(Projects funded under the Call 2014 onwards must use this format)

LIFE Project Number

LIFE16 ENV/ES/000341

Final

Covering the project activities from 01/11/2017[1] to 31/12/2020

Reporting Date[2]

20/02/2021

LIFE PROJECT NAME or Acronym

DESEACROP

Data Project

Project location: MURCIA Y ALMERIA		
Project start date:	01/11/2017	
Project end date:	30/10/2020	**Extension date:** <31/12/2020 >
Total budget:	1,048,026 €	
EU contribution:	607,329 €	
(%) of eligible costs:	59,03	

Data Beneficiary

Name Beneficiary: UNIVERSIDAD POLITÉCNICA DE CARTAGENA	
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Project Website:	www.deseacrop.eu

This table comprises an essential part of the report and should be filled in before submission

[1] Project start date

[2] Include the reporting date as foreseen in part C2 of Annex II of the Grant Agreement

Please note that the evaluation of your report may only commence if the package complies with all the elements in this receivability check. The evaluation will be stopped if any obligatory elements are missing.

Package completeness and correctness check	
Obligatory elements	**✓ or N/A**
Technical report	
The correct latest template for the type of project (e.g. traditional) has been followed and all sections have been filled in, in English *In electronic version only*	
Index of deliverables with short description annexed, in English *In electronic version only*	
Mid-term report: Deliverables due in the reporting period (from project start) annexed Final report: Deliverables not already submitted with the MTR annexed including the Layman's report and after-LIFE plan Deliverables in language(s) other than English include a summary in English *In electronic version only*	
Financial report	
The reporting period in the financial report (consolidated financial statement **and** financial statement of each Individual Beneficiary) is the same as in the technical report with the exception of any terminated beneficiary for which the end period should be the date of the termination.	
Consolidated Financial Statement with all 5 forms duly filled in and signed and dated *Electronically Q-signed or if paper submission signed and dated originals* and in electronic version (pdfs of signed sheets + full Excel file)*	
Financial Statement(s) of the Coordinating Beneficiary, of each Associated Beneficiary and of each affiliate (if involved), with all forms duly filled in (signed and dated). The Financial Statement(s) of Beneficiaries with affiliate(s) include the total cost of each affiliate in 1 line per cost category. *In electronic version (pdfs of signed sheets + full Excel files) + in the case of the Final report the overall summary forms of each beneficiary electronically Q-signed or if paper submission signed and dated originals**	
Amounts, names and other data (e.g. bank account) are correct and consistent with the Grant Agreement / across the different forms (e.g. figures from the individual statements are the same as those reported in the consolidated statement)	
Mid-term report (for all projects except IPs): the threshold for the second pre-financing payment has been reached	
Beneficiary's certificate for Durable Goods included (if required, i.e. beneficiaries claiming 100% cost for durable goods) *Electronically Q-signed or if paper submission signed and dated originals* and in electronic version (pdfs of signed sheets)*	
Certificate on financial statements (if required, i.e. for beneficiaries with EU contribution ≥750,000 € in the budget) *Electronically Q-signed or if paper submission signed original and in electronic version (pdf)*	
Other checks	
Additional information / clarifications and supporting documents requested in previous EASME letters (unless already submitted or not yet due) *In electronic version only*	
This table, page 2 of the Mid-term / Final report, is completed - each tick box is filled in *In electronic version only*	

**signature by a legal or statutory representative of the beneficiary / affiliate concerned*

1. Table of contents

Mid-Term Report

Figures

2. List of key-words and abbreviations

DSW: Desalinated Sea Water
SE: South Eastern
UW: Underground Water
KPI: Key Performance Indicator
MICINN: Ministry of Science, Innovation and Universities of Spain
PM: Project Manager
UAL: University of Almeria
UPCT: University of Cartagena
JCR: Journal Citation Reports
LCA: Life Cycle Analysis

3. Executive Summary

The main objective of DESEACROP is to put into practice, test, evaluate and disseminate the sustainable management of desalinated seawater in soilless irrigation systems with partial reutilization of drainages, to boost resource-use efficiency and productivity. Additionally, DESEACROP strengthens crop production resilience as a key productive, economic, social and environmentally friendly sector in the water-stressed Mediterranean region and promotes the replication of the project results and innovations to other places and contexts.

DESEACROP has run as planned in the proposal without any major deviations. Minor amendments have been implemented without critical modification or delays in the project schedule. All milestones proposed in the grant agreement (GA) up to the final report date have been accomplished and all tasks has been finished. An extension of the project of two months was approved by the commission with new end 31/12/2020.

Within **action A1**, the current and the expected desalinated sea water (DSW) resources for irrigation in Southeast of Spain (≈ 163 Mm^3) and nine international water-stressed areas have been documented, considering aspects related to energy consumption and carbon dioxide (CO_2) emission at the plants. The quality of the DSW produced and its suitability for irrigation based on crop protection criteria have been assessed, with particular focus on boron toxicity hazards. The type of crops, extension and water requirements of soilless agriculture in south Spain have been described and the capacity to spread project results has been assessed (**action B4**). Although not all desalination plants could provide all data requested for our comprehensive survey, most missing data could be retrieved from reports, articles and statistics. The achievements of this action are presented in the deliverables DA1.1 to DA1.5.

As regards **action B1**, the demonstrative plots were set up, including fertigation equipment and the solar-assisted drainage treatment plant (deliverable DB1.1). The setup of the plot was delayed 3 months, but it did not have any major impact on project timelines, since it was ready for the first planned crop cycle. The frequent fluctuations in the water reservoir, initially planned to provide brackish UW, could hinder the assessment of salinity effects in the plant and soil. To address this issue, additional equipment (info in the Annex I presented within the Mid-Term Report) was installed to produce water with the physic-chemical characteristics of local UW and constant salinity levels. There were several complications in the installation and final tuning of the desalination module. The greenhouse drainages could not be treated until the second crop cycle (drainages are on average 20% of irrigation water per cycle; 540 m^3/ha). During the 3th and 4$^{th\ cycle}$ drainages have been collected and treated satisfactorily (deliverable DB2.5) and have allowed assessing the technical and economic aspects of the desalination module (info in Annex II presented within the Mid-Term Report).

Action B2 and B3 ran as scheduled. **Task B2.2** was approved by EASME to continue until the end of the last crop cycle (deliverables DB2.1 to DB2.4 show the main results of the action). Four cycles of tomato crop have been completed (Sep-18 to Jan-19; Feb-19 to Jul-19; Sep-19 to Jan-20 and Feb-20 to Jul-20). All deliverables corresponding to these tasks have been presented with the Final report.

In **action B4** potential clients and interested stakeholders have been identified and business cases have been developed, looking for financing options in the selected regions (Campo de Cartagena in Spain, La Puglia Region in Italy and Malta). Business cases for the specific case of implementing an on-farm desalination plant have been also developed. Deliverables DB4.1 to DB4.5 have been completed.

Monitoring **actions C1 (agronomic and technical issues) and C2 (socioeconomic issues)** ran according to schedule but deliverables DC1.1 – DC1.4 were delayed a few months due to the belated end of the second and fourth tomato cycle (July 2019 and July 2020), but on time for the final report.

In **action D1**, DESEACROP website, Facebook, LinkedIn and Twitter accounts have been operational and frequently updated, a newsletter has been periodically published, and notice boards and stickers have been displayed in the demonstration site to increase the visibility of the project to the visits. The project has been presented in digital press, radio, TV and international conferences. In addition, 12 technical articles have been published, out of which, 7 are listed in JCR journals. The project communication, dissemination and exploitation plans, the portfolio and flyer are ready and available for all partners from the first term of the project as well as dissemination materials such as folders, pens and pen-drives. Concerning networking activities, it is highlighted that project partners visited the facilities of irrigation manufactures company (1), aligned LIFE (2), ERANET (1) and *Retos-Colaboración* (MICINN) (1) projects and met Regional Water Authorities including the General Director of Water in the Region of Murcia (current Agricultural Adviser of the Region of Murcia) to discuss project prospects. Missing deliverables DD1.7 to DD1.11 are presented with the final report.

The progress of **actions E1, E2 and E3** is described in section 6 of this report.

4. Introduction

Feeding 9 billion people in 2050 will require increasing the world food production from 70 to 100% and escalating global energy figures up to 40%. However, freshwater availability is being reduced by the climate change, agricultural greenhouse gas emissions already account for 14% in the EU and other resources such as mineral nutrients are limited, which limits the ability to produce enough food. Additionally, conventional intensive irrigated agriculture; *i.e. fertirrigated agriculture in soil*, which is usually more productive and efficient in arid and semiarid regions, tends to overexploit non-conventional water resources such as groundwater and pollute aquifers. This extreme situation jeopardizes the sustainability of irrigated agriculture, its resilience and hence food production.

In the case of SE Spain, which is the region selected in DESEACROP to tackle the proposed environmental problem, the main issues are: (i) more than 3,000 km^2 of polluted aquifers (50% of total aquifers), (ii) an structural water deficit in the basin of 400 hm^3/year, (iii) 90.1% of the aquifers with bad quality mainly affected by nitrates contamination, (iv) direct deterioration of *Mar Menor* coastal lagoon, (v) seawater intrusion by depletion of groundwater and hence agricultural land salinization, (vi) significant secondary salinization of soils due to the use of waters with low quality for irrigation. Although traditional conservation agricultural practices have been done in recent years, such as precision and regulated deficit irrigation, the use of reclaimed water, evaporation mitigation in on-farm reservoirs by using shade covers, it seems that this is not enough. Consequently, other more innovative alternatives such as the irrigation with desalinated seawater and drainage treatment with reverse osmosis assisted with solar panels demonstrated in this project must be taken into account. In the case of the desalinated seawater, it is a water resource that can contribute to effectively remove the hydrological constraints for crop production in arid and semiarid coastal regions. The current production of DSW in SE Spain for irrigation is 270 hm^3, which represents 67% of the water deficit in the basin. In the case of soilless cultivation, drainages represent, on average for a tomato cycle, 20% of the irrigation doses and up to 70% of drainages could be recovered for irrigation.

