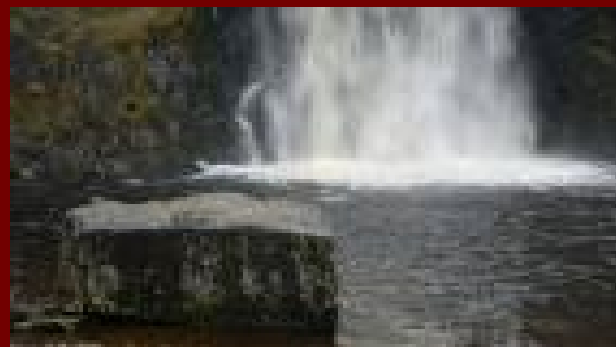


# Land Use, Water, Energy, Sustainable Development



Mahendra Shah  
IIASA, Laxenburg, Austria  
CSD 16 Side Event 9<sup>th</sup> May 2008  
United Nations , New York  
Organizing Partner IAEA



# Sustainable Development

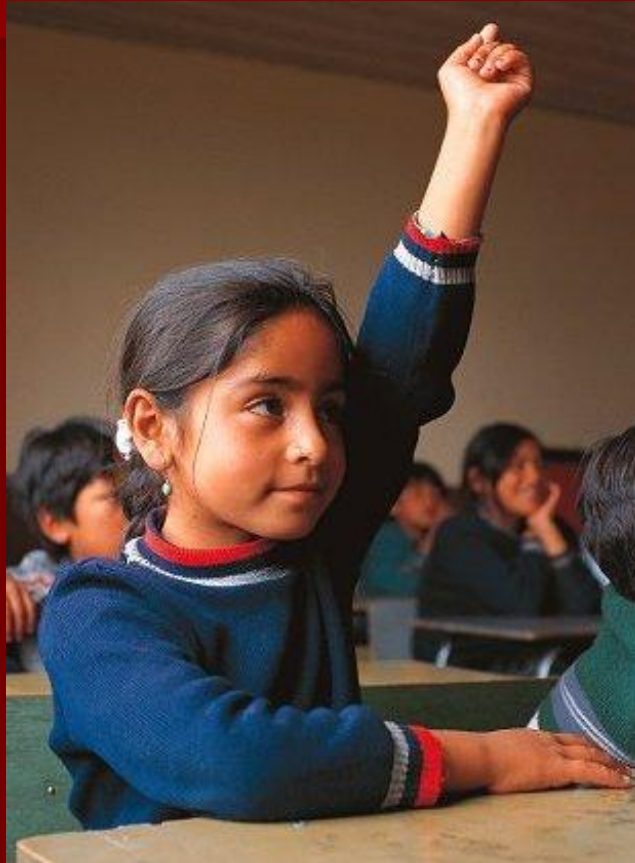
**Stockholm 1972: Environment**

**Rio de Janeiro 1992: Agenda 21**

**Johannesburg 2002: PPP**

*Achieving Sustainable Development  
Not an Option but an Imperative in the 21<sup>st</sup> Century  
From Agendas to Actions*

# Human Well-being



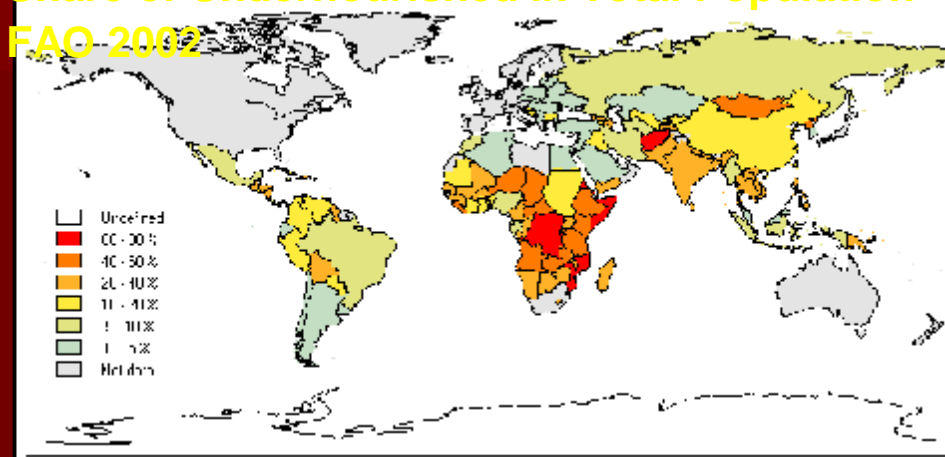
**Food**  
**Water**  
**Energy**  
**Education**  
**Health Care**  
**Social Security**  
**Clean/Safe Environment**  
**Freedom from Harassment**  
**Freedom from Discrimination**  
**Opportunities for Participation**

