Greater Mekong Subregion Sustainable Agriculture & Food Security Program

Food and Agriculture Organization of the United Nations

Water accounting in the GMS

Policy implications for water, food and energy security in a changing climate

4-5 July 2023, Bangkok
Day 2

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Greater Mekong Subregion Sustainable Agriculture & Food Security Program

Food and Agriculture Organization of the United Nations

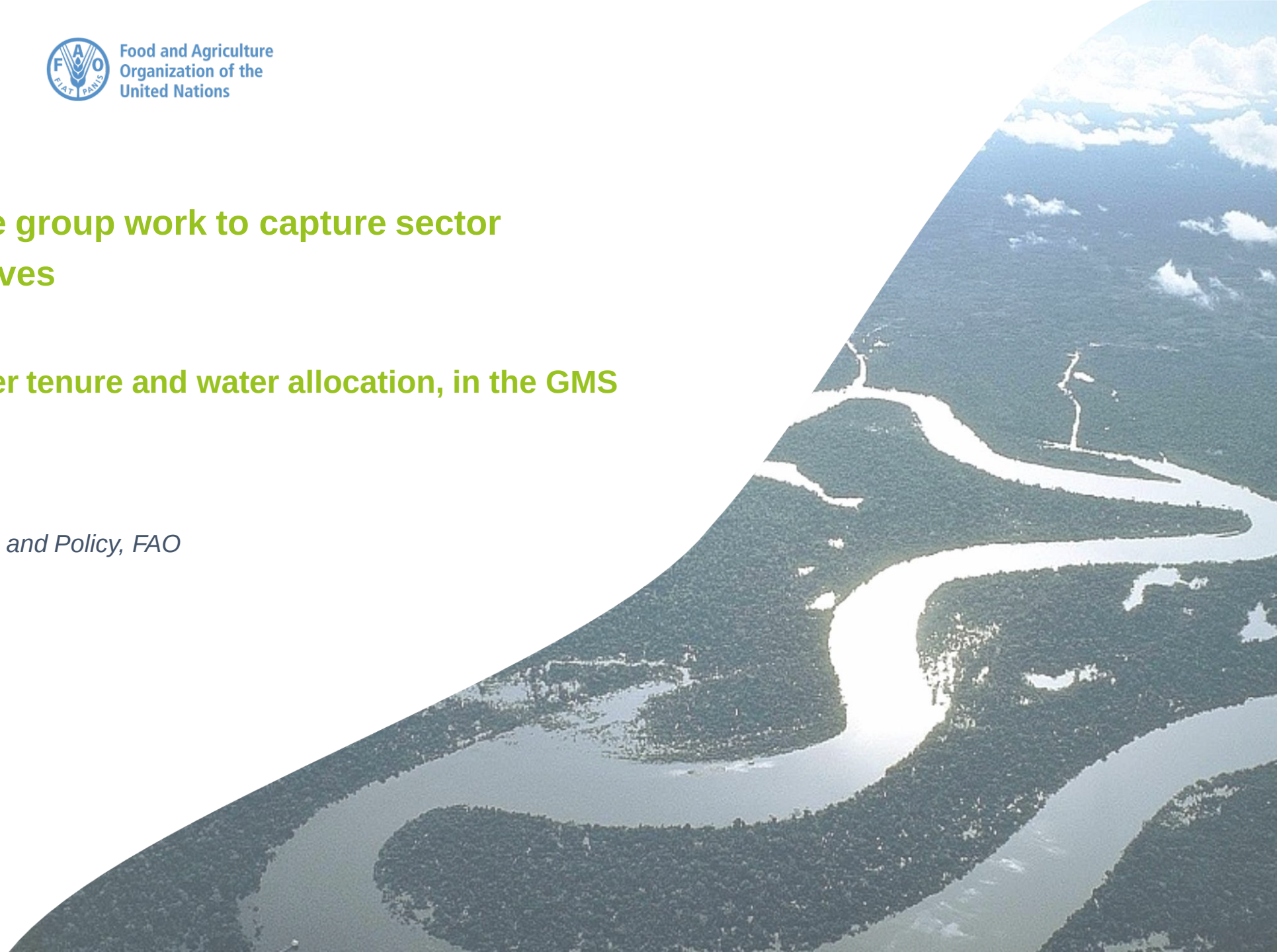
Session 3: Interactive group work to capture sector investment perspectives

Water governance, water tenure and water allocation, in the GMS

Dubravka Bojic

Programme Officer, Governance and Policy, FAO

See video presentation



Greater Mekong Subregion Sustainable Agriculture & Food Security Program

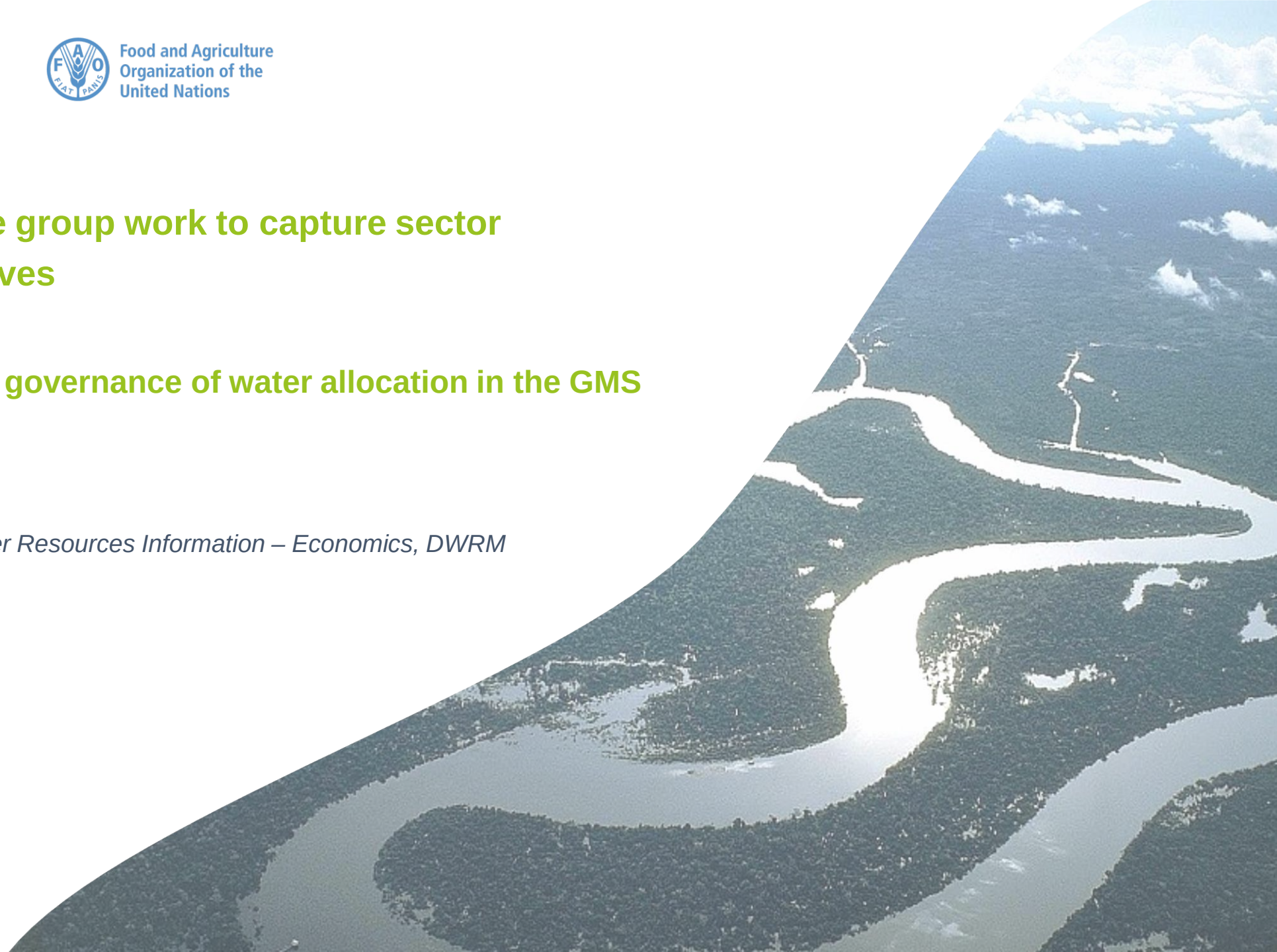
Food and Agriculture Organization of the United Nations

Session 3: Interactive group work to capture sector investment perspectives

Panel 3: The policy and governance of water allocation in the GMS

Giang Thanh Binh

Deputy Director, Centre for Water Resources Information – Economics, DWRM



VIET NAM'S POLICY AND GOVERNANCE OF WATER ALLOCATION

Water accounting in the GMS – Policy implications for water, food and energy security in a changing climate
Bangkok, 4-5 July 2023

Vietnam water resources

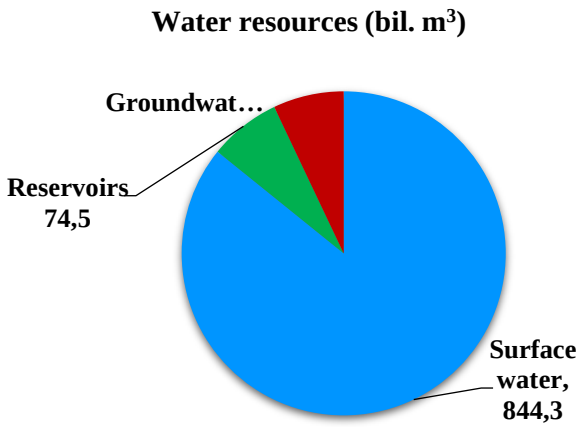
Current policy and implementation of water allocation

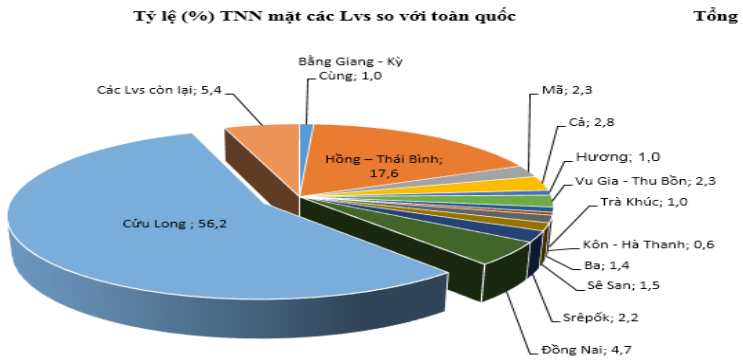
Perspective on the policy and governance of water allocation

Vietnam water resources

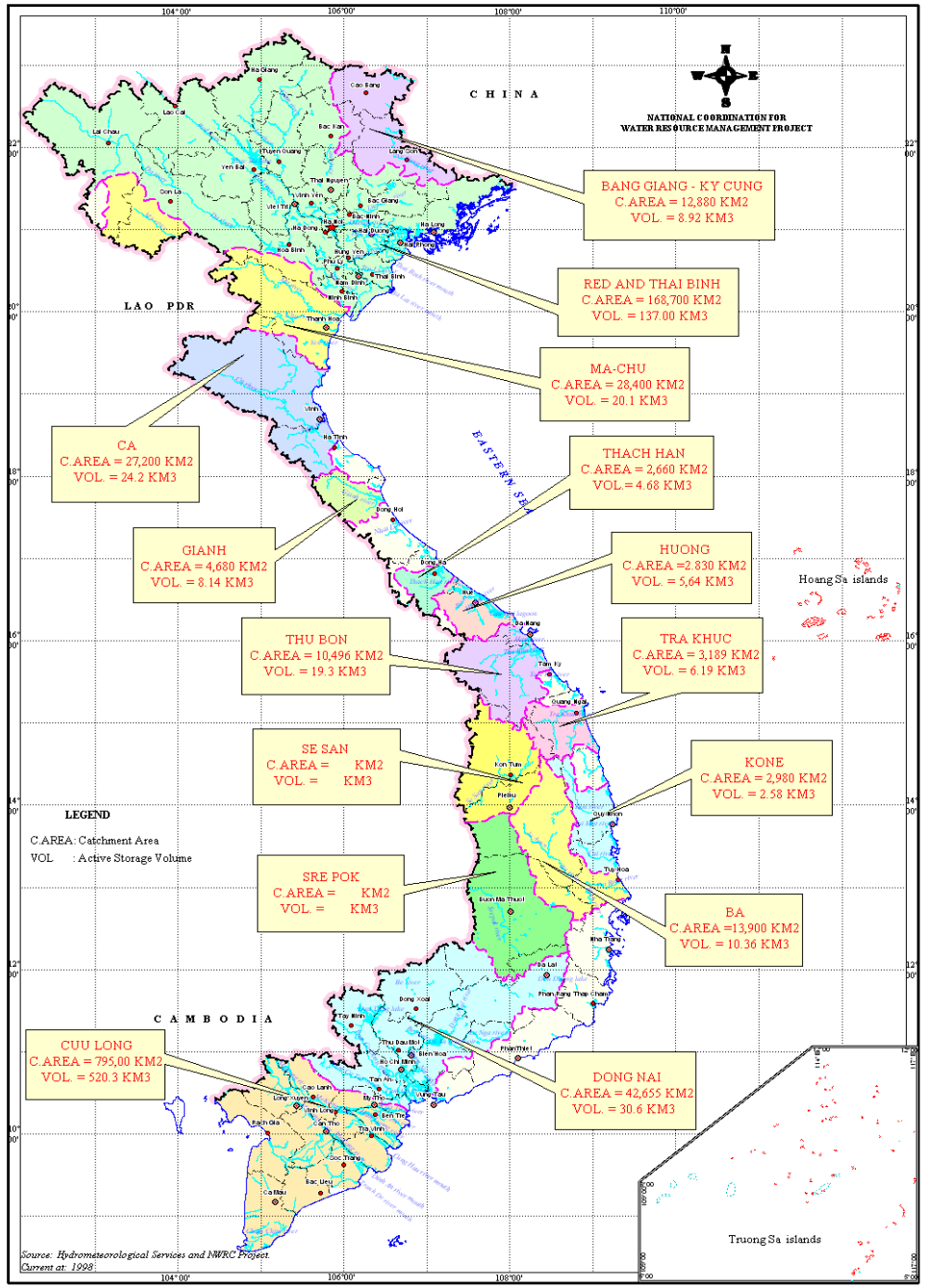
❖ Rivers

- More than 3450 perennial rivers over 10 km in length
- The total area of river basins is 1,167,000 km2 with out-of-border river basin area at 835,422 km2, accounting more than 70%
- 13 rivers whose basin area is over 10,000 km2, of which 10 are international ones; and the out-of-border basin area is 3.3 times bigger than the within-border basin area.





MAJOR RIVER BASINS



❖ Groundwater

- Total ‘groundwater potential’ : 63,000 million m3 per year.
- The distribution of groundwater potential per capita ranges from 3,770m/cap/year in the North-west to as low as 84 m/cap/year in the Mekong Delta

MAJOR WATER ISSUES

Water resources in Vietnam has been faced to challenges:

- Most of the large river basins of Vietnam are transboundary river basins which Vietnam is a downstream country
- The Water Resources of Viet Nam is unevenly distributed in space and time, concentrated mainly in the 4-5 months of rainy season (accounting for 75-85% of the annual rainfall), dry season rainfall accounts only 15-25%.
- Water pollution, degradation and depletion because of socio-economic development activities in the country has not yet improved. There is no control mechanism of pollution sources , deforestation activities, low un-improved of forest quality. Those are the reasons of water resources deterioration in the river basin in the dry season
- The economic growth increases the water sources exploitation and use of sectors, urbans while the water waste, inefficient use of water is still popular
- Climate change will impact significantly on the water resources of Vietnam. Viet Nam is one of the five countries most impacted by climate change in which water resources is the most and earlies impacted by climate change because of un predictable changes of rainfall and sea level rise

Current policy and implementation of water allocation

❖ Legislations

- Law on Water Resources 2012
- Laws on specific sectors: Law on Irrigation,
- Legal documents under Laws (Decrees, Circulars…)

❖ Principles of water allocation

i) Exploitation, use of water resources must be in **saving, safety and effectiveness**; ensure to synthetic use, for **multiple objectives, be fair, reasonable, harmonious on benefit, equal** on interests and duties among organizations, individuals.

ii) Master plans, plans. Programs, projects on development of society-economy, national defense and security must **associate with water sources, water resource protection**; ensure **maintaining minimum flow on rivers not exceeding exploitation threshold with respect to aquifers and have measure ensuring life of inhabitants**.

iii) Assurance of **territory sovereignty, national benefits, equality and reasonable in protection, exploitation, use and develoment of water resources**, as well as the prevention of, combat against and overcoming of harmful effects caused by water with respect to inter-country water sources.

(Law on Water Resources 2012)

Article 54. Regulation, distribution of water resources

1. Regulation, distribution of water resources for use purposes must base on master plan on water resources, actual capacity of Water sources, plan on regulation, distribution of water resources and ensure the following principles:

a) To ensure fair, reasonable among organizations, individuals on the same river basin, between upstream and downstream, between right-shore and left-shore;

b) To priority on quantity, quality of water for living, agricultural manufacture to contribute in ensuring security of food and other essential demands of people;

c) To ensure the minimum flow on rivers, underground water exploitation threshold;

d) To combine exploitation, use of surface water sources with exploitation, use of underground water sources, rain water; increase storage of water in rainy season to use for dry season.

2. If lacking water, regulation and distribution must be prioritized for living purpose; other use purposes must be regulated and distributed as prescribed in master plan on water resources, river basins and ensure the fair and reasonable principle.

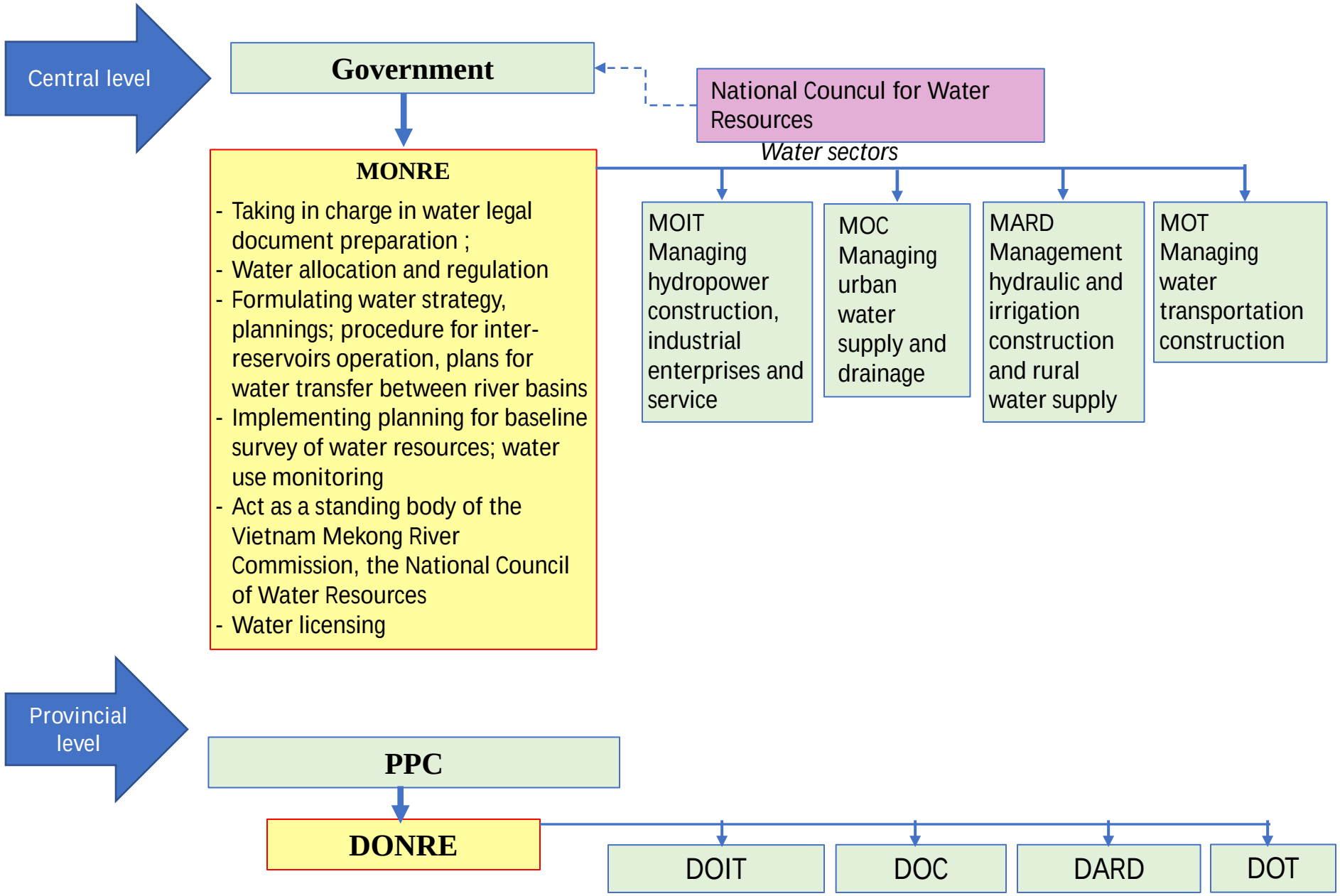
3. The Ministry of Natural Resources and Environment organizes implementation of regulation, distribution of water resources on inter-country river basins. The provincial People's Committees organize implementation of regulation, distribution of water resources in scope of lacalities.

(Law on Water Resources 2012)

❖ Water allocation tools

- Water planning
- Water licensing
- multi-reservoirs operational rules
- Water functional zoning, minimum flow, groundwater exploitation threshold
- Water supply plan, water use norms of sectors

ORGANIZATIONAL STRUCTURE OF WATER RESOURCES MANAGEMENT



❖ Governance issues

- Overlapping in water regulation and water related management of sectors: weak coordination
- Limited water information and database system
- Unbalanced investment and allocation of resources for water sector; lack of funding, lack of synchronization, low efficiency. Funds allocated for baseline survey of water resources, planning, database building, etc. are still lacking and not synchronized to solve the problems posed.
- The value of water resources has not been properly and fully calculated. Water use is wasteful and inefficient
- The integrated water resources management is still inefficient due to lack of the competent river basin organizations.
- Lack of tools to support decision-making (recovery of pollution and degradation of water resources; monitoring of water resources, etc.)

Perspective on the policy and governance of water allocation

❖ Context

- Implement Conclusion No. 36/KL-TW of Political Bureau on ensuring water source security and safety of dams and reservoirs by 2030, with a vision to 2045.
- Formulate and finalize the revised Law on Water Resources (Expected to submit to the National Assembly for consideration and approval in October 2023)
- Formulate and implement national master plans on water resources and integrated river basin master plans

❖ Orientation to revise, supplement and strengthen legislation and policies on water resources allocation

- Ensure national water resources security, reduce dependence on water sources coming from other countries and the affects of climate change.
- Separate the integrated water resources management from the management and operation of water exploitation and use works (irrigation works, hydropower projects, urban and rural water supply, industrial and service water supply, water transportation...).
- Focus on prevention, control and restoration of degraded, depleted and polluted water sources.
- Strengthen policies on water resource development with promoting solutions for water storage and preservation; water reuse; switch from single to multi-purpose water use.
- Towards managing water resources on the basis of digital technology, unifying the database, building a decision support system based on real-time data
- Regulate responsibilities of MONRE, ministries and organizations and individuals in developing scenarios to respond to, regulate and allocate water sources in the event of a drought and water shortage.
- Strengthen resources for river basin organizations
- Water resources accounting

Thank you for your attention

Water Resources Management in Thailand

PANEL 3: The policy and governance of water allocation in the GMS

Dr. Siriwat Boonwichai
River Basin Management Division
Office of the National Water Resources (ONWR)

5th July 2023

“Types of water source”

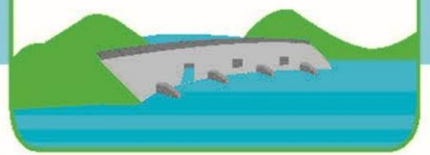
Rainfall

- ✓22 river basins
- ✓515,934 sq.km.
- ✓annual rainfall 1,500 mm.

(30 years average rainfall 1991 - 2020)

Natural flow

- ✓ annual runoff 224,024 mcm.



Ground water

- ✓ ground water 1.13 million mcm.

Water Storage

- ✓ Water storage 78,747 mcm.

