ADAPTaRES Project: Adaptation to climate change in Macaronesia through the efficient use of water and its reuse [1]

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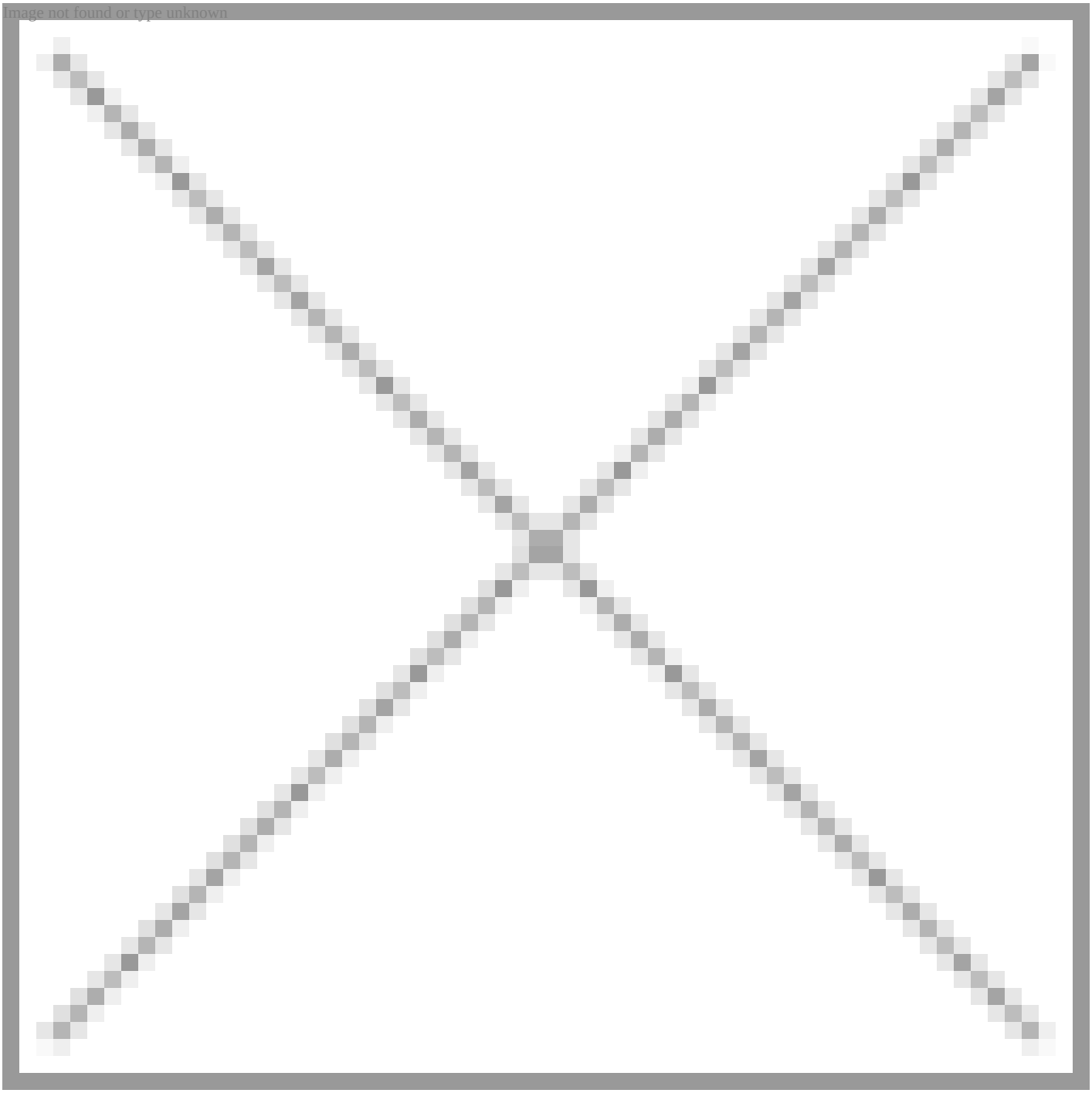

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The islands of Macaronesia are not spared from the effects of climate change, being very vulnerable to their consequences given their particular geographical situation, insularity, remoteness from the continent, fragmentation, external dependency, scarcity of natural resources, demographic density, dependence on the

tourism sector and great biodiversity.

The decrease in their already scarce water availability coupled with a growing demand for water (increase in population, standard of living, tourism, ...) causes a deficit that favors competition for water among the different economic sectors, considerably affecting their global development.

Under these conditions, adequate management of water resources and reuse of treated water with adequate physico-chemical and microbiological quality is essential and necessary for agricultural irrigation, golf courses, green areas, and other non-drinking water uses, which helps to alleviate its deficit and foster environmental conservation.