# Millennium Development Goals 1 and 2

## MDG Hunger

% Hungry	Ctrys	Millions
5 to 20%	28	223
20 to 35%	27	339
+ 35%	23	220

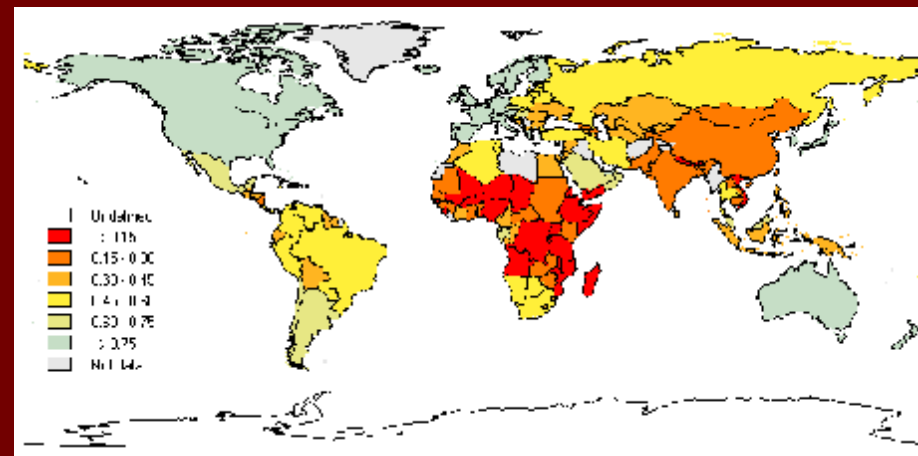
Share of Undernourished in Total Population  
FAO 2002



## MDG Poverty

% Poor Pop.	<\$1 Ctrys	<\$2 Ctrys
< 25%	54	22
25 to 50%	19	25
50 to 75%	7	1
> 75%	--	16

Per Capita GDP Index



GDP Index =  $(\log(\text{GDP}/\text{CAP}) - \log(100)) / (\log(40000) - \log(100))$   
UNDP 2001

# Energy & Millennium Development Goals : 2015

## Differentially Vulnerable Populations : Access and Affordability

### 50% Reduction in POVERTY (1a)

Energy > Lighting, Cooking, Motive Power, Micro-enterprise and Employment

### 50% Reduction in HUNGER (1b)

Energy > Food production, Water, storage, marketing and transport, affordability, cooking

### Universal Primary Education (2); Eliminate Gender Disparity (3)

Energy > Enrollment & Productivity : Lighting, Water, Cooking, Heating, School Equipment

### 67% Reduction in child mortality (4) 75% Reduction in maternal mortality (5)

### Halt and reverse spread/incidence of HIV/AIDS/Malaria/Diseases (6)

Energy > Reduced air pollution, Accident safety, Clean cooking and water, Health Facilities

### Ensure Environmental sustainability (7)

Energy > Sustainable natural resources use, reduced emissions and pollution

### Develop a global partnership for development (8)

Energy > Trade, finance, Aid, Debt, Technology – Global, Regional, National, sub.National