Water Demands in Thailand

Agricultural

65 billion cubic meters per year for irrigated area
48.961 billion cubic meters per year for rainfed area

Consumption and Tourism

4.783 billion cubic meters
Increase to 5.991 billion cubic meters in 2037

Industry

1.913 billion cubic meters
Increase to 3.488 billion cubic meters in 2037

Ecosystem

over 27.090 billion cubic meters
to preserve the ecosystem during droughts

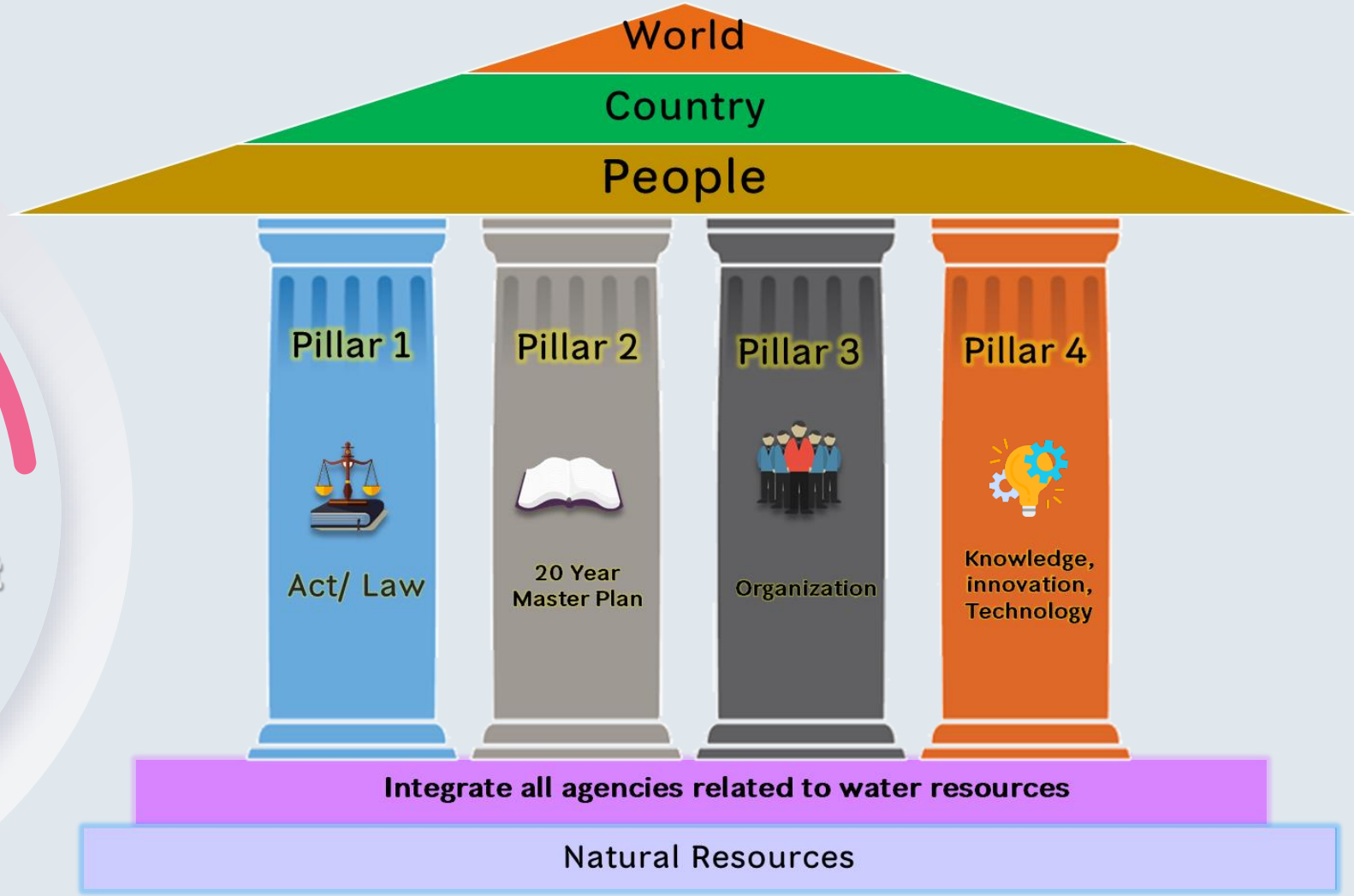
“Water demand management”

The Water Resources Act, B.E. 2561 of Chapter 4 : Water Allocation and Water Usage in order of prioritization, recognizing water for

1. Consumption
2. Ecosystem conservation
3. Disaster Prevention
4. Cultural Preservation
5. Transportation
6. Agriculture
7. Industry
8. Commerce
9. Tourism

Mechanism

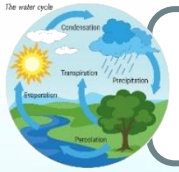
of the National Water Resources Management



Pillar 1

The Water Resources Act, B.E. 2561

effective on 27th January 2019



section 1 Water Resources

section 2 Rights in Water

section 3 Water Resource Management Bodies

section 4 Water Allocation and Water usage

section 5 Drought and Flood

section 6 Conservation and development of public water resources

section 7 Competent Officials

section 8 Civil liability in the case of damage to public water resources

section 9 Penalties

Pillar 2

The 20 Year Water Resources Master Plan

December 19, 2018

The NWRC. approves

June 18, 2019

The Cabinet approves

September 18, 2019

publish

The 20 Year-Water Resources Master Plan

Remark : The revised master plan has been improved which is approved by NWRC after that to propose to approval from the Thai Cabinets before announcement of the Government Gazette will be published to be effective

1 The management of consumer water

Drinking water standard, Quality and Reasonable price

By using digital technology

Goal : Everyone can access to the service

2 To build water security in the production sector

Be able to deal with Climate Change,

By using smart farming, automotive intelligence)

Goal : Supports economic growth /reduce damage /increase agricultural income /increase water security

3 Flood Management

Using seasonal countermeasure, early warning system and cooperates with local and community

Goal : Reduce / prevent damage and economic impact

5 Management

Empower and strengthen local and community by educate useful knowledge and providing digital technology for utilize

Goal : Good Governance

4 Water quality management and water conservation (Upstream to Downstream)

Ramsar site and degraded watershed forests

Goal : To conserve ecosystem and reduce environment impact

Pillar 3

Water Resources Management Organization

Under the Water Resources Act, B.E. 2561

The National Level

The National Water Resources Committee (NWRC)

Section 9

Publish Regulate and Drive Water Resources Management Policies (National Level)

Subcommittee

Section 20 (2)

- Water Resources Development and Conservation
- Water Resources Management
- Technical and Academic

In Case of Crisis

The Ad Hoc water Crisis Center

Section 24

กองอำนวยการแห่งชาติ National Water Administrative Center

Cabinet Resolution

Subcommittee by Area

The River Basin Level

The River Basin Committee

Section 27

Provincial Water Resources Subcommittee

Section 20 (3)

Regulate and Drive Water Resources Management Policies (Basin and Provincial Level)

Regional Water Resources Subcommittee

North | Central | Northeast | East | South

Section 20 (1)

The local level

The Water User Organization

Section 38

Cooperate and suggest for water resources management (Local Level)

- Agricultural sector
- Commercial sector
- Industrial sector

Pillar 4

Knowledge Innovation and Technology

Development of innovation, technology, and research

National water innovation repository

☑ แหล่งรวมนวัตกรรมด้านน้ำของชาติ

- งานวิจัยและงานนวัตกรรมด้านน้ำ

Building networks of cooperation in the national and international levels

Memorandum of Understanding (MOU)

- Thailand (ONWR) and Hungary : Integrated water resource management, Water and wastewater management and Research and development for water aspect.
- Thailand (ONWR) and the Republic of Korea (Ministry of Environment) : Water management with ecological management and Utilizing satellite technology in water management.
- Thailand (ONWR) and the Kingdom of the Netherlands (Ministry of Infrastructure and Water Management) : Integrated water resources management and Climate change adaptation.
- Thailand (ONWR) and Australia (Ministry of Infrastructure and Water Management) : Utilization of water resources for drought management, Water resources management, Water-Food-Energy Nexus and Soil management
- Thailand (ONWR) and Germany (GIZ) : To develop and strengthen the capacity of water resource management to support climate change adaptation in the national and river basin levels.

Promoting a process of participation of related agencies in managing water resources

Knowledge Management

☑ ระบบบริหารจัดการองค์ความรู้

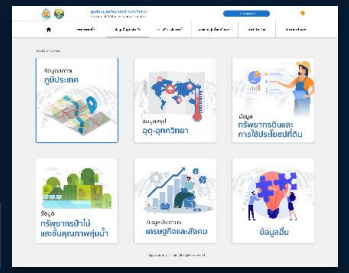
- Web Application, Mobile Application
- รองรับการทำกิจกรรมที่หลากหลาย เช่น การสัมมนาออนไลน์

Tools for WRM

1 Water Resources Management Operation Center , Provincial Level

ศูนย์ข้อมูลทรัพยากรน้ำจังหวัด

http://pwrc.thaiwater.net



2 National Thai Water

ระบบติดตาม และคาดการณ์สถานการณ์น้ำ

http://nationalthaiwater.onwr.go.th

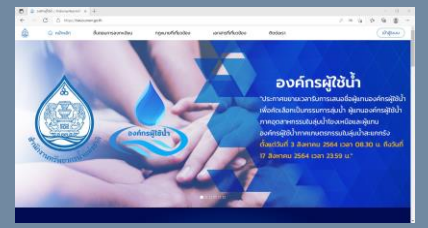
3 Thai Water Plan (TWP)

ระบบบริหารจัดการแผนงานโครงการ และฐานข้อมูล สำหรับบูรณาการแผนเพื่อการบริหารจัดการทรัพยากรน้ำของประเทศ

https://twp.onwr.go.th

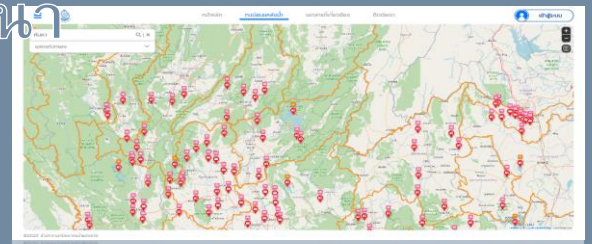
4 Thai Water User Organization (TWUO)

การขึ้นทะเบียนองค์กรผู้ใช้น้ำ



5 Thai Water Resources (TWR)

การขึ้นทะเบียนแหล่งน้ำ



6 Water Chart (ผังน้ำ)

แผนที่หรือแผนผังแสดงระบบทางน้ำที่มีน้ำไหลผ่าน ซึ่งเชื่อมโยงกันตั้งแต่ต้นน้ำจนถึงทางออกสู่พื้นที่แหล่งน้ำ

7 Protection plan on Drought and Flood problem-solving in advanced

แผนป้องกันและแก้ไขภาวะน้ำแล้ง/ภาวะน้ำ

เพื่อเตรียมการรองรับทั้งกรณีปกติ และกรณีที่เกิดภาวะน้ำแล้งอย่างรุนแรง / กรณีฉุกเฉินที่มีน้ำท่วมเกิดขึ้นโดยฉับพลัน

Thank You

"as water is the national security"

OFFICE OF THE NATIONAL WATER RESOURCES

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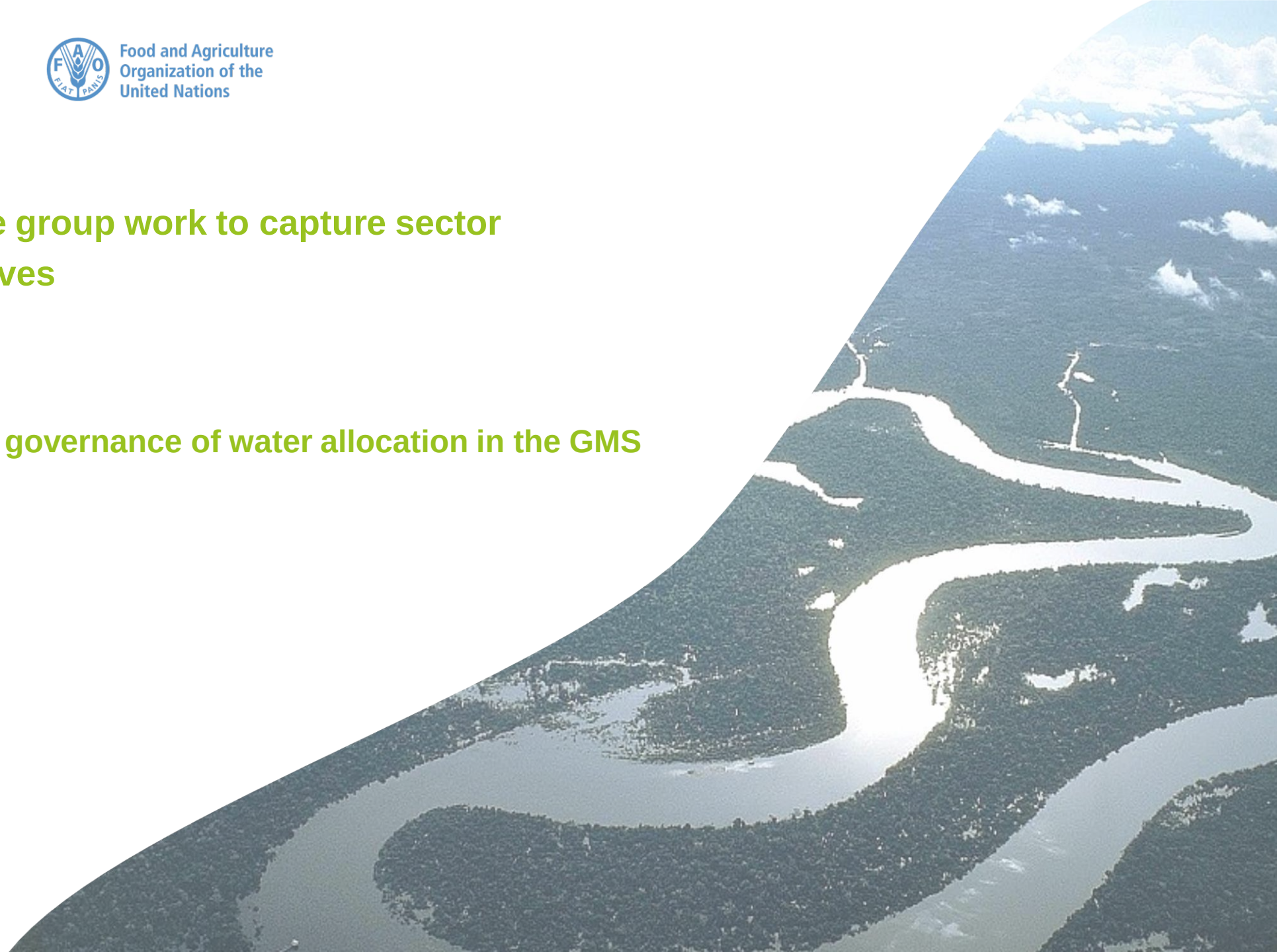


Lao Water Strategy and Water Management

Prepared by

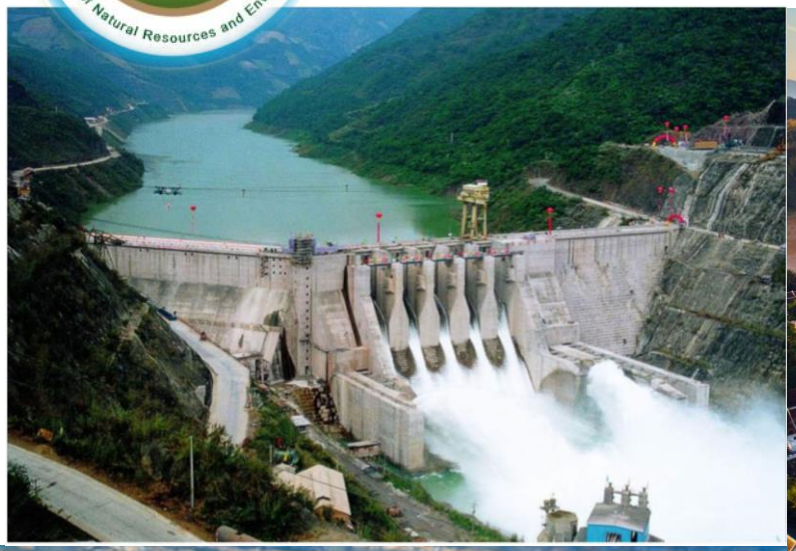
Somvang Bouttavong

Director

Water Utilization Management Division

Department of Water Resources

Ministry of Natural Resources and Environment




LAOS
River Map
CHINA
VIETNAM
MYANMAR
THAILAND
CAMBODIA
VIENTIANE
Mekong
Ou
Ta
Bang
Xeng
Khan
Neun
Xam
Ma
Lik
Ngum
Ngiap
Kading
Ang
Nam Ngum
Theun
Noi
Xe Bangfai
Se Banghiang
Don
Xe Kong
Kaman
Gulf of Tonkin
0 25 50 Km
0 10 25 Miles
LEGEND
International Boundary
Capital
River
Copyright © 2013 www.mapsofworld.com
(Updated on 9th March, 2013)

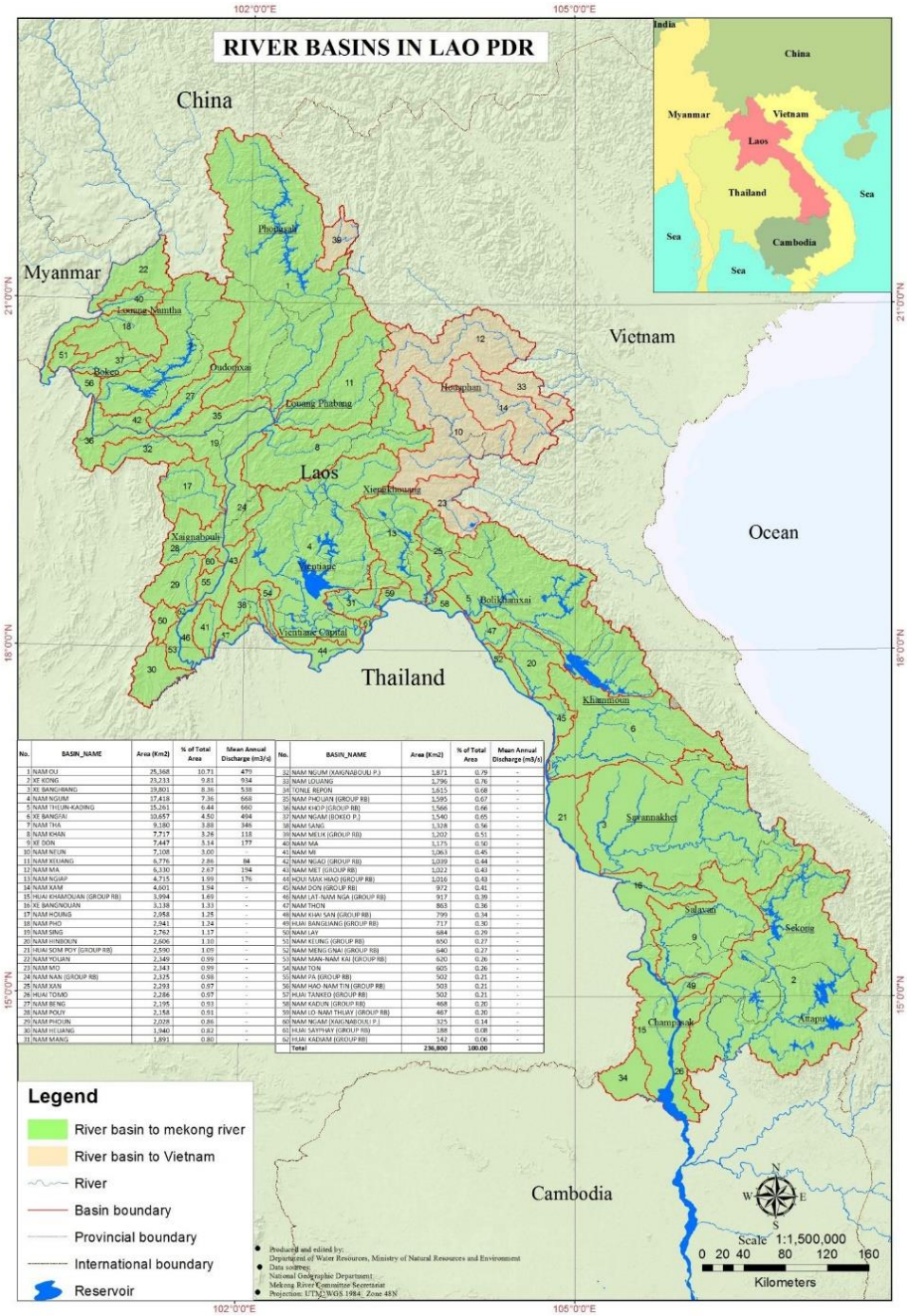
Lao Water Strategy and Water Management

1. Overview-Water Resources in Laos
2. Water consumption and water demand prediction
3. River basin management
4. Key Achievements
5. Projects and Cooperation
6. International Cooperation
7. Challenges
8. Work Opportunities
9. Water policy/strategy, vision, targets
10. Key Action Plan 2025

Overview-Water Resources in Laos

- Lao PDR is located in South-East Asia with total land area of 236,800 km2, approx. population 6.49 mill. (2015);
- 90% of the country territory is located in the Mekong Basin
- Average rainfall is 1.850 mm/yrs or 462 billion m3/yrs.
- Water resources per capita is around 55,000 m^3 per year;
- 35% of annual flow (or equal 270,000 mil. m^3) in Mekong flow is from tributaries in Laos;
- The monthly rivers flow by the pattern of rainfall is around 80% (flood season) during the rainy season and 20% (drought season) in the dry season.

Lao PDR has abundance of water resources which there are total 62 river basins.



Water consumption and water demand prediction (mill. m^3)

Nb.	Water uses	2007	2020	2040
1	Consumption & domestic use	160.79	264.03	502.26
2	Irrigation	176.87	303.64	577.60
3	Industries	16.08	39.61	75.34

Notes:

- Water stored in 41 reservoirs for electricity generation is 35 billion m^3
- About 50% of total land area could find the groundwater and used for consumption & consume, agriculture, industries, construction.

River Basins Management

Large size>4.000 km^2

Ministry of Natural Resources and Environment (MoNRE) is responsible for management of the river basins of large size and river basins flowing across two countries or across more than two provinces.

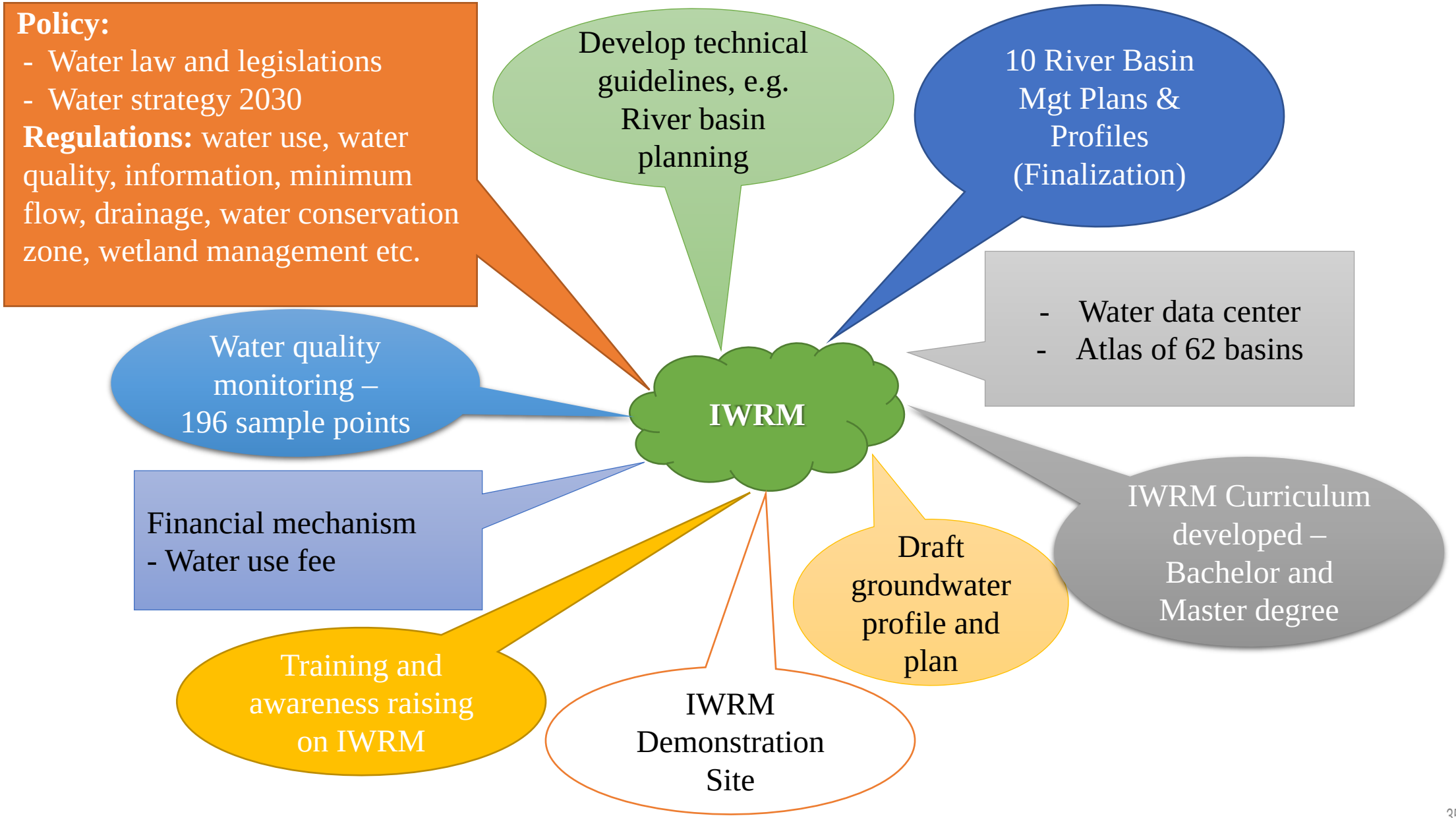
Medium size 1.000-4.000 km^2

Provincial of Natural Resources and Environment (PoNRE) level are responsible for management of river basins of medium size within the limits of the provinces, capitals

Small size <1.000 km^2

District of Natural Resources and Environment (DoNRE) level are responsible for management of river basins of small size within the limits of the district, municipalities, cities.