Case Study Description

Challenges:

The Macaronesian region is particularly sensitive to the effects of climate change due to its intrinsic island characteristics and geographic location, which also generates a great dependence on the outside. In turn, pressures from tourism and the high urban demographic concentration are equally determining factors in this area.

Under these baseline conditions and with an ecosystem rich in biodiversity and especially sensitive to external aggressions and in view of expected drought risks caused by the increase of dry periods and the evapotranspiration of plants and soils, added to the overexploitation of water resources during the last century, Macaronesia faces the pressing challenge of halting the effects and consequences of climate change in terms of water availability and the securing of hydraulic resources.

In this sense, the ADAPTaRES project aims to tackle and face the challenges associated with this water shortage, addressing technological solutions for obtaining reclaimed water, efficient irrigation techniques and natural water purification and treatment models, among other initiatives.

Particularly important is the reuse of purified water with adequate physical, chemical and microbiological quality, which constitutes a necessary and fundamental resource for all irrigation tasks. Thus, an important part of the adaptation strategies in the agricultural, landscaping and maintenance of green facilities (soccer fields, golf courses, ...) are aimed at promoting more efficient irrigation and mobilizing alternative, insufficiently exploited water resources, as is the safe reuse of wastewater treated with advanced irrigation techniques.

This poses numerous challenges locally, such as:

- developing the necessary water transport, storage, treatment and quality control infrastructure
- guaranteeing the quality of the purified water through appropriate treatment technologies
- having good practice manuals, training for farmers and advisory services
- overcoming barriers and extra costs that current regulations impose on small-scale reuse
- generating trust through transparency of information and awareness, promoting social acceptance of the use of reclaimed water
- promoting affordable prices for purified water that are cheaper than desalinated or groundwater

Objectives:

The general objective of the project is to promote adaptation to climate change, as well as to increase prevention and resilience to specific risks through the efficient use of water, the search for alternative resources and their reuse in agricultural activities in Macaronesia.

In general, the project includes a whole series of actions aimed at the reuse of treated wastewater, efficient irrigation and pollution prevention and reduction, which help to overcome existing regulatory, social, economic or

technological barriers, all of this accompanied by a significant awareness and informative efforts and qualification actions at all levels of society.

n this sense, the priorities set out among the partners were the following:

• awareness-raising actions for the population, in addition to imparting training to technicians and farmers in the areas of sanitation, treatment and reuse of treated wastewater, efficient irrigation and loss control in hydraulic networks

• promotion of quality control, evaluation of alternative indicators and continuous monitoring of treated wastewater destined for reuse, in addition to monitoring products, soils and plants

• definition and installation of technologies adapted to local conditions, especially on a small and medium scale, to improve the quality of treated wastewater for reuse

• support experience management and sharing between regions to enable and guarantee the economic, social and environmental sustainability of the various systems

To achieve its purpose, the project is structured into three main specific objectives:

1. Awareness, information and qualification, to enable the active participation of society in the promotion of the efficient use and reuse of reclaimed water as an adaptive strategy before climate change and water scarcity situations

2. Application and evaluation of treatment technologies and control systems to guarantee the efficient use of water and the production of reclaimed water of sufficient quality, in order to build resilient communities in situations of water scarcity caused by climate change

3. Demonstration, optimization and evaluation of the reuse of reclaimed water and promotion of good irrigation practices adapted to climate change and risk situations associated with water scarcity

Adaptation measures implemented in the case study:
Structural/physical: Engineering alternatives and options for built environments [3]
Structural/physical: Technology options [4]
Structural/physical: Ecosystemic options [5]
Social: Education options [6]
Social: Information options [7]
Social: Behavior options [8]
Solutions:
To achieve the stated objectives, ADAPTaRES proposes the development of a whole series of activities:

- awareness to drive active participation of society in the efficient management of water resources and building resilience in situations of scarcity of water resources associated with climate change
- App-based information systems for key public stakeholders such as farmers, to promote the efficient use of irrigation water and the safe reuse of reclaimed water as a strategy for adaptation to climate change
- qualification and experience sharing, to achieve efficient management of hydraulic networks and the reuse of treated wastewater as adaptive strategies to climate change through distance learning (on-line and radio broadcast), in-person training, organization of specialized seminars, ...
- promotion of water resource management, treatment and reuse systems resilient to climatic changes through ecozone definition
- development of viable, advanced reuse quality control systems adapted to risk situations associated with climate change

