



Treated Wastewater as NON-CONVENTIONAL WATER RESOURCES, NCWR, and its potential role in Water Management in Lebanon

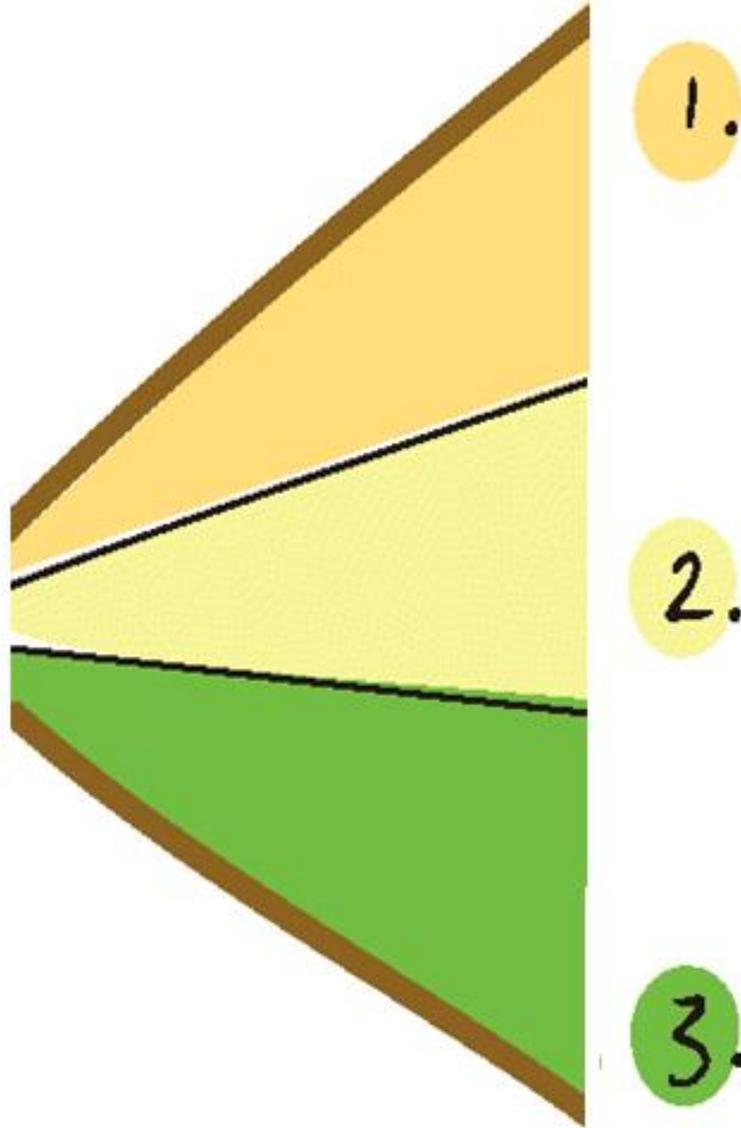
Dr. Ahmad ELMOLL, UL

☎ [+961 70 724979](tel:+96170724979)

✉ aelmoll@ul.edu.lb

Treated Wastewater as NCWR, and its potential role in Water Management in Lebanon

Treated Wastewater as NCWR and its potential role in the management of water resources in Lebanon



1) Impact of climate change on the water cycle in Mediterranean region and study the implications for agriculture

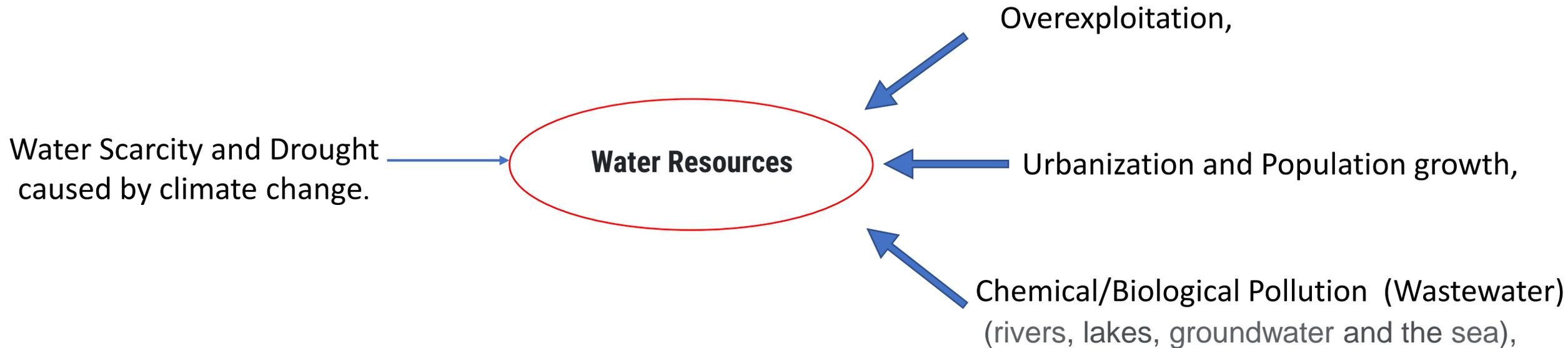
2) Innovate with wastewater for a sustainable water resource in the Mediterranean region. Wastewater treatment to optimize treatment technologies and offer sustainable solutions, wastewater can be safely managed as an effective investment in agriculture sector and ecosystems.

3) The use of treated domestic wastewater for farming irrigation using WebGIS as a tool to draw up action plans for the reuse of treated wastewater. Due to rising water use in recent years, especially in agricultural sector and increasing pressure on freshwater resources in water deficit regions, using of NCWR has been considered as a solution for water requirements in agricultural sector.

Water Resources in the Mediterranean Region

The majority of Mediterranean basins are overexploiting their water resources, and the situation is likely to worsen with the impact of climate change.

Population growth, human development, and climate change are today the main drivers that increase the pressure on water resources, in both quantity and quality.



Scarce water resources is one of the strongest factors affecting agriculture and the livelihoods of farming communities

I. The water cycle in the Mediterranean Region and the impacts of climate change

The climate change has an impact on the quality, quantity and availability of water resources, agriculture production and human health around the world and in particular in the MENA region.

This impact on water is observed via the water cycle diagram and global warming alters almost all the stages of the diagram (evaporation, precipitation, condensation etc.).

