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LitusGo Manual

Module 4

Water Resources Management

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Preface to the LitusGo Education Manual

The LitusGo Manual is part of the LitusGo educational package which is included in the LitusGo portal: www.litusgo.eu. LitusGo aims at the training and capacity building of Local Authorities and local stakeholders in Integrated Coastal Zone Management issues and the reaction to the impacts of climate change.

This Manual consists of 20 autonomous, self-contained and inter-related modules. The modules are available in four languages, Greek, English, Maltese and Turkish and in three different forms: the dedicated wiki application in the LitusGo portal, the dvd and the hard copy version. This hard copy version of the LitusGo Manual consists of 20 self-contained booklets, one for each module, kept in a hard collective case.

List of modules of the LitusGo Educational Manual

Module 1:	European legal framework
Module 2:	Stakeholder involvement/Public participation
Module 3:	Sustainable tourism-carrying capacity
Module 4:	Water resources management
Module 5:	Fisheries/fish farming
Module 6:	Coastal water quality
Module 7:	Ecosystems management (land and coastal ecosystems)
Module 8:	Waste management/recycling/compost
Module 9:	Air pollution
Module 10:	Land uses/urban planning/coastal over-development
Module 11:	Landscape and marine-scape management
Module 12:	Coastal erosion control
Module 13:	Community annoyance issues 1: noise pollution
Module 14:	Community annoyance issues 2: light and thermal pollution, odours
Module 15:	Archeological areas/historic sites/cultural heritage
Module 16:	Extreme conditions management: flood risks, coastal flooding and storm surge
Module 17:	Droughts
Module 18:	Desertification
Module 19:	Energy use, consumption and management
Module 20:	Green buildings

Credits

The LitusGo Education Manual has been developed by the LitusGo Educational Manual Working group:
Modules 1, 2, 6, 7, 8, 9, 12, 13, 14, 16, 17, 18, 19 have been prepared by the scientific team of the beneficiary/coordinators ISOTECH Ltd. Major authors: Michael I. Loizides, Chemical/Environmental Engineer and Xenia I. Loizidou, Civil/Coastal Engineer. Constantinos Georgiades (MSc in ICZM) is responsible for the overall editing. The hard copy of the educational Manual is designed by Anastasia Georgiou.

Modules 3, 4, 5, 10, 11, 15, 20 have been prepared by the scientific team of the Sustainable Aegean Programme of ELLINIKI ETAIRIA - Society for the Environment and Cultural Heritage. Major authors: Georgia Kikou, Geographer, MSc Environment (Manager of the Sustainable Aegean Programme), Alexandros Moutaftsis, Economist, MSc Environment, Leonidas Economakis, Political Sciences, MA International Development.

Dr Alan Pickaver on behalf of partner The Coastal & Marine Union (EUCC) was responsible for the quality control of the educational material.

LitusGo partnership:

Coordinator/Beneficiary**:**

ISOTECH Ltd Environmental Research and Consultancy www.isotech.com.cy

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Greece:

ELLINIKI ETAIRIA - Society for the Environment and Cultural Heritage www.ellet.gr **/ Sustainable Aegean Programme**, www.egaio.gr

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Malta:

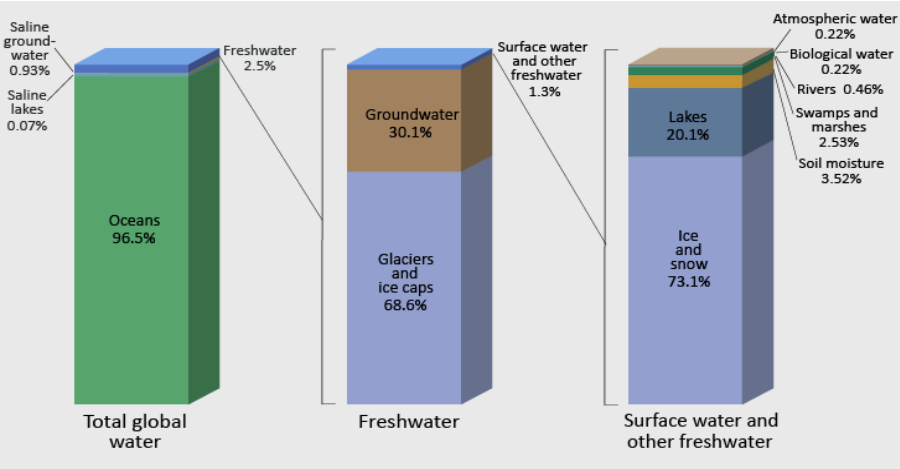
Municipality of Kirkop www.kirkop.gov.mt