The main objective of DESEACROP is to put into practice, test, evaluate and disseminate the sustainable management of desalinated seawater in soilless irrigation systems with partial reutilization of drainages, in order to boost resource-use efficiency and productivity. Additionally, this project contributes to strengthen crop production resilience as a key productive, economic, social and environmentally friendly sector in a water-stressed Mediterranean semiarid region and to extrapolate the new techniques to other places and contexts under similar circumstances. The specific objectives are:

a) The characterization of the current and expected (i) capacity of DSW production, (ii) crop surface with possibility of being irrigated with DSW by means of soilless systems, including both outdoor and greenhouses, and (iii) water demand for soilless agriculture, in the water-stressed south eastern Spain. *Already achieved.*
b) The evaluation of the quality of DSW supplied to farms and to analyse its suitability based on the quality standards for crop protection criteria. *Already achieved.*
c) The improvement of the efficiency in the treatment of the drainage flows to increase the water use efficiency and productivity and preserve the environment. *Already achieved.*
d) The optimization of the use of DSW in soilless systems in order to increase productivity and production quality. *Already achieved.*
e) The demonstration of the sustainability of replacing conventional soil cultivation and water resources with re-mineralized DSW and soilless systems based on the assessment of performance indicators to determine the energy consumption, the water-energy nexus, the carbon footprint, the farming costs and the profitability in soilless cultures. *Already achieved.*

f) The assessment of the socio-economic, environmental impacts and implications of DSW management for irrigation in selected study cases; including the challenges and opportunities it provides to policy makers in their decisions aimed at a more sustainable management of agriculture and water resources. *Already achieved.*
g) The replication and transfer the project results and approaches in other contexts with similar and different contour conditions. *Business cases and Financial opportunities achieved. Replication and transference in Progress.*

By fulfilling the proposed specific objectives, the main expected results and environmental benefits are shown in the following table (*table as shown in the DESEACROP grant agreement*)

Result or Benefit	Baseline scenario	Scenario I	Scenario II	Scenario III
Yield (kg/ha)**	140,000	140,000	307,000	307,000
Water used (m^3/ha)	8,000	6,400	6,400	6,400
Water saved (m^3/ha)	0%	20%/1,600	20%/1,600	20%/1,600
Energy used (kW·h/ha)	3,840	3,072	15,776	28,480
Energy saved (kW·h/ha)	0	768	-11,936	-24,640
CO_2 emissions ($kgCO_{2eq}$/ha/year)	1,014	811	4,165	7,519
CO_2 reduction ($kgCO_{2eq}$/ha/year)	0	203	-3,151	-6,505
Specific energy (kW·h/Tm)	27	22	51	93
Specific CO_2 ($TmCO_2$/Tm)	0.007	0.005	0.014	0.025
CO_2 fixed*** ($kgCO_{2eq}$/ha/year)	18,046	18,046	39,572	39,572
Total CO_2 reduction ($kgCO_{2eq}$/ha/year)	17,032	17,235	35,407	32,053

*Values refer to two cycles of a tomato crop; ** Tomato yield in soilless cultivation = 140 tm/ha. Tomato yield in soilless cultivation with DSW irrigation at 50% or 100% mix = 307 tm/ha. *** Considering that 1 kg of tomato is able to fix 128.9 g CO_2; Baseline Scenario: Soilless open systems + 100% underground water; Scenario I: Closed soilless system + 100% underground water, Scenario II: Closed soilless system + 50% mix of desalinated and underground water, Scenario III: Closed soilless system + and 100% of desalinated water.

Considering the *expected longer-term results*, the project envisages having impacts at least beyond 3 years once the project finishes. In this sense, the compilation of the EASME KPIs is focused on this purpose. DESEACROP has conducted the "*Replicability and transferability business model plan developed*" and elaborated, for the selected areas (Cartagena, La Puglia, and Malta), the business cases and finding financing opportunities to transfer and replicate the project. Virtual meetings have been already established with Cartagena and Malta.

In DESEACROP, saving water and conserving the environment (atmosphere, soil and aquifers) while increasing water productivity and efficiency are in line and will contribute to the Water Directive 2000/60/EC, the Groundwater Directive (2006/118/EC), the Nitrates Directive 91/676/EEC or the EU Common Agricultural Policy (CAP).

5. **Administrative part**

Project management and coordination

The project manager (PM) manages and controls project actions in terms of time and budget. Every participating partner has appointed staff in charge of the administrative and financial aspects. The Management Board (MB) meets every six months to review the progress of the project. The MB decides on all contractual matters and resolve any potential issues of conflict. All modifications with relevant impact on the project, such as reallocation of project budget and resources are carefully examined by the MB. Since the number of beneficiaries in this project is four, the MB has assumed the role of the Steering Committee (SC).

The PM has organized the following events held to date: the kick-off meeting (October 2017), the first follow-up meeting with the monitor (March 2018), the second follow-up meeting with the monitor (November 2018) and the MB meetings (10/11/2017, 10/07/2018, 25/09/2018, 30/05/2019, 09/10/2019, 22/06/2020, 10/12/2020 (**action E1**)). He created and keeps updated a digital repository in Google Drive, in which all the administrative and technical information are continuously uploaded. All partners have actively collaborated with the PM and provide him with the information to be uploaded. The PM has worked with Encarna Aznar (from UAL) to keep updated the website and DESEACROP media networks (Facebook, Twitter and Linked in). He defined and agreed with the associated beneficiaries the schedule for taking samples at the demo plot for each tomato cycle and for experimental data uploads in order to continuously monitor project results. Project partners have arranged guided visits to desalination plants and the demo plot and organized workshops on project topics. No significant problems have been found in management and coordination up to Final report date. The work plan has run as expected. Project management and coordination has been also supported by the OPECT (European project office in the UPCT) and HIPATIA consultancy, which was hired in April 2018 to support project administrative and financial matters.

Communication with the EASME and the monitoring team

Communication with the monitoring team, in our case Ms Patricia Serrano, has been mainly by email. Our communications have dealt with: (i) project start-up, (ii) how to make expenditures and how to justify deviations, (iii) how to manage person-months in the project, (iv) amendment to change Sadyt for Valoriza-Agua, (v) support with the LIFE Key Performance Indicators, (vi) organization of the control visits, (vii) revision of the technical changes carried out in the project, (viii) amendment to change Valoriza-Agua for Sacyr Water, (ix) support with the progress report, (x) amendment to apply for project extension and (xi) other minor matters.

Amendments to the Grant Agreement

Since the beginning of the project, we have requested three amendments. In the first one (01/2018) we requested the change Sadyt for Valoriza-Agua. The change was justified and approved by EASME (03/2019; ARES 2018 1318376). In the second (01/2019) we requested the change of Valoriza-Agua for Sacyr Water. It was also justified and approved by EASME (06/2019; ARES 2019 1608419). In the third (21/09/2020) we requested a project extension of two months. It was also justified and approved by EASME (10/2020; ARES 2020 5555745)

6. Technical part

6.1. Technical progress, per Action

A1. Characterization of current and expected desalinated seawater production for crop irrigation in the water-stressed south eastern Spain				
A1.1. To identify seawater desalination plants supplying irrigated agriculture and their technology, capacity production, amounts supplied to farmers and expected availability				
- **Status:** Completed	Foreseen start	01/11/2017	Actual start	01/11/2017
	Foreseen end	31/05/2018	Actual end	30/09/2018

- **Activities undertaken and outputs achieved:** The inventory of seawater desalination plants supplying desalinated water for agriculture in South Eastern (SE) Spain has been completed. Data from 19 plants were collected of which 8 have been visited by project partners. The combined annual water production is 406 Mm^3 of which 163 Mm^3 are used for irrigation. Due to the growing demand, a short-term increase of 211 Mm^3 in annual production is expected. In addition, data from plants located in 9 international water-stressed regions were collected to characterize the current situation and future prospects.
- **Actual vs. planned outputs:** Outputs as expected. The current situation of desalinated seawater production in southeast of Spain and 9 international regions has been quantified and characterised.
- **Modifications:** Only minor.
- **Problems:** Not all plants could provide all data requested for our comprehensive survey, and some data needed to be retrieved from reports, articles and statistics.
- **Complementary actions:** Interaction with stakeholders to assess the future needs of desalinated seawater for irrigation in SE Spain.
- **Future perspectives:** New seawater desalination plants are planned in South Eastern (SE) Spain in the short term, might be characterised and included in the current inventory.
- **Deliverables:** DA1.1. Report on results of surveys, one month later than surveys are finished.
- **Achieved milestones:** M1. All surveys conducted.
- **Figures**

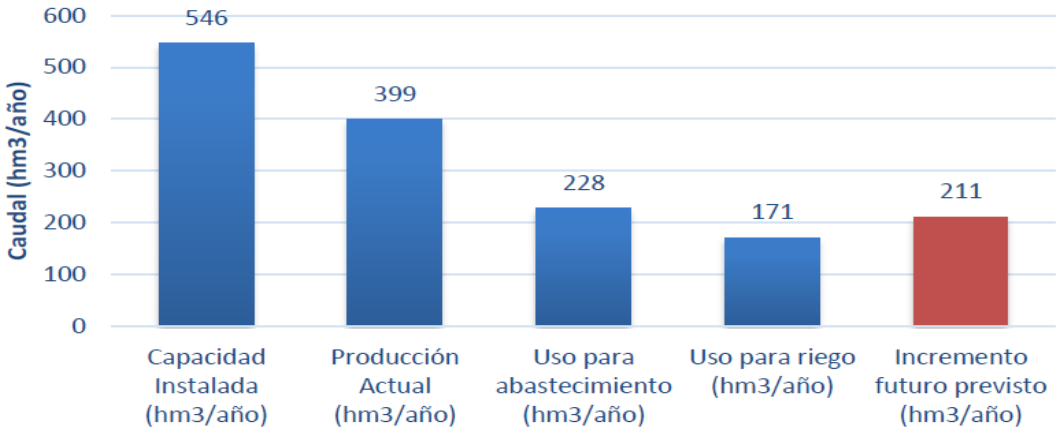


Fig. 1. Current and envisaged DSW production in SE Spain

A1.2. To evaluate desalinated seawater quality and compare with required water quality for soilless irrigation				
- **Status:** Completed	Foreseen start	01/11/2017	Actual start	01/11/2017
	Foreseen end	31/05/2018	Actual end	31/05/2018

- **Activities undertaken and outputs achieved:** A comprehensive report on the potential hazards of boron toxicity in plants and soil was delivered. This report provides the norms and recommendations established for boron concentration in irrigation water.
- **Actual vs. planned outputs:** Outputs as expected.
- **Modifications:** None.
- **Problems:** None.
- **Complementary actions:** One of the main issues of the use of DSW for irrigation is the fact that osmosis membranes cannot remove boron concentration like for the rest of elements. A closely aligned project, SEARRISOST, in which DESEACROP partners (UPCT) participate is focused on in-field boron-removal equipment.
- **Future perspectives:** New boron-removal equipment will enable to safely irrigate boron-sensitive crops (like citrus) with DSW, contributing to the adoption of DSW technologies demonstrated in DESEACROP.
- **Deliverables:** DA1.2. Review on the impact of boron on soils and plants.
- **Achieved milestones:** M2. Baseline situation of desalinated seawater characterized.
- **Figures**

Crop	Plant Part Sampled	mg B kg^{-1} in Dry Matter		
		Deficiency	Sufficiency	Toxicity
Beans	43-d-old plants		12	>160
Kidney beans	Plants cut 50 mm above the soil		44	132
Faba bean	Whole plants		25-100	
Snap beans	Pods		28	43
	Recently matured leaves a prebloom			109
	Plant tops at prebloom	<12	42	>125
Broccoli	Leaves		70	
	Leaf tissue when 5% heads formed	2-9	10-71	
Brussels sprouts	Leaf tissue when sprouts begin to form	6-10	13-101	
	Leaf tissue when sprouts begin to form			161
Cabbage	Mature leaf blade prior to head formation			132
Carrots	Mature leaf lamina	<16	32-103	175-307
	Leaves	18		
	Whole plants at swelling of roots	<28	54	
Cauliflower	Whole tops before the appearance of curd	3	12-23	
	Leaves	23	36	
	Leaf tissue when 5% heads formed	4-9	11-97	
Cucumber	Mature leaves 2 weeks after first picking	<20	40-120	>300
Potatoes	32-d-old plants		12	>180
	Fully developed first leaf 75 d after planting	<15	21-50	>50
Radish	Whole plant when roots began to swell	<9	96-217	
Strawberries	Old and young leaves at active growth stage			123
Tomatoes	Mature young leaves from top of the plant	<10	30-75	>200
	63-d-old plants			>125
	Whole plants when 15 cm tall	>12	51-88	<172
	Whole plant			10-20

Fig. 2. Deficiency, Sufficiency, and Toxicity Levels of Boron in Horticultural Crops. Adapted from Gupta (2008).

