

SEEA FOR AGRICULTURE CURRENT FAO ACTIVITIES

20-21/06/2013

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SEEA for Agriculture

-- Framework to integrate all agricultural activities

SEEA - Agriculture will link together:

- Activities in all sub-sectors (crop and livestock production, fishery and forestry)
- Production activities, utilization of natural resources (land, water, energy, soil, biological resources) and their sustainability
- Economic (SNA-based data), Natural resource use (SEEA Central framework), food security, livelihood, gender, poverty



- Shared concepts, classification, and data collection framework -- Integration of various surveys and census
- Integrated database and multi-purpose information system



Main Area of FAO Activities

- Harmonizing classification / Revise data collection and processing
 - Revision of land use and irrigation questionnaire
 - Land cover classification (LCCS3)
 - Global land cover database (GLC-SHARE)
 - Green gas emission account
 - Federated Water Monitoring System (FWMS), Key Water Indicator Portal (KWIP) – UN-Water
 - Revision of Handbook of Standard Aquaculture monitoring and statistics
- Case study / Experimental compilation of SEEA
 - Forestry
 - Fishery, aquaculture and water
 - Integrated SEEA compilation on one testing country

SEEA-AGRI



- Conceptualize and documenting SEEA-AGRI
 - Build upon SEEA Central Framework – common structure, classifications
 - Expand to cover the need for agriculture monitoring and management
 - food security
 - social dimensions – poverty, rural livelihood, gender
 - sustainability of sector operation
 - disaster impact assessment, monitoring animal/ plant diseases
 - Strengthen data component
 - define minimum data requirement
 - link with World Census of Agriculture 2020
 - guideline on alternative processing where direct data not available
 - quality assessment, clarify an extent of uncertainty
- Standard indicators of sector performance and sustainability
 - Potentially, central compilation for global comparability



Harmonization of classifications / data

Revision o Land Use and Irrigation Questionnaire



Land Use and Irrigation Questionnaire

- Harmonized with SEEA Land Use Classification
 - Land use other than agricultural use :
 - Land used for aquaculture
 - Built-up and related area
 - Land used for maintenance and restoration of environmental functions
 - Further details for Inland waters
 - Coastal waters
- Issues identified:
 - Discrepancies in concepts used in areas “for maintenance and restoration of environmental functions” between land and water areas
 - Confusion in marine water classification and definitions
 - Additional information needs, specifically for SEEA-AGRI

Issue – “Area for maintenance and restoration of environmental functions”



Original concept – cover the protected area defined by IUCN

Corresponded inland/ coastal area include:

“enhanced area” : stocking, fertilizations, engineering, predator control, habitat modifications and/or limit: commonly applied in fishing areas

■ Temporal solution:

- Keep the SEEA classification
- Insert FAO specific sub-classification for “enhanced area”

Issue – “Confusion in marine water classification and definitions”



	SEEA	UNCLOS/ general in FI
Coastal water	Internal water	No specific definition
National territory	Internal water	Internal water + 12 n.m. (gen)
EEZ	EEZ – Internal water ?	EEZ

- Temporal solution:
 - “Territorial sea and internal waters” as equivalent of “Coastal water” in SEEA classification
 - Water use information was asked for “Coastal water and Exclusive Economic Zone (EEZ)”



Overall structure

■ Country area:

- Land area :
 - Agriculture area
 - Forest area
 - Other wooded land
 - Other land
- Inland water
- Territorial sea and internal waters

■ Supplemental questions:

- Total planted area
- Area equipped for irrigation
- Organic land
- Coastal water and EEZ
- Permanent water
- Seasonal water

SEASONAL WATERS

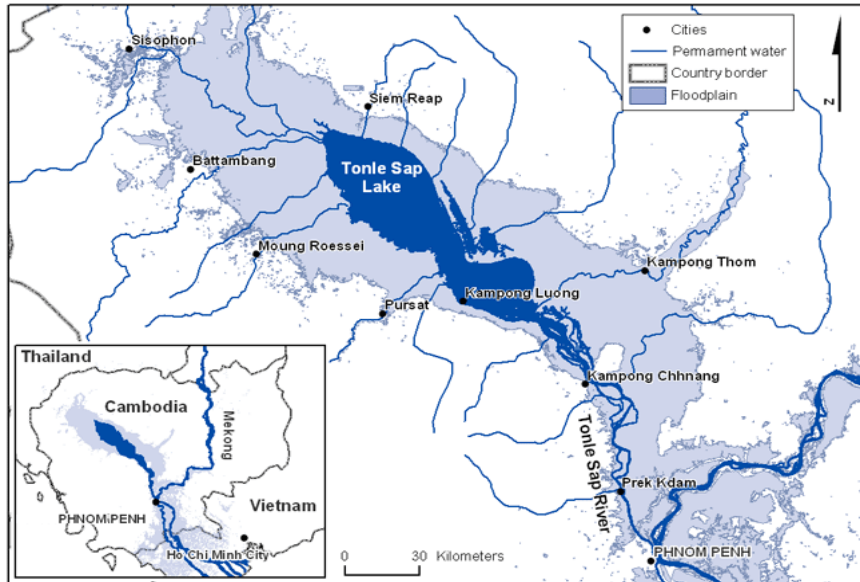
Need of full water bodies data describe fishery and aquaculture performance:

- seasonally flooded areas
- rice pads for aquaculture
- coastal lagoons

Fish Life Cycle

Spawn & migrate on to the floodplain
Feed & grow
Migrate off the floodplain
Survive the dry season & prepare to spawn

Flood Cycle



Supplementary questions on

- Permanent waters (Lake and reservoirs/ Rivers/ Coastal lagoons)
- Seasonal waters (Max and Min water surface area) and rice field in water



Harmonization of classifications / data

Green House Gas Emissions Database for Agriculture



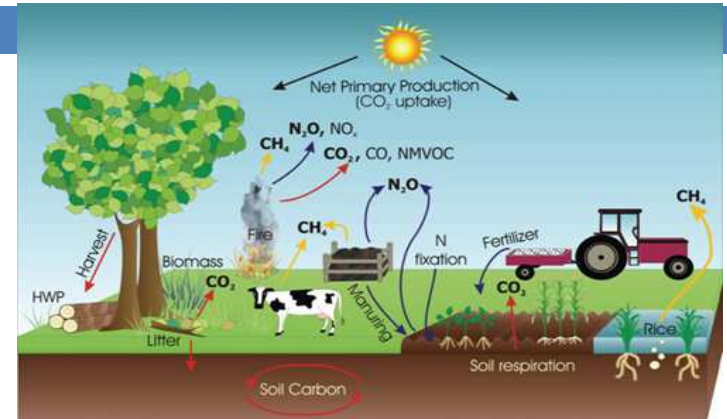
FAOSTAT GHG Emissions Database



Food and Agriculture Organization of the United Nations
FAOSTAT

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IPCC 2006 Guidelines



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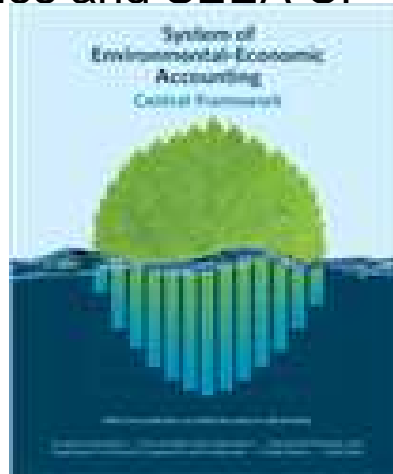
The screenshot shows the FAOSTAT website interface. At the top, there are navigation tabs: Home, Browse Data, Download Data, Compare Data, Search Data, Analysis, and Methods & Standards. The main content area is titled 'Browse Data' and includes a sidebar with a tree view of categories such as Production, Trade, Food Supply, and Emissions. The 'Emissions - Agriculture' section is selected, showing a world map of emissions by country (CO₂ equivalent) for the period 1990-2010. The map uses a color scale from yellow (low emissions) to dark red (high emissions). Below the map, there are two summary boxes: 'Emissions (CO₂ equivalent) 1990-2010' and 'Emissions growth rate by continent 1990-2010', with Africa showing a 2.29% growth rate.