## The Energy Challenge

Concrete Targets towards ensuring availability, access and affordability



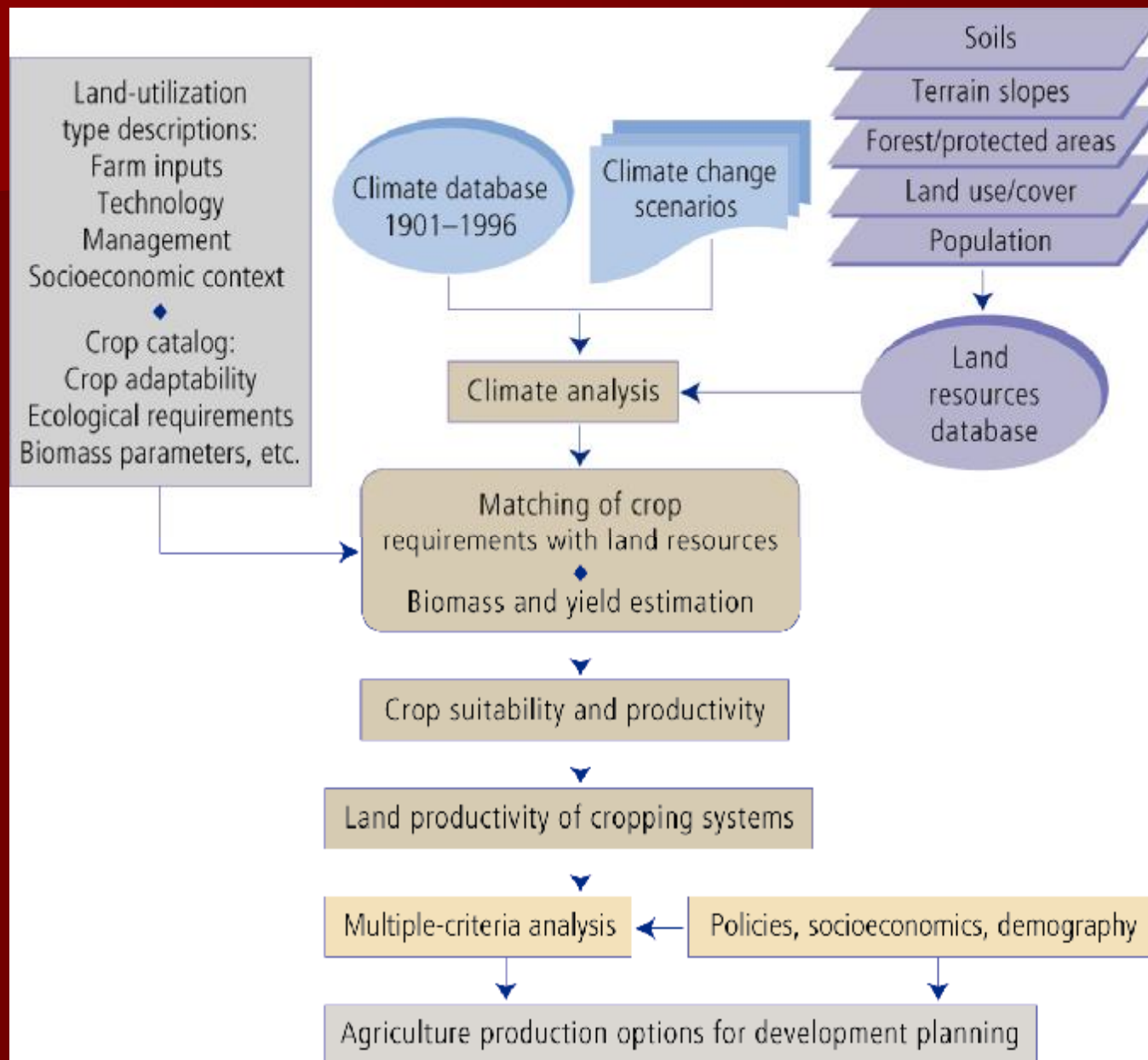
# Methodological Challenges

- n Land Resources : Food, Non-food Ag, Forestry, Bioenergy, Ecosystems Sustainability, Biodiversity ( MEA, CBD), Carbon Sinks Recreation....
- n Water Resources : Crop Agriculture and Livestock, Hydro Power, Fisheries, Recreation....
- n Energy : Agriculture and Water Resources