Key Achievements



Projects and Cooperation

1

Wetland and Peatland

3

LaoWIS

5

Demonstration Site on IWRM

2

Groundwater

4

Climate Resilience and Ecosystem-based Adaptation

International Cooperation

United Nations

UN WATER

SUSTAINABLE DEVELOPMENT GOALS

Global Water Partnership

Ramsar

CONVENTION ON WETLANDS

Asia-Pacific Water Forum

Shared River Shared Future

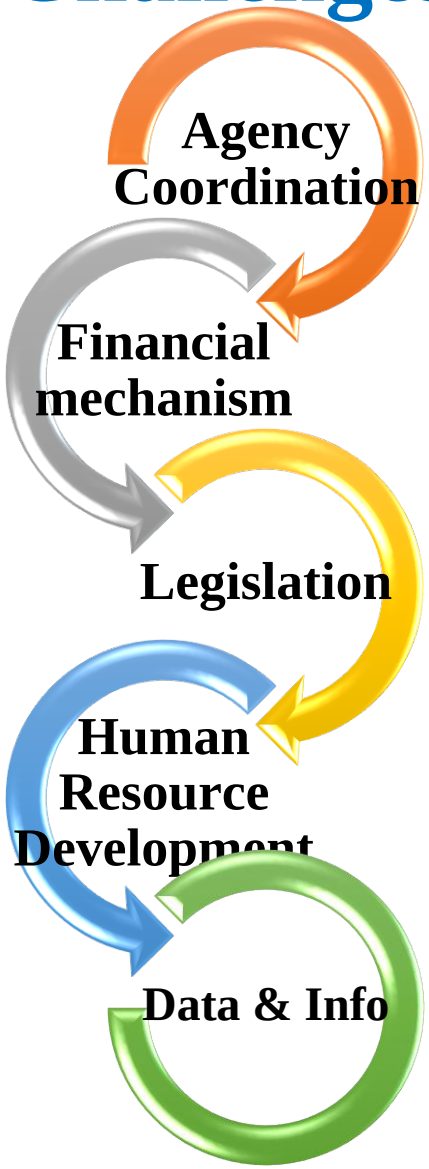
LMC Water Center

MEKONG RIVER COMMISSION

MRC

FOR SUSTAINABLE DEVELOPMENT

Challenges



Institutional arrangement & establishment – need to strengthen cross sector collaboration;
.

Limited financial support & sustainable mechanism – equipment, tools, technologies…

Legislations & guidelines need to be developed and enforced

Limited capacity of concerned staff

Low public awareness & participation in IWRM.

Lack of efficient & accurate Water data & information

Work Opportunities

- Water resources in Laos is abundant, human resources facing many challenges, but professional water managers and experts are limited
- Requires more water experts:
- Water infrastructure development;
- Water management and conservation;
- Water rehabilitation and treatment.

Water policy/strategy

The national water strategy, water and water resources use, reflects the direction of the government in managing water resources in order to justice of water use, water use and sharing the benefits of water development, contribute to poverty reduction, conservation, restoration water environment and enhancing water resources security.

Vision

Manage, water and water resources use in an integrated ways, ensuring good water quality and enough quantity for supplying consumption, sustainable development and reduction the damage from water.

Targets

- Target 1: management, water and water resource use with integrated and efficient ways by coordinating with all stakeholders at central and local levels.
- Target 2: Water and water resources conservation and restoration
- Target 3: Promote the infrastructure development in consistent with sustainable water use

Key Action Plan 2025

1. Formulate/update and implement legislations – such as water law, related regulations, technical guidelines
2. Develop/implement river basin management plans for 14 large basins and others
3. Conduct groundwater assessment and develop groundwater management plans
4. Water permits for water use and wastewater discharge
5. Water quality monitoring and management
6. Wetland and Peatland survey and management
7. Continue to develop water resources database, network, inventory, and modeling
8. Capacity building and awareness raising with gender mainstreaming and participation of all stakeholders
9. Regional and international cooperation.


Thank you

Food and Agriculture Organization of the United Nations

WaPOR

FAO's portal to monitor Water Productivity through Open-access of Remotely sensed derived data

Water accounting through new technologies and innovations

Jippe Hoogeveen, Land and Water Division, FAO | July 2023

Water and agriculture in a changing climate

Over 828 million people suffer from hunger (SOFI 2022)

Around 3.2 billion people live in agricultural areas with high to very high water shortages or scarcity (SOFA 2020)

Agricultural production needs to grow globally by 50% by 2050 (SOLAW 2022)

Current patterns of intensification are not proving sustainable (SOLAW 2022)

From 2000 – 2019 total cropland increased with 63 M ha, almost 85% of this increase is irrigated (SOLAW 2022)

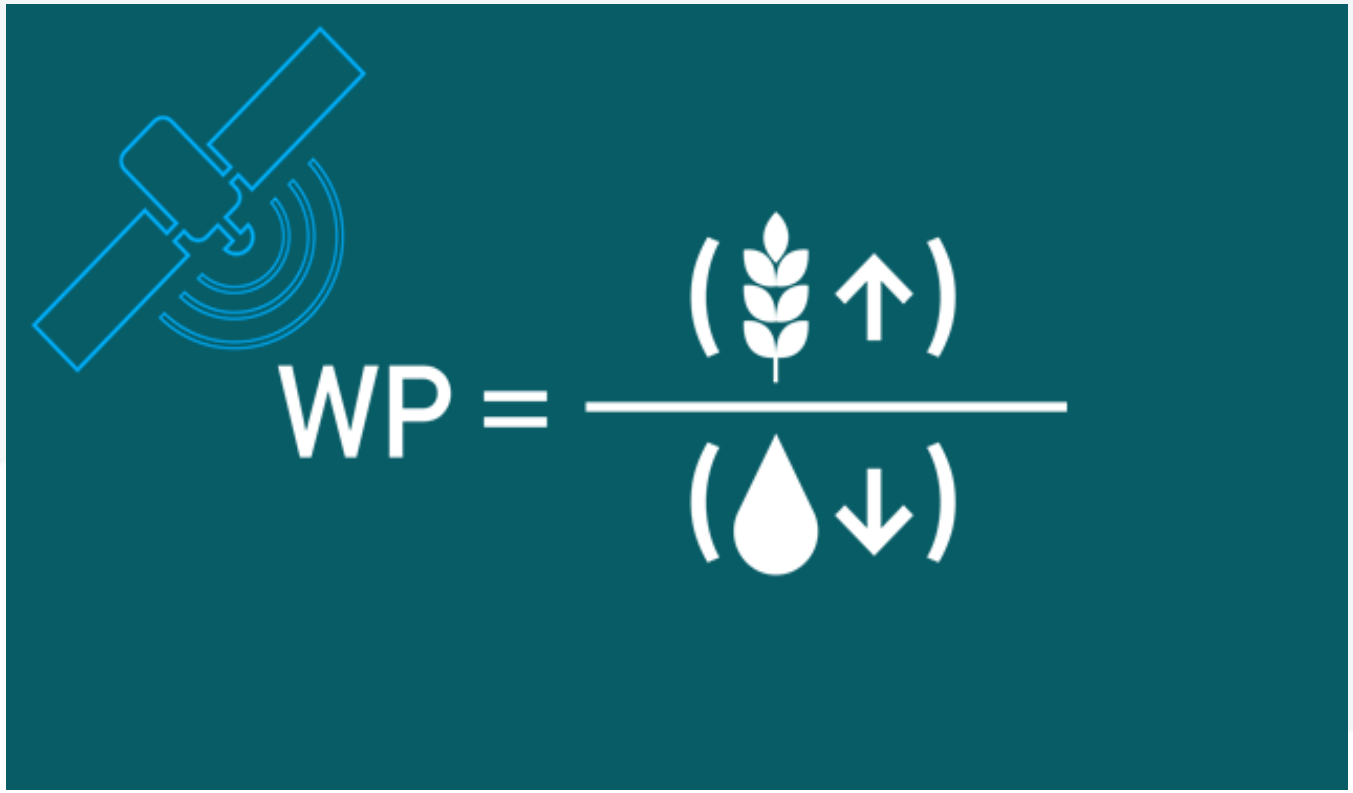
We need to produce more food with less water

Water productivity in agriculture measures the output (kg/ha) per unit of water consumed (m^3/ha).

Measuring these two variables is not easy at appropriate scales for decision making

Satellites can help monitor water productivity in cost-effective ways.

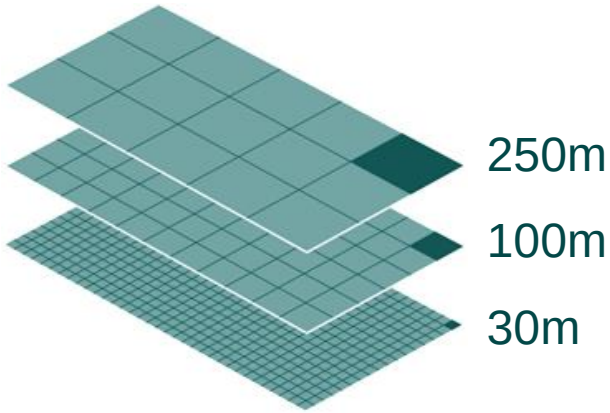
Increasing water productivity is now a globally recognized target (SDG 6)

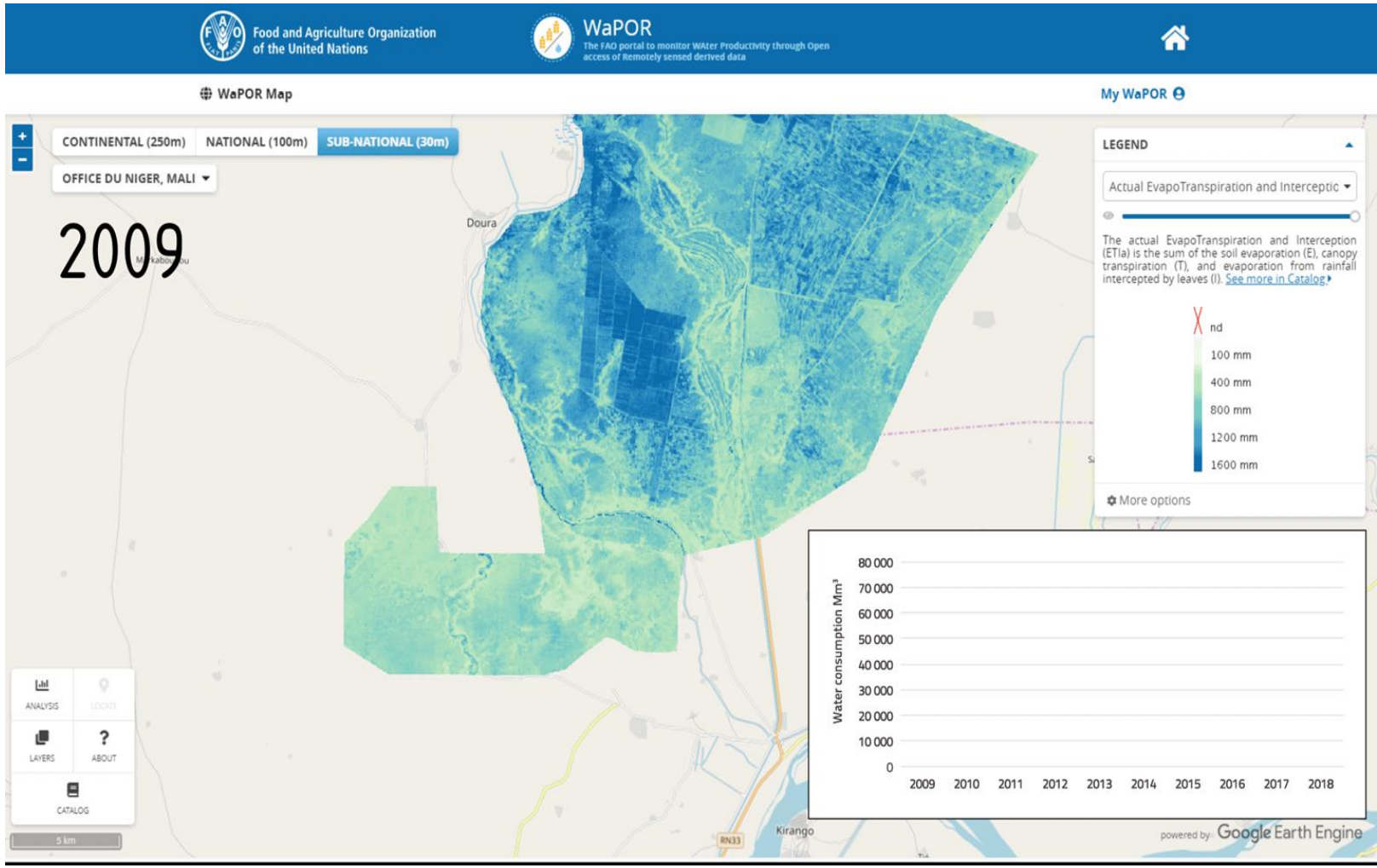


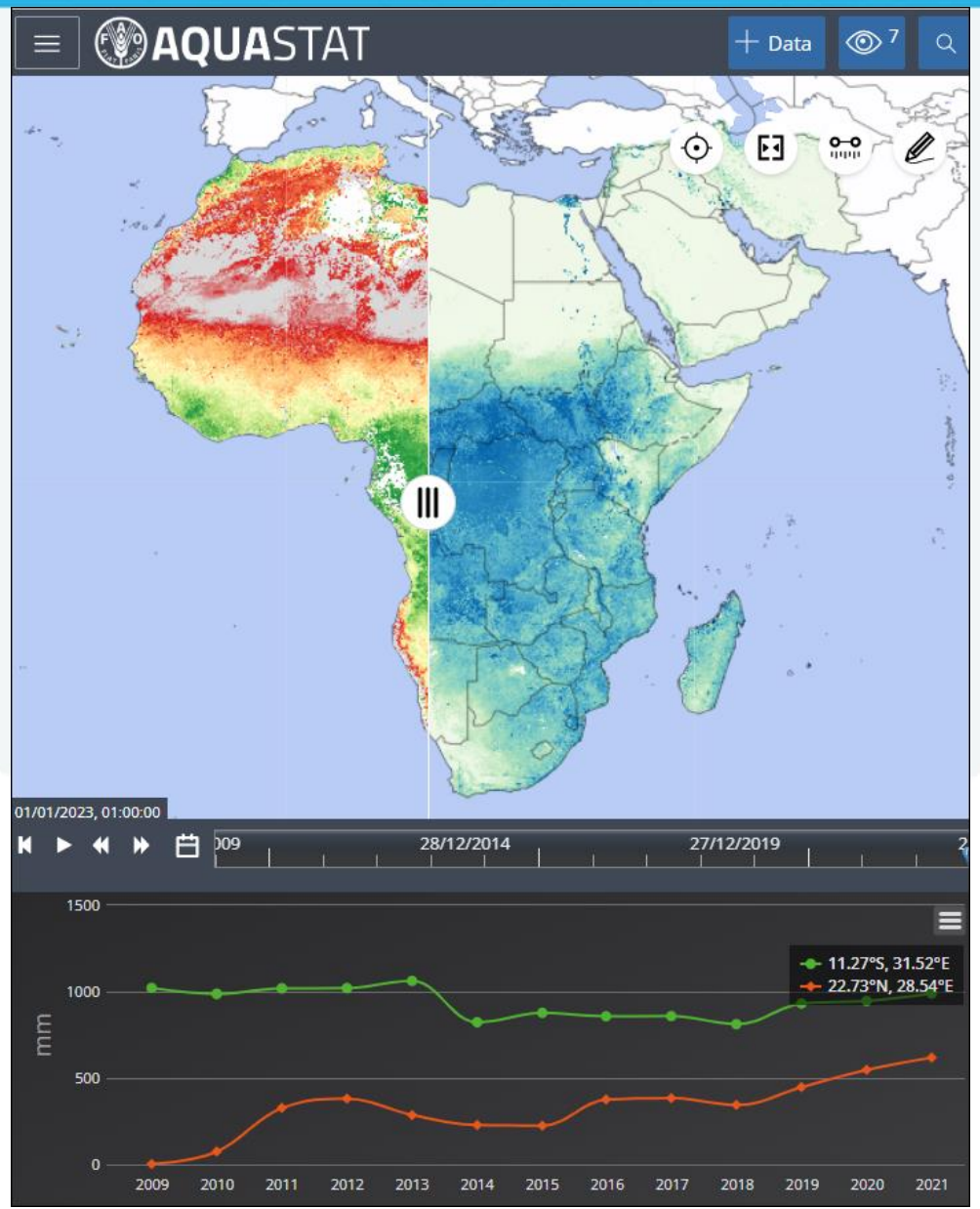
WaPOR provides actionable information

Near-real time (every 10 days) data on biomass development and water consumption (actual evapotranspiration), in addition to agro-climatic parameters on a daily time step (reference ET and precipitation).

Spatial resolution ranges between 250 m and 30 m





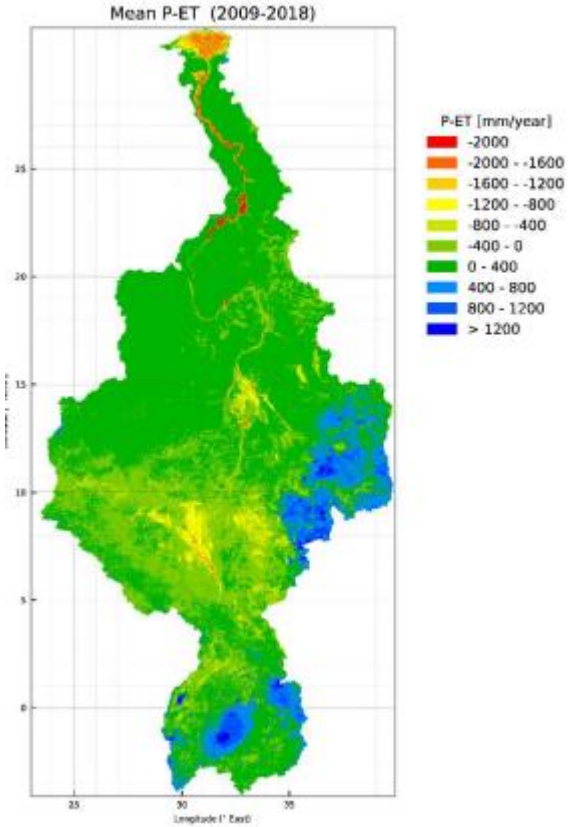


Data components	Level[1] 1 (~250m)	Level 2 (~100m)	Level 3 (~30m)	Remarks
Water Productivity (WP)	Annual[2]	Dekadal[3]/ Seasonal[4]	Dekadal/ Seasonal	Level specific calculations
Evaporation (E)	Dekadal/ Annual	Dekadal/ Annual	Dekadal/ Annual	
Transpiration (T)	Dekadal/ Annual	Dekadal/ Annual	Dekadal/ Annual	
Interception (I)	Dekadal/ Annual	Dekadal/ Annual	Dekadal/ Annual	
Actual Evapotranspiration and Interception (ETIa)	Dekadal/ Annual	Dekadal/ Annual	Dekadal/ Annual	
Net Primary Production (NPP)	Dekadal	Dekadal	Dekadal	
Total biomass production (TBP)	Annual	Seasonal	Seasonal	
Phenology		Seasonal	Seasonal	
Harvest Index (HI)			Seasonal	
Reference Evapotranspiration (RET)	Daily/ Dekadal/ Annual			Different resolution: 20km
Precipitation	Daily/ Dekadal/ Annual			Different resolution: 5km
Land cover classification	Annual	Annual	Dekadal	Level specific classes

Applications
Data for Water Accounting

Water Accounting from Remote Sensing aims to complement the lack of routine water resources data collection and incorporates spatially distributed water consumption.

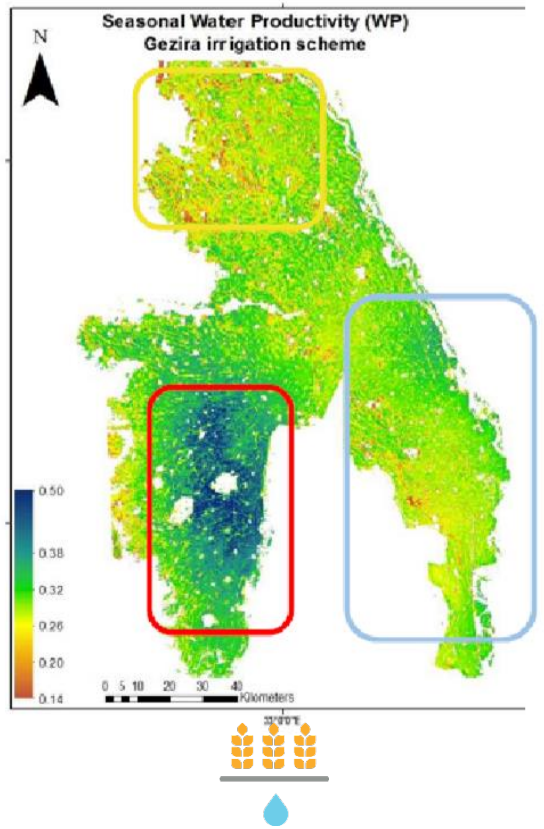
Rapid WaPOR-based WA describes the use of WaPOR data for water rescources assessment, its challenges and the scope for improving accuracy with integration of national data sources.

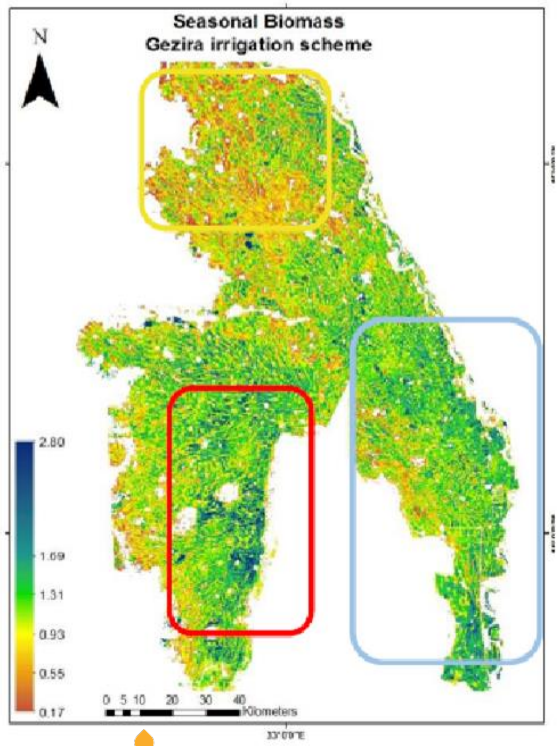


Applications:
Performance indicators to understand variability

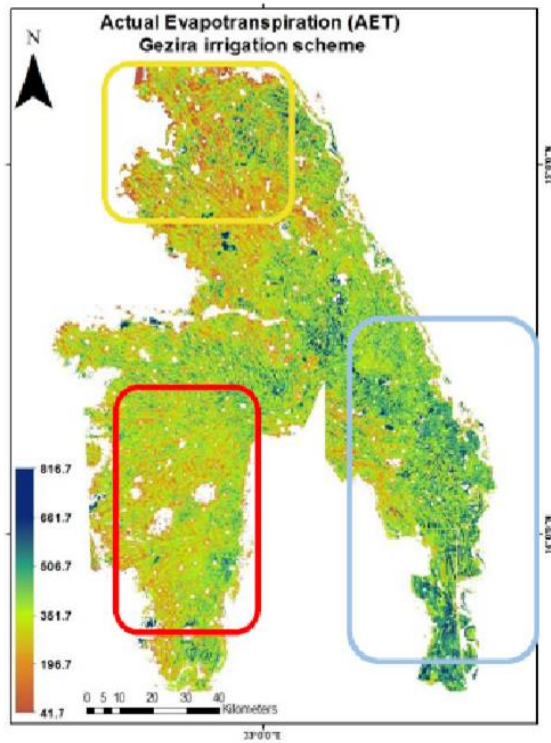
In the Gezira irrigation scheme (Sudan) WaPOR data helps monitor how different zones are performing.