FAOSTAT SEEA-AGRI and GHG Emissions Database

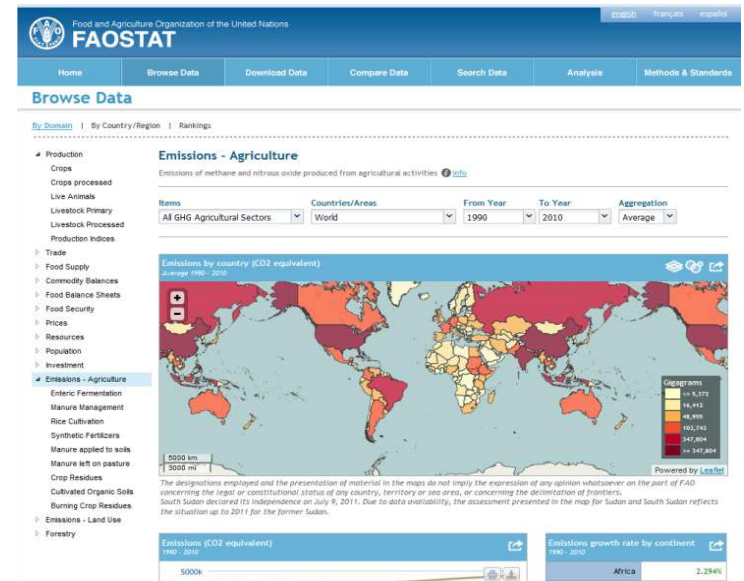
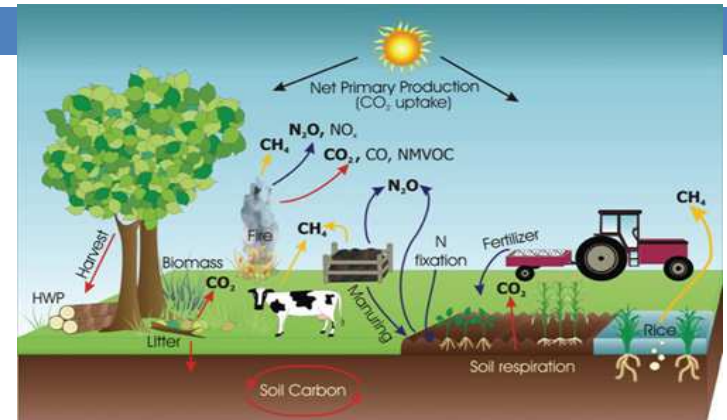


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IPCC 2006 Guidelines and SEEA CF



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Harmonization of classifications / data

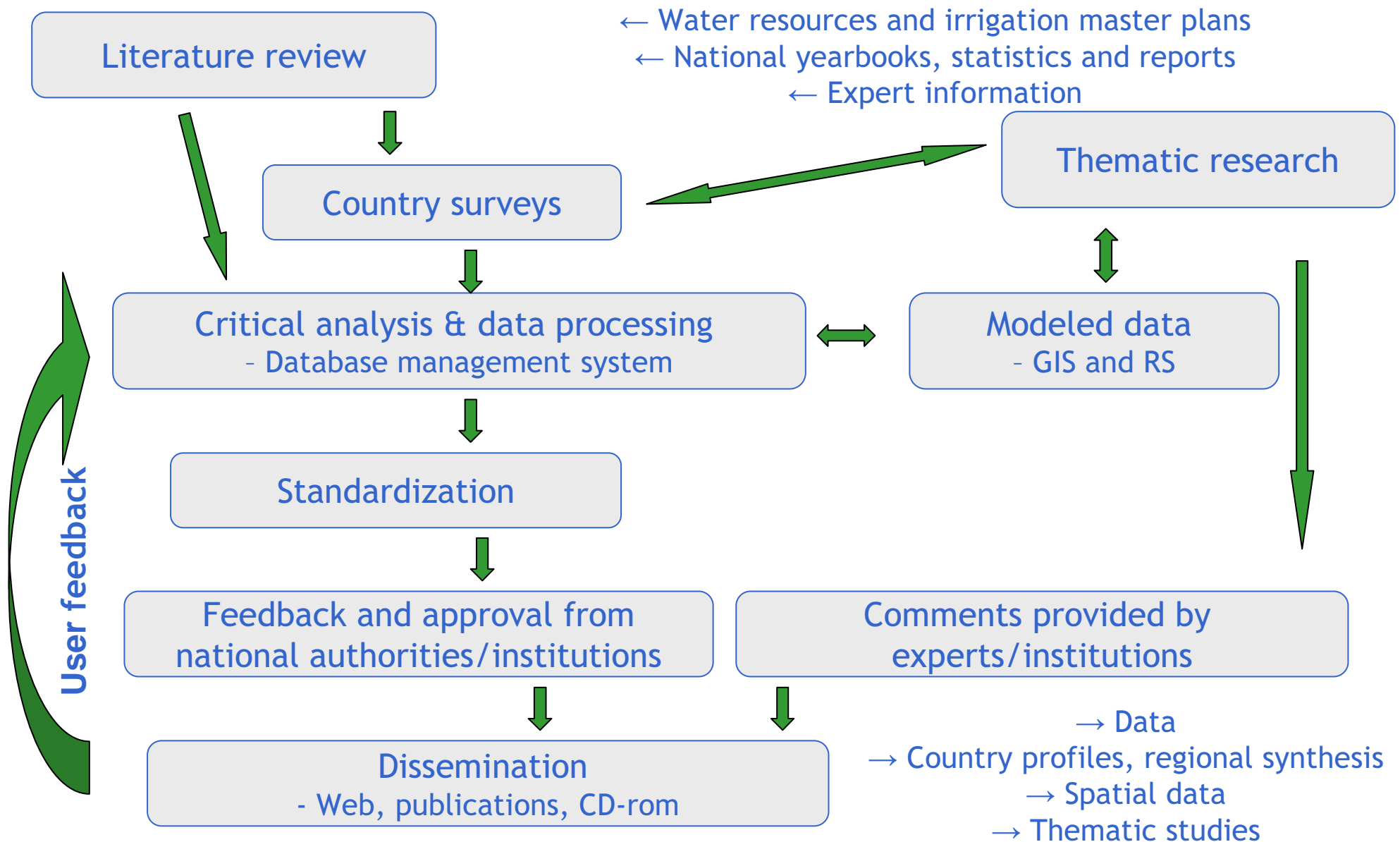
WATER

UN-Water

Federated Water Monitoring System

Key Water Indicator Portal

How water information is gathered



Main AQUASTAT products



- **Online country database and metadata: 160 variables**
Geography et population (15), Water resources (45), Water use (30), Irrigation et drainage (60), Environment and health (10)
- **Country profiles and fact sheets: 140 countries**
Profiles: Africa, Asia, Latin America and the Caribbean. Fact sheets: World
- **Regional overviews: 6 regions**
Africa, Western Asia (Middle East), Central Asia, Southern and Eastern Asia, Former Soviet Union, Latin America and the Caribbean
- **Climate information tool**
Interactive tool to query spatial data-set containing mean monthly climate data
- **Water resources: 200 countries**
Water resources sheets for all countries, containing internal, external and total renewable water resources, considering agreements
- **Geo-referenced database on dams: 4 regions**
Dam location (coordinates, river name), characteristics (height, capacity, surface area), purpose; also available in Google Earth

Main AQUASTAT products (cont.)



