Part 5: Water Management - Irrigation

Developed by Miletia – Sustainable Social Development

Funded by the Erasmus+ Programme of the European Union

Sustain4Rural

BE RESPONSIBLE, BE SUSTAINABLE

Consortium

Co-Ordinator: ECECT

Partners: PSC PARPOUNAS SUSTAINABILITY CONSULTANTS; ΜΙΛΕΤΙΑ ΒΙΩΣΙΜΗ ΚΟΙΝΩΝΙΚΗ ΑΝΑΠΤΥΞΗ

Funded by the Erasmus+ Programme of the European Union

Τι θα μάθουμε στη συγκεκριμένη ενότητα;

- Part 1: Introduction
- Part 2: What is Water Management and Irrigation
- Part 3: The impact of climate change on water quality
- Part 4: Lack of water and protection of water resources
- Part 5: Effective watering methods and soil quality
- Part 6: Use of decision support systems for forecasting

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE

Funded by the Erasmus+ Programme of the European Union

What is Water Management?

- Water management is the control and movement of water resources to minimize damage to life and property and to maximize efficient beneficial use.
- Good water management of dams and levees reduces the risk of harm due to flooding. Irrigation water management systems make the most efficient use of limited water supplies for agriculture.

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE
Funded by the Erasmus+ Programme of the European Union

What is Irrigation?

Irrigation is the provision of water to help crops grow when rainfall is not sufficient. While new farming methods and technologies allow some types of crops to be grown without soil, a certain amount of water is needed to grow any kind of crop. In today's economy, agriculture is one of the sectors that consumes the most water resources.

Irrigation is the major cause of water consumption in agriculture. It contributes to increasing crop productivity, but it is also a threat to the preservation of water resources. Therefore, the issue of water scarcity requires careful reflection on the trade-off between higher agricultural productivity and the deterioration of water resources.

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE
Funded by the Erasmus+ Programme of the European Union

Threats

- The low-lying areas of Europe are under threat from **tidal and inland flooding** and are dependent on land drainage to sustain land use.
- **Scarcity** caused by overexploitation of water resources
- **Droughts** that have cost Europe over 100 billion through the last 30 years and are increasing in frequency and impact.
- Southern Europe faces severe **water stress** problems, which occur throughout the year in many river basins, with water consumed by agriculture, public water supply and tourism being the key pressure on water resource availability. The pressures from these economic sectors reach a significant seasonal peak in summer.
- **Climate change** is projected to cause seasonal reductions in water availability in most parts of Europe, except in north-eastern areas. The strongest impact is expected in southern and south-western Europe, with river discharge reductions in summer of up to 40 % in some basins, under a 3 °C temperature rise scenario. Large parts of western and central Europe will also be affected, albeit to a lesser degree. Changes in aquifer recharge follow roughly the same pattern.
- Continued **urbanization** and growth in coastal tourism will further concentrate water demand geographically. A warmer and drier climate could increase irrigation requirements by 20 %, adding to a stronger concentration of water demand in already drought-prone regions of Europe.

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE
Funded by the Erasmus+ Programme of the European Union

Sustainability

In order to ensure a sustainable environment for the future generations we must focus on conserving water by using it more efficiently but also by protecting the reserves and their ecosystems.