Water Productivity =





field production



water consumption

Struggling area needing intervention: Low water productivity with a low field production but also a low water consumption

Best performing area: High water productivity fields with a fairly high production and a low water consumption

Mixed zones of high and low productivity

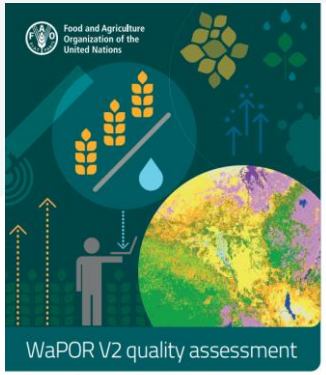
HRC SUDAN Hydraulics Research Center مركز البحوث الهيدروليكية

WaPOR: resources

- Website and map portal
  https://wapor.apps.fao.org
  http://www.fao.org/in-action/remote-sensing-for-water-productivity

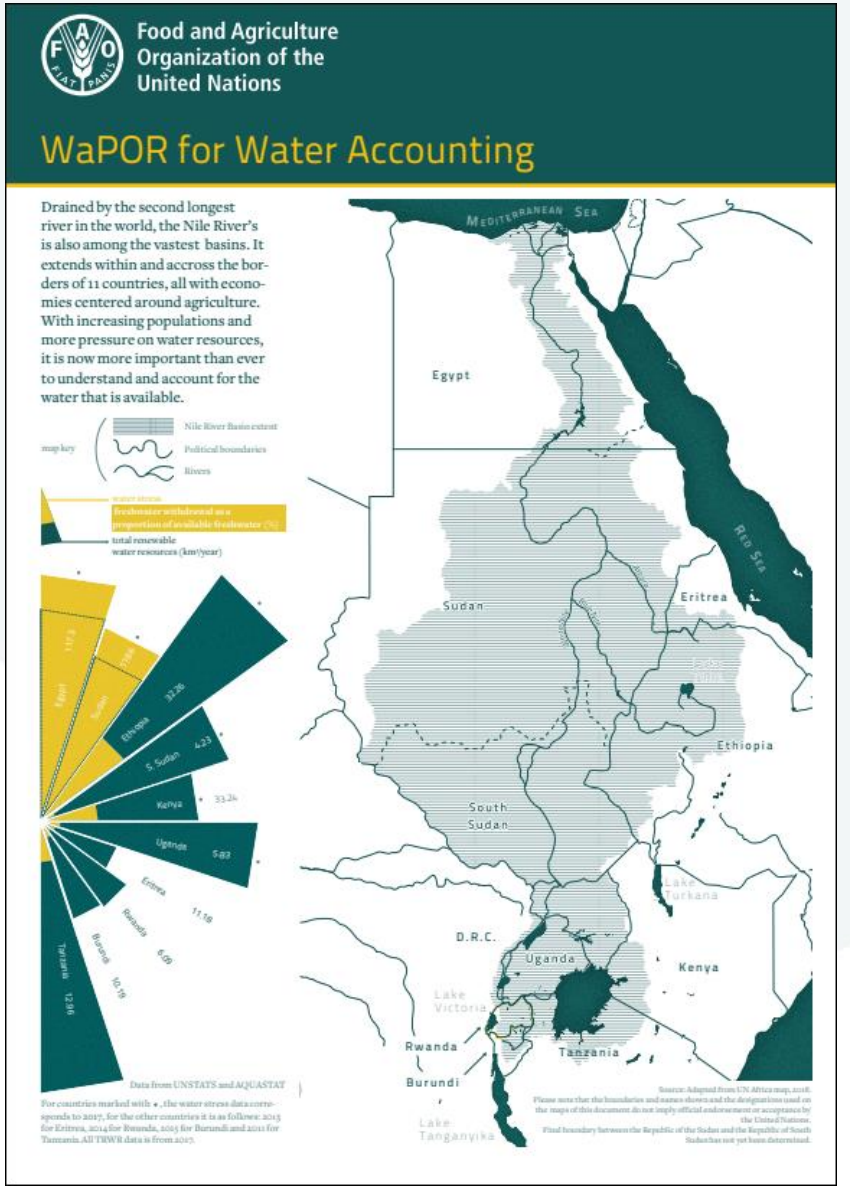
- Data is also available through: FAO HiH, EarthMap, GEE, and for any application built on API

- Methodology documents, data manuals (from website)
  Methodology document
  2 Independent Quality Assessment reports
  Open scripts and source code
  Water accounting and technical reports



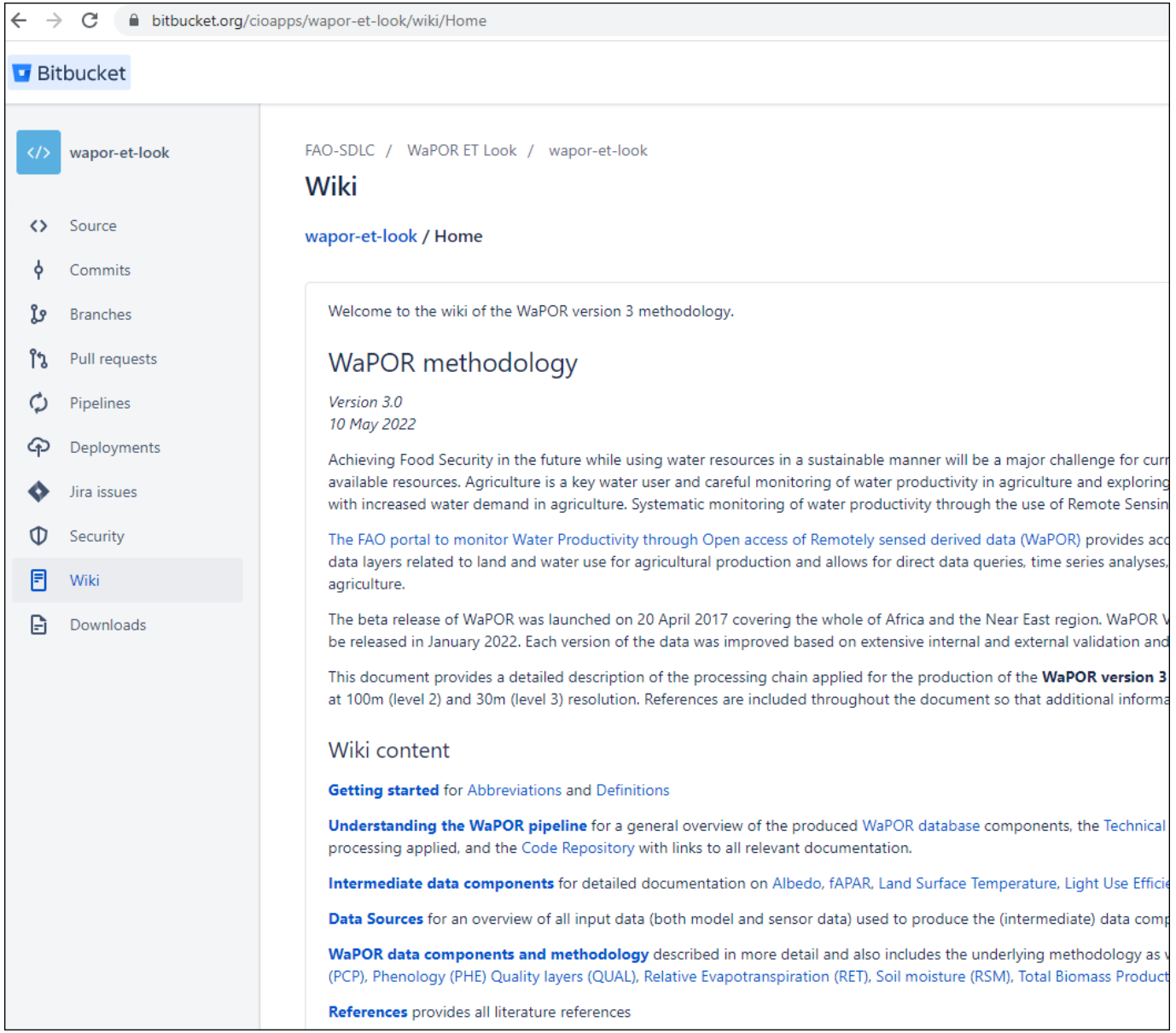
- Online courses in English, French and Arabic
https://www.un-ihe.org/open-course-water-productivity-and-water-accounting-using-wapor

- Applications catalogue
http://www.fao.org/in-action/remote-sensing-for-water-productivity/use-casesresources/en/



WaPOR wiki

- Open methodology, now with improved documentation: https://bitbucket.org/cioapps/wapor-et-look/wiki/Home



https://www.fao.org/aquastat/py-wapor/index.html

WaPOR

pyWaPOR

This repository contains a Python implementation of the algorithm used to generate the WaPOR datasets. It can be used to calculate evaporation, transpiration and biomass production maps.

Installation

Its recommended to install in a clean conda environment and use conda to install all the important packages from the `conda-forge` channel.

```
conda create -n my_pywapor_env --yes -c conda-forge python pip gdal pydap numpy pandas requests mat

conda activate my_pywapor_env
```

Then use the package manager pip to install pywapor.

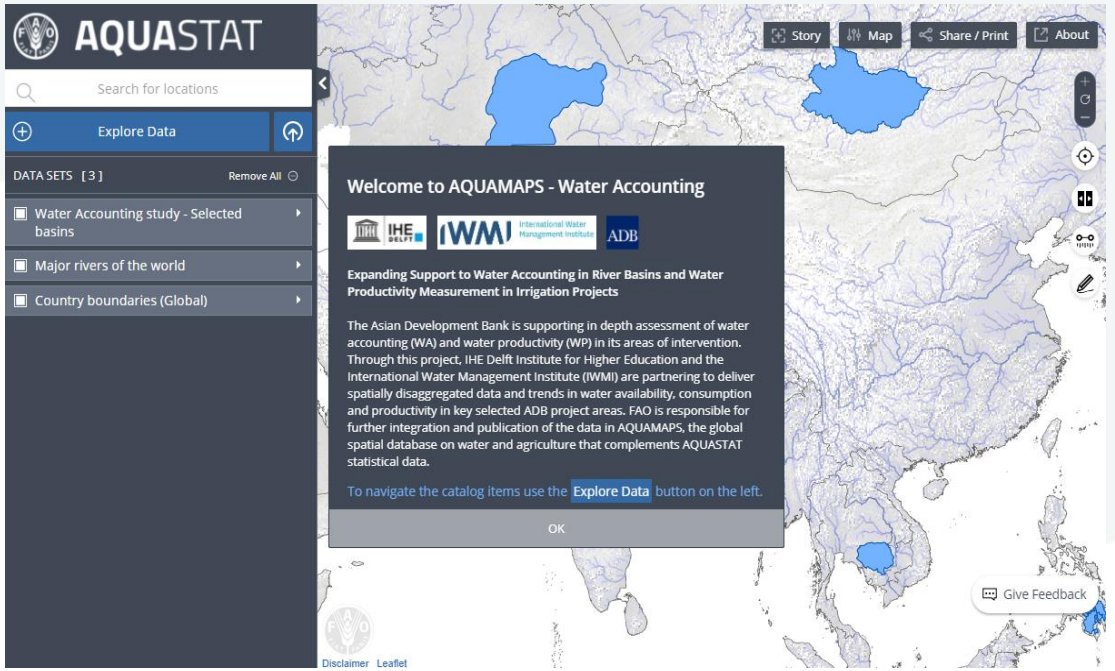
WaPOR is being used by international finance institutions

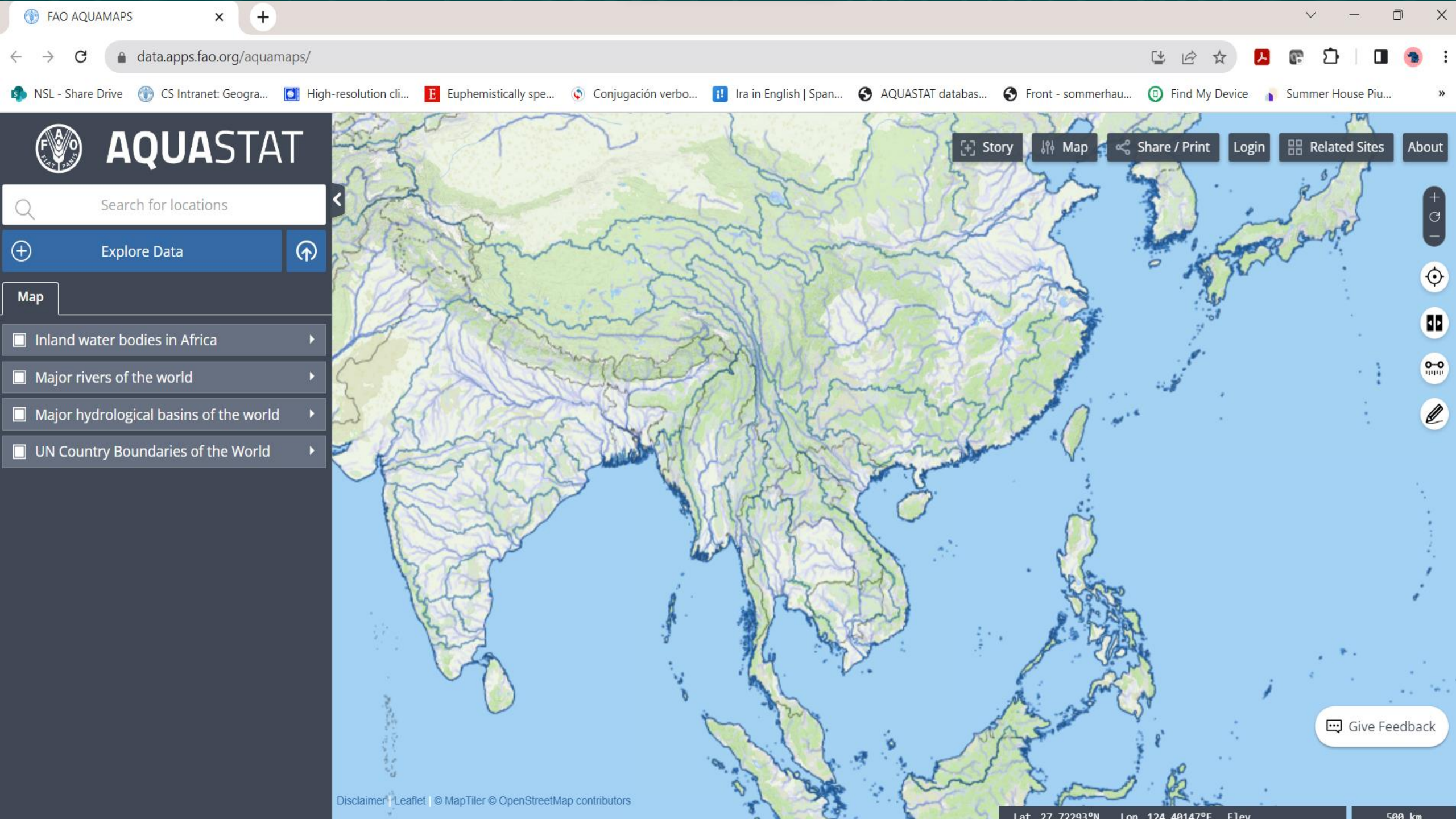
Asian Development Bank
Is partnering with FAO for the Water Accounting Portal, integrated in AQUASTAT

Islamic Development Bank
Is using WaPOR-based indicators as inputs to its water strategy (feeding into the Guidelines on Water Allocation for Agriculture recently approved by the League of Arab States)

African Development Bank
Supporting FAO projects that use WaPOR for monitoring water use and infrastructure damage (ex. Libya)

World Bank
through FAO Investment Centre is using WaPOR data in water productivity assessments in India and NENA




FAO AQUAMAPS
data.apps.fao.org/aquamaps/
NSL - Share Drive
CS Intranet: Geogra...
High-resolution cli...
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Conjugación verbo...
Ira in English | Span...
AQUASTAT databas...
Front - sommerhau...
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Summer House Piu...
AQUASTAT
Search for locations
Explore Data
Map
Inland water bodies in Africa
Major rivers of the world
Major hydrological basins of the world
UN Country Boundaries of the World
Story
Map
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Give Feedback
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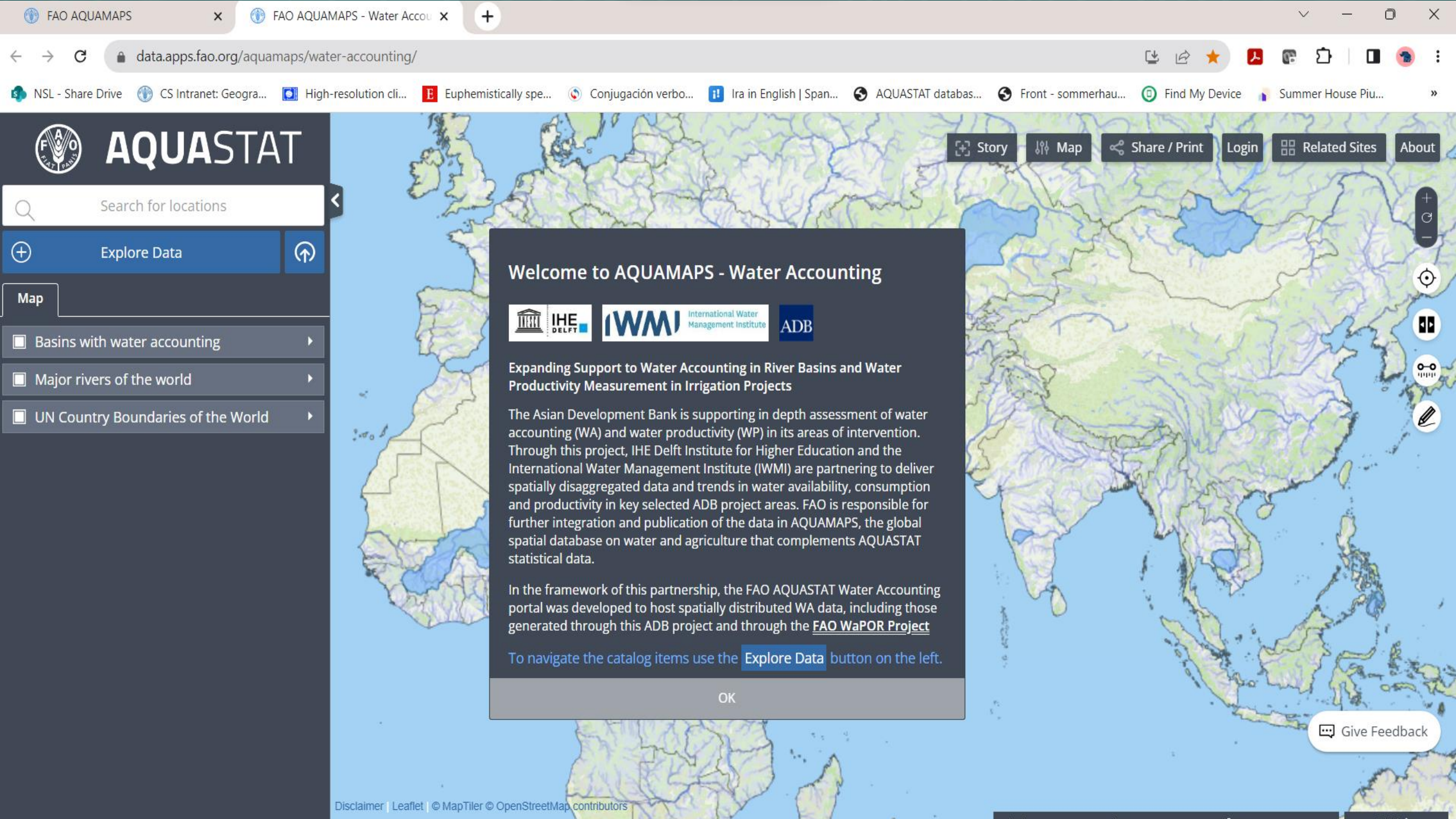
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NSL - Share Drive
CS Intranet: Geogra...
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AQUASTAT databas...
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AQUASTAT
Search for locations
Explore Data
Map
Basins with water accounting
Major rivers of the world
UN Country Boundaries of the World
Story
Map
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Related Sites
About
Welcome to AQUAMAPS - Water Accounting
IHE DELFT
IWMI International Water Management Institute
ADB
Expanding Support to Water Accounting in River Basins and Water Productivity Measurement in Irrigation Projects
The Asian Development Bank is supporting in depth assessment of water accounting (WA) and water productivity (WP) in its areas of intervention. Through this project, IHE Delft Institute for Higher Education and the International Water Management Institute (IWMI) are partnering to deliver spatially disaggregated data and trends in water availability, consumption and productivity in key selected ADB project areas. FAO is responsible for further integration and publication of the data in AQUAMAPS, the global spatial database on water and agriculture that complements AQUASTAT statistical data.
In the framework of this partnership, the FAO AQUASTAT Water Accounting portal was developed to host spatially distributed WA data, including those generated through this ADB project and through the FAO WaPOR Project
To navigate the catalog items use the Explore Data button on the left.
OK
Give Feedback
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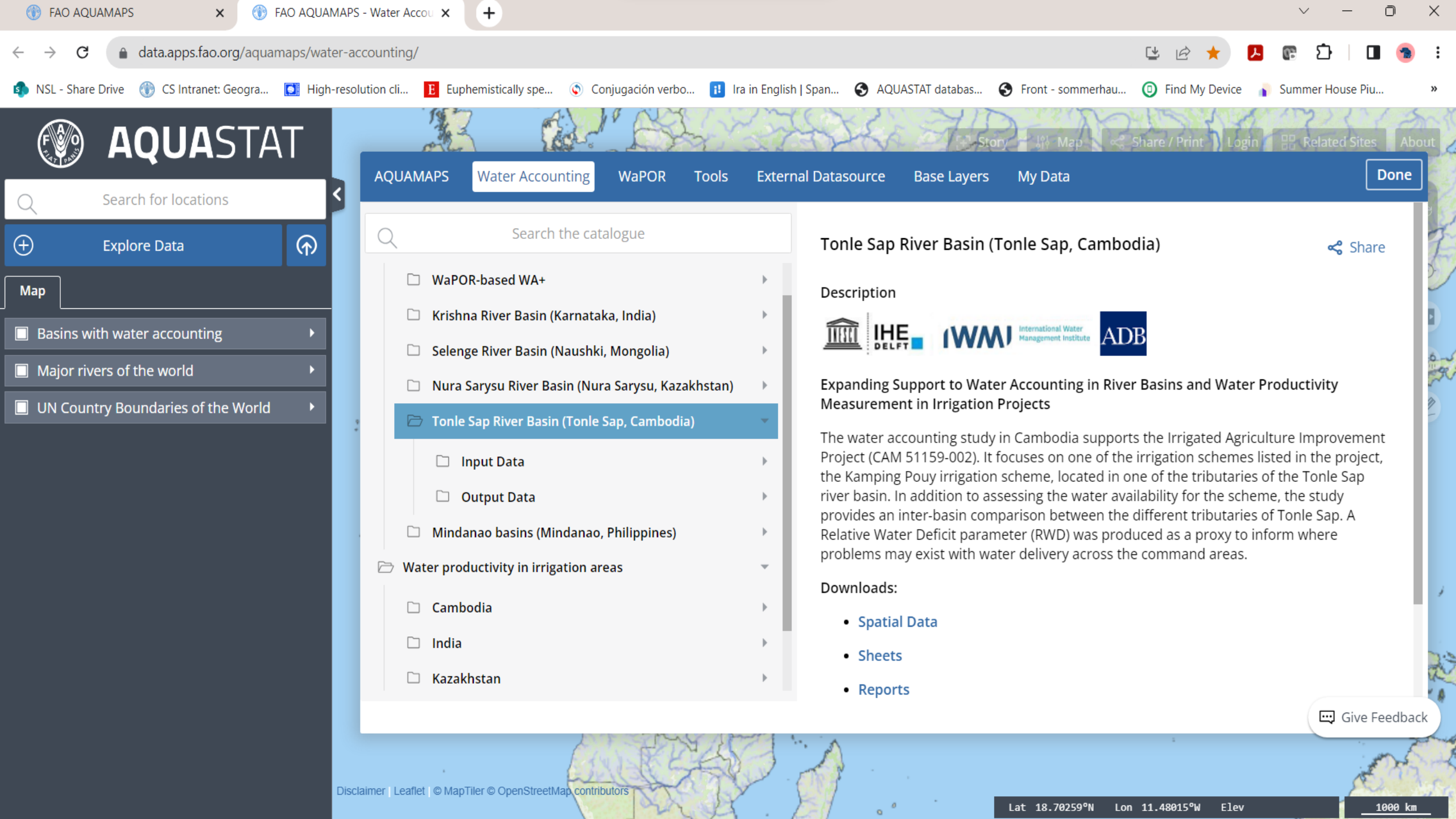
FAO AQUAMAPS
FAO AQUAMAPS - Water Accou
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WaPOR
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Base Layers
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Done
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WaPOR-based WA+
Krishna River Basin (Karnataka, India)
Selenge River Basin (Naushki, Mongolia)
Nura Sarysu River Basin (Nura Sarysu, Kazakhstan)
Tonle Sap River Basin (Tonle Sap, Cambodia)
Input Data
Output Data
Mindanao basins (Mindanao, Philippines)
Water productivity in irrigation areas
Cambodia
India
Kazakhstan
Tonle Sap River Basin (Tonle Sap, Cambodia)
Share
Description
IHE DELFT
IWMI International Water Management Institute
ADB
Expanding Support to Water Accounting in River Basins and Water Productivity Measurement in Irrigation Projects
The water accounting study in Cambodia supports the Irrigated Agriculture Improvement Project (CAM 51159-002). It focuses on one of the irrigation schemes listed in the project, the Kamping Pouy irrigation scheme, located in one of the tributaries of the Tonle Sap river basin. In addition to assessing the water availability for the scheme, the study provides an inter-basin comparison between the different tributaries of Tonle Sap. A Relative Water Deficit parameter (RWD) was produced as a proxy to inform where problems may exist with water delivery across the command areas.
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Sheets
Reports
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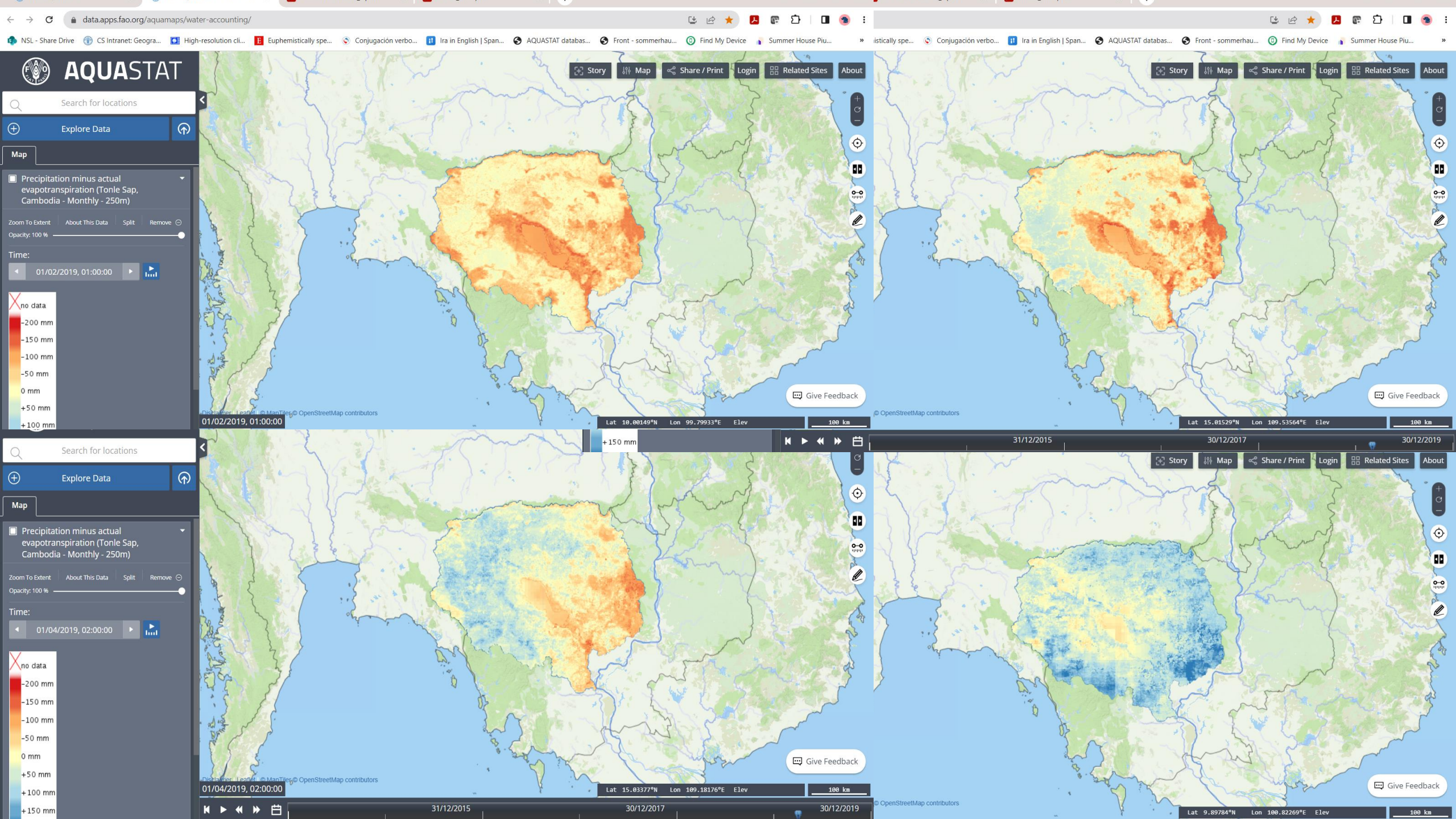
Disclaimer | Leaflet | © MapTiler © OpenStreetMap contributors
Lat 18.70259°N Lon 11.48015°W Elev
1000 km


