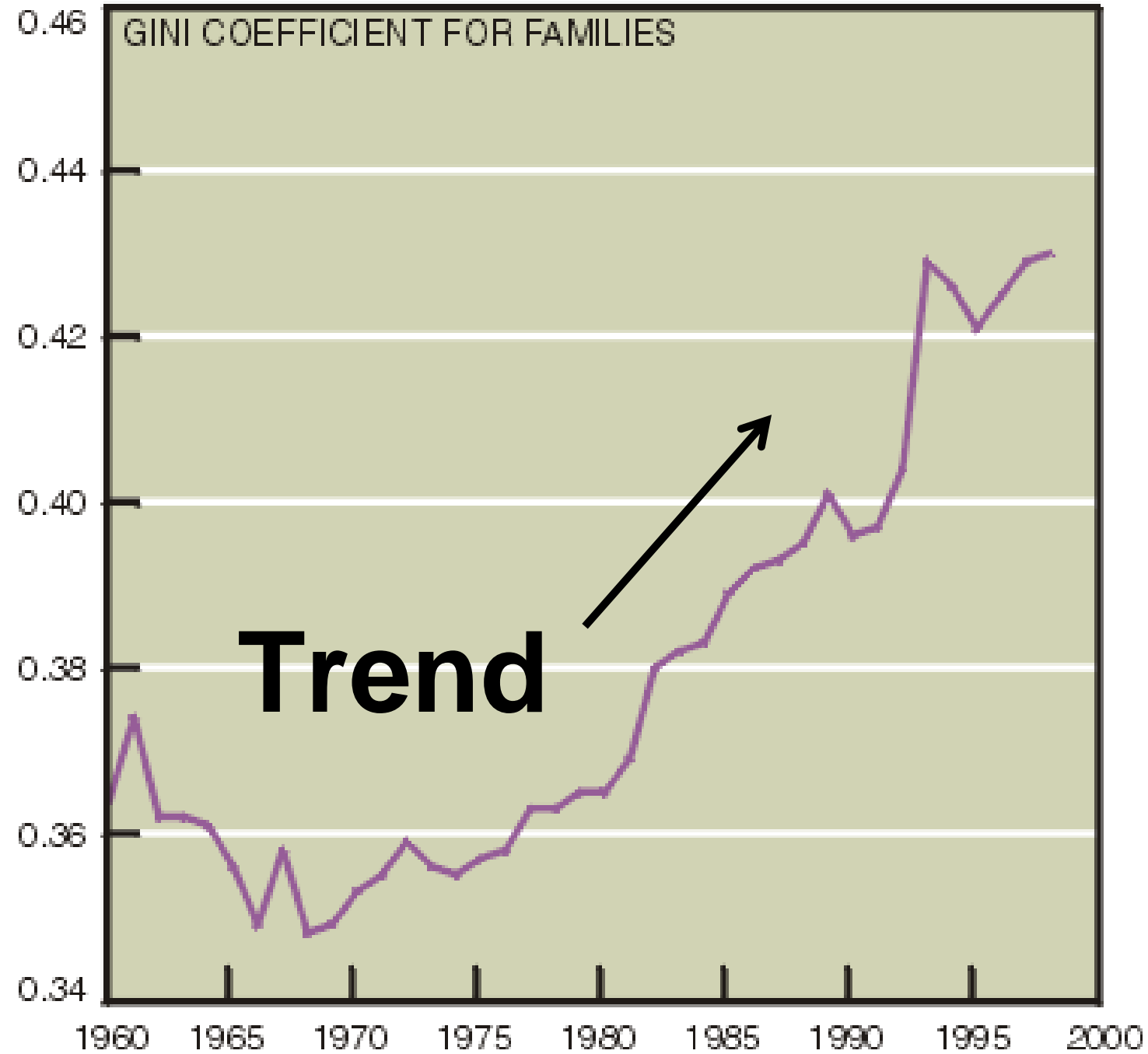


## List extracted from the Gini Index for a selected group of nations

Japan	24.9	United Kingdom	36.0
Sweden	25.0	Iran	43.0
Germany	28.3	United States	46.6
France	32.7	Argentina	52.2
Pakistan	33.0	Mexico	54.6
Canada	33.1	South Africa	57.8
Switzerland	33.1	Namibia	70.7

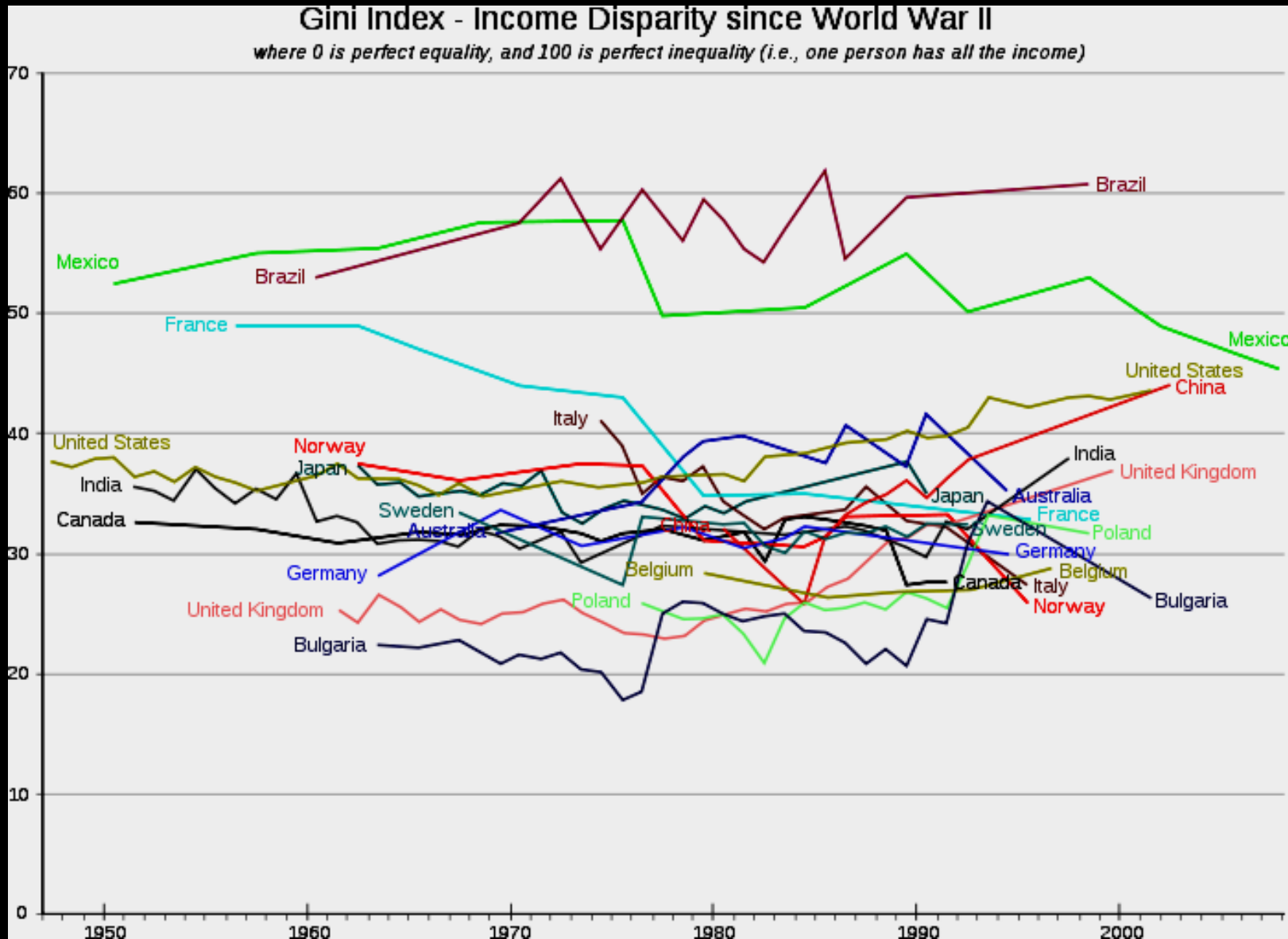


Index: 0 = perfect equality; 1 = perfect inequality





# Gini Index – Income Disparity Since WWII





# The Gini Coefficient & the Criteria for a good measure of Inequality:

- **Mean independence.** This means that if all incomes were doubled, the measure would not change. The Gini satisfies this.
- **Population size independence.** If the population were to change, the measure of inequality should not change, ceteris paribus. The Gini satisfies this too.
- **Symmetry.** If you and I swap incomes, there should be no change in the measure of inequality. The Gini satisfies this.
- **Pigou-Dalton Transfer sensitivity.** Under this criterion, the transfer of income from rich to poor reduces measured inequality. The Gini satisfies this too.



## Additional desirable features that the Gini Does **NOT** satisfy

- **Decomposability**. This means that inequality may be broken down by population groups or income sources or in other dimensions. The **Gini index is not easily decomposable or additive across groups**. That is, the total Gini of society is not equal to the sum of the Gini coefficients of its subgroups.
- **Statistical testability**. One should be able to test for the significance of changes in the index over time. **This is less of a problem than it used to be** because confidence intervals can typically be generated using bootstrap techniques.

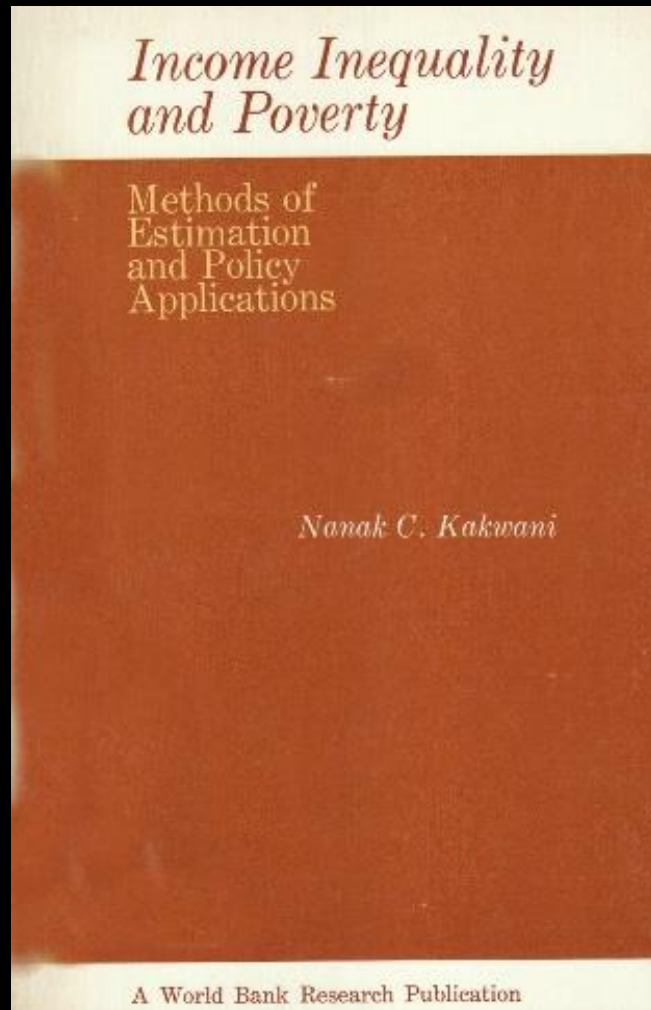


# Other measures of inequality

- Theil's Entropy
- Atkinson's generalized measures
- Etc.



# Additional Measures



**Kakwani (as well as others) have also suggested other ways of measuring, including comparing the length of the Lorenz Curve to the diagonal**



**Thoughtful use of multiple indicators for analysis will lead to richer and more nuanced policy and program design**



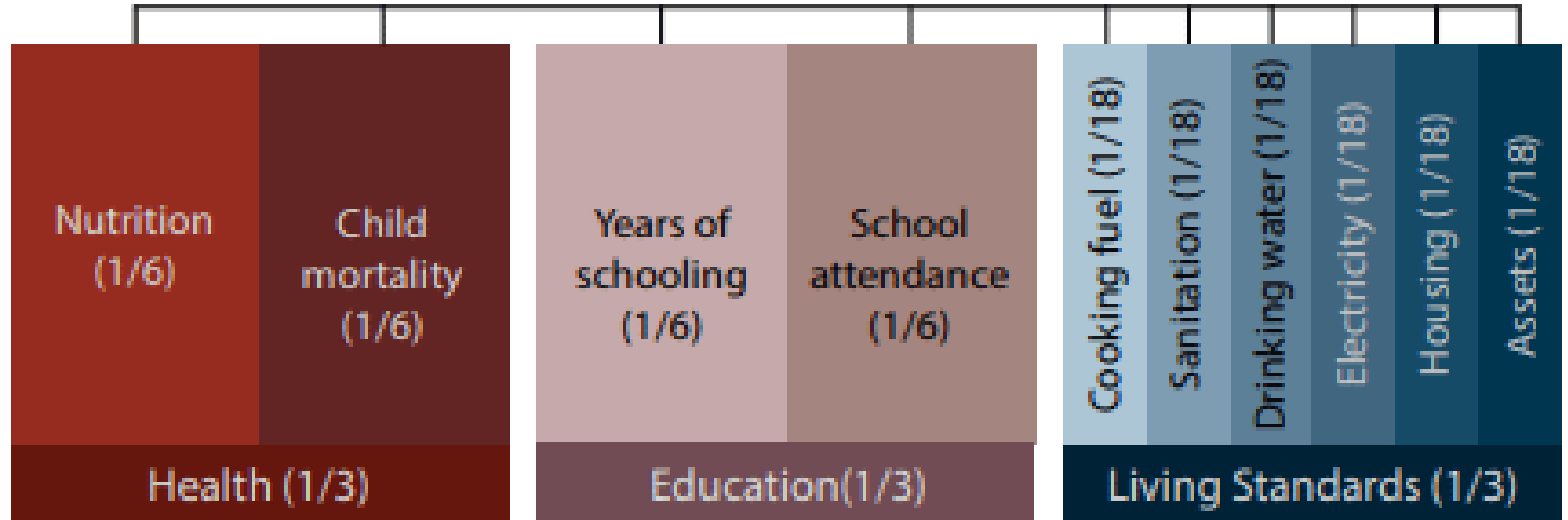
# **The MPI**

## **Multi-Dimensional Poverty Index**

- **Global MPI are calculated at the national level using comparable benchmarks of deprivation on multiple indicators**
- **National or regional MPIs apply the approach to better analyze local conditions within a country or region.**



## 10 Indicators



## 3 Dimensions of Poverty



## Recall

**85% of the Poor live in the Rural Areas**

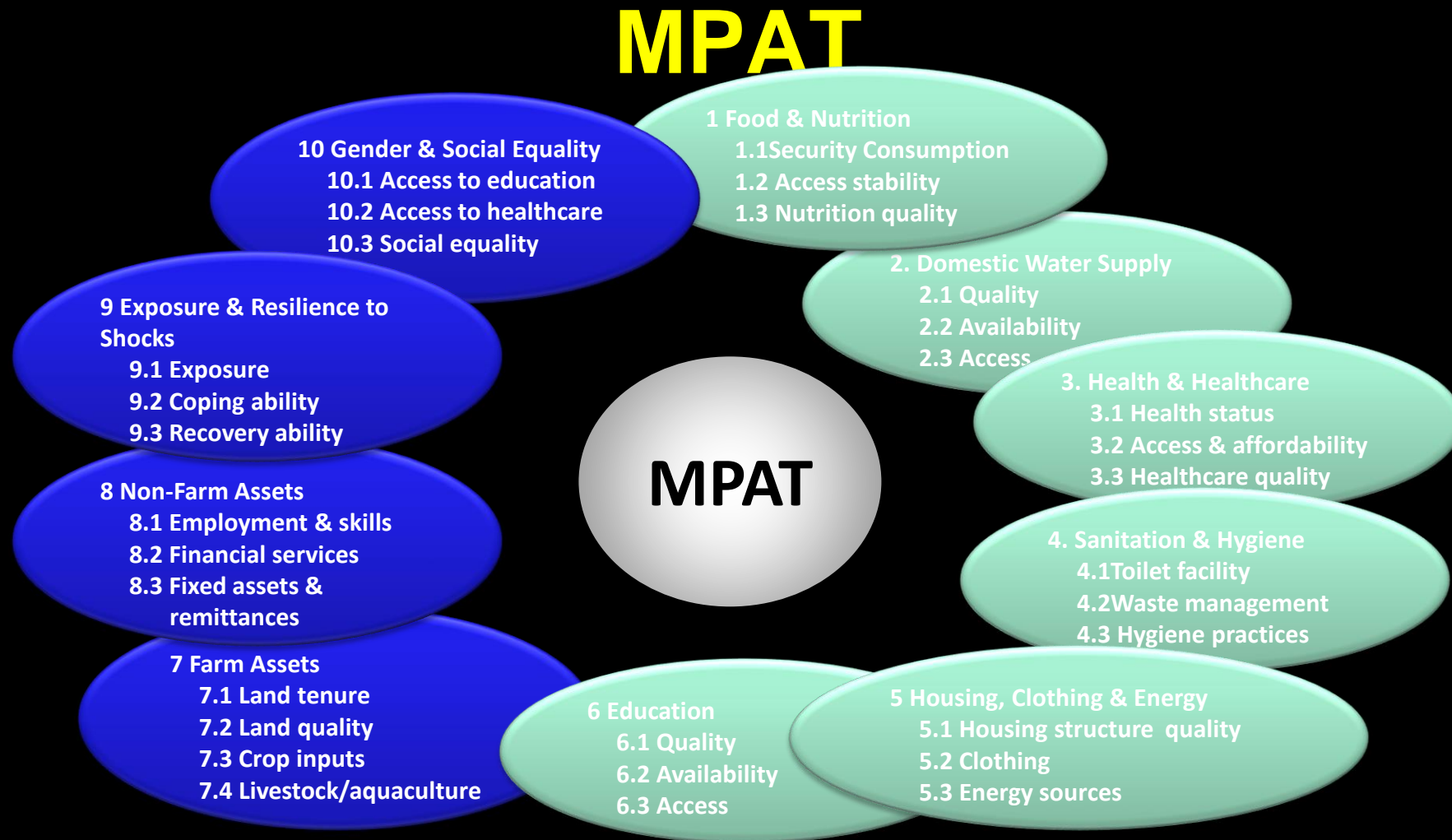
- The Multidimensional Poverty Index (**MPI**) suggests that the rural share of poverty is ca. 85% , i.e. higher than income poverty estimates of 70 to 75%.



# **Other Multi-dimensional Indicators Exist**

**MPAT:**  
**Multidimensional Poverty Assessment Tool**  
**(Developed by IFAD)**





Organizational diagram of MPAT's components and subcomponents



**Item # 9 of the MPAT is:  
On Resilience to Shocks**



**But let's first look at extreme poverty**



# Extreme Poverty and Hunger



# Extreme Poverty & Hunger...

- Extreme poverty is associated with hunger and malnutrition
- The situation gets worse in cases of drought and/or conflict







## **Defining Extreme Poverty**



# Original Definition

- It was Robert S. **McNamara**, then President of the World Bank, who, in his famous Nairobi speech in **1973**, proposed the term '**absolute poverty**'. . .
- **It is a condition of deprivation that 'falls below any rational definition of human decency.'**
- I live by that definition... That is "extreme poverty"
- I fight for the eradication of extreme poverty.





THE MILLENNIUM DEVELOPMENT GOALS (MDGs) ARE THE MOST SUCCESSFUL GLOBAL ANTI-POVERTY PUSH IN HISTORY. LET'S STEP UP ACTION TO THE 2015 MDG TARGET DATE AND BEYOND.

**MDG1**



ERADICATE  
EXTREME POVERTY  
AND HUNGER



**EXTREME  
POVERTY**

RATES HAVE BEEN

**CUT IN  
HALF** SINCE 1990

**LET'S  
STEP  
UP**

WORLD  
WIDE

**1 IN 8 REMAIN  
PEOPLE HUNGRY**

UN.ORG/MILLENNIUMGOALS



# Where are those in Extreme Poverty located?

- The vast majority of those in extreme poverty – 96% – reside in South Asia, Sub-Saharan Africa, The West Indies, East Asia and the Pacific; nearly half live in India and China alone.
- As of 25 June 2018, **Nigeria** became the poverty capital of the world with more than **86 million of its citizens living in extreme poverty** despite abundant resources.



# From the MDGs to the SDGs

- The reduction of extreme poverty and hunger was the first Millennium Development Goal (MDG1), as set by the UN in 2000.
- Specifically, **MDG1** set a target of **reducing the extreme poverty rate in half by 2015, a goal that was met 5 years ahead of schedule.**
- In the **SDGs** we want to **end extreme poverty in all its forms everywhere, by 2030.**



“Unfairness in the human  
condition can only be  
remedied when people  
everywhere care.”

THE DALAI LAMA

# LIVING ON A DOLLAR A DAY

BY THOMAS NAZARIO

FOUNDER, THE FORGOTTEN INTERNATIONAL

PHOTOGRAPHS BY RENÉE C. BYER  
PULITZER PRIZE WINNER

FOREWORD BY THE DALAI LAMA  
NOBEL LAUREATE









**My Definition:**

**Extreme poverty is a condition beneath  
any definition of human decency**





**Extreme poverty is a condition beneath  
any definition of human decency**





**Extreme poverty is a condition beneath  
any definition of human decency**





**Extreme poverty is a condition beneath  
any definition of human decency**





**Extreme poverty is a condition beneath  
any definition of human decency**





**Extreme poverty is a condition beneath any  
definition of human decency  
– Exploitation and Child Labor**



**Hundreds of millions are  
chronically malnourished!**







**Hunger**



**Many studies...**



phar Prasad Sati  
Vangchhia

Sustainable  
hood Approach  
erty Reduction  
pirical Analysis  
oram, the Eastern  
ion of the  
ay

## Technology Reduction gies (PRSSs)

and Implications

S

rom  
frica



JULIAN MAY,  
EEN DIGA

India

Sustaining Reform, Reducing Poverty



A World Bank Development Policy Review

3TU.

TU Delft  
TU Eindhoven  
U Twente

## Technology, Poverty Reduction & the

Premier Reference So

Affordability Issues Surro  
the Use of ICT for Develop  
erty Reduction

Insight and Innovation in International Development

Elias T. Ayuk  
Samuel T. Kabore  
Editors

## Wealth through Integr

Regional Integr  
and Poverty-Red  
in West Africa

IDRC CRDI

MyCopy

DIRECTIONS IN DEVELOPMENT  
Science, Technology, and Innovation

## Science, Technology, and Innovation

Capacity Building for Sustainable Growth  
and Poverty Reduction

Alfred Watkins and Michael Ernst, Editors

THE WORLD BANK



Economic Studies in Inequality, Social Exclusion  
and Well-Being  
Series Editor: Jacques Silber

Almas Heshmati  
Esfandiar Maasoumi  
Guanghua Wan Editors

## Poverty Reduction Policies and Practices in Developing Asia

ADB

Springer Open

POVERTY  
IN THE  
OF  
DEVELOPMENT

MACHIKO NISHI





Mahesh Joshi

## Agriculture System: Problems and Issues

Problems and Issues Related to Technology  
in Gender Perspectives and Poverty

URBAN MANAGEMENT SERIES

# Urban Futures

Economic Growth  
and Poverty Reduction

Edited by Wabeel Hamdi

"OUT OF POVERTY teaches us to think simple. Paul Polak brings forward ideas and solutions that bypass government agencies and other leaden institutions. Ideas that work!" —PAUL NEWMAN

PAUL POLAK

# OUT OF POVERTY

WHAT WORKS WHEN TRADITIONAL APPROACHES FAIL



One extra year of  
schooling increases an  
individual's earnings  
by up to 10%.



palgrave  
macmillan

The International Society of Business, Economics,  
and Ethics Book Series

Pauline L. Albert  
Patricia Werhane  
Timothy J. Minchin - Editors

## Global Poverty Alleviation: A Case Book



Springer

## REGIONAL TRADE INTEGRATION, ECONOMIC GROWTH AND POVERTY REDUCTION IN SOUTHERN AFRICA

Edited by  
MOSES TEKERE



## Poverty Reduction and Changing Policy Regimes in Botswana

Onalenna Selolwane

ASIA-PACIFIC  
DEVELOPMENT  
JOURNAL  
Vol. 21, No. 1, Jan 2014

### IN THIS ISSUE:

Maximizing non-renewable export potential  
after the lifting of economic sanctions:  
a gravity model analysis  
Foreign aid and investments in the Greater Mekong  
Subregion: case studies of Australia,  
Japan and Thai-Aid Coordination  
Should agriculture be exempt from trade  
policy reforms in South Asia?  
Rural labour markets: insights from Indian villages  
An empirical analysis of energy shortages  
in Pakistan  
Book review: *Foreign Aid in South Asia*  
The Emerging Scenario

UN  
ESCAP



Copyrighted Material



# THE INTERNATIONAL HANDBOOK OF GENDER AND POVERTY CONCEPTS, RESEARCH, POLICY

Edited by SYLVIA CHANT

## And Never Forget the Gender Dimension

NEW GENDER MAINSTREAMING SERIES ON DEVELOPMENT ISSUES

### Gender Mainstreaming in Poverty Eradication and the Millennium Development Goals:

A handbook for policymakers and other stakeholders

Naila Kabeer



COMMONWEALTH SECRETARIAT

NEW GENDER MAINSTREAMING SERIES ON DEVELOPMENT ISSUES

### Gender Mainstreaming in HIV Taking a Multisectoral Approach



COMMONWEALTH SECRETARIAT

NEW GENDER MAINSTREAMING SERIES ON DEVELOPMENT ISSUES

### Gender Mainstreaming in the Health Sector Experiences in Commonwealth Countries



COMMONWEALTH SECRETARIAT



**But in the end:**

**Extreme poverty is a condition beneath  
any definition of human decency**

**And it must be abolished**



**And additional shocks are coming...**

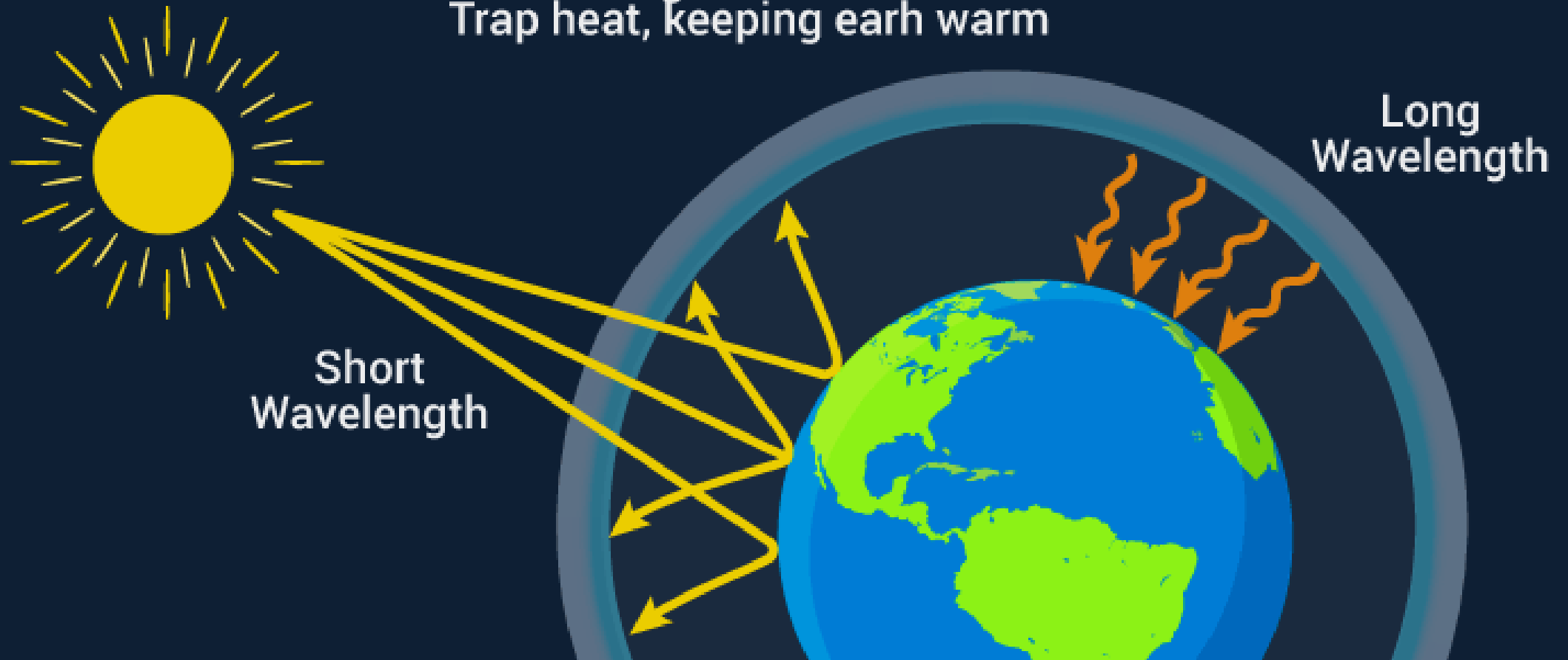


# Climate Change & Its Impacts



# GREENHOUSE EFFECT

Co<sub>2</sub> and other gases in the atmosphere  
Trap heat, keeping earth warm





SPACE

solar insolation  
(shortwave)terrestrial radiation  
(longwave)

ATMOSPHERE

absorption  
reflection  
emission

clouds

rain



Wind

air-ocean  
interactionvolcanic gases  
and particles

snow and ice

human  
influences

OCEAN

air-ice  
interactions

sea ice

currents

ice-ocean  
interaction

lakes and rivers

land-air  
interaction





**Variability in Rainfall and in temperature  
is expected according to climate models**



**Generally more extreme weather events:**

**Hurricanes, Floods, Drought, Heat and  
Forest Fires**



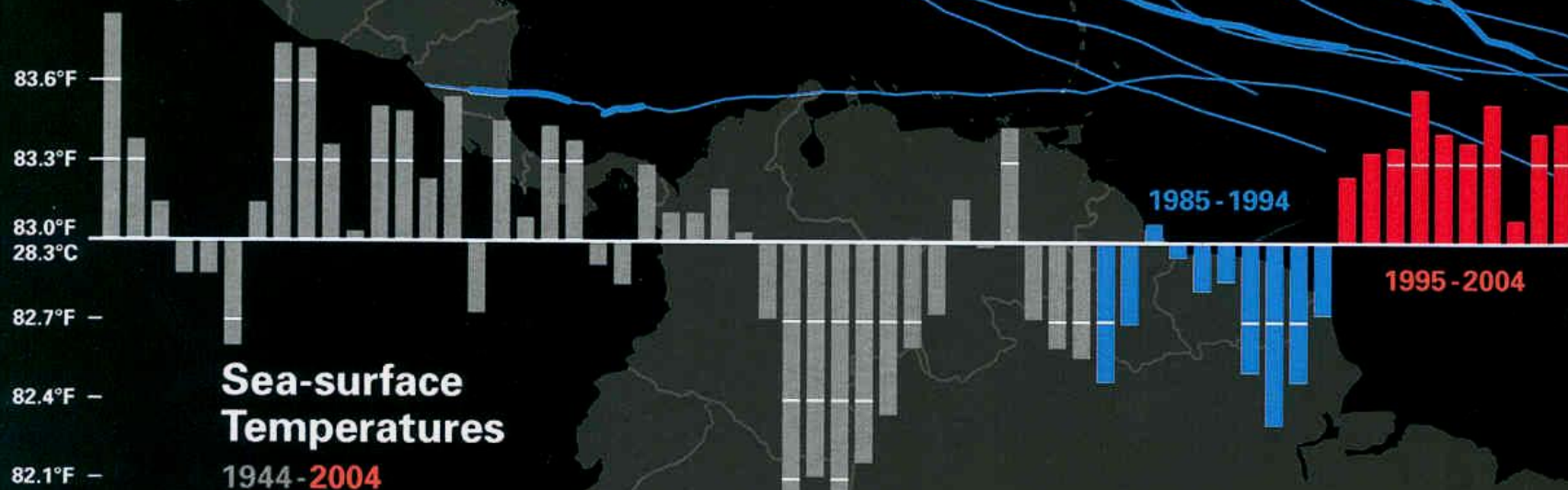




# Hurricane Tracks

When sea-surface temperatures were cooler (1985-1994)

- Category 3-5
- Lower-intensity storm





**Now that they're warmer (1995-2004)**

**RELATIVE CALM GIVES WAY TO FRENZY** Two ten-year periods of hurricane activity show that from 1985 to 1994, when sea-surface temperatures were low, there were half as many major hurricanes as during the most recent decade, when temperatures rose by one to two degrees F—the result of changes in ocean currents that cycle water and heat between the far northern Atlantic and the tropics. Frequency of major hurricanes rises and falls on a multidecadal time frame (graph at left) that scientists are still trying to understand.