- **Sectoral water use & irrigation water use: 200 countries**
Irrigated crop calendar, crop water requirement, irrigation water requirement, water requirement ratio, irrigation water withdrawal
- **Map on surface water and groundwater irrigation areas**
Global map of irrigation areas based on statistical data from > 15 000 administrative units analyzed, standardized and rules applied to determine if area is irrigated by surface water or groundwater
- **Maps, tables and GIS products: wide variety**
Global, regional and national maps and tables, geo-referenced database on dams, spatial data; also available in GeoNetwork
- **Country water investment envelop and portfolio: Africa**
Country surveys on investments related to water for agriculture and energy
- **Institutions: around 300**
Addresses and links to institutions in the field of agricultural water resources management, presented by country
- **Glossary: around 300 terms**
In Arabic, Chinese, English, French, Russian and Spanish
- **Publications: around 30**
Around 30 publications

Harmonization



- **Within FAO:** Statistical Programme Steering Committee and Statistics Committee Working Group
- **Interagency collaboration (UN-Water):** To avoid duplication and promote harmonization of concepts, definition and data used
- **Inter-secretariat Working Group on Environment Statistics:** Established in 2004 at the request of the UN Statistics Commission: FAO, UNSD, UNEP, GEMSWater, WMO, WHO, UNICEF, OECD, Eurostat, UN economic Commissions (ECA, ECE, ESCWA, ESCAP, ECLAC), etc.
 - **Mandate:** To foster close collaboration in collection and compilation of statistics on the quantitative and qualitative aspects of freshwater resources and their use
 - **Exchange:** On concepts, definitions and classifications, on actual data received or compiled, on metadata
- Contribution to the **System of Environmental-Economic Accounting on Water (SEEAW)**
- Contribution to the **International Recommendations for Water Statistics (IRWS)** (sub-group of SEEAW)



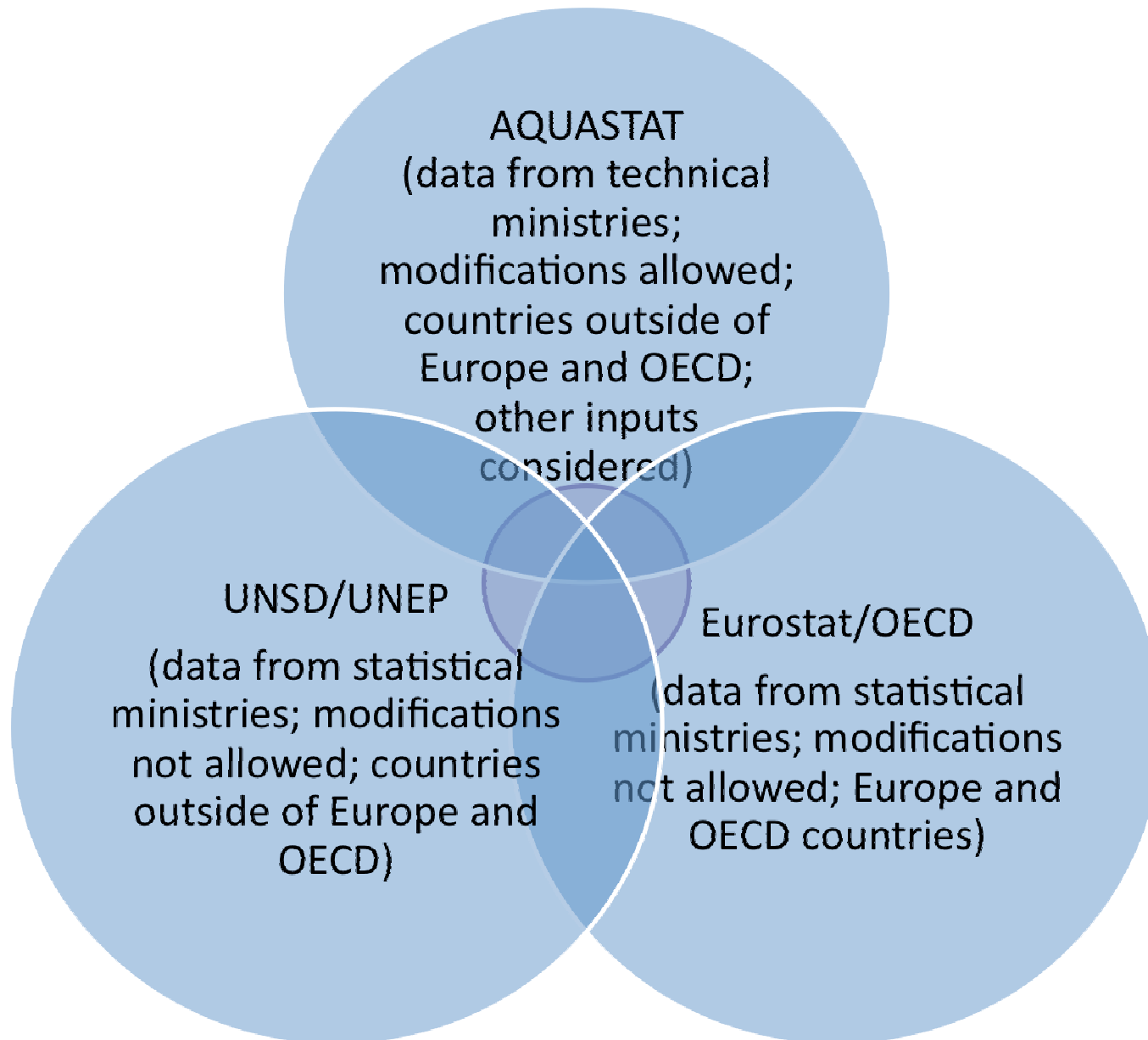
Example showing importance of inter-agency collaboration on harmonization of definitions and data

Area equipped for irrigation in OECD countries (1 000 ha)

	OECD	AQUASTAT & UniBonn	IWMI	Δ AQUA - OECD	Δ IWMI - OECD	Δ IWMI - AQUA
Australia	2 497	3 343	11 865	846	9 368	8 522
Austria	4	90	116	86	112	26
Czech Republic	20	51	518	31	498	467
Finland	64	88	125	24	61	37
Hungary	166	242	242	76	76	0
Italy	2 698	3 977	2 830	1 279	132	- 1 148
New Zealand	285	619	125	334	- 160	- 494
Slovakia	70	209	110	139	40	- 99
Sweden	54	188	84	134	30	- 105
Switzerland	25	55	30	30	5	- 25
United Kingdom	170	242	971	72	801	729
USA	22 543	27 914	28 045	5 371	5 502	132
Other 18 *	26 211	26 513	23 223	302	- 2 988	- 3 290
TOTAL	54 807	63 533	68 284	8 726	13 477	4 751
ABSOLUTE DIFFERENCE				9 373	29 378	24 654

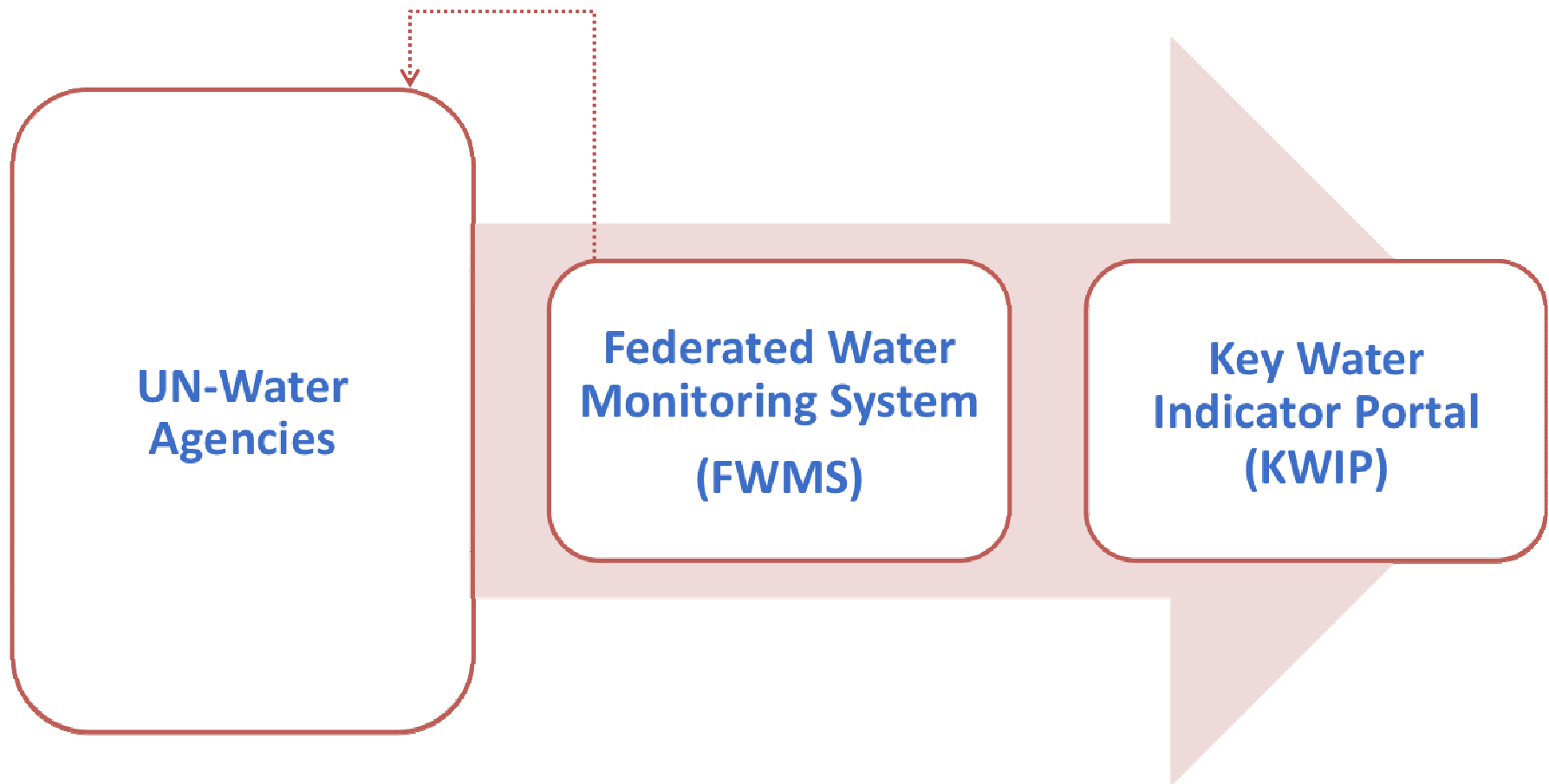
* Difference between AQUASTAT and OECD < 15%