data.apps.fao.org/aquamaps/water-accounting/
AQUASTAT
Search for locations
Explore Data
Map
Precipitation minus actual evapotranspiration (Tonle Sap, Cambodia - Monthly - 250m)
Zoom To Extent
About This Data
Split
Remove
Opacity: 100 %
Time:
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-200 mm
-150 mm
-100 mm
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Story
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About
Give Feedback
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Lat 10.00149°N Lon 99.79933°E Elev
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Lat 15.03377°N Lon 109.18176°E Elev
Lat 15.01529°N Lon 109.53564°E Elev
Lat 9.89784°N Lon 100.82269°E Elev
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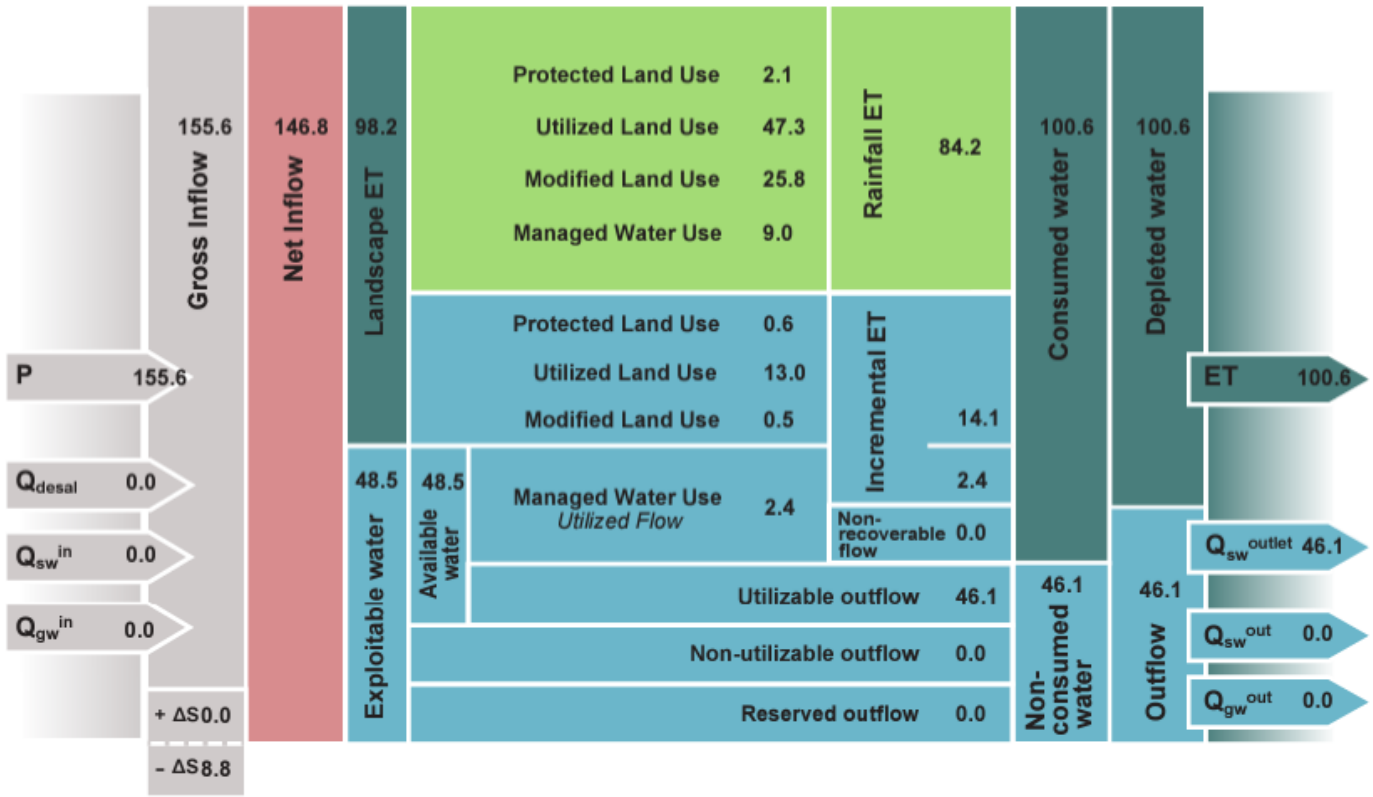
Sheet 1: Resource Base (km3/year)

Basin: TonleSap
Period: 2014

Water



By Dimitry A. Mottl - Own work, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=37877226

Water Accounting in Selected Asian River Basins: Pilot study in Cambodia

Elga Salvadore, Claire Michailovsky, Bert Coerver, and Wim Bastiaanssen
IHE-Delft, Water Accounting Expert
e.salvadore@un-ihe.org

July, 2017

Summary latest updates

- Country activities advanced in 12 countries, despite travel restrictions in the first 1.5 years and political and security constraints;
- Top-up for global coverage and 2 additional countries for implementation (Pakistan and Colombia);
- Version 3 of methodology, with improved data inputs and processing, and pyWaPOR;
- New Copernicus ET product in pipeline recommends WaPOR methodology;

Conclusions

- Open source and open access methodologies allow for uptake in countries outside current project extent, with fexibility on spatial and temporal resolution;
- A global database will be operational by the end of the year, in cooperation with additional partners (EU Copernicus);
- Usable for different types of stakeholders: i.e.: policy makers for example to monitor progress towards SDG6.4, science community, water users associations, extensionists and farmers, private sector can develop tailored services.

Join us to build a water and food secure future where no one is left behind

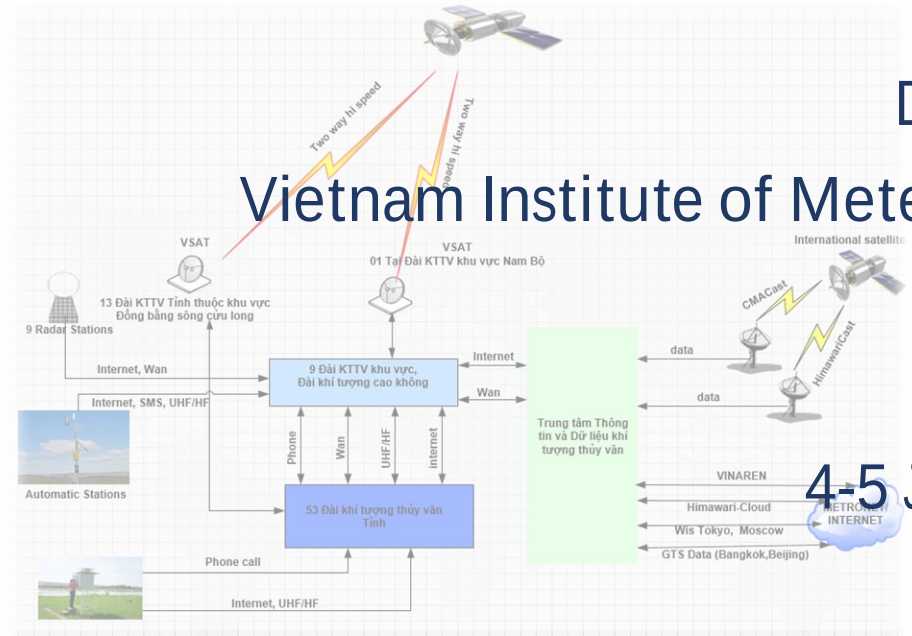
WaPOR

wapor.apps.fao.org

wapor@fao.org

www.fao.org/in-action/remote-sensing-for-water-productivity

THE CHALLENGES OF WATER DATA MANAGEMENT AND AVAILABILITY IN VIETNAM



Dr. Le Ngoc Cau

Vietnam Institute of Meteorology Hydrology and Climate Change

4-5 July 2023, Bangkok

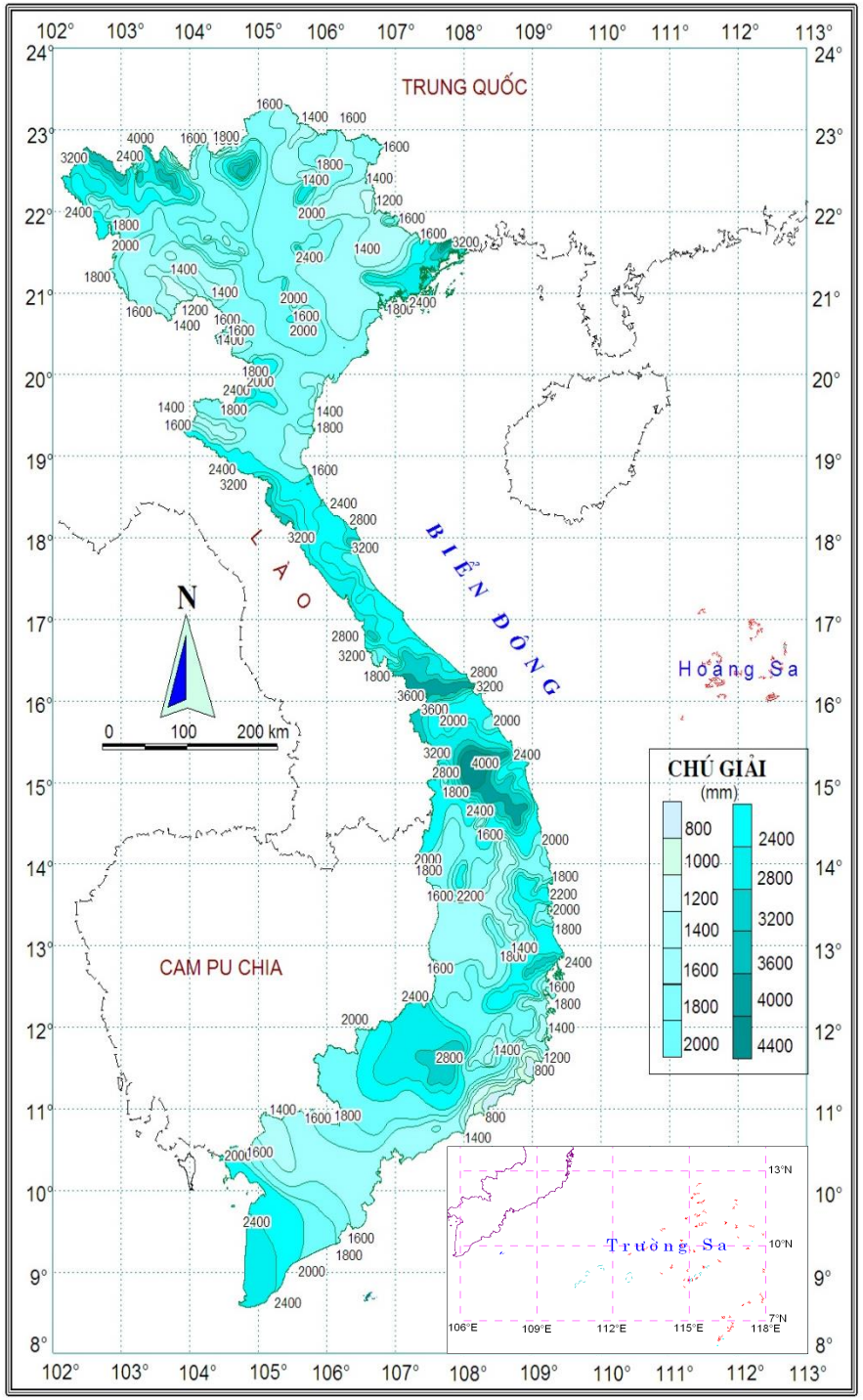
Water availability in Vietnam

Annual rainfall

- uneven distribution in time and space
- range from 600-700mm to 4,000-5,000mm

Water resources

- 9 major river basins with around 3,450 rivers from 10km length
- Mean annual water volume: approx. 835 km^3 corresponding to discharge of 26,470 m^3/s
- External water volume (from China, Laos, Cambodia) is 513 km^3 (61.4%)



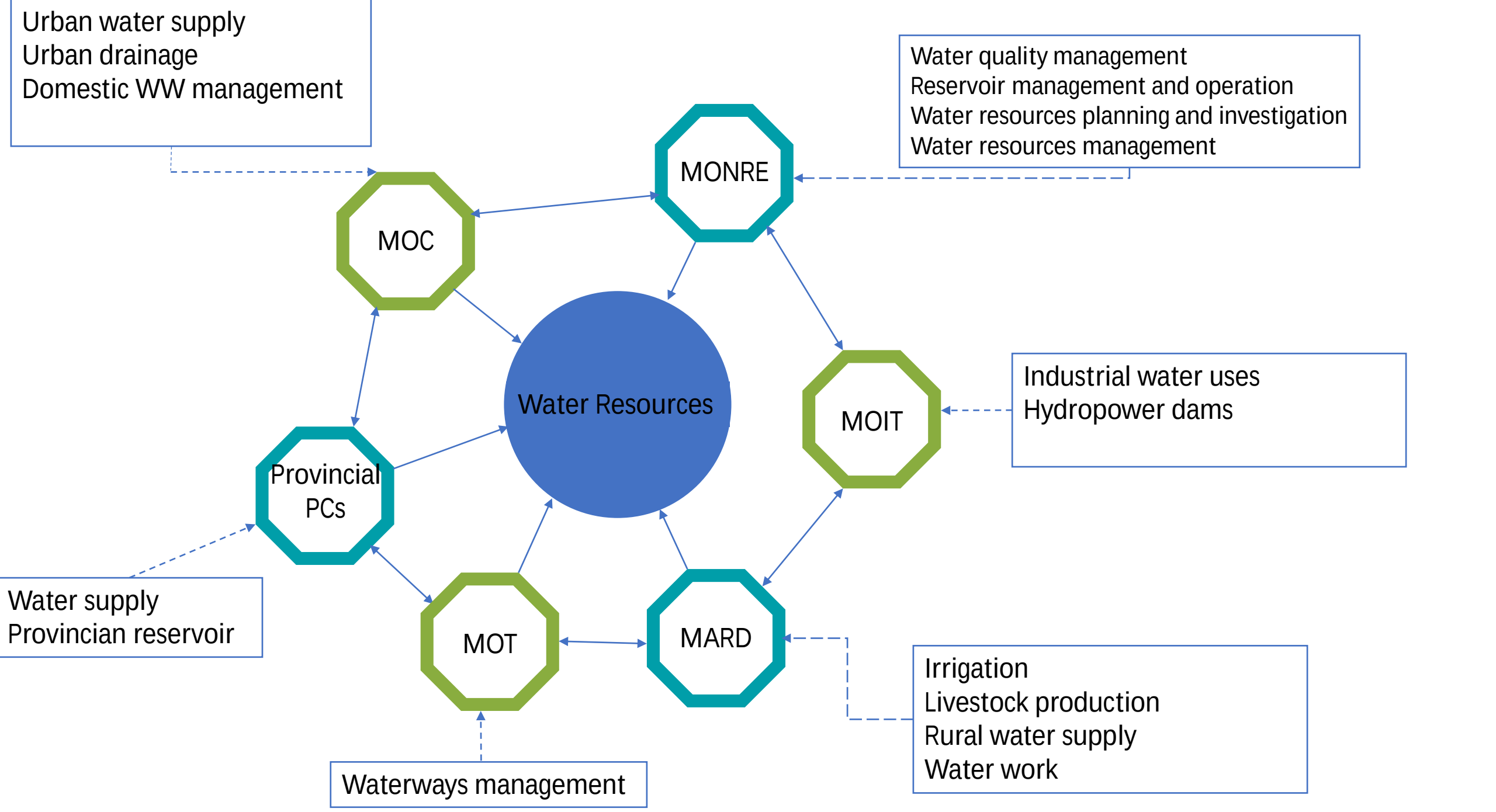
Water resources management

Reservoirs and dams

- More than 6,750 reservoirs
- Total volume of 67.5 bil.m^3
- 11 inter-reservoirs have assigned operation procedures.