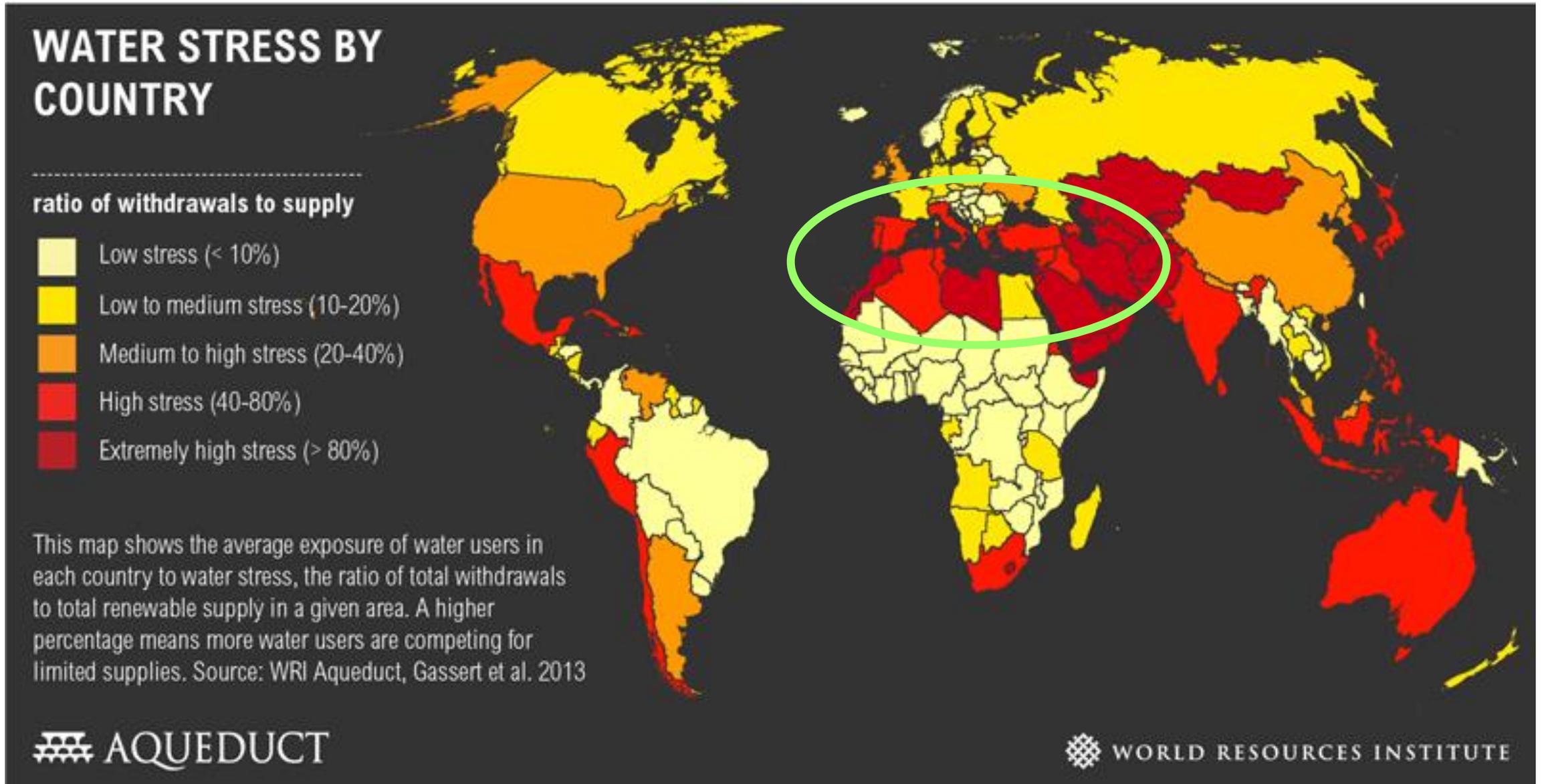
I. The water cycle in the Mediterranean Region and the impacts of climate change

Water stress and shortage in the Mediterranean basin

The Mediterranean Basin is one of the regions in the world most vulnerable to climate changes, as well as one of the most impacted by human water demand. [1]

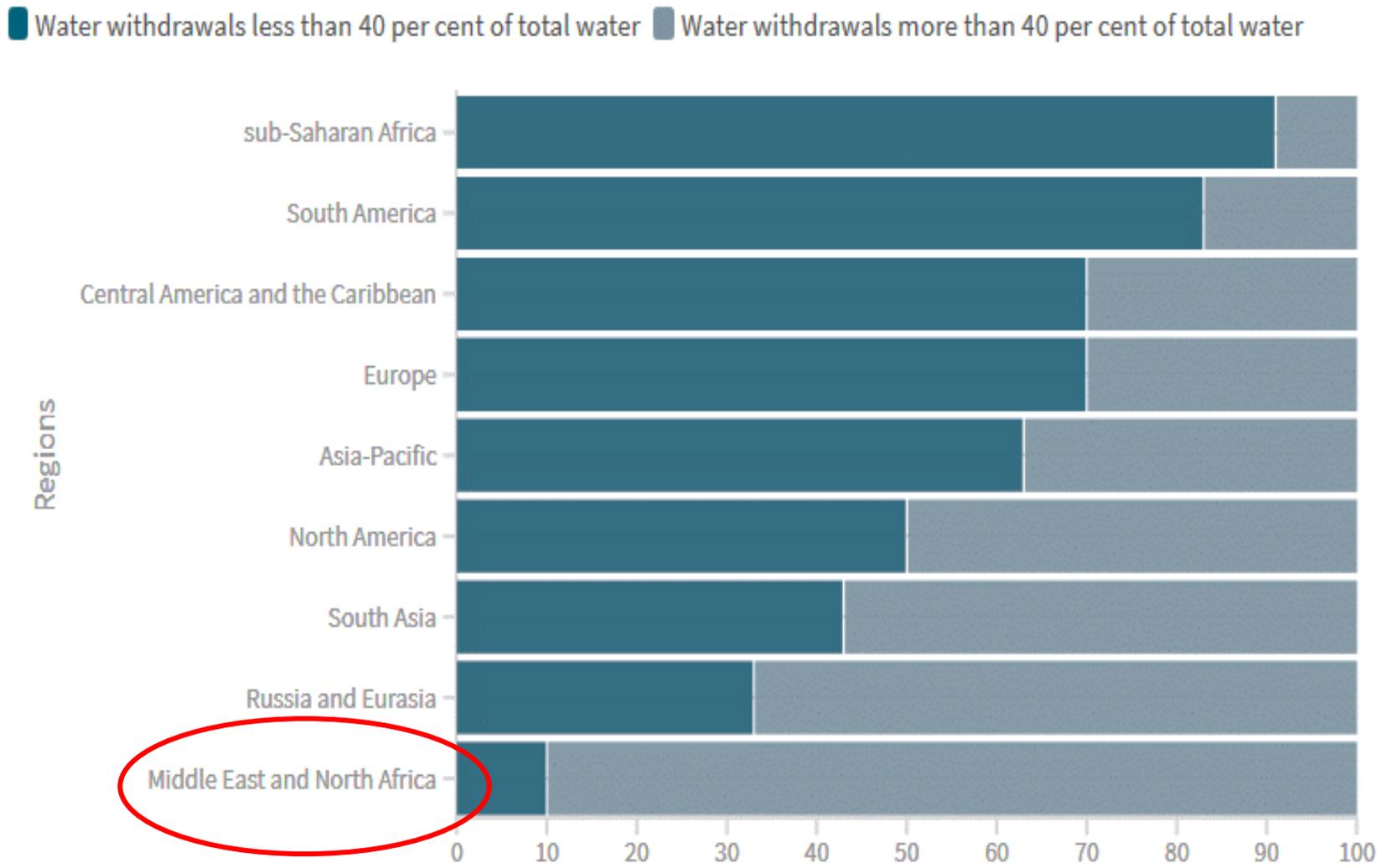
The main cause of the water stress suffered by the Mediterranean and Middle East is the increasing use of natural resources by the rising population and the higher demand for water per capita. [2].