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE

Funded by the Erasmus+ Programme of the European Union

Sustainability

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE

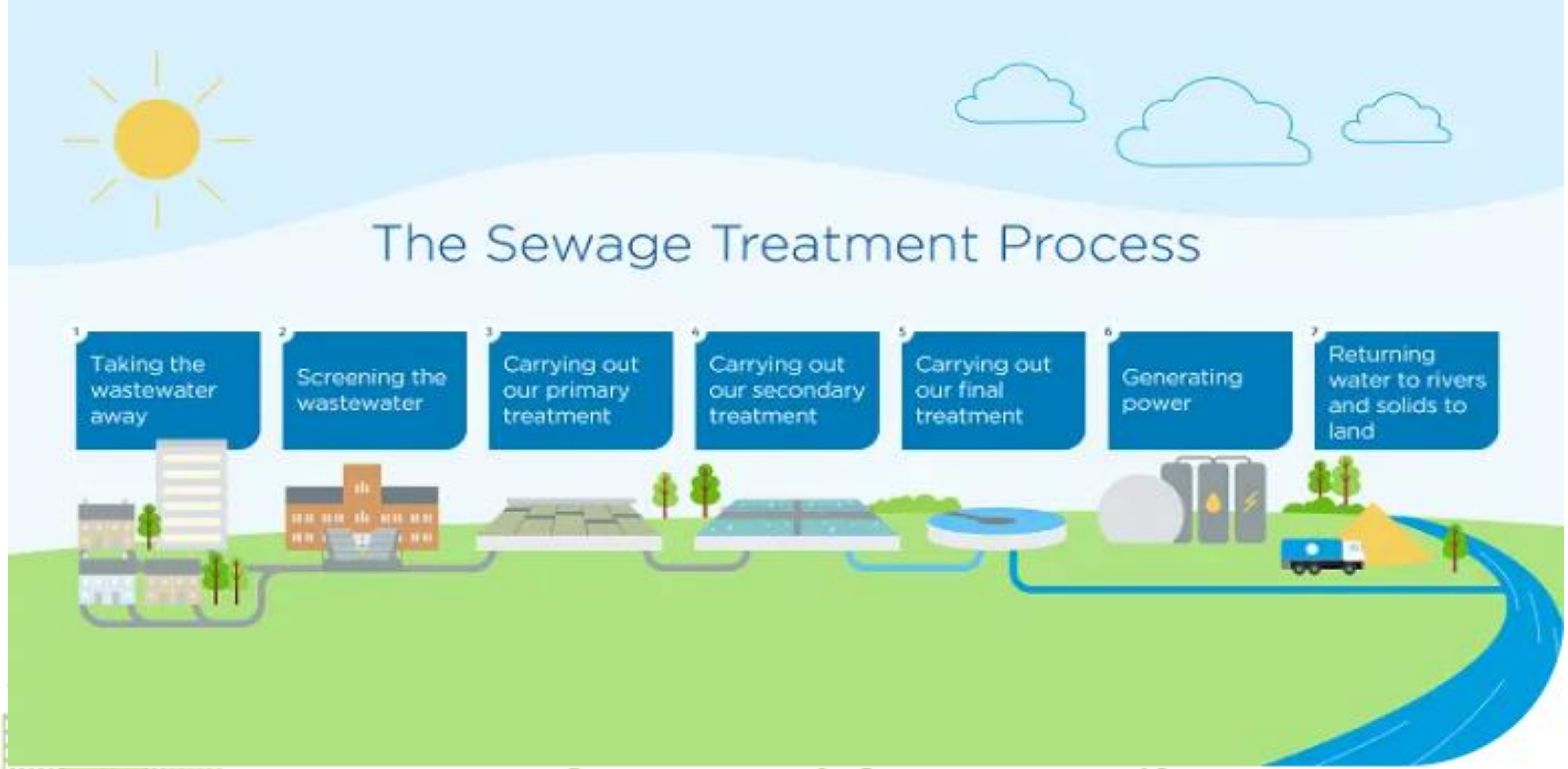
Funded by the Erasmus+ Programme of the European Union

Waste Water re-use Statistics

- Around 700Mm 3/annum wastewater treated and reused in Europe.- equivalent to 2.4% of all treated wastewater.
- Spain accounts for half of the current use
- Reuse rates are high in some countries like Cyprus, lower in others: Greece, Spain and Italy (between 5% - 12%)
- Applications: agriculture (75%) environmental enhancement (8%), industry use (6%) groundwater recharge (6%)- urban uses (6%)
- Regulations/standards in many countries are mostly WHO-guided; but not at EU level.

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE

Funded by the Erasmus+ Programme of the European Union



Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE

Funded by the Erasmus+ Programme of the European Union

Reusing Treated Wastewater

- Alleviate water scarcity.
- Reduce demand on potable water supplies and high quality sources .
- Supplement conventional sources.
- A valuable buffer against drought and water shortage especially for industry and irrigation.
- Improve operational efficiency; reduce energy costs.
- Reduce nutrient discharge to the environment.
- Reduce water stress on specific sectors.

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE

Funded by the Erasmus+ Programme of the European Union

What can we do to protect Fresh water sources?

- Use Signs to notify others of fresh water reservoirs.

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE

Funded by the Erasmus+ Programme of the European Union

What can we do to protect Fresh water sources?

Dispose harmful materials properly

- Motor Oil
- Pesticides
- Leftover paints and paint cans
- Household cleaners

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE
Funded by the Erasmus+ Programme of the European Union

What can we do to protect Fresh water sources?

Important: Don't overuse pesticides or fertilizers. Many fertilizers and pesticides contain hazardous chemicals. These can travel through the soil and contaminate groundwater. If you feel you must use these chemicals, please remember to use them in moderation.

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE
Funded by the Erasmus+ Programme of the European Union

What can we do to protect Fresh water sources?

Join in a beach, stream or wetland cleanup.

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE

Funded by the Erasmus+ Programme of the European Union

What can we do to protect Fresh water sources?