A1.3. To determine the carbon dioxide emission at the desalinated seawater production sites

- **Status:** Completed	Foreseen start	01/11/2017	Actual start	01/11/2017
	Foreseen end	31/05/2018	Actual end	31/05/2018

- **Activities undertaken and outputs achieved:** The CO_2 emissions were estimated for plants identified in A1.1. The Life Cycle Analysis (including CO_2 emissions) of a representative plant of SE Spain (Carboneras) was done. The main findings were that the production of 1 m^3 of desalinated seawater uses 87.62 MJ/m^3 (mainly in treatment and post-treatment stages) and generates 4.82 kg of CO2eq/m^3.
- **Actual vs. planned outputs:** Outputs as expected.
- **Modifications:** None.
- **Problems:** None.
- **Complementary actions:** Building on the literature review of the nexus water-energy-greenhouse gas emissions done in this project, a regional study of the CO_2 emissions of the main crops in SE Spain was conducted.
- **Future perspectives:** Manuscript has been submitted to a high impact journal in the field of environment with the full picture of agricultural impacts (including DSW) in SE Spain.
- **Deliverables:** DA1.3 Report on carbon dioxide emission.
- **Figures**

Impact category	Unit	Total	Stage		
			Seawater extraction	Treatment and post-treatment	Water distribution
Cumulative Energy Demand	MJ/m^3	87.62	6.08	71.91	9.62
• Non-renewable	MJ/m^3	79.58	5.21	66.13	8.24
• Renewable	MJ/m^3	8.04	0.87	5.79	1.38
GHG emissions	kg CO_{2eq}/m^3	4.82	0.26	4.15	0.41

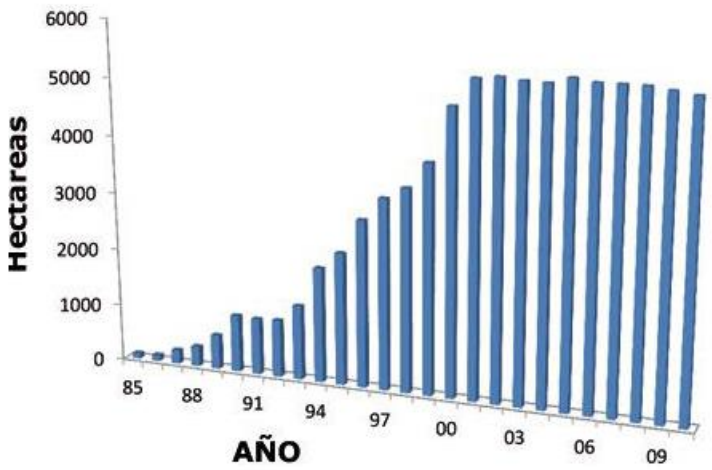
Fig. 3. Energy use and CO_2 emissions of Carboneras plant.

A1.4. To identify irrigated crop surface and water demand by means of soilless systems, including both outdoor and greenhouses

- **Status:** Completed	Foreseen start	01/11/2017	Actual start	01/11/2017
	Foreseen end	31/05/2018	Actual end	31/05/2018

- **Activities undertaken and outputs achieved:** A comprehensive study of soilless agriculture in SE Spain was carried out. The characterization of the current situation (type of crops, extension, water requirements and resources) and the capacity to spread project results are presented in the report DA1.5. Currently, there are approx. 6,000 ha of soilless crops in SE Spain. They require advanced fertigation equipment which is very demanding in terms of water quality. In particular, the high salinity water resources of this region is the main limitation for these systems. We have demonstrated that the combination of DSW and soilless production together with in-field desalination support can enable the expansion (25% increase) of a highly profitable soilless agriculture.
- **Actual vs. planned outputs:** Outputs as expected.
- **Modifications:** None.
- **Problems:** None.
- **Complementary actions:** The networking with LIFE-DRAINUSE has been very beneficial for all parts and opened new collaboration perspectives.
- **Future perspectives:** To submit follow-up projects in collaboration with LIFE-DRAINUSE team. A National project (Call I+D+i 2020 has been applied for).
- **Deliverables:** DA1.4. Report on the differences and complementarities between DESEACROP and DRAINUSE.
  DA1.5. Report on soil surface available and capacity to spread the project results.

- **Achieved milestones:** M3. Differences between DESEACROP and DRAINUSE stated.
- **Figures**



	DESEACROP	DRAINUSE
Origen del agua	Subterránea, superficial y desalinizada	Subterránea y superficial
Escenarios	**3 Escenarios** - Agua subterránea - Agua desalinizada marina - Agua mezcla (50%)	1 Escenario
Tratamiento de los drenajes	**3 opciones** -Jardinería -Envío a planta desalinizadora costera -Mezcla de agua desalinizada y salmuera -Envío a balsa de pluviales -Envío a balsa de evaporación	-Desinfección del agua -Mezcla de los drenajes con agua destilada y reutilización
Fertilización	Ajustada basada en los diferentes tratamientos	No ajustada
Suministro eléctrico	Paneles fotovoltaicos	Red eléctrica
Energía, emisiones y análisis de ciclo de vida	Si	No

Fig. 4. Soilless crop surface in Almeria from 1985 to 2010 and comparison of LIFE DESEACROP and DRAINUSE projects.

B1. Setup of demonstrative plots

B1.1. Setup of demonstrative plots

- **Status:** Completed	Foreseen start	01/11/2017	Actual start	01/02/2018
	Foreseen end	31/05/2018	Actual end	05/09/2018

- **Activities undertaken and outputs achieved:** Four cycles of tomato crop have been monitored in the experimental greenhouse. For each trial, 18 plots with tomato crop have been monitored, corresponding to 3 treatments (DSW and two types of brackish water) and 3 repetitions for each kind of soil (substrate and "enarenado" soil).
- **Actual vs. planned outputs:** Outputs as expected with some delays. The setup of the plot was delayed 3 months, but it did not have any major impact on project timelines, since it was ready for the first planned crop cycle. Then four cycles have run as scheduled.
- **Modifications:** The frequent fluctuations in the water reservoir initially planned to provide brackish UW hindered the initial assessment of salinity effects in the plant and soil. To address this issue, additional equipment (info in Annex I presented within the Mid-Term Report) was installed to produce water with the physico-chemical characteristics of local UW and constant salinity levels.
- **Problems:** Resolved with the modifications explained in the previous paragraph.
- **Complementary actions:** The networking with LIFE-DRAINUSE has been very beneficial for all parts and opened new collaboration perspectives.
- **Future perspectives:** To continue to use the expert fertigation system installed for this project in future trials.
- **Deliverables:** DB1.1. Report on the configuration of the demonstrative plot.
- **Achieved milestones:** M4. Demo plot ready for demonstration.
- **Figures**

Fig. 5. Tomato plants in the experimental greenhouse.

B2. Setup of sustainable irrigation treatments

B2.1. Determination of irrigation treatments

- **Status:** Completed	Foreseen start	01/11/2017	Actual start	01/05/2018
	Foreseen end	31/05/2018	Actual end	31/07/2018

- **Activities undertaken and outputs achieved:** The three irrigation treatments planned for the trial, corresponding to salinity of 0.5 dS/m (DSW), 1.5 dS/m (simulated mixture of DSW and UW) and 3 dS/m (simulated UW), have been applied to four cycles of tomato in the experimental greenhouse.
- **Actual vs. planned outputs:** Outputs as expected with some delays without any impact on project timelines.
- **Modifications:** None. The reference treatments continue to be the same as initially planned.
- **Problems:** The smart fertigation system has undergone several upgrades to enable the accurate application of the treatment. All these modifications are described in Annex I presented within the Mid-Term Report.
- **Future perspectives:** To continue carrying out trials that demonstrate the benefits and risks of using DWS for irrigation (new projects and initiatives; see after LIFE plan.
- **Deliverables:** DB2.1. Report on irrigation treatments and procedures to the water quality adjustment.
- **Achieved milestones:** M5. Irrigation treatment defined.
- **Figures**

Fig. 6. Tanks per treatment in the irrigation head.

B2.2. Monitoring and adjustment of water quality

- **Status: Completed**	Foreseen start	01/11/2017	Actual start	01/06/2018
	Foreseen end	31/05/2018	Actual end	31/07/2020

- **Activities undertaken and outputs achieved:** The water quality of each treatment have been continuously monitored during each crop cycle to identify the adjustments required for the Nutricompact® equipment. The data collected has enabled the continuous improvement of the fertigation machine as well as the assessment of the treatments.
- **Actual vs. planned outputs:** All the samples were collected and analyzed according to schedule and the database is complete.

- **Modifications:** All the modifications required to adjust water quality are described in Annex I presented within the Mid-Term Report.
- **Problems:** Same as B2.1.
- **Future perspectives:** To continue to closely work with providers of fertigation equipment in the adaptation of machines to particular conditions derived from the use of DSW.
- **Deliverables:** DB2.1. Report on irrigation treatments and procedures to the water quality adjustment.
- **Figures**

Tratamiento 1 (2,2)										
	NO_3^-	$H_2PO_4^-$	SO_4^{2-}	HCO_3^-	Cl^-	NH_4^+	K^+	Ca^{2+}	Mg^{2+}	Na^+
me L^{-1}	12,01	2,02	5,91	0,83	3,66	0,50	8,00	14,36	3,64	3,48
ppm	**744,56**	**191,97**	**283,66**	**50,59**	**129,91**	**9,06**	**312,80**	**287,75**	**44,27**	**80,05**
Tratamiento 2 (2,5)										
	NO_3^-	$H_2PO_4^-$	SO_4^{2-}	HCO_3^-	Cl^-	NH_4^+	K^+	Ca^{2+}	Mg^{2+}	Na^+
me L^{-1}	10,49	1,50	2,95	3,63	6,46	1,61	8,11	10,94	3,19	5,12
ppm	**650,31**	**142,59**	**141,80**	**221,31**	**229,11**	**29,09**	**317,10**	**219,14**	**38,76**	**117,70**
Tratamiento 3 (3,5)										
	NO_3^-	$H_2PO_4^-$	SO_4^{2-}	HCO_3^-	Cl^-	NH_4^+	K^+	Ca^{2+}	Mg^{2+}	Na^+
me L^{-1}	10,42	1,50	7,19	7,82	10,66	2,00	9,00	14,63	7,43	7,58
ppm	**645,97**	**142,59**	**345,43**	**477,40**	**377,91**	**36,12**	**351,90**	**293,16**	**90,28**	**174,17**

Fig. 7. Irrigation treatments.

B2.3. Drainage treatment and reutilization

- **Status:** Completed	Foreseen start	01/11/2017	Actual start	01/06/2018
	Foreseen end	31/05/2018	Actual end	01/09/2019

- **Activities undertaken and outputs achieved:** The desalination module for drainage treatment was deployed in the experimental field and it has been treating the drainage outflows to be reused in the trial.
- **Actual vs. planned outputs:** There were several complications in the installation and final tuning of the desalination module. The greenhouse drainages could not be treated until the second crop cycle. However, the data collected since then have allowed assessing the technical and economic aspects of the modules. The drainages pump was eventually connected to the solar panels and working out well.
- **Modifications:** Described in Annex II presented within the Mid-Term Report.
- **Problems:** Described in Annex II presented within the Mid-Term Report.
- **Future perspectives:** To promote the adoption of solar powered desalination modules to treat drainages in-farm. To spread the results of this project as a demonstration of the twofold benefit of the modules: leaching prevention and water reuse. To continue with the business cases show to other potential stakeholders.
- **Deliverables:** DB2.2. Report of information of the plant.
  DB2.3. Operation manual and report with pictures.
  DB2.4. Annual report with results of treatment of drainage water, including main significant parameters.
  DB2.5. Annual report with results of treatment of drainage water, including main significant parameters.
- **Achieved milestones:** M6. Operation manual finished.
- M7. Desalination plant ready for working.
- **Figures**

Fig. 8. Desalination module for drainage treatment.