- analysis of emerging pollutants, especially drugs, to assess the risk of using reclaimed water as a strategy for adaptation to climate change
- Installation of demonstration plots for reuse of reclaimed water using crops and irrigation technologies with minimal sanitary risk and maximum efficiency.
- development of experimental plans for the efficient use of irrigation in various applications adapted to climate change
- elaboration of codes of good irrigation practices and adaptation to climate change for Macaronesia

Importance and relevance of the adaptation:
In a region such as Macaronesia, so particularly exposed to the undesirable effects of climate change and its possible consequences (sea level rise with marine intrusion and aquifer salinization, increased periods of drought with soil degradation, desertification and deforestation, reduction of available water resources with a decrease in surface and aquifer reserves, loss of ecosystems and biodiversity, ...), it is vitally important to become aware of the essential efficient use of water and the need to reuse purified water to supply irrigation systems and other uses.

In this sense, the non-exhaustive proposed adaptation strategies focus on promoting diversified agricultural systems, having better information available on the choice of crop varieties and soil management and alternative, insufficiently exploited water resources, such as reuse of wastewater treated with advanced irrigation techniques, for which adequate sanitation management, treatment plants and the promotion of good reuse practices is essential.

In accordance with the aforementioned, ADAPTaRES clearly addresses sustainable adaptation to climate change, improving the response capacity of the islands of this region to its possible and foreseeable effects and consequences on the natural water cycle.

Additional Details
Stakeholder engagement:
ADAPTaRES is an ambitious project in which 8 organizations participate as ERDF beneficiaries (from the Canary Islands and Madeira) and 7 take part as participants from third countries or partners (outside the EU), all from Cape Verde, with the Canary Islands Technological Institute (ITC) being responsible for its coordination.

The entities involved thus affect representatives of all the agents and areas involved in water management in Macaronesia, and include the following:

- Madeira:
- Aguas e Resíduos de Madeira (ARM)
- Agência Regional da Energia e Ambiente (AREAM)
- Canary Islands:
- Instituto Tecnológico Canarias (ITC) (Coordinador)
- Consejo Insular de Aguas de Gran Canaria (CIAGC)
- Universidad de Las Palmas de Gran Canaria (ULPGC)
- Radio ECCA, Fundación canaria
- Mancomunidad del Sureste de Gran Canaria (MANSURESTE)
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Consejo Insular de Aguas de Fuerteventura (CIAFT)

- Cape Verde:
- Agencia Nacional de Agua e Saneamento (ANAS)
- Aguas de Santiago (ADS)
- Instituto Nacional Investigação e Desenvolvimento Agrário (INIDA)
- Universidade de Cabo Verde (Uni-CV)
- Direção Nacional do Ambiente (DNA)
- Direção Geral da Agricultura, Silvicultura e Pecuária (DGASP)
- Águas de Ponta Preta Lda (APP)
- Direção Nacional de Educação (DNE)

Project interest:
ADAPTaRES promotes different water saving and reuse strategies to alleviate drought and to adapt to the changes caused by climate change in the islands of Macaronesia.

In this sense, and although the project is still in development, many achievements have been made that refer, among others, to the following aspects of particular interest to the project:

- Deployment of educational resources and awareness tools through practical implementation for the majority of the population, including all types of age groups and academic level. In this sense, radio classrooms, the audio knowledge bank and the radio spots from some interviews have constituted a tool that has enabled making complex concepts accessible to a population normally excluded from or alien to this type of training.
- Creation of a mobile application (App) geared at providing differentiated quality services, especially to reclaimed water users, to promote efficiency in the use of water and good practices in situations of risk and water emergencies, such as shortages or droughts
- Evaluation of emerging pollutants (such as drugs, for example) present in treated wastewater and groundwater, as well as the behavior of broad-reaching and low energy cost technologies in terms of their degradation, geared at promoting reuse as an adaptation strategy against climate change, demonstrating its lower environmental impact and minimal risks to health and the environment
- Design, development and implementation of plots in Cape Verde and the Canary Islands to demonstrate good irrigation and reuse practices adapted to climate change and risk prevention. In these plots, underground irrigation has been proposed as a technique to adapt to climate change, preventing water evaporation since the irrigated soil surface remains dry and, on the other hand, contact of regenerated water with the aerial parts of harvested plants is avoided.

