



**D. Ballayan,**

**Statistics Division**

**Food and Agriculture Organization of the  
United Nations (FAO)**

**Workshop on Environment Statistics**

**Abuja, Nigeria, 19-23 May 2008**

# Session 6: AGRICULTURE

## Agriculture Production Index(FAO)

- Show the relative level of the aggregate volume of agricultural production for each year in comparison with the base period 1999-2001

### **Policy relevance**

- Productivity growth in the agricultural sector
- Agricultural sector output to meet the demands for food and raw materials arising out of steady population growth.

## FAO indices of agricultural production

### Methodology

Based on the sum of price-weighted quantities of different agricultural commodities produced after deductions of quantities used as seed and feed weighted in a similar manner

The resulting aggregate represents, therefore, disposable production for any use except as seed and feed



## FAO indices of agricultural production

- All the indices at the country, regional and world levels are calculated by the Laspeyres formula
- Production quantities of each commodity are weighted by 1999-2001 average international commodity prices and summed for each year
- To obtain the index, the aggregate for a given year is divided by the average aggregate for the base period 1999-2001
- The "international commodity prices" are used in order to avoid the use of exchange rates for obtaining continental and world aggregates, and also to improve and facilitate international comparative analysis of productivity at the national level



## **FAO indices of agricultural production**

- The commodities covered in the computation of indices of agricultural production are all crops and livestock products originating in each country
- The category of food production includes commodities that are considered edible and that contain nutrients. Accordingly, coffee and tea are excluded along with inedible commodities because, although edible, they have practically no nutritive value.



## FAO indices of agricultural production

- The indices are calculated from production data presented on a calendar year basis.
- The only difference with previous issues of the yearbook is that the base period has been shifted from 1989-1991 to 1999-2001; the producer prices consequently also now refer to 1999-2001.
- The FAO indices may differ from those produced by the countries themselves because of differences in concepts of production, coverage, weights, time reference of data and methods of calculation



## FAO indices of agricultural production

- FAO questionnaires, national publications and international publications, etc.
- Food and Agriculture Organization of the United Nations (FAO), *FAOSTAT on-line statistical service*. Available on-line at <http://apps.fao.org> .

# Forests and woodlands-

## Forest change (loss/ degradation)

Proportion of land area covered by forest .

### Policy Relevance

- ❖ The purpose of the indicator is to show the area covered by the forest formations of a region/country over time
- ❖ a continuing and fast decreasing forest area in a country might be a alarm signal of unsustainable practices in the forestry and agricultural sector
- ❖ A change in the forested area in a country or region over time can be positive showing a loss of forest area or negative showing an increase



# Forests and woodlands

## **Forest change (loss/ degradation)**

Proportion of land area covered by forest

## **Measurement Methods**

The forest area is calculated as the sum of plantations and natural forests areas with tree crown cover equal and more than 10%

## **Data Availability**

Data on the extent of forest areas (natural and plantations) are available for most countries, both at national and sub-national scales

# Forests and woodlands

## Forest change (loss/ degradation)

Proportion of land area covered by forest .

### Data Sources:

International data are available from FAO Forest Resources Assessments. National data is available from ministries responsible for forestry and statistics

# Forests and woodlands

## **Forest change (loss/ degradation)**

% of forests damaged (abiotic, biotic and human induced)

## **Policy Relevance**

- To provide information on the state of forest ecosystem health and vitality at the global, regional and national levels

The indicator provides an indication of the state of health of forests, and forest health is a precondition for sustainable forest management. abiotic, biotic and human induced influenced by a combination of climatic factors (especially drought), soil conditions, atmospheric pollution ,etc require policies which reduce the occurrence of such influencing factors, in particular air pollution

# Forests and woodlands

## **Forest change (loss/ degradation)**

% of forests damaged (abiotic, biotic and human induced)

## **Measurement method**

Forest condition is measured by an annual assessment of the crown condition of a sample of trees

To measure the spatial and temporal changes on a large scale and over a necessary period of time, a network of monitoring plots needs to be systematically arranged in nominal grid at regional or national level

# Forests and woodlands

## Forest change (loss/ degradation)

% of forests damaged (abiotic, biotic and human induced)

## Data Availability and Sources

FAO; -Forests collect data through the so-called Level I network surveys, which covers the main forests in Europe with approximately 6 000 monitoring plots arranged in a 16 x 16 km grid

# Forests and woodlands

## **Forest change (loss/ degradation)**

Area under sustainable forest management as a percent of forest area.

## **Policy Relevance**

The purpose of the indicator is to show the area under sustainable forest management of a region/country over time.

Forests provide many significant resources and functions including wood products and non-wood products, recreational opportunities, habitat for wildlife, conservation of biological diversity, water and soil, and play a crucial role in the global carbon cycle.

# Forests and woodlands

## **Forest change (loss/ degradation)**

Area under sustainable forest management as a percent of forest area.

## **Measurement method**

The underlying definitions and concepts of sustainable forest management are under development. The Food and Agriculture Organization of the United Nations (FAO) Forest Resources Assessment (FRA) will include this indicator in the next Global Forest Assessment (FRA 2010).

## **Data Availability and Sources**

The Food and Agriculture Organization of the United Nations (FAO). The contact point is the Assistant Director-General, Sustainable Development Department, FAO

# Session 6: Environment and agriculture

The environmental impact of the use of:

- irrigation
- fertilizers
- pesticides
- **FAO Forest statistics**

**Issues and Concerns for Developing Countries**





AGRICULTURAL  
POLICY  
Government program

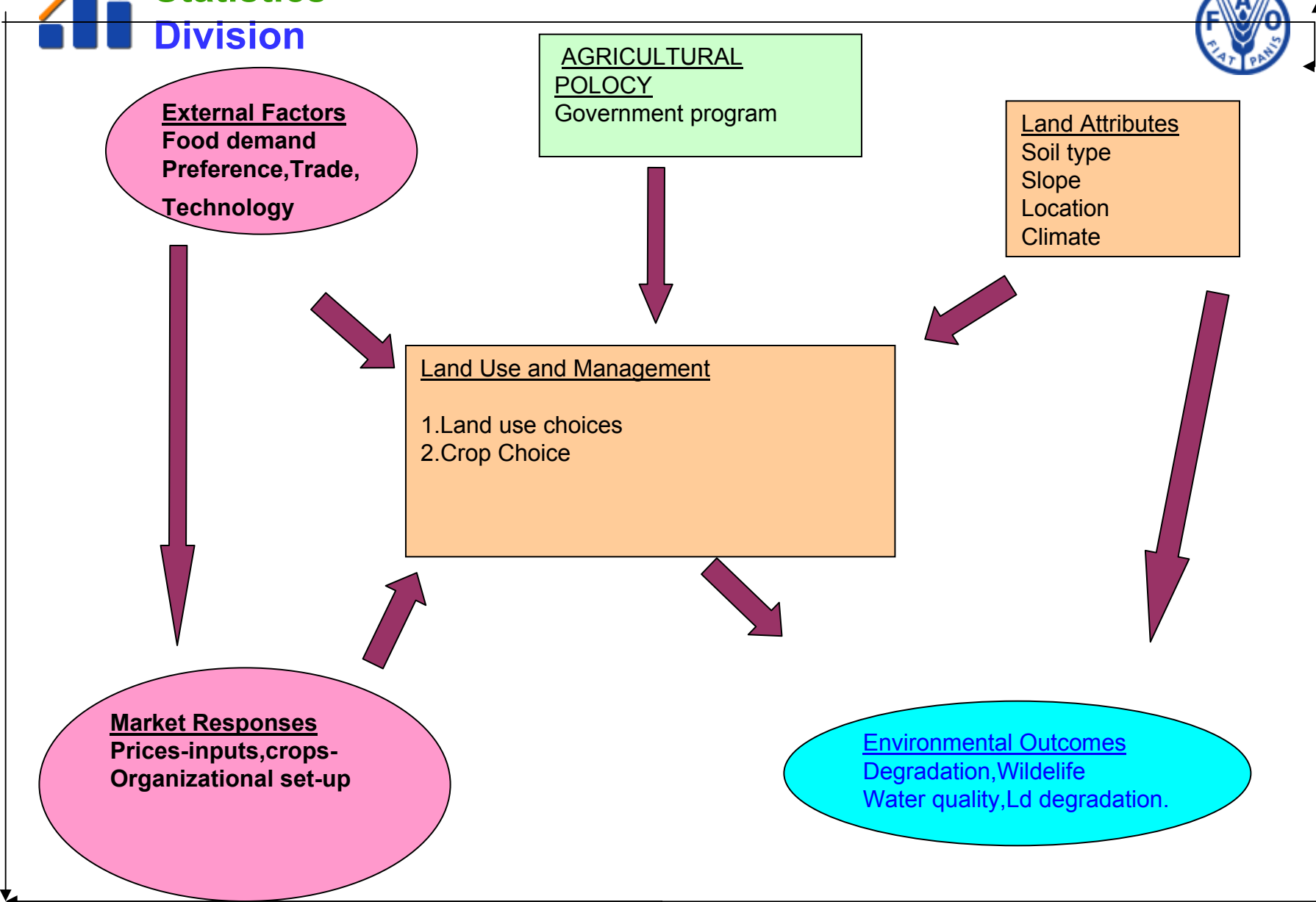
External Factors  
Food demand  
Preference, Trade,  
Technology

Land Attributes  
Soil type  
Slope  
Location  
Climate

Land Use and Management  
1. Land use choices  
2. Crop Choice

Market Responses  
Prices-inputs, crops-  
Organizational set-up

Environmental Outcomes  
Degradation, Wildlife  
Water quality, Ld degradation.



# linking policy, LU and Env

- agricultural inputs like irrigation,
- fertilizers,
- pesticides,
- Agricultural machinery,
- and including Land use could provide valuable information of having direct bearing on environmental conditions

# Irrigation: Sources of Environmental Impact



# Irrigation- Source of Environmental Impact



benefit-Irrigated lands contribute significantly to the world agriculture output and food supply.

- alteration of the natural conditions of the landscape
- big dams and reservoirs
- impact on wildlife, particularly endangered species,

benefit-dams and reservoirs are vital for national economic prosperity and agricultural survival.

# Agricultural runoff



- benefit-a key factor behind the increase in agricultural productivity global food production

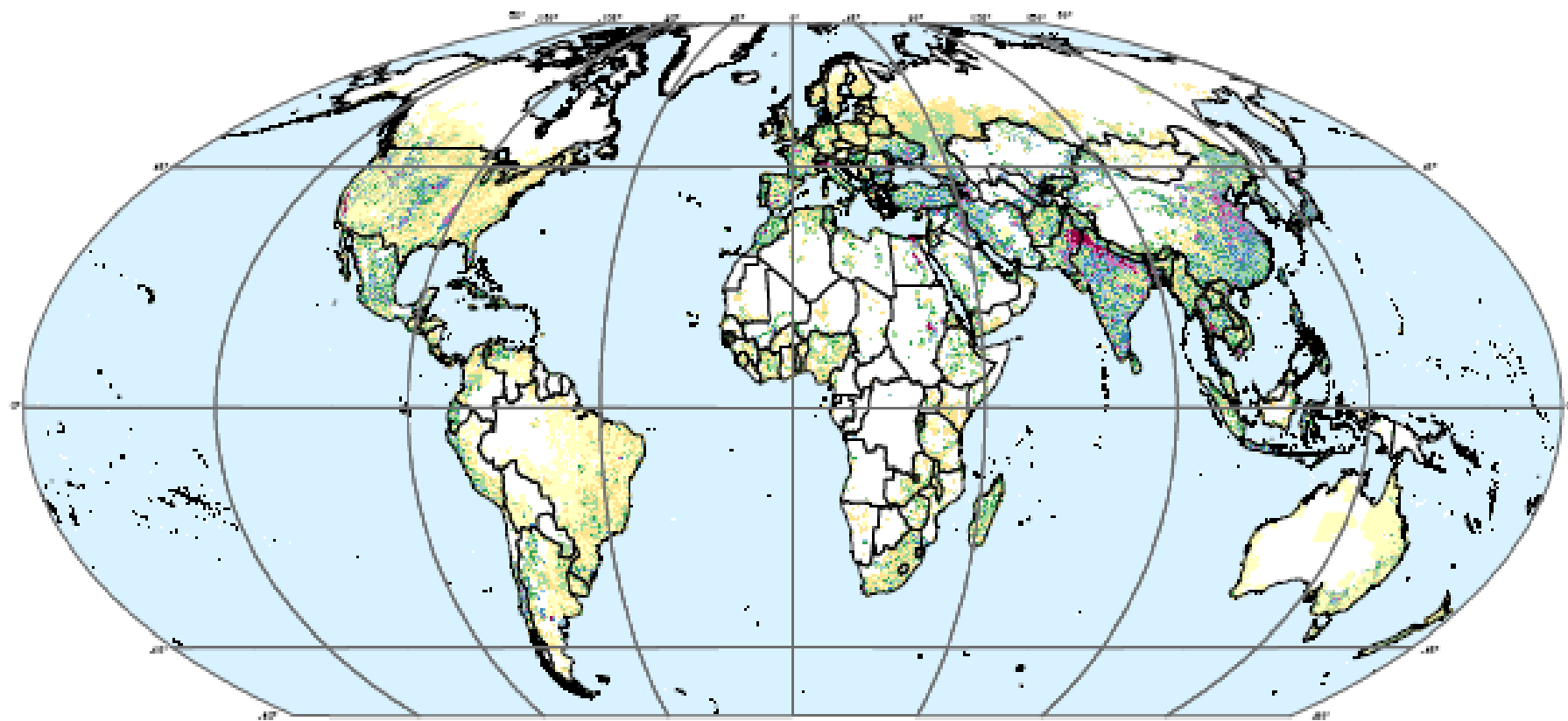
- source of water pollution is runoff from agriculture.
- Runoff of agricultural chemicals is primarily a localized problem where agricultural input use is high.