B3. Crop and soil response to treatments and set up of drainages quality

B3.1. Measurements of vegetative growth

- **Status:** Completed	Foreseen start	01/04/2018	Actual start	01/09/2018
	Foreseen end	30/06/2020	Actual end	30/07/2020

- **Activities undertaken and outputs achieved:** The samples have been taken periodically as described in the proposal, for each crop cycle.
- **Actual vs. planned outputs:** The measurement of fresh and dry matter of roots, stems and leaves has been done according to schedule.
- **Modifications:** None.
- **Problems:** None.
- **Deliverables:** DB3.1 First year report: Evolution of physical-chemical soil properties and plants nutrients; DB3.3 Second year report: Evolution of physical-chemical soil properties and plants nutrients
- **Achieved milestones:** M12. Final report delivery (1st Year); M13. Final report delivery (2nd Year).
- **Figures**

Fig. 9. Vegetative growth sampling.

B3.2. Measurements of fruit growth, crop yield and quality parameters

- **Status:** Completed	Foreseen start	01/04/2018	Actual start	01/09/2018
	Foreseen end	30/06/2020	Actual end	30/07/2020

- **Activities undertaken and outputs achieved:** The samples have been collected at each harvest of all crop cycles.
- **Actual vs. planned outputs:** All has been done according to schedule.
- **Modifications:** None.
- **Problems:** None.
- **Deliverables:** DB3.2 First year report: Report on fruit quality; DB3.4 Second year report: Report on fruit quality
- **Achieved milestones:** M8. First fruit quality analysis; M9. Second fruit quality analysis;
- **Figures**

Fig. 10. Fruit quality monitoring.

B3.3. Evolution of soil properties and nutrients content in crop

- **Status:** Completed	Foreseen start	01/04/2018	Actual start	01/09/2018
	Foreseen end	30/06/2020	Actual end	30/07/2020

- **Activities undertaken and outputs achieved:** The initial samples have been taken before each plantation. The rest of the samples were taken 75 days after planting and at final harvest.
- **Actual vs. planned outputs:** All has been done according to schedule.
- **Modifications:** None.
- **Problems:** None.
- **Deliverables:** DB3.1 First year report: Evolution of physical-chemical soil properties and plants nutrients**;** DB3.3 Second year report: Evolution of physical-chemical soil properties and plants nutrients
- **Achieved milestones:** M10. First soil sampling (1er Year); M11. Second soil sampling (2nd year).
- **Figures**


Fig. 11. Soil sampling.

B4. Development of a replicability and transferability plan

B4.1. Identification and evaluation of potential EU areas

- **Status:** Completed	Foreseen start	01/11/2017	Actual start	01/02/2018
	Foreseen end	31/10/2018	Actual end	31/12/2018

- **Activities undertaken and outputs achieved:** The available water resources and current practices of agriculture in the European Union were identified. The information was compiled from the reports of the European Environment Agency and international organizations, as well as scientific publications related to the subject. The pioneer agricultural use of desalination in SE Spain is currently a reference for Europe. Several geographical areas of interest for the replicability of project results were identified: Campo de Cartagena y Campo de Almería (SE Spain), Canary Islands (Spain), La Puglia (Italy), Kentriki Makedonia (Greece), Algarve/Alentejo (Portugal), Aravay Valley (Israel) and coastal areas of Malta and Cyprus.
- **Actual vs. planned outputs**: The identification and evaluation of potential EU areas, as well as the elaboration of the replicability and transferability plan developed were done according to schedule.
- **Modifications:** None
- **Problems:** None
- **Future perspectives:** The main goal is to replicate the project results in the most suitable agricultural regions. A flexible transferability plan for these areas has been developed, which enables the constant reformulation of the business and take advantage of the continuous update of strategic and tactical opportunities as they become available. In the long run, these approaches improve the effectiveness and sustainability of the implementations.
- **Deliverables:** DB4.1 Report on water resources and current desalination practice in EU agriculture.
  DB4.2 Report on value of supplementary desalination supplies in context of European agricultural production. EU agricultural opportunities.
- **Achieved milestones:** M14. Replicability and transferability plan developed.

- **Figures**

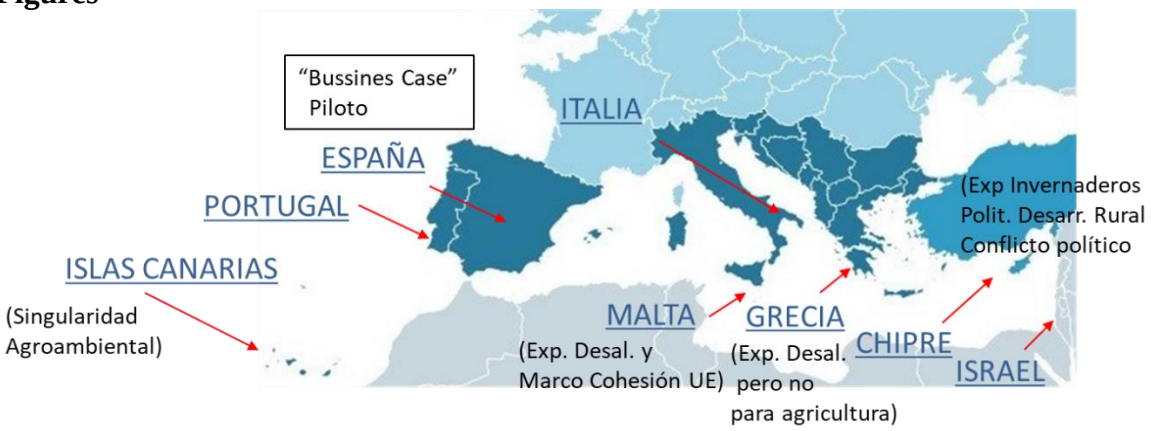


Fig. 12. Identified areas.

B4.2. Compilation of database of contacts with other national and foreign stakeholders, irrigation associations and hydrographic confederations

- **Status:** Completed	Foreseen start	01/11/2017	Actual start	01/02/2018
	Foreseen end	31/10/2018	Actual end	31/12/2018

- **Activities undertaken and outputs achieved:** For each area identified in B4.1., information and contact details of stakeholders, associations and governmental institutions were collected.
- **Actual vs. planned outputs**: Done according to schedule.
- **Modifications:** None.
- **Problems:** None.
- **Future perspectives:** For the replication of project results the advice and collaboration of these contacts will play a key role.
- **Deliverables:** DB4.3 Report on identification and characterization of areas and contacts and new plots selected for transference.
- **Achieved milestones:** M15. Other regions characterized.

Contactos en España. Almería y Cartagena e Islas Canarias:

- Ministerio de Agricultura Pesca y Alimentación: https://www.mapa.gob.es/es/ministerio/servicios/informacion/default.aspx
- Ministerio para la Transición Ecológica: https://www.miteco.gob.es/es/agua/temas/default.aspx
- Fundación Instituto Euromediterráneo del Agua: http://www.f-iea.es/servlet/s.SI?sit=c,759,i,1
- Instituto Agricultura Sostenible: http://www.ias.csic.es/presentacion/
- Instituto Agronómico Mediterráneo: http://www.iamz.ciheam.org/es/about/ciheam/who_we_are
- Asociación Española de Desalación y Reutilización: https://www.aedyr.com/es/quienes-somos_5a01d9741ae65
- Confederación Hidrográfica del Segura: https://www.chsegura.es/chs/index.html
- Comunidad Regantes Campo Cartagena: https://www.crcc.es/contactar/ https://www.crcc.es/cargos-directivos-y-empleados/
- Comunidad Regantes de Almería: http://www.comunidadtierrasdealmeria.com/es/empresa/
- Primaflor. Productor Comercializador: http://primaflor.com/contacto/
- NGS. Productor Comercializador: http://ngsystem.com/es/contacto
- Gobierno de Canarias: https://sede.gobcan.es/sede/la_sede
- Fundación Centro Canario del Agua: http://fcca.es/la-fcca/contacto/
- Comunidades de Regantes Gran Canarias: http://cabildo.grancanaria.com/-/noticia-aprobacion-de-la-creacion-de-tres-comunidades-de-regantes-que-beneficiaran-a-40-agricultores-de-gran-canaria

Fig. 13. Contacts in Spain

B4.3. Preparation of business cases &
B4.4. Evaluation of the access to financing of identified contacts

- **Status:** Completed	Foreseen start	01/11/2018	Actual start	01/11/2018
	Foreseen end	31/10/2019	Actual end	31/12/2019

- **Activities undertaken and outputs achieved:** A "Business Model Canvas" (BMC) was chosen for the developing the business cases of the replication and transferability plan. Such a BMC included several critical elements for the correct characterization of the business model such as key partners, resources, value proposition or customer relations. The proposed model allowed exporting the benefits and results associated with the use of desalinated sea water for agriculture to other regions of the European Union, as well as assessing their economic, agronomic and environmental impact in various contexts. Please note that our deliverable MB4 to fulfil with the Milestone M14 "Replicability and transferability plan developed" was due to 12/2018 by mistake in the agreement, but it was delivered in 12/2019 which makes more sense with a more advanced project. The MB4 was presented within the Mid-Term report and represented the base of the future Plan of Replicability and Transferability.
- **Actual vs. planned outputs**: Going according to schedule. Milestone MB4 was changed to 12/2019 with a more developed project.
- **Modifications:** None.
- **Problems:** None.
- **Deliverables:** The deliverables DB4.4. Report on EU financial opportunities of implementing DSW and soilless systems and DB4.5. Business cases developed and benefits of the implementation of soilless systems and irrigation with DSW.
- **Achieved milestones:** M16. Business cases developed and license agreement developed.
- **Figures**

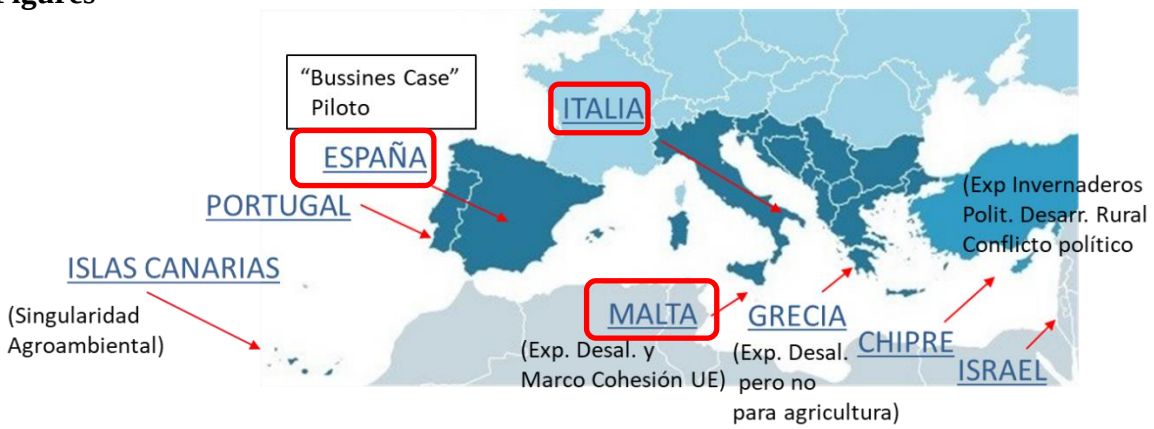


Fig. 14. Pilot business cases.

B4.5. Negotiation of agreements for know-how transference in new location

- **Status:** Completed	Foreseen start	01/11/2019	Actual start	01/11/2019
	Foreseen end	31/10/2020	Actual end	31/12/2020

- **Activities undertaken and outputs achieved:** To transfer the results, the business cases developed were prepared through an attractive proposal for the selected regions. With a viable model, both for the producer of desalinated seawater and for the farmer, the winning combination of desalination and agriculture is consolidated. Bilateral meetings were held with stakeholders interested in the Cartagena business case and the Malta business case. In both, manifest intentions of interest were expressed.