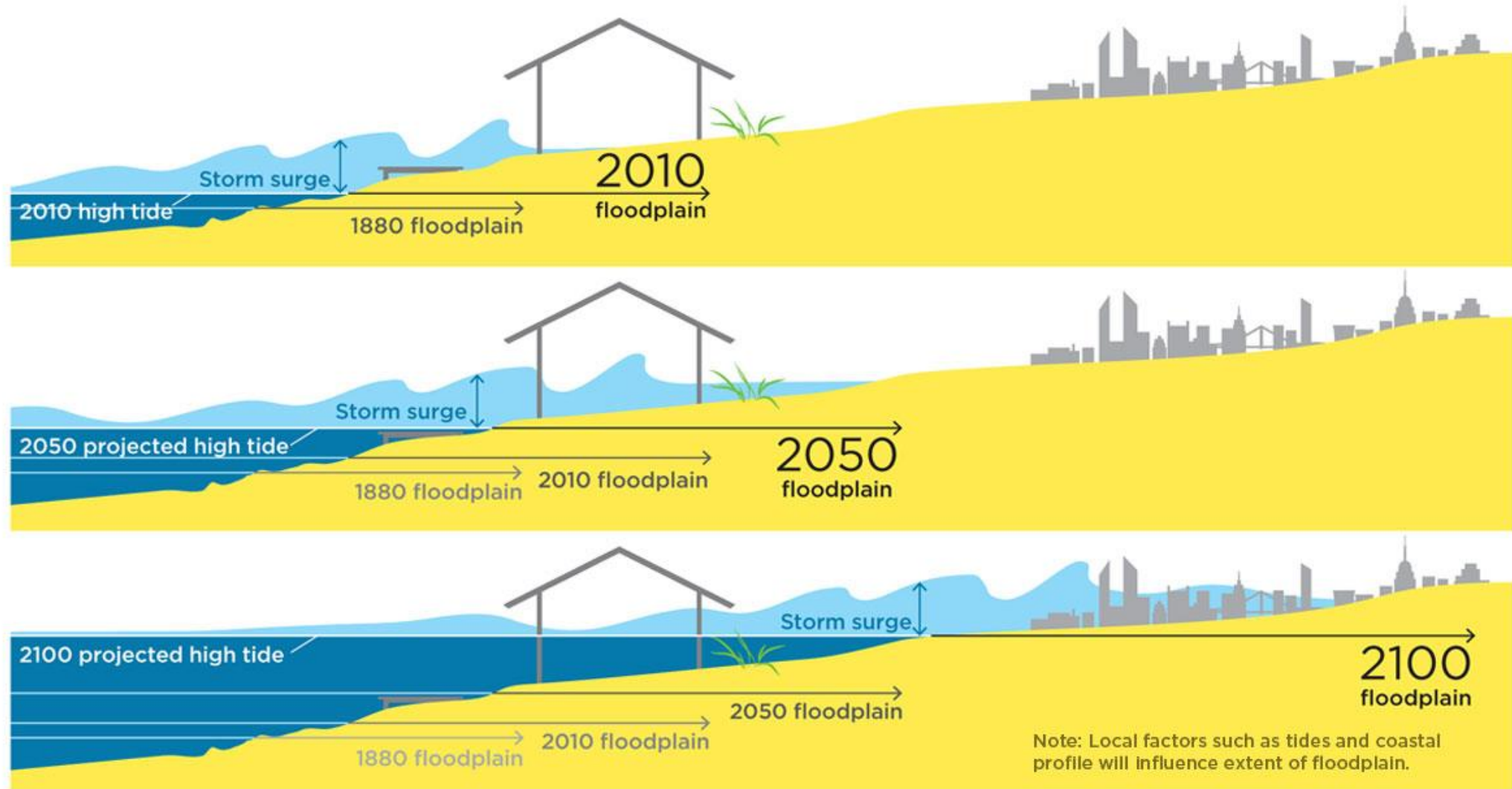
# Forest Fires



**Plus sea level rise, storm surges... (different from earthquakes, volcanoes and tsunamis)**



FIGURE 3. Storm Surge and High Tides Magnify the Risks of Local Sea Level Rise



Sea level sets a baseline for storm surge—the potentially destructive rise in sea height that occurs during a coastal storm. As local sea level rises, so does that baseline, allowing coastal storm surges to penetrate farther inland. With higher global sea levels in 2050 and 2100, areas much farther inland would be at risk of being flooded. The extent of local flooding also depends on factors like tides, natural and artificial barriers, and the contours of coastal land.



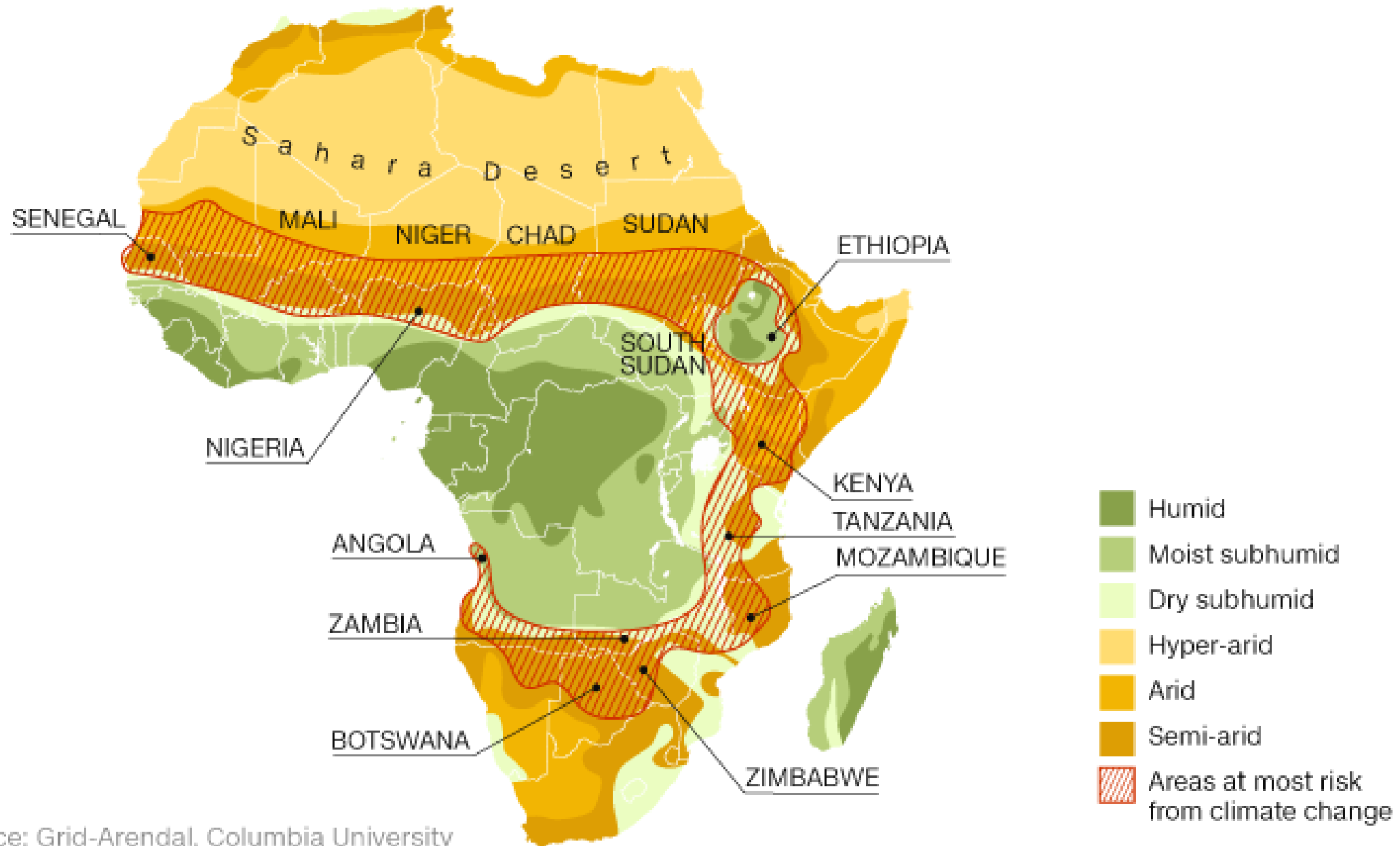
**But that is a topic for another lecture...**



**Africa:**  
**Erratic rainfall and desertification**



# Areas most at risk from climate change in Africa



Source: Grid-Arendal, Columbia University



# Droughts







**Floods**





### **Flooding in Sudan in 2013**

**Source: Climate Vulnerable Forum; <https://thecvf.org/mena-countries-agree-14-points-to-tackle-climate-change/>**



**But 95% of agriculture in Sub-Saharan Africa relies on rain-fed agriculture...**

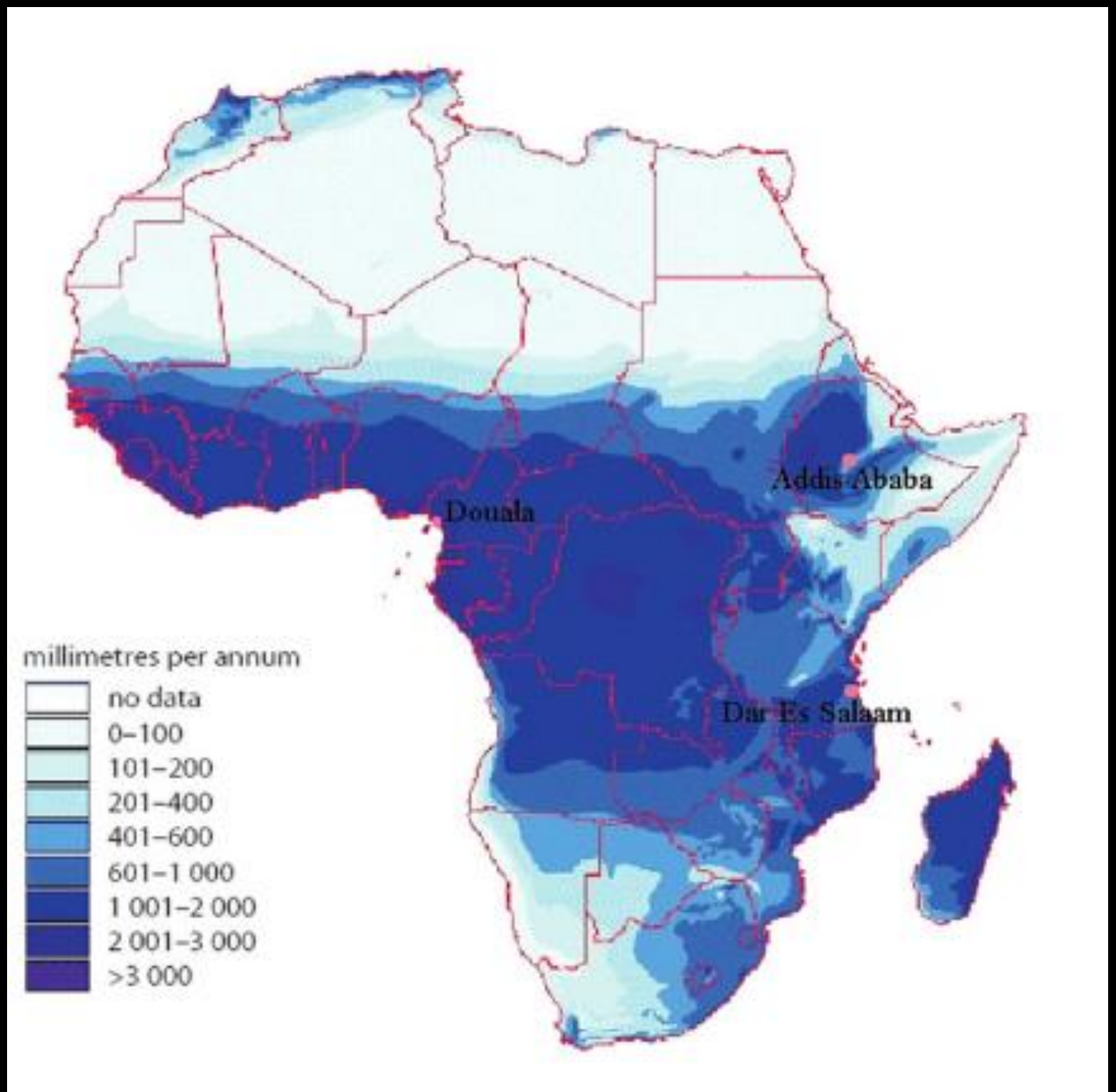




**Pastoralists live a very precarious existence**



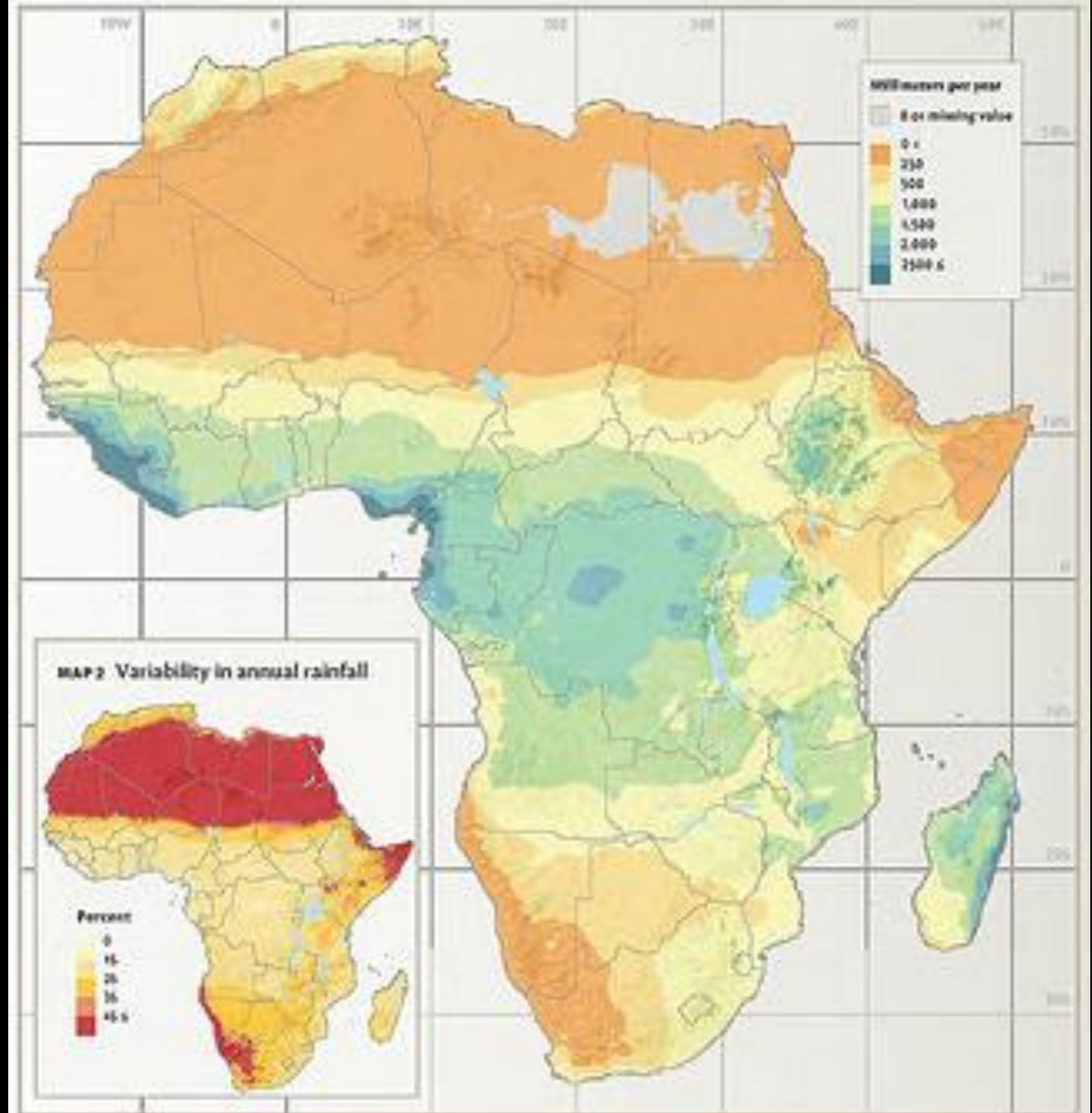
**Rainfall  
varies  
greatly  
throughout  
Africa**





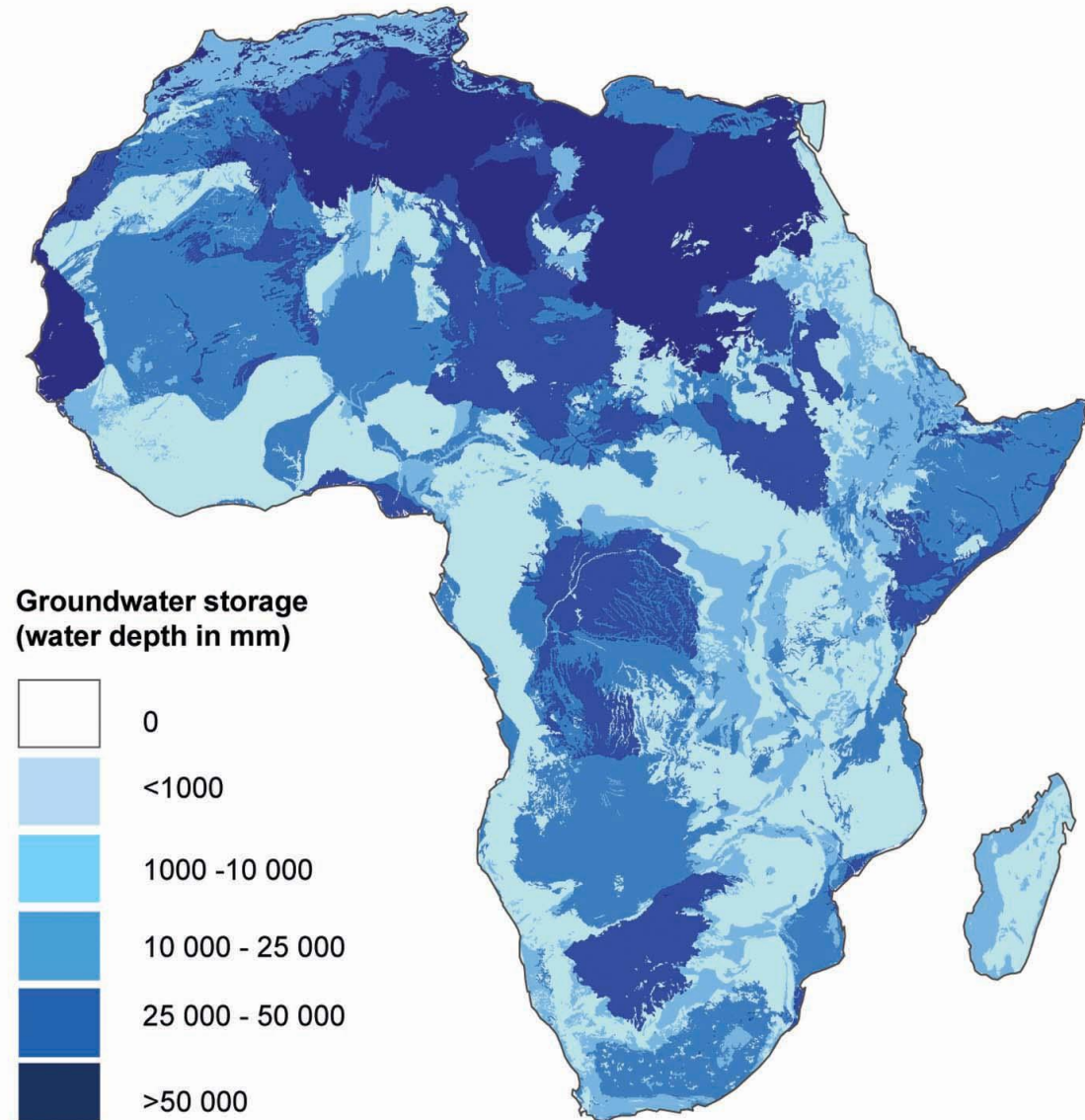
**Variability of  
rainfall will  
increase  
with Climate  
Change...  
Leading to  
erratic  
cycles of  
floods and  
droughts**

MAP 1 Average annual rainfall





**Distribution of  
groundwater  
and depth of  
aquifers also  
varies greatly**



British Geological Survey © NERC 2011. All rights reserved.  
Boundaries of surficial geology of Africa, courtesy of the U.S. Geological Survey.  
Country boundaries sourced from ArcWorld © 1995-2011 ESRI. All rights Reserved



















**The negative impacts of Climate Change can  
destroy the livelihoods of many and push them  
back into  
extreme poverty and hunger**

















**Prolonged two year drought leaves (parts of) Kenya on the verge of famine**





**To better prepare for drought and flood, India needs an integrated system to map water, air, climate and so do the countries in the Arid Zones.**





**India: Worst drought in living memory**





© picture-alliance/dpa/D. Solanki





**Water Shortages:  
Prelude to Water conflicts?**





**Kerala 2018**





**South Asia floods 2017: More than 1,000  
dead in India, Bangladesh and Nepal**



# Conflicts



**Current conflicts destroy livelihoods and induce out migration...**





**And the stresses resulting from the impacts of  
Climate Change can also induce additional  
conflicts over reduced resources...**

**(Remember Darfur...)**



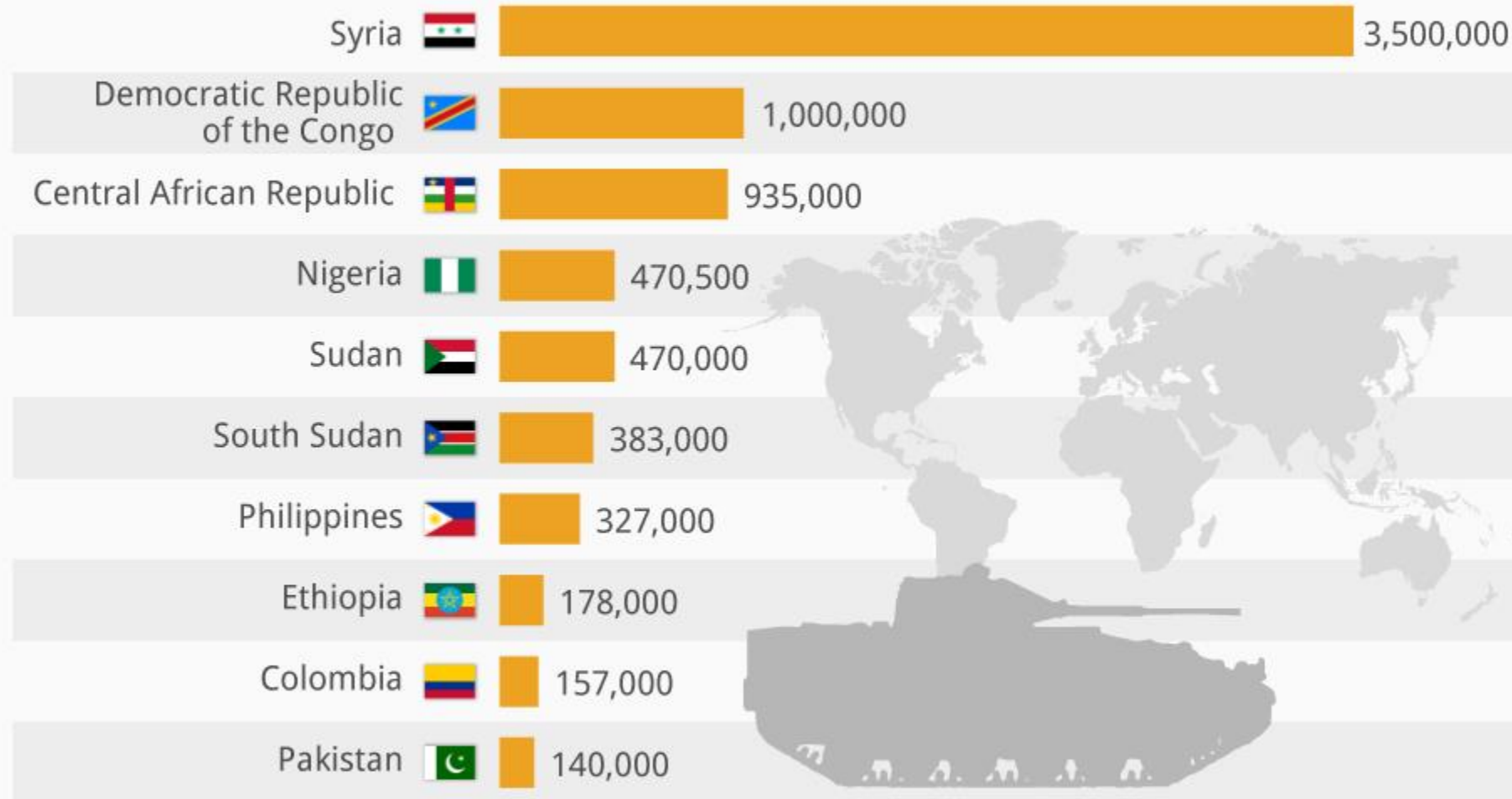
**Conflict is pervasive in many parts of the  
Middle East and in Africa...**





## 8.2 Million People Newly Displaced by Conflict in 2013

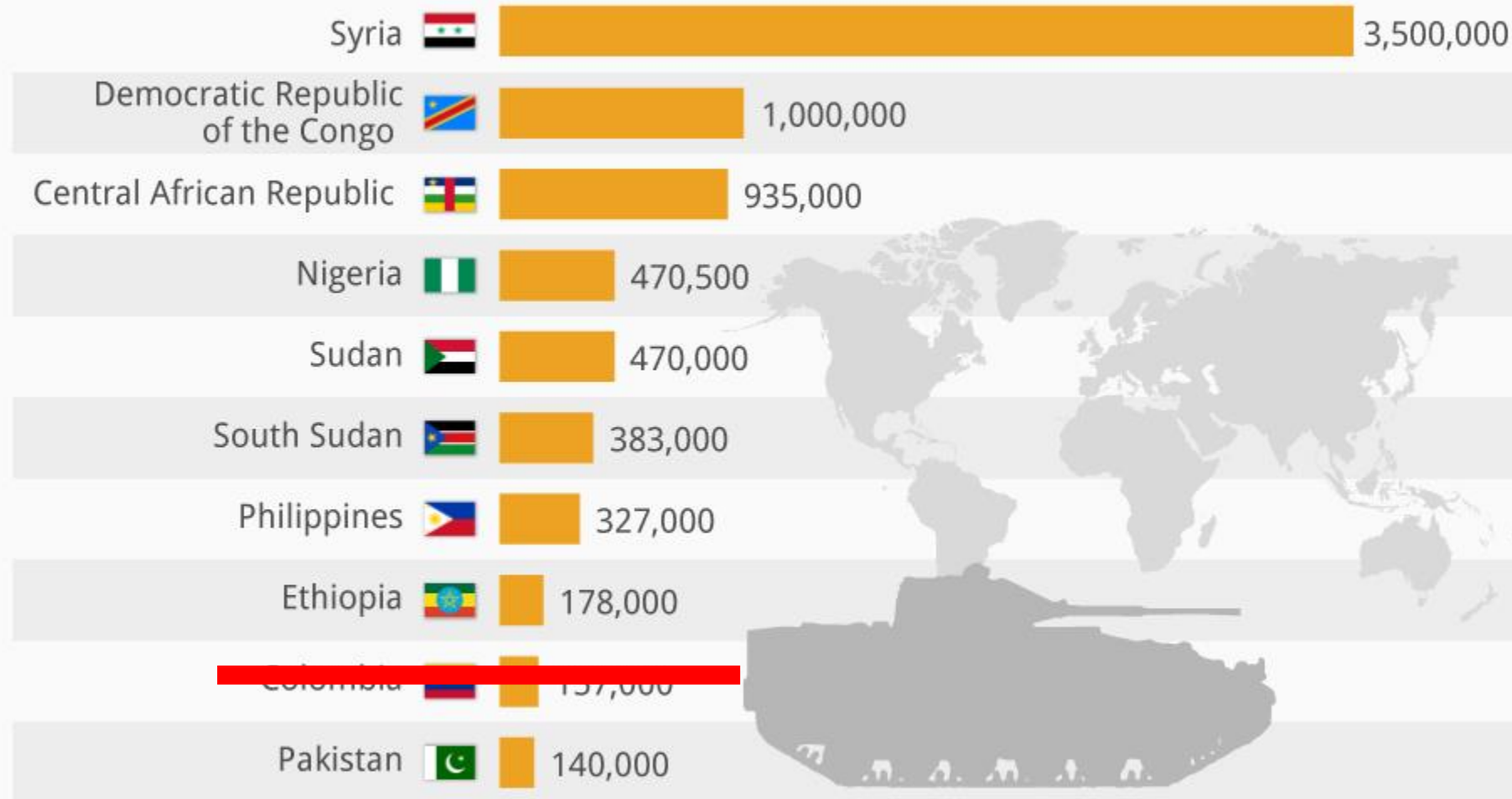
The 10 countries with the highest number of newly internally displaced people in 2013