I. The water cycle in the Mediterranean Region and the impacts of climate change



Nawamed, Thursday, July 29, 2021: Barriers for the uptake of WDM/NCWR in Lebanon.

I. The water cycle in the Mediterranean Region and the impacts of climate change



Percentage of countries with high or extreme water stress by region, 2040 predictions

In the Mena region, 90 per cent of countries will face high to extremely high water stress by 2040

Source: WRI, Institute for Economics and Peace calculations

I. The water cycle in the Mediterranean Region and the impacts of climate change

The hydrological cycle in the Mediterranean region is thus a key scientific, environmental and socio-economic issue in a large region that includes Middle East and the North Africa, MENA

The water extraction in water scarce part of the region like the Southern and Eastern rim countries are exposed as overriding management issues.

Furthermore, climatic variations are superimposed on natural hydro-stress and water dependency on external resources in most of the cases.

Climate change affects the entire water cycle.

It negatively impacts the quantity and quality of water resources, increases the pressure on them and increases the risk of natural disasters. These variations will have strong human, economic and environmental repercussions, which already affect and will primarily affect the most vulnerable populations.

I. The water cycle in the Mediterranean Region and the impacts of climate change

Feeding 9 billion people by 2050 will require a 60% increase in agricultural production, (which consumes 70% of the resource today), and a 15% increase in water withdrawals.

By 2025, about 1.8 billion people will be living in regions or countries with absolute water scarcity. Water security is a major – and often growing – challenge for many countries today.

Cooperation is needed to achieve optimal water resources management and development solutions for all riparians.

To deal with these complex water challenges, countries will need to improve the way they manage their water resources [3]

⇒ [NCWR can play a significant role in sustainable water resources protection and management in the Eastern Mediterranean Region: case of Lebanon](#)

[3] www.worldbank.org/en/topic/waterresourcesmanagement, Sep 20, 2017]

II . Innovate with wastewater for a sustainable water resource in the Mediterranean region

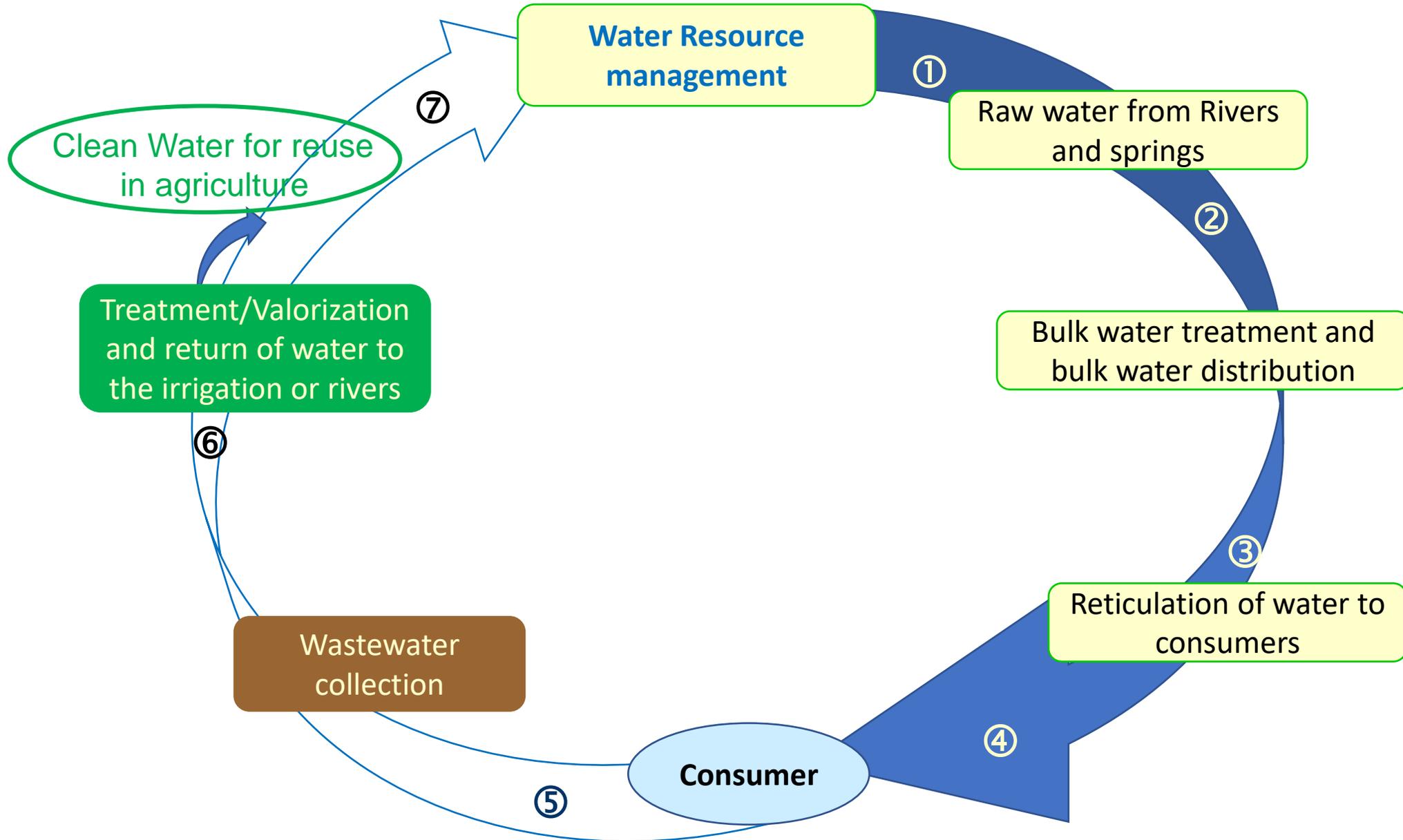
Achieving a Sustainable water resource in the Mediterranean region.

Paradigm shifts are necessary to achieve the Sustainable Development Goal for Water in Mediterranean region.