- **Actual vs. planned outputs**: To continue with bilateral meetings and negotiations of agreements with the transfer zones identified within the EU.
- **Modifications:** None
- **Problems:** None
- **Deliverables**: DB4.6. Report on the transference of Know-How to other locations. (Cartagena Case; Spain, Malta Coastal Case, La Puglia Case; Italy)
- **Achieved milestones:** M16. Business cases developed and license agreement developed.
- **Figures:**

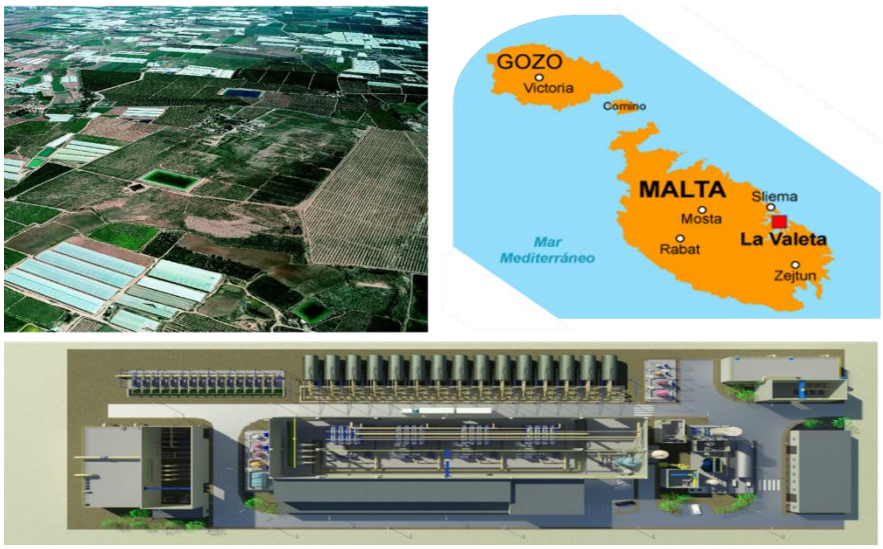


Fig. 15. Transference of Know-How to other locations.

C1 Monitoring the environmental impacts of irrigation with desalinated seawater				
C1.1. Monitoring the impacts on the water & C1.2. Monitoring the impacts on the soil				
- **Status:** Completed	Foreseen start	01/04/2018	Actual start	07/09/2018
	Foreseen end	31/05/2020	Actual end	31/09/2020

- **Activities undertaken and outputs achieved:** The impacts of desalinated seawater have been monitored and its effects on soil and plant quantified based on project results.
- **Actual vs. planned outputs**: There were some delays but without any impact on project timelines.
- **Modifications:** None
- **Problems:** None
- **Future perspectives:** To publish these recommendations and spread this information across stakeholders.
- **Deliverables:** DC1.1 Report of first year assays about recommendations and tasks to optimize the use of desalinized seawater. DC1.3. DC1.3 Final report about recommendation to use desalinized seawater in horticulture in terms of soil conservation and nutrients balance.
- **Achieved milestones**: M17 First reports delivery (1º year); M18. Final reports delivery (2º year)
- **Figures**

Fig. 16. Sampling in the experimental greenhouse.

C1.3. Monitoring the impacts on the energy &
C1.4. Monitoring the impacts on CO2 emissions

- **Status:** Completed	Foreseen start	01/04/2018	Actual start	07/09/2018
	Foreseen end	31/05/2020	Actual end	31/09/2020

- **Activities undertaken and outputs achieved:** The environmental sustainability of irrigating greenhouse tomatoes with DSW in hydroponic systems with drainage reuse has been assessed with a Life Cycle Analysis (LCA). This methodology integrates all the environmental effects derived from the consumption of raw materials, energy and water as well as from emissions and residues. The main conclusions are that the use of water DSW implies only a slight increase of environmental impact (<5%), mainly related to the higher fossil fuel consumption (and therefore higher CO_2 emissions) and that drainage recycling increase cumulative energy demand but for a good cause: *i.e.*, its reduces acidification and eutrophication potential.
- **Actual vs. planned outputs**: The LCA has been carried out with the data of the four cycles of tomato.
- **Modifications:** None
- **Problems:** None
- **Deliverables:** DC1.2 Report on first year on the impacts of the treatments on energy consumption and carbon dioxide emission. Life Cycle Analysis; DC1.4 Final report on the impacts of the treatments on energy consumption and carbon dioxide emission. Life Cycle Analysis
- **Achieved milestones**: M17 First reports delivery (1º year); M18. Final reports delivery (2º year)
- **Figures**

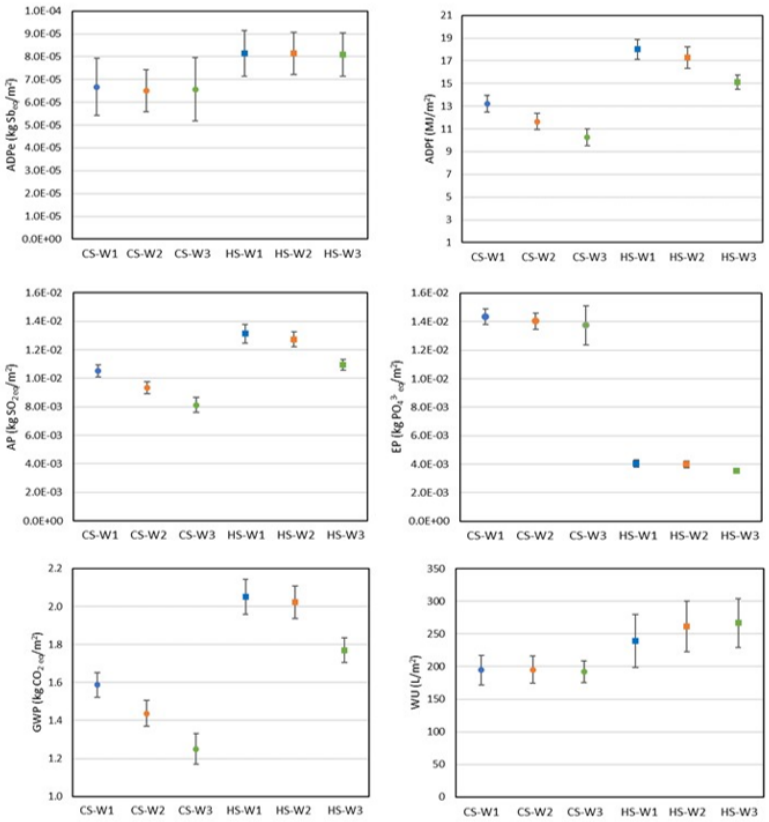


Fig. 17. Impact indicators per treatment: abiotic depletion (ADP), acidification potential (AP), eutrophication potential (EP), global warming potential (GWP), water use (WU).

C2. Monitoring the socioeconomic impact of irrigation with desalinated seawater

C2.1. Monitoring the social and economic implications

- **Status:** Completed	Foreseen start	01/07/2018	Actual start	01/07/2018
	Foreseen end	30/06/2020	Actual end	30/06/2020

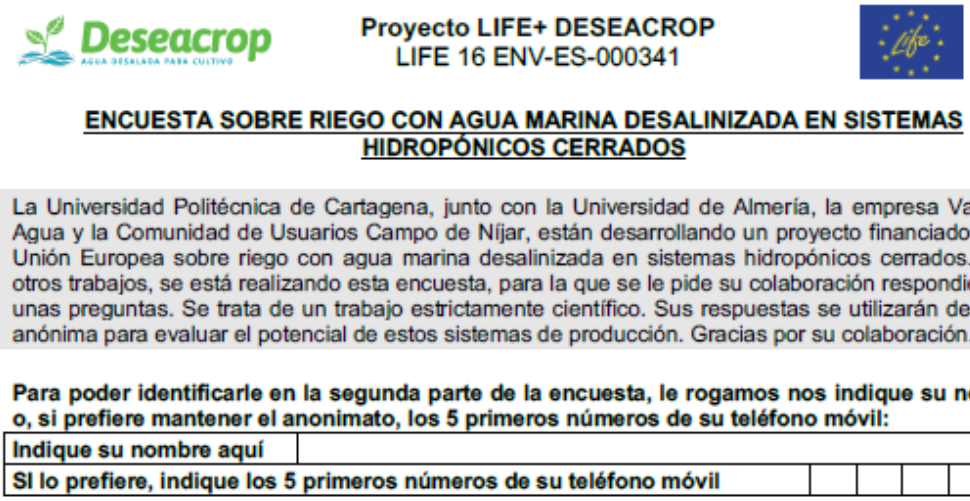
- **Activities undertaken and outputs achieved:** The technical-economic information from the trial required for calculations have been collected to date according to the standard template proposed by UPCT. The secondary data was retrieved from previous studies on tomato production costs (conventional greenhouse and hydroponic systems) and from public agricultural statistics databases.
- **Actual vs. planned outputs**: Data from all production cycles have been codified, revised and analysed.
- **Modifications:** There was mistake in the deadline of deliverable DC2.1. This deliverable was delivered in 12/2019 as it went in parallel with deliverable DC2.2.
- **Problems:** None
- **Deliverables:** The deliverables DC2.1 Comparative socio-economic assessment of impact of the implemented agricultural practices on farm profitability, input productivity and farm vulnerability; DC2.2 Report on data collection and codification).

- **Achieved milestones**: M19. Collection and codification of secondary data for the socio-economic analysis.
  Milestone M20. Collection and codification of primary data for the socio-economic analysis.
  M21. Evaluation of farm productivity, sustainability and vulnerability under the different agricultural practices implemented.

C2.2. Monitoring the impacts on the stakeholders' perceptions

- **Status:** Completed	Foreseen start	01/07/2018	Actual start	01/07/2018
	Foreseen end	30/06/2020	Actual end	30/06/2020

- **Activities undertaken and outputs achieved:** The survey templates have been used to collect data of the impact of communication and dissemination activities (training courses, seminars and technical visits) and assess attendees' perception.
- **Actual vs. planned outputs**: As expected.
- **Modifications:** None
- **Problems:** None
- **Future perspectives:** Many lessons have been learnt from the interaction with the respondents, which came from all walks of life. The survey questionnaires have been continuously extended and improved to better understand the opinions and perceptions of people with diverse backgrounds, from farmers and agricultural workers to company managers and academics.
- **Deliverables:** DC2.3 Comparative assessment of stakeholders' perception of the sustainable irrigation strategies and evaluation of the potential for its adoption at a larger scale
- **Milestones**: M22. Assessment of stakeholders' knowledge and perceptions about the potential for the diffusion of the agricultural practices.
- **Figures**


Deseacrop
AGUA DESALADA PARA CULTIVO

Proyecto LIFE+ DESEACROP
LIFE 16 ENV-ES-000341

ENCUESTA SOBRE RIEGO CON AGUA MARINA DESALINIZADA EN SISTEMAS HIDROPÓNICOS CERRADOS

La Universidad Politécnica de Cartagena, junto con la Universidad de Almería, la empresa Valoriza-Agua y la Comunidad de Usuarios Campo de Níjar, están desarrollando un proyecto financiado por la Unión Europea sobre riego con agua marina desalinizada en sistemas hidropónicos cerrados. Entre otros trabajos, se está realizando esta encuesta, para la que se le pide su colaboración respondiendo a unas preguntas. Se trata de un trabajo estrictamente científico. Sus respuestas se utilizarán de forma anónima para evaluar el potencial de estos sistemas de producción. Gracias por su colaboración.

Para poder identificarle en la segunda parte de la encuesta, le rogamos nos indique su nombre o, si prefiere mantener el anonimato, los 5 primeros números de su teléfono móvil:

Indique su nombre aquí						
SI lo prefiere, indique los 5 primeros números de su teléfono móvil						

Fig. 18. Stakeholders perception questionnaire.