## 8.2 Million People Newly Displaced by Conflict in 2013

The 10 countries with the highest number of newly internally displaced people in 2013











## AFRICA: PROGRESS AND PROBLEMS CIVIL WARS IN AFRICA



**Senior Consulting Editor: Dr. Robert I. Rotberg**

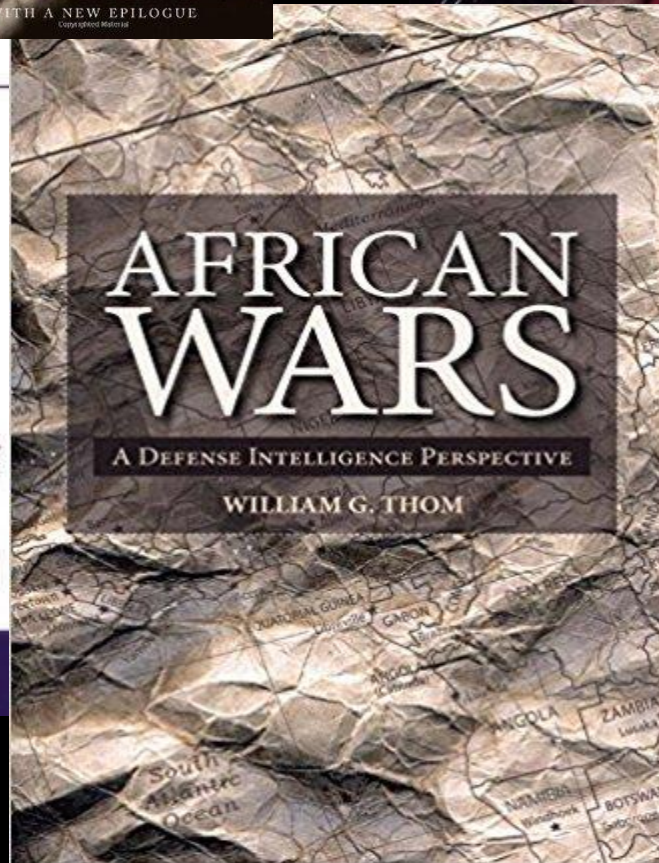
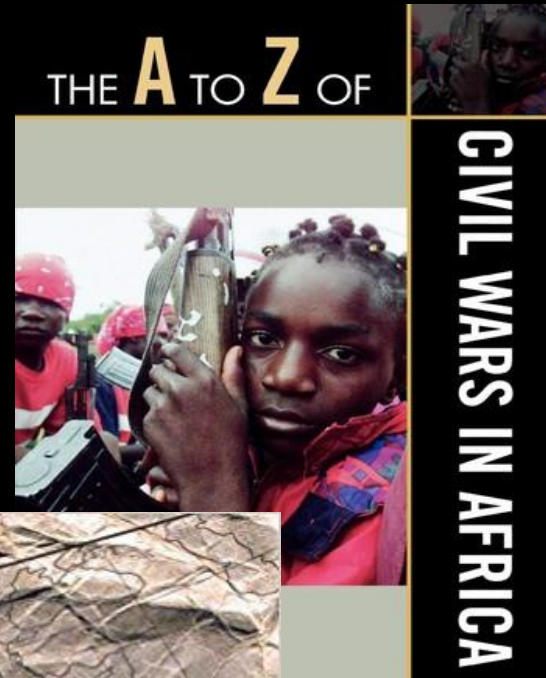
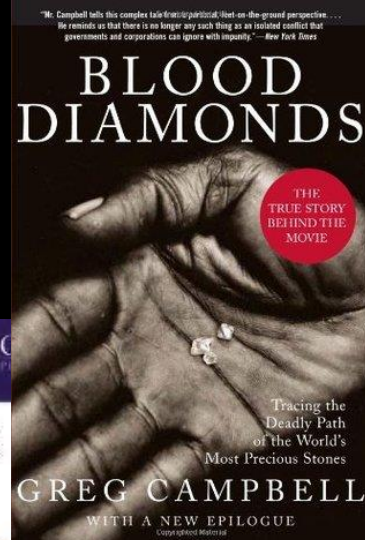
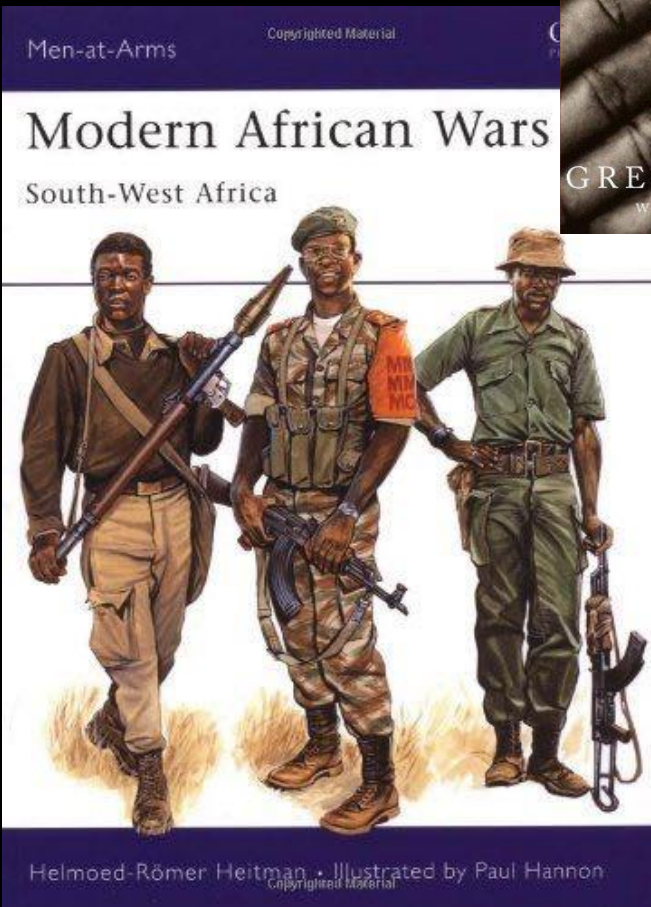
Former Director of the Institute for Conflict & Gender Resolution programs at the Kennedy School, Harvard University and President of the World Peace Foundation

**Senior Consulting Editor: Dr. Victor Ojiako**

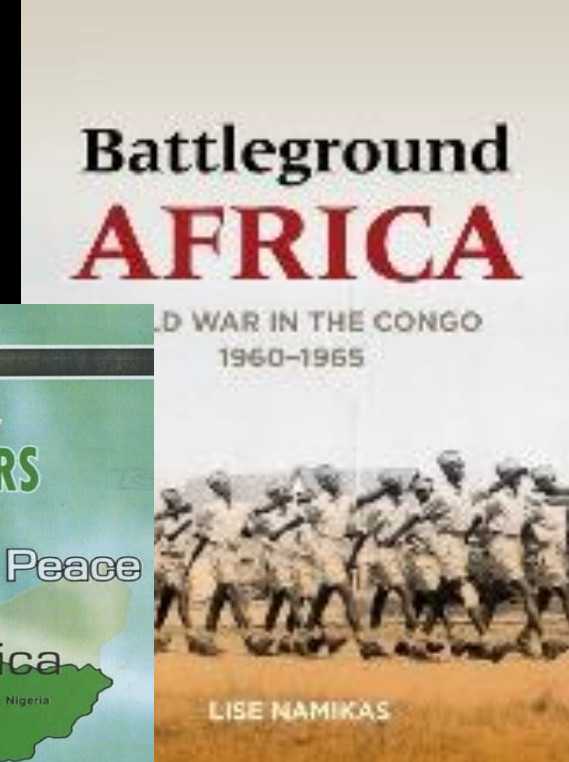
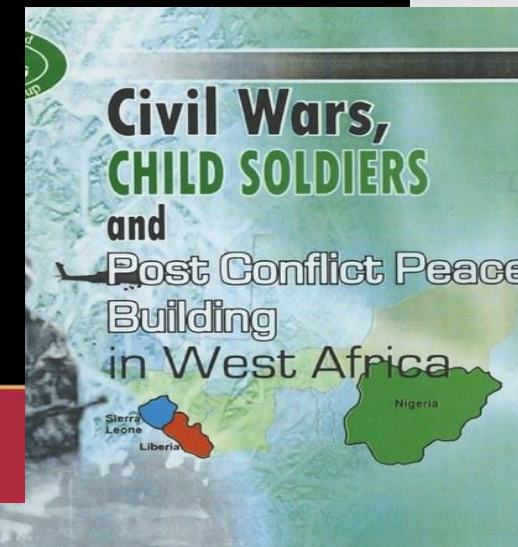
Department Head of Politics & International Relations at North West University in Potchefstroom, South Africa

by William I. Zartman



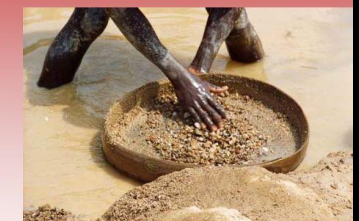


GUY ARNOLD



## Blood Diamonds

- War diamonds, conflict diamonds, hot diamonds
- Diamonds mined in a war zone and sold to finance civil wars, terrorism, genocide, or a dictator's activities
- Takes place in Africa, where 2/3 of the world's diamonds are mined



















**UNHCR**  
The UN Refugee Agency

**GLOBAL TRENDS**  
FORCED DISPLACEMENT IN 2016

# 65.6 MILLION FORCIBLY DISPLACED WORLDWIDE

as a result of persecution, conflict,  
violence, or human rights violations



# Assessing the Challenge



TABLE 1: POPULATION OF THE WORLD AND MAJOR AREAS, 2015, 2030, 2050 AND 2100

<i>Major area</i>	<i>Population (millions)</i>			
	<i>2015</i>	<i>2030</i>	<i>2050</i>	<i>2100</i>
World .....	7 336	8 505	9 804	11 213
Africa .....	1 171	1 658	2 473	4 387
Asia .....	4 397	4 939	5 324	4 889
Europe.....	742	744	728	646
Latin America and the Caribbean .....	630	716	776	721
Northern America .....	357	401	445	500
Oceania .....	40	48	59	71

*Sources:* For populations in 2015, 2030, and 2050, see Population Reference Bureau, *2015 World Population Data Sheet*, [Washington, DC: Population Reference Bureau](#). For populations in 2100, see United Nations, *World Population Prospects: The 2015 Revision. Key Findings and Advance Tables*, [New York: United Nations, Department of Economic and Social Affairs, Population Division](#), 2015.



**The Key:**  
**Lower the cost of food**

**200**



**The Key:**

**Lower the cost of food**

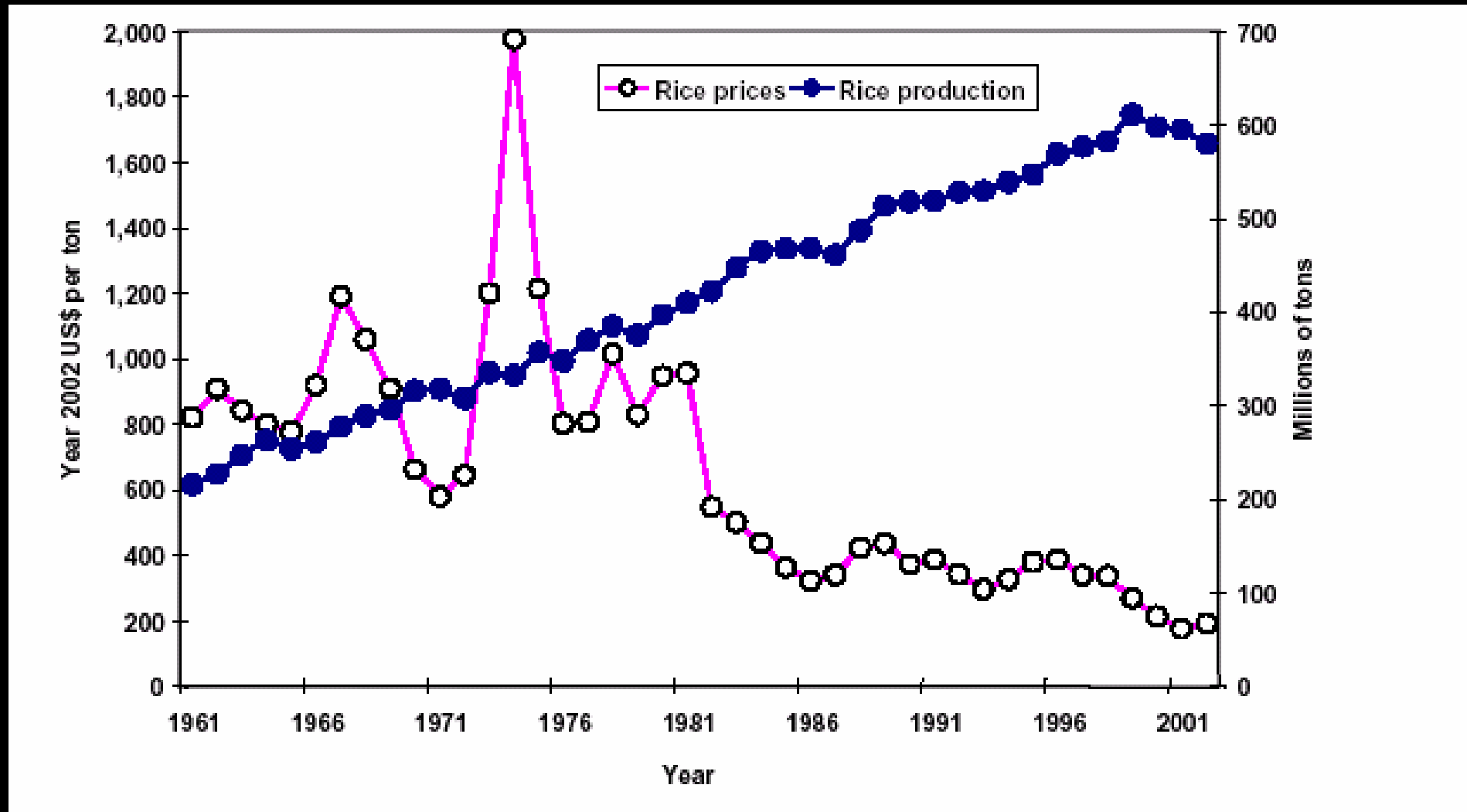
**but**

**Increase production of the rural poor**

**FASTER than the price drops**



# Rice production and Rice price over time





**Global Food Production**  
**Must Grow by**  
**+40% by 2030**  
**&**  
**+70% by 2050**



# **Food Security and Production**

- **Production is a necessary but not sufficient condition for food security**
- **Focusing on the small-holder farmer in developing countries is key to environmental protection, poverty reduction and food security**

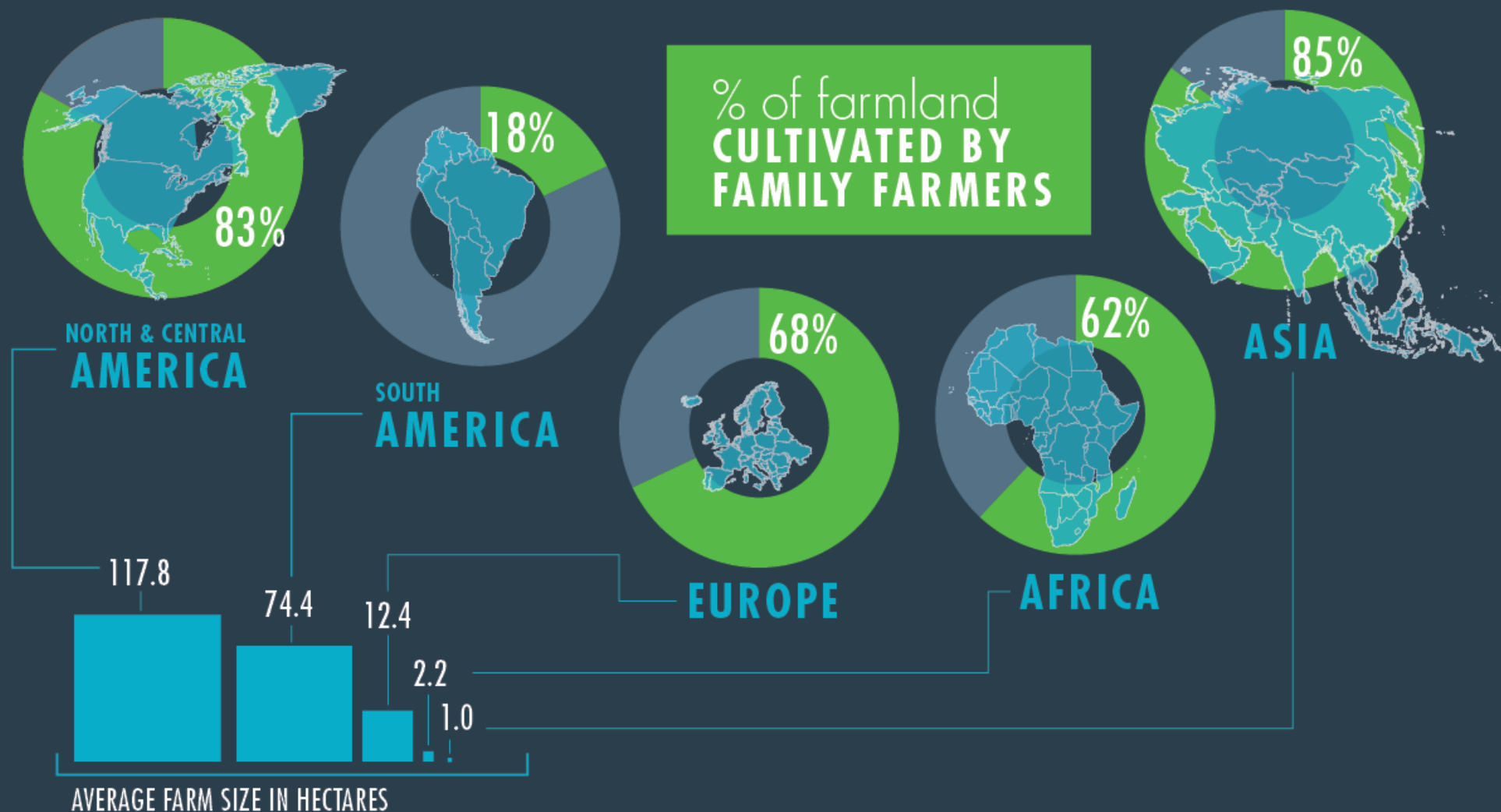


# Responding to the Production Challenge:

- Increasing area under cultivation
- Increasing yields



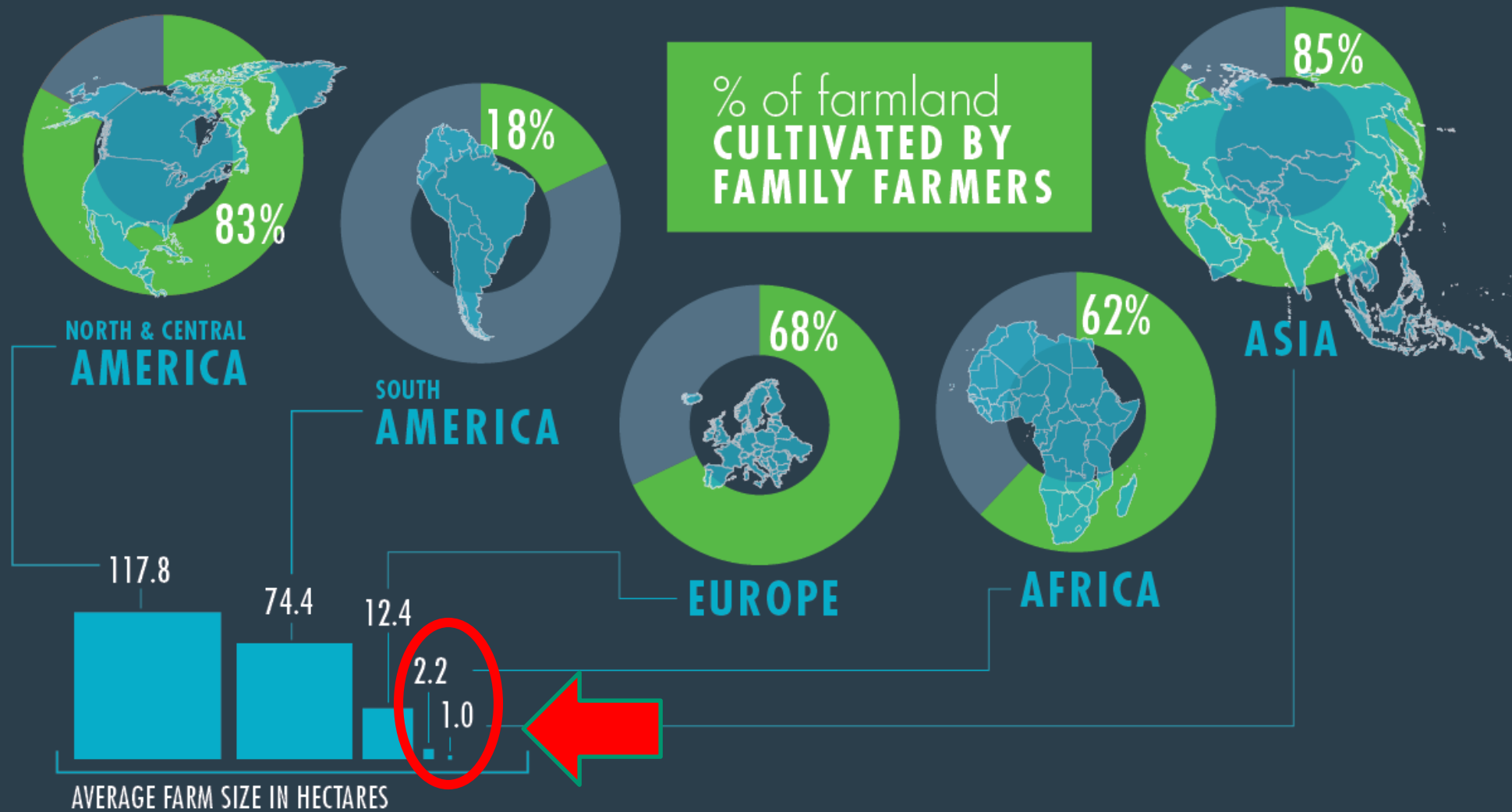
**FIGURE 1** Distribution of land held by family farms and average farm size by region



**Sources:** Food and Agricultural Organization of the United Nations, *Family Farmers: Feeding the World, Caring for the Earth*, infographic, 2014, [www.fao.org/resources/infographics/infographics-details/en/c/230925](http://www.fao.org/resources/infographics/infographics-details/en/c/230925); FAO, *2000 World Census of Agriculture: Analysis and International Comparison of the Results (1996–2005)* (Rome, 2013), [www.fao.org/fileadmin/templates/ess/ess\\_test\\_folder/World\\_Census\\_Agriculture/Publications/WCA\\_2000/Census13.pdf](http://www.fao.org/fileadmin/templates/ess/ess_test_folder/World_Census_Agriculture/Publications/WCA_2000/Census13.pdf).



**FIGURE 1** Distribution of land held by family farms and average farm size by region



**Sources:** Food and Agricultural Organization of the United Nations, *Family Farmers: Feeding the World, Caring for the Earth*, infographic, 2014, [www.fao.org/resources/infographics/infographics-details/en/c/230925](http://www.fao.org/resources/infographics/infographics-details/en/c/230925); FAO, *2000 World Census of Agriculture: Analysis and International Comparison of the Results (1996–2005)* (Rome, 2013), [www.fao.org/fileadmin/templates/ess/ess\\_test\\_folder/World\\_Census\\_Agriculture/Publications/WCA\\_2000/Census13.pdf](http://www.fao.org/fileadmin/templates/ess/ess_test_folder/World_Census_Agriculture/Publications/WCA_2000/Census13.pdf).



# Meeting the Production Challenge

- Increasing biological yields
- Improving nutrient content
- Intensifying agriculture
- Managing natural resources sustainably



# **African Urbanization – Sometimes driven by economic boom**





# **African Urbanization – Sometimes driven by economic desperation**





# Urban Poverty is Pervasive





**Much of  
the urban  
growth  
will be in  
the form  
of slums**





**Discussion of urban farming and vertical hydroponics, etc. is – to say the least – a challenge**





# World's largest rooftop farm – in Chicago, USA





# The most Likely outcomes of rapid African urbanization:



- More demand for **storability**
- More demand for **transportability**
- And the possibilities for expansion of the food transport and **processing** and **retailing** industries.

**BUT**

- The condition of **infrastructure** will be a major obstacle



# What Science Can Do



**The Green Revolution that had such an effect on India, and Asia more generally, has largely by-passed Africa**



**So, Let's go  
From the Green Revolution to  
the Doubly Green Revolution  
to the  
Ever Green Revolution**



# **Doubly Green Revolution**

## **(Going Towards the Ever Green Revolution)**

- **More genetically diverse crops**
- **Less chemical inputs (IPM and other means)**
- **Integrated soil, water and nutrient management**
- **Small holder farming system context, environmentally and socio-economically**













**Integrated Pest Management**









**Integrated Soil, Water & Nutrient Management**



# Recognize The Gender Dimension







**Promoting  
Alternatives to  
Slash and Burn**





**Reduce  
Post-Harvest Losses**







**Always**  
**Pro-Poor**  
**Pro-Women**  
**Pro-Environment**





# The Genetic Imperative



**Different Regions Will Need to  
Address Different Problems... But  
All Will Require the Best of  
Science!**

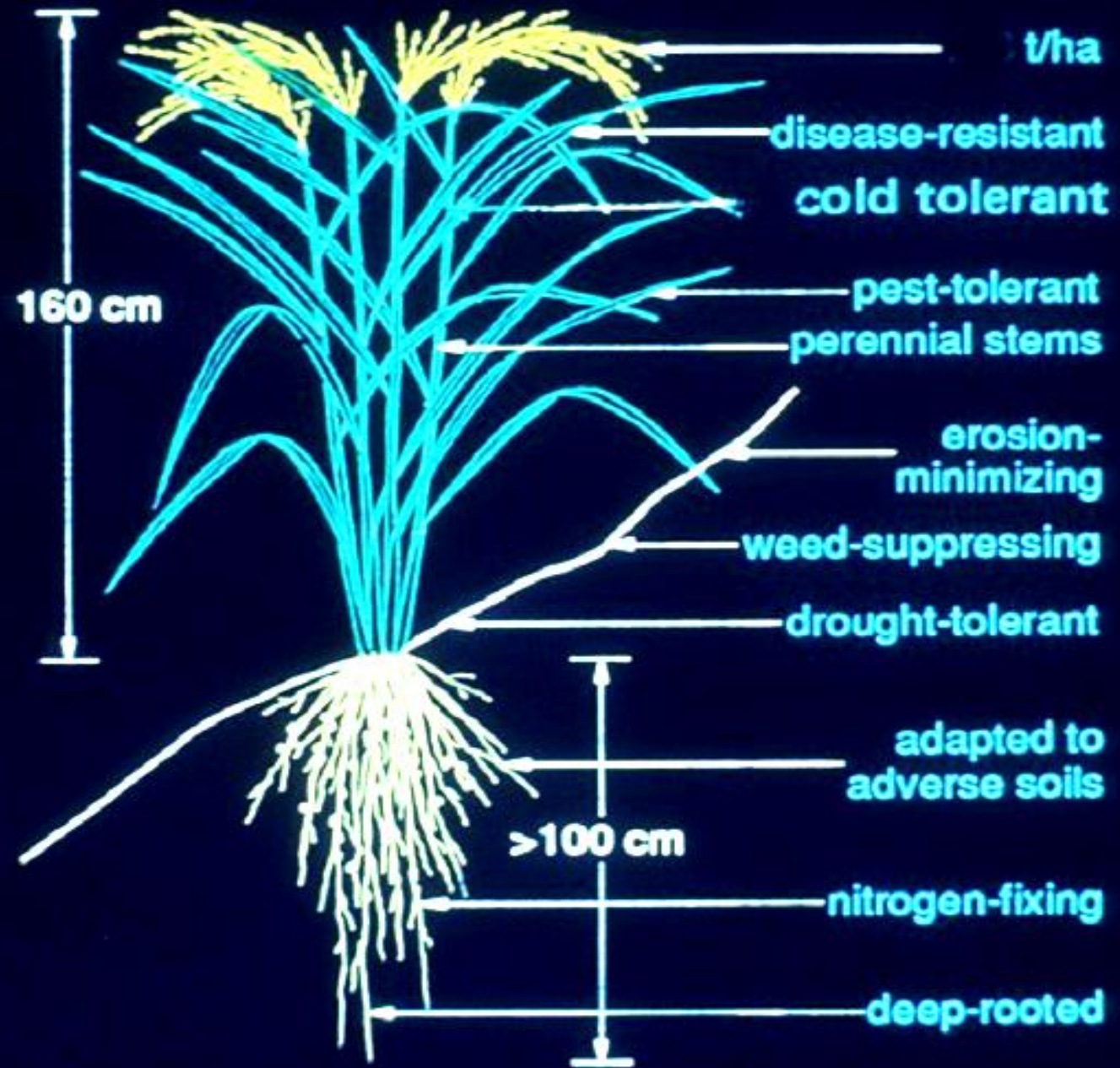




**Focusing on the problems of  
the poor**



# How About Super Upland Rice by 2020?





**We must intensify the various successes we have had with conventional programs of agricultural research and extension as well as the pro poor, pro-women and pro-environment policies...**