Choose non-toxic household products whenever possible. The best way to keep from polluting is to use products that are not dangerous to the environment in the first place.

For some suggestions of such alternatives, go to https://www.co.polk.or.us/cd/eh/hhw/safe-alternatives-toxic-household-products

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE

Funded by the Erasmus+ Programme of the European Union

What can we do to protect Fresh water sources?

Properly Dispose of Unwanted Medicine

Don't flush or pour down a drain.

After being flushed or poured down a drain, many medicines pass through sewer and septic systems causing irreversible damage to the environment.

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE
Funded by the Erasmus+ Programme of the European Union

What can we do to protect Fresh water sources?

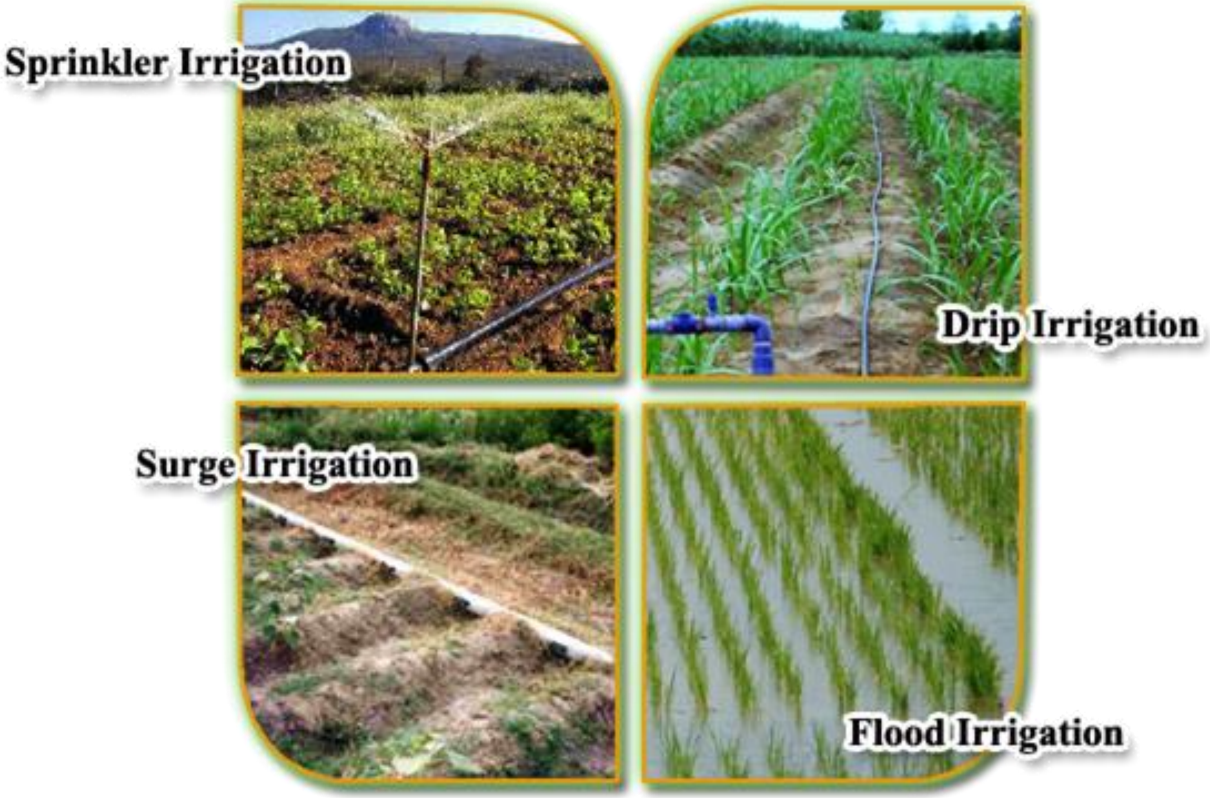
- https://www.youtube.com/watch?v=V5WiD8ZPSNk

- https://www.youtube.com/watch?v=DI3VqTkbuRA

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE
Funded by the Erasmus+ Programme of the European Union

Irrigation Methods

1. Surface
2. Sub-Surface
3. Pressurized irrigation



Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE
Funded by the Erasmus+ Programme of the European Union

Irrigation Methods

Criteria for selection of irrigation method:

- Water supply source
- Topography
- Quantity of water to be applied
- The crop
- Method of Cultivation

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE
Funded by the Erasmus+ Programme of the European Union

Water stress

Water stress — a situation where there is not enough water of sufficient quality to meet the demands of people and the environment — is already a reality in many parts of Europe.