# Irrigation Data Sources

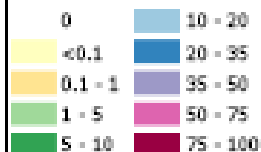
- **FAO**
  - AQUASTAT database  
<http://www.fao.org/ag/agl/aglw/aquastat/main/index.stm>)  
provides country specific information on the area salinized by irrigation (ha).

# The digital global map of irrigation areas

February, 2007



Area under irrigation in  
percentage of land area



The map depicts the area equipped for irrigation in percentage of cell area.  
For the majority of countries the base year of statistics is in the period 1997 - 2002.

Projection: Mollweide

<http://www.fao.org/ag/agl/aglw/aquastat/irrigationmap/index.stm>

Stefan Siebert, Petra Doll, Sebastian Feick (Institute of Physical Geography, University of Frankfurt/M., Germany) and  
Jippe Hoogeveen, Karen Frenken (Land and Water Development Division, Food and Agriculture Organization of the United Nations, Rome, Italy)



# Irrigated Land Use Systems

- This global irrigation map was produced by the University of Frankfurt in cooperation with FAO (Siebert et al., 2007). Irrigated agricultural land comprises less than one-fifth of the total cropped area of the world but produces about two-fifths of the world's food. At the same time, irrigation accounts for about 70 % of the global water withdrawals and for about 90% of the global consumptive water use.



# Fertilizer use

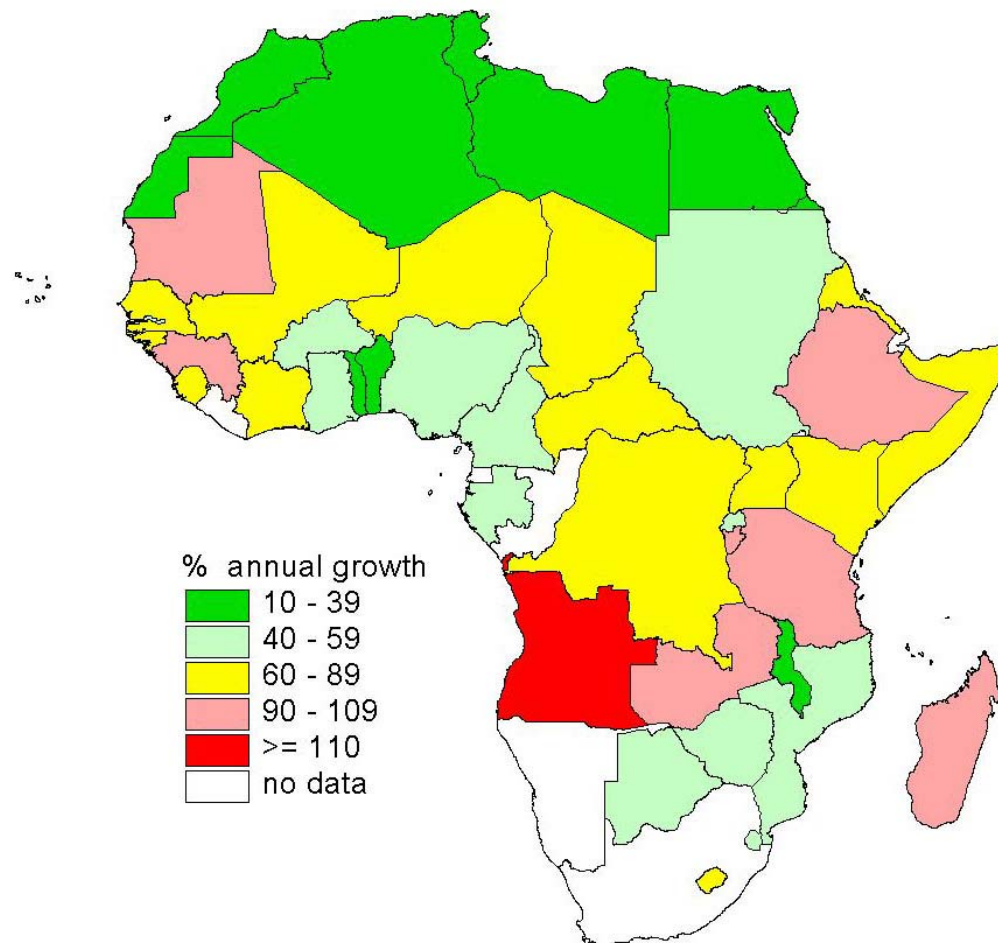


- Plants require nutrients (nitrogen, phosphates and potash) in order to grow, and develop fully to a productive capacity. and complete their life

- benefit-fertilizer use contribute significantly to the world agriculture output and food supply.