**And**

**Also pursue the future technologies...**



# **Science and the Transformation of Agriculture**



**We must go for Precision Farming**





**One Calorie = One Liter**



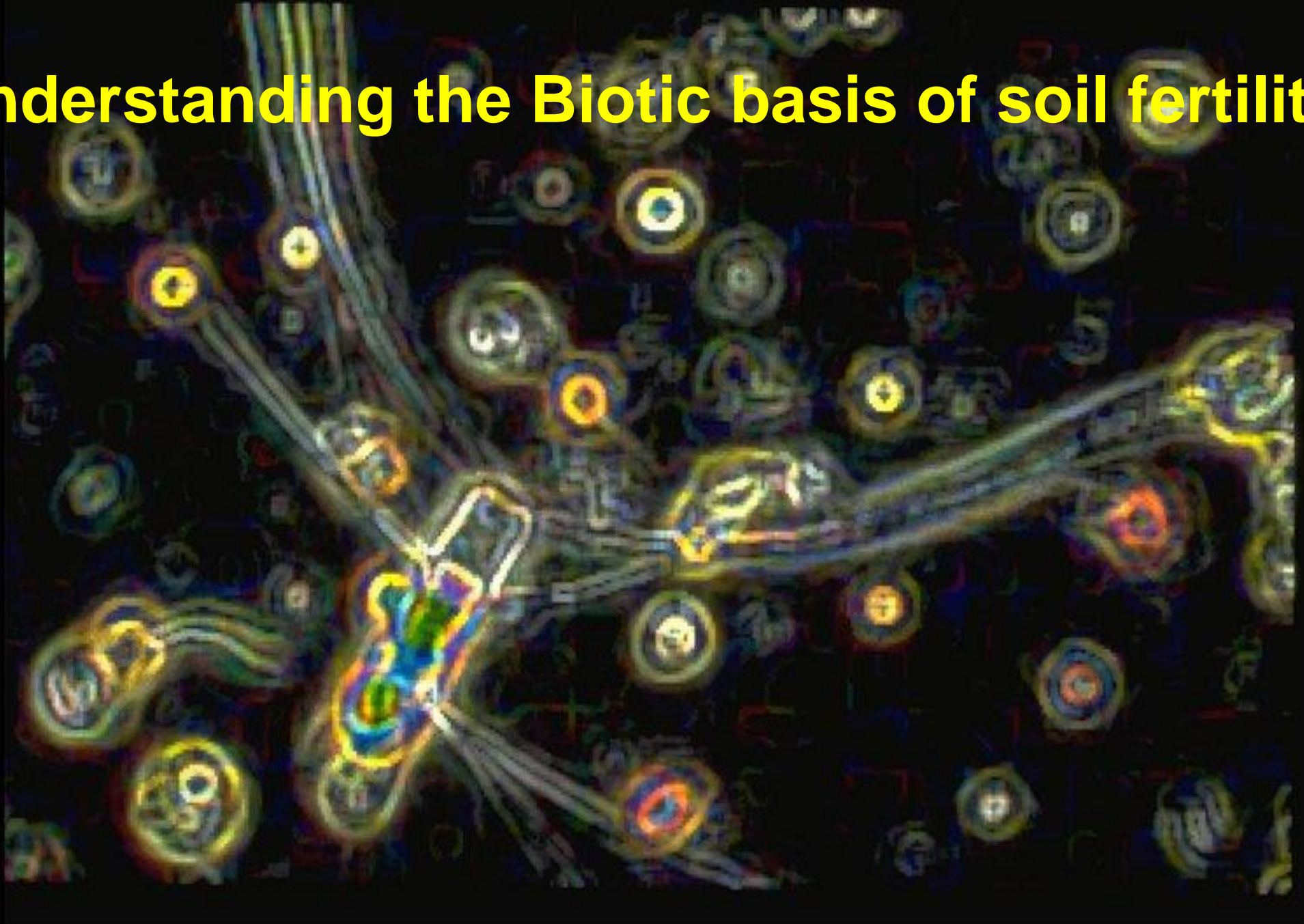




**More Crop Per Drop!**



# Understanding the Biotic basis of soil fertility





# Science for Precision Agriculture

- **Better Management**
- **Today's Robots**
- **Remote Sensing and Mobile Phones**
- **Early Biotechnology**
- **The New Biotechnology**
- **The Future**



# Science for Precision Agriculture

- **Better Management**
- Today's Robots
- Remote Sensing and Mobile Phones
- Early Biotechnology
- The New Biotechnology
- The Future



**Scientific Management  
Improves Tremendously  
The Output Of Traditional  
Farms**

**-- Example: System of Rice  
Intensification (SRI)**





**Also better management of :  
Lab to Farm & Farm to Consumer**



# The possibility of using protected agriculture for particular crops



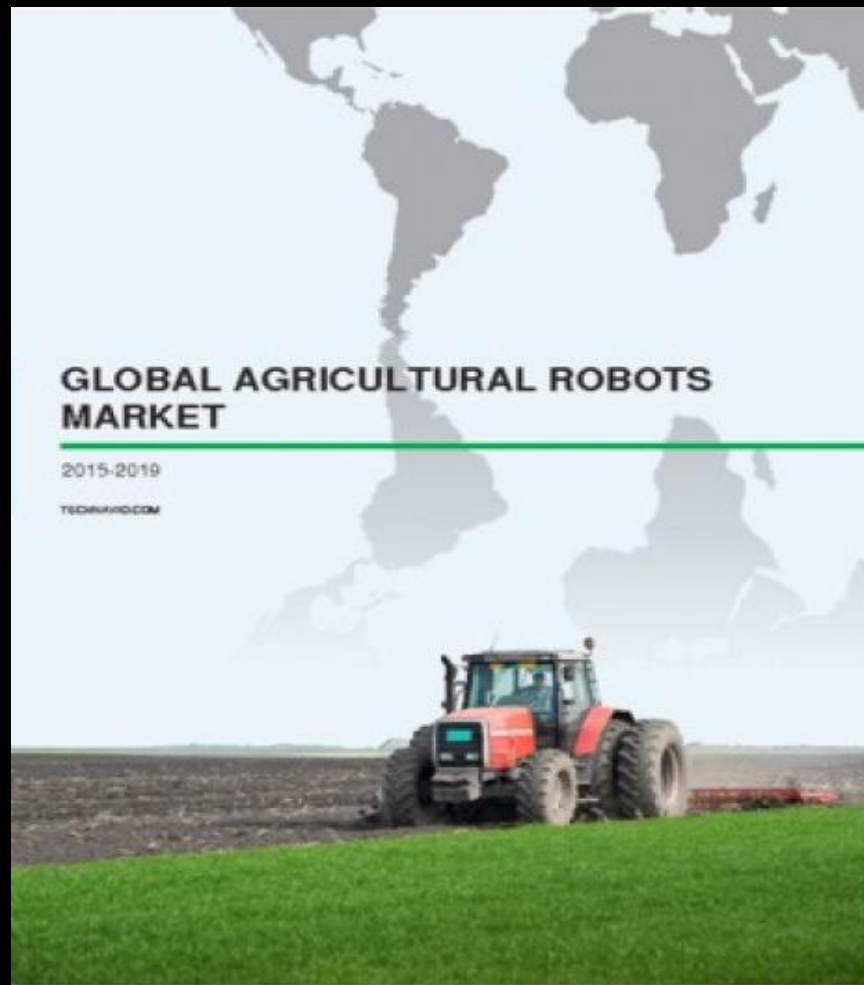
Source: Dr. Ayman Abou Hadid, India 11 02 2019



# Science for Precision Agriculture

- Better Management
- **Today's Robots**
- Remote Sensing and Mobile Phones
- Early Biotechnology
- The New Biotechnology
- The Future





**More and more  
sophisticated robots are  
coming on the market**









**But for sub-Saharan Africa we would want  
more basic machines with great efficiency  
and lower cost**









250



# Science for Precision Agriculture

- Better Management
- Today's Robots
- **Remote Sensing and Mobile Phones**
- Early Biotechnology
- The New Biotechnology
- The Future



**And we could link satellite remote sensing, supplemented by drones with hand held mobile phones or tablets.**







# Multisensor Data Fusion and Machine Learning for Environmental Remote Sensing

Ni-Bin Chang  
Kaixu Bai

 CRC Press  
Taylor & Francis Group



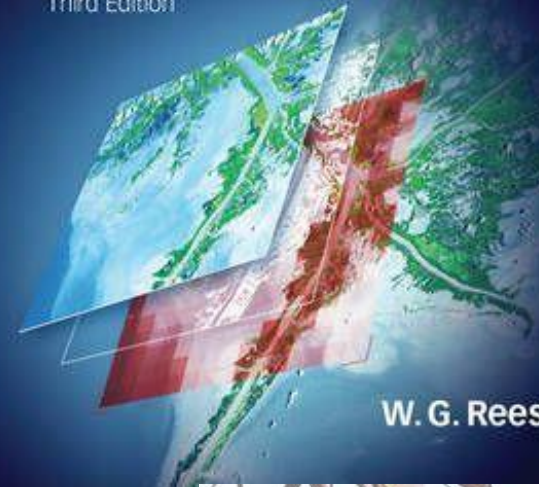
## Application of Remote Sensing in Agriculture

By - UTTAM KUMAR

29/09/2015

## PHYSICAL PRINCIPLES of REMOTE SENSING

Third Edition



W. G. Rees

## ADVANCES IN AGRICULTURAL TECHNOLOGY

Mr. Ronnie Z. Valenciano Jr.

## REMOTE SENSING APPLICATIONS IN ENVIRONMENT

By:

Muhamma  
PH# 03



 isprs  
International Society for  
Photogrammetry and Remote Sensing

ISPRS Book Series



## Recent Advances in Remote Sensing and Geoinformation Processing for Land Degradation Assessment

Edited by Achim Röder and Joachim Hill

 CRC Press  
Taylor & Francis Group  
A TAYLOR & FRANCIS BOOK



**Satellite data can give us 10mx10m pixels...  
Drones can bring that to 20cmx20cm images!**







A high-resolution aerial satellite image of a vast agricultural landscape. The terrain is divided into a dense grid of rectangular fields, each with varying shades of green, brown, and tan, indicating different crops and land management practices. A network of dark, winding lines represents rivers and irrigation canals. The overall scene is a mosaic of agricultural land use.

**Satellite imagery for agriculture – 37% of the  
land use of the planet**

3.36 mi

Image © 2010 DigitalGlobe  
© 2010 Google  
Image USDA Farm Service Agency

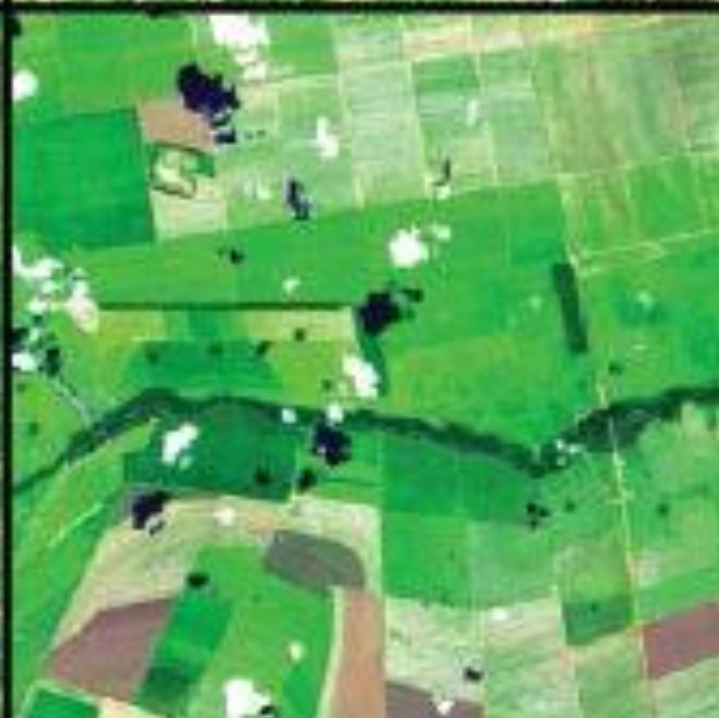
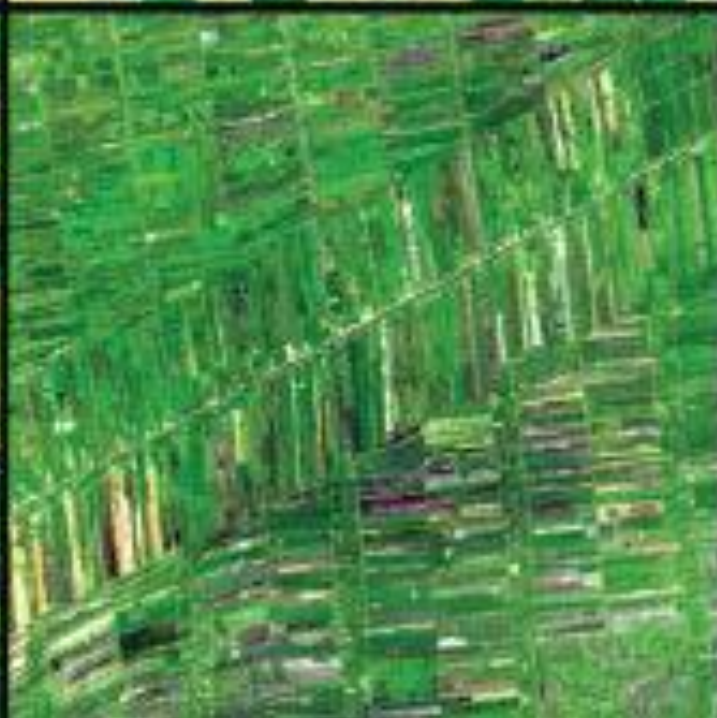
© 2010 Google

Rosenlen

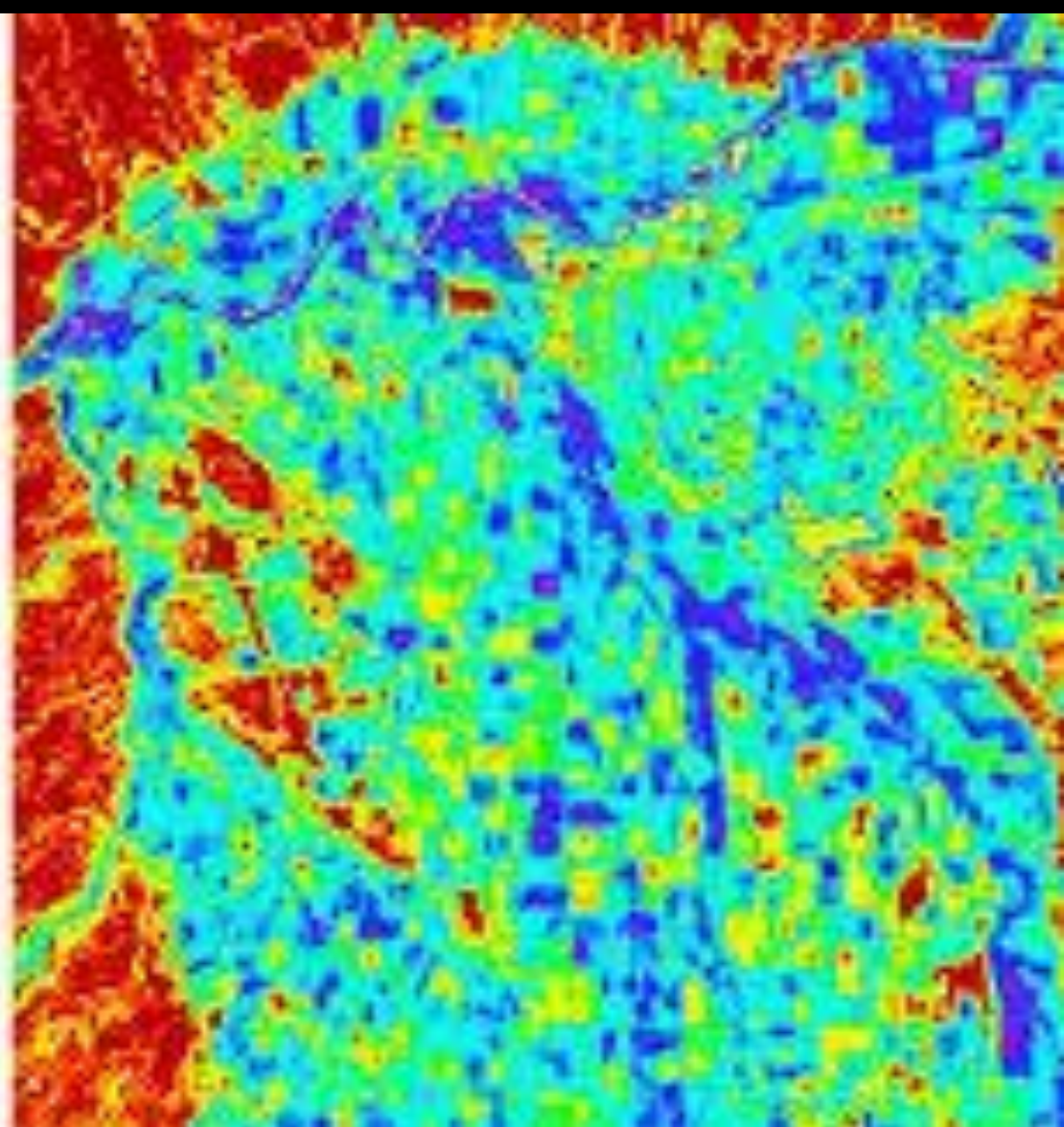






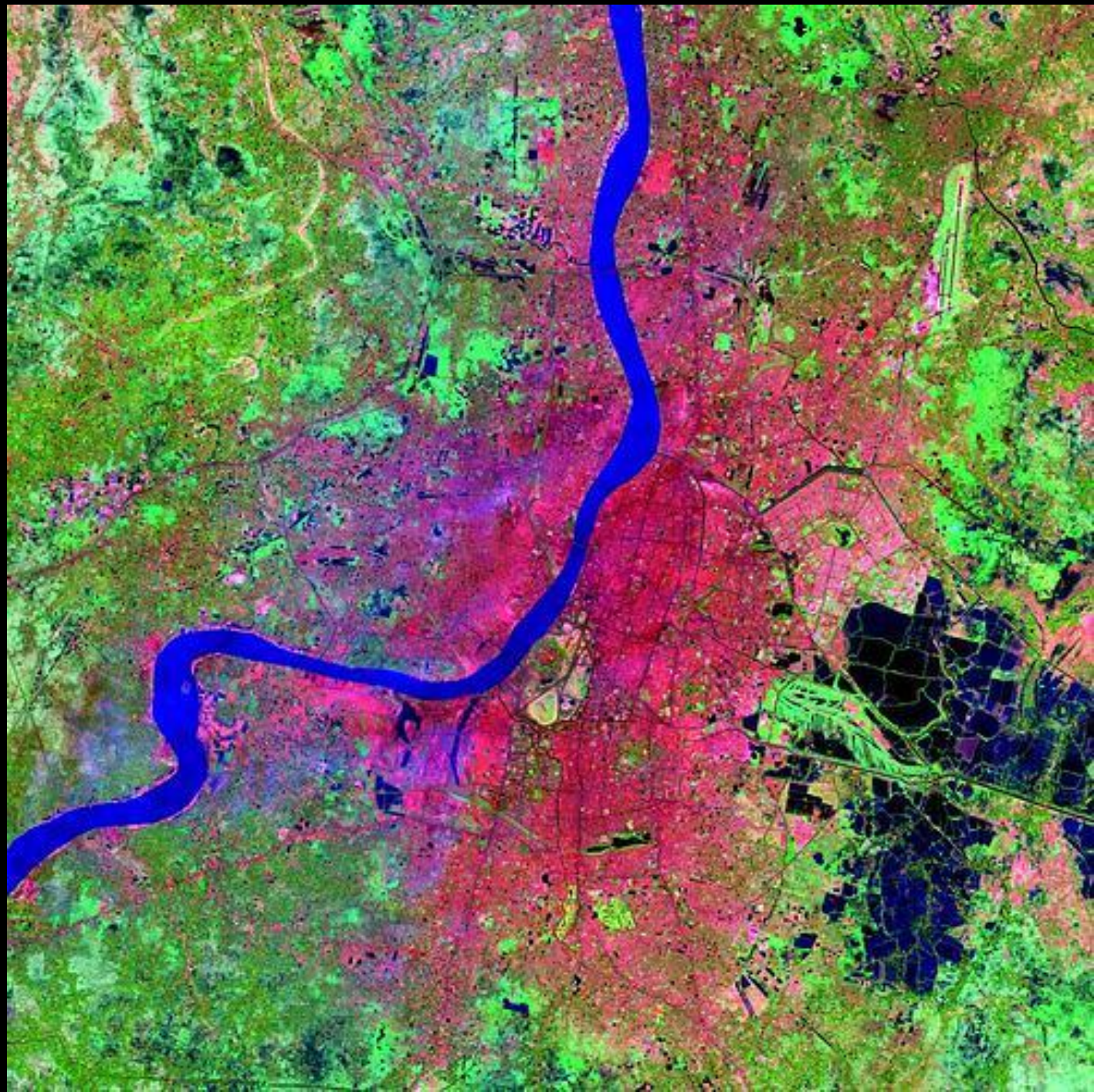






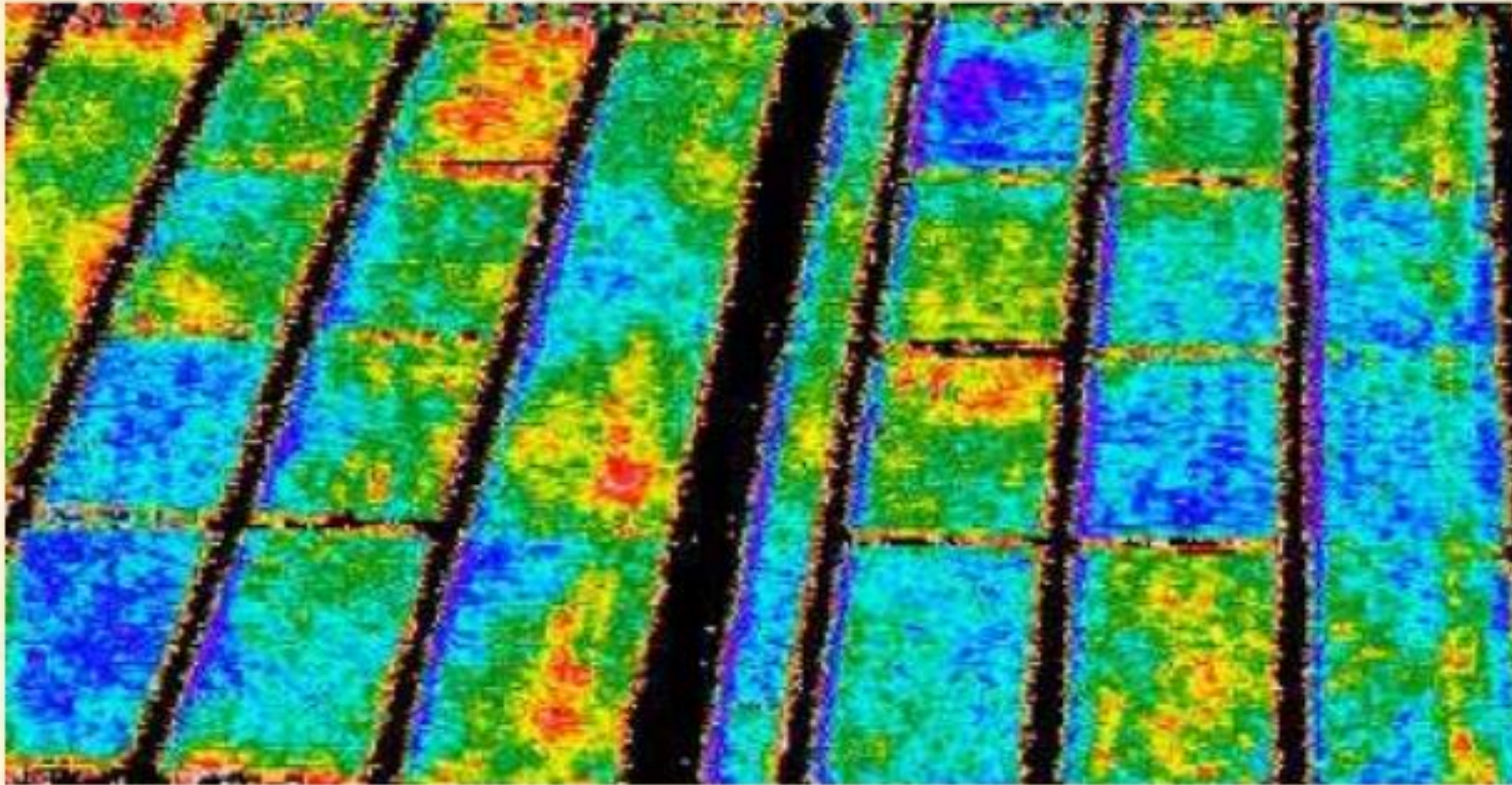


**Damage  
caused by  
flooding**





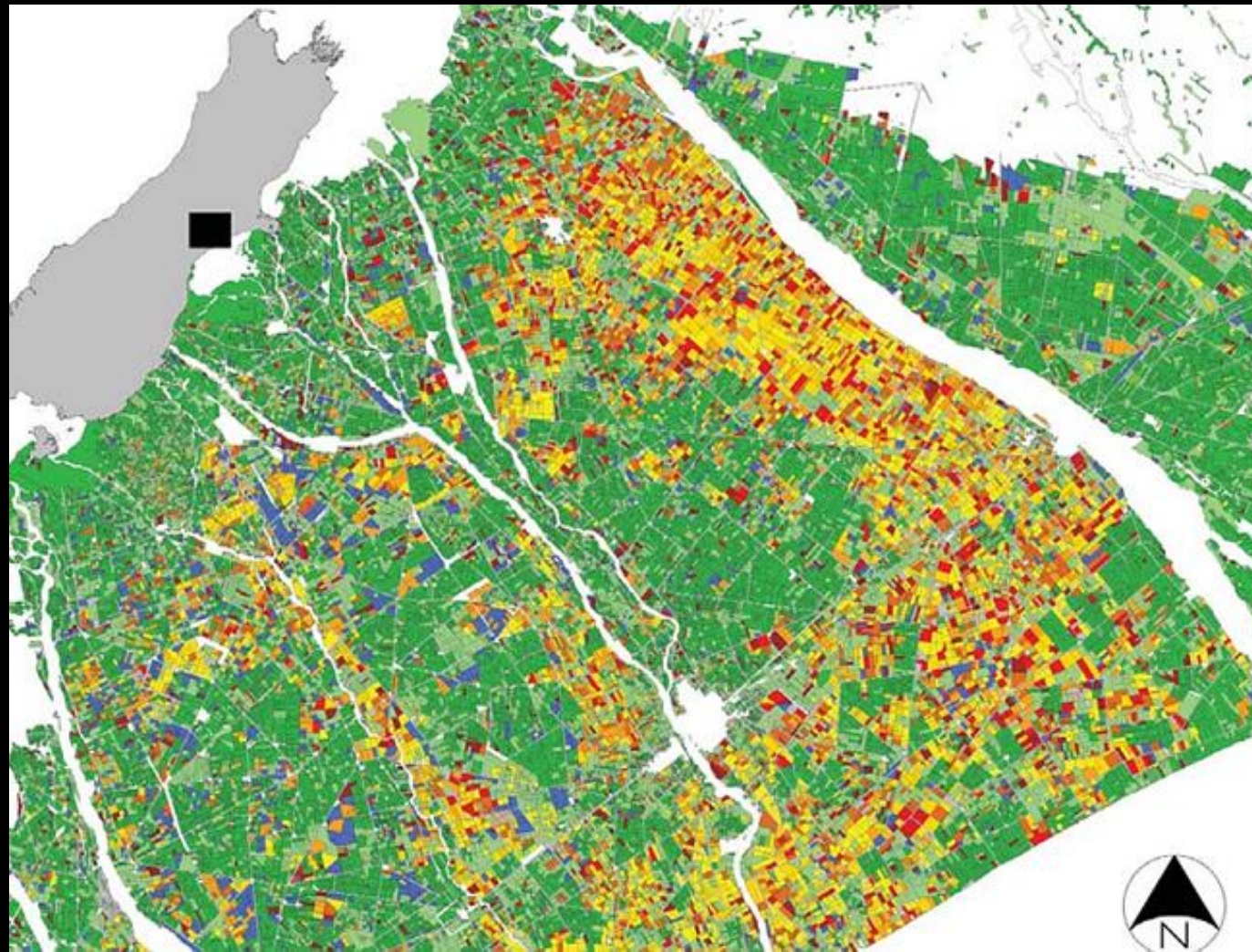
# Water content of field crops



Water content of crop fields with thermal imaging.

*Isdo et al (1977)*





**Monitoring agricultural land use with time series data**



**With an intensified and expanded system  
of Agricultural Extension staff (e.g.  
Ethiopia) this could be very effective**

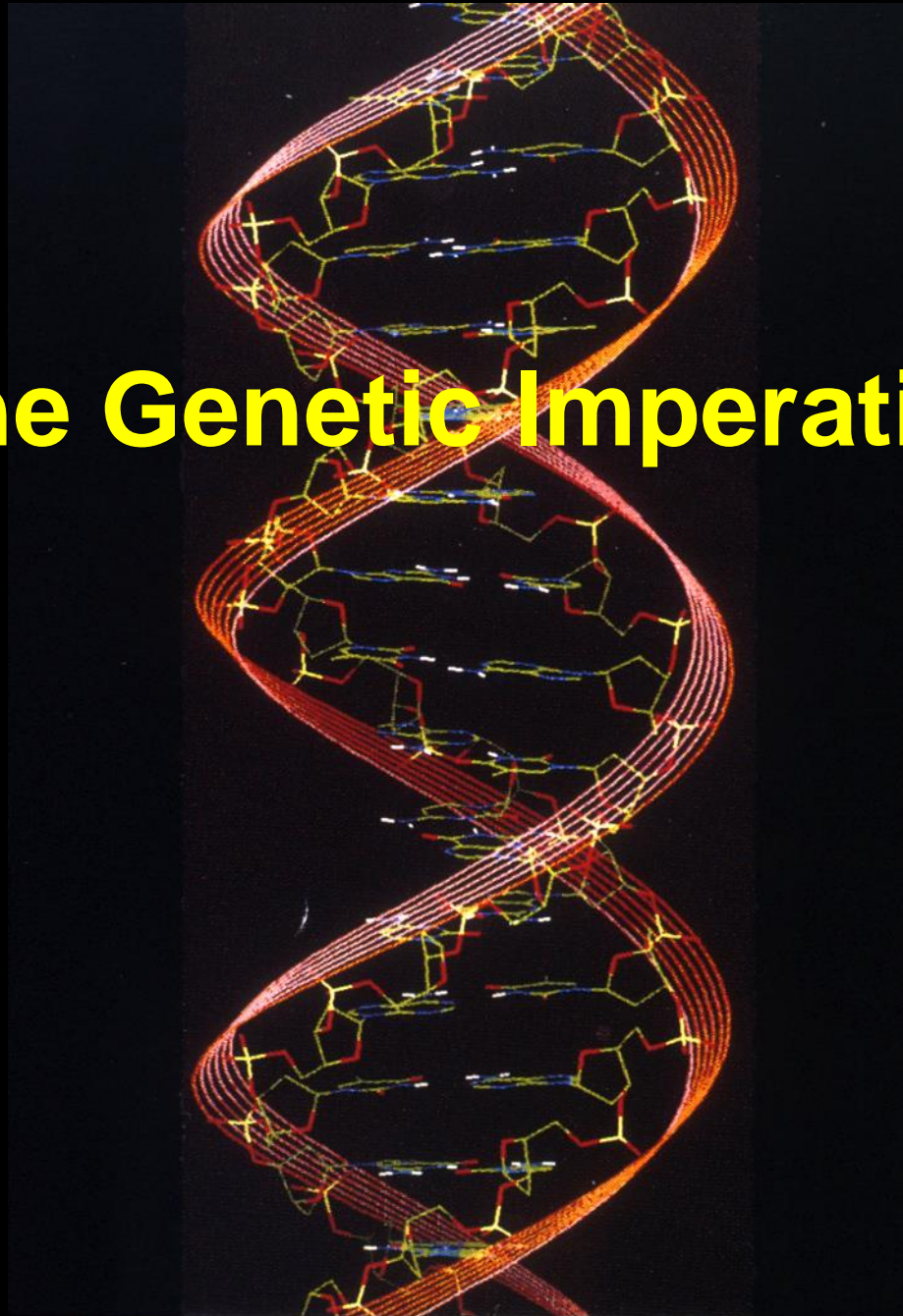


# Science for Precision Agriculture

- Better Management
- Today's Robots
- Remote Sensing and Mobile Phones
- **Early Biotechnology**
- The New Biotechnology
- The Future



# The Genetic Imperative





A close-up, artistic photograph of two hands reaching towards each other. The hand on the left is a vibrant orange, while the hand on the right is a deep blue. They are positioned as if about to clasp or have just released each other. The background is a dark, deep blue, filled with a multitude of small, bright white and yellow particles that resemble dust or light, creating a dreamlike, ethereal atmosphere. The lighting is soft, highlighting the textures of the skin and the contrast between the two colors.