# Integrating Land Use, Water , Energy, Climate Spatial Methodology and Policy Analysis

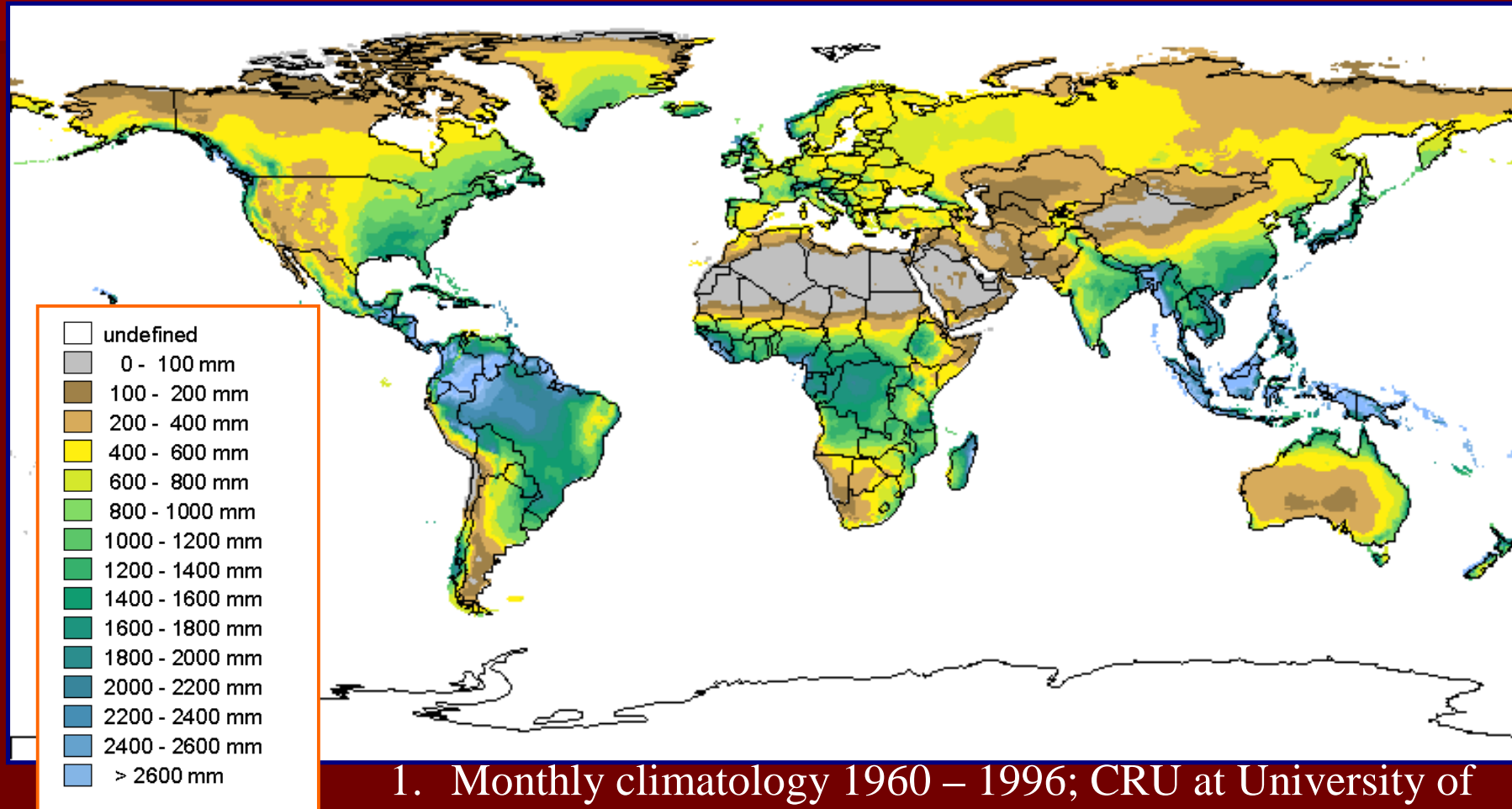
- n Land Resources: Arable, Forests, Urban, Protected ....
- n Water Resources: Surface( Lakes, Rivers), Ground, Rain
- n Climate Change and Variability
  
- n Agriculture: Arable Land & Water Resources
- n Energy: Hydro, Bioenergy.....
  