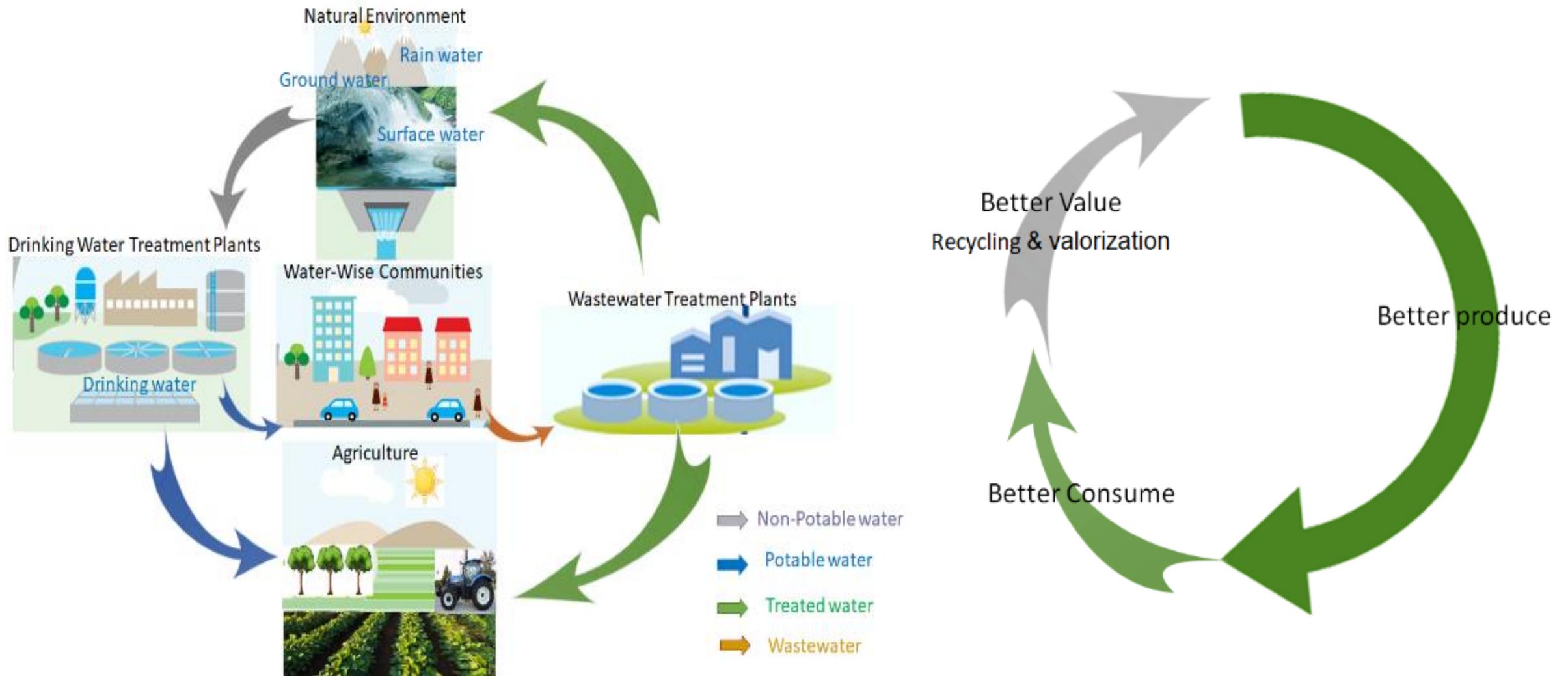
From Wastewater Treatment to Resource Recovery. Take in account the efforts to address the highest priority problems within hydrologically-defined geographic areas, taking into consideration all sources of water.

While sharing similar water resource challenges and being exposed to emerging drivers and pressures such as climate change, increasing water scarcity, Untreated wastewater and Economic Slowdown

L'économie circulaire appliqués à l'eau

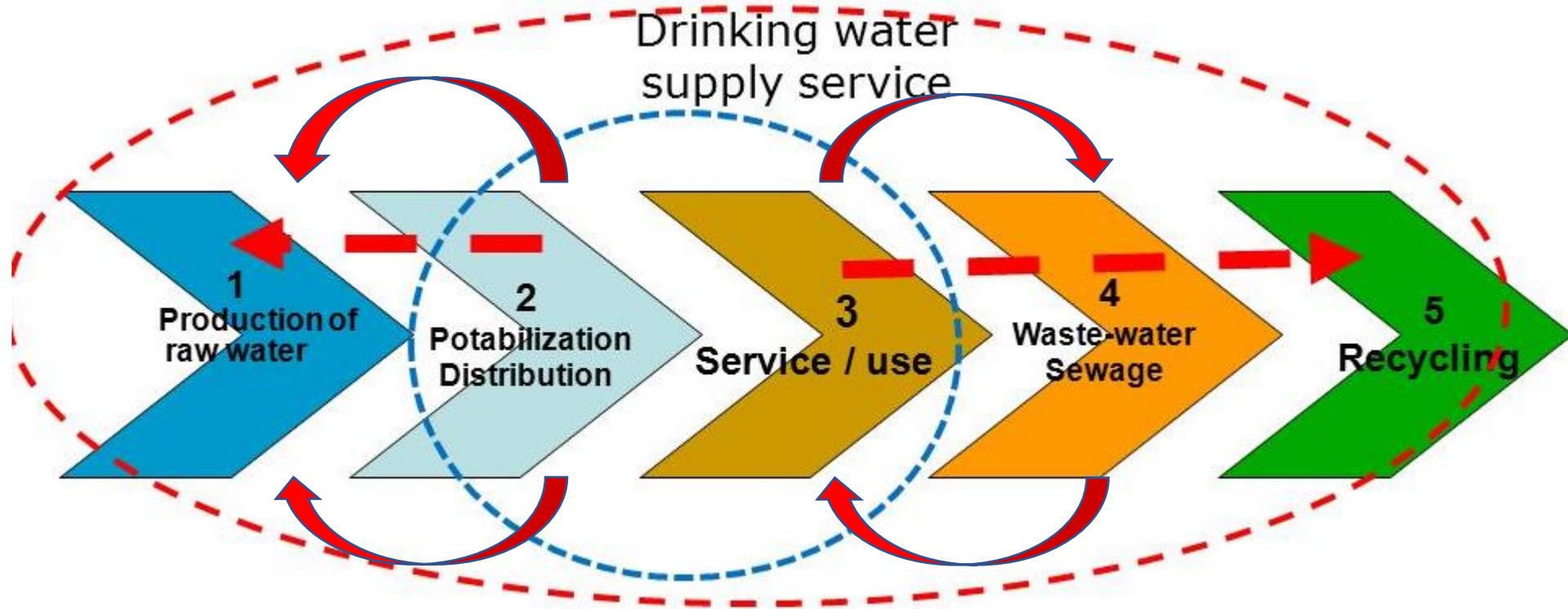


L'économie circulaire appliqués à l'eau



Stratégie pour une gestion durable de ressources en eau

Les systèmes d'approvisionnement en eau durables devraient fournir une quantité d'eau adéquate et une qualité d'eau appropriée pour un besoin donné, sans compromettre la future capacité de fournir cette capacité et cette qualité.



Gestion durable des ressources en eau: Pour décider si un système d'eau est durable, diverses considérations écologiques, économiques, et sociales doivent être prises en compte.