Inter-agency data harmonization



UN-WATER

Federated Water Monitoring System (FWMS) & Key Water Indicator Portal (KWIP)





➤ **Benefits of FWMS**

- Improve data quality
- Updated information available immediately
- Identify method through which to harmonize data

➤ **Purpose of KWIP**

- **One-stop location to find constantly updated key data**
- Transparently denote data differences



Harmonization of classifications / data

Global Land Cover Database

GLC-SHARE

2013 Beta-Release 1.0

prepared by FAO NRL geospatial unit

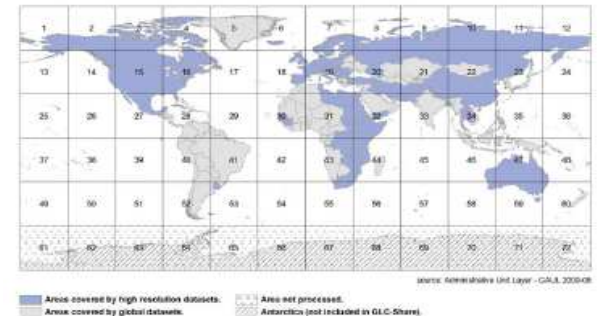
A significant step in improving the information accuracy of global land cover database integrating the best land cover data available (at sub-national, national, and regional and global level) into one single harmonized database using international standards.

- **Use FAO SEEA LCML(*) legend**
- **30 arc-second resolution**
- **11+1 layers indicating the % share of each LC class**
- **Dominant land cover layer and quality score**
- **Overall class accuracy ~80%**
- **Designed as a platform to facilitate crowd-sourcing**
- **Compatible with FAOSTAT classification**
- **Designed to be used for GAEZ 2010 update**
- **Methodology and datasets will be published in 2013**



Coverage of land cover databases

Main Source databases:



National Land Cover Datasets

LAND COVER DATASETS : Europe					
CORINE Land Cover	European Environment Agency http://www.eea.europa.eu/publications/COR0-landcover	based on Landsat 30 m	2006		
Russian Federation	Joint Research Center of the E. C.; RAS Space Research Institute, RAS Center for Forest Ecology and Productivity		2000		
LAND COVER DATASETS : North America					
Usa – Canada – Mexico Hawaii	Commission for Environmental Cooperation www.cec.org	based on MODIS 250 m resolution and FAO LCCS	2005		
Cuba	FAO	based on Landsat 30 m	2010		
LAND COVER DATASETS: South America					
Uruguay	Presidencia OPP; Ministerio de Ganaderia Agricultura I Pesca; MVOTMA; FAO; UNESCO; Oficina Regional de Ciencia para America Latina y el Caribe	based on Landsat 30 m	2011		
LAND COVER DATASETS: Africa					
Democratic Republic of Congo	FAO	based on Landsat 30 m	2001		
Egypt					
Burundi					
Eritrea					
Rwanda					
Somalia					
United Republic of Tanzania					
Uganda					
Libya					
Senegal					
Tunisia					
Fouta Djallon Highlands Region					
Kenya					
Malawi					
Sudan					
South Sudan					
Lesotho			Southern African Development Community (SADC)		1990 - 1995
Monzambique					
South Africa					
Swaziland					
Zambia					
Zimbabwe					
Ethiopia	National Project				

LAND COVER DATASETS: Asia

Afghanistan	FAO	based on Landsat 30 m, SPOT 10 m and AirPhotos 1 m	2012
Himalayan Region			2009
Iraq	National Renewable Energy Laboratory (NREL)		2000
Bangladesh			2007
China	Institute of Geographical Sciences and Natural Resources Research Chinese Academy of Sciences	based on Landsat 30 m	2002
Islamic Republic of Iran	Global Mapping project (ISCGM) www.iscgm.org		2005
Lao People's Democratic Republic	AsiaCover FAO project		2004
Thailand	AsiaCover FAO project		
Lebanon	Conseil National de la Recherche Scientifique au Liban - CNRS; Ministère de l'Agriculture; FAO	based on Ikonos 4 m	2011
Pakistan	Pakistan Space and Upper Atmosphere Research Commission (SUPARCO)	based on Landsat 30 m	2010
Yemen	FAO		1998
Australia	Australian Government; Geoscience Australia; Australian Bureau of Agricultural and Resource Economics and Sciences. www.ga.gov.au/earth-observation/landcover.html		2011

Global Land Cover Datasets

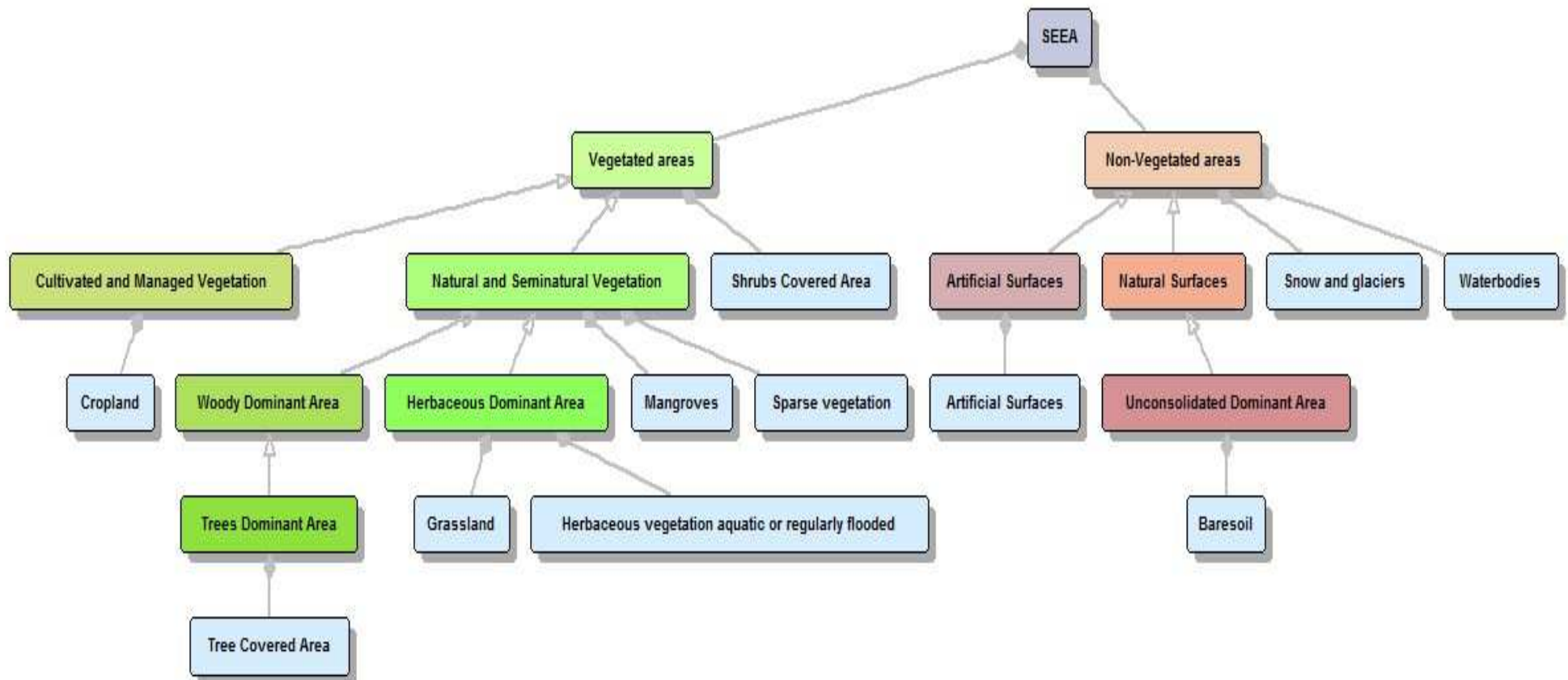
Globcover 2009	European Space Agency http://due.esrin.esa.int/globcover/ (GLC_2009)	based on MERIS 300m	2009
MODIS VCF	Global Land Cover Facility - MODIS Vegetation Continuous Fields http://www.landcover.org/data/vcf/	based on MODIS 250m	2010
CROPLAND Hybrid database	http://www.geo-wiki.org/ (CROPLAND)	mixed resolution	2012
GLC2000	Join Research Centre - Global Land Cover of year 2000 http://bioval.jrc.ec.europa.eu/products/glc2000/glc2000.php (for validation and comparison purposes only)	based on SPOT VEGETATION 1km	2000
Mangroves	FAO – Global Database of Mangroves	based on Landsat 30 m	2008