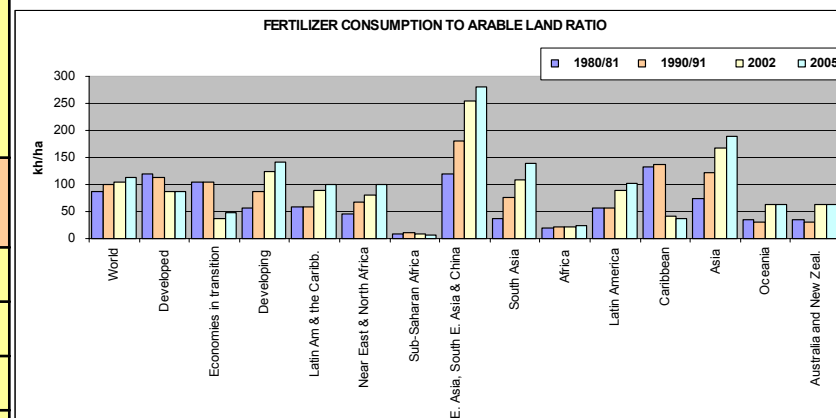
- Food security
- Improved agricultural productivity

# Fertilizer consumption growth for food security goal



# Fertilizer consumption pattern per region

	(kg nutrients/ha)			
	1980/81	1990/91	2002	2005
World	87	99	104	114
Developed	120	112	87	88
Economies in transition	104	104	38	47
Developing	56	87	124	141
Latin Am & the Caribb.	59	59	89	101
Near East & North Africa	45	67	80	99
Sub-Saharan Africa	8	10	8	7
E. Asia, South E. Asia & China	120	180	255	280
South Asia	37	77	109	139
Africa	20	22	22	25
Latin America	56	56	90	102
Caribbean	132	137	42	37
Asia	73	122	167	190
Oceania	35	30	64	64
Australia and New Zeal.	35	30	64	64



# Fertilizer consumption pattern per region

	(kg nutrients/ha)			
	1980/81	1990/91	2002	2005
World	87	99	104	114
Developed	120	112	87	88
Economies in transition	104	104	38	47
Developing	56	87	124	141
Latin Am & the Caribb.	59	59	89	101
Near East & North Africa	45	67	80	99
Sub-Saharan Africa	8	10	8	7
E. Asia, South E. Asia & China	120	180	255	280
South Asia	37	77	109	139
Africa	20	22	22	25
Latin America	56	56	90	102
Caribbean	132	137	42	37
Asia	73	122	167	190
Oceania	35	30	64	64
Australia and New Zeal.	35	30	64	64

Consumption Pattern of Nitrogen to Phosphate and to Potash (average application ratio) (where Nitrogen = 1.00)												
	1980/81			1990/91			2002			2005		
	Nitro gen	Phosp hate	Pot ash	Nitro gen	Phosp hate	Pot ash	Nitro gen	Phosp hate	Pot ash	Nitro gen	Phosp hate	Pot ash
<b>World</b>	1	0.52	0.40	1	0.47	0.32	1	0.39	0.29	1	0.40	0.31
Developed countries	1	0.62	0.57	1	0.56	0.50	1	0.40	0.44	1	0.42	0.39
Economies in transition	1	0.67	0.61	1	0.77	0.54	1	0.34	0.51	1	0.42	0.51
Developing countries	1	0.39	0.16	1	0.38	0.17	1	0.38	0.22	1	0.39	0.28
Latin America and the Caribbean	1	0.97	0.65	1	0.61	0.53	1	0.72	0.76	1	0.75	0.76
Near East and North Africa	1	0.67	0.07	1	0.59	0.07	1	0.35	0.10	1	0.32	0.09
Sub-Saharan Africa	1	0.49	0.31	1	0.51	0.32	1	0.54	0.23	1	0.52	0.39
East Asia and South East Asia	1	0.25	0.08	1	0.31	0.13	1	0.34	0.20	1	0.35	0.27
South East Asia	1	0.33	0.14	1	0.39	0.15	1	0.36	0.13	1	0.39	0.18
<b>Continental and Other Regional Groupings</b>												
Africa	1	0.62	0.22	1	0.50	0.23	1	0.39	0.19	1	0.32	0.12
Latin America	1	1.06	0.65	1	0.64	0.51	1	0.73	0.76	1	0.76	0.76
Caribbean	1	0.30	0.70	1	0.32	0.74	1	0.25	0.56	1	0.14	0.42
Asia	1	0.32	0.11	1	0.37	0.15	1	0.35	0.19	1	0.37	0.25
Oceania	1	4.17	0.87	1	1.59	0.48	1	1.17	0.29	1	1.09	0.27
Australia & New Zealand	1	4.39	0.90	1	1.63	0.47	1	1.16	0.30	1	1.10	0.28

# Adverse effects on the environment

- run off the land due to heavy rainfall/erosion
- leaching into groundwater
- escape in the form of gas into atmosphere

The results of the above related to inappropriate use of fertilizer to suite and fertile the soil conditions.

# DATA SOURCES

## FAO Fertilizer Resource Questionnaire

- **OFFICIAL STATISTICAL PUBLICATIONS FOR INDIVIDUAL COUNTRIES;**
- **UN COMTRADE**
- **FAO/FERTILIZER INDUSTRY ASSOCIATION MEETINGS**

# Fertilizer source

- **Fertilizer Links**
- [FAO Plant Production and Protection Division.](#)
- [FAO Nutrient Response Database \(FERTIBASE\).](#)
- [United Nations Commodity Trade Statistics Database \(COMTRADE\).](#)
- [European Fertilizer Manufacturers Association.](#)
- [International Fertilizers Industry.](#)
- [The Fertilizer Institute.](#)



# Fertilizer source

- Fertilizers:  
(<http://faostat.fao.org/site/575/DesktopDefault.aspx?PageID=575>) :
- by subjects: Production-Import-Export-Non fertilizer use-Consumption
- by commodity: Nitrogen-Phosphate-Potash-Ammonia-NPK Complex, etc.

▪

# Fertilizer-Data source

- National level-Ministry of Agriculture
- **FAO's FertiBase**  
**Worldwide:**[http://faoint0b/landandwater/fertistat/index\\_en.htm](http://faoint0b/landandwater/fertistat/index_en.htm)//This site has been conceived as a means to compile and store statistics on fertilizer use by crop for selected key years and to make them available on-line.
- Clicking on a this site in the map,a dark green country will be displayed with all available statistics on fertilizer use by crop for that very country.
- For a more refined database search, please click the menu item '[Fertilizer Use Statistics](#)'.

