

## SHORT TERM SCIENTIFIC MISSION (STSM) SCIENTIFIC REPORT

This report is submitted for approval by the STSM applicant to the STSM coordinator

**Action number:** CA15206 (PESFOR-W)

**STSM title:** Incentive-based mechanisms for W-f-W: PES schemes and carbon credits comparison and likelihood of uptake

**STSM start and end date:** 21/01/2019 to 22/03/2019

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### PURPOSE OF THE STSM:

(max.200 words)

The purpose of the STSM was to address the following research questions: (1) which type of W-f-W scheme would increase the likelihood of actor acceptance and uptake?; (2) which is the uptake likelihood of carbon credits and by which actors? Both research questions focused on the motivations behind the demand/buyers' side and the allocation of incentives. At the same time, the STSM targeted several from the objectives mentioned in the call for applications, namely: (a) characterize and critically evaluate the governance models and design structure of W-for-W PES schemes; indirectly, (c) Develop a European PES repository of Case Studies. Additionally, and because the STSM took place in the context of two EU-funded projects taking place simultaneously in the case study region, it also aimed at contributing to the capacity-building objectives, by facilitating the interaction between specialists with different skill sets. Finally, in terms of outputs, the purpose was to achieve the following: a scientific contribution culminating in one peer-reviewed publication on these type of incentive-based mechanisms; a policy contribution, by participating in the process of W-for-W PES scheme design in the case study region; and a methodological contribution, by developing an agent-based model (ABM) of W-for-W PES design applicable to different contexts.

### DESCRIPTION OF WORK CARRIED OUT DURING THE STSMS

(max.500 words)

The official starting date of the STSM was 21<sup>st</sup> January 2019. However, preparation work started December 2018 with two main activities: a literature review and self-learning activities on the chosen ABM software. The literature review was structured following these key themes: efficient and effective PES design from European experiences; willingness-to-pay and willingness-to-accept; and, ABM and similar models applied to the design of payment for ecosystem or environmental systems. The purposes of reviewing strictly examples from the European context is because the literature on PES has so far stressed the examples from other geographic areas (e.g. Latin America, Asia), but which have too distinct situations and needs at the social, political and environmental levels that made the application of their lessons learnt difficult in the European context, in which we have completely different challenges and political frameworks. Additionally, whereas reviews have been performed for these geographic areas, there are some voids in the literature with regard specifically to European countries. The second activity performed pre-STSM, self-learning, consisted on following both text books and online tutorials to learn Netlogo, which is the software chosen to develop the agent-based model to explore W-for-W PES design.

During the official time of the STSM, the additional activities consisted on: **1. meeting with the project managers of the EU-funded projects** which were the platform from which to obtain part of the data

collection for the STSM; **2. start building the ABM** applied to the case study area but also flexible enough to be used by other actors willing to design W-for-W PES in different case study areas; **3. participating in the organized stakeholders activities** of the mentioned EU-funded projects; and, **4. preparing the structure for the manuscript** accompanying the results of these several activities together with this scientific report.

In 1. my work consisted on coordinating with them on the focus points and find the synergies of the STSM with their own work for the EU projects. Also, the preparation of the model was discussed in several occasions involving the presence of specialists with different skill sets: two practitioners from the forest regional authority, two academics experts, one project coordinator and a specialist in building climate change models. Following these meetings, I could further develop 2., as I also received geographical data from the practitioners which allowed to construct a context-specific ABM model for W-f-W PES schemes, which is the design suggested in the literature. This activity was validated in 3. as the model was presented to the stakeholders with the aim to raise the awareness of the interactions of water and forests and the impact that PES schemes can have on the maintenance of these two natural resources. The different feedbacks received during the completion of these 1-3 activities together with the work pre-STSM, were used for 4. in the writing of the manuscript and this scientific report. The manuscript is expected to be submitted by May and can be shared with the Cost Action members upon request in case of interest.

## DESCRIPTION OF THE MAIN RESULTS OBTAINED

In this section we present the results of the different activities and work carried out during the months of December 2018 (pre-STSM), January to March 2019 (during the STSM), together with the expected output contributions expected during April-May 2019 (post-STSM). We present the results by the different purposes aimed at and presented in the first section of this report.

- **Motivations behind the demand/buyers' side and the allocation of incentives**
  - **RQ1: Which type of W-f-W scheme would increase the likelihood of actor acceptance and uptake?**
  - **RQ2: Which is the uptake likelihood of carbon credits and by which actors?**

Both the literature review and the outputs of the stakeholder meetings suggest that ecosystem services are different to recognize by the same stakeholders that the facto manage or make use of the natural resources that provide them. Also, in the study area, (RQ2) carbon storage was not sufficient to support the design of a market of carbon credits, and the solution was found in proposing the bundle of several ecosystem services under the same market scheme umbrella. This later can possibly be the situation in the majority of the Mediterranean countries due to their climate and structure of natural resources, specifically forests. Also, in line with the literature, despite in the region water scarcity is as much as a problem as water quality, the link between forest management and water quantity was not clear to stakeholders. Displaying the evolution of the ABM (the ecological submodel, please refer to the last bullet point), helped strengthen the perception of importance and imminence of the challenges of the region.

Specifically, for forests for water PES (W-f-W PES), despite few examples found in peer-reviewed papers, the stakeholder meetings revealed that these expectations in the literature of the importance of both monetary but also non-monetary factors that support PES schemes, could be possibly met. Rural tourism stakeholders were for instance interested in developing forest management in the region, displaying non-monetary motivations for supporting the establishment of W-f-W PES. Forest owners, on the contrary, mentioned that monetary incentives would be required to cover at least the costs of the management. Currently in the region, only 1% of the forest is being managed due to low rentability of forests. This could explain why this stakeholder group (PES demand side) displayed rather materialistic interests, whereas the stakeholders that would be providing the subsidies (PES supply side), were displaying both materialistic and non-materialistic factors for their decision-making process.