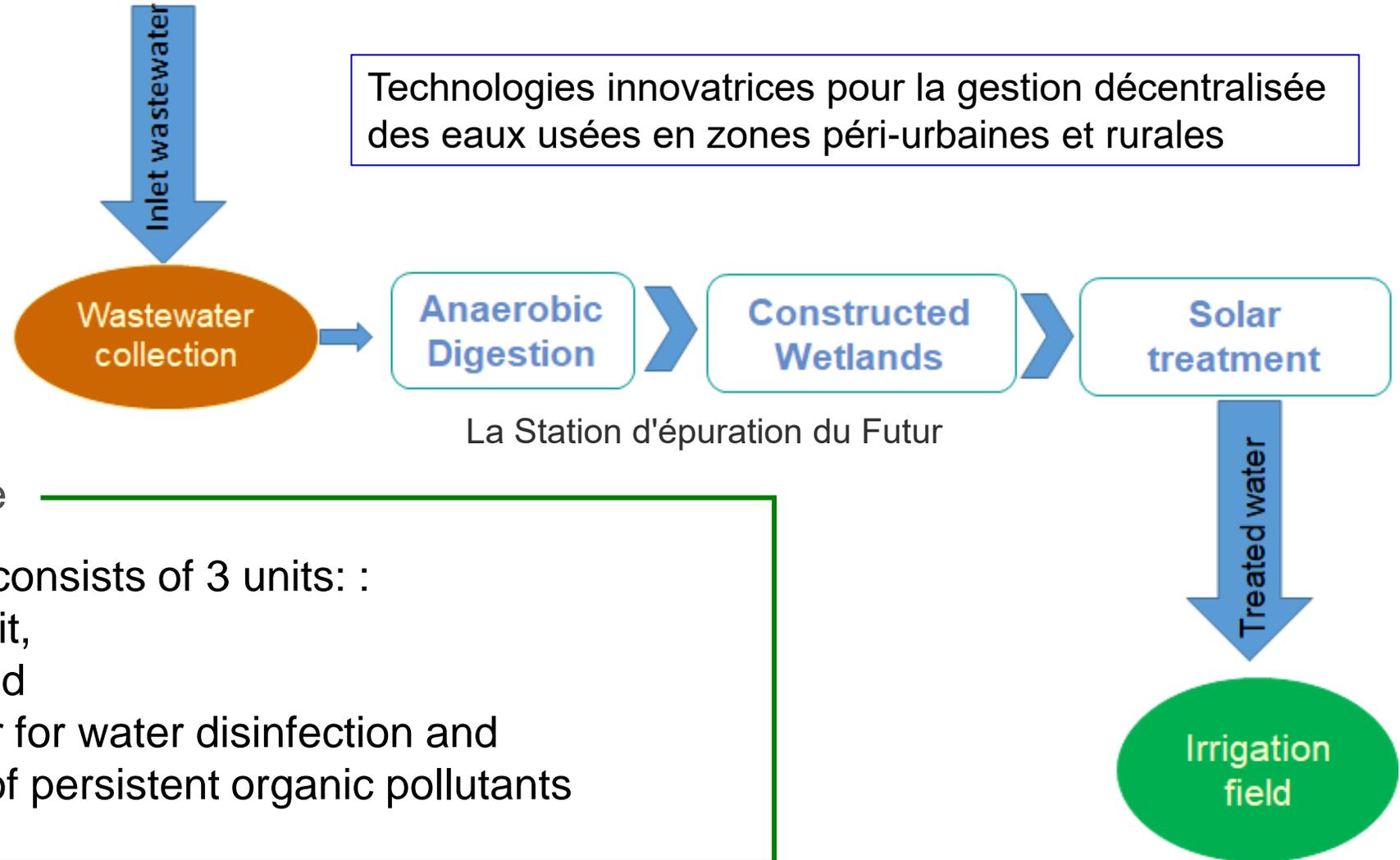
The use of treated wastewater for irrigation

NCWR, including rainwater capture, Greywater re-use and recycled wastewater, are means to make a **valuable resource from waste products**

Technology can help the transition to a more sustainable approach to the increasing demand for water, through **improved efficiency, re-use and recycling**

Technologies de traitement des eaux usées, le Système Décentralisé

Effluents from
domestic wastewater



Performance du Système

The eco-innovative system consists of 3 units: :

- an anaerobic digestion unit,
- a constructed wetland and
- a solar treatment reactor for water disinfection and photocatalytic oxidation of persistent organic pollutants

II . Innovate with wastewater for a sustainable water resource in the Mediterranean region

Treated Wastewater as a potential 'new' source of clean water for irrigation

Wastewater is increasingly recognized as a potential 'new' source of clean water for irrigation and others uses, resulting in social, environmental and economic benefits.

We discusses in this part the potential of recycled wastewater to become a significant source of clean water for irrigation purposes in the context of circular economy in support of the Sustainable water resource in the Mediterranean region.

Technologies de traitement des eaux usées, le Système Décentralisé

Water Demand Management/
NCWR

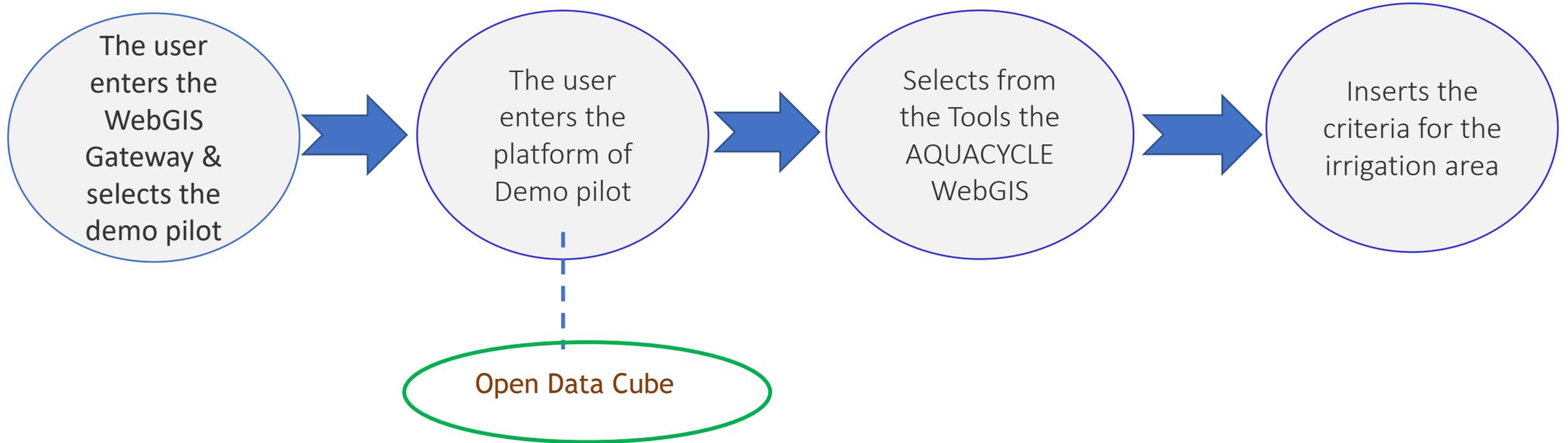
to create a more secure regional
water future, especially in the
Eastern Mediterranean.

In this part will explore how wastewater is a valuable resource in the circular economy and how it can be safely managed as an efficient investment in the agriculture sector and ecosystems.