The Netherlands:

EUCC – The Coastal & Marine Union www.eucc.net

1| Theoretical background

The importance of water for our planet is undisputed. The oceans cover 75% of the earth's surface and contain 97% of its surface water. The number of people who live within 100 km of a coastline is also high – 39% of the world's population, according to the "United Nations' Atlas of the Oceans". At the same time, on land, freshwater systems have equal importance. Transboundary river basins, lakes, wetlands, estuaries, and desert oases blanket 45% of the world's land surface and are home to nearly 60% of the world's population (UNDP, 2004:1). Yet, inland freshwater systems amount for only 1% of the world's water reserves, with the remaining 2% being restricted in the Glaciers and ice caps.



Histogram 1: Distribution of Earth's Water (*Peter H. Gleick, 1993*).

Main Uses of Water:

- Industrial: it is estimated that 22% of worldwide water use is industrial
- Household: 8% of worldwide water use is for household purposes
- Agricultural: 69% of worldwide water use is for irrigation, with 15-35% of irrigation withdrawals being unsustainable.

2| Objective

Water resources all over the world and in the European Union are under increasing pressure from the continuous growth in demand for good quality water. However, EU policy defines water not as a commercial product like any other, but as heritage, which must be protected, defended and treated as such. Internationally and in the Community it has become clear that water will be a critical factor for the development of many countries. It is already mainly responsible for the increasing problem of desertification of many boondocks. The need for action to avoid long-term deterioration of freshwater quality and quantity is recognized and requires actions for the sustainable management and protection of freshwater resources [14, 15, 16].

Improvement in water management techniques and actions is urgently needed, and Local Authorities have a significant role to play. Thus, LitusGo included this crucial issue as a training issue, aiming to increase awareness and improve local skills to secure an optimization in the present management schemes.

3| Problem

Climate change consequences related to water resources are mainly the following:

A) Increase in temperature.
B) Shifts in precipitation patterns and snow covers.
C) Increase in the frequency of flooding and droughts.

A) Higher temperatures will intensify the global hydrological cycle, at a time when Northern Europe has already become 10%-40% wetter over the last century, while Southern Europe 20% drier (EEA, Climate Impacts on Water Resources [11]). In addition, higher temperatures push the snow limit upwards in Northern Europe and mountainous regions, reducing the snow reservoir and decreasing glaciers, which eventually will mean less water for the low flow rates of the summer and higher winter run-offs in Northern Europe and mountain-fed rivers, which may also lead to more frequent floods and landslides. It is indicative that in the Alps for example, where 40% of Europe's freshwater reserves lie, it has been estimated that for every 1 ºC increase in temperature, the snowline rises by 150 meters. As a result, less snow will accumulate at low elevations. That, of course, has very serious effects both on the ecosystem (plants facing extinction) and human well-being (let us not forget the 2003 heat wave that killed thousands of people all over Europe- *EEA, Alps [12]*). In the last hundred years alone, temperatures in the Alps have increased by 2 ºC.