GLC-SHARE EEA Legend

Land Cover types	Label	Description
Artificial Surfaces	01	The class is composed of any type of areas with a predominant artificial surface. Any urban or related feature is included in this class, for example urban parks (parks, parkland, sport facilities). The class also includes industrial areas, waste dump deposit and extraction sites.
Cropland	02	Herbaceous Crops: The class is composed of a main layer of cultivated herbaceous plants (graminoids or forbs). It includes herbaceous crops used for hay. All the non-perennial crops that don't last for more than two growing seasons and crops like sugar cane where the upper part of the plant is regularly harvested while the root system can remain for more than one year in the field are included in this class. Woody Crops: The class is composed of a main layer of permanent crops (trees and/or shrub crops) and includes all types of orchards and plantations (fruit trees, coffee and tea plantation, oil palms, rubber plantation, Christmas trees etc.).
		Multiple or Layered crops: This class combine different land cover situations: <ul style="list-style-type: none"> ▣ Two layers of different crops (woody + herbaceous): A common case is the presence of one layer of woody crops (trees or shrubs) and another layer of herbaceous crop, such as for wheat fields with olive trees in the Mediterranean area and intense horticulture, oasis or typical coastal African agriculture where herbaceous fields are covered by palm trees, etc. ▣ Presence of one important layer of natural vegetation (mainly trees) that cover one layer of cultivated crops: A typical example are coffee plantations shadowed by natural trees in the equatorial area of Africa.
Grassland	03	This class includes any geographic area dominated by natural herbaceous plants (grasslands, prairies, steppes and savannahs) with a cover of 10% or more, irrespective of different human and/or animal activities, such as: grazing, selective fire management etc. Woody plants (trees and/or shrubs) can be present assuming their cover is less than 10%.
Tree Covered Areas	04	This class includes any geographic area dominated by natural tree plants with a cover of 10% or more. Other types of plants (shrubs and/or herbs) can be present, even with a density higher than trees. Areas planted with trees for afforestation purposes and forest plantations are included in this class. This class includes areas seasonally or permanently flooded with fresh water. It excludes coastal mangroves (>07).

Land Cover types	Label	Description
Shrubs Covered Areas	05	This class includes any geographical area dominated by natural shrubs having a cover of 10% or more. Trees can be present in scattered form if their cover is less than 10%. Herbaceous plants can also be present at any density. The class includes shrub covered areas permanently or regularly flooded by inland fresh water. It excludes shrubs flooded by salt or brackish water in coastal areas (>07).
Herbaceous vegetation, aquatic or regularly flooded	06	This class includes any geographic area dominated by natural herbaceous vegetation (cover of 10% or more) that is permanently or regularly flooded by fresh or brackish water (swamps, marsh areas etc.). Flooding must persist for at least 2 months per year to be considered regular. Woody vegetation (trees and/or shrubs) can be present if their cover is less than 10%.
Mangroves	07	This class includes any geographical area dominated by woody vegetation (trees and/or shrubs) with a cover of 10% or more that is permanently or regularly flooded by salt and/or brackish water located in the coastal areas or in the deltas of rivers.
Sparse vegetation	08	This class includes any geographic areas where the cover of natural vegetation is between 2% and 10%. This includes permanently or regularly flooded areas.
Bare soil	09	This class includes any geographic area dominated by natural abiotic surfaces (bare soil, sand, rocks, etc.) where the natural vegetation is absent or almost absent (covers less than 2%). The class includes areas regularly flooded by inland water (lake shores, river banks, salt flats etc.). It excludes coastal areas affected by the tidal movement of salt water.
Snow and glaciers	10	This class includes any geographic area covered by snow or glaciers persistently for 10 months or more.
Waterbodies	11	This class includes any geographic area covered for most of the year by inland water bodies. In some cases the water can be frozen for part of the year (less than 10 months). Because the geographic extent of water bodies can change, boundaries must be set consistently with class 11 according to the dominant situation during the year and/or across multiple years.

SEEA Legend using ISO Standard for Land Cover Classification Land Cover Meta Language (LCML)