# Fertilizer-Data source

- National level-Ministry of Agriculture
- **FAO's FertiBase**  
**Worldwide:**[http://faoint0b/landandwater/fertistat/index\\_en.htm](http://faoint0b/landandwater/fertistat/index_en.htm)//This site has been conceived as a means to compile and store statistics on fertilizer use by crop for selected key years and to make them available on-line.
- Clicking on a this site in the map,a dark green country will be displayed with all available statistics on fertilizer use by crop for that very country.
- For a more refined database search, please click the menu item '[Fertilizer Use Statistics](#)'.

# FAO definition of Pesticides

**Pesticide** means any substance or mixture of substances intended for preventing, destroying or controlling any pest, including vectors of human or animal disease, unwanted species of plants or animals causing harm during or otherwise interfering with the production, processing, storage, transport or marketing of food, agricultural commodities, wood and wood products or animal feedstuffs, or substances which may be administered to animals for the control of insects, arachnids or other pests in or on their bodies. The term includes substances intended for use as a plant growth regulator, defoliant, desiccant or agent for thinning fruit or preventing the premature fall of fruit, and substances applied to crops either before or after harvest to protect the commodity from deterioration during storage and transport.

From: International Code of Conduct on the Distribution and Use of Pesticides

# Classification of Pesticides

- Pesticides are classified in many different ways
- Two common ways are:
  - according to target organism (e.g. fungicides, insecticides, herbicides)
  - according to chemical nature (e.g. organophosphates, parathyroid).
- The method of data collection followed in the FAO questionnaire relates to target organism.

# FAO involvement -Global level

- Provides reference framework for regulatory control of pesticides: International Code of Conduct on Distribution and Use of Pesticides, and supporting Technical Guidelines
- Secretariat of the Rotterdam Convention (Pesticides)
- Secretariat of the International Plant Protection Convention
- Codex and JMPR
- Promote IPM to reduce reliance on pesticides
- Prevention and disposal of obsolete pesticide stocks



# Some facts and figures

- Pesticide market (2005)

Asia	US\$	7.7 Bn
Europe	US\$	9.1 Bn
World	US\$	32.2 Bn
- All countries in Europe and Asia have pesticide legislation
- Pesticides are purposely released into the environment

# Issues

- Overuse and abuse of pesticides at many places  
E.g.: cotton, vegetables, rice
- Highly toxic products: Some countries are lagging behind in phasing out high incidence of accidental poisoning  
+ an estimated 300.000 self-poisoning cases in Asia p.a.
- Food safety and other public health risks (residues)
- Environmental risks
- Market access Pesticide residue requirements are increasingly important in trade
- Pesticide quality (Illegal trade in pesticides; counterfeit products; some countries lack sufficient quality control)
- Obligations under international instruments



# PESTICIDES STATISTICS

## The FAO database

- For more than three decades FAO has been collecting data on pesticides;
- The information compiled covered consumption/sales quantity used in or sold to the agricultural sector expressed in metric tons of active ingredient;

# PESTICIDES STATISTICS

## The FAO database

- Information on quantities applied to single crops is not available
- Database on pesticides were presented for major groups and sub-groups (fungicides, insecticides, herbicides, plant growth regulator)

# PESTICIDES STATISTICS

## The FAO database

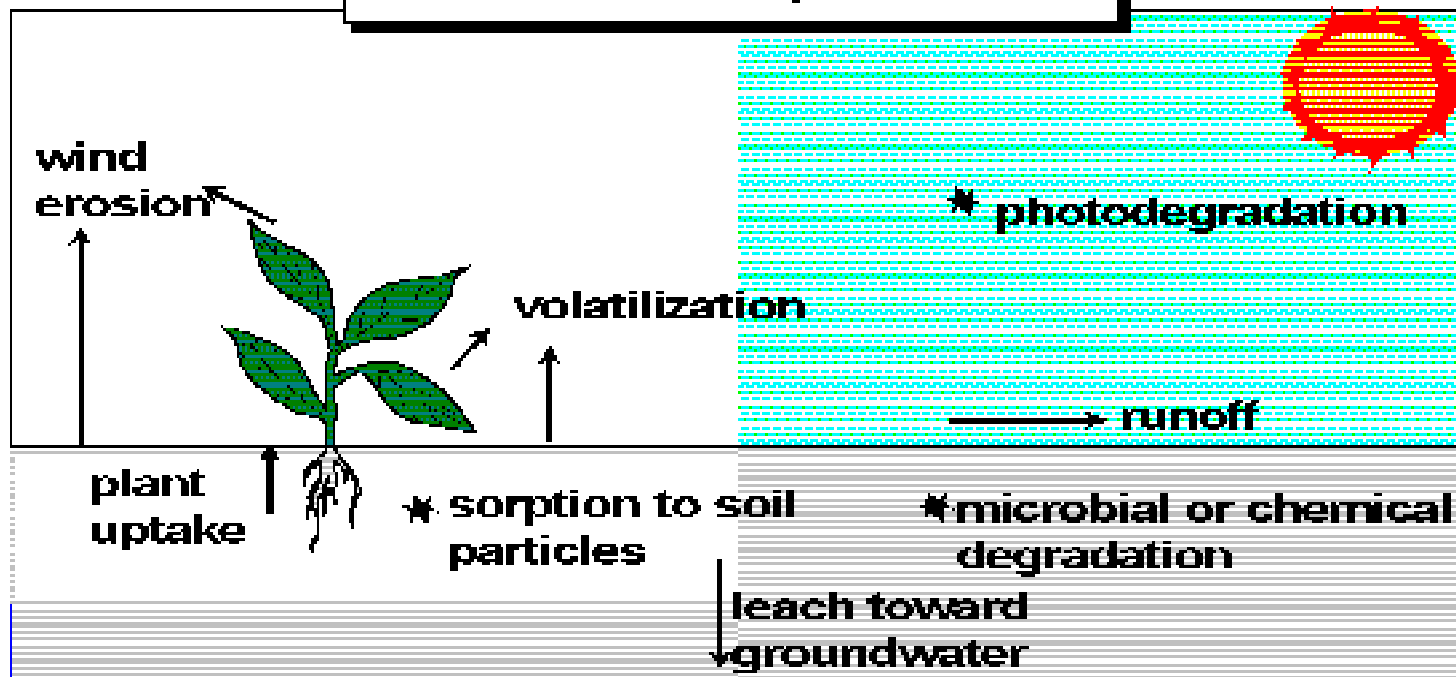
- The result was not very encouraging - comprehensive statistics for production, consumption and trade were never available.
- The country coverage and time series were incomplete due to a high rate of non-response

# Data availability & Source

- Producers sometimes reluctant to disclose information required for fear that competitors might acquire strategic information.