The use of treated domestic wastewater for farming irrigation using WebGis

WebGIS,

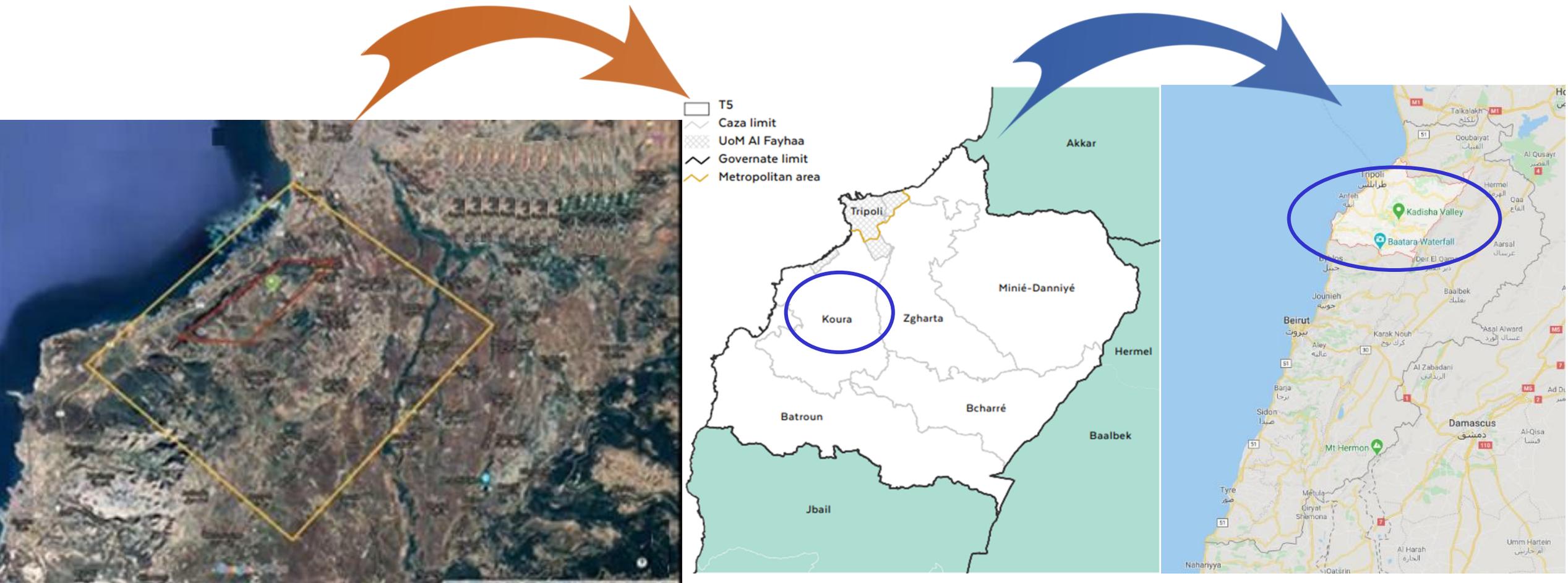
- 1) tools to guide users to optimum wastewater reuse action plans.
- 2) To invite local communities to bring their suggestions as well as preferences for the reuse of treated wastewater.



Use of non-conventional water resources : considered as a solution for water requirements in agricultural sector.

Satellite images of the demonstration location sites in Lebanon,
Station pilote de démonstration pour le traitement et la réutilisation des eaux usées





Nawamed, Thursday, July 29, 2021: Barriers for the uptake of WDM/NCWR in Lebanon.