River basin management

- Red River Basin Committee
- Mekong Delta Committee incorporated with Mekong River Commission
- Dong Nai River Basin Committee
- North Central River Basin Committee
- South Central River Basin Committee


Urban water supply
Urban drainage
Domestic WW management
Water quality management
Reservoir management and operation
Water resources planning and investigation
Water resources management
MONRE
MOC
Water Resources
MOIT
Industrial water uses
Hydropower dams
Provincial
PCs
Water supply
Provincian reservoir
MOT
MARD
Irrigation
Livestock production
Rural water supply
Water work
Waterways management

Challenges

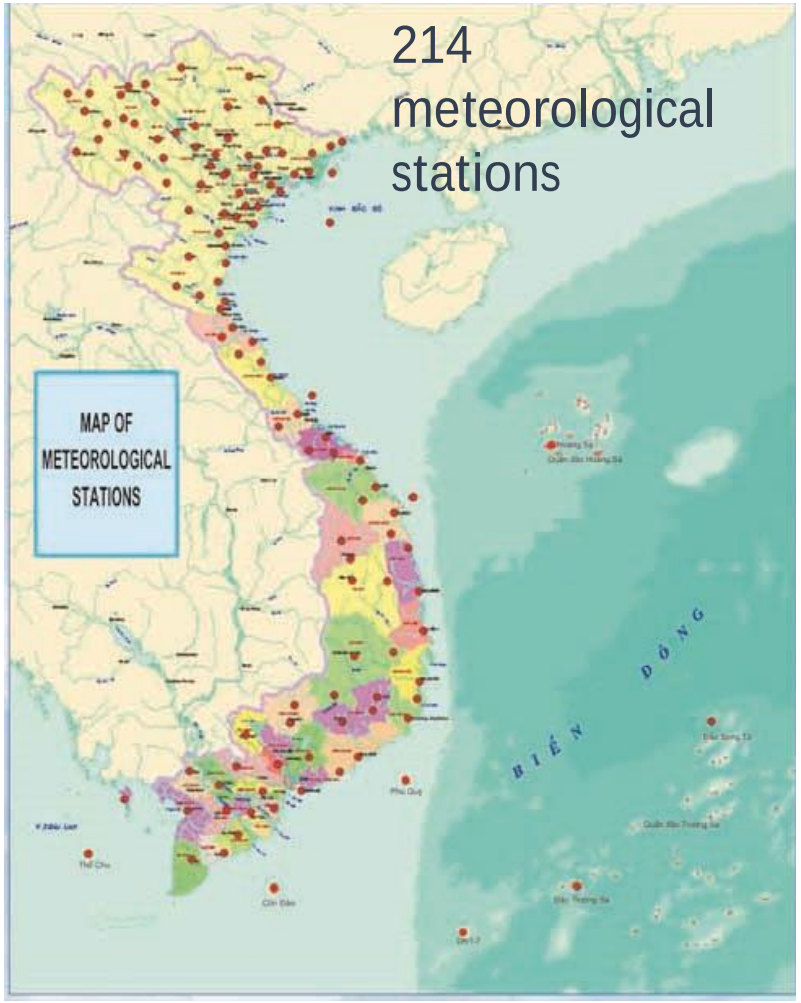
1. Data collection
   - Inadequate coverage of monitoring network
   - Tranboundary data sharing
   - Inadequate remote observation
   - Coordination of data management

2. Data storage
   - Bigdata in different extensions
   - Different databases managed by different stakeholders

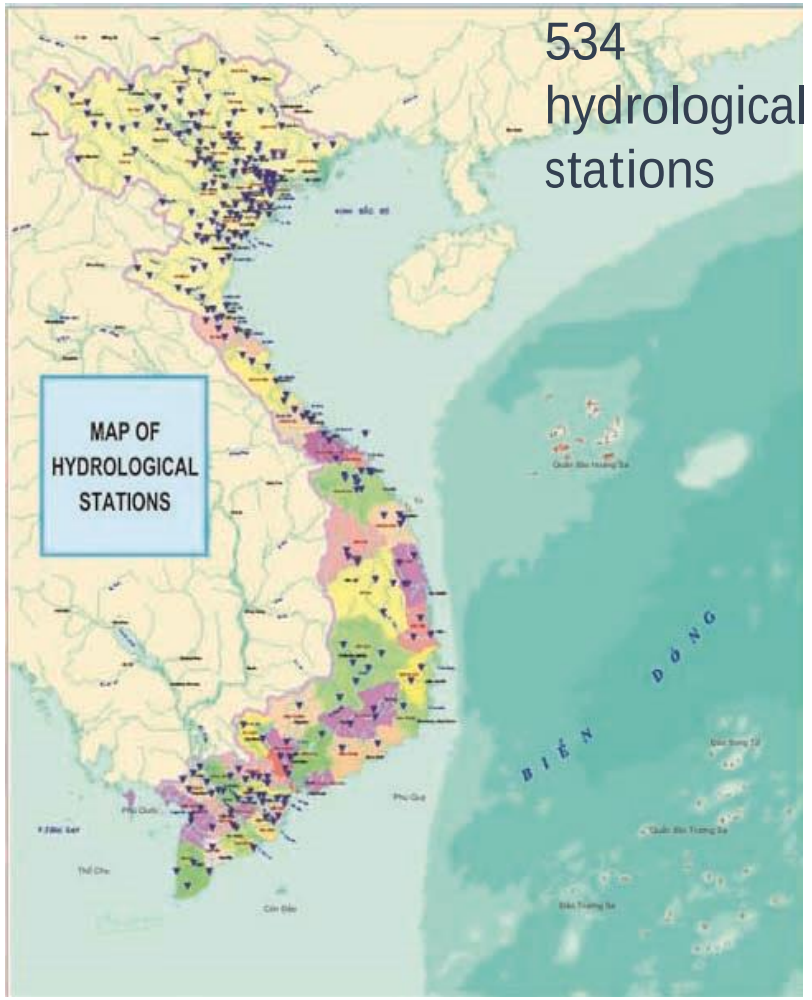
3. Data Management
   - Data observed and storage by different organizations
   - Meteo-hydrological data: Ministry of Natural Resources,
   - Reservoir and water work data: Ministry of Agricultural and Rural Development
   - Hydropower data: Ministry of Industry and Trade

4. Allocation of water
   - Prioritization of uses by different stakeholders
   - Harmonization of interests/multi-sectors

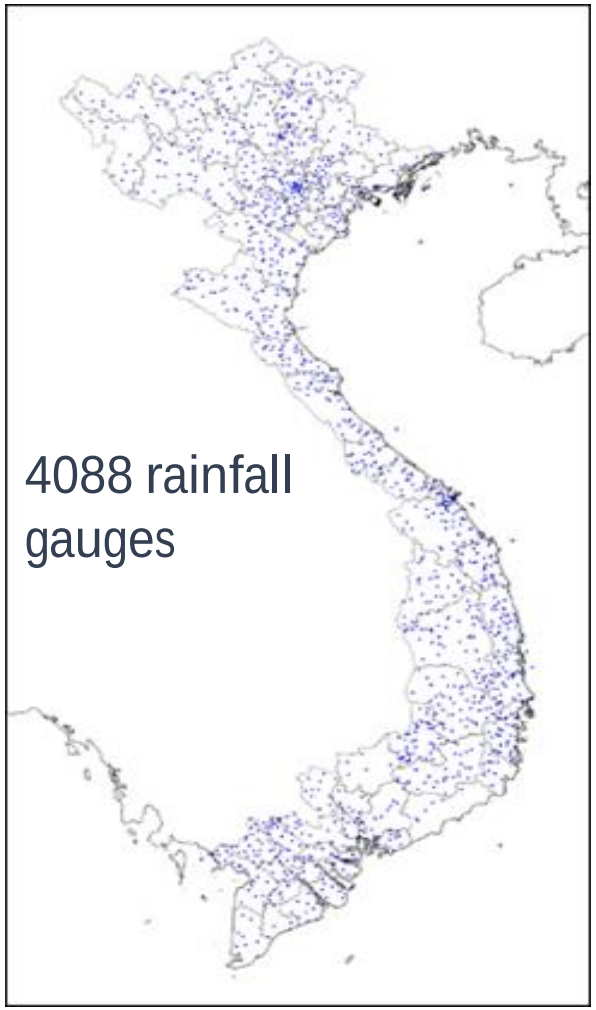
Meteo-hydrological monitoring in Vietnam



214 meteorological stations



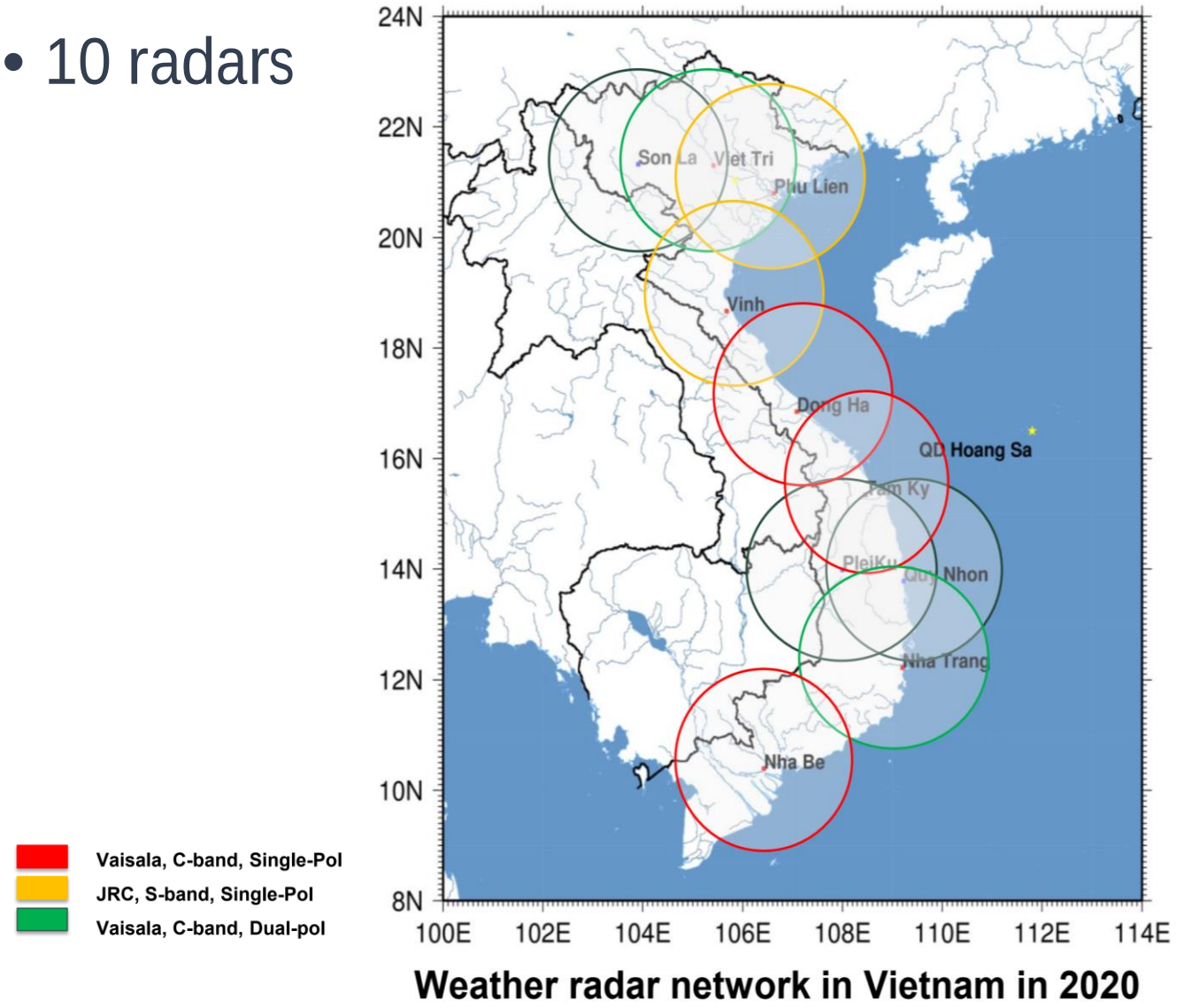
534 hydrological stations



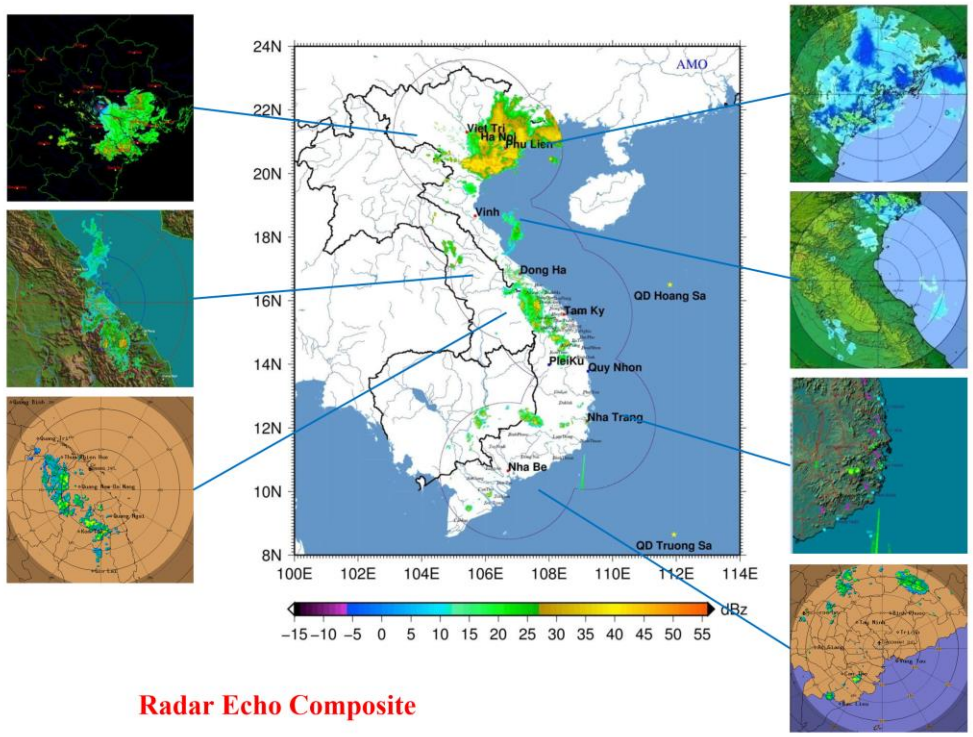
4088 rainfall gauges

Meteo-hydrological monitoring in Vietnam

- 10 radars



Weather radar network in Vietnam in 2020



Radar Echo Composite

Thank you for your attention!

Water accounting in the GMS-Policy implications for water, food and energy security in a changing climate
4-5 July 2023 in Bangkok, Thailand

Hydro-meteorological products and services for water accounting, Climate Change and Disaster Risk Reduction in Lao PDR.

Ms. Sonephet PHOSALATH

Director of Hydrology Division

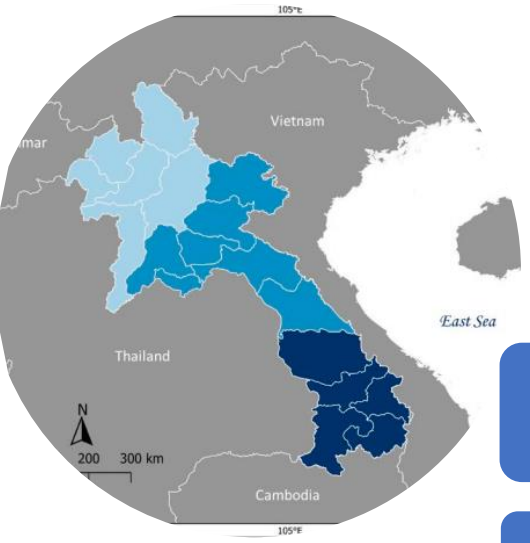
Department of Meteorology and Hydrology (DMH)

Ministry of Natural Resources and Environment, Lao PDR

OUTLINE

1. **Major challenges to establish (and/or improve) Early Warning System**
2. **Key role of NMHS among various stakeholders in the country, such as central/local government, media and private sectors**
3. **Challenges you are facing in resource mobilization**

1. Major challenges to establish (and/or improve) Early Warning System



- **Lao PDR is landlocked country in Southeast Asia, the country's thickly forested landscape is generally comprised of rugged mountains, plains and plateaus.**
- **The country's principal waterway is the Mekong River. The Mekong and many small rivers or tributaries are critical natural resources for socio-economic development, particularly for agriculture and hydroelectric sectors**

Floods, droughts, and extreme weather are the dominant hazards in Lao PDR and cause loss of life, damage agricultural production, and threaten livelihoods.

The number of significant flood events has been increasing over the years.

Furthermore, climatic variability is expected to exacerbate food insecurity and result in an increase in food prices.

Following the severe flooding and devastation in 2008, Typhoon Ketsana in 2009, Typhoons Haima and NokTen in 2011, and Dam Break caused catastrophe 2018





- **Due to the serious impacts of recent weather and climate events in the region which affected economic and business operations, the various sectors in the country are beginning to demand for the improvement of increasing hydro-meteorological products and services.**
- **It is therefore critical to prioritize the upgrading of the capabilities of the Department of Meteorology and Hydrology of Lao PDR in providing improved hydrometeorological products and better delivery of services**
- **To be able to address these demands, it is necessary and urgent to put in place or to enhance the very basic requirements for an NMHS to function effectively as follows:**
  - **Adequate networks to monitor hydro-meteorological parameters;**
  - **Robust communication system for data transmission, dissemination of forecasts and sharing of information;**
  - **High speed computing system for data assimilation and numerical weather prediction;**
  - **Human resource equipped with appropriate trainings; and**
  - **more interaction with users of weather and climate information.**

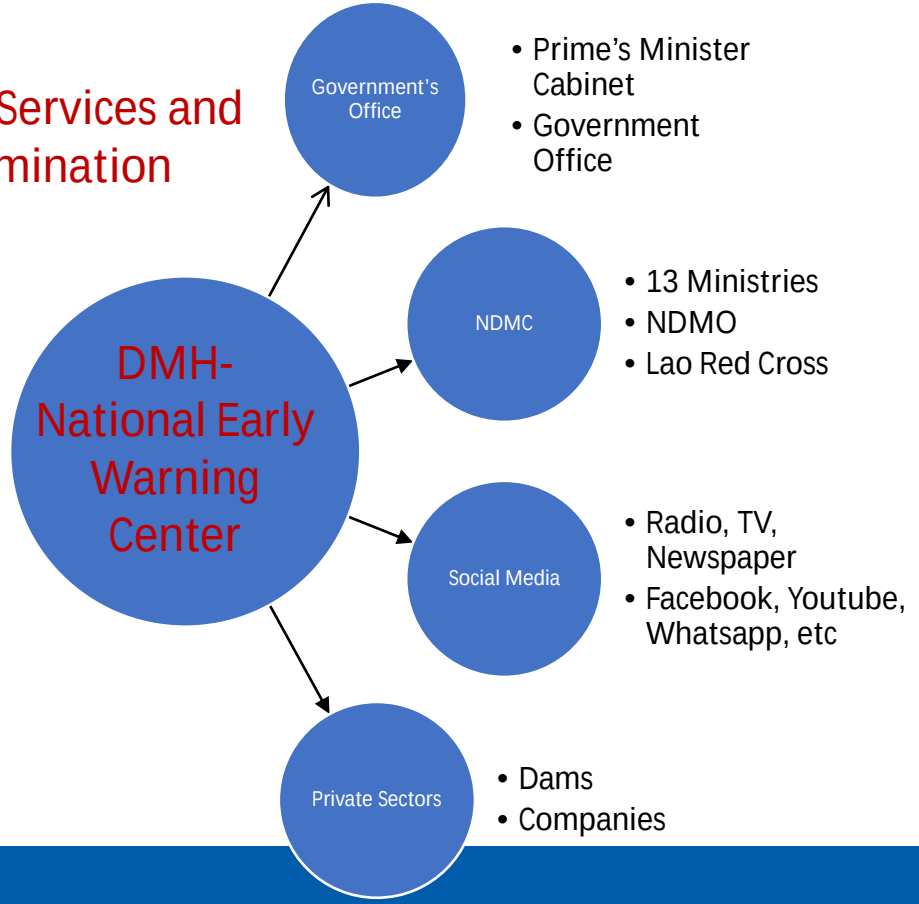
2. Key role of NMHS among various stakeholders in the country, such as central/local government, media and private sectors

- **Lao National Meteorological and Hydrological Service is public agency mandated to provide public meteorological, hydrological, earthquake information and warning services.**

DMH Structure

- Ministry of Natural Resources and Environment (MONRE)
- Department of Meteorology and Hydrology (DMH)
- Provincial Hydro-met Office
- District Hydro-met Observatory
- Meteorological Station
- Hydrological Station
- Rain gauges

Warning Services and Dissemination



3. Challenges you are facing in resource mobilization

- By supporting from foreign donors to modernize of Hydromet in Lao PDR such as Korea, Japan, China, WMO, USAID, AusAID, the World Bank, ADB and FAO
- The selection of stations is based on the main socio-economic development plan, there is no master plan on meteorological and hydrological development.
- Each project has its own unique system which makes it difficult to implement
- Each system requires an upgrade or renew license, which consumes a budget
- Increase training for technical staff, such as short-term, medium-term and long-term to ensure the sustainable management of the system
- Each project must be fully allocated budget to the management and maintenance of equipment within 2 years after the project is handed over.
- System Integration is needed



- **Potential initiatives/actions at national, regional, and global levels**

➢**Regional Level**: Continue hydromet data exchange for free and unrestricted

➢National Level:

- Fostering structured dialogue with the private sector;
- Putting in place appropriate legislation and business models; performing change management and building on core strengths;
- Promoting the uptake of WMO standards and guidance
- Fostering partnerships with civil society entities;
- Exploring new national and cross-border partnerships.

Thank you very much for your kind attention

Greater Mekong Subregion Sustainable Agriculture & Food Security Program

Food and Agriculture Organization of the United Nations

Session 3: Interactive group work to capture sector investment perspectives

From

National Hydro-Informatics Data Center (NHC)

to Local Action

NHC
National Hydroinformatics and Climate Data Center

Dr. Sutat Weesakul
Director of the Hydro-Informatics Institute (HII), Thailand

Mr. Wirit Kavayapanik,
Secretary to the Chief Executive of the Phrae Provincial Administrative Organizations (PAO)

Operation connected between agencies

Ministry of Agriculture and Cooperatives

Ministry of Natural Resources and Environment

Ministry of Interior

Ministry of Transport

52 Agencies
12 Ministries
435 Dataset

Ministry of Higher Education, Science, Research and Innovation

Ministry of Digital Economy and Society

Ministry of Industry

Ministry of Public Health

Ministry of Energy

Ministry of Finance

Ministry of Defense

Office of Prime Minister

Hydroinformatics for Water Management

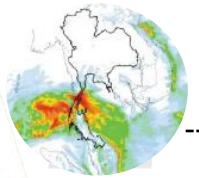
Twelve models on daily operation

HII is the only agency that links an operating system with modeling from "Sky to Sea"

Hydrological Model

Remote Sensing Technology

Seven days rainfall forecast (WRF-ROMS)



Weather Radar

Urban Flood Model

Flash Flood Model

Reservoir Optimization Model

Automated Telemetry Station

Hydrodynamic Model

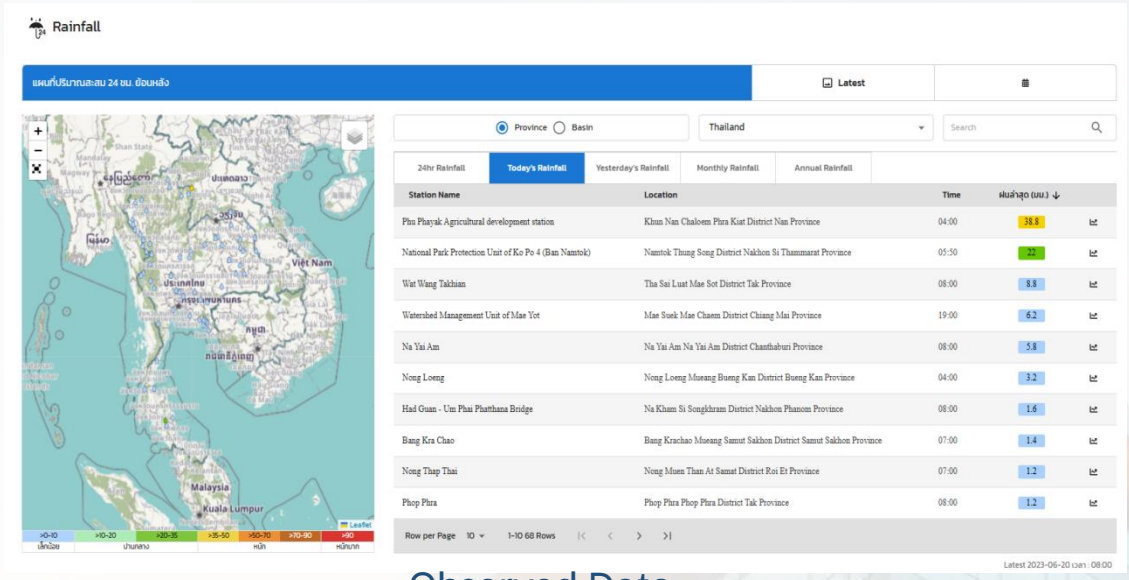
Storm Surge Model

Salinity Intrusion Model

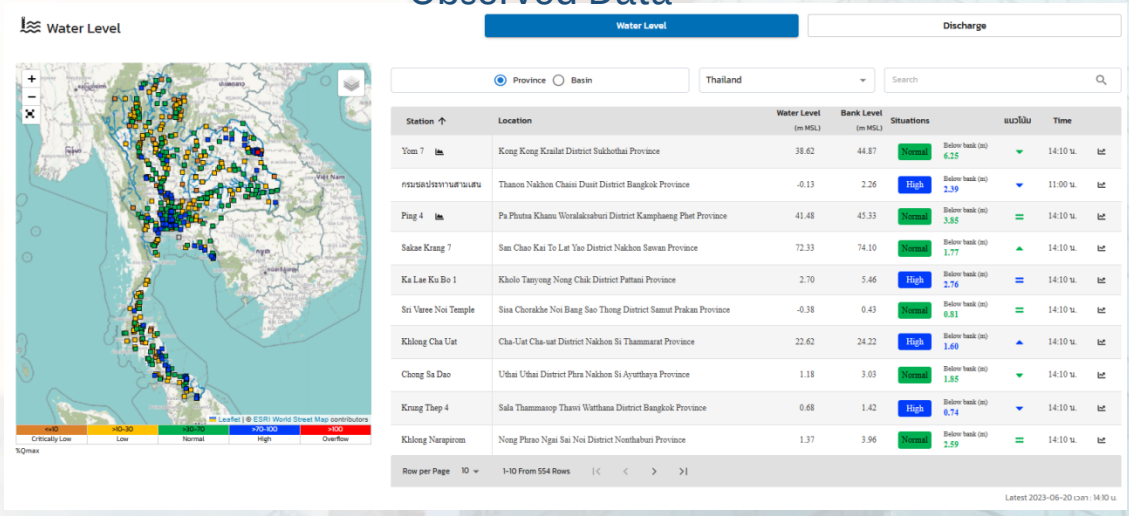
Water Resource Model

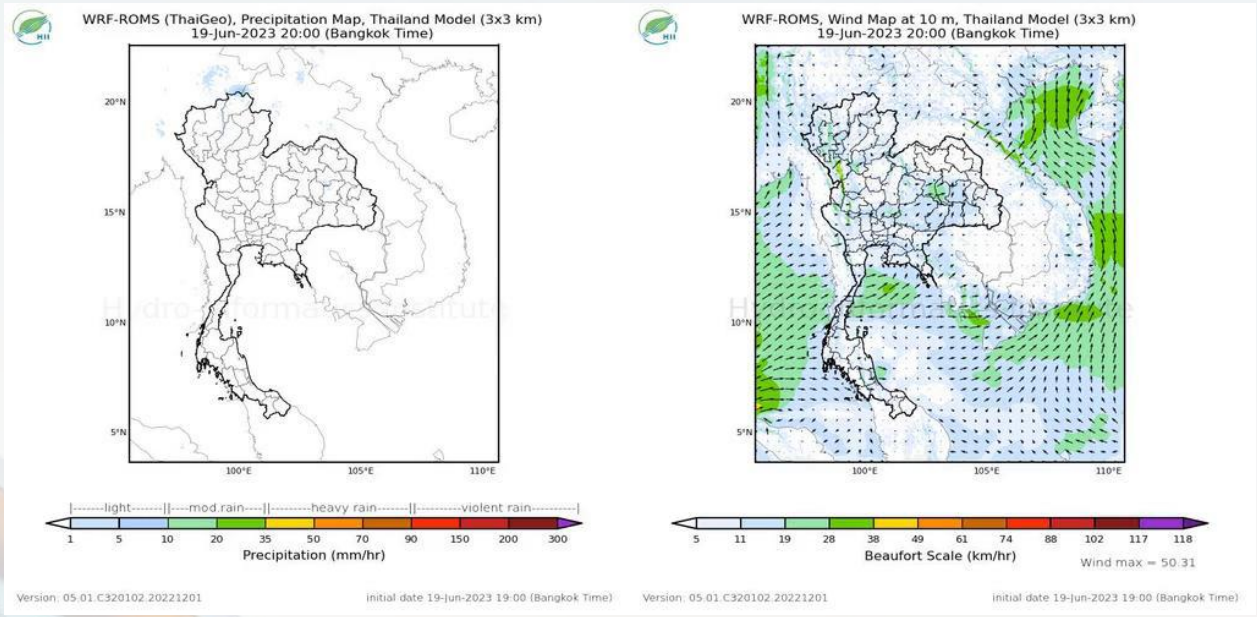
Website and Application “ThaiWater”

