

## **After-LIFE Plan**

The After-LIFE plan of the EBRO-ADMICLIM project is structured into two main blocks. First block corresponds to the continuation of some tasks carried out within the pilot and monitoring actions that have been implemented throughout the project. Second block refers to the dissemination of the results obtained in the project after its completion.

Regarding the first block, the planned tasks are:

- Implementation of a permanent system of reinjection of sediment generated in the water purification plant of the Tarragona Water Consortium (Action B1).

Currently, the CAT is working on the construction project to implement the reinjection system, and is in the process of applying for all the required licenses and studies (i.e. study of the alternative routes of the reinjection system; environmental impact assessment, etc.). Once licenses will be available, the construction works of the reinjection system will begin. It is expected that the system could be built in a period no longer than 4 years.

- Use of the river 2D model and the irrigation network 1D model and the tool INYECTAEBRO for planning and implementation of the river sediment transport along the river and canals; towards the most vulnerable areas of the delta plain (due to subsidence and sea level rise) and towards the river mouth (for coastal erosion mitigation), provided that a by-pass of sediment is implemented in Riba-Roja reservoir (Action B1 & B2).

The construction of a sediment by-pass system through the reservoirs of the lower Ebro River will allow to transfer part of the sediment remobilized from the reservoirs to the river and irrigation network of the Ebro Delta. The sediment could be transported to rice fields that require a more urgent sediment contribution by the opening and closing different canals of the secondary and tertiary network. This fact represents, on the one hand, knowing the most vulnerable zones that require a more immediate action to compensate the subsidence and, on the other hand, a good management of the irrigation network. The 1D model of the delta canal network, developed within the LIFE + EBRO-ADMICLIM project will allow to simulate the sediment transport through the canals and establish which gates should be manipulated for making the sediment reach the desired areas, while determining the critical points (i.e. siphons, areas with low slope, etc.) for the correct circulation of water and sediment until the paddy fields. In case a sediment by-pass system is implemented, these tasks will be carried out by the CRESAE, ACA and IRTA in coordination with other official and non-official agencies. A pilot trial to test a sediment by-pass system could be included in the budget of the Spanish Government for the years 2019-2020, but it is not confirmed yet.

- Definition of a new solid and liquid flow regime for the lower Ebro River and Delta (Action B2).

Nowadays, the Catalan Water Agency in collaboration with IRTA is working on the definition of an updated environmental flow regime of liquid and solid discharges for the lower Ebro River and Delta. The definition of this new fluvial regime is being carried out with the support of the 2D model developed within the life EBRO-ADMICLIM project, and mainly consists on performing several simulations using real flood hydrograms (of different magnitude and frequency) that have been recorded during the last 5-10 years in this area. The main aim of these simulations is, on the one hand, to estimate (according to the model) how much sediment could be transported to the coast by these floods (if a sediment by-pass from the reservoirs of the lower Ebro river is built), considering different sediment concentrations. From here, the total sediment transported in a normal hydrological year (under current conditions) may be determined taking into account, for example, a flood with a return period of one year, or a five-year return period (or a combination of both). On the other hand, a calculation of how many floods and what type of flood (in magnitude) would be necessary to transport a certain volume of sediments over a year (circa 1 million Tonnes) will be carried out. This task will be finished along the year 2019.

- Sediment injections and modelling in Catalan Rivers (Action B2).

In 2018 the Catalan Water Agency issued a competitive bidding for analysing, testing and designing sediment management measures, such as the release of controlled floods from dams, the opening of the reservoir gates during flood events, or the implementation of measures such as the extraction of sediments from the tail of the reservoir, its transport (by mechanical means) downstream of the reservoir and its further mobilization during flood events. These tasks will be carried out in two Catalan rivers (namely, Ter and Llobregat) where sediment injection tests will be performed based on methods developed in the LIFE+ EBRO-ADMICLIM project. This project develops in the period 2018-2020.

- Monitoring the constructed wetlands of the Ebro delta (Action B3-C3).

As indicated in Section 6.1.2.5., on December 2016 IRTA started a collaboration with Aquambiente that has been extended up to 2019 (at least) through a new agreement beyond the LIFE + EBRO-ADMICLIM project. The main aim of this collaboration is to continue monitoring the efficiency of this green infrastructure as long as possible. New data obtained will allow a better understanding of the physicochemical and biological processes that occur in these artificial wetlands while observing whether the efficiency of the filters remains constant or there is a progressive fall. Indeed, several studies have shown that the efficiency of this infrastructures falls after 4 to 6 years of operation when they begin to reach a stage of maturity. This is a key element in determining when different maintenance tasks (e.g. dredging of the constructed wetland) must be carried out to maintain the maximum efficiency of the constructed wetland.

Parallel to these monitoring project, IRTA in collaboration with the CSIC in Barcelona is carrying out in the constructed wetlands the monitoring of several

emerging compounds (i.e. caffeine, aspirin, ibuprofen, etc.) present in the water that comes from the river and the drainage of rice fields. This monitoring, started in June 2018, will allow assessing the capacity of the artificial wetlands to retain these chemical compounds. The monitoring of the emergent pollutants is innovative since there are very few studies that have been conducted in these types of green infrastructure and therefore, the role of the artificial wetlands in the elimination of these substances is unknown to a great extent.

- New projects studying the influence of different water and straw management schemes on GHG emissions, funded by public institutions and private companies (Action B4).