GLC-Share Database

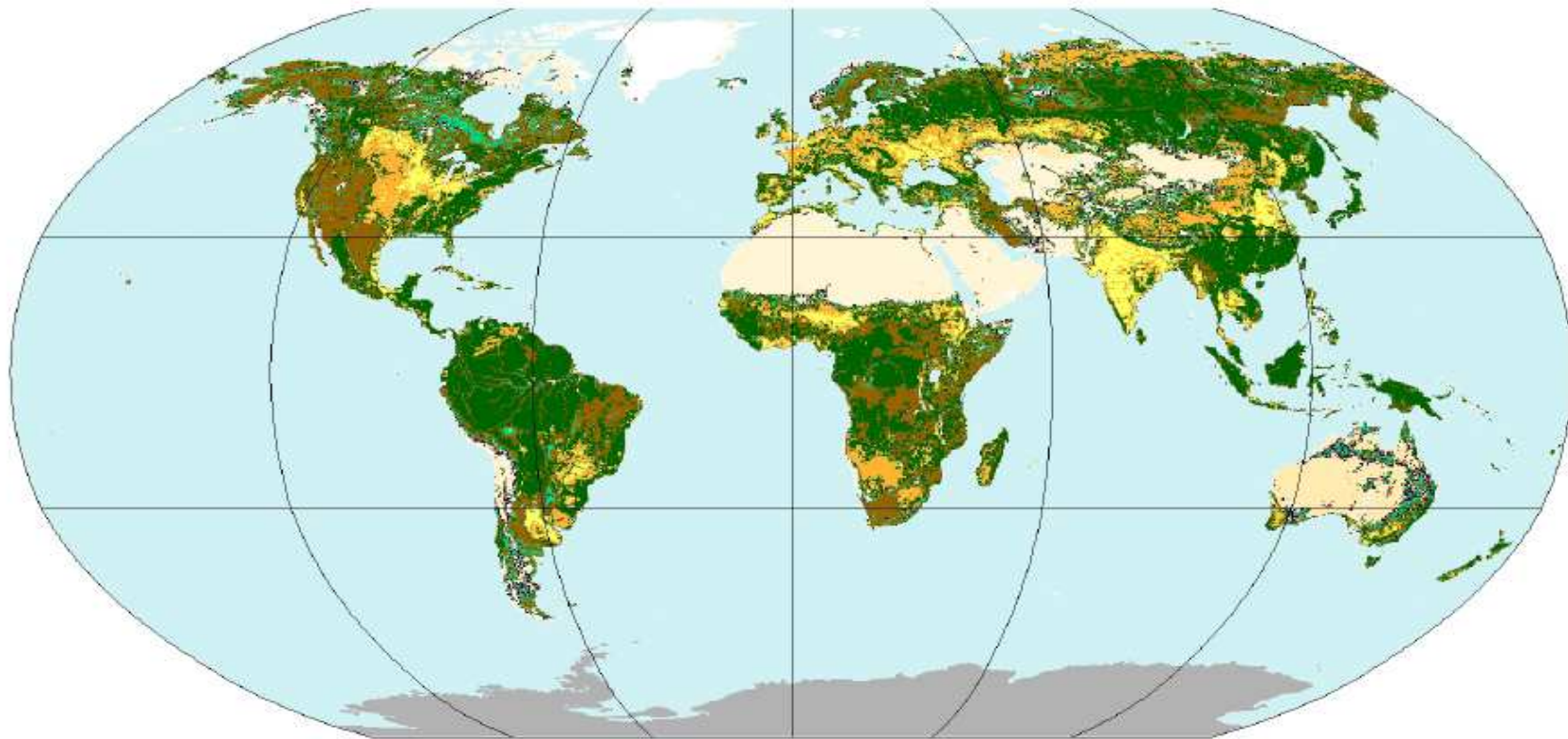
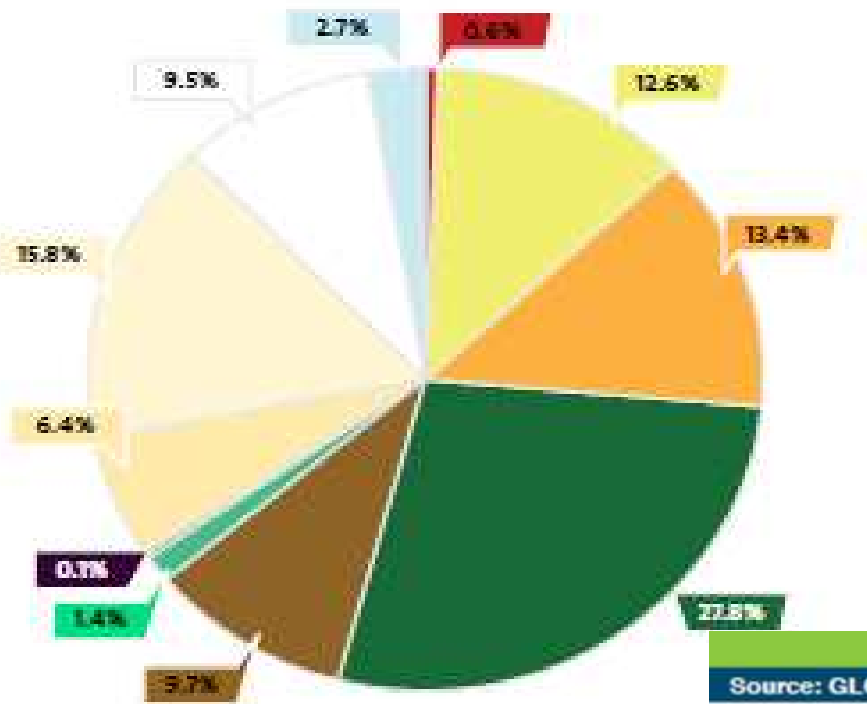


Figure 3 – Distribution of dominant GLC-SHARE Land Cover Database.



GLC-SHARE LC types Distribution



Land Cover types	Label
Artificial Surfaces	01
Cropland	02
Grassland	03
Tree Covered Areas	04
Shrubs Covered Areas	05
Herbaceous vegetation, aquatic or regularly flooded	06
Mangroves	07
Sparse vegetation	08
Baresoil	09
Snow and glaciers	10
Water bodies	11

Distribution of Land Cover classes globally			
Source: GLC-SHARE		Source: GLC 2000	
Class	Percentage	Class	Percentage
Artificial Surfaces	0.6	Urban	0.2
Cropland	12.6	Cropland	15.7
Grassland/Shrubs/Herbaceous/Sparse vegetation	30.9	Grassland/Shrubland	30.0
Tree Covered Area	27.8	Forest	29.4
Baresoil	15.8	Bare areas	13.3
Snow and Glaciers + Antarctica	9.5	Snow and Ice	9.7
Water bodies/Mangroves	2.8	Wetlands	1.7
TOTAL	100		100

Quality Assessment performed using ~1,000 points (ArcGIS and Google Earth validation) - Overall dominant class accuracy ~80%

GLC-SHARE-2012		Validated											Total Users	User's accuracy
		cls_01	cls_02	cls_03	cls_04	cls_05	cls_06	cls_07	cls_08	cls_09	cls_10	cls_11		
Interpreted	cls_01	7	0	0	1	0	0	0	0	1	0	1	10	70.0%
	cls_02	0	150	4	2	1	0	0	0	1	0	0	158	94.9%
	cls_03	0	6	126	8	9	4	0	3	5	5	1	167	75.4%
	cls_04	0	3	3	356	1	3	0	6	2	1	0	375	94.9%
	cls_05	0	5	12	13	38	2	0	6	0	0	0	76	50.0%
	cls_06	0	1	6	2	0	14	0	0	0	2	0	25	56.0%
	cls_07	0	0	0	1	1	0	8	0	0	0	0	10	80.0%
	cls_08	0	3	16	5	2	0	0	27	0	1	0	54	50.0%
	cls_09	0	1	25	0	4	3	0	18	86	11	2	150	57.3%
	cls_10	0	0	0	0	0	0	0	1	1	52	0	54	96.3%
	cls_11	0	0	0	0	0	0	0	0	0	0	8	8	100.0%
Total Producers		7	169	192	388	56	26	8	61	96	72	12	1087	
Producer's accuracy percentage		100.0%	88.8%	65.6%	91.8%	67.9%	53.8%	100.0%	44.3%	89.6%	72.2%	66.7%		80.2%



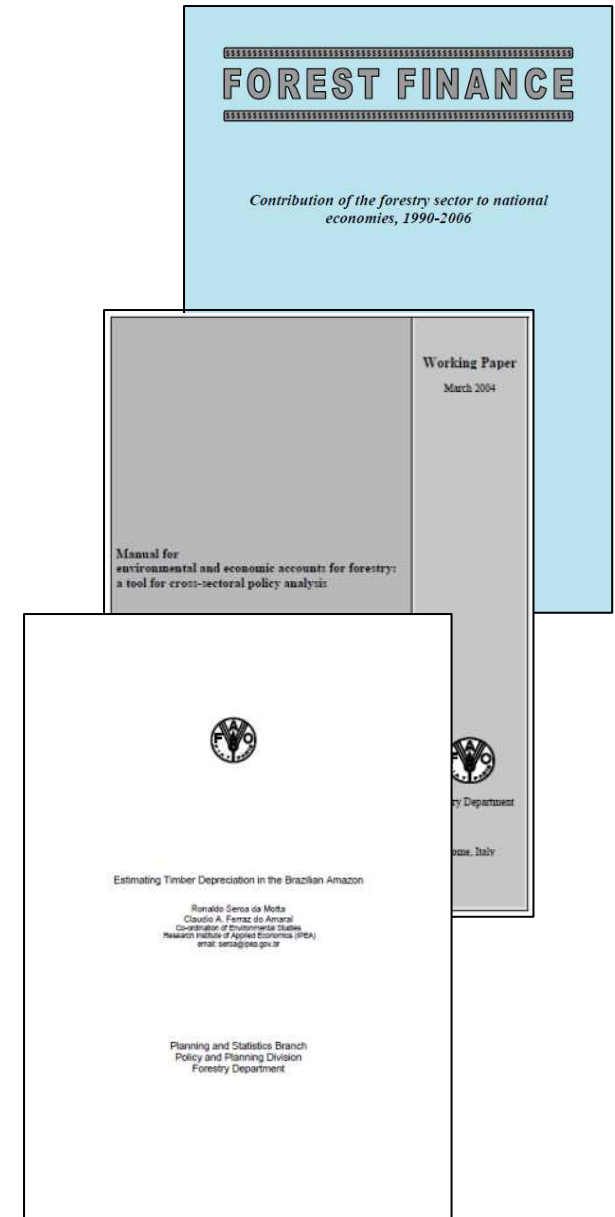
Case studies/ experimental compilation

FORESTRY

FORESTRY

SEEA and National Accounting Activities:

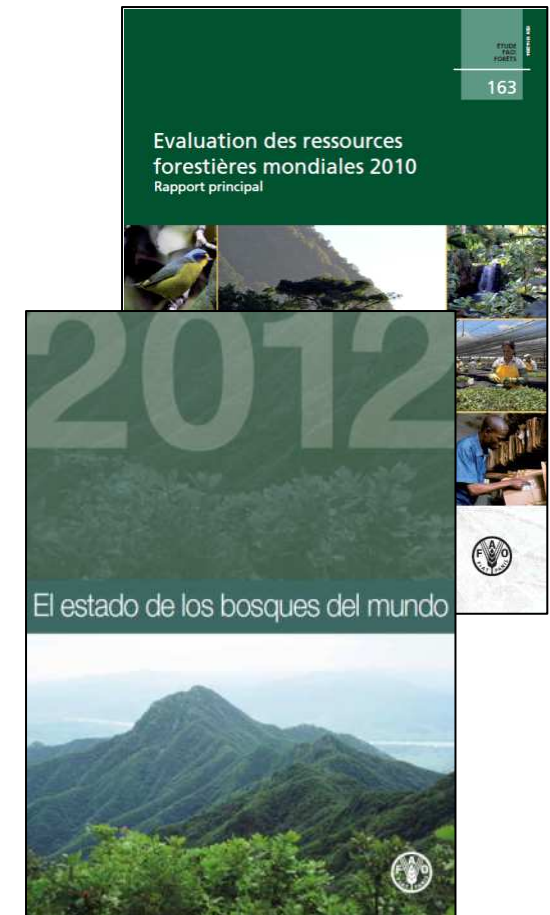
- Case-studies on forest accounting
- Manual for forestry in SEEA (2004)
- Reporting and analysis of forestry sector in National Income Accounts
- Provide technical assistance on forest valuation and contribution to economies at the country level (field projects).



FORESTRY

Forest Resource Assessment and SOFO:

- FRA is produced every 5 years and contains much of the information needed for SEEA
- FRA attempts to measure progress towards “sustainable forest management” with a set of internationally agreed indicators
- FRA focuses on stocks rather than flows, especially bio-physical measurements
- SOFO 2014 will focus on measuring the socio-economic benefits of forests.