# MOVEMENT OF PESTICIDES IN THE ENVIRONMENT

## Pesticide fate processes



# FAO database

- In 2002, suspended the data collection why undertaking a study for a new dimension

# What information is needed?

- Sales database
  - how many kilograms are sold of each compound allowed on the market?
- Usage database
  - what is the distribution of 1 compound over the crops?
  - which part of the compound is used as a granules or as a spray?
  - which part of the compound is used in glasshouses or in the field?
  - What is the average application rate of a compound for a particular crop?
  - (which crop is grown in which part of your research object?)

# What information is needed?

- Compound related database
  - Toxicity values
  - information on degradation
- GIS database (e.g. OM%, pH, slope, soil type, etc.)
- **Possible layout of FAO indicators**

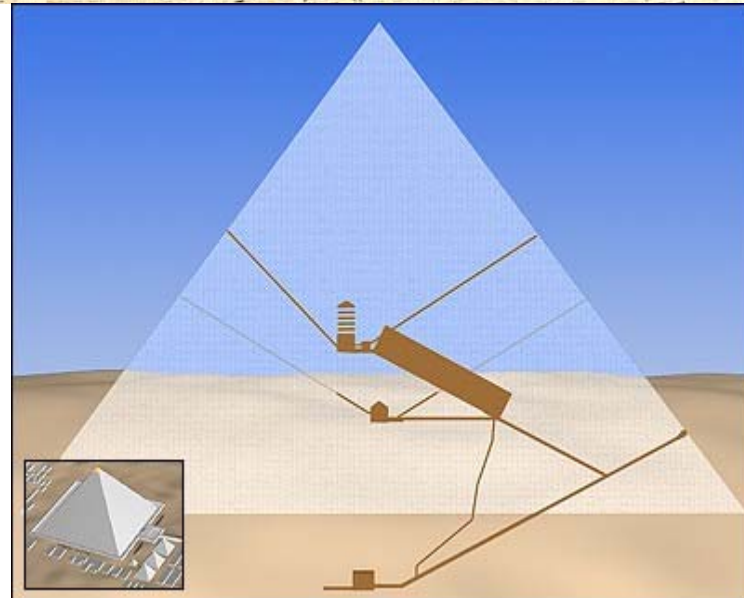
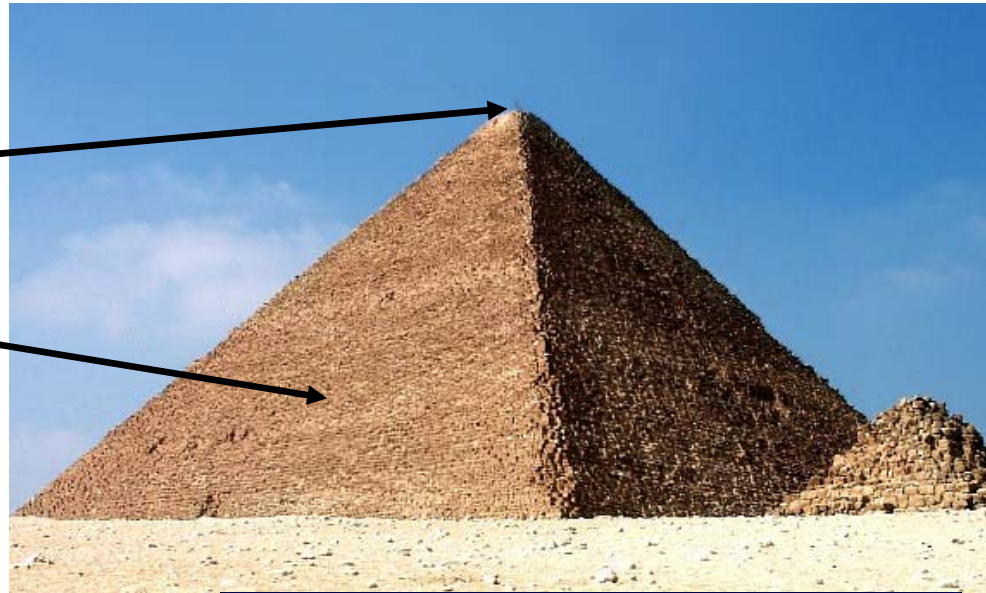


# What is next?

- Developing indicators to interpret pesticide use data as environmental load or risk figures.

Policy makers

Scientists



# FAO Global Forest Resources Database



# T1 Forest area

<b>FRA 2010 categories</b>	<b>Area (1000 hectares)</b>			
	<b>1990</b>	<b>2000</b>	<b>2005</b>	<b>2010</b>
Forest				
Other wooded land				
Other land				
...of which with tree cover				
Inland water bodies				
<b>Total for country</b>				

# Forest

**Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds *in situ*. It does not include land that is predominantly under agricultural or urban land use.**



# Other wooded land

**Land not classified as “Forest”, spanning more than 0.5 hectares; with trees higher than 5 meters and a canopy cover of 5-10 percent, or trees able to reach these thresholds *in situ*; or with a combined cover of shrubs, bushes and trees above 10 percent. It does not include land that is predominantly under agricultural or urban land use.**

# Other land with tree cover

**Land classified as “Other land”, spanning more than 0.5 hectares with a canopy cover of more than 10 percent of trees able to reach a height of 5 meters at maturity.**

(i.e. the same cover criteria as forest, but different land use criteria (primary land use is agriculture, horticulture or urban (parks)))