Results on Action B4 has stressed the need of providing mitigation strategies based on straw management, to be implemented during post-harvest season. As well, there is a need to deepen the study on water management techniques to mitigate CH<sub>4</sub> emissions. With this aim, IRTA has obtained a new project to identify the best post-harvest management techniques in Andalusian rice fields (Doñana area) while maximizing carbon sequestration. The project, supported by the rice industrial sector, is expected to start in April 2019. In addition, IRTA is preparing a proposal to be submitted to a public call from Catalan government aiming at assessing the up scaling of the Alternate Wetting and Drying (AWD) water management scheme, for its implementation in commercial rice fields considering the agronomic and environmental variability of rice fields in the Ebro Delta. The final goal of this project is to deliver precise guidelines to the rice sector for AWD implementation according to particular rice field traits, i.e. soil texture, field size, salinity, etc. Currently, the consortium of partners (with different stakeholders related to the rice farming sector in Ebro Delta) is being established in parallel to the proposal preparation. The research-rice sector partnership will allow a participatory approach that will ensure a more spread and site-specific adapted implementation of AWD. Finally, IRTA with Tour du Valat (Research Institute for the Conservation of Mediterranean Wetlands in France) and the Centre Français du Riz have recently started a research project funded by Total Foundation (2019-2020) to study the GHG emissions in rice fields and wetlands of the Rhône Delta (Camargue, France).

In the field of soil carbon stock and carbon sequestration, a Spanish consortium called CARBOCERT was created with the objective of identifying measures to promote carbon sequestration in rice and other crops (olive, wheat, almond) and provide easy usefully methodology for the certification for carbon storage. The consortium is formed by research institutions, agriculture union and certification authorities, and it is expected to start in 2019.

- Monitoring of subsidence and acquisition of new satellite data (Action B6).

The ICGC will continue getting new data on subsidence processes by maintaining the corner reflectors (CR) network and acquiring new satellite data. These new data will be integrated into the existing database allowing the update of the subsidence map, to set up over the time the evolution of the sinking rates of the delta plain and

better determining those areas more susceptible to relative sea level rise. With that purpose, a new agreement with the landowners of the areas where the CR were placed has been carried out allowing the permit to access the properties and the maintenance of CR (at least for the next 5 years). These data will also be used for feeding existing (or new) models that will lead to the establishment of scenarios such as, for instance, the evolution of soil salinity and its effects on the rice yield.

- Map of the zonation of subsidence in the Ebro Delta (Action B6)

The subsidence map of the Ebro delta can be a useful tool for the territory's managers (e.g. town halls; Catalan government offices; Spanish Ministry; etc.) that allows a first assessment of the delta plain subsidence and the establishment of the most vulnerable areas where urgent actions must be carried out in the first instance. It is also seen as a tool to perform simulations of different scenarios of sea level rise and sinking of the delta plain to determine (based on modelling) which would be the most affected areas and what actions should be carried out.

- Implementation of the document Action for Climate in the Ebro Delta (Action B7)

The first challenge that has been established within the ACDE document is to engage all the social, economic players together with administrations involved in the sustainable development of the territory, through a transparent and participatory process that facilitates the governance of climate change. The goal is to break individualism and promote a common project for the territory, agreed by all actors, which allows defining a new model of governance. This idea has ended up with the constitution of a dialogue table where the main social and political actors of the delta are represented. In this sense, the first steps towards the constitution of the table have already been made. On July 17 of 2018, the two irrigation communities in the Ebro Delta (two of the most important social actors in the area), representatives of the seven municipalities of the Ebro Delta and the Government's subdelegation in Tarragona plus the General Director of Mountain and Coastal Policies of the Generalitat de Catalunya participated in a first meeting in order to advance towards the establishment of a common road-map. The first purpose of the dialogue table is to maintain the current morphology of the delta (as much as possible) and also promote a regeneration plan for bays and lagoons.

The agenda of actions continues now with the approval of the creation of this table by the respective municipal plenary sessions and boards of government. Efforts of support and consensus among the social and economic players of the territory are being carried out in order to increase the representativeness of the dialogue table.

Concerning to the second block (dissemination and communication of project results) the main tasks that have been established are as follows:

- Maintenance and updating of the website.

As described in the original proposal of the LIFE + EBRO-ADMICLIM project, the webpage of the project will be maintained during the next 5 years after the completion of the project. This task will be mainly carried out by the OCCC team.

- Dissemination of project results in scientific conferences and technical and scientific journals.

The large amount of information that has been generated and compiled throughout the project will be exposed progressively from different perspectives. Further analyses will be carried out to deepen into the most relevant aspects of the different implemented techniques. The obtained results will be transferred to the scientific community either through participation in conferences or through the writing of scientific-technical articles. For example, in 2018 there has been an attendance at two conferences: “16th IWA International Conference on Wetlands systems for Water Pollution Control” and “Near Surface Geoscience 2018” to present some of the results obtained in action B3 and action B6. In addition, some scientific papers are currently being drafted. These tasks will be mainly carried out by IRTA, UCO and ICGC.

- Dissemination of the project results to the students of schools and universities.

The CAT constantly receives a large number of schools (primary and secondary students) that visit their facilities. During its visits, students (and other visitants such as professionals of the water sector, managers, etc.) will be introduced to the functioning of the sediment reinjection system, its advantages (from an economical and environmental point of view) and its management. In addition, IRTA will continuously disseminate the obtained results to University students through dissemination talks and field excursions.

- Transfer of deliverables to managers, administration and stakeholders.

The deliverables: Actions for Climate in the Ebro Delta (ACDE) document, subsidence map, 1D model for the irrigation canals, 2D river model, and the GHG emission model will be delivered to the governmental and non-governmental institutions so that these can be used as management and planning tools with the common goal of achieving the sustainability of the Ebro Delta.

- Dissemination to mass media.

The new progress related with the project will be communicated to the different mass media (i.e. radio, television and newspapers) either through press releases or by directly contacting with journalists.