**Playing God**





**Playing God**





**By selecting on the genetic material rather than the phenotype, the new biology unleashes enormous potential**





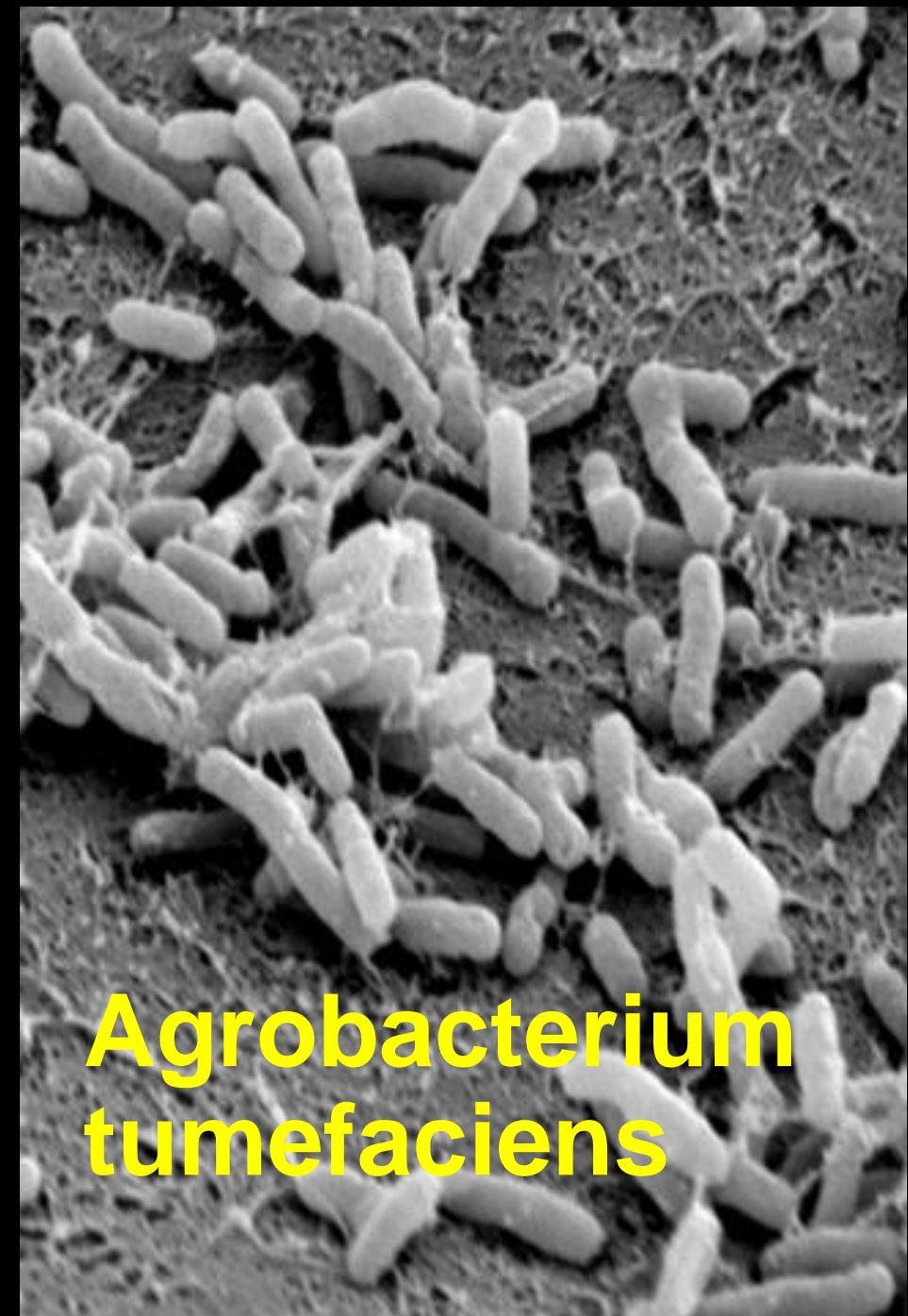
# Use of agrobacterium



**Jozef Schell**  
**(1935-2003)**



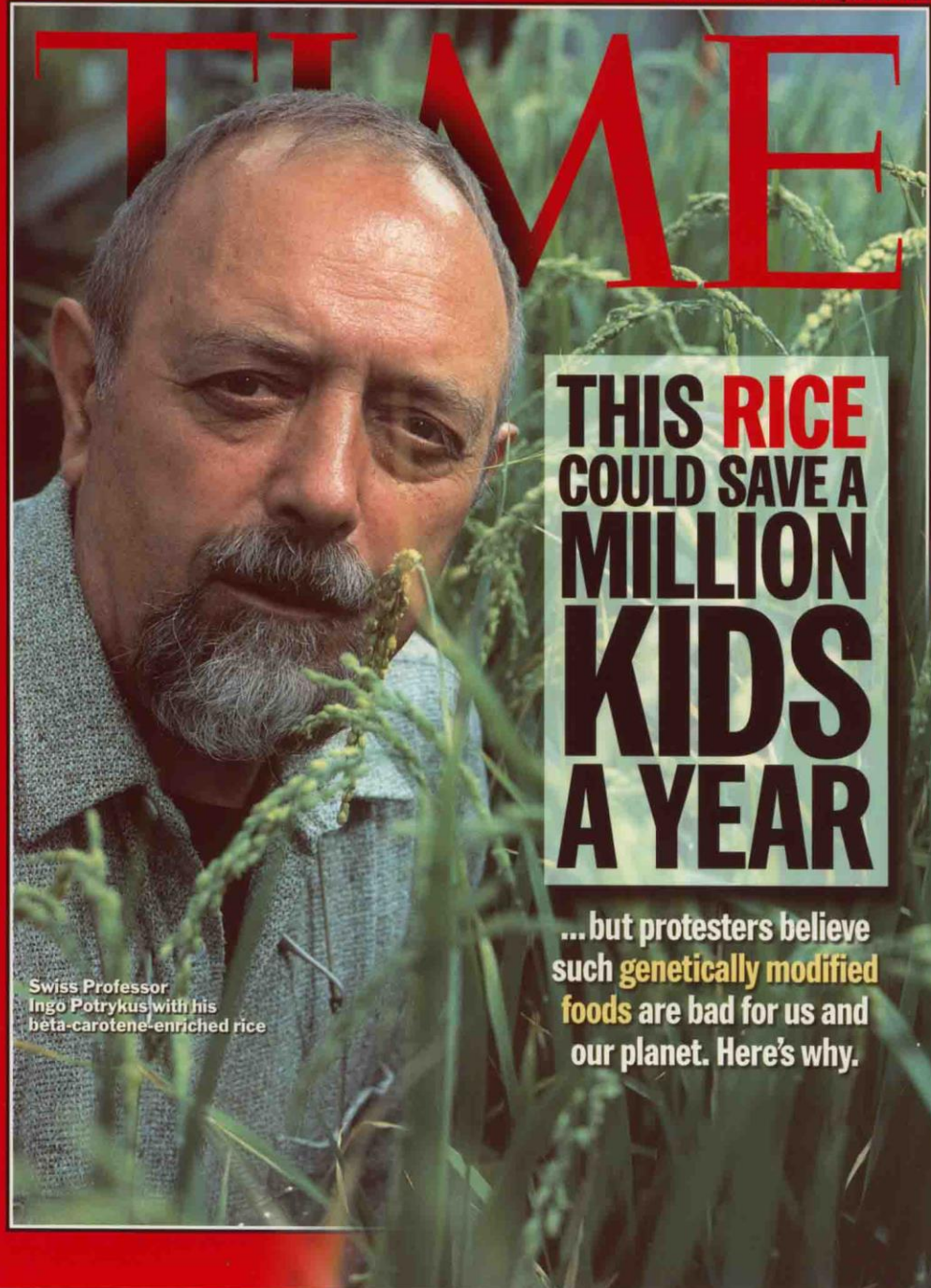
**Marc Van Montagu**  
**(1933 - )**





**We should not only try to produce more food through plants with more desirable traits for planting in the difficult regions...  
We should also think in terms of  
nutritional content...**





# Ingo Potrykus and Peter Beyer





# White and Golden Rice





# Science for Precision Agriculture

- Better Management
- Today's Robots
- Remote Sensing and Mobile Phones
- Early Biotechnology
- **The New Biotechnology**
- The Future



# **New Genome Editing Techniques**

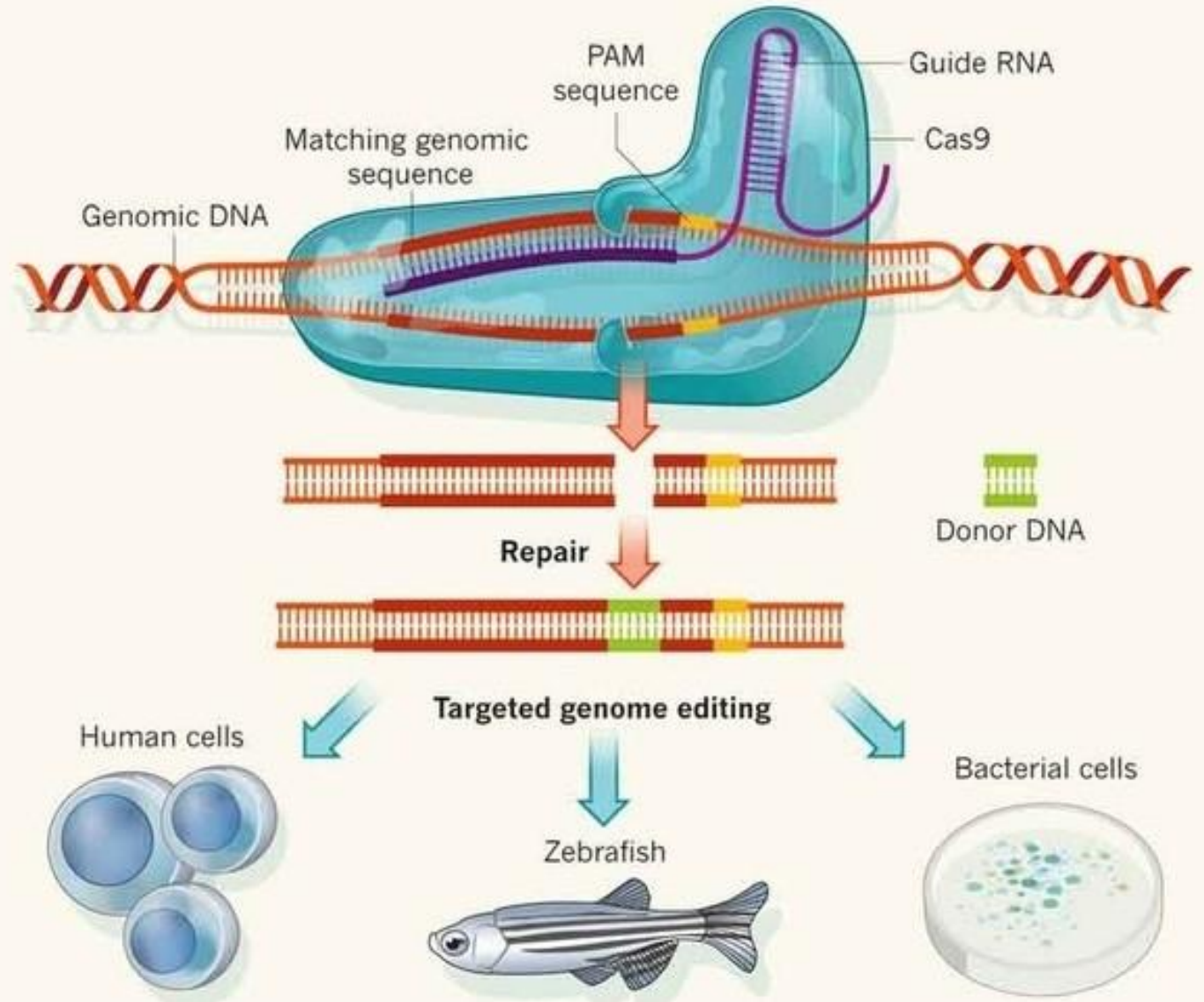




# **Clustered Regularly Interspaced Short Palindromic Repeats**



# CRISPR-Cas9



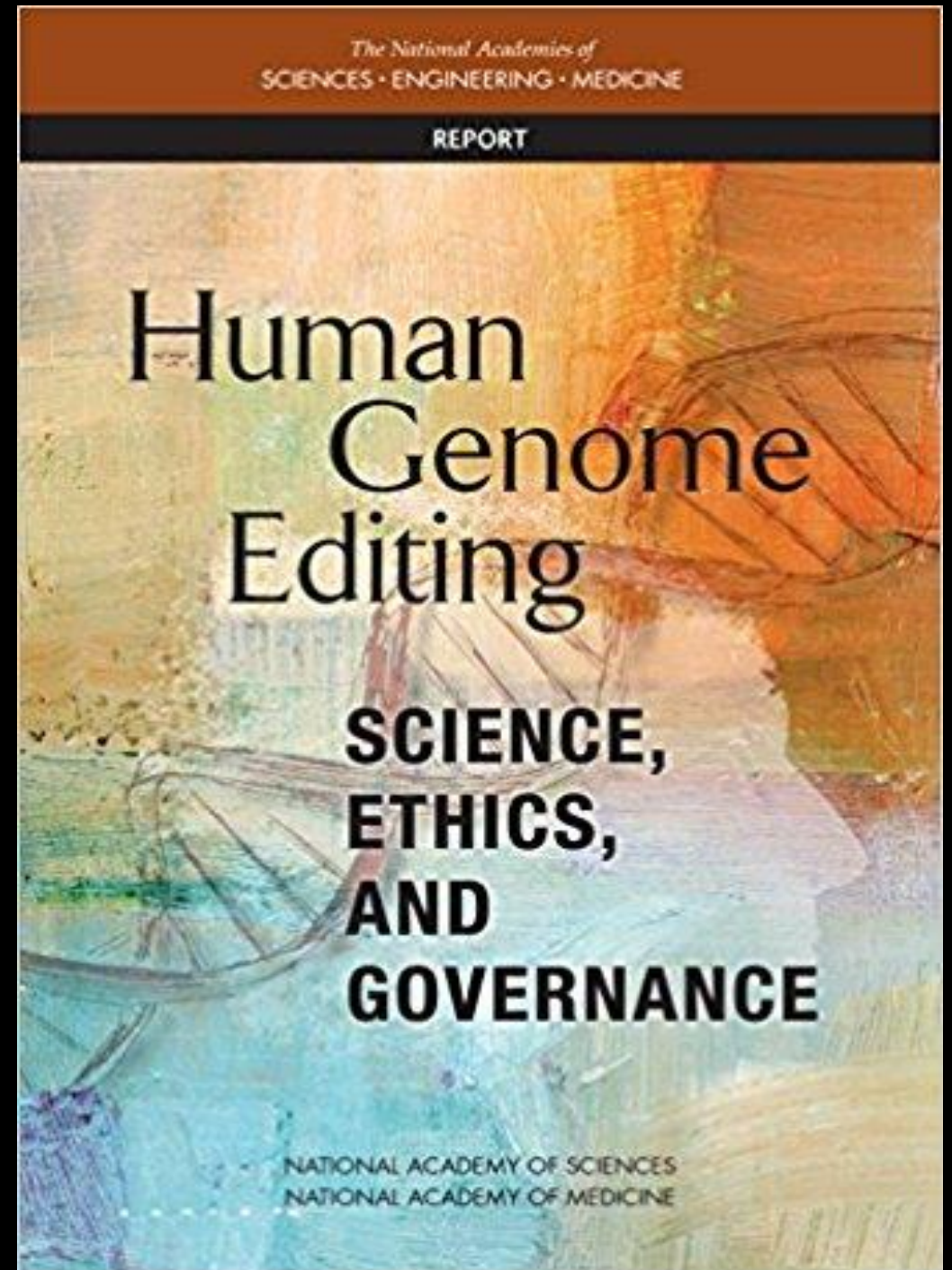


**18 month effort, hearings in USA  
and in Europe, plus review of the  
latest literature...**



# The NAS / NAM Report

- **Defines Principles**
- And**
- **Defines how to apply them to the issues of Human Genome Editing**





**BUT...**





**2018: CRISPR babies in China**





**Chinese babies Lulu and Nana born in 2018 are the first genetically modified humans**



## **Dr. He was Internationally Condemned**

**“We heard an unexpected and deeply disturbing claim that human embryos had been edited and implanted, resulting in a pregnancy and the birth of twins.**

**Even if the modifications are verified, the procedure was irresponsible and failed to conform with international norms.”**

**From the statement released by the organizing committee of the Second International Summit on Human Genome Editing in Hong Kong on 29 November 2018.**





**Elsewhere existing guidelines are being followed, and the promise of gene therapy is becoming ever more a reality**



**We are on the cusp of many, many new  
breakthroughs...**



# Back to Agriculture

- The new techniques are incredibly fast, accurate and inexpensive...
- They promise a true biological revolution as profound as the ICT revolution



# Science for Precision Agriculture

- Better Management
- Today's Robots
- Remote Sensing and Mobile Phones
- Early Biotechnology
- The New Biotechnology
- The Future



**How?**

**The combination of  
the Biological and the ICT revolutions  
will bring down costs dramatically...**



# Exploring the possibilities of radically new concepts:

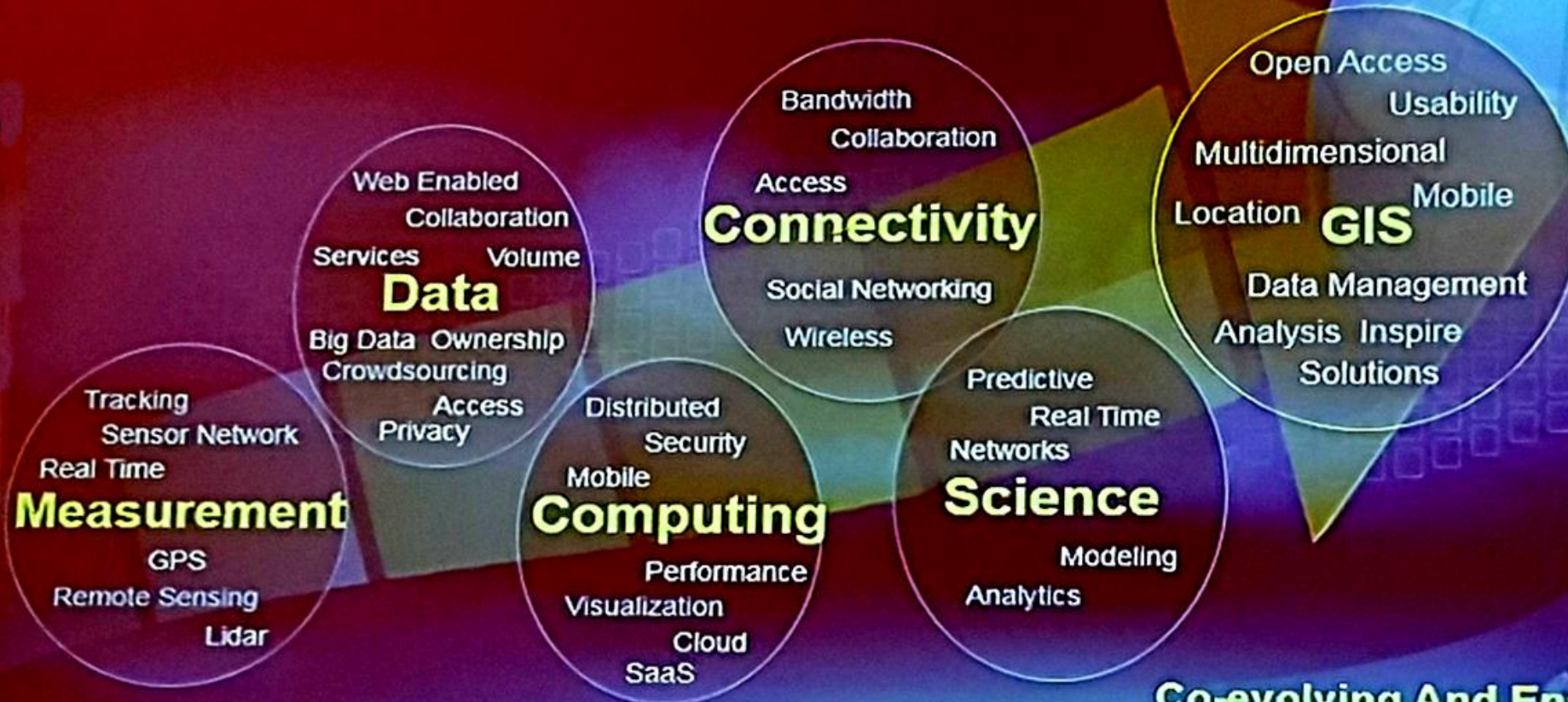
- Here I mean the scientific study of the possibilities of :
  - lab-produced meats,
  - single cell proteins
  - New developments in aquaculture,
  - algae-based fuels. And..
  - New approaches to enriching soil fertility through biological approaches rather than just adding chemical fertilizers.



**The future will belong to those who will  
promote Science, Technology And Innovation  
(STI)**



# Technology Is Changing Rapidly



Co-evolving And Enabling New Possibilities



# Science for Precision Agriculture

- **Better Management**
- **Today's Robots**
- **Remote Sensing and Mobile Phones**
- **Early Biotechnology**
- **The New Biotechnology**
- **The Future**



**But, in General...**



**First, make sure that existing best practices are  
generalized, from conservation agriculture to  
water management, etc. ...**



# Conservation , no till Agriculture...



Conservation Agriculture (CA): Increase yields  
and improve farmlands



A large school of fish, likely mackerels, swimming underwater. The fish are silvery with dark stripes and are densely packed, moving in a coordinated manner. The water is a deep blue color.

**We should also diversify into properly managed aquatic resources**

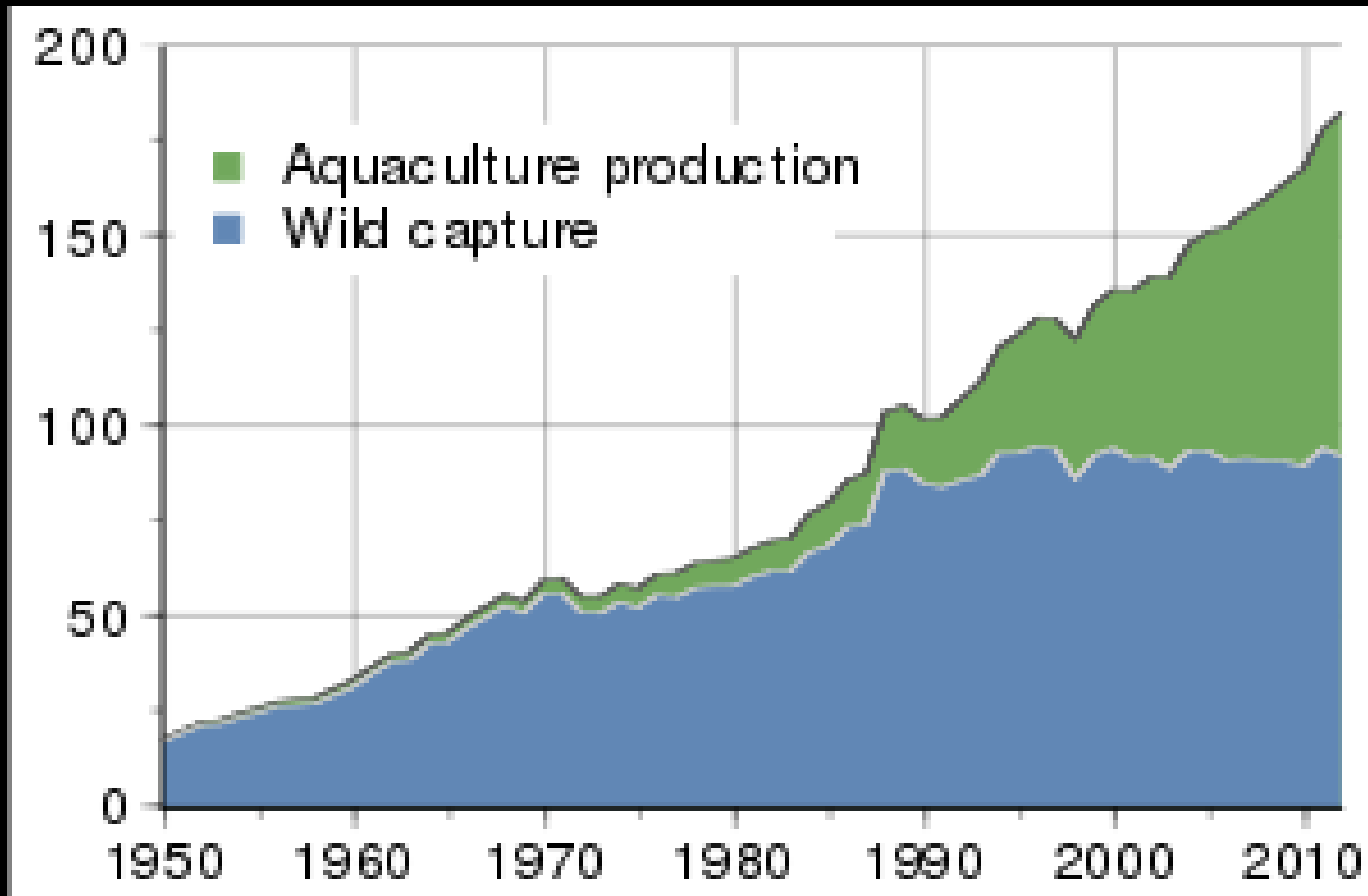


**Fisheries catch has plateaued since the 1990s**





# Global Resources





**All this in addition to working on all the other  
SDGs....**



**This will require better scientific understanding  
of our environmental reality and our processes  
of interaction with it...**



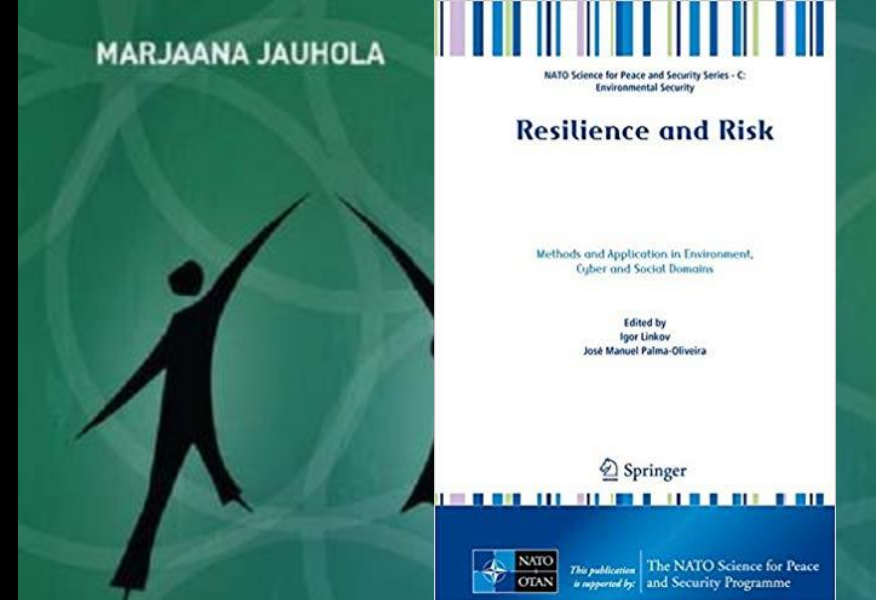
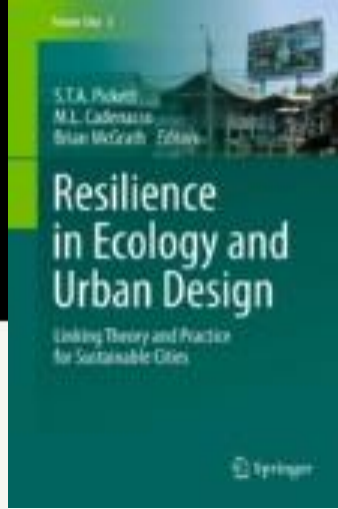
**This will require a lot of research...  
Let's look at a program for **deltas**...**

**(although I believe that **the layer model** is  
applicable much more widely than just deltas)**



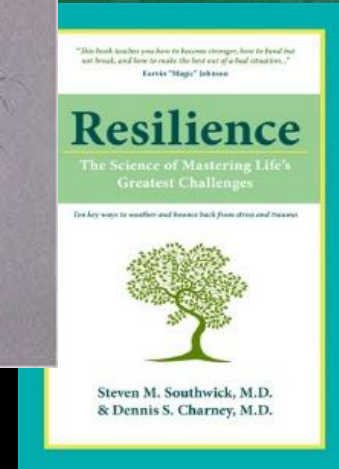
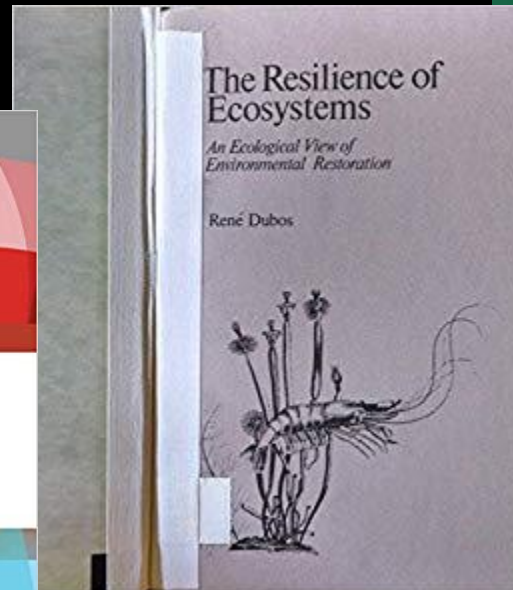
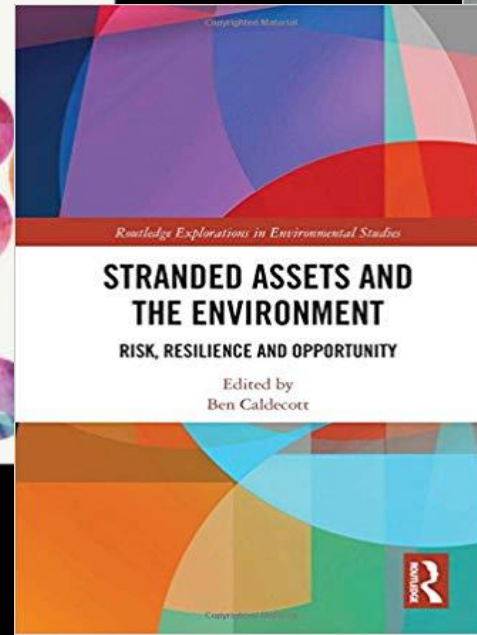
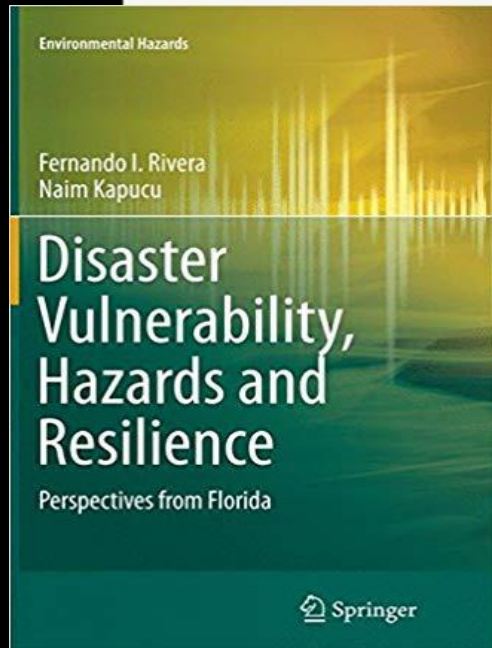
# **On Building Resilience**





resilience  
WHY THINGS BOUNCE BACK

Resilience ...