# Global Forest Resources Assessment 2005

Progress towards sustainable forest management

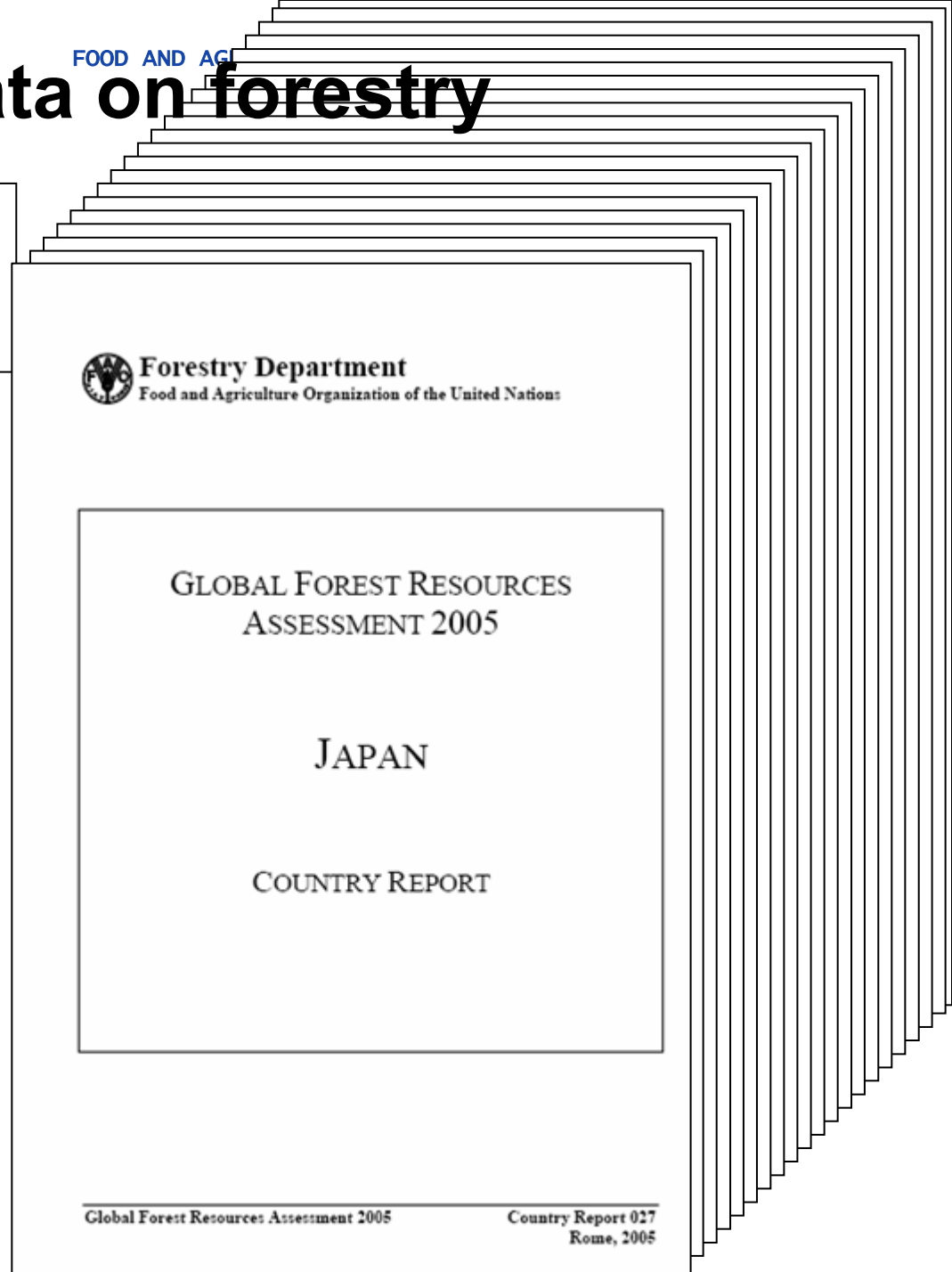




## Global forest resources assessment (FRA 2005)

- 229 country reports
- Data for 1990, 2000, 2005
- Status and trends of more than 40 variables, such as
  - *Forest area*
  - *Growing stock, biomass stock and carbon stock*
- Best available global dataset on forests, available at

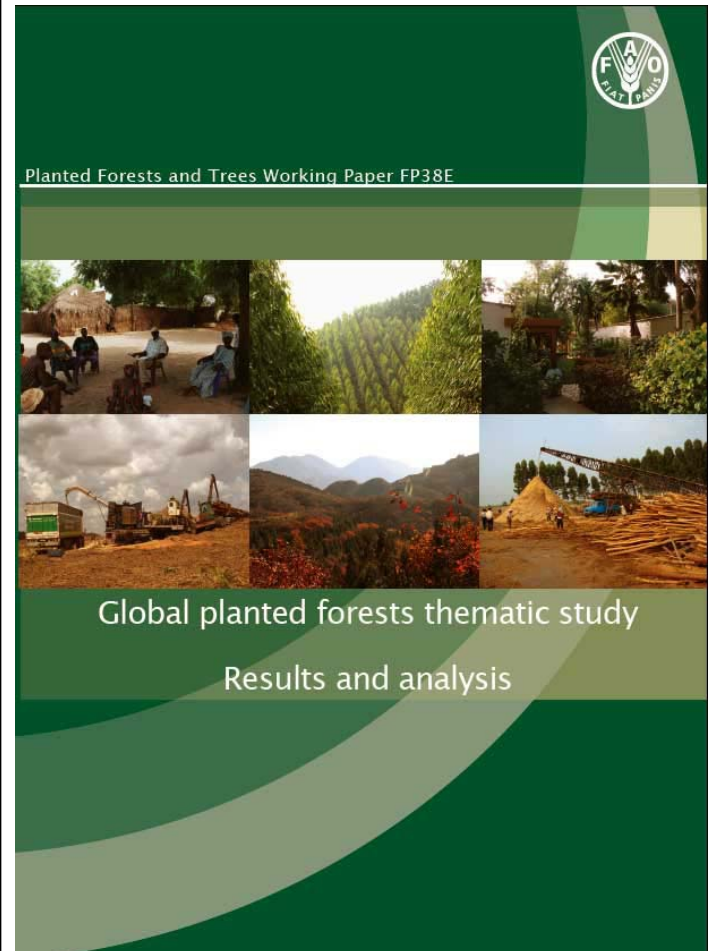
[www.fao.org/forestry/fra](http://www.fao.org/forestry/fra)



# Planted forests

## Planted forest study

- Database on planted forest for about 60 countries
- Areas, species, growth rates, etc.
- Available on CD-ROM