Depletion of water resources

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE
Funded by the Erasmus+ Programme of the European Union

Depletion of water resources

Depletion of water resources can be caused by natural phenomena (drought events), by phenomena arising from human activities (unsustainable water abstraction, deterioration of water quality, lack of access to water) or by a combination (climate change).

Climate change is manifesting itself with increasing impact. It is expected to cause a major increase in the occurrence of water stress, affecting an increasing area of the EU and an increasing percentage of its inhabitants annually.

Water stress caused by overabstraction is persistent, but the annual reports present clear evidence that the efforts made to reduce it are having an effect.

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE
Funded by the Erasmus+ Programme of the European Union

Depletion of water resources

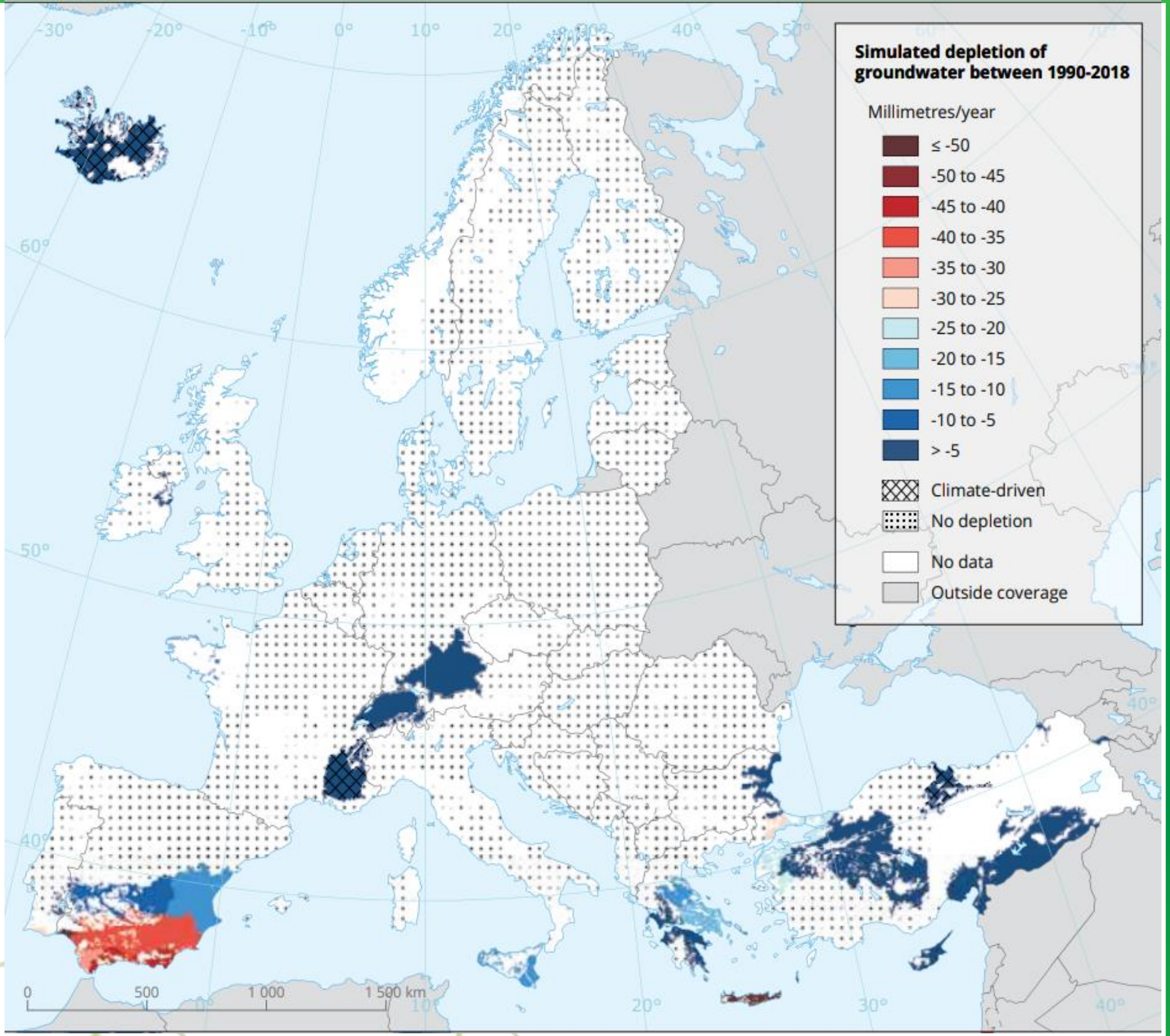
Decline in groundwater levels due to over abstraction — indicative cases in Europe