**Example:**  
**A Scientific Approach to the Study of Deltas**  
**(Established at Wageningen University -- 2010)**



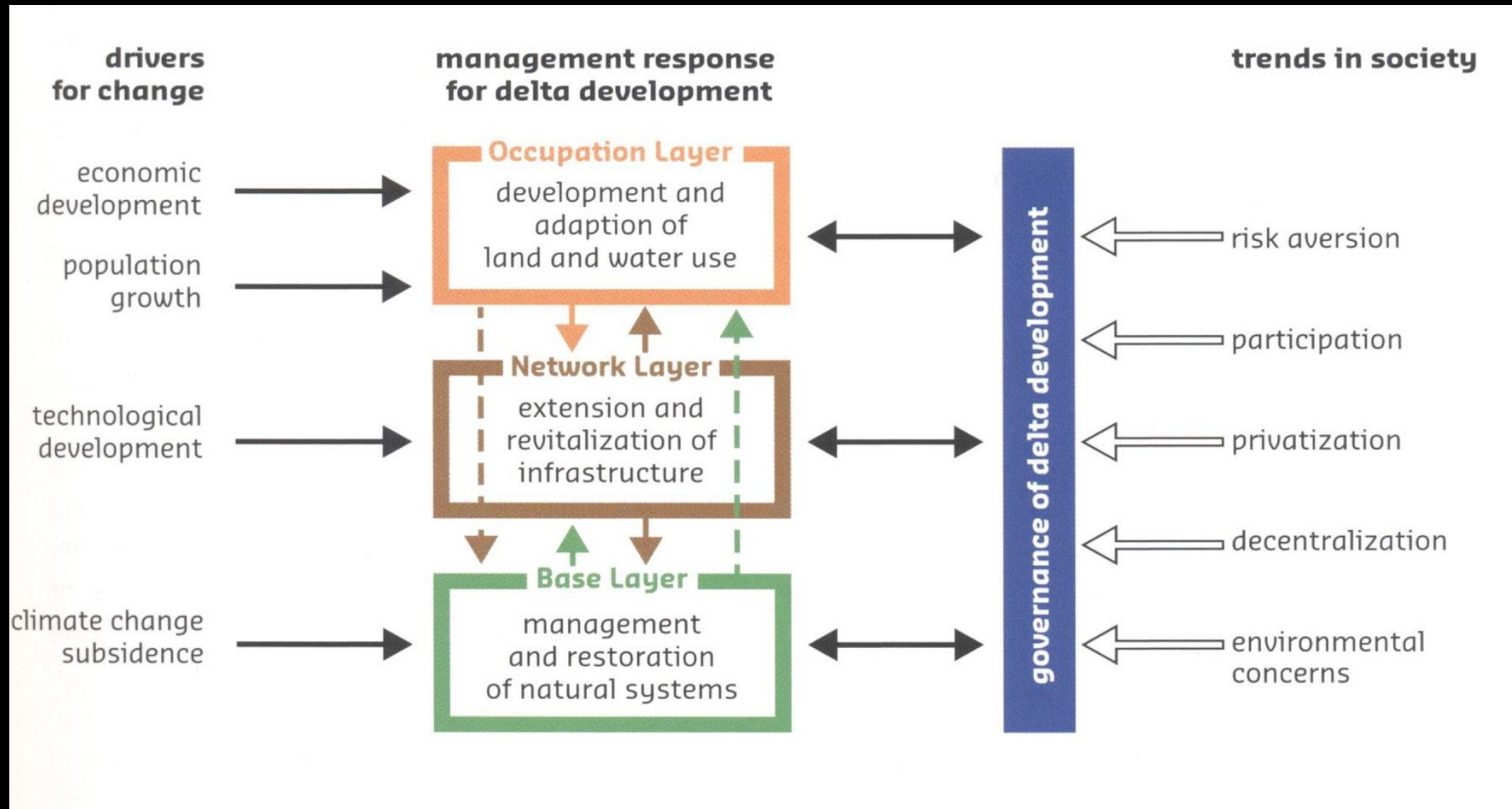


# **Comparative assessment of the vulnerability and resilience of 10 deltas**

**synthesis report**



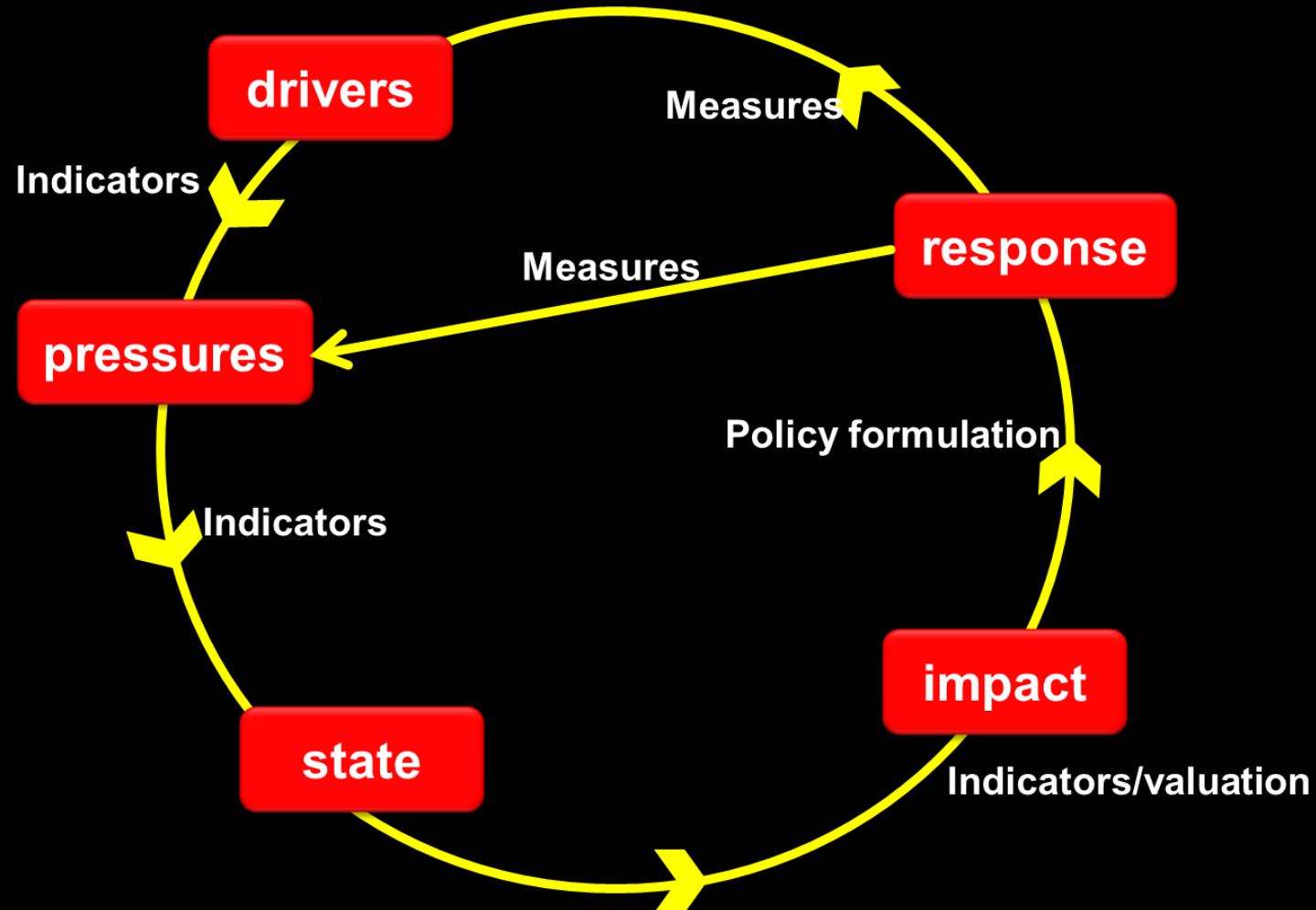
# Framework for Delta Assessment



Source: Delta Alliance, Comparative Assessment of the Vulnerability and Resilience of Ten Deltas, Synthesis Report, Wageningen University, Netherlands, 2010, p.



# DPSIR Approach of OECD



*Source: Delta Alliance, Comparative Assessment of the Vulnerability and Resilience of Ten Deltas, Synthesis Report, Wageningen University, Netherlands, 2010, p.18*



**Once we know the path we want to pursue, we must prioritize actions, monitor implementation and revise our plans continuously**



**BUT...Every question  
is linked to a host of other issues**



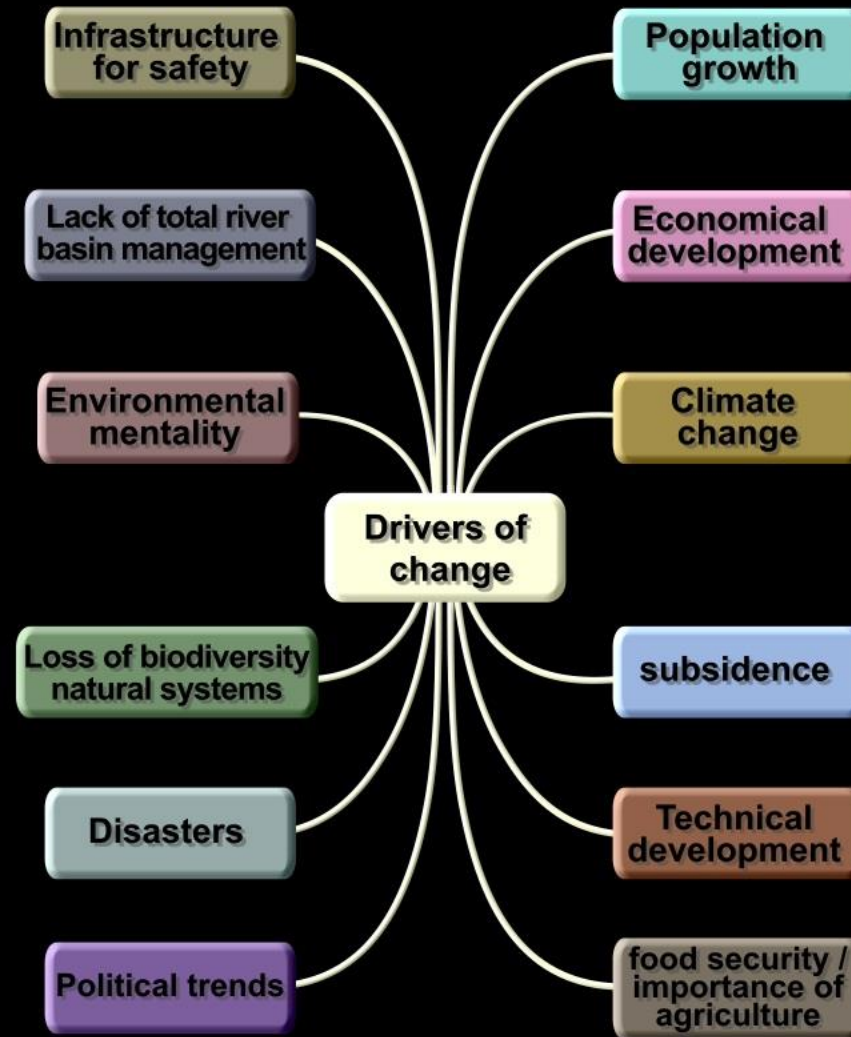
# Drivers of change



Drivers of  
change

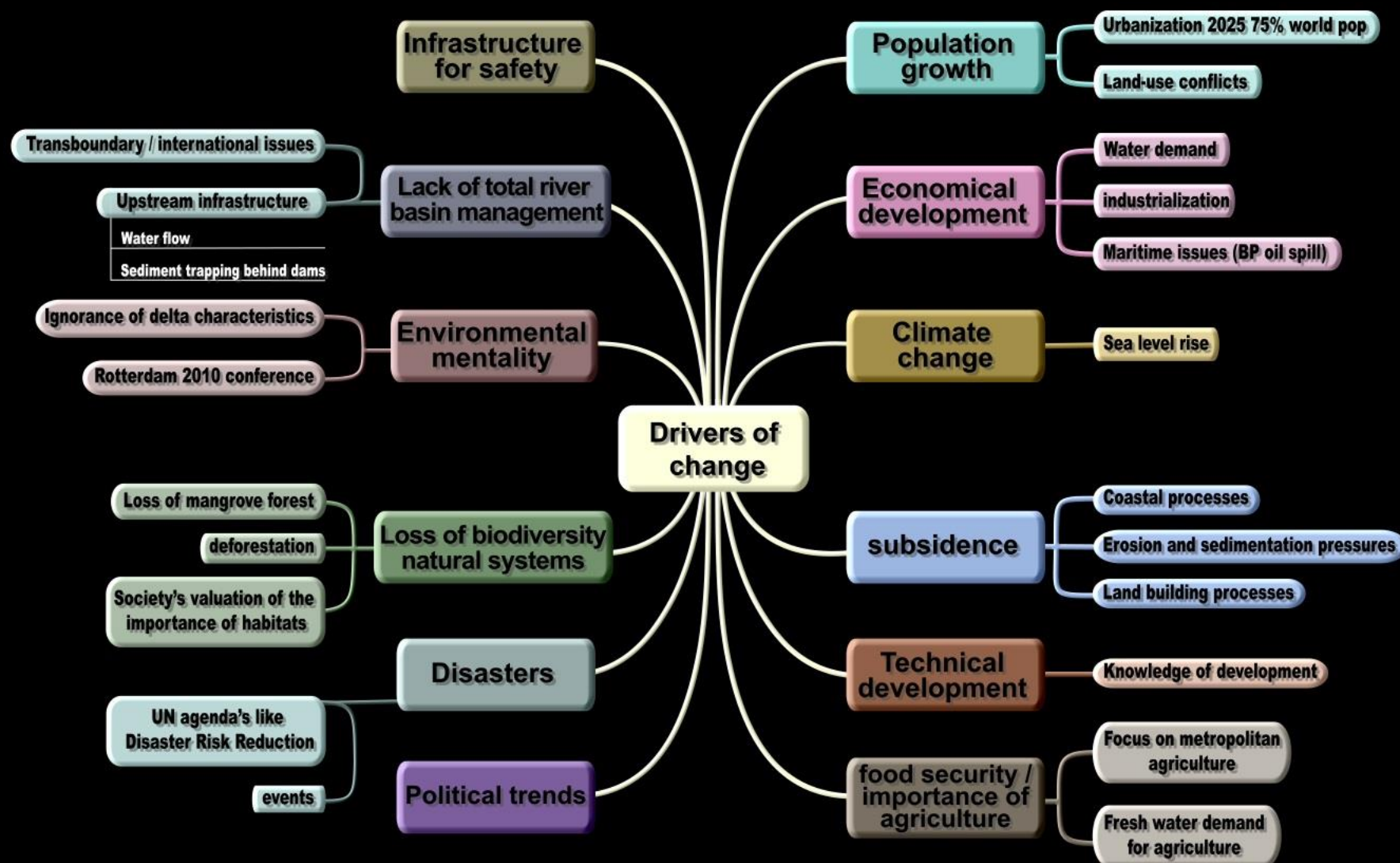


# Drivers of change





# Drivers of change



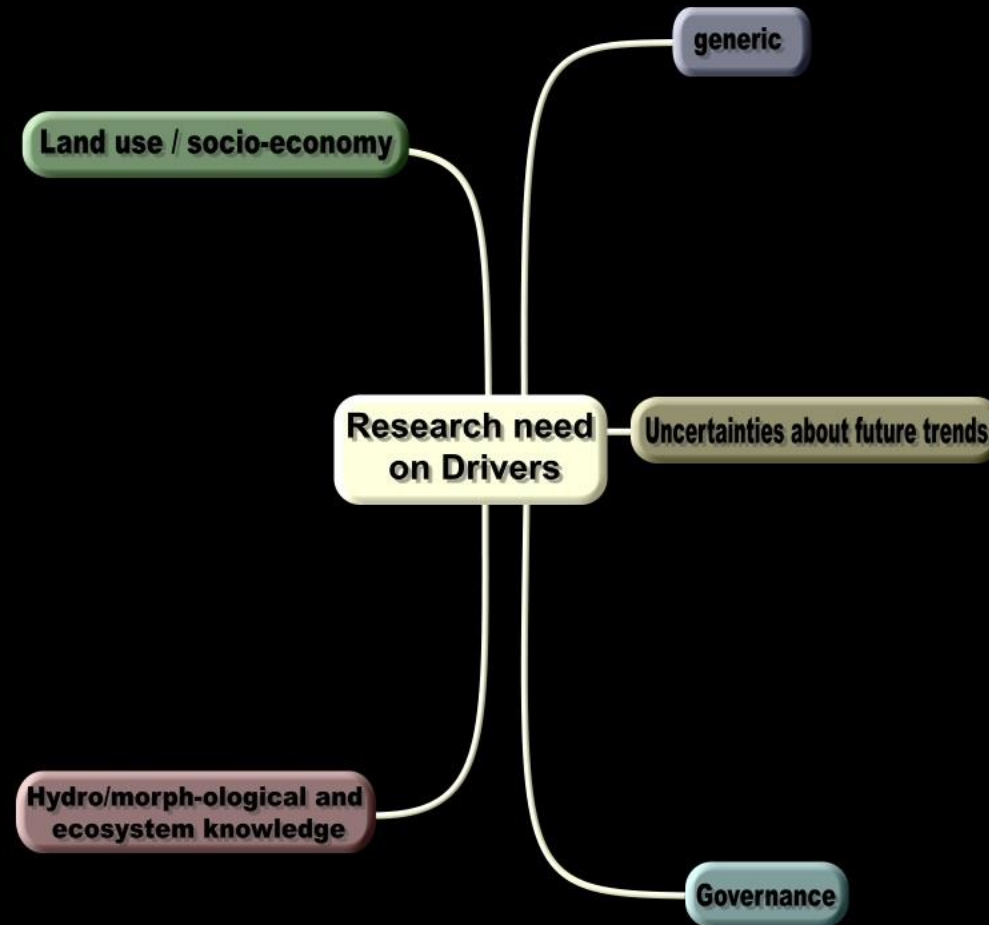


# Research needed on Drivers

Research need  
on Drivers

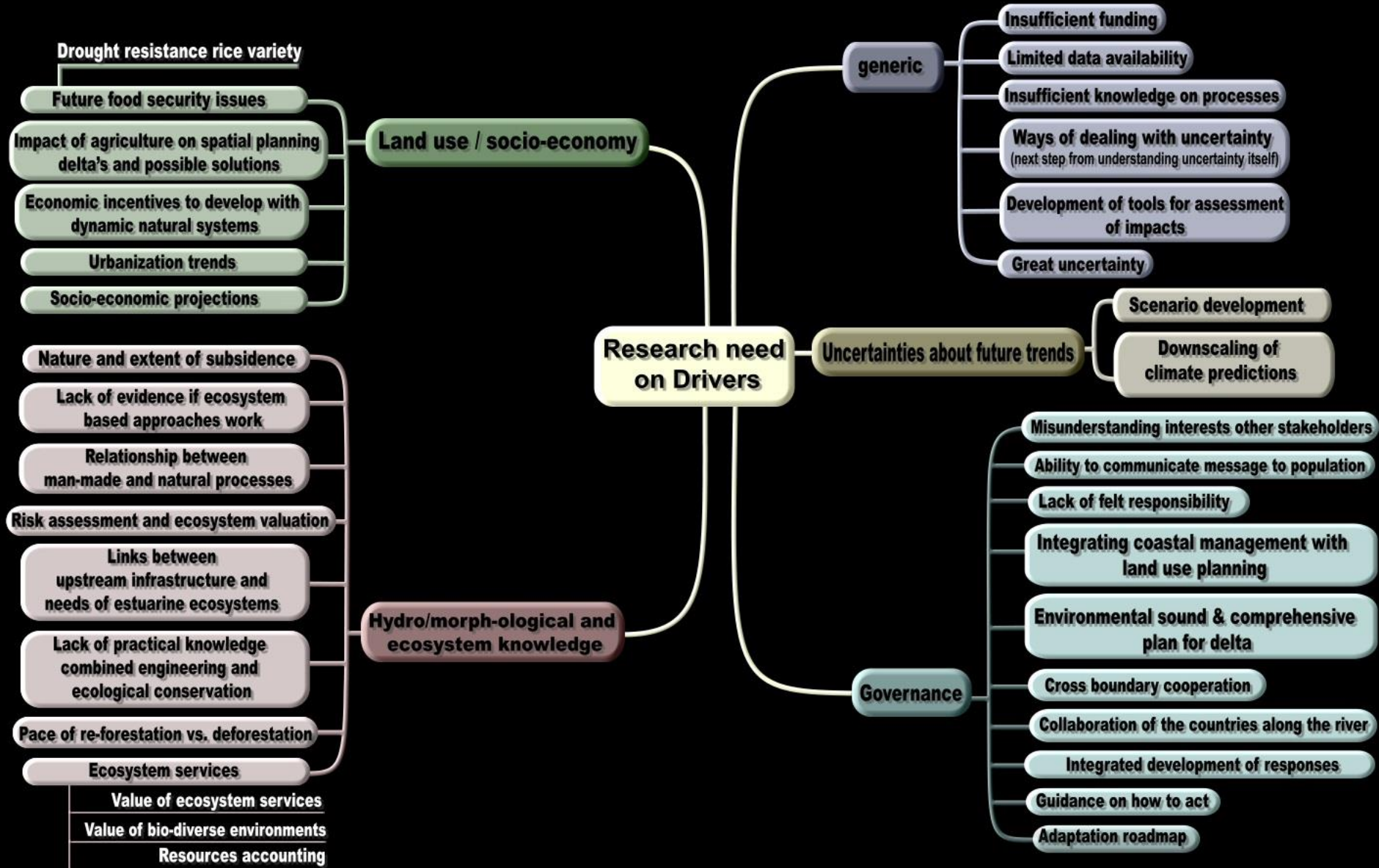


# Research needed on Drivers



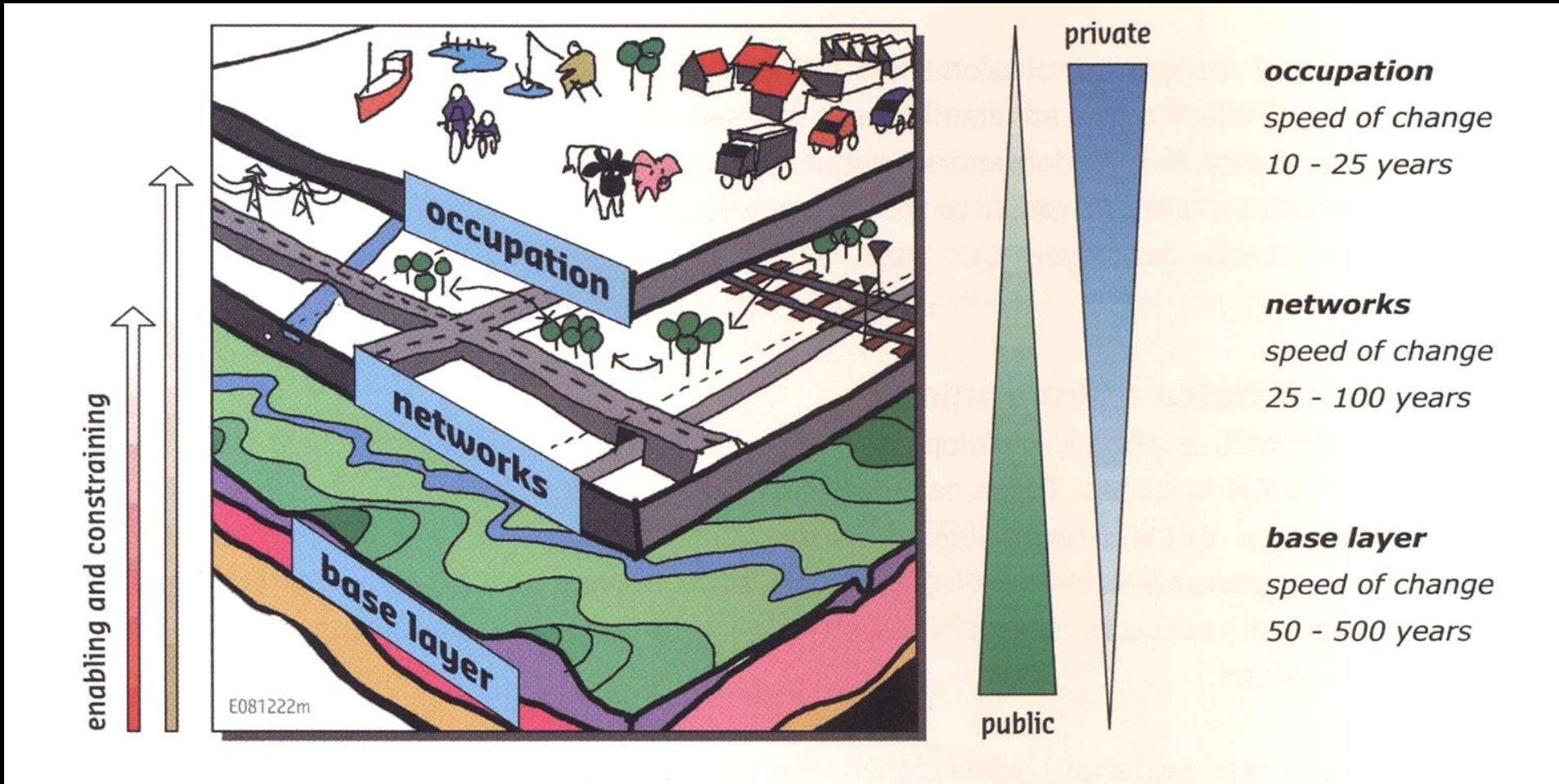


# Research needed on Drivers





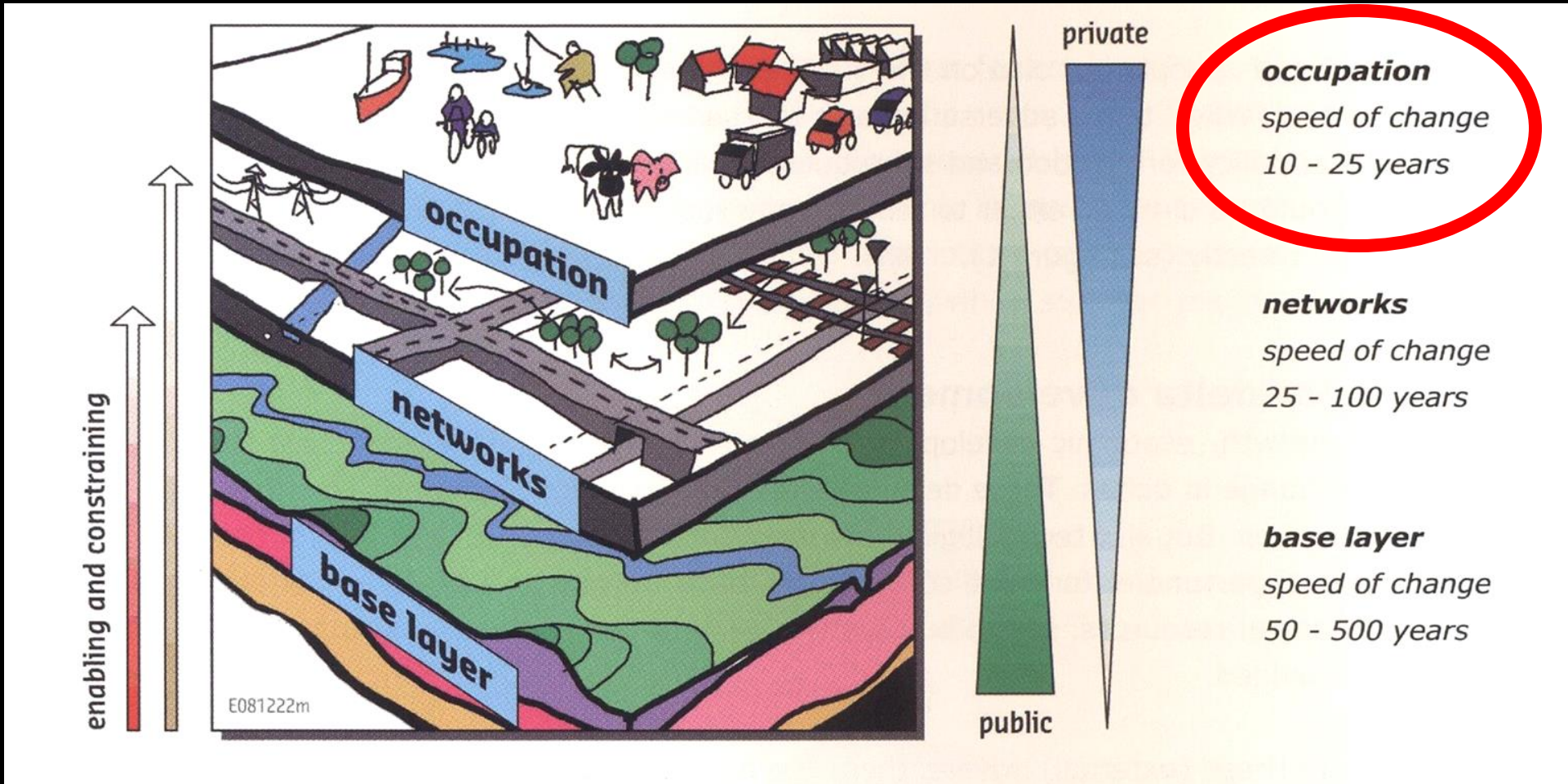
# The Layer Model



**Source: Delta Alliance, Comparative Assessment of the Vulnerability and Resilience of Ten Deltas, Synthesis Report, Wageningen University, Netherlands, 2010, p.20**