- n Population and Demography
- n National Economy ...embedded in Global Economy

# Agro-ecological Zones Methodology



# Agro-ecological Zones Methodology

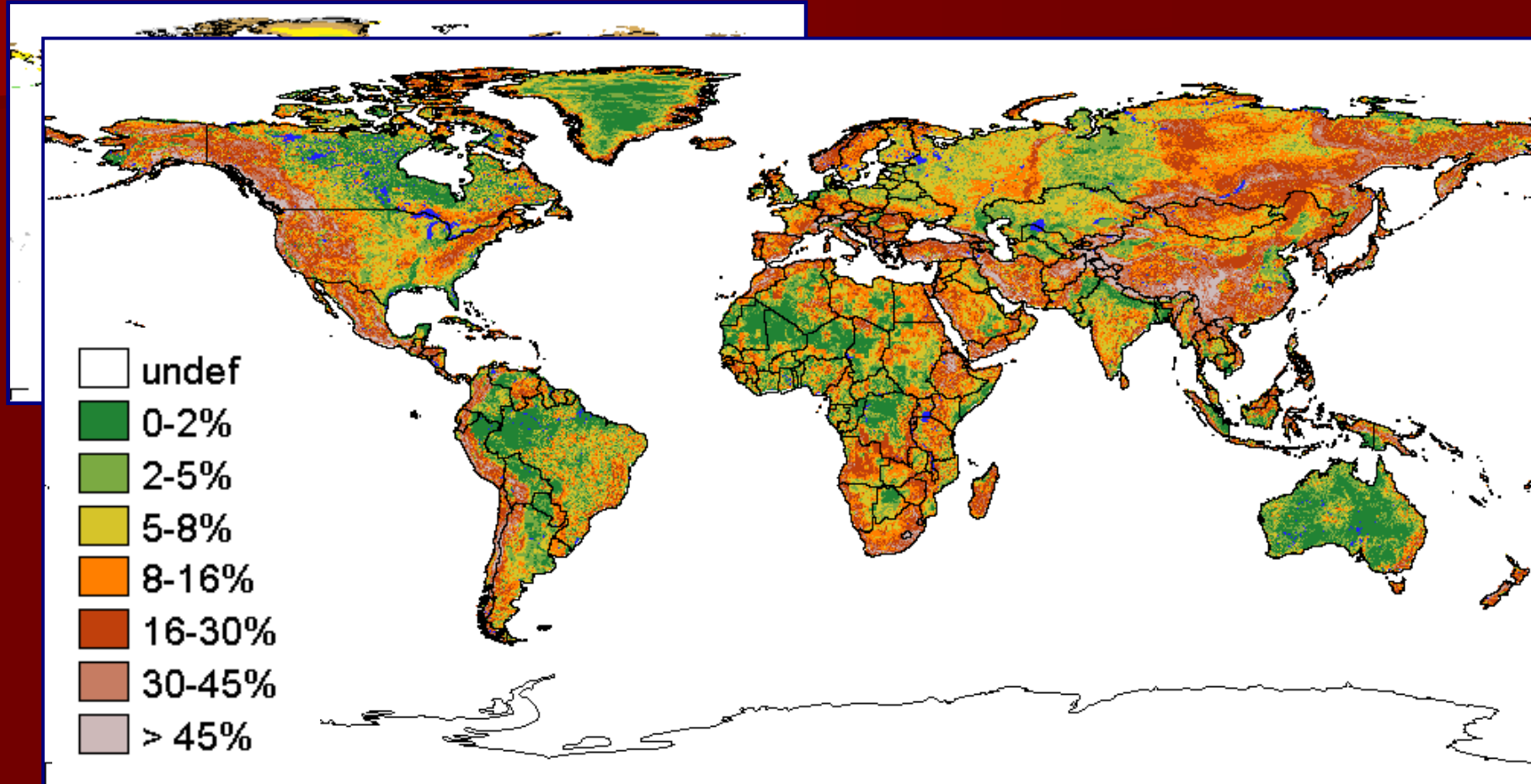
## Geographical Data Layers



1. Monthly climatology 1960 – 1996; CRU at University of East Anglia; at 0.5 deg. latitude/longitude

# Agro-ecological Zones Methodology

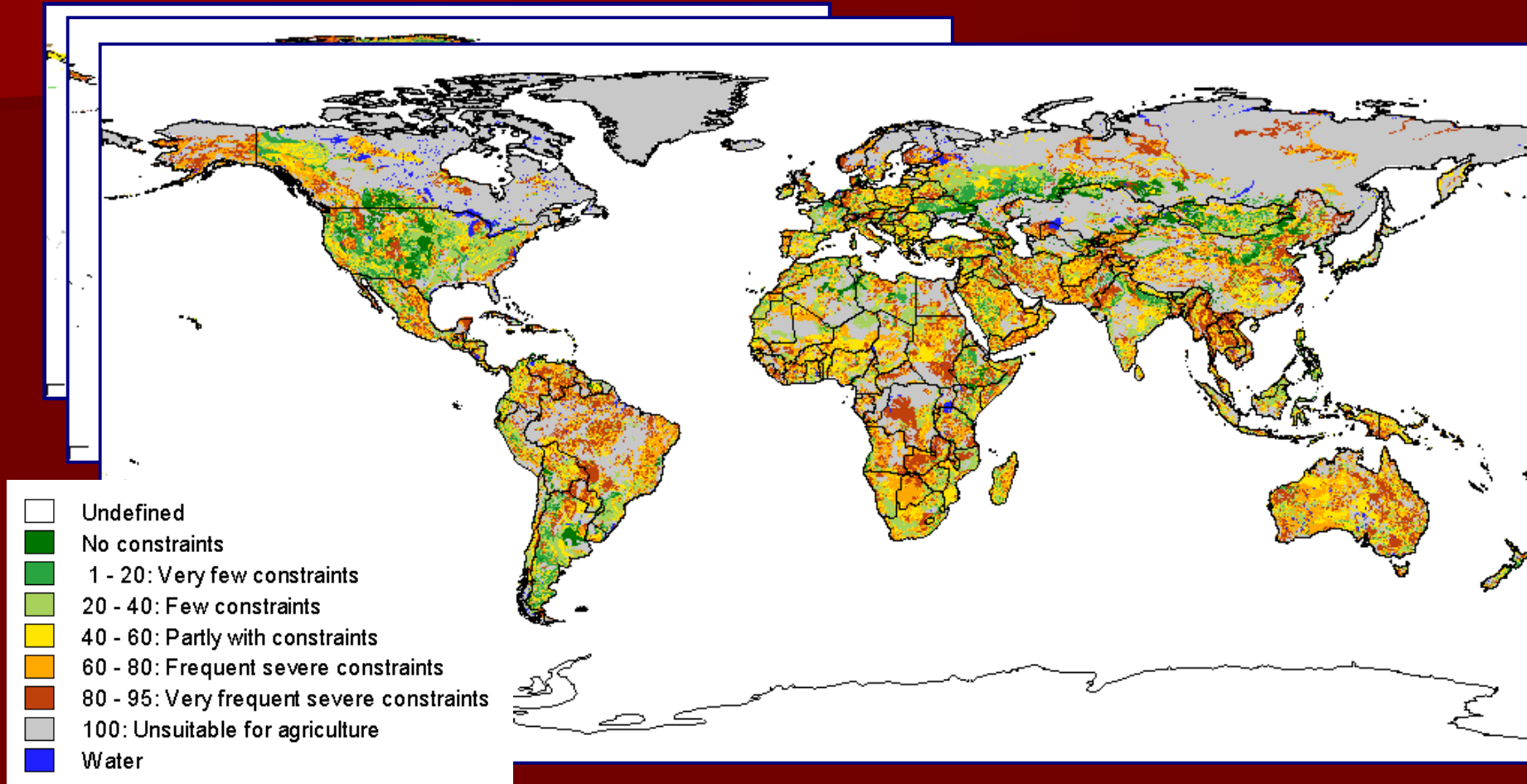
## Geographical Data Layers



2. Terrain slope database; USGS Eros Data Center; digital elevation at 30 arc-seconds latitude/longitude

# Agro-ecological Zones Methodology

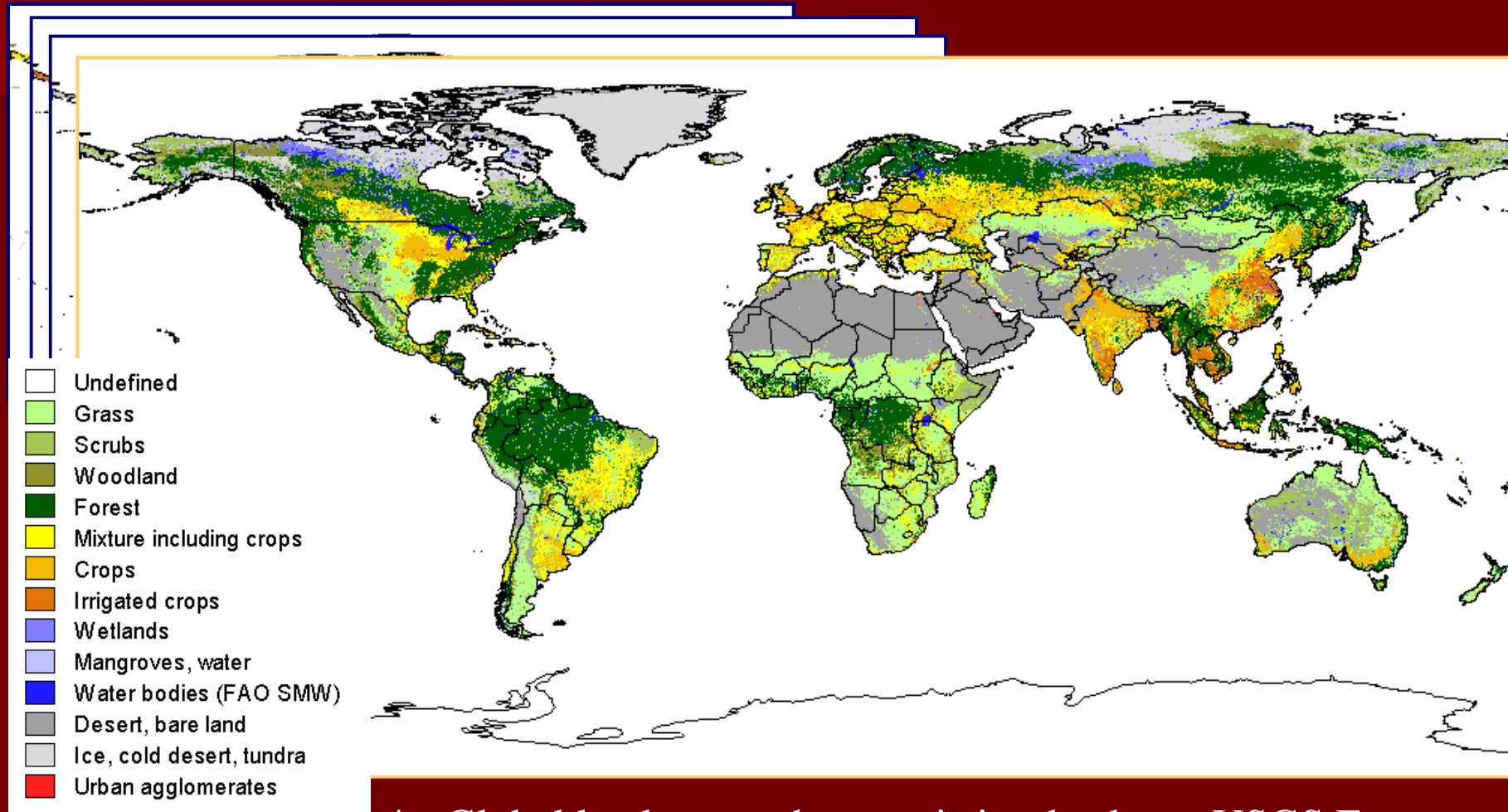