B) Shifts in precipitation patterns and snow covers will also have a major impact on water resources, especially in the countries of the Mediterranean - which happens to be hosting 60% (180 million, according to Plan Bleu, SOED 2009) of the world's "water-poor" population (people with less than 1000 cubic meters of renewable water resources per inhabitant and year – Blue Plan Notes, 2010). In this already vulnerable region, it is estimated that by 2100 rainfalls in southern Mediterranean will have decreased by 20% to 30%, while in the North there will be an increase of approximately 10% (Giorgi and Lionello, 2008). In addition, according to the Intergovernmental Panel on Climate Change (IPCC, 2007), temperatures are expected to rise by 2 ºC to 3 ºC in the Mediterranean region by 2050, and by 3 to 5 ºC by 2100.

C) Increases in the frequency of flooding (in the Northern Mediterranean) and droughts (in the Southern), will also have serious effects in several economic sectors, including agriculture, forestry, energy, and of course drinking water provision. In addition, wetlands and aquatic ecosystems will also be threatened, together with the sectors dependent on the goods and services they provide. If we add up to all these the fact that water demand has already doubled over the second half of the 20th century and is expected to rise by a further 20% by 2025, it is easily understood that water is an issue we will have to deal with in the very near future.

4| How to deal with the problem

While the problem of water scarcity is already visible in the Mediterranean (Morocco, Egypt, Cyprus, Syria), unfortunately water recycling and reuse techniques have not yet managed to become part of our everyday life. Raising awareness is an issue of major importance.

Alongside with awareness-raising campaigns, local authorities and stakeholders should also focus on four issues:

a) Water-saving techniques: reducing consumption.
b) Further development of the already existing water sources.
c) Desalination.
d) Water Recycling and Re-use

a) Water-saving techniques: Reducing consumption.

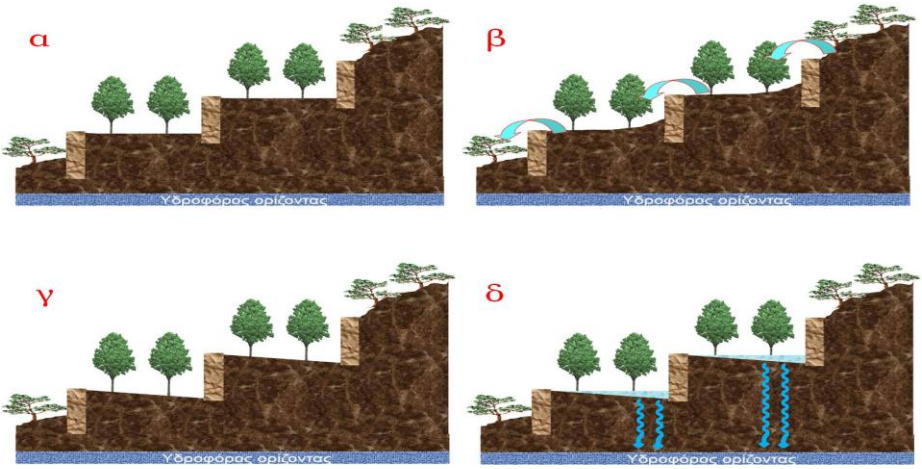
Water saving tips that can be immediately implemented by local authorities and local stakeholders:

- Hotels: Local Authorities should encourage the hotels of the area to incorporate environment-friendly practices within the hotels, one of them being water saving practices (e.g. the "use your towel once more" urge to the tourists, or install tap aerators to diminish water consumption). And above all, to inform the visitors and raise awareness amongst them too.
- Stakeholders/households: Most of the appliances mentioned below are very cheap to buy and the Local Authorities could provide them for free to the public:

- Install a low-flow shower head and tap aerators on all taps.
- Use waterless toilets.
- Plant water-wise indigenous plants.
- When using a hose pipe use a shut-off nozzle.
- Water gardens only early in the morning or the evening and only when necessary.
- Collect rainwater for re-using in the garden or washing the car.
- Insulate hot water pipes so that not too much water is wasted when waiting for water to get hot.
- Install a multi-flush or dual-flush mechanism in the toilet. A multi-flush device allows the user to choose exactly how much water goes to waste when flushing.
- Use latest technology dishwashers and washing machines with EU rating A.
- Install grey water re-use systems.

b) Further development of the already existing water sources - Utilizing rainwater.