Case studies/ experimental compilation

FISHERY AND AQUACULTURE

SEEA - WATER and FISH ASSETS

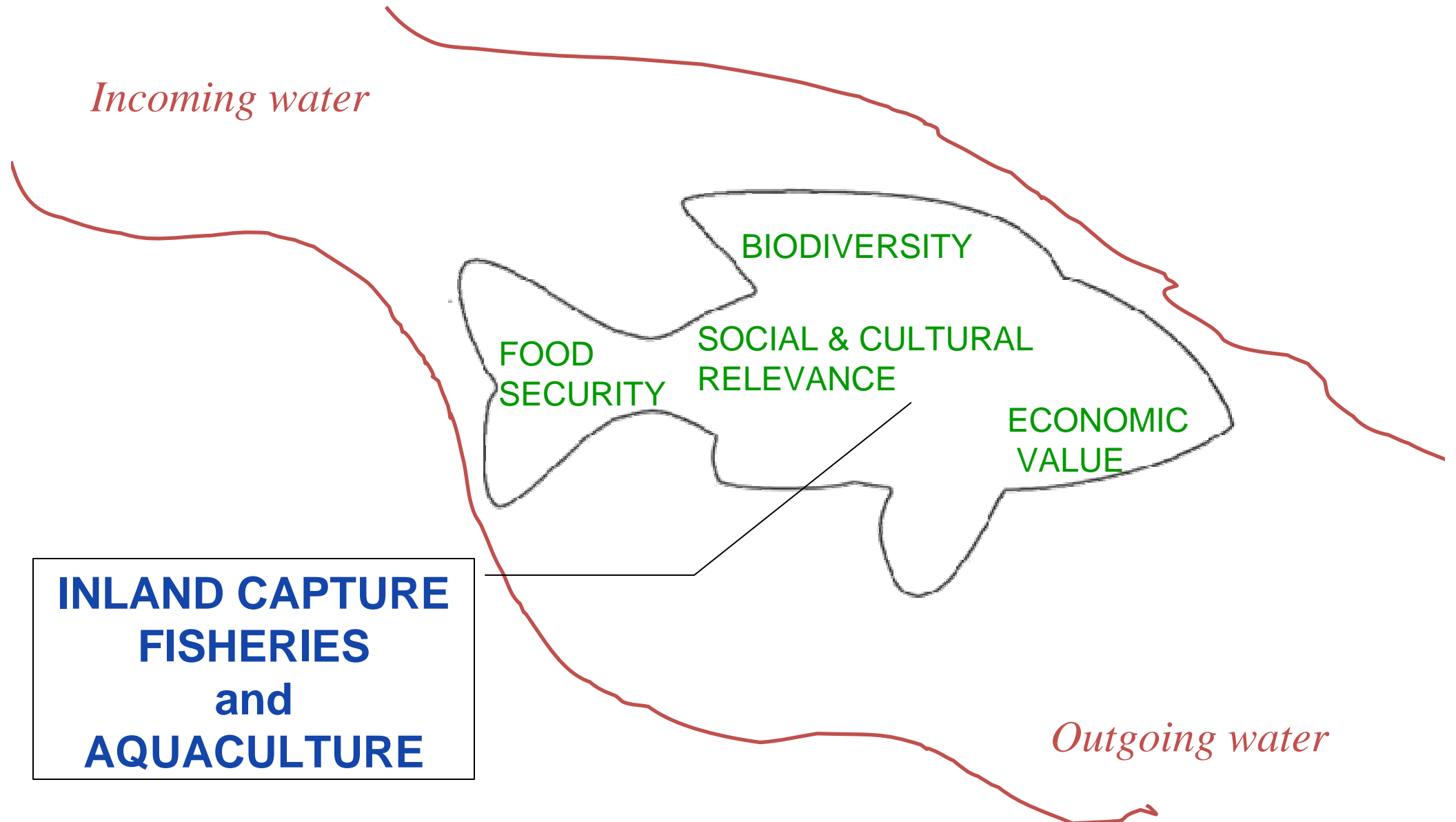


Incoming water

BIODIVERSITY
FOOD SECURITY
SOCIAL & CULTURAL RELEVANCE
ECONOMIC VALUE

INLAND CAPTURE FISHERIES and AQUACULTURE

Outgoing water



CLARIFY POTENTIAL WATER CONFLICTS

AQUACULTURE

**INLAND
CAPTURE
FISHERIES**



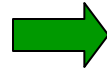
INDUSTRY

AGRICULTURE

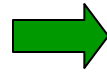
DOMESTIC USE

COUNTRY PROFILE for SEEA

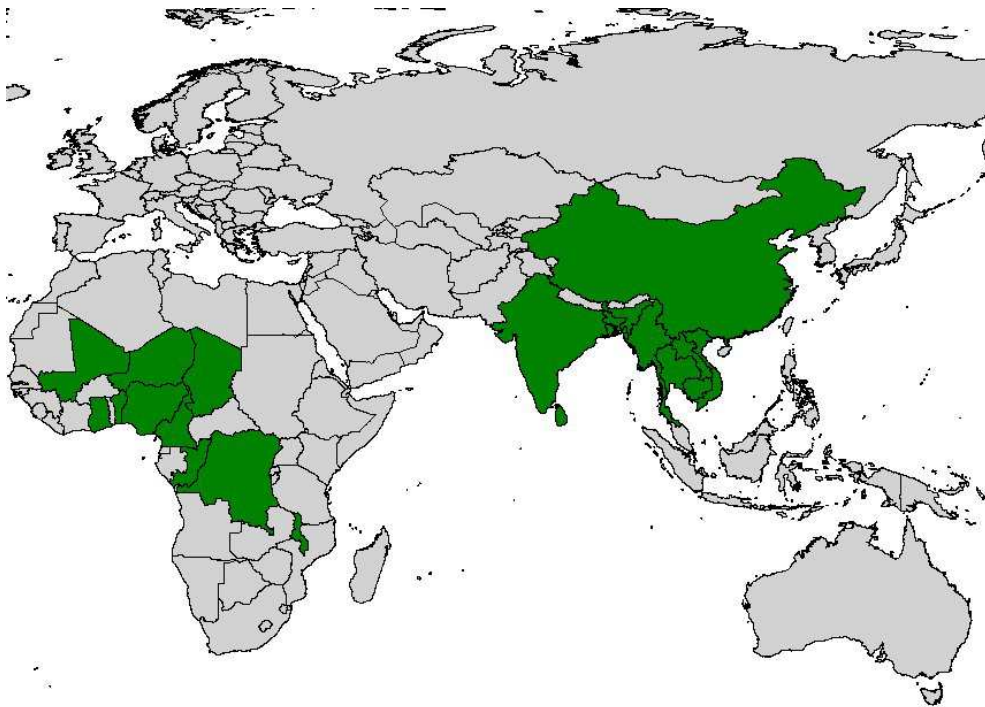
**ASSESSMENT OF
WATER RESOURCES**



**TESTING SEEA WATER
PROPOSED CLASSIFICATION**



**TESTING A SET of INDICATORS to
DESCRIBE BENEFITS PROVIDED
by the FISHERY SECTOR**



18 ANALYSED COUNTRIES

WATER and FISH ASSETS - DATA MINING

FAO DATABASE - Fishstatj

Fish production

Aquaculture structural data

GIS and REMOTE SENSING

Global Land and Water Database

Globecover

Africover

African Water Resource Database

MORE THAN 180 PUBLISHED REFERENCES

Scientific articles

Statistical yearbook

FAO publications

ENVIRONMENTAL

SECTIONS

COMPONENTS

INDICATORS

**WATER
AVAILABILITY**

- Permanent inland waters
- Seasonally flooded areas

- Country area

- Aquaculture ponds

- Rainfed/Deep rice areas
- Total rice area

**FISH
PRODUCTION
&
WATER
PRODUCTIVITY**

- Inland capture fisheries production
- Aquaculture production

**SOCIAL
RELEVANCE**

NATURAL INLAND WATERS

PERCENT OF SEASONALLY FLOODED AREAS

PERCENT OF NATURAL WATERS OVER COUNTRY AREA

TOTAL INLAND WATERS

**PERCENT OF RAINFED AND DEEP RICE CULTIVATED AREAS
OVER TOTAL RICE AREA**

PERCENT OF TOTAL FISH PRODUCTION FROM AQUACULTURE

AVERAGE NATIONAL WATER PRODUCTIVITY

**NUMBER OF PEOPLE ENGAGED IN AQUACULTURE AND INLAND
CAPTURE FISHERIES**

AVERAGE DENSITY OF FISHERMEN AND AQUACULTURE FARMERS

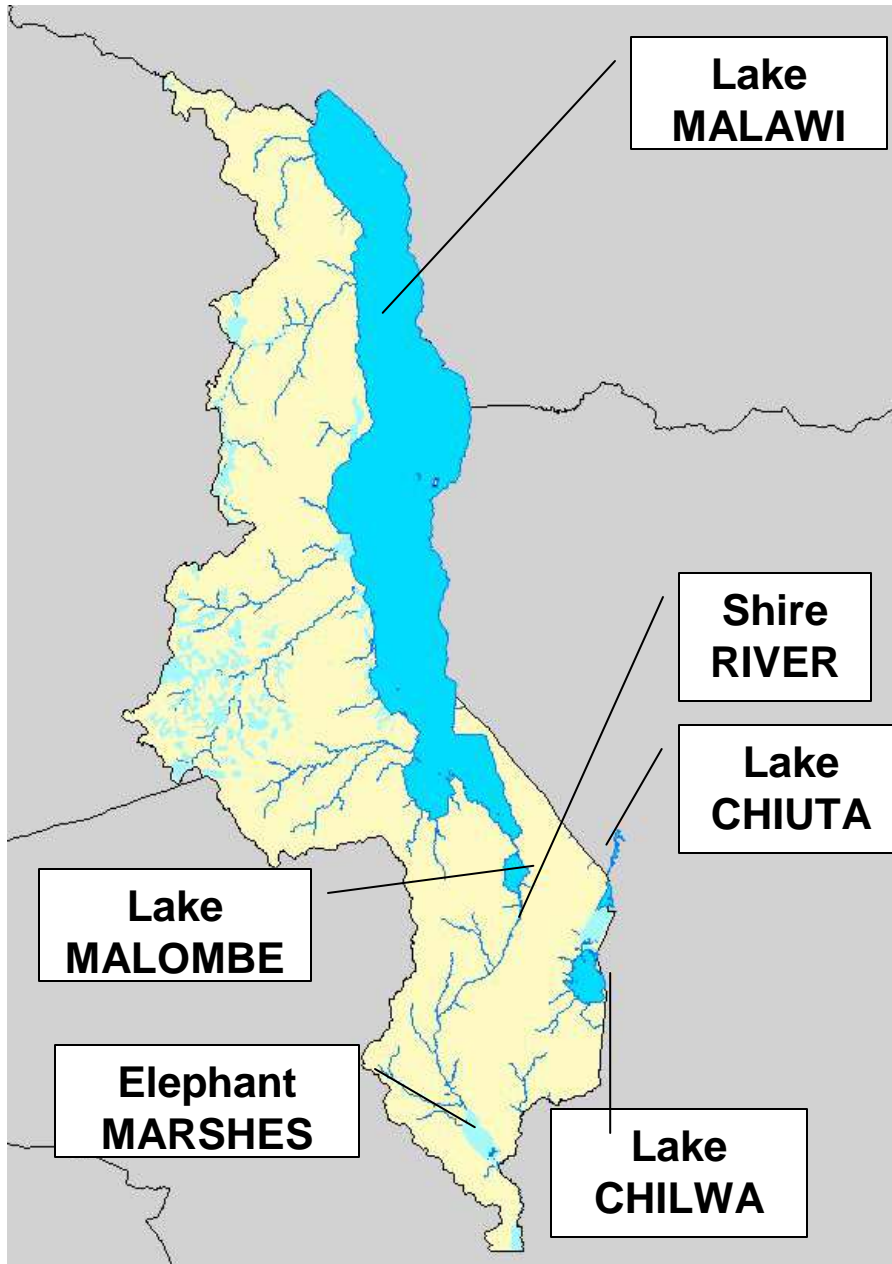
**THEORETICAL NUMBER OF FISHERMEN BASED ON THE EXTENT OF
DIFFERENT TYPES OF WATER RESOURCES**

**PERCENTAGE OF PEOPLE DEPENDING ON FISHERIES
FOR THEIR LIVELIHOOD**

ECONOMIC

SOCIAL

MALAWI – SEEA Pilot



IMPLEMENTATION of:

- WATER ACCOUNT
- FISH ACCOUNT
- SUPPLY-USE ACCOUNT
(qualitative)

WATER ASSET – SEEA IMPLEMENTATION

POINTS NOTED:

- **Baseline consideration of water surfaces**
- **Identification of permanent waters and seasonal flooded areas**
- **Subdivision in major water resources/fishing areas**
- **Specification of the salinity level of the major water resources**
- **Expected water losses from net evaporation driven by climate change**
- **The estimate of the number of fishermen or number of vessels in major water resources/fishing areas**

FISH ASSET – SEEA IMPLEMENTATION

POINTS NOTED:

- **Distinction commercial/artisanal fisheries**
- **Hybrid fish asset accounts (comparing tonnes and value)**
- **Importance of time-series analysis**
- **Importance of information on fish species**
- **Importance of accounting for fishing effort**

SUPPLY-USE TABLE

POINTS NOTED:

- **Estimating the water conflict**
- **Relevance of supply-use table in water scarce countries**
- **Distinction amongst surface and groundwater resources**
- **Primary data sources for water flow estimates at country level (hydrological modeling, monitoring, statistics)**
- **Estimate of water use in absence of primary data sources**
- **Importance of accounting by catchments**