# The Layer Model



Source: Delta Alliance, Comparative Assessment of the Vulnerability and Resilience of Ten Deltas, Synthesis Report, Wageningen University, Netherlands, 2010, p.20

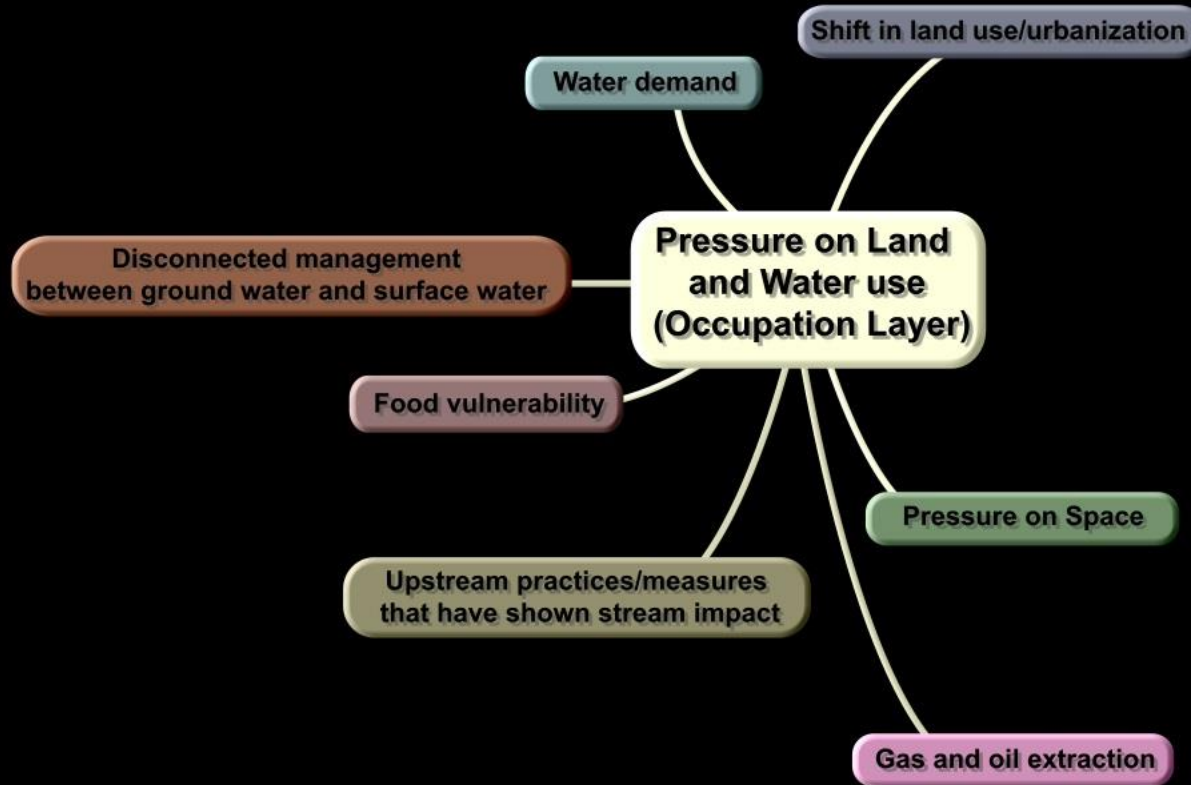


# Pressures on Land and Water (Occupational Layer)

Pressure on Land  
and Water use  
(Occupation Layer)

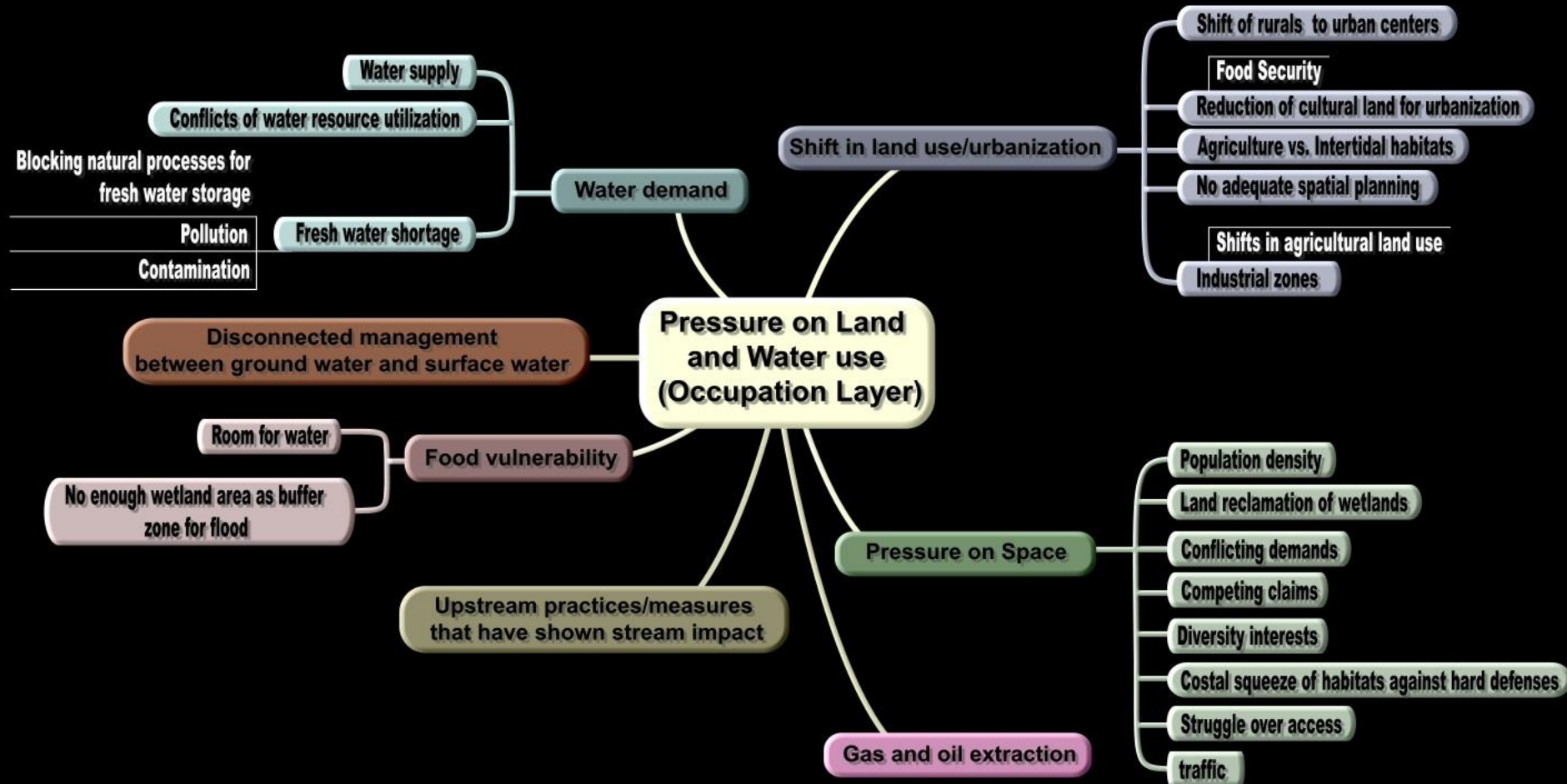


# Pressures on Land and Water (Occupational Layer)



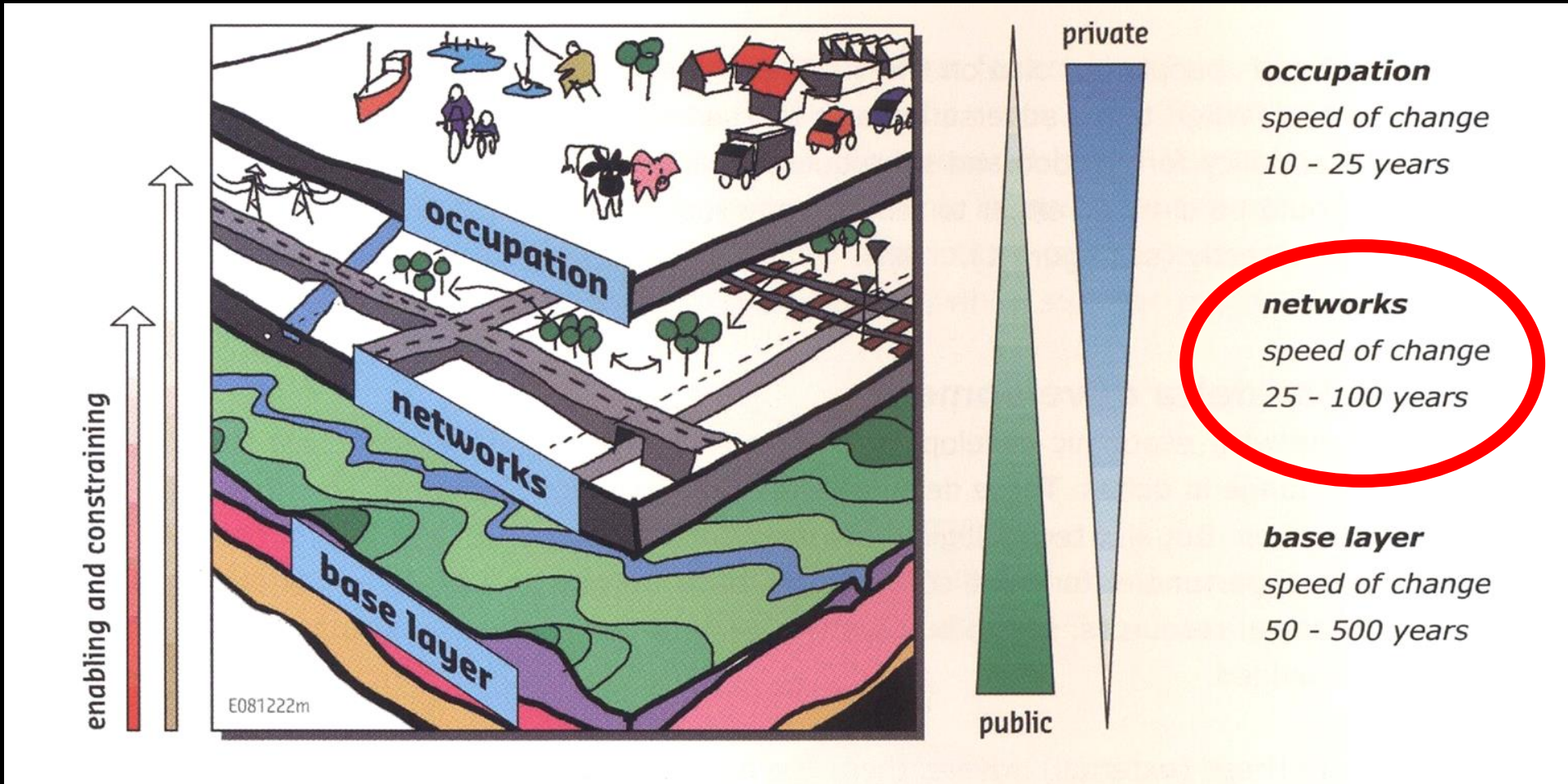


# Pressures on Land and Water (Occupational Layer)





# The Layer Model



Source: Delta Alliance, Comparative Assessment of the Vulnerability and Resilience of Ten Deltas, Synthesis Report, Wageningen University, Netherlands, 2010, p.20

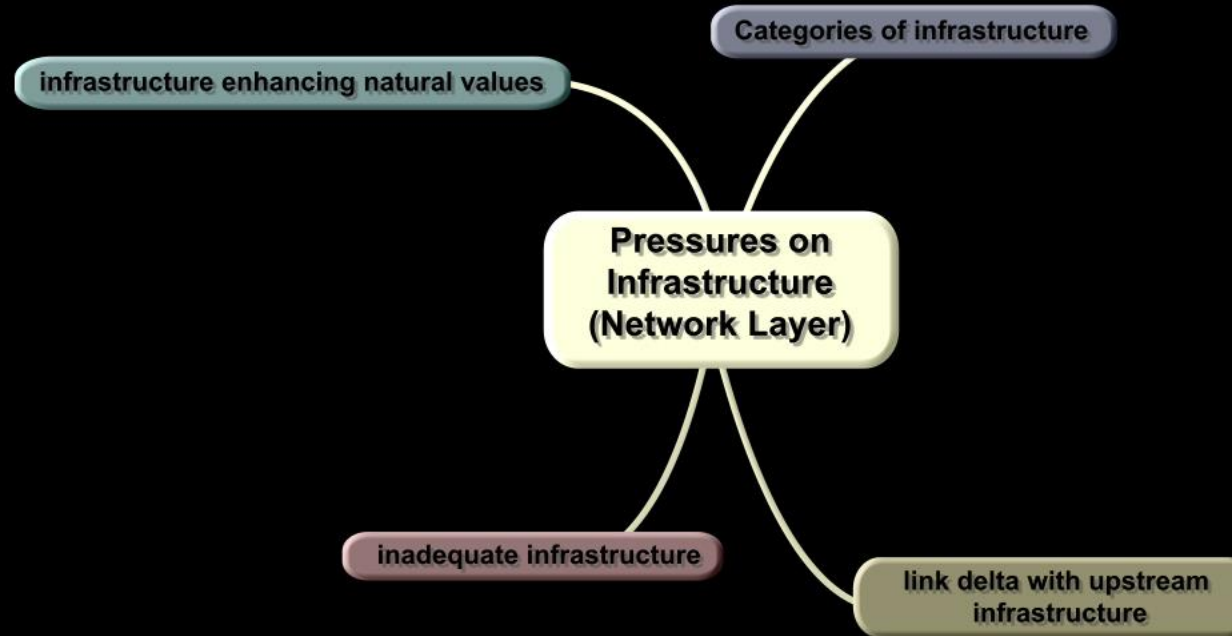


# Pressures on Infrastructure – (Network Layer)

Pressures on  
Infrastructure  
(Network Layer)

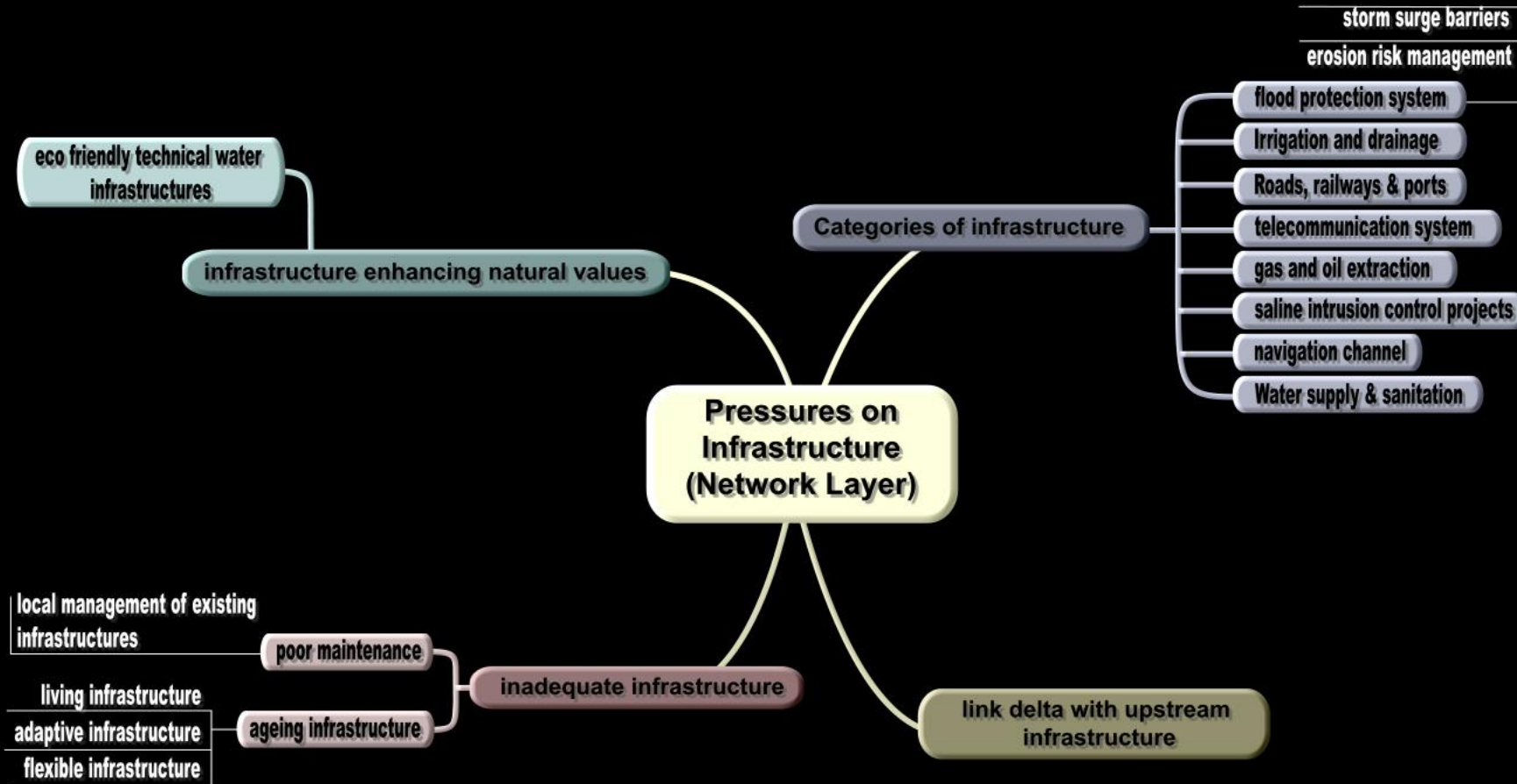


# Pressures on Infrastructure – (Network Layer)



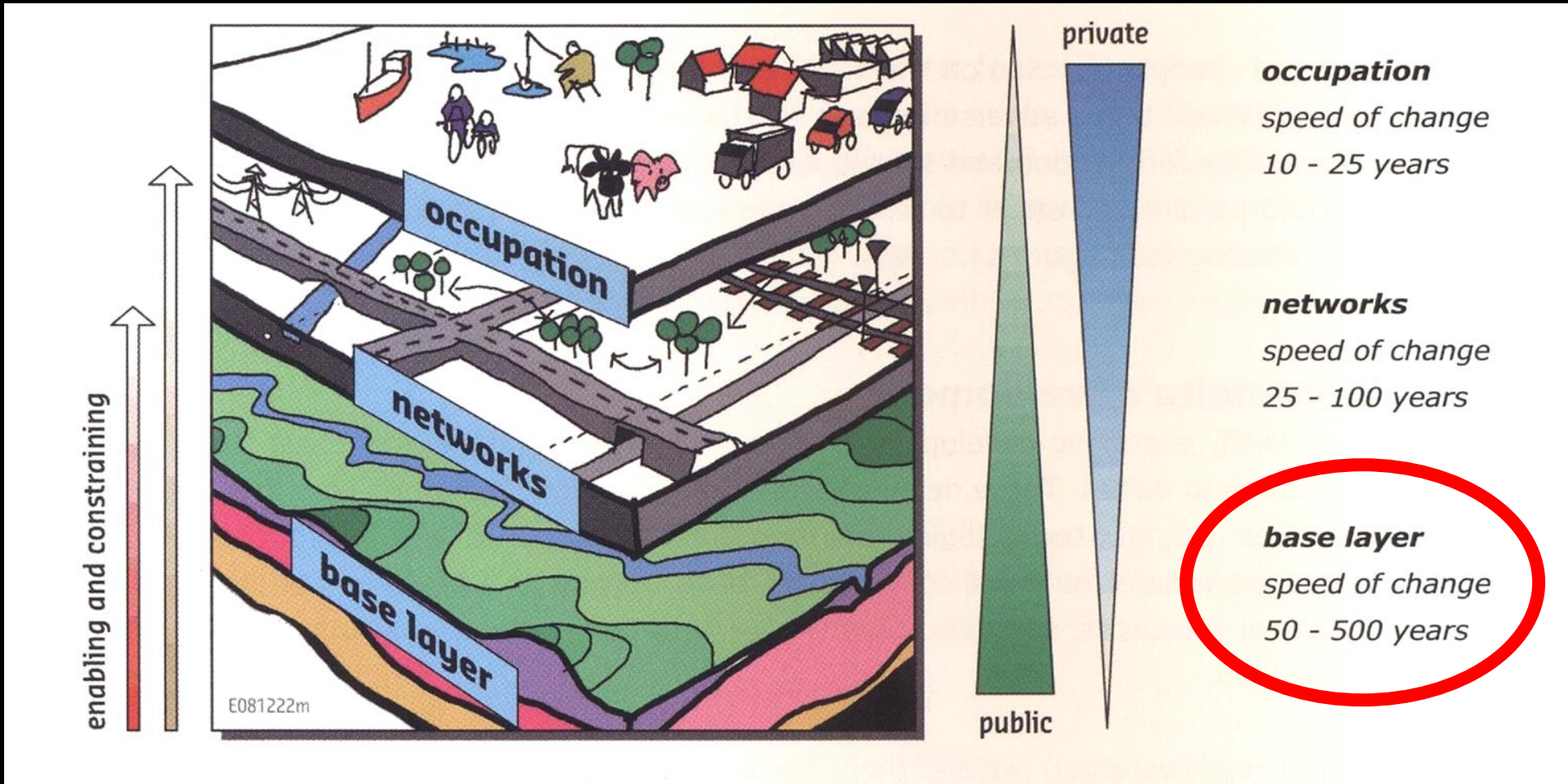


# Pressures on Infrastructure – (Network Layer)





# The Layer Model



Source: Delta Alliance, Comparative Assessment of the Vulnerability and Resilience of Ten Deltas, Synthesis Report, Wageningen University, Netherlands, 2010, p.20

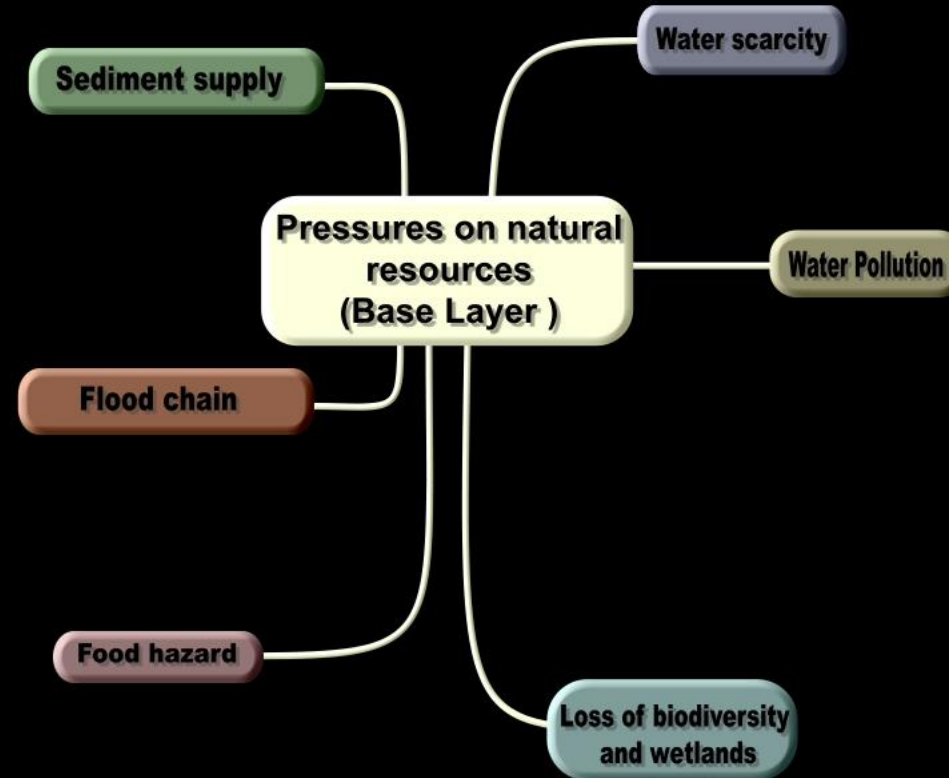


# Pressures on natural resources (Base Layer )

Pressures on natural  
resources  
(Base Layer )

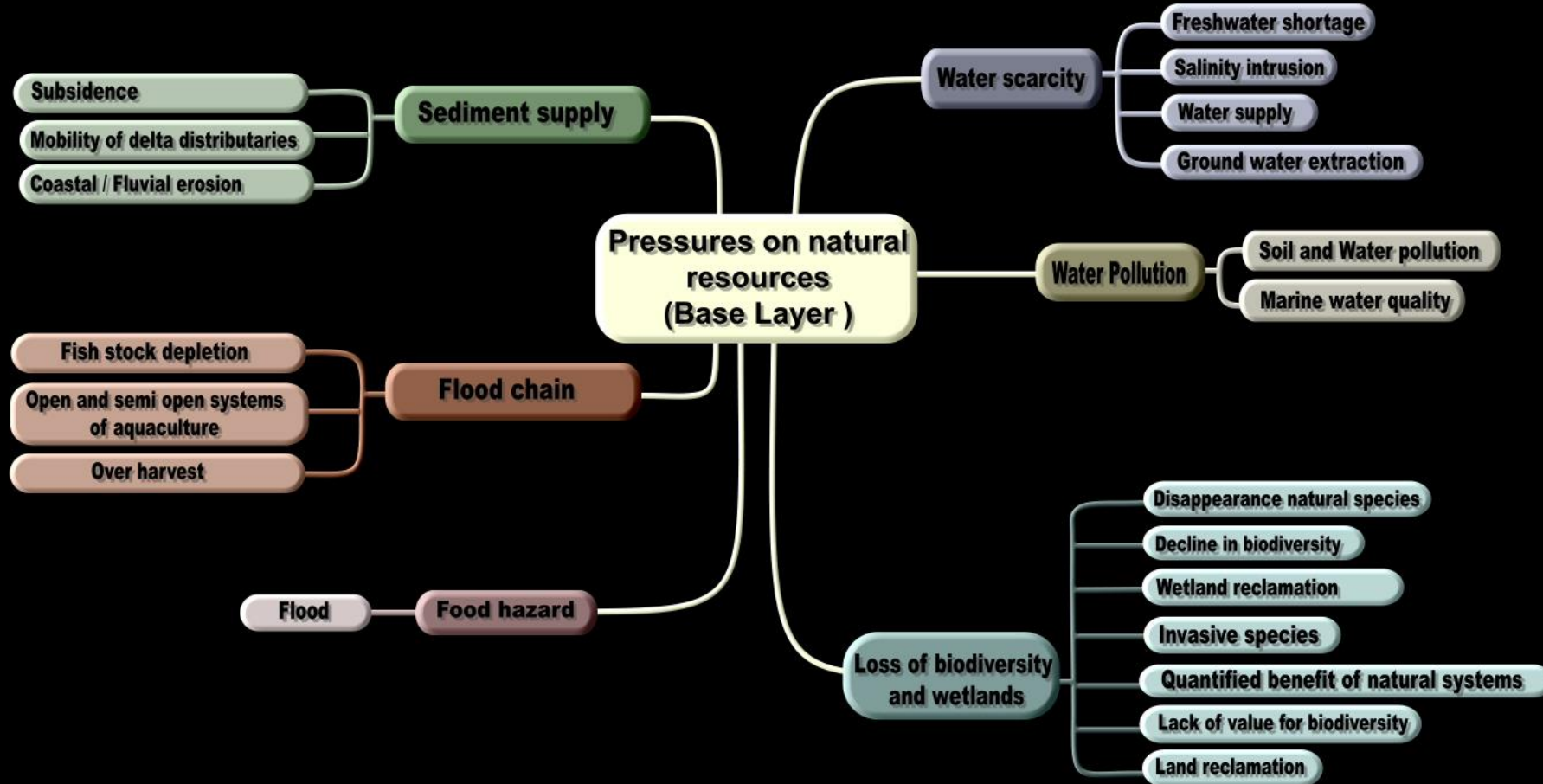


# Pressures on natural resources (Base Layer )



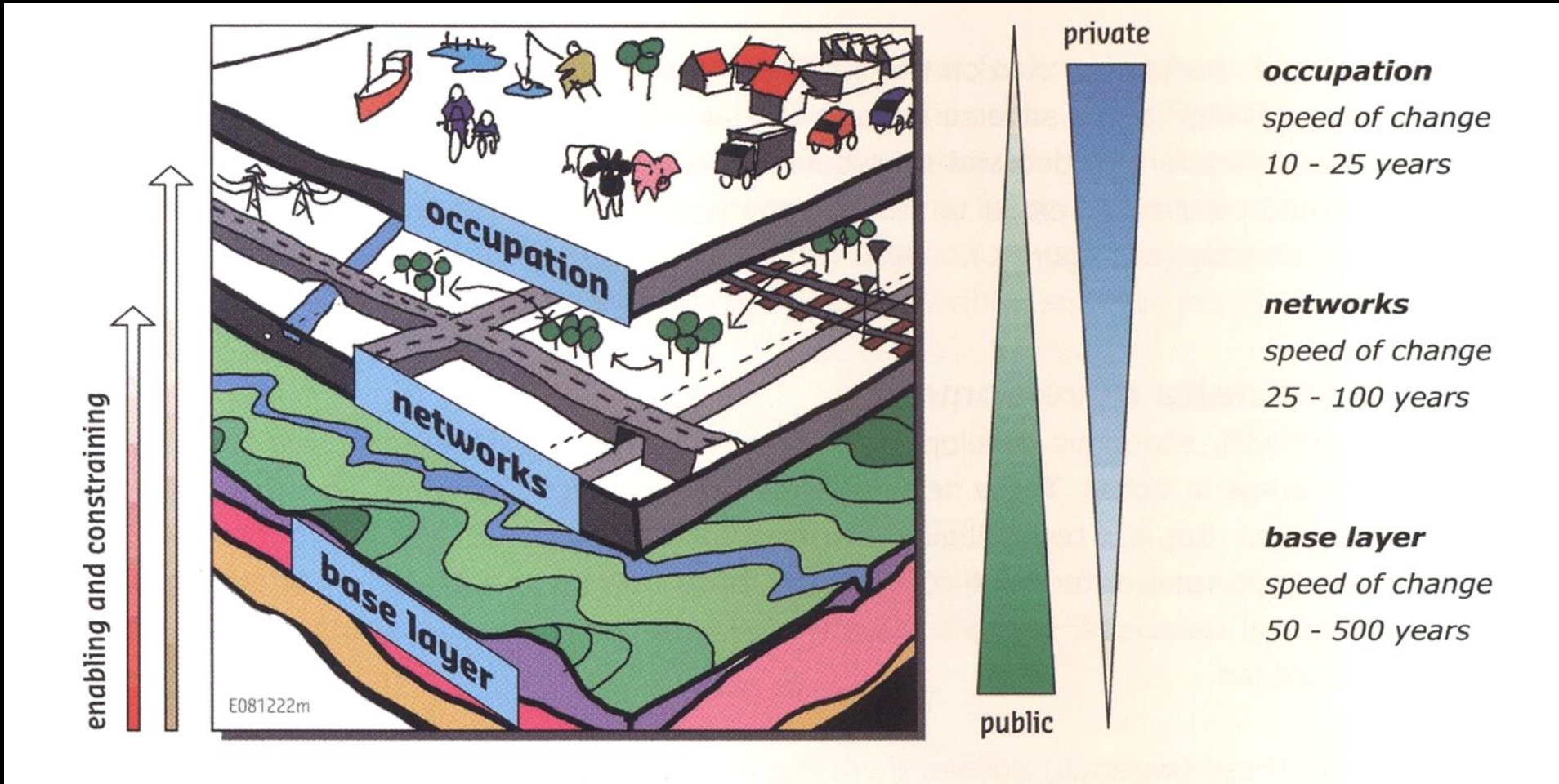


# Pressures on natural resources (Base Layer)





# The Layer Model



Source: Delta Alliance, Comparative Assessment of the Vulnerability and Resilience of Ten Deltas, Synthesis Report, Wageningen University, Netherlands, 2010, p.20