# Expected outputs

- **Regional, biome and global trends related to forests 1975-1990-2000-2005:**
  - area change statistics
  - information on land use dynamics
- **A framework to support further monitoring of forests, land use and the environment, e.g. Country level!**
- **Baseline data research & modeling (& negotiation)**

# Forest area and area change

Country/area	Forest						
	Area			Annual change rate			
	1990	2000	2005	1990-2000		2000-2005	
	1000 ha	1000 ha	1000 ha	1000 ha/yr	%	1000 ha/yr	%
Angola	60 976	59 728	59 104	-125	-0.2	-125	-0.2
Botswana	13 718	12 535	11 943	-118	-0.9	-118	-1.0
British Indian Ocean Territory	3	3	3	0	0	0	0
Comoros	12	8	5	n.s.	-4.0	-1	-7.4
Kenya	3 708	3 582	3 522	-13	-0.3	-12	-0.3
Lesotho	5	7	8	n.s.	3.4	n.s.	2.7
Madagascar	13 692	13 023	12 838	-67	-0.5	-37	-0.3
Malawi	3 896	3 567	3 402	-33	-0.9	-33	-0.9
Mauritius	39	38	37	n.s.	-0.3	n.s.	-0.5
Mayotte	6	6	5	n.s.	-0.4	n.s.	-0.4
Mozambique	20 012	19 512	19 262	-50	-0.3	-50	-0.3
Namibia	8 762	8 033	7 661	-73	-0.9	-74	-0.9

**Next plan is for FRA 2010.**

# **Global Forest Resources Assessment**

## **Towards FRA 2010**



## **Next plan is for FRA 2010.**

- FAO has recently launched the next round of Global Forest Resources Assessment (FRA2010).
- It contains a new component – a global remote sensing survey, based on 10x10 km
- sample plots from LANDSAT, at each latitude-longitude intersection

**Next plan is for FRA 2010.**

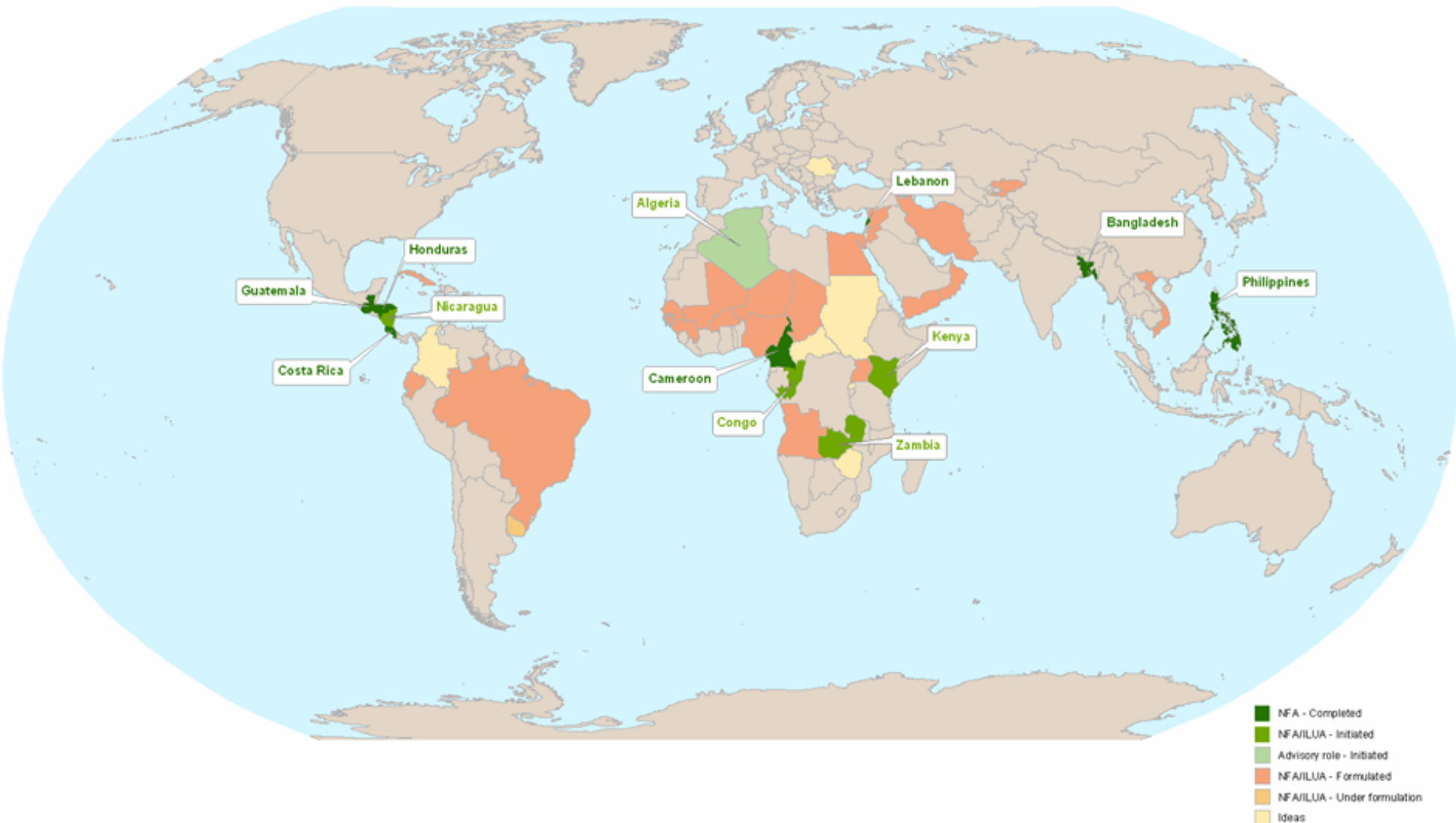
- Sample size of more than 13000 sample plots. It is planned to compare images from 1975, 1990, 2000
- and 2005, which will give very good data on land use change dynamics and trend statistics

## Next plan is for FRA 2010.

- related to land cover and land use on global, regional and biome level. It is expected that data
- from this survey will be available in 2011



# FAO support to national forest inventories



**More information is available from:**

**[www.fao.org/fra](http://www.fao.org/fra)**

**[fra@fao.org](mailto:fra@fao.org)**



Thank you

***Email: [dominic.ballayan@fao.org](mailto:dominic.ballayan@fao.org)***



Thank you

*[dominic.ballayan@fao.org](mailto:dominic.ballayan@fao.org)*