Monitor water and weather situation
Suitable for executive, government sector, and public

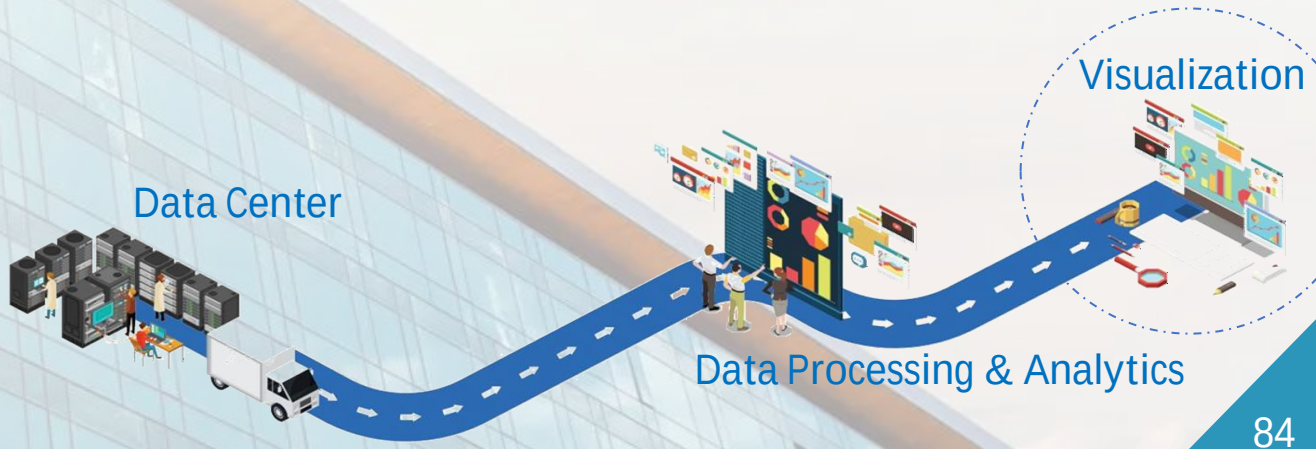


Observed Data





Forecasted Spatial rainfall and Wind direction from WRF-ROMS Model



Sufficiency Economy Philosophy towards Sustainable Development

Integrated Sufficiency Economy Philosophy (SEP) concept with S&T tools moving towards Sustainable Development

SEP — Sufficiency Economy Philosophy

S&T — Science and Technology

SDGs — Sustainable Development Goals: SDGs

Knowledge : Learning and doing

Moral: Community's rule and regulation to collaborate together with fairness and transparency

Reason: Availability of Information, Fact, and Analysis

Moderate: Management, Planning, & Monitoring

Immunity: Preparation for Climate change and Disaster Risk Reduction

Science and Technology transfer to create:

- Community's background information
- Water map
- Water chart
- Water Balance

Knowledge transfer from 60 core communities

- Guideline on water resources development
- Guideline on water resources management

Land, Water, Forest, & Energy security

- Water for consumption and agriculture

Food security

- Agroforestry and New-theory agriculture (Integrated agriculture)
- Collaboration on planning, production and marketing

Economy security

- Reduce expenses, increase income, reduce debt, increase savings, and community fund

Social security

- Better livelihood
- Good Governance, strong community and expandable network

The community can be Self-management on soil, water, and forest, increase water for drinking, consumption & agriculture, Increase income, Risk management, Immunity, lead to Security and Sustainability of the people






LINKAGE to the Local Community

The 2011 Chao Phraya Flood:
The world's fourth costliest disaster (as of 2011)

Overflowing Yom River level in Phrae remains steady, but Districts of Sung Men, Den Chai, Long, and Wang Chin Raises Concerns

Published on 3 August 2011, 10:45 am by MGR Online

2012: Drought problems

Severe Drought in Phrae: Yom River Runs Dry

Published on 26 Feb 2012, 11:51 am

"Drought Crisis in Phrae Province Continues to Be Concerning: Severe drought change the upstream of Yom river's weir to villagers' cattle farming."

Phrae Province recognizes the importance of hydroinformatics in the area

June 2013
Establish "Phrae Provincial Water Resource Management Center"

Integrated Water Management to Local Communities

National Hydroinformatics Data Center: NHC

- Enhance water management analysis and data processing
- Link and exchange “data" with relevant agencies.
- Utilize information systems for monitoring, analyzing, and forecasting water situations.
- Manage water resources cohesively during normal and critical situations.

Information system for situation monitoring

Phrae Water Resources Management Center

ศูนย์บริหารจัดการน้ำจังหวัดแพร่
Phrae Water Resources Management Center

Preparation for normal and crisis situations

- Management during normal and crisis situations
- Planning, rehabilitating, maintaining, and development
- Monitoring the progress of development projects
- Link data between local and central levels promptly for action anytime

Demand - water usage
Supply - water capital
Logistic - water diagram
Management - water management
Money - budget

Past
- No water accounting for reservoir volumes
- Most of the reservoirs cannot be used and managed

Process
- Survey 164 reservoirs
- Rehabilitated over 100 reservoirs

Present (2023)
- Rehabilitated 25 reservoirs (7 reservoirs in Saroi Sub-district)

Integrated Water Management to Local Communities

National Hydroinformatics Data Center: NHC

HII's Data & Knowledge Management Center

Phrae Water Resources Management Center
2013

Collaborate with HII & local
Convey knowledge
Collect water data

Community Water Management School
2017

Sharing Knowledge
to All Head of Villages:
Water Map & Diagram
Water Data Collection
Water Accounting

Water Diagram – Data : Sub district – Village level

Knowledge to Action
Head of Village and Villagers' team collect and gather water data, map and diagram

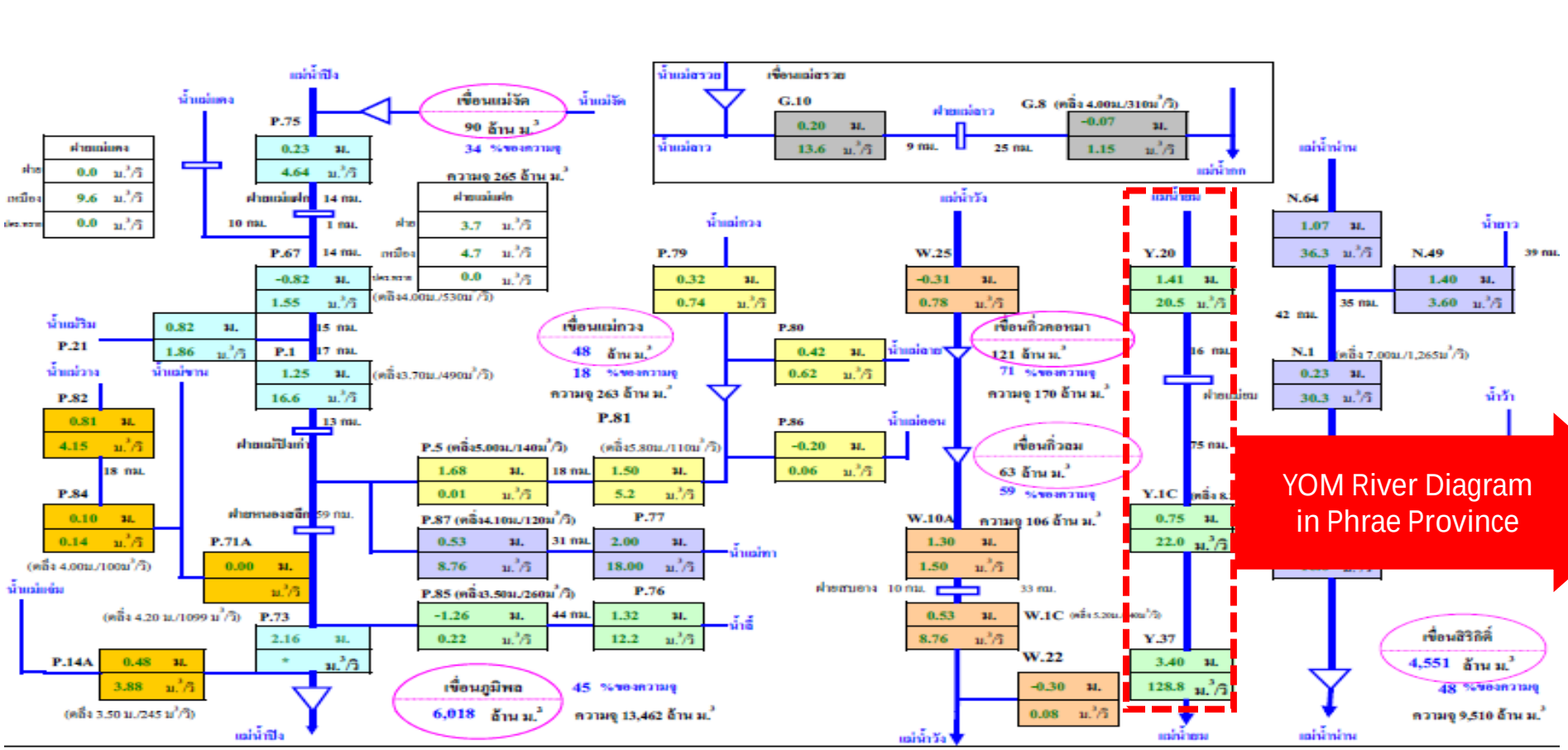
Water Diagram – Data : Yom sub-river basin

Data Linkage
water data, map and diagram of each village, sub district, and district link to be Yom sub-river basin data

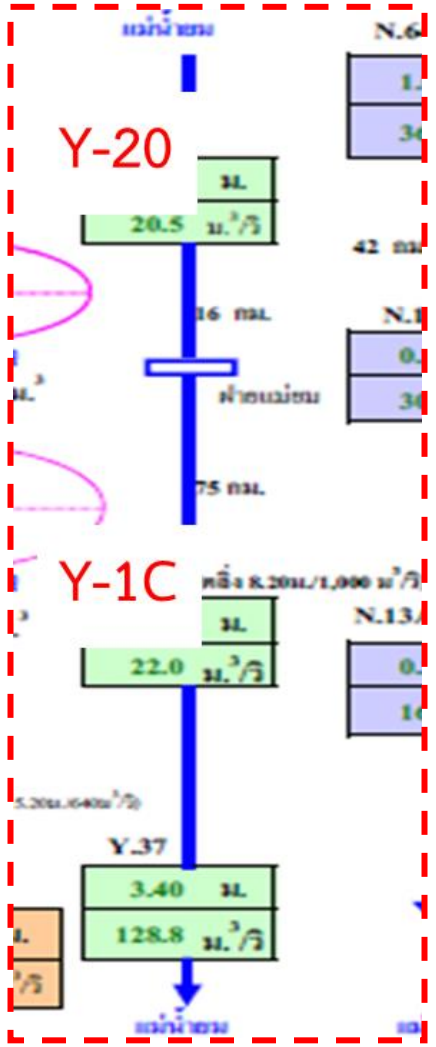
Water Resource Management Yom sub-river basin

Local Action
Yom sub-river basin management by Phrae Water Resources Management Center

National Level: YOM River Diagram by Government Agency



YOM River Diagram in Phrae Province



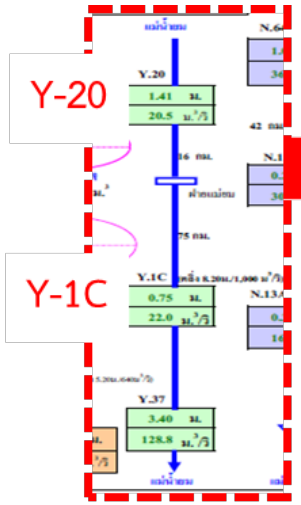
Dams

Rivers

Watergates

Provincial Level: YOM River Diagram
by Phrae Water Resources Management Center

ผังน้ำจังหวัดแพร่

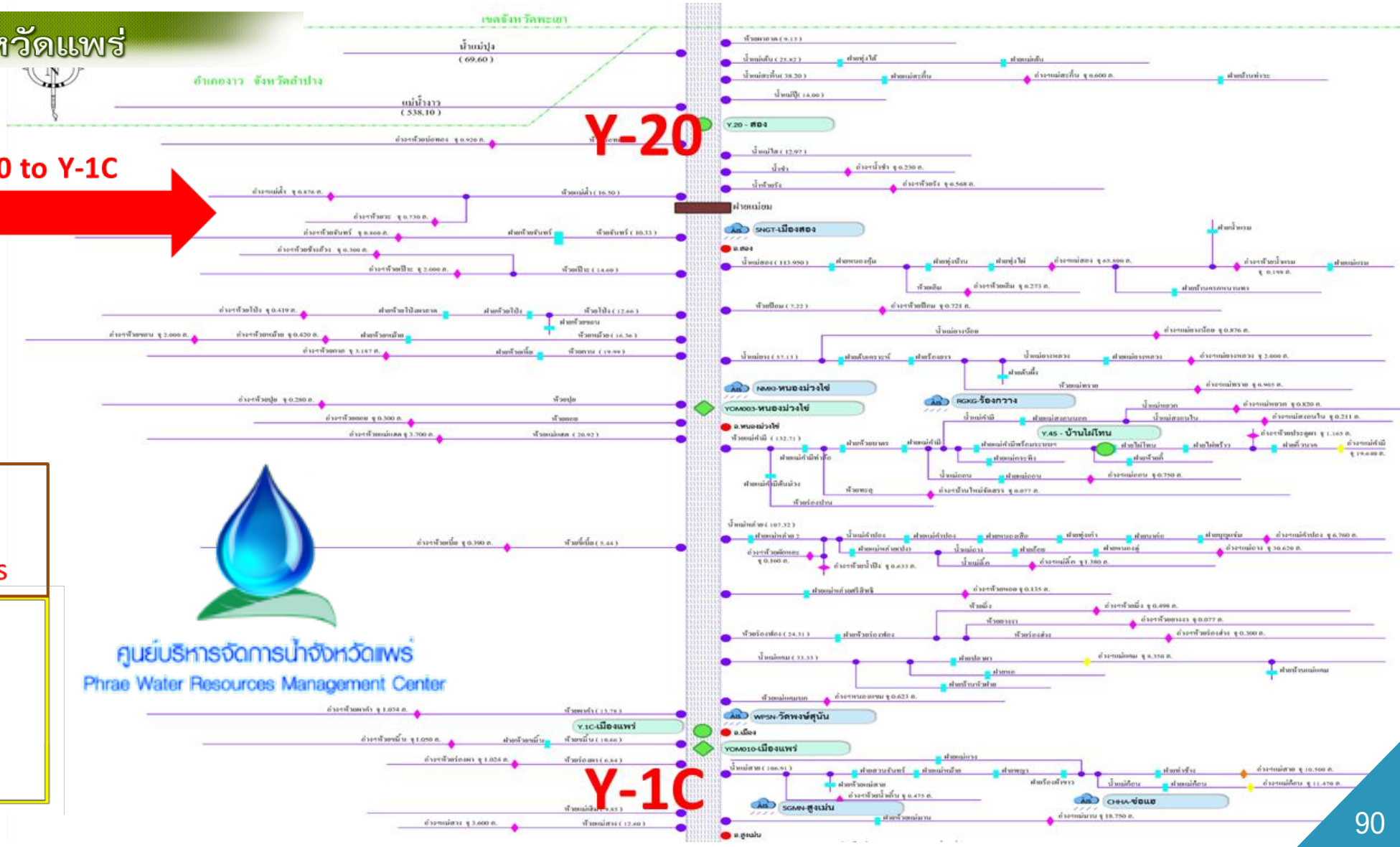


Y-20 to Y-1C

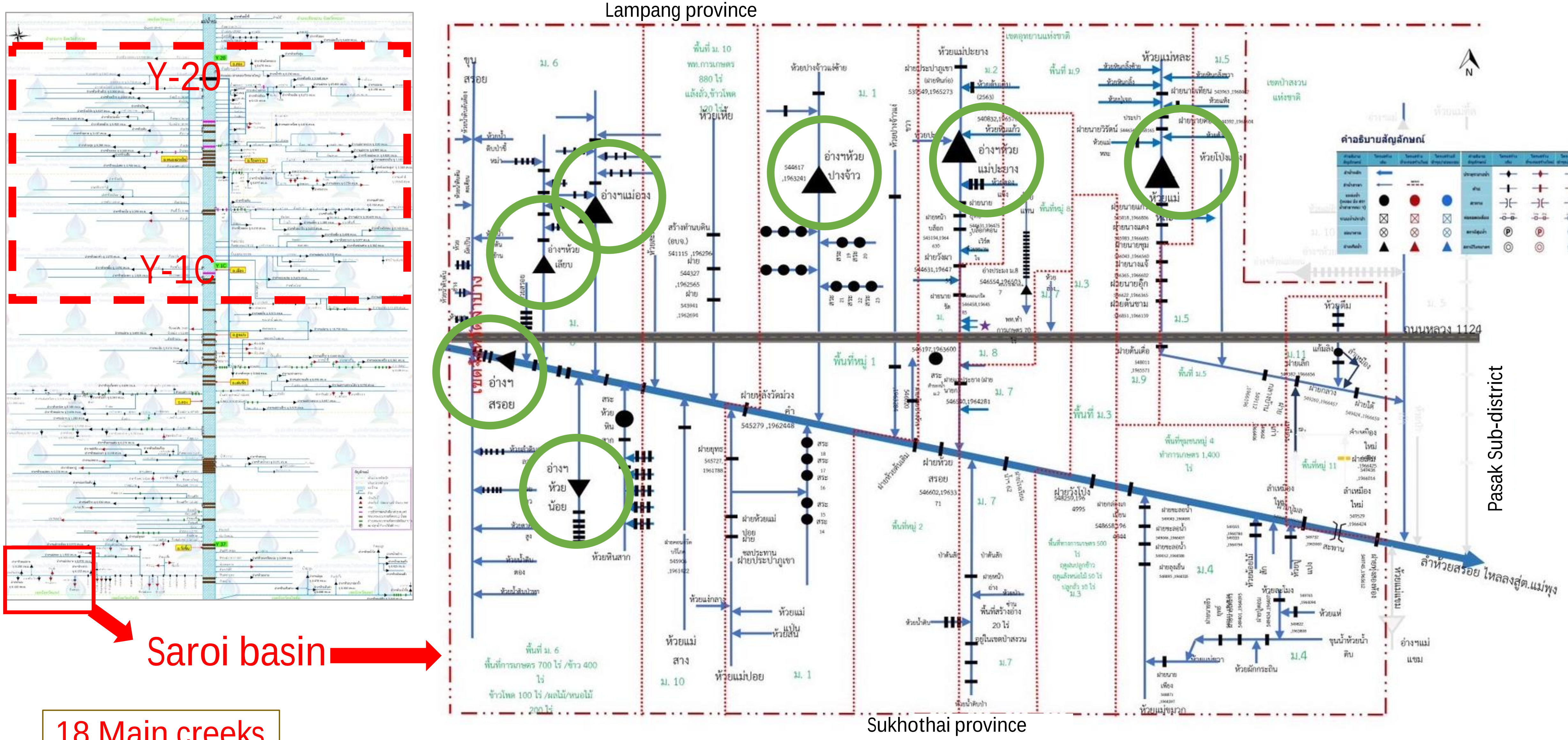
Add up:
- 36 Creek branch
- 164 small reservoirs

สัญลักษณ์
- เส้นแบ่งเขตจังหวัด
- แม่น้ำ
- ห้วย
- ฝาย
- อ่างเก็บน้ำ(สร้างเสร็จแล้ว)
- อ่างเก็บน้ำ(กำลังก่อสร้าง)
- อ่างเก็บน้ำ(มีแผนก่อสร้างในอนาคต)
- สถานีตรวจอากาศอัตโนมัติ AIS
- สถานีตรวจวัดน้ำท่ากรมชลประทาน
- สถานีตรวจวัดระดับน้ำ สสนก.