D1. Dissemination of the project results

D1.1. Communication, dissemination and exploitation plan

- **Status:** Completed	Foreseen start	01/11/2017	Actual start	01/11/2017
	Foreseen end	31/10/2020	Actual end	31/12/2020

- **Activities undertaken and outputs achieved:** The communication, dissemination and exploitation plans are ready and available for all partners.
- **Actual vs. planned outputs**: As expected. Following internal communication between partners (within the communication and dissemination plan) we have organized periodic meetings (each six months or more) and DESEACROP partners have been in close contact by email, phone and Microsoft Teams. Concerning the external communication, please read tasks D1.2 to D1.5 to see specific activities.
- **Modifications:** None
- **Problems:** None
- **Deliverables:** DD1.3. A project dissemination portfolio including all the dissemination materials and means produced and used in the project; DD1.4. Communication and dissemination plan; DD1.5. Report on the exploitation plan; DD1.7 A project dissemination portfolio including all the dissemination materials and means produced and used in the project
- **Milestones**: M23. Communication and dissemination plan elaborated.
- **Figures**

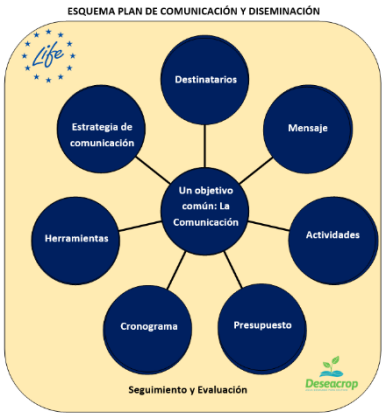


Fig. 19. Communication, dissemination and exploitation plan.

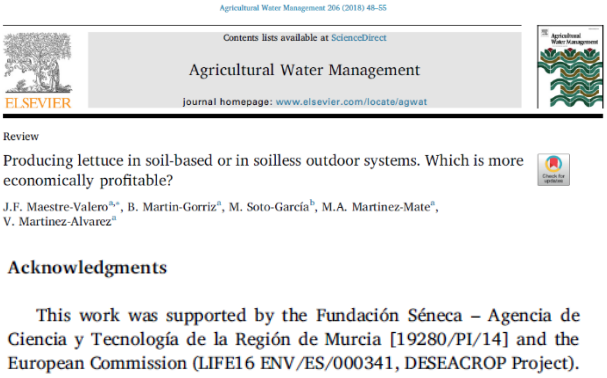
D1.2. Production of dissemination and communication materials and means

- **Status:** Completed	Foreseen start	01/11/2017	Actual start	01/11/2017
	Foreseen end	31/10/2020	Actual end	31/12/2020

- **Activities undertaken and outputs achieved:** The public website and Facebook, LinkedIn and Twitter accounts have been set up and have been updated frequently. The website has received, as of December 2020, 17,168 visits. Most of these visits are from Spain, USA and EU countries) and with an average visit duration of 2 minutes and 27 seconds. DESEACROP's Facebook and Twitter accounts currently have 27 and 45 followers, respectively. DESEACROP's LinkedIn profile currently has 348 contacts. Throughout the project, three newsletters have been sent to everyone subscribed to the website.

A subscription link has been set up on the website. A DESEACROP dissemination portfolio and a DESEACROP brochure (explaining the project) are available to all partners for dissemination.

- **Actual vs. planned outputs**: As expected.
- **Modifications:** None
- **Problems:** None
- **Future perspectives:** To continue updating the information updated in the webpage and the Media and producing more materials and publications to widen the visibility of DESEACROP.
- **Deliverables:** DD1.1 Notice boards developed; DD1.2 Webpage development and structure; DD1.3 Project dissemination portfolio including all the dissemination materials and means produced and used in the project; DD1.7. Project dissemination portfolio including all the dissemination materials and means produced and used in the project.
- **Milestones**: M25. Creation of the public website.
  M29. Laymans` report printed (by the end of the project)**.**
- **Figures**


Agricultural Water Management 206 (2018) 48–55

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Review

Producing lettuce in soil-based or in soilless outdoor systems. Which is more economically profitable?

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Acknowledgments

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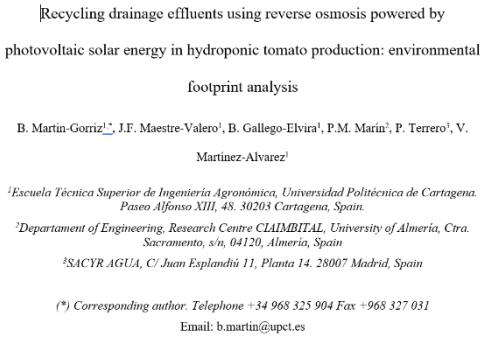
Recycling drainage effluents using reverse osmosis powered by photovoltaic solar energy in hydroponic tomato production: environmental footprint analysis

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Under revision

Fig. 20. Scientific manuscripts acknowledging DESEACROP.

D1.3. Transfer and capacitation activities

- **Status:** Completed	Foreseen start	01/11/2017	Actual start	01/11/2017
	Foreseen end	31/10/2020	Actual end	31/12/2020

- **Activities undertaken and outputs achieved:** Guided visits to three desalinations plants were organized in March 2018 (Águilas-Guadalentín, Escombreras and Cuevas del Almanzora). In addition, 5 more desalination plants were visited (CR Águilas, Campo de Dalías, CR Mazarrón, Valdelentisco, Águilas-Marina de Cope). Five workshops and seven courses on the topic of DSW and the soilless systems took place between 2018 and 2020. Among all, more than 400 attendees. Many visits to the Demo plots have occurred during the project (see webpage).
- **Actual vs. planned outputs**: Everything performed as expected with a minor change at the end of the project due to COVID19 that made us delay a bit the capacitation courses.
- **Modifications:** Change of course dates.
- **Problems:** None
- **Future perspectives:** To continue with the organization of courses and open-day-meetings within the transfer plan of the project.
- **Deliverables:** None
- **Milestones**: - M26. Four training courses done; M28. Four training courses done.

- **Figures**

Fig. 21. Flyers of two of the training courses organized by DESEACROP

D1.4. Communication activities in specialized and scientific forums

- **Status:** Completed	Foreseen start	01/11/2017	Actual start	01/11/2017
	Foreseen end	31/10/2020	Actual end	31/10/2020

- **Activities undertaken and outputs achieved:** In the Grant Agreement DESEACROP was committed to attend (i) the Smagua, (ii) the ISHS Congress, (iii) AgroIng 2020, (iv) CNR 2018, (v) EDS, (vi) AEDYR and (vii) IDA congresses. Some of the events in which DESEACROP project has presented its results have been: (i) Workshop "La CUCN por un precio justo del agua". Níjar (03/2018), (ii) II Jornada Cátedra Trasvase y sostenibilidad JMCV (04/2018), (iii) IWA Regional conference on Water Reuse and Salinity Management. Murcia (06/2018), (iv) XXXVI Congreso Nacional de Riegos. Valladolid (06/2018), (v) XII Congreso Internacional AEDYR. Toledo (10/2018), (vi) III International Conference on Food and Agriculture. Malasia (11/2018), (vii) X Congreso Ibérico de Agroingeniería. Huesca (09/2018), (viii) Congreso Nacional del Agua. Orihuela (02/2019), (ix) Workshop "Water pricing: Models, Approaches and Implementation". Cyprus and (x) Congreso Nacional de Riegos. Badajoz (06/2019), XXXVIII Congreso Nacional de Riegos. Cartagena (09/2020)
- **Actual vs. planned outputs**: DESEACROP planned to go to 8 conferences and it already accounts for 20. It is also envisaged to attend to XIII Congreso Internacional AEDyR. Córdoba (02/2021), Desalination for the Environment. IDA 2021 International Water Reuse and Recycling Conference (03/2021) and Congreso EDS Las Palmas (05/2021).

- **Modifications:** Some conferences were eventually changed by others which does not affect the right project development.
- **Problems:** None
- **Future perspectives:** To continue with the dissemination and publication of the results achieved in the DESEACROP framework.
- **Deliverables:** DD1.6. Communications sent to specialized events and conferences. DD1.10. Communications sent to specialized events and conferences.
- **Milestones**: None
- **Figures**

Fig. 22. DESEACROP researchers in X Congreso Ibérico de Agroingeniería (Huesca, 09/2019)

D1.5. Networking activities with other projects and institutions

- **Status:** Completed	Foreseen start	01/11/2017	Actual start	01/11/2017
	Foreseen end	31/10/2020	Actual end	31/10/2020

- **Activities undertaken and outputs achieved:** Networking activities done to date include visits to the facilities of the LIFE project DRAINUSE (05/2018), the ERANET project DESERT (07/2018), the Retos-Colaboración Project SEARRISOST (09/2019), the Project LIFE AGREMSOIL (09/2019), the *Dirección General del Agua* (Water Authorities of Murcia Region Government) and the company AZUD among others. In addition, DESEACROP has done networking with the company Miguel Torres which was interesting in the desalination innovation and in the development of equipment to desalinated seawater.
- **Actual vs. planned outputs**: As expected.
- **Modifications:** None.
- **Problems:** None.
- **Future perspectives:** To continue doing networking to look for synergies between projects and new paths for collaboration.
- **Deliverables:** DD1.8. Report including the networking performed in the project and DD1.9. Final year report including the networking performed in the project.
- **Milestones**: M24. First list of networking elaborated. M27. Final list of networking elaborated.
- **Figures**


Fig. 23. DESEACROP researchers networking with (a) the LIFE AGREMSOIL team and (b) the former director of water for the Murcia Region.

E1. Project management

E1.1. Project management

- **Status:** Completed	Foreseen start	01/11/2017	Actual start	01/11/2017
	Foreseen end	31/10/2020	Actual end	31/12/2020

- **Activities undertaken and outputs achieved:** The kick-off meeting took place in October 2017. The Google Drive repository was created in November 2017. HIPATIA consultancy was hired in April 2018. Organization of the first follow-up meeting with the monitor (March 2018), the second follow-up meeting with the monitor (November 2018), the third in (June 2020) and the management meetings (10/11/2017, 10/07/2018, 25/09/2018, 30/05/2019, 09/10/2019, 22/06/2020 and 10/12/2020). Creation of the digital repository in Google Drive. Development of the webpage and the social Media (Facebook, Twitter and Linked in). Amendment to change Sadyt for Valoriza-Agua and amendment to change Valoriza-Agua for Sacyr Water. Amendment to apply for the project extension.
- **Actual vs. planned outputs**: As expected.
- **Modifications:** None.
- **Problems:** None.
- **Future perspectives:**
- **Deliverables:** DE1.1 First management meeting minutes; DE1.2 Second management meeting minutes; DE1.3. Third management meeting minutes; DE1.4. Fourth management meeting minutes; DE1.5. First year report on the actions carried out by the project manager; DD1.6 Five management minutes; DD1.7. Final management minutes

  Milestones: M30. Kick off meeting.

  M31. Report on the actions carried out by the project manager; M32. Report on the actions carried out by the project manager.