- **Greece: Thessaly:** Intensive cultivation of cotton, maize and lucerne have increased agricultural water abstractions rapidly, especially since the 1980s. Groundwater levels have been affected significantly to the south-west, where coarse-grained deposits are mixed with low-permeability clays, creating successive semi-confined and confined aquifers and aquitards. Existing buildings and public infrastructure have been damaged because of land subsidence.
- **Italy: Venice lagoon:** Industrial abstractions at Marghera mainly in the 1960s, caused draw-down of the groundwater table and significant land subsidence. Groundwater levels have not recovered to natural levels, despite measures adopted since the 1970s.
- **Netherlands: Noord-Brabant, Regge catchment:** In rural areas of the Netherlands covered with drought-sensitive soils, such as Noord-Brabant and the Regge catchment, land use change has led to a reduction in groundwater recharge (e.g. soil sealing from urban expansion, more intensive use of soil water by crops). Water abstraction has caused draw-down of groundwater tables, reducing the base flow to streams and impacting natural areas.

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE
Funded by the Erasmus+ Programme of the European Union

Current situation

- Per capita freshwater resources reduced by 20% in the past two decades.
- More serious stress in the southern regions of Europe.



Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE

Funded by the Erasmus+ Programme of the European Union

Environmental impact

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE
Funded by the Erasmus+ Programme of the European Union

Impact on the environment

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE
Funded by the Erasmus+ Programme of the European Union

Sustainable Solutions for water stress

Within a couple decades, **water scarcity may affect about two thirds of the world's population**. In many countries there is still a tendency to deal with water scarcity problems by augmenting the *water supply*, e.g., by increasing surface and groundwater storage and allocation through the creation of new infrastructure, desalination of saltwater or brackish water, reuse of wastewater, or recharging aquifers.

This tendency has prevailed over focusing on reducing *water demand*, e.g., by stemming the losses in transport and distribution systems, implementing adequate tariff systems, which seek to encourage lower water demand levels, changing water use technologies, and, generally, increasing the efficiency of water use in domestic, industrial, and irrigation systems; in other words, seeking to increase overall water productivity.

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE
Funded by the Erasmus+ Programme of the European Union

Sustainable Solutions for water stress

- Sustainable water management needs to rely more on **water demand management**, **supply from alternative water resources,** and **circular and nature-based solutions**. Improvements in efficiency should be transparently documented to promote cross-fertilisation and **transfer of technology and knowledge**.
- A key factor contributing to the effectiveness of water directives are the (binding) cross-references to the objectives of the **Water Framework Directive** (WFD) in other EU policies. However, although the WFD has been in force for 20 years, few integrated governance frameworks have been implemented.
- **Major technological innovations** that will contribute to improved drought risk management are expected in the field of **Earth observation, mobile data collection** and **data integration**.

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE

Funded by the Erasmus+ Programme of the European Union

Sustainable Solutions for water stress

- Reduce losses in the supply system
– Reduce losses during use
– Raise awareness
– Introduce economic measures
– Apply more water-efficient technologies
– Select products for their low water demand
- Store water temporarily during water-abundant times
– In surface reservoirs
– In the soil and in aquifers, natural water retention measures and nature-based solutions
- Accept shortage and focus on dealing with its consequences
– Prioritize water allocation
– Introduce insurance schemes
- Increase water availability or water supply
– Reuse wastewater
– Desalinate brackish or salt water
– Divert water from water-abundant to water

-stressed locations (only if no other options remain)