Success and limiting factors:
Although the project is still under development, the achievements to date are remarkable; as a result:

- Quantitatively, information to and awareness-raising among up to 140,000 people on the effects of climate change and active adaptation strategies is under way, having reached 66,000 citizens to date, including 12,000 schoolchildren and young people from 90 educational communities and 150 workers of the agricultural sector
- a reduction of 27% of solid waste reaching the regional treatment plant from the sanitation network in southeast Gran Canaria island has been ascertained, reducing treatment costs and increasing the possibilities of reusing purified water in the area where part of the communication campaigns have been

targeted

- Wastewater treatment technologies and control systems in the sewer system of the Canary Islands and Cape Verde are being evaluated to ensure the safe and sustainable reuse of water. An integrated quality control system for reclaimed water is currently being implemented.
- in the islands of Gran Canaria and Santiago, the project is specifically analyzing the levels of pharmaceutical pollutants in wastewater treatment plants, having elimiated up to 99% of these chemical products after conducting more than 5,000 tests
- a network of 4 demonstration pilot plots has been created to develop proposals for good practices in soil and crop protection, as well as for buried irrigation systems and the possibilities of using reclaimed water and its effect on these and on the health of farmers, including a reduction in the use of fertilizers, taking into account the nutrients provided by these regenerated waters. Twenty jobs have been created in this regard.
- A mobile app has been created, available in Madeira and Gran Canaria to facilitate rapid and efficient communication between organizations managing water resources and irrigation water end users. The app is expected to reach some 40,000 people throughout 2019 and 2020, and will allow application of a demand management policy in drought risk situations
- In light of the drought situation and the low level of the reservoirs on the southern side of the island, the Insular Water Council of Gran Canaria has established several adaptation measures, among which, temporary irrigation restrictions using surface water in agricultural areas adjacent to reservoirs must be highlighted. In this sense, reclaimed water in the southeast area could be transferred to these irrigated areas, allowing to overcome a climate crisis situation without loss of farms or crops. Once the reservoirs recovered a certain level of water, transfer of reclaimed water stopped, but the infrastructure remains as an element of resilience in critical situations
- farmers in irrigated areas have received training on best irrigation practices, based on experiences developed in communities resilient to climate change. These practices are associated with low-energy treatment systems, such as in the cases of Saint Lucia in Gran Canaria or Cape Verde, which are examples to be replicated in other settings
- numerous activities as well as didactic, training and informative tools have been generated (workshops, videos, exhibitions, ...), which can be used in other projects with similar undertakings.

Among the obstacles and/or limiting factors for the development of the project and the proposed adaptation measures, the following should be highlighted:

- In some institutions, no specific staff is available to carry out some of the project activities and the adaptation strategies proposed, which leads to delays in the implementation of some actions.
- The implementation of measures in Cape Verde, with the shipment of materials from the Canary Islands, has led to some delays with customs clearance procedures, which has caused delays in their execution

Budget, funding and additional benefits:
The total investment of the project is € 1,959,083, with a contribution from the European Regional Development Fund of the European Union of € 1,665,221.00 (85%) through the operational program «Interreg VA Spain-Portugal [Madeira- Açores-Canarias (MAC)]» for the 2014-2020 programming period. The investment corresponds to the priority "Climate change and risk prevention".

The remaining financing amount, amounting to € 293,862.59 (15%), is provided by different collaborating partners, according to the following breakdown:

- Instituto Tecnológico de Canarias SA. ITC 3,44 %
- Consejo Insular de Aguas de Gran Canaria CIAGC 3,70 %
- Universidad de Las Palmas de Gran Canaria ULPGC 2,94 %
- Consejo Insular de Aguas de Fuerteventura CIAFT 0,53 %
- Agencia Regional da Energia e Ambiente

da Regiao autónoma da Madeira AREAM 0,47 %

- Agua e Resíduos de Madeira SA. ARM 1,07 %

Legal aspects:
Among the relevant legal aspects affecting the project, the following should be highlighted:

- Directive 2000/60/EC of the European Parliament and of the Council of October 23, 2000, establishing an European Community framework for action in the field of water policy
- Royal Decree 1620/2007 of December 7, which establishes the legal regime for the reuse of treated water
- Proposal for a Regulation of the European Parliament and of the Council, regarding the minimum requirements for the reuse of water COM/2018/337 Final - 2018/0169 (COD)
- Adaptação às Alterações Climáticas da Região Autónoma da Madeira Strategy. Resolution of Conselho de Governo No. 1062/2015, of November 26, and published in JORAM I series, No. 188, of December 2

The recent Agreement of the Government Council of the Canary Islands, dated August 30, 2019, regarding a Declaration of Climatic Emergency in the Autonomous Region of the Canary Islands brings particular significance in this regard.

Implementation time:
ADAPTaRES is in full execution; its development is planned for a period of three years, between January 2017 and December 2019. However, an extension to the project has recently been approved, extending its full execution period to four years and ending in December 2020.

Reference Information
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Websites:
http://adaptares.com/es/ [10]

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What I can do?

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