ศูนย์บริหารจัดการน้ำจังหวัดแพร่
Phrae Water Resources Management Center



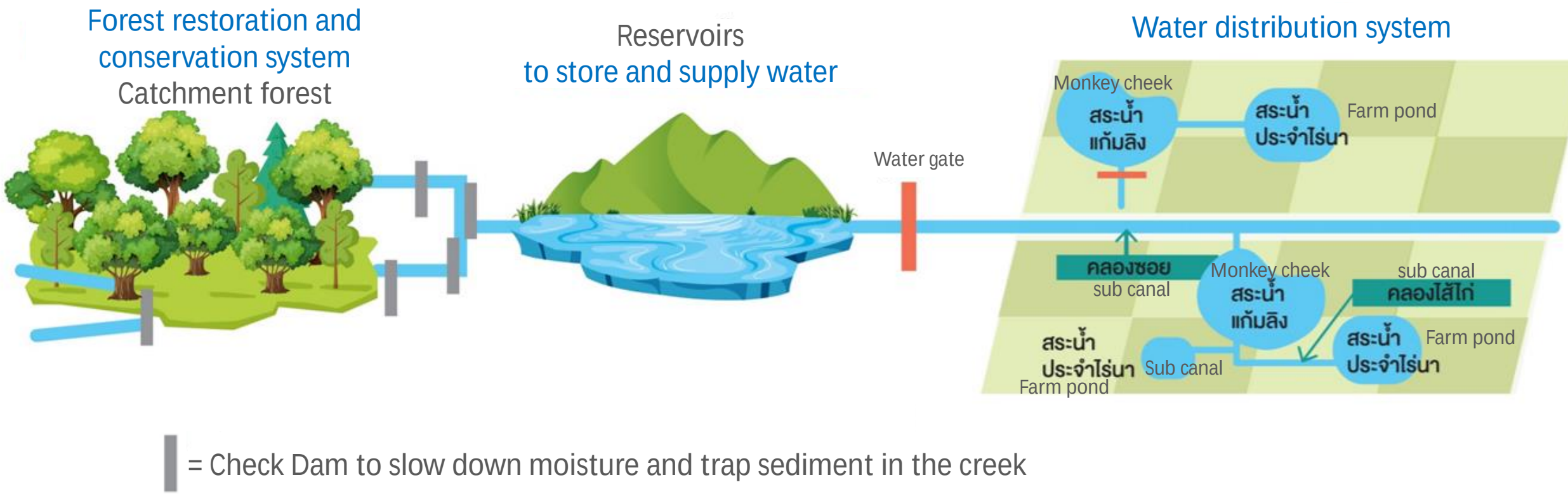
Local/Community Level: Saroi Basin Diagram by Mae Kaming Community



18 Main creeks
49 Sub-creeks

= Rehabilitated reservoirs in Saroi basin (Total 7 reservoirs)

Technique: Medium and Small-Scale Water Reservoir Systems

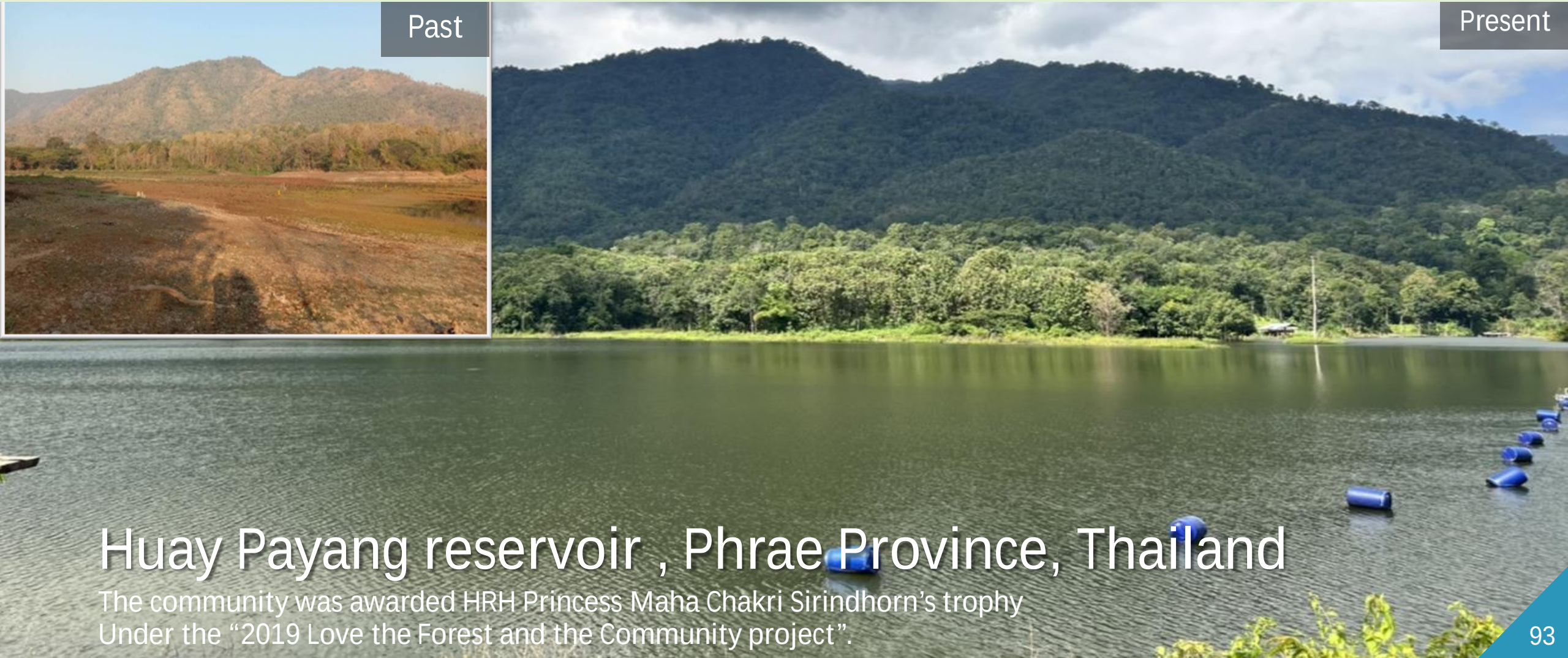


Water management for self-reliant communities, aims to reduce flood and drought disasters and ensure water security in crisis situations, so the communities will have enough access to clean drinking and consumption water.

How data from NHC can be Implemented at local level?

Good Practice: Mae Kaming Community, Saroi Sub-district, Wang Chin District, Phrae Province

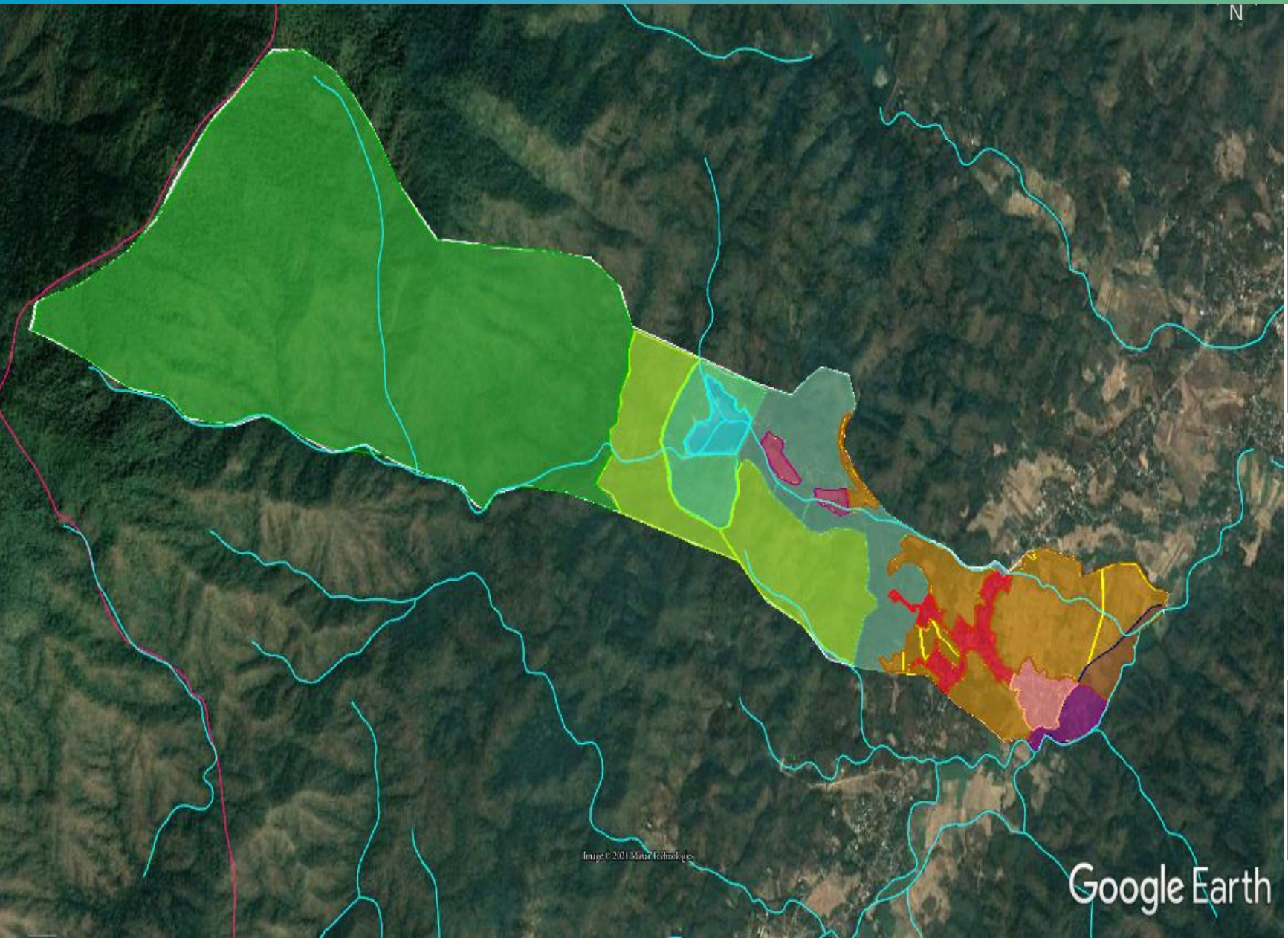
Past: Flash floods and landslides in Saroi sub-district in 2001. A year later, Huay Payang reservoir, a small reservoir with a capacity of 650,000 m^3, which can supply water for the community 3 times per year. However, community's water scarcity, shallowed water resources, and insufficient water supply were remained unresolved.
Present: Reuse water 6 times per year.



Huay Payang reservoir , Phrae Province, Thailand

The community was awarded HRH Princess Maha Chakri Sirindhorn's trophy
Under the "2019 Love the Forest and the Community project".

Land use map of Mae Kaming Moo 2,
Saroi Sub-district, Wang Chin District, Phrae Province



Forest
647.36 ha.
(65%)

- National park forest (520.32 ha.)
- Reserved forest (14.24 ha.)
- Community forest (33.92 ha.)
- Agricultural land reform area (78.88 ha.)

Residential
188 ha.
(19%)

- Residential area 188 ha., 235 households, 785 ppl.
- Area with water security 42% 330 people
- Area without water security 58% 455 people

Agriculture
135.84 ha.
(13%)

- Area of agricultural land 135.84 ha.
- Area of agricultural land suitable for cultivation in rainy season (119.2 ha.)
- Area of agricultural land suitable for cultivation in rainy and dry season (16.64 ha.)

Water
31.68 ha.
(3%)

- Flooded area (19.68 ha.)
- Reservoir's area (12 ha.)
- Waterway

Reforestation

Water-related Development

Agriculture

From 2017 – present: built 400 check dams (into the forest area only)

Water Accounting of
Mae Kaming Moo 2, Saroi Sub-district, Wang Chin District, Phrae Province

Water Capital

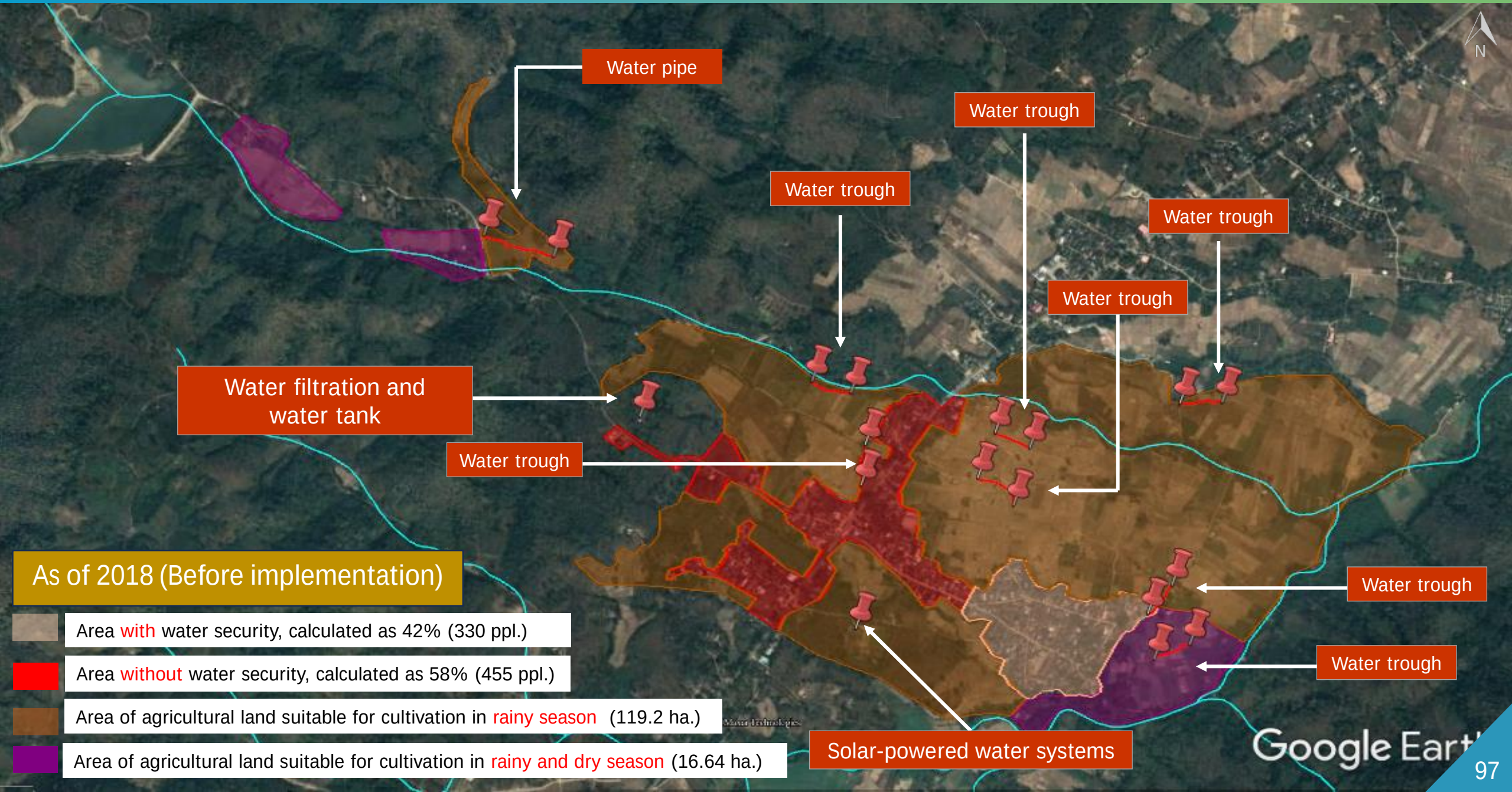
Before implementation (2018)		After implementation (2023)	
Rainwater	8,390,266 m³	Rainwater	8,390,266 m³
Water storage	967,000 m³	Water storage	1,371,800 m³

Water Demand

Before implementation (2018)		After implementation (2023)	
Drinking water	1,146 m³	Drinking water	1,146 m³
Water for consumption	34,383 m³	Water for consumption	34,383 m³
Water for livestock	74,059 m³	Water for livestock	74,059 m³
Water for agriculture	893,682 m³	Water for agriculture	893,682 m³

Total Demand = 1,003,270 m³

Ban Mae Kaming Moo 2's Implementation for Water Security Development



Water Security: from 2018 - present

Summary of the progress in water security

in Mae Kaming Moo 2, Saroi Sub-district, Wang Chin District

Water Security in Ban Mae Kaming moo 2	Beneficiaries	Water demand (m^3)	Water supply in 2018 (Before implementation)	Water supply (After implementation)		
				2021	2022	2023
Drinking water	785 ppl.	1,146	0 ppl.	330 ppl.	445 ppl.	785 ppl.
Water for consumption	785 ppl.	34,383	0 ppl.	330 ppl.	445 ppl.	785 ppl.
Water for agriculture (Rainy season)	135.84 ha.	893,682	135.84 ha.	135.84 ha.	135.84 ha.	135.84 ha.
Water for agriculture (Dry season)	16.64 ha.	155,000	0 ha.	16.64 ha.	119.2 ha.	135.84 ha.

Water for consumption ➔ Expanded to 1,538 people, 3 villages in Saroi Sub-district
Drinking water ➔ Plan to expand to Moo 1, 7, 8 in Saroi Sub-district, Wang Chin District in 2023

Local Action
Mae Kaming Community, Saroi Sub-district, Wang Chin District, Phrae Province

2011

Big Flood and Land Slide
Saroi Sub-district

Caused: degraded forest

Crisis

2012->

Reforestation
Recovery Ecosystem

over 400 checked dams
in 62 ha. (from total 647.36
ha. of forest area)

Water Capital

2018

Water
Data – Map – Diagram

School's knowledge to action:
Water Data Collection
Water Map + Diagram
Water Accounting

Water Data

2023

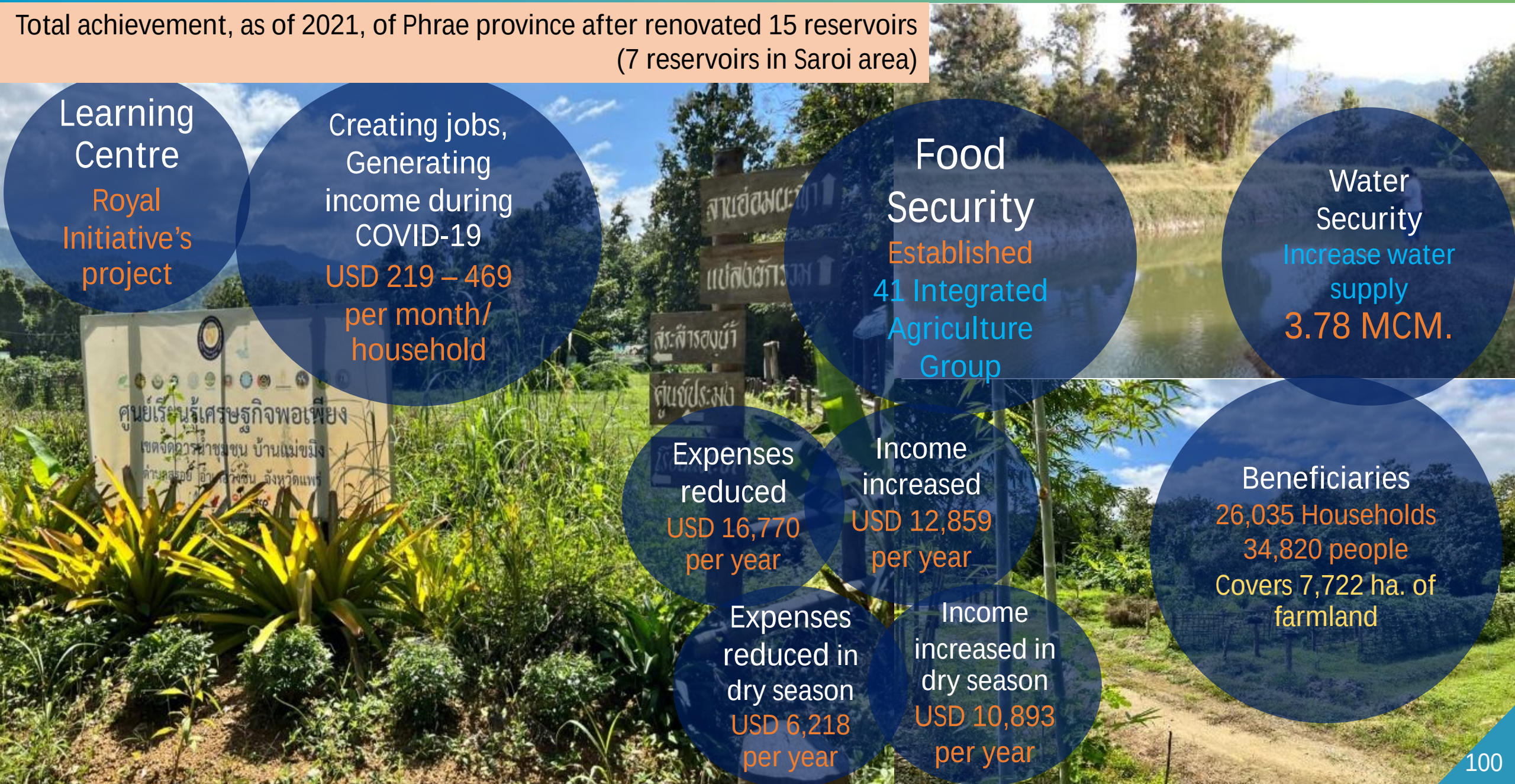
Water
Resource Management

- Whole Year Water Usage for Consumption and Agriculture
- Learning Center for youth & others
- Prototype of Reforestation, Medium and Small-Scale Water Reservoir Systems, and Good Governance

Environment Social
Good Governance

Achievement: Reforestation and improvement of water resource structure. (2017-2021)

Total achievement, as of 2021, of Phrae province after renovated 15 reservoirs
(7 reservoirs in Saroi area)



Learning Centre
Royal Initiative's project

Creating jobs, Generating income during COVID-19
USD 219 – 469 per month/ household

Food Security
Established 41 Integrated Agriculture Group

Water Security
Increase water supply
3.78 MCM.

Expenses reduced
USD 16,770 per year

Income increased
USD 12,859 per year

Expenses reduced in dry season
USD 6,218 per year

Income increased in dry season
USD 10,893 per year

Beneficiaries
26,035 Households
34,820 people
Covers 7,722 ha. of farmland

Thank you!

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Session 3: Interactive group work to capture sector investment perspectives

Break-out group discussion - What does this mean for the design of future investments in water, food, and energy?

Discuss actual operational steps for benefiting from a water accounting framework as well as how sectors can effectively contribute to effective water accounting

ADB

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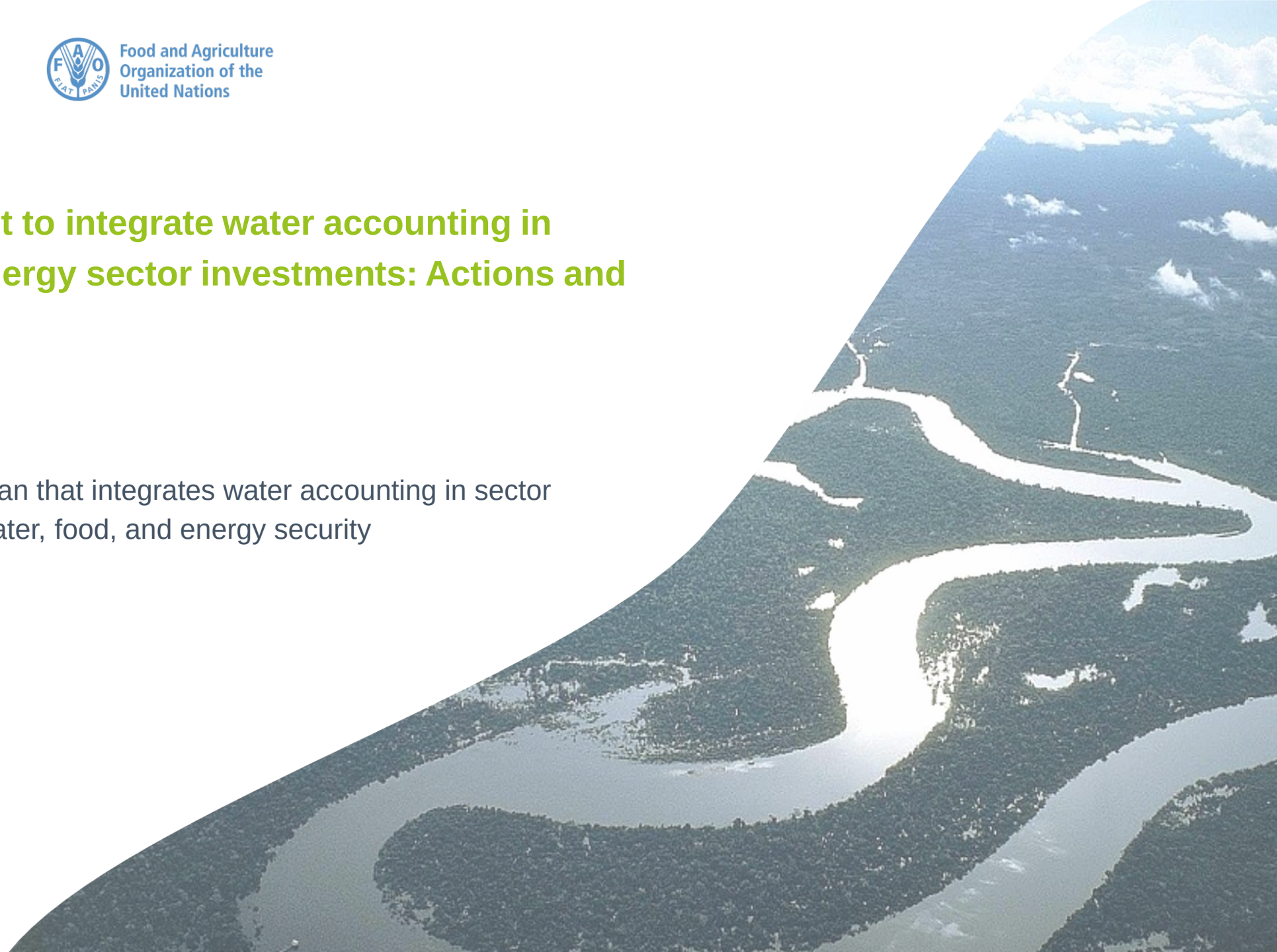
Summary of how best to integrate water accounting in future water, food, energy sector investments: Actions and sector benefits

Plenary discussion

Towards a regional action plan that integrates water accounting in sector investments for improved water, food, and energy security



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Leave us your feedback!