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE

Funded by the Erasmus+ Programme of the European Union

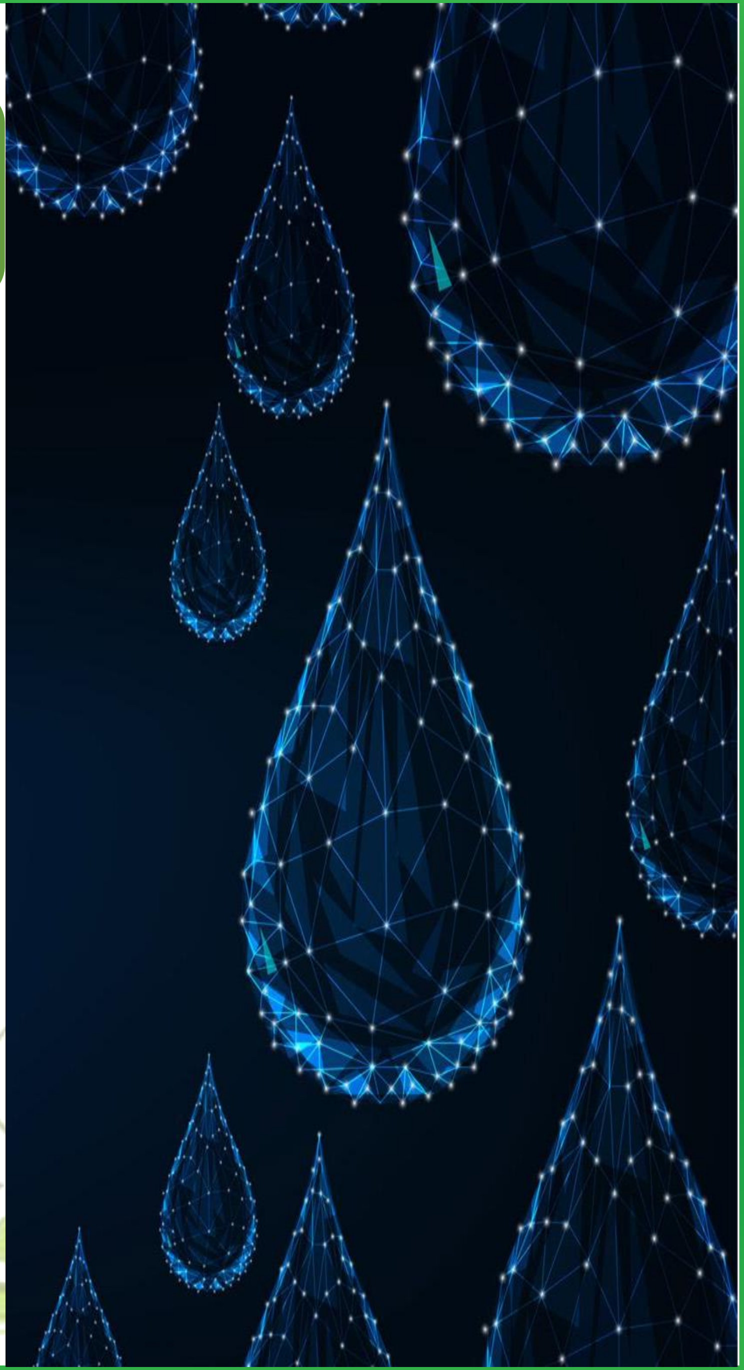
Sustainable Solutions for water stress

To ensure that there will be sufficient water to feed a growing and wealthier population in the future, to sustain vital life support systems, and to produce and distribute enough other goods and services, it will be essential to achieve
“more crop per drop,”
“more jobs per drop,”
“better environment per drop,”
“improved nutrition per drop,”
among many such goals.

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE
Funded by the Erasmus+ Programme of the European Union

Technology to our advantage

Many believe that technology, the tools and methods used in the production of goods and services, will make it possible to achieve the future we want. Indeed, there is a long list of technological trends and advances that are likely to benefit rapid and effective adaptation of the water sector.



Technology to our advantage

- Cybernetics, artificial intelligence and instantaneous information technology (smarter internet)
- Nanotechnology
- Cost-effective energy technology (solar, space-based energy, algae as fuel)
- Biotechnology (genetic engineering) to help feed the populace and save endangered species
- Space-based environmental monitoring systems and instantaneous feedback to predictive models even to remote areas of the globe
- Geoengineering to reverse global warming (e.g., giant reflectors in orbit; greening deserts; iron fertilization of the sea; aerosols in the stratosphere)
- Effective, reliable prediction of most weather and climate events

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE
Funded by the Erasmus+ Programme of the European Union

Technology to our advantage

- Renewable energy replacing fossil fuel entirely – low carbon societies
- Desalinization (in conjunction with cheap fusion energy) becoming cost-effective and providing water for most large coastal urban areas and megacities
- Vastly improved sanitation and wastewater treatment technologies and recycling
- Biotech approaches to pest control for improved agricultural yields
- Ecological engineering to preserve habitats, reverse species extinctions and combat invasive species
- Mapping groundwater resources and sustainable extraction levels

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE
Funded by the Erasmus+ Programme of the European Union

Technology to our advantage

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE

Funded by the Erasmus+ Programme of the European Union

Potential water savings from applying indicative technical measures in the agricultural sector

Measure	Potential water saving (%)
Upgrading conveyance infrastructure (e.g. closed pipes replacing open trenches)	10-25
Changing to use irrigation methods with higher application efficiency (e.g. drip micro-irrigation replacing furrow irrigation)	15-60
Changing irrigation practices (e.g. rescheduling irrigation, mulching)	30
Crop restructuring (e.g. drought-resistant crops replacing water-demanding and drought-sensitive crops)	50
Irrigating with reclaimed water	10

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE

Funded by the Erasmus+ Programme of the European Union

A change in perspective

- As salt water constitutes 97 percent of all global water resources, methods to use sea water for agriculture, which uses 70% of the world's available freshwater resources, would represent a major technological breakthrough that would reduce the freshwater burden.