Traditionally, especially in "water poor" regions, people have learnt to manage and utilize rainwater in such a way that it can be: a) deposited in traditional deposits such as wells b) directed towards strengthening and enriching the aquifer. A good practice of this can be found in the work which was implemented in Naxos island and the community of Aperathou, during the administration of Mr. Manolis Glezos, where traditional terraces have been preserved in such a way to redirect rainwater towards the aquifer.



Picture 1: Preserving traditional terraces and enriching the aquifer (P. Gikas, 2011).

c) Desalination

One of the increasingly popular "*solutions*" to water shortage is desalination: the process of converting salt water into fresh water, suitable for human consumption or irrigation. However, desalination has already become a very popular means of "*creating freshwater*" in several parts of the world, with Malta, Spain, Saudi Arabia, as well as Cyprus and certain Aegean islands (Syros for instance) being some examples. Desalination has been accused of having severe environmental impacts, related to the disposal of brine on *Posidonia* sea grasses (Latorre, 2005), as well as of being energy-consuming. The use of renewable energy technologies could be a solution regarding the energy-consumption, while the disposal of brine in areas with strong currents could be an idea of how to avoid creating environmental problems at local level.

d) Water Recycling and Re-use.

Recycled or reclaimed water is former wastewater that has been

treated to remove solids and certain impurities, and then can be reused. Water recycling requires much less energy than desalination for example, while its production is also cheaper. Therefore, recycled water can be used in irrigation for example where quality standards are not that high, allowing for fresh or desalinated water to be used for other purposes. Recycled water can be used in: agricultural irrigation, urban irrigation, industry, toilets, car-washing, fire protection, while high quality recycled water can be used to recharge groundwater aquifers.

It needs to be noted though, that recycled water is not yet totally safe for drinking (Gikas and Tchobanoglou, 2008; Gikas, Liu, and Papageorgiou, 2009).

References/useful information:

1. **UNDP (2004).** Protecting International Waters. Sustaining livelihoods. Lessons for the future, UNDP.
2. **UN. 'Atlas of the Oceans'** , Available at: http://www.oceansatlas.org/index.jsp,accessed on 11/03/2011
3. **Blue Plan Notes**, Environment and development in the Mediterranean, No 16, July 2010.
4. **Gikas, P. 2011.** "Sustainable use of water resources in greek islands", found in Water for the islands**,** Elliniki Etaireia (eds) 2011 (forthcoming).
5. **Gikas, P., Liu, S. and Papageorgiou, L.G., 2009,** "Integrated Management of desalinated and reclaimed water in water deficient islands", 7th IWA World Congress on Water Reclamation and Reuse (REUSE09), 21-25 September, Brisbane, Australia, Paper No. PL20-3.

6. **Gikas, P. and Tchobanoglous, G., 2008.** The Importance of Water Reuse in Sustainable Water Resources Management: State of the Art through the Presentation of Selected Case Studies. 2nd Specialised Conference on Decentralised Water Management, Skiathos, Greece.
7. **Giorgi, F., Lionello, P., 2008.** "Climate change projections for the Mediterranean Region." Global Planet Change, 63, 90-104.
8. **Latorre, M., 2005.** "Environmental impact of brine disposal on Posidonia seagrasses." Desalination, 000 (2005), 517-524, available at: http://www.desline.com/articoli/6690.pdf [13]
9. **Water in Crisis: A Guide to the World's Fresh Water Resources,** Edited by Peter H. Gleick, 1993.
10. **IPCC Fourth Assessment Report: Climate Change, 2007.**

E-sources:

11. http://www.eea.europa.eu/themes/water/water-resources/climate-impacts-on-water-resources
12. http://www.eea.europa.eu/signals/articles/alps
13. http://www.desline.com/articoli/6690.pdf
14. http://www.watersave.gr
15. http://www.wateruseitwisely.com/
16. http://www.watereuse.org/

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