  Figures:

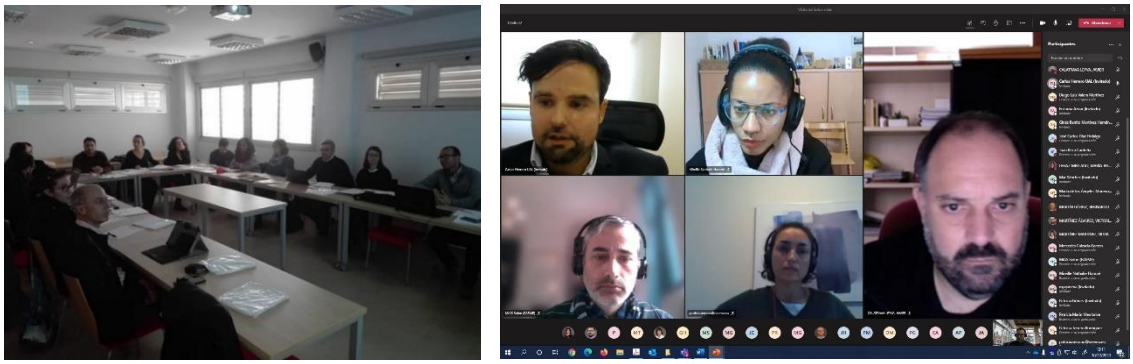

Fig. 24. DESEACROP meetings

E1.2. Project monitoring and evaluation

- **Status:** Completed	Foreseen start	01/11/2017	Actual start	01/11/2017
	Foreseen end	31/10/2020	Actual end	31/12/2020

- **Activities undertaken and outputs achieved:** The first follow-up monitoring visit took place on 15-16/03/2018. Positive feedback from the project adviser was received after the evaluation of the project initial progress and control of deliverables, milestones and deadlines. The second follow-up monitoring visit took place on 23/11/2018. The project adviser was glad to learn that the demonstration plots had been set up and the first tomato cycle was currently being irrigated with the three experimental treatments proposed. The third was on 22/06/2020. The project officer noted that the project was progressing according to schedule. Final meeting was celebrated on 10/12/2020. The project officer was pleased to note that we have almost completed the implementation of the project.
- **Actual vs. planned outputs**: As expected.
- **Modifications:** None.
- **Problems:** None.
- **Future perspectives:**
- **Deliverables:** None.
- **Milestones**: M33. End of project
- **Figures**

Subject: LIFE16 ENV/ES/000341 - "LIFE-DESEACROP" - First monitoring visit

Dear Mr. Maestre,

I wish to thank you for welcoming Ms Patricia Serrano, from the External Monitoring Team, in Cartagena on 15 March 2018. I am grateful to all the participants for taking part in this meeting, during which useful information and opinions were exchanged. I hope that the External Monitoring Team was able to address any queries you may have had.

I am pleased that the project has started appropriately and is progressing towards its targets. Even so, I have been informed that the preparation of the demonstration plots is slightly delayed. I would like to encourage you to speed up work in order to ensure that the first cycle of tomato cultivation starts at the end of August 2018.

Subject: LIFE16 ENV/ES/000341 - "LIFE-DESEACROP" - Fourth monitoring visit

Dear Mr Maestre,

I would like to thank you for the meeting with Ms Patricia Serrano, from the External Monitoring Team, and myself on 10 December 2020. I am grateful to all the participants for taking part in this meeting, during which useful information and opinions were exchanged.

I am pleased to note that you have almost completed the implementation of the project. In this regard, I would like to encourage you to continue your efforts towards the continuation and replication of the project results after its end. As you know, the sustainability and replication of the LIFE projects is a matter of great importance to EASME.

Fig. 25. Some of the acknowledgments received by the commission.

E2. Compilation of information for indicator tables				
- **Status:** Completed	Foreseen start	01/11/2017	Actual start	01/11/2017
	Foreseen end	31/10/2020	Actual end	31/12/2020

- **Activities undertaken and outputs achieved:** In 01/2018 the DESEACROP team filled in the first KPI database of environmental and social indicators (https://webgate.ec.europa.eu/eproposalWeb/kpi). This KPI has been updated with the Progress report, with the Mid-term report and with the Final report.
- **Actual vs. planned outputs**: As expected.
- **Modifications:** None
- **Problems:** None
- **Deliverables:** DE2.1. Initial report for indicators table; DE2.2. Mid-term report for indicators table; DE2.3. Final-term report for indicators table
- **Milestones**: M34. Indicator table performed.
- **Figures**

Fig. 26. KPI application interface (European Commission).

E3. Capitalization and long-term sustainability plan				
- **Status:** Completed	Foreseen start	01/01/2020	Actual start	01/01/2020
	Foreseen end	31/10/2020	Actual end	31/12/2020

- **Activities undertaken and outputs achieved:** To ensure that the project results are effectively capitalized after the end of LIFE a DESEACROP Project After LIFE Plan has been developed and presented within the Final report.
- **Actual vs. planned outputs**: The plan development has been carried out as scheduled.
- **Modifications:** None
- **Problems:** None
- **Deliverables:** DE3.1 Afterlife plan
- **Achieved milestones:** M35. Capitalization and afterlife plan written.

Figures:

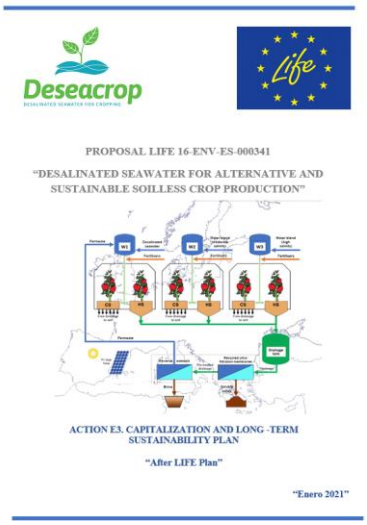

Fig. 27. DESEACROP After LIFE Plan

6.2. Main deviations, problems and corrective actions implemented

All the problems and difficulties encountered in the project have been described per action and per task in section 6.1. These issues have been tackled and no relevant impacts are foreseen on the outcomes of the project.

The main corrections to fix technical issues were:

- Upgrades to the fertigation system (described in detail in Annex I presented within the Mid-Term Report)
- Modifications to the drainage treatment plant (described in detail in Annex II presented within the Mid-Term Report)

6.3. Evaluation of Project Implementation

Please evaluate the following aspects of the project:

- Methodology successes and failures

  Successes:
  - Experimental plot (greenhouse, irrigation system, data collection, drainage treatment plant) fully operational, despite some delays and amendments.
  - All reports and expected results have gone according to schedule.
  - Scientific production (publications) progressing well.
  - High dissemination, capacitation, transference and networking productivity.

  Failures:
  - Lack of complete set of data in the first tomato crop cycle, due to upgrade requirements in the irrigation system and drainage treatment plant.

- Results achieved vs. the proposal objectives and expected results

Action	Foreseen in proposal	Achieved	Evaluation
A1	Objectives: - Characterize plants supplying DSW to irrigated agriculture - Assess DSW quality - Estimate CO_2 footprint of DSW production - Characterize soilless systems in SE Spain Expected results: Description of the baseline situation of desalinated seawater and soilless systems	All achieved As expected	The current situation of DSW production in SE Spain and 9 international regions has been described This information is key for the transferability plan of the project. The benefits and risks of using DSW for horticultural greenhouse production have been reported. A LCA was conducted to estimate CO_2 emissions. The soil surface available and capacity to spread the project results in SE Spain has been estimated.

B1	Objectives: Deployment of experimental plot	All achieved	A high-tech greenhouse ready for complex fertigation trials and continuous monitoring
B2	Objectives: - Determination of irrigation treatments - Monitoring irrigation water - Set up solar-power in-situ drainage treatment plant Expected results: - To have trial treatments defined as well as the water monitoring protocol. - In-situ desalination plant ready to treat crop drainage	All achieved Met with corrections	Due to the complexity of the trial (3 treatments in each type of system, soilless or soil with random repetitions), the irrigation head needed more tanks and a more advanced software than anticipated. It needed more investment and time than anticipated. In the end, all the deficiencies were dealt with by a substantial upgrade of the fertigation system. Since the beginning of the second crop cycle the trial is running smoothly. Desalination plant only ready for working, after amendments described in Annex II presented within the Mid-Term Report. During the first crop cycle it could not operate, but data collected since the second cycle should be enough to evaluate the plant.
B3	Objectives: - To measure vegetative growth, fruit growth, crop yield and quality parameters. - To follow the evolution of soil properties and nutrients content in crop.	All achieved	All data have been collected according to schedule. The reports with the evolution of physical-chemical soil properties, plant nutrients and fruit quality have been completed.

B4	Objectives: - Identification of potential areas to replicate results - Contact database compilation - Evaluate financing opportunities in areas of interest for replication. - To negotiate agreements for know-how transference Expected results: Business cases built for replication	All achieved	Replicability and transferability plan was developed. All the reports are now complete: - Water resources and current desalination practice in EU agriculture - DSW EU agricultural opportunities - Identification and characterization of areas and contacts for transference - Business cases are currently being developed and license agreements will be the focus at the end of the project. - Financial opportunities for DSW and soilless production implementation.
C1	Objectives: - Monitoring the impacts on water, soil, energy and CO_2 emissions. Expected results: - To provide guidance for the use of DSW in horticultural systems	All achieved	The final assay about recommendations and tasks to optimize the use of DSW has been delivered. The impacts of the treatments on energy consumption and CO_2 emission. Life Cycle Analysis LCA.
C2	Objectives: - Monitoring the social and economic implications. - Assessing the impacts on the stakeholders' perceptions. Expected results: - Demonstrate the positive socio-economic impacts of the innovative agricultural practices implemented.	All achieved	The technical-economic information from the trial and stakeholder surveys' data have been processed and associated reports have been delivered.

D1	Objectives: - To present and communicate, project activities. - To network with other projects and institutions. - To disseminate project results. Expected results: - Communication, dissemination and exploitation plan. - Transfer and capacitation activities. - Network establishment - Publications	All achieved	The public website, Facebook, LinkedIn and Twitter accounts and the newsletter are active. The project has been presented in digital press, radio and TV. A good collaboration network has been established and follow-up project are being considered. Five workshops and seven courses on the topic of DSW for agriculture and the implementation of soilless production have been organized. The experiential site has received many visitors (documented on the website). Ten technical articles (including 7 JCR papers) have been published, and the project results and activities has been presented in more than 20 conferences.
E1	Objectives: - Project Management - Technical and financial supervision	All achieved	The kick-off meeting and all the scheduled follow-up meetings with the monitor and/or the project officer and management meetings have been done according to the grant agreement. The minutes are always uploaded to the Google Drive repository in which all project information has been stored and shared among partners. All the financial reports and timesheets are up-to-date.
E2	Objectives: - Gather information for the indicators table.	All achieved	The Initial, Mid-term and Final-term reports for indicators have been elaborated.
E3	Expected results - Capitalization and afterlife plan	All achieved	The After-LIFE Plan has been developed and revised by all partners. It will be on

			working at least for 5 more years from now.

– Project results immediately visible and future expectations

The demonstration site is a great example of sustainable management of soilless systems. The drainages are treated in-situ with renewable (solar) energy which has a twofold benefit: it prevents leaching to the (already polluted and overexploited) aquifer while proving clean water of high quality for irrigation (up to 70% of drainages can be reutilised for irrigation). The site is irrigated with DSW demonstrating its suitability and profitability (despite having higher price than brackish UW).
It is expected that in the near future farmers in the area may adopt the crop production system and the best practises demonstrated in this project. Such good management practices to prevent DSW risks (mainly boron) have been presented to stakeholders as well as experimental proof of this cleaner production system.

– Replication efforts

The replicability and transferability plan has been drawn. The water resources and current desalination practices in EU agriculture has been described and the areas of interest for replication identified. The business cases together with funding opportunities has been evaluated, developed and presented to Campo de Cartagena and Coastal area of Malta (Ministry for Agriculture, Fisheries, and Animal Rights).

– Effectiveness of the dissemination activities and major drawbacks

There has been serious interest and attendance to events (guided visits to demos plot, trainings, seminars) from general public. The website and social media have been well positioned in search engines.
As regards drawbacks, all the trainings have been locally and in Spanish. Broadcasting the courses online in English would have reached a bigger audience, but this kind of actions were not planned in the proposal. For future proposals, we will foresee some activities to reach the global community.