**That is how Science will help us cope with every aspect of dealing with poverty and inequality**



# Conclusions



**From the design of evidence-based regulations,  
to proper assessment of how policies and  
programs are working...  
Science is essential...**



**For dealing with poverty we must reach to the small holder farmers, especially in Africa and Asia, and bring a doubly green revolution that will lower food prices and increase production... Again Science is essential... it will transform agriculture.**



# **Revisiting past recommendations**

- **I have always been committed to the following recommendations**
- **I have always believed that only Science will help us overcome the challenges**
- **But now the challenges have grown bigger...**
- **But science has and is evolving dramatically...**



**So for what Science can do for poverty and inequality...**



# Ten Commandments For Global Agriculture





# **The Ten Commandments For Transforming Global Agriculture**

- 1. Reform Policies And Markets**
- 2. Focus On Small-holder Farmers**
- 3. Husband Natural Resources**
- 4. Raise Agricultural Productivity**
- 5. Improve Nutritional Content**
- 6. Address Short-term Vulnerability**
- 7. Empower Women**
- 8. Reach Out To The Ultra-poor**
- 9. Support Science**
- 10. Translate Rhetoric Into Action**



# **The Ten Commandments For Transforming Global Agriculture**

- 1. Reform Policies And Markets**
- 2. Focus On Small-holder Farmers**
- 3. Husband Natural Resources**
- 4. Raise Agricultural Productivity**
- 5. Improve Nutritional Content**
- 6. Address Short-term Vulnerability**
- 7. Empower Women**
- 8. Reach Out To The Ultra-poor**
- 9. Support Science**
- 10. Translate Rhetoric Into Action**



# 1. Reform Policies And Markets

- **Globally:** Fair trade
- **Locally:**
  - Remove urban bias (education, health, etc.)
  - Improve access to markets
  - reduce post harvest losses



# **The Ten Commandments For Transforming Global Agriculture**

1. Reform Policies And Markets
- 2. Focus On Small-holder Farmers**
3. Husband Natural Resources
4. Raise Agricultural Productivity
5. Improve Nutritional Content
6. Address Short-term Vulnerability
7. Empower Women
8. Reach Out To The Ultra-poor
9. Support Science
10. Translate Rhetoric Into Action



**So, dealing with global poverty  
requires that we address rural  
poverty...**

**AND**

**A special focus on small-holder  
farmers in developing countries in  
particular to address the problem of  
food security**



# The Ten Commandments For Transforming Global Agriculture

1. Reform Policies And Markets
2. Focus On Small-holder Farmers
- 3. Husband Natural Resources**
4. Raise Agricultural Productivity
5. Improve Nutritional Content
6. Address Short-term Vulnerability
7. Empower Women
8. Reach Out To The Ultra-poor
9. Support Science
10. Translate Rhetoric Into Action



### **3. Husband Natural Resources**

- **Agriculture is the major interface between people and nature**
- **Sustainable development is beneficial for all**
- **Resource degradation hits the poor worst**



A wide-angle photograph of a lush green rice paddy field. In the middle ground, a person stands next to a dark-colored water buffalo. The field stretches towards a distant horizon where a small village and a range of blue mountains are visible under a heavy, overcast sky with large, dark clouds. A single utility pole stands in the field.

**One of the most important environmental actions is to reduce the need for more land under cultivation**



A photograph of a dense forest. Several large, thick tree trunks are visible, surrounded by lush green foliage and branches. The scene is captured from a slightly low angle, looking up into the canopy. The lighting is soft, suggesting a shaded forest environment.

**It will preserve habitats and  
biodiversity**



# The Ten Commandments For Transforming Global Agriculture

1. Reform Policies And Markets
2. Focus On Small-holder Farmers
3. Husband Natural Resources
- 4. Raise Agricultural Productivity**
5. Improve Nutritional Content
6. Address Short-term Vulnerability
7. Empower Women
8. Reach Out To The Ultra-poor
9. Support Science
10. Translate Rhetoric Into Action

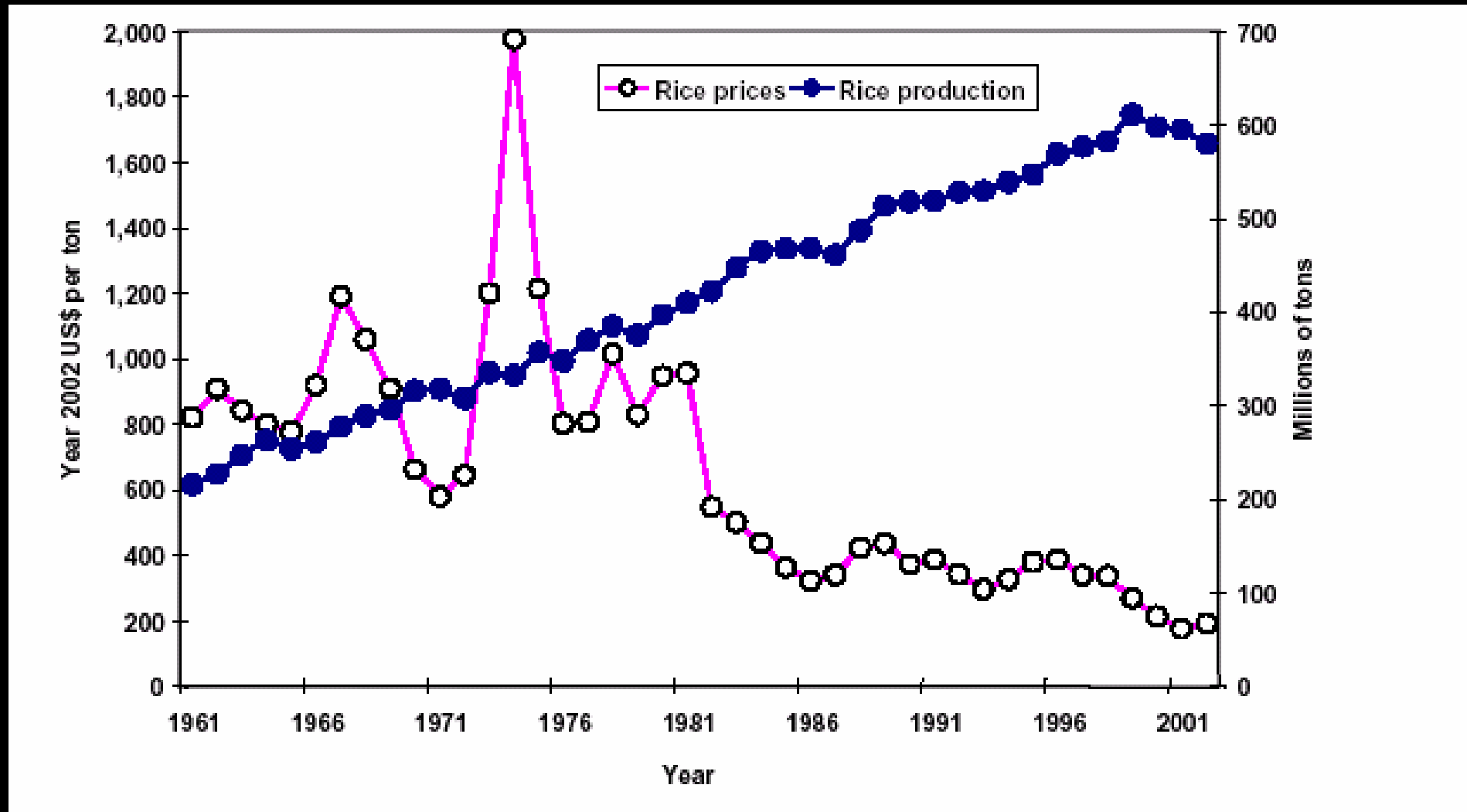


## **4. Raise Agricultural Productivity**

- **Productivity must rise faster than price declines to generate surpluses for the small-holder farmers and reduce their poverty as their cheaper products help reduce the poverty in the cities**
- **Measure in terms of Total Factor Productivity (land, water, labor, energy and chemical inputs)**

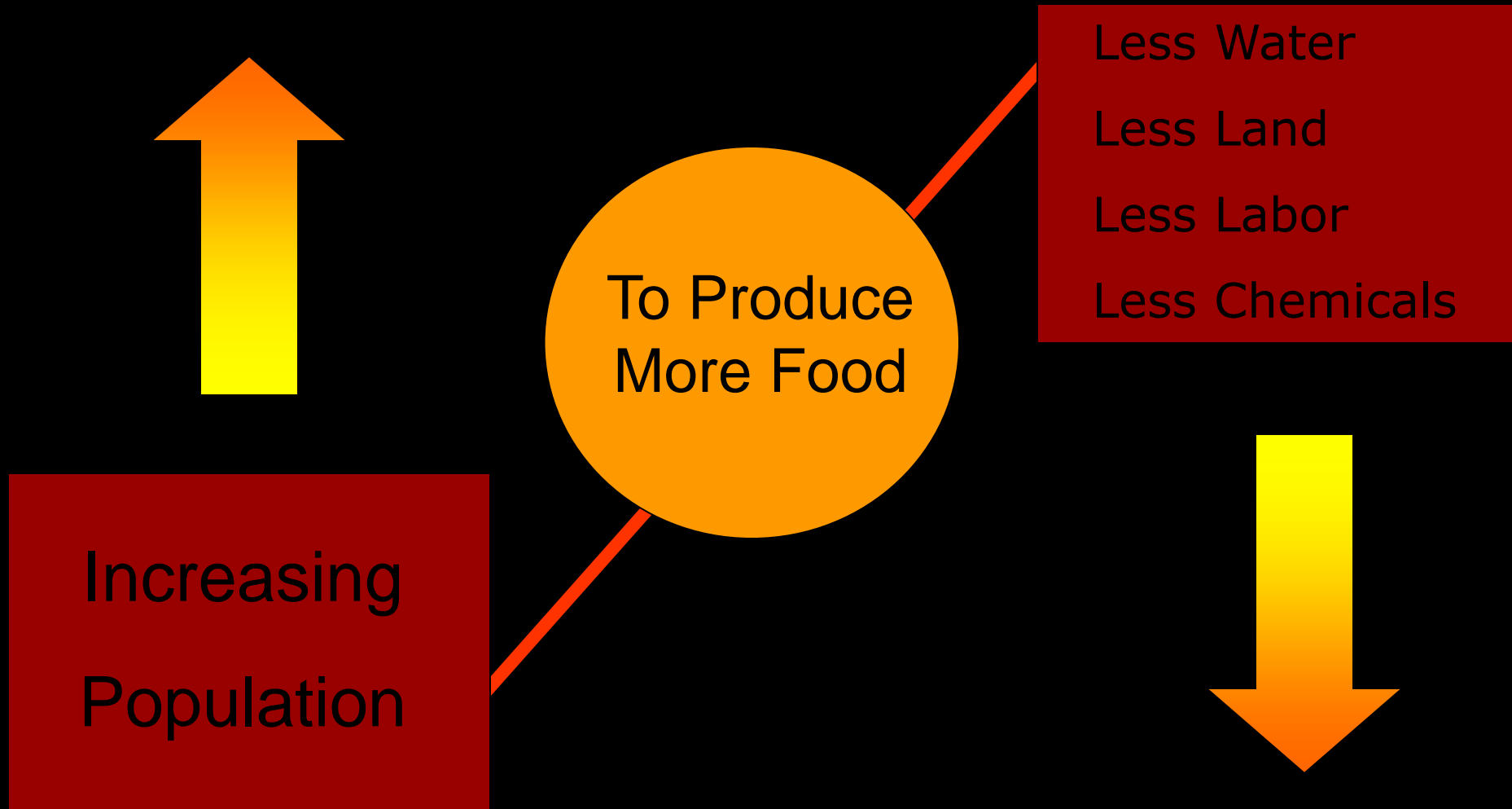


# Rice production and Rice price over time





# Future Challenges





# The Ten Commandments For Transforming Global Agriculture

1. Reform Policies And Markets
2. Focus On Small-holder Farmers
3. Husband Natural Resources
4. Raise Agricultural Productivity
- 5. Improve Nutritional Content**
6. Address Short-term Vulnerability
7. Empower Women
8. Reach Out To The Ultra-poor
9. Support Science
10. Translate Rhetoric Into Action

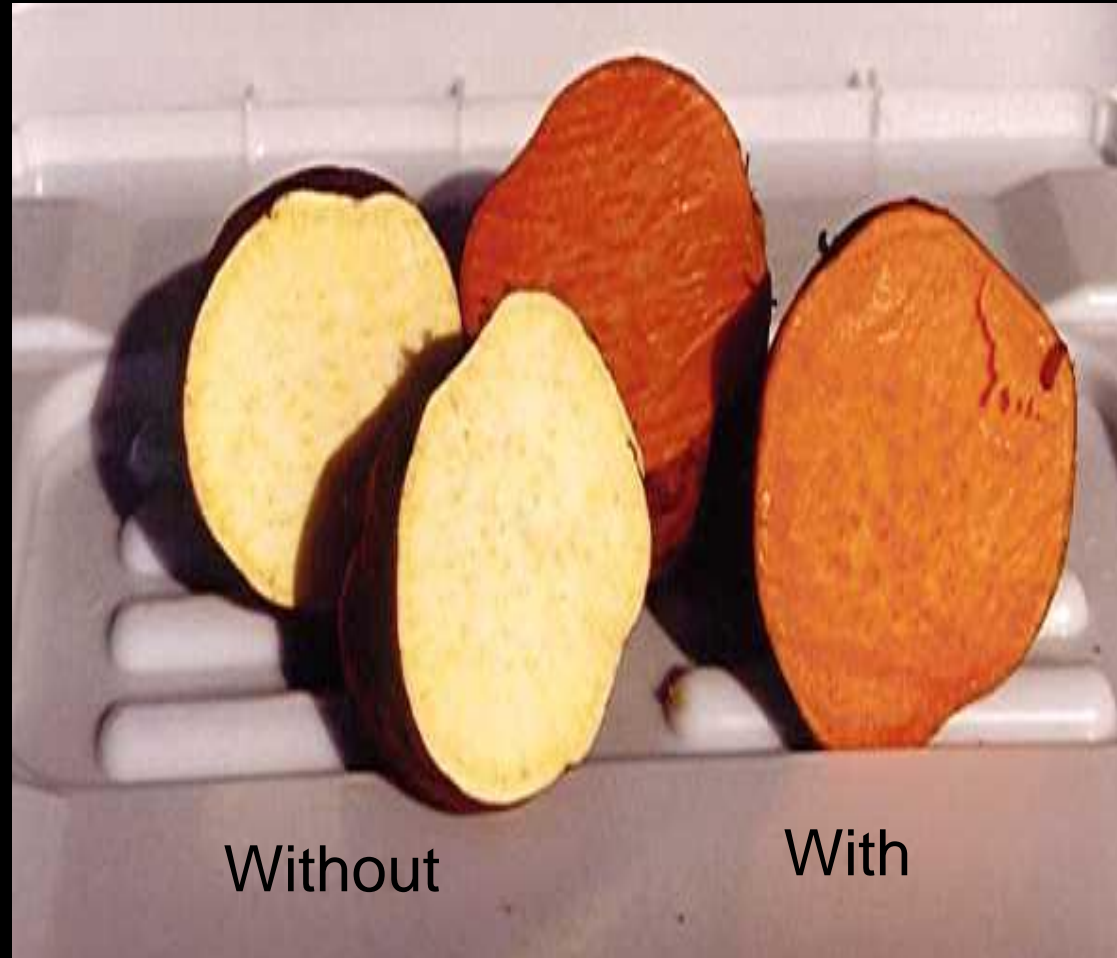


## **5. Improve Nutritional Content**

- **Enormous health benefits**
- **Bio-fortification is just the beginning**
- **Edible vaccines?**



# Sweet Potatoes with and Without Beta-Carotene



Without

With







# Longer, More Productive Lives





# The Ten Commandments For Transforming Global Agriculture

1. Reform Policies And Markets
2. Focus On Small-holder Farmers
3. Husband Natural Resources
4. Raise Agricultural Productivity
5. Improve Nutritional Content
- 6. Address Short-term Vulnerability**
7. Empower Women
8. Reach Out To The Ultra-poor
9. Support Science
10. Translate Rhetoric Into Action



## **6. Vulnerability and Resilience**

- **Floods, Droughts and pests (e.g. Locusts)**

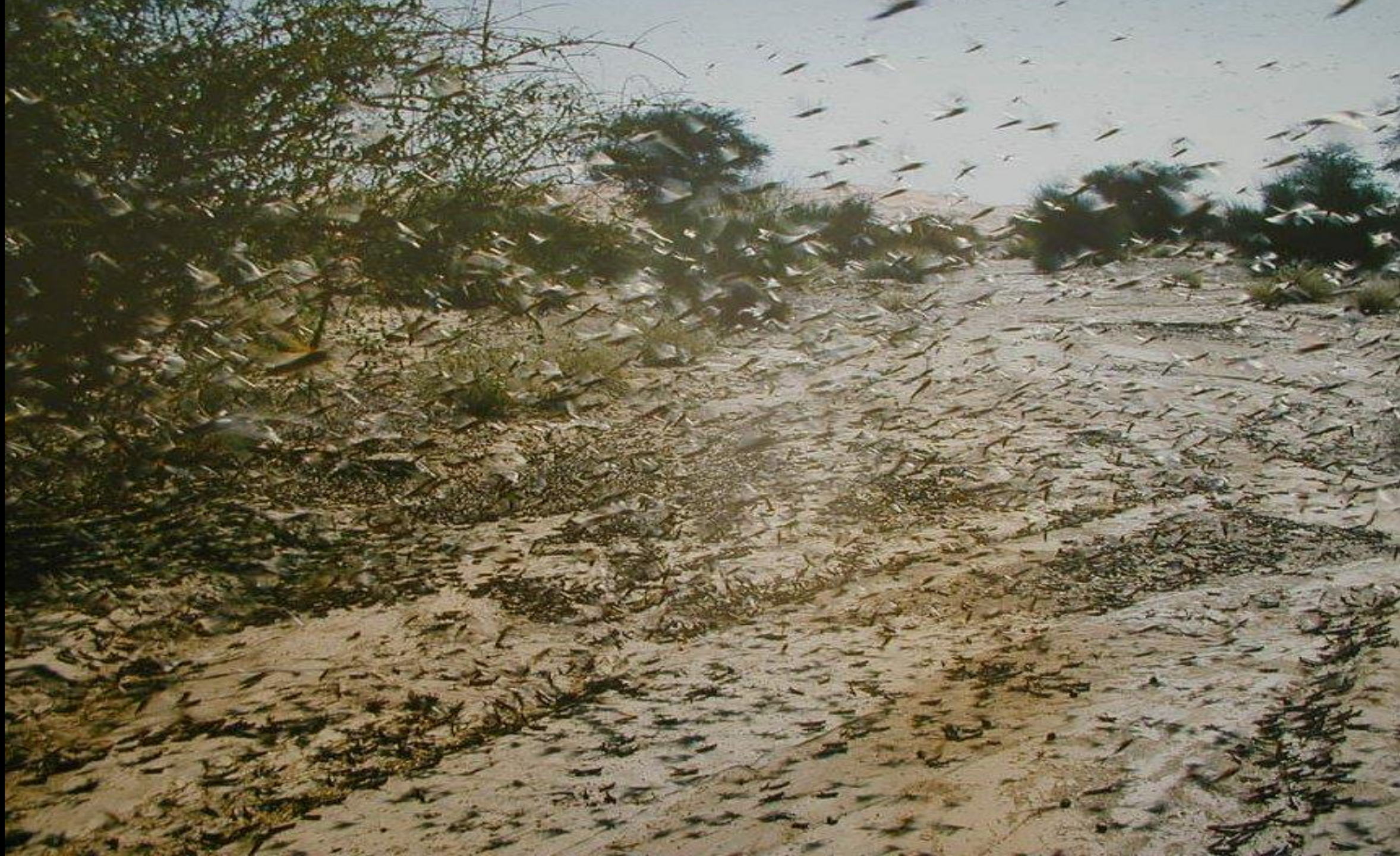














# The Ten Commandments For Transforming Global Agriculture

1. Reform Policies And Markets
2. Focus On Small-holder Farmers
3. Husband Natural Resources
4. Raise Agricultural Productivity
5. Improve Nutritional Content
6. Address Short-term Vulnerability
- 7. Empower Women**
8. Reach Out To The Ultra-poor
9. Support Science
10. Translate Rhetoric Into Action



## **7. Empower Women**

- **Essential to recognize the gender dimension of agriculture**
- **Empowering Women results in major improvements in infant mortality, school enrolments, child morbidity**











# **The Ten Commandments For Transforming Global Agriculture**

1. Reform Policies And Markets
2. Focus On Small-holder Farmers
3. Husband Natural Resources
4. Raise Agricultural Productivity
5. Improve Nutritional Content
6. Address Short-term Vulnerability
7. Empower Women
- 8. Reach Out To The Ultra-poor**
9. Support Science
10. Translate Rhetoric Into Action



## **8. Reach Out To The Ultra-Poor**

- **Market incentives do not work for the ultra-poor**
- **Trickle-down does not work**
- **Special Programs will be needed**





**Landless Farm Workers**



**Refugees and  
Internally  
Displaced  
persons and  
those in very  
poor  
environments**





# The Ten Commandments For Transforming Global Agriculture

1. Reform Policies And Markets
2. Focus On Small-holder Farmers
3. Husband Natural Resources
4. Raise Agricultural Productivity
5. Improve Nutritional Content
6. Address Short-term Vulnerability
7. Empower Women
8. Reach Out To The Ultra-poor
- 9. Support Science**
10. Translate Rhetoric Into Action



## **9. Support Science**

- **We need more support for science in developing countries**
- **Not just technology to be purchased from the rich countries**



January 2004

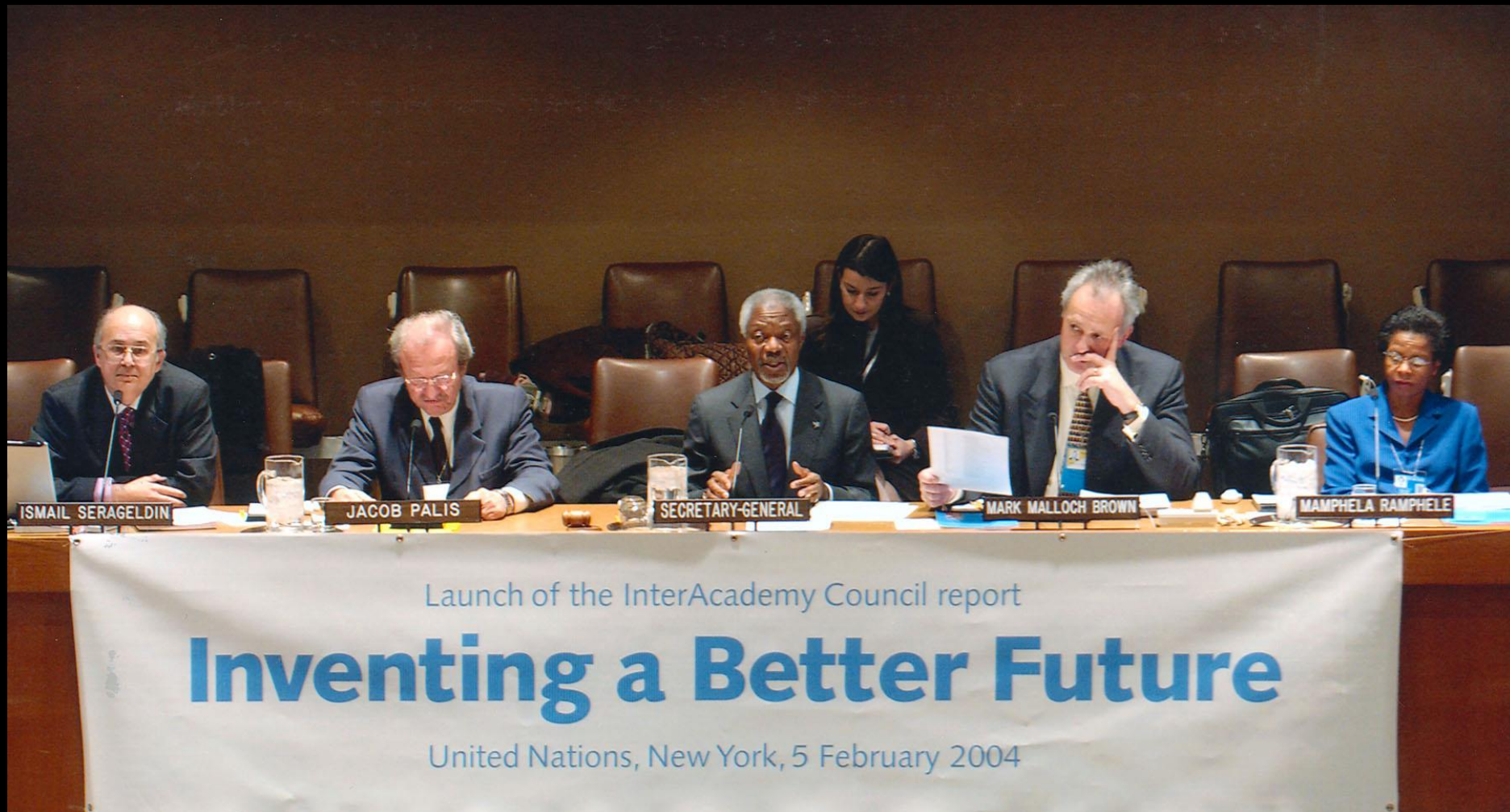
## **Inventing a better future**

A strategy for building worldwide  
capacities in science and technology



InterAcademy Council





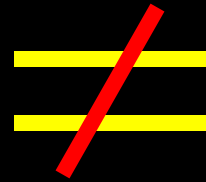


# **The Ten Commandments For Transforming Global Agriculture**

1. Reform Policies And Markets
2. Focus On Small-holder Farmers
3. Husband Natural Resources
4. Raise Agricultural Productivity
5. Improve Nutritional Content
6. Address Short-term Vulnerability
7. Empower Women
8. Reach Out To The Ultra-poor
9. Support Science
- 10. Translate Rhetoric Into Action**



**Rhetoric  
Declarations  
Plans  
Targets**



**Action**



***“We have the capacity to  
eliminate hunger from the  
face of the earth in our  
lifetime.  
We need only the will.”***

**President John F. Kennedy  
World Food Congress 1963**







# **The Ten Commandments For Transforming Global Agriculture**

- 1. Reform Policies And Markets**
- 2. Focus On Small-holder Farmers**
- 3. Husband Natural Resources**
- 4. Raise Agricultural Productivity**
- 5. Improve Nutritional Content**
- 6. Address Short-term Vulnerability**
- 7. Empower Women**
- 8. Reach Out To The Ultra-poor**
- 9. Support Science**
- 10. Translate Rhetoric Into Action**



**Envoi**



**There is  
so much  
we can do  
for a  
whole  
generation**





**For The Whole World...**





A close-up photograph of a stone wall covered in various carved symbols. At the top center is a crown-like symbol. Below it, the word "SAR" is carved in large, bold letters. At the bottom, there is a row of numbers: 10, 1, 2, 2, 1, 2, 1. The text "Thank You" is overlaid in the center in a bright yellow font.

**Thank You**







**The images used in this presentation are strictly for the educational purpose of this lecture. Any use by anyone for any other purpose should be after consulting the copyright owners of these pictures**