## Geographical Data Layers



3. FAO/Unesco digital Soil Map of the World; UN Food and Agriculture Organization; at 5 arc-min. latitude/longitude

# Agro-ecological Zones Methodology

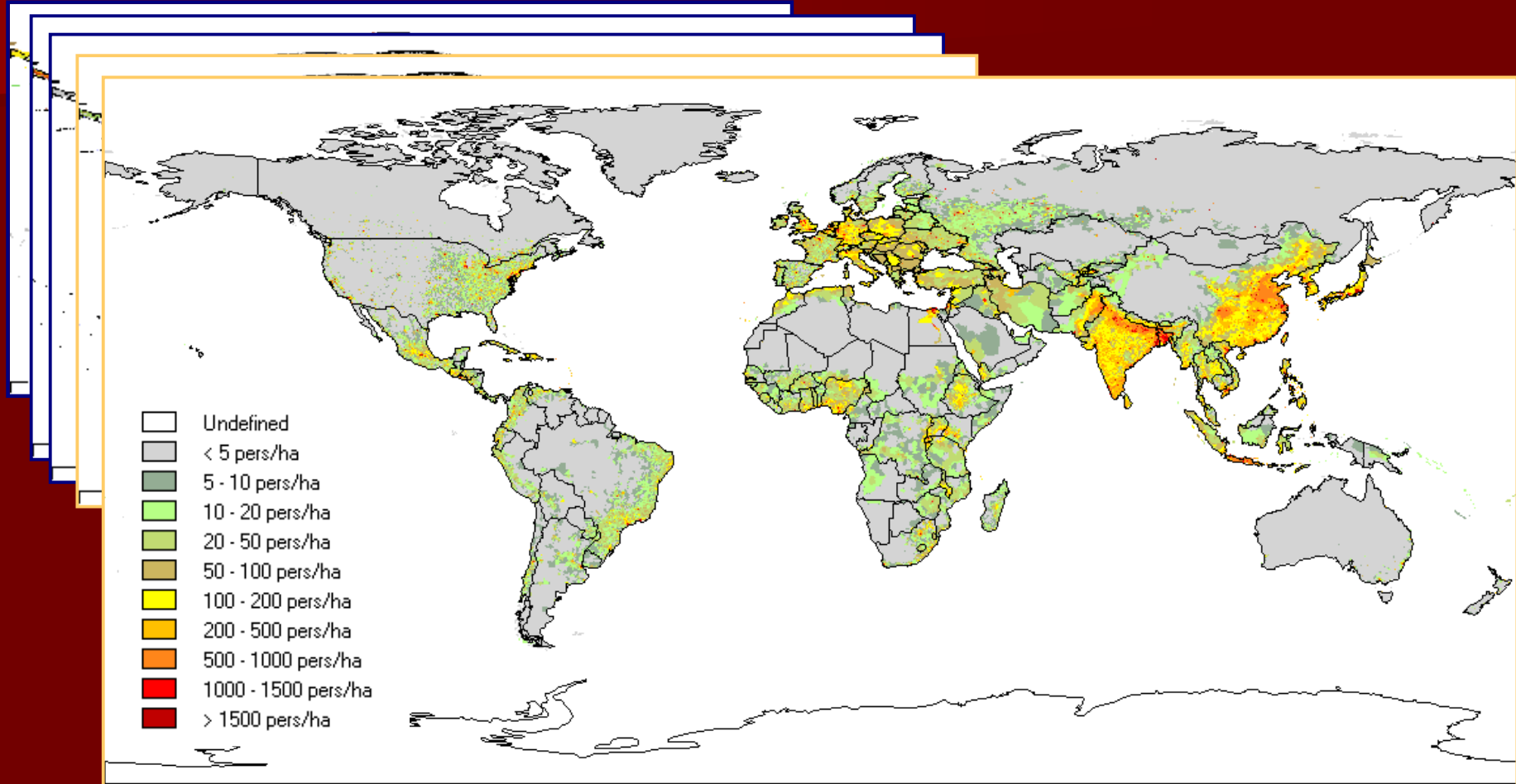
## Geographical Data Layers



4. Global land cover characteristics database; USGS Eros Data Center; at 1 km resolution.

# Agro-ecological Zones Methodology

## Geographical Data Layers

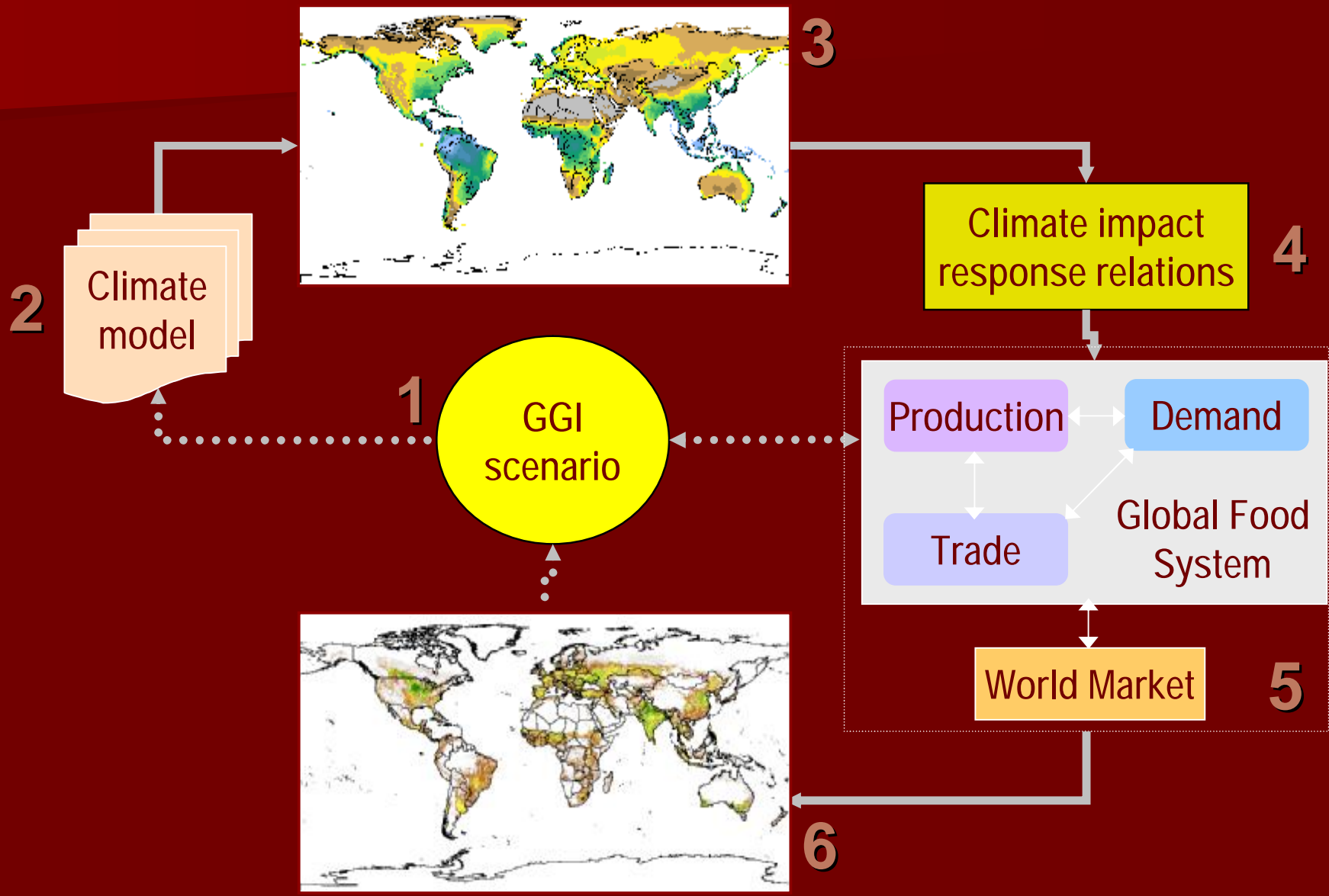


5. Global gridded population distribution data of 1995; CIESIN; at 2.5 arc-min. latitude/longitude resolution.

# Spaitla Land and Water Resources

Land and Water resources database  
including climate, soil, terrain, land cover  
, irrigated areas, lakes, rivers etc  
comprising 2.2 million grid cells,

# Agroecology-Socioeconomic Modeling



# National Planning and Coordination

## Inter-linkages Food, Water, Energy

- n Ministries of Food and Agriculture
- n Ministries of (Agro-) Industries
- n Ministries of Water
- n Ministries of Power Energy
- n Ministries of Environment
- n Ministries of Demography and Population
- n Ministries of Economic Planning
- n Ministries of Commerce and Trade
- n Ministries of Finance
- n Ministries of Foreign Reforms

Setting Development Priorities, Policy Analysis and Policy choice  
Budgeting and Resource Allocation, Implementation, Monitoring



# International Development Partnership

- n UN System (Agriculture and Water – FAO, WB, IFAD, WFP, UNDP, UNIDO.....)
- n Bilateral Donors ( Food, Water, Energy...)
- n Regional Development Banks
- n Private Sector ( Land Leasing, Water Operations...)
- n NGOs.....
- n Universities and Academia
- n National Development Planning : NCSD Coordination



**THANK YOU**

**Mahendra Shah**  
**[www.iiasa.ac.at](http://www.iiasa.ac.at)**