– Policy impact

- The major achievement so far has been to meet with the Water Authorities of Murcia Region Government and relevant irrigators communities involved in policy issues. They all are now aware of our developments in the project. Our final results will be transferred to them in order to support the policy campaigns.
- Main barriers identified and the action undertaken to overcome them: Policy makers are very difficult to reach. Our approach has been to arrange meetings with aligned projects like DRAINUSE to boost our appeal for authorities. Through our network (LIFE-DRAINUSE, DESERT, SEARRISOST, LIFE-AGREMSOIL) we might propose to arrange a joint session with other projects to communicate science result to authorities.
- In line with the EU Environment and Resource Efficiency priority area, DESEACROP has demonstrated to stakeholders the higher sustainability of using DSW for irrigation in soilless systems with solar-powered drainage treatment and reutilisation of treated drainages for irrigation compared to the

current cultivation practices in terms of economic and environmental benefits. The disseminations activities have improved the knowledge of stakeholders about the need for resilient agricultural systems that preserve socio-economic prospects while preserving ecosystems and natural resources.

6.4. Analysis of benefits

The results achieved (computed as Key Project-level Indicators; KPIs) are discussed in this section. Deviations, if any, are highlighted and not achieved, achieved and exceeded targets are commented. Please note that most of the results presented here are based on the deliverable DBE2.3. Final report for indicators table_(UPCT).

- Environmental benefits
  - Direct / quantitative environmental benefits:
    - Reductions of emissions, energy or resource savings.
      - Water consumption. Irrigation in the soil system for the three treatments has used approx. half of water than the soilless system (from 3,840 m^3/ha in soil to 6,660 m^3/ha in soilless systems). This is not in agreement to what we expected (20% of savings). The reason for this is that soilless culture needs to maintain the substrate always wet and much of the water used for irrigation is drained (about 30-40%). However, the designed treatment plant is able to recover up to 70% of the drainages which return to the system. Then, 28% of the initial irrigation water is recovered. The water productivity in our trial was 0.03 m^3/kg (irrigation with DSW and soilless system with drainage recovery) which represents an improved figure compared to the envisaged situation. Differences in production with respect to the expectation are due to the duration of the cycle of tomato and the presence of plague *Tuta Absoluta* at the end of some tomato cycles. In our case tomato cropped in soil and irrigated with DSW reached yields of 101,400 kg/ha with 3,900 m^3/ha. These figures were 132,568 kg/ha with 4,780 m^3/ha when cropped in soilless system, irrigated with DSW and with drainage recovery. This target is not to be met and neither to be exceeded as yields and water consumption have changed.
      - Energy saving. Our values have been similar to what were presented in the proposal. Energy consumption was 3,197 kW·h/ha when the tomato was cropped in soilless system and irrigated with UW. This was a lower value to the one envisaged in the proposal (3,840 kW·h/ha). When the crop was irrigated with DSW under soilless system with drainages recovery energy consumption was 23,804 kW·h/ha which was lower than envisaged (28,480 kW·h/ha).
      - CO_2 emissions. As observed for energy consumption, carbon emissions were somewhat similar in the real plot. CO_2 emission was 1,178 $KgCO_2$/ha when the tomato was cropped in soilless system and irrigated with UW. This was a similar value to the one envisaged in the proposal (1,1014 $KgCO_2$/ha). When the crop was irrigated with DSW under soilless system with drainages recovery energy consumption was 8,772 $KgCO_2$/ha which was slightly higher than envisaged (7,519 $KgCO_2$/ha). It is of note that to compare with the envisaged data proposed in the proposal our results have not considered aspects such as the nursery, the greenhouse

infrastructure, the irrigation equipment, the fertilizers production, the machinery, etc. (they are considered in the scientific publications).

- Qualitative environmental benefits

Mainly environmental benefits quantified in the DESEACROP project are water and energy savings and CO_2 emissions (see epigraph 6.4.1.a). Additionally, as the system treat and reuse the drainages for irrigation and gardening, underground aquifers are not affected as it is the case in soil cultivation. Organized one-day conferences and formation courses have increased awareness among involved communities. In fact, this is the main result of the surveys performed in Action C2.2. The replication and the transference plan of the project (Action B4) has also allowed to widen the project impact.

- Economic benefits

In DESEACROP we practice precision fertigation and treat and reuse the drainages at zero direct energy consumption (photovoltaic panels). This innovative technology together with our replicability and transferability plan are encouraging the visibility of DESEACROP across the Mediterranean region, which could lead to a notable rural development. Concerning the full-time equivalent jobs, DESEACROP has created, up to date, two new qualified direct jobs and non-countable indirect ones (mainly external companies that have hired people (qualified/non-qualified) to serve on the project setting up).

- Social benefits – Positive effects on:

DESEACROP has reached more than 17,168 people (6,748 sessions) in its website with an average visit duration of 2 minutes and 27 seconds. Both the project and its results have been also presented in specialised conferences and dissemination and research articles. In addition, Five workshops and seven courses on the topic of DSW and the soilless systems took place between 2018 and 2020. They have caught the attention of community (more than 400 people).

- Replicability, transferability, cooperation:

The replicability work (Action B4), has identified the potential areas and stakeholders and developed specific business cases and studied the different options for financing projects. Two business cases have been presented to stakeholders; one to Irrigators Community of Campo de Cartagena and another to the Coastal area of Malta, specifically to the Ministry for Agriculture, Fisheries, and Animal Rights. This has been, definitely, one of the main pillars that will allow DESEACROP to spread the results and innovation. In addition, SACYR is now immersed in the C2M initiative which will help the company to position its innovations into the market.

- Best Practice lessons:

DESEACROP project has run as scheduled in most Actions. In this sense, no new strategies to adjust the best practices are envisaged by the moment.

- Innovation, demonstration value and policy implications:

DESEACROP has demonstrated to have a high level of innovation. In areas where most of farmers use soil cultivation, a step forward to soilless systems is the treatment and recovering of water and the preservation of the aquifers. Results achieved by the project as already commented are in line with the nitrates directive (91/676/EEC), the ecological and chemical protection of surface and ground waters (2006/118/EC), the Water Framework Directive (WFD) and the Agriculture Policy (CAP).

7. Key Project-level Indicators

The KPI database indicators presented as deliverable E2.2 within the mid-term report have been updated to be presented within the final-term report. At this point we have detected the following significant deviations from the targets set initially, and comment on targets already met or exceeded:

- Project area. Its envisaged between 1 ha and 500 ha of closed soilless culture. However, the demonstration area for soilless culture is 758 m^2. It has been not possible for us to analyse the total surface that has been change to soilless culture from the implementation of DESEACROP. *The target is already to be met.*
- Humans influenced. We have influenced more than 2000 people. This figure is also difficult to determine as we have to take into account not only people acceding to the webpage but people from conferences and congress, visits, publications. *The target has been exceeded.*
- Water consumption. (Please see epigraph 6.4. Environment). This target is not to be met and neither to be exceeded as yields and water consumption have changed.
- Energy consumption. (Please see epigraph 6.4. Environment). *Energy consumption has been slightly lower than envisaged in the proposal.*
- CO_2 emissions. (Please see epigraph 6.4. Environment). *Emissions have been slightly higher than envisaged in the proposal.*
- Involvement of stakeholders and NGO. We have reached more than 10 external companies/stakeholders who have worked in DESEACROP activities up to the final-term report. *The target has been exceeded.*
- Website. Measured items have already exceeded what was proposed. *The target has been completed.*
- Other tools. Publications/reports, events and displayed information have exceeded the proposed. Print media has run as scheduled. *The target has been completed.*
- Surveys. Surveys have exceeded the proposed. *The target has been met.*
- Networking. It has run as scheduled. *The target has been completed.*
- Professional trainings. It run as scheduled. *The target has been completed.*
- Jobs. Between direct (2) and indirect (+10) jobs, *the target has been exceeded.*

8. Envisaged progress until next report

Figure 26 shows the DESEACROP Gantt chart to illustrate the progress at the end of the project.

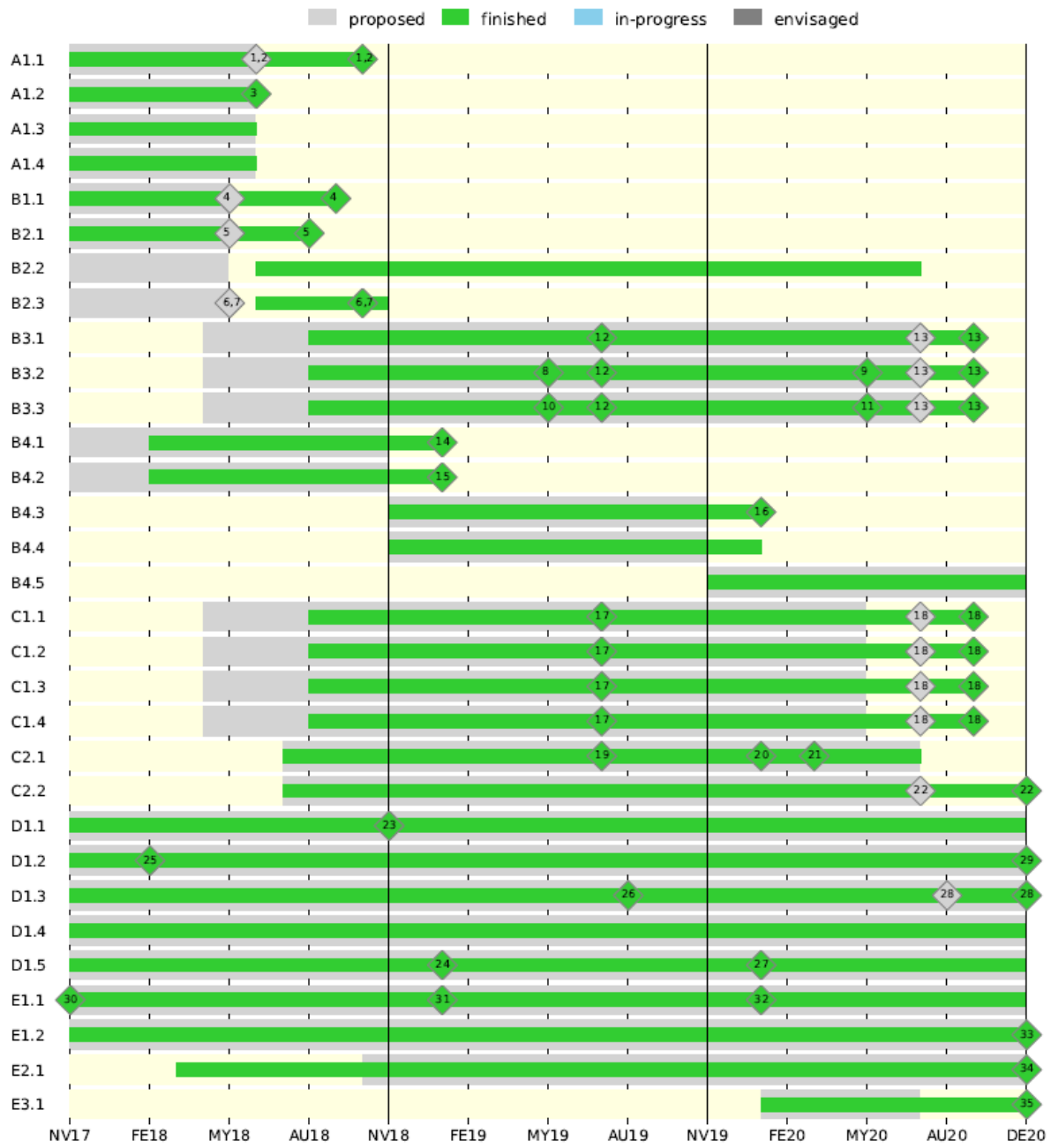

Figure 28. Gantt chart with proposed, actual (finished or in-progress) and envisaged (for Final Report) progress per action (A-E). Black vertical lines indicate dates for first, mid-term and final progress reports. Diamonds represent milestones.

In short, the project has run as schedule and all planned milestones planned have been achieved.