Cultivated Area: 24% of total land

of which 42% irrigated area

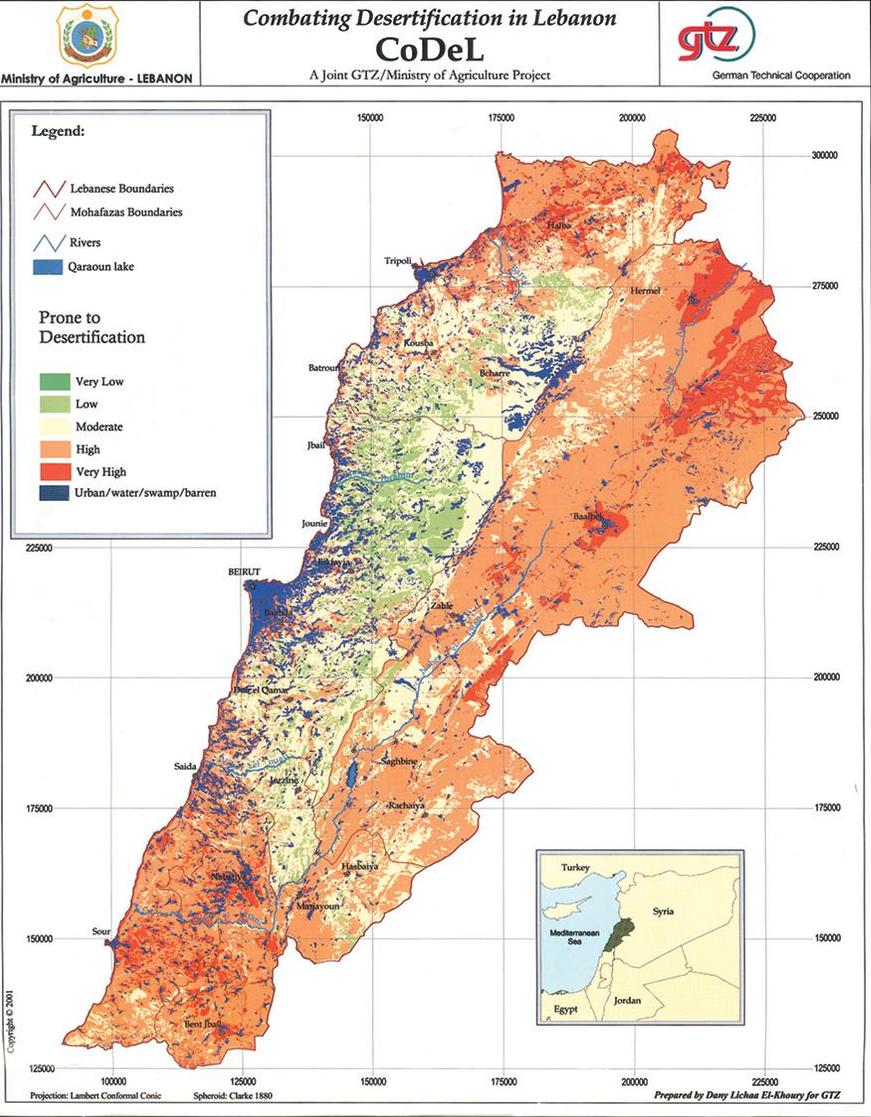
And of which 47% perennial crops

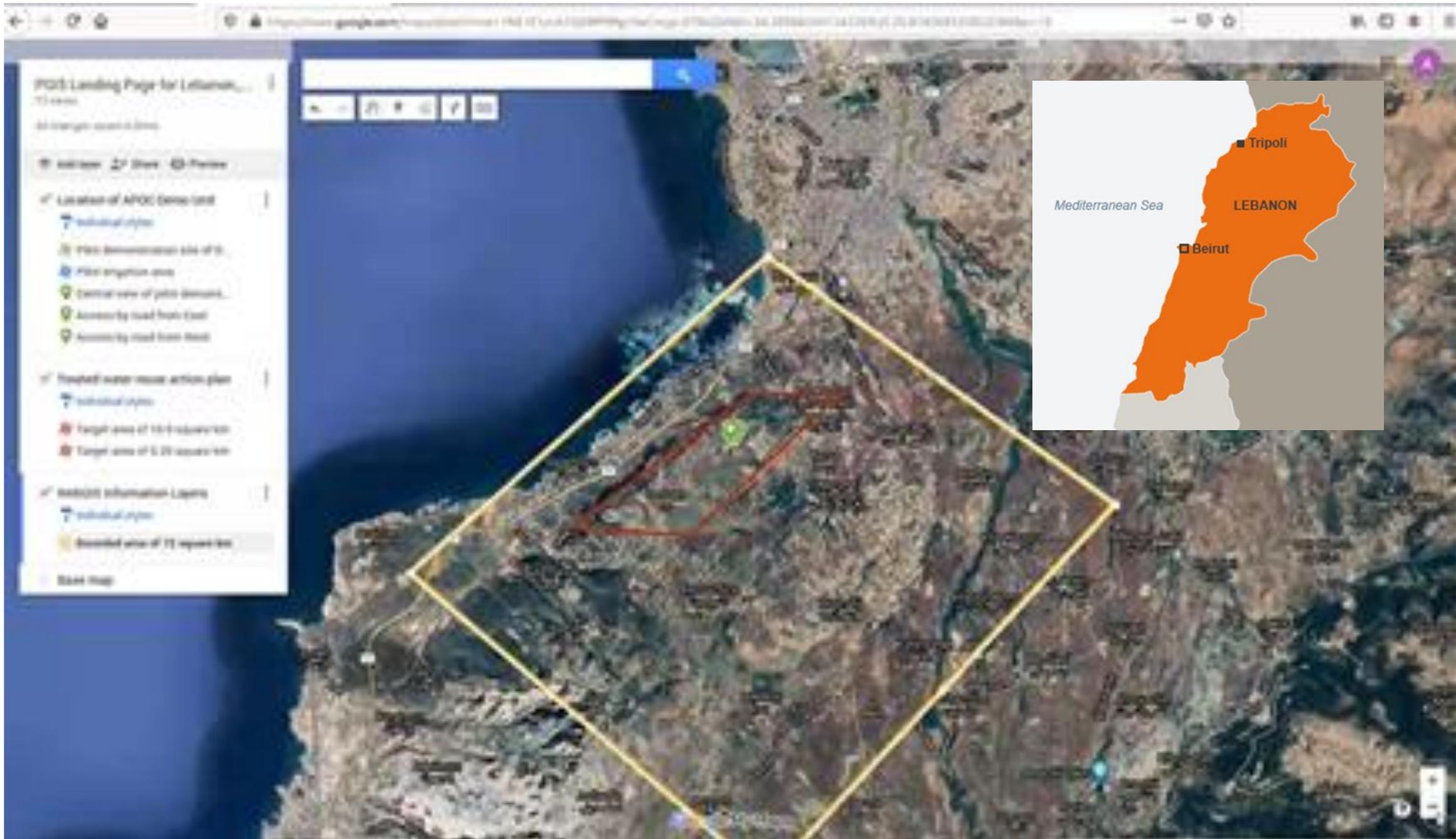
49% annual crops

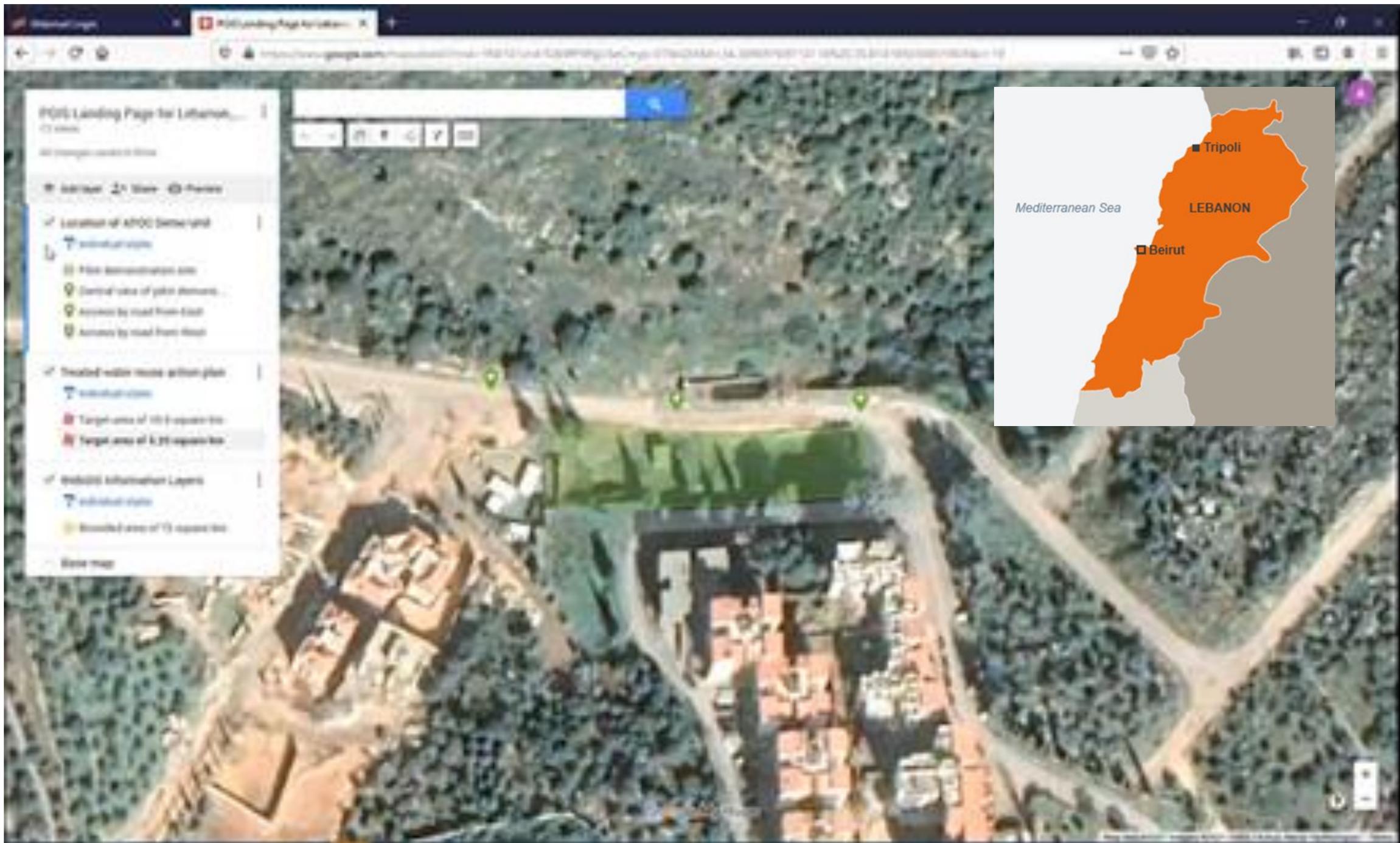


60% of the Lebanese territory are under threat of land degradation, mainly in:
- Akkar /North Lebanon
- Bekaa Valley
- South Lebanon.

country maps' of water scarcity







- PGIS Landing Page for Lebanon...
- 03 views
- All maps created here
- Layers: 21 items
- Location of AFCC Service Unit
- File Administration site
- Central site of police stations
- Access by road from East
- Access by road from West
- Treated water reuse within plant
- Target area of 100 hectares
- Target area of 500 hectares
- Geospatial Information Layers
- Resettled area of 10 hectares
- Save map



Increasing wastewater reuse in Lebanon: Challenges and opportunities

Guidelines, norms and policies:

The users and WWTP operator must have guidelines, norms and policies to follow to reuse/produce treated water.