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE
Funded by the Erasmus+ Programme of the European Union

A change in perspective

A wide array of “on-farm” agricultural management technologies and practices are available or development that could increase yields and decrease pollution and water use;

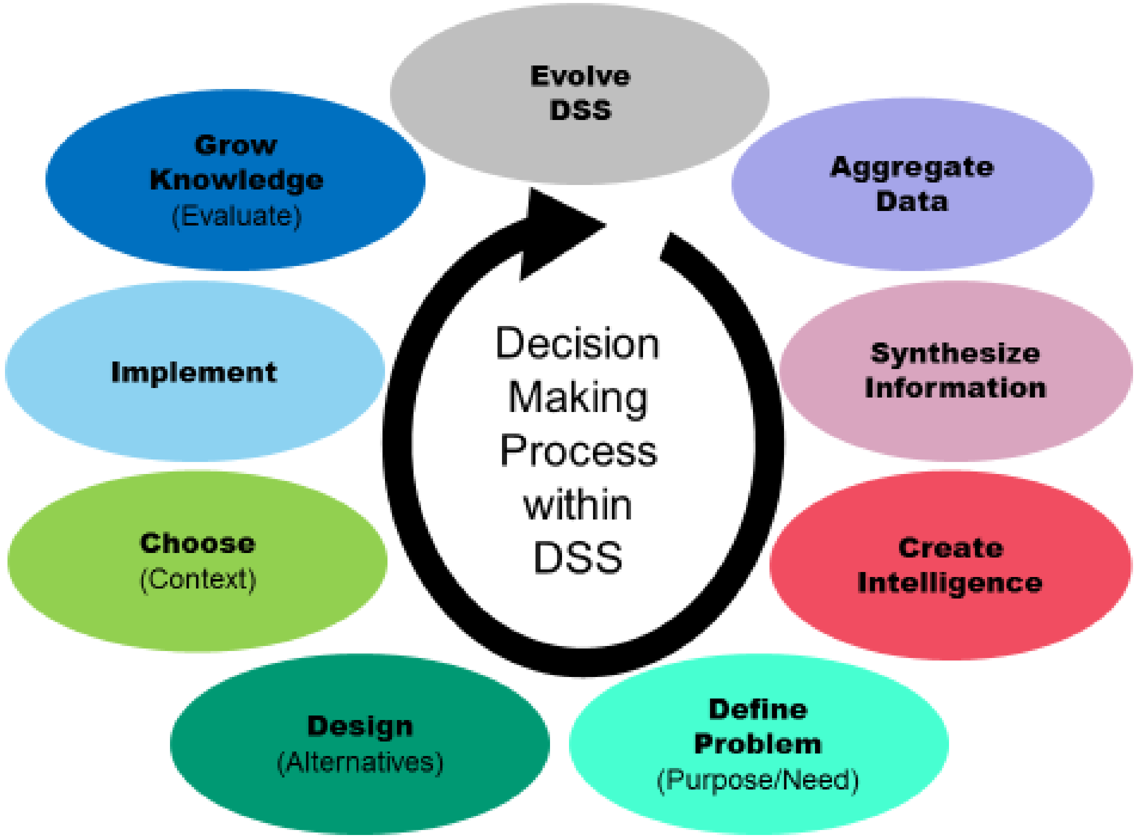
for example reducing yield gaps (not as high in Asia as in Africa), reducing subsidies, change land use and crop types, improving irrigation efficiency, diversified and intense cropping systems, limiting food waste, water harvesting, supplemental irrigation and precision farming and nutrient management.

Innovative technologies and investments for are required for education and training in the management of water for both irrigated and rainfed settings so as to achieve more productive use of water in agriculture. Decision-support tools that inform farmers will be particularly important to smallholders.

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE
Funded by the Erasmus+ Programme of the European Union

A change in perspective

- **What is a DSS?**



Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE

Funded by the Erasmus+ Programme of the European Union

A change in perspective

Using a Decision Support Tool (DSS) to monitor cropping.

1. How much groundwater, pond water and rainwater will be available in different months
2. How water balance will look like in different months (present and future)
3. Whether available water is suitable for different uses
4. How much additional water storage is desired; and at what locations
5. How we as a community, can allocate the available water for different uses
6. Suitability of available land and water for various crops
7. Crop combinations that maximize income and risk involved)
8. Amount of water needed (& at what stages) for particular crop combinations.
9. How soil fertility will change and which fertilizers should be used.
10. What crop/PH processing will add value to products and enhance income

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE
Funded by the Erasmus+ Programme of the European Union

A change in perspective

Using a Decision Support Tool (DSS) to monitor cropping.

11. Besides agriculture, what other livelihood options will be viable given location, land-holding, income group, etc.
12. What market avenues are available.
13. Which gov't. schemes are available and for what purpose and when
14. Which gov't./local institutions can offer assistance and for what and when
15. Which TK/products can enhance income
16. What infrastructure facilities will be required (seed bank, storage, implements, fertilizers, insecticides, market, insurance, technologies) (V. C. Goyal, personal communication, 2015)

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE
Funded by the Erasmus+ Programme of the European Union

A change in perspective

Such a DSS would enhance agricultural risk management, particularly for smallholders, and would be critical in enabling farm households to adopt new technologies, diversify their activities, and sustain food security during periods of high input prices, low crop yields and major weather events.

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE
Funded by the Erasmus+ Programme of the European Union

An Energy Crisis

An Energy Crisis

Water management policies must focus on ensuring sufficient water to produce the energy demanded by society. Humans and their economies and societies critically depend on reliable supplies of energy. Energy, as electricity and liquid and gaseous fuels, available when and where needed, requires water to produce, such as for cooling and refining.

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE
Funded by the Erasmus+ Programme of the European Union

An Energy Crisis

Water, of sufficient quality and pressure, available when and where needed, requires energy to produce. In short, **energy is needed to provide much of the water we need and use, and water is needed to provide most of the energy we need and use**. How can we ensure enough of both to meet all future water and energy demands? Limitations of either can constrain future economic and social development as well as adversely impact human and environmental health.

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE

Funded by the Erasmus+ Programme of the European Union

An Energy Crisis

The global population in **2050** is expected to be two billion more than it is today. Greater wealth in many emerging markets is resulting in new and growing cities and **increased energy and water consumption**. The inhabitants of the new cities will likely consume more water than their forebears and to do this they will need more electricity. This of course could increase global carbon emissions.

The impact on our ecosystems and our health is currently unpredictable. If we are to be dependent on hydrocarbons for a large share of our energy for the next several decades, we need clean fossil fuel technologies and effective carbon capture and storage mechanisms. But **current technological** solutions for both are **water intensive**, and water **may not always be available** where and when it is needed.

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE

Funded by the Erasmus+ Programme of the European Union

EU Legislation

- Putting the right price tag on water
- Allocating water and water-related funding more efficiently
- Improving drought risk management
- Considering additional water supply infrastructure
- Fostering water-efficient technologies and practices
- Fostering a water-saving culture in Europe
- Improving knowledge and data collection

2000
- WFD into force

2007
- WS&D addressed under
- FD into force

2008-2010
- Follow up reports on 2007 Communication
- CAP reform initiation

2012
- Review of the EU WS&D Policy

2013
- EU strategy on adaptation to climate change

2014
- Reformed CAP comes into force

2015
- End of first WFD management cycle

2019
- Fitness check of the EU Water Legislation

2020
- EU Green Deal
- Circular Economy Action Plan
- F2F Strategy
- EU Biodiversity Strategy for 2030

2021
- End of 2nd WFD management cycle
- EU Climate Adaptation Strategy

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE

Funded by the Erasmus+ Programme of the European Union

The **W**ater **F**ramework **D**irective

- expanding the scope of water protection to all waters, surface waters and groundwater
- achieving "good status" for all waters by a set deadline
- water management based on river basins
- "combined approach" of emission limit values and quality standards
- getting the prices right
- getting the citizen involved more closely
- streamlining legislation

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE
Funded by the Erasmus+ Programme of the European Union

What can we do to protect freshwater sources?

- https://www.youtube.com/watch?v=V5WiD8ZPSNk

- https://www.youtube.com/watch?v=DI3VqTkbuRA

Sustain4Rural
BE RESPONSIBLE. BE SUSTAINABLE
Funded by the Erasmus+ Programme of the European Union

Sustain4Rural

BE RESPONSIBLE, BE SUSTAINABLE

Please complete the participants' feedback and evaluation form.

Funded by the Erasmus+ Programme of the European Union

Sustain4Rural

BE RESPONSIBLE, BE SUSTAINABLE

Thank you!

For more information:

- www.sustain4rural.eu
- www.facebook.com/Sustain4Rural

✉ecect.projects@gmail.com

☎+ 357 22462920 (Cyprus)

☎ +30 210 922 4392 (Greece)

Funded by the Erasmus+ Programme of the European Union