Lack of cooperation between:

Government and civil society, private sector and the user

Different sector: water-agriculture-environment

Corruption /Lack of investment:

The WWTP/network doesn't cover all the country region

Decentralization:

To cover all the region using low cost and maintenance techniques.

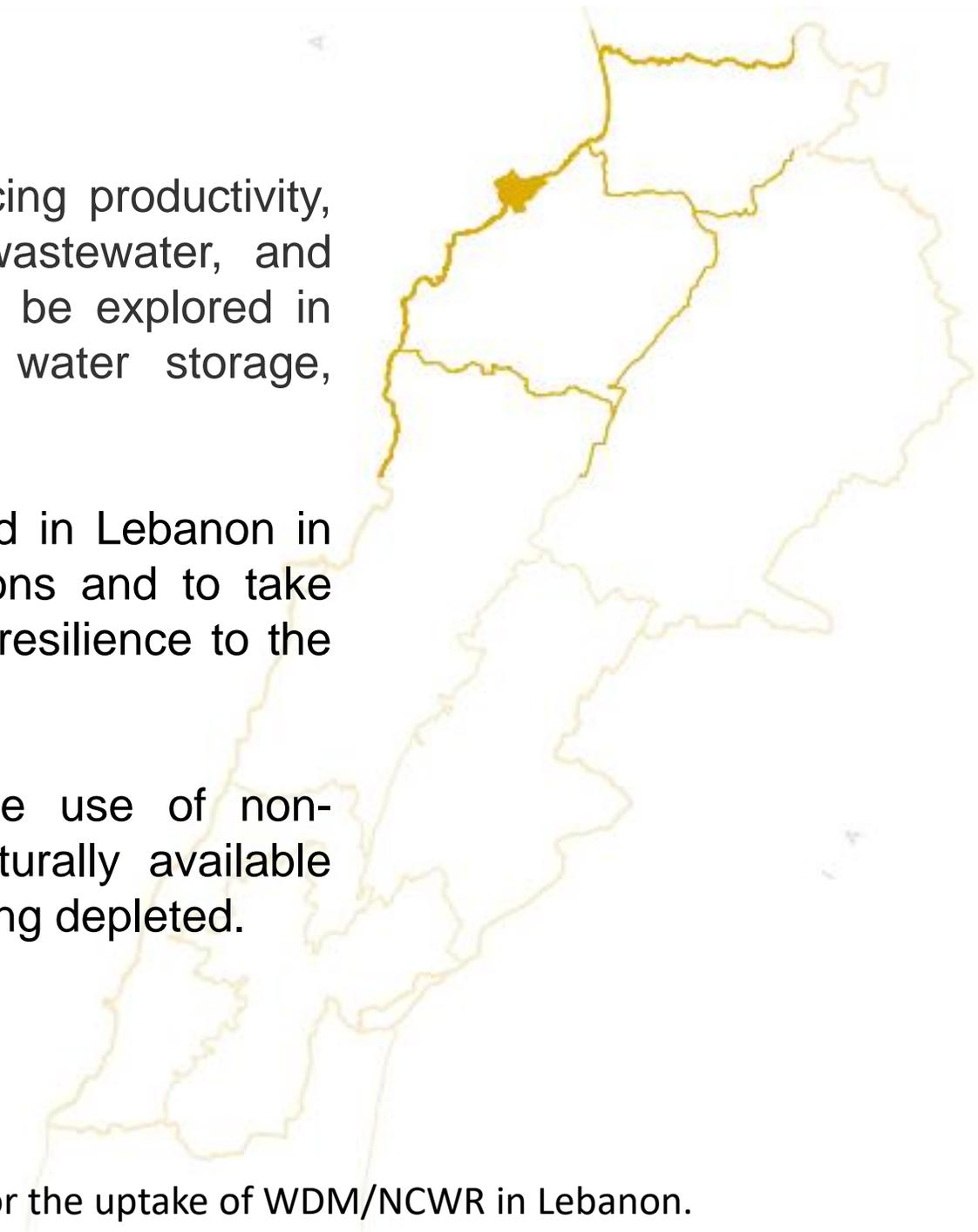
Reaction of people towards new rules, implementation and technologies

Prospects for solutions

Investments in innovative technologies for enhancing productivity, conserving and protecting resources, recycling wastewater, and developing non-conventional water sources should be explored in addition to seeking opportunities for enhanced water storage, including aquifer recharge and recovery

The priority in the countries of the Middle East and in Lebanon in particular is to adapt to changing climatic conditions and to take quick and efficient measures that will help to build resilience to the impacts of climate change impacts.

In particular, such measures should concern the use of non-conventional water resources to augment the naturally available resources such as groundwater which is fast becoming depleted.



Prospects for solutions

All the relevant public authorities in Lebanon should urgently come together to set the appropriate standards and guidelines for the safe reuse of treated wastewater.

The upcoming activities in the **AQUACYCLE project** are set to bring an important contribution to this debate in a variety of ways.

A clearly crucial ambition of the project is to demonstrate the effectiveness of an eco-innovative wastewater treatment system that is specifically suited to the means and needs of low-income communities in rural areas.

The treatment process is designed to guarantee a safe, plentiful and all-year-round supply of water for irrigation purposes in the agricultural sector, and hence to bring a solution to achieving sustainable development while protecting the environment.



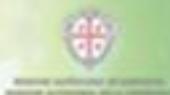
**Thanks
for your attention!**



Dr. Ahmad ELMOLL,

- aelmoll@ul.edu.lb
- <http://www.ul.edu.lb/aquacycle>

Finally, we would like to highlight the great effort of the **ENI CBC Med** program for the support and the help to the implementation a demo plant in Lebanon in the **AQUACYCLE** project context



AQUACYCLE

*Towards Sustainable Treatment and Reuse
of Wastewater in the Mediterranean Region*



The use of treated wastewater as a solution to address the impacts of climate change in Lebanon and MENA region ¶

ElMoll Ahmad, Tawfik Al-Nabulsi, Fatima Yahya, Lebanese University (UL), Lebanon ¶
<http://biotech.ul.edu.lb/aquacycle> ¶

Dirk De Ketelaere, Integrated Resources Management Company Ltd. (IRMCo), Malta ¶
www.environmentalmalta.com ¶