In terms of W-f-W PES design (RQ1), stakeholders considered that the first step would be to change the legal framework to allocate the definition of ecosystem services of forests to water. They considered that this factor could help convey the idea of the necessity of the scheme to the potential payers. In terms of payers, the solutions suggested were the increase of taxes of water users or tourism, the latter implying the creation a private-to-private local fund, in line with the *purest* form of PES as defined in the literature.

- **Characterization and evaluation of governance models and design structure of W-for-W PES schemes**

As mentioned above, one of the major problems is to gain the support of both the demand and the supply sides in implementing PES schemes. In this case, the literature review of over 50 peer-reviewed articles on PES or similar schemes implemented in the European context suggested that best design practices to evade these challenges payed attention to these key elements: time-bound, stakeholder involvement, spatial targeting and monitoring. In terms of time-bound, the PES schemes with better performances suggested a series of **recurrent payments during a long period of time** was superior to lump-sum single payment. The rationale behind this suggestion was that the recognition of the actual ecosystem services being paid for was cemented by stakeholders and helped maintain the WTP. With respect stakeholder involvement, the **involvement of stakeholders in the design of the scheme** increased the likelihood of their long-term interest in maintaining the policy as well as enhancing the perception of ecosystem services. However, this latter in terms of overall ecosystem services but not specifically one. As mentioned above, this was also observed during the stakeholder discussions, in which they saw carbon credits insufficient. This “insufficiency” was actually later confirmed by the pilot study in the context of one of the EU-funded projects. On spatial targeting, in several sources it was mentioned that the **PES design needed to be tailored to the characteristics of the area** and thus it would be difficult to replicate experiences from the same PES. However, these tailoring is rather in terms of amount of payment and ecosystem services provided, rather on these major key elements on PES design. Finally, in terms of monitoring, there are two related aspects. The first mentioned is that one of the pitfalls was that monitoring activities related to the check on compliance of the required management activities to obtain the ES, but not **on verifying whether the actual ES paid for is achieved**. This second aspect was perceived as best practice, despite not usually being done. The second monitoring-related aspect was the role of the government, as **intermediary in the PES scheme**. The presence of a public institution being the intermediary was perceived as superior in several of the reviewed case studies in the European context.

- **Development of a European PES repository of Case Studies**

Currently, the several EU-funded projects being developed in the region aim at designing and implementing PES at the local level. However, in the case study region for this STSM there is not yet any PES scheme implemented. Therefore, and for the contribution of this STSM to the purpose of developing a European PES repository of case studies, I rely on the results of the literature review in which just PES or related examples in Europe were reviewed. This literature and its main outputs are summarized in the above bullet points and introduced in the scientific publication accompanying the results of the ABM model. The excel file containing the literature review can be shared with the Cost Action members upon request in case of interest.

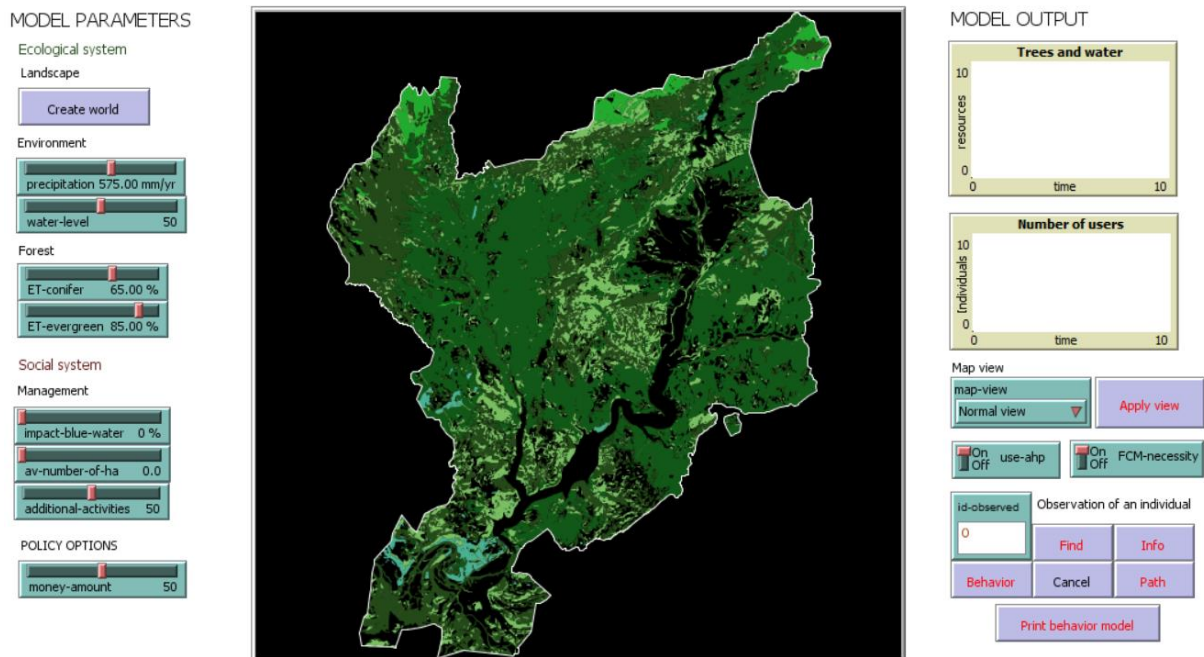
- **The three output contributions:**
  - **Scientific contribution**
  - **Policy contribution**
  - **Methodological contribution**

The results from the three expected contributions following the output of this STSM are: the scientific, the policy and the methodological contributions. These all involve the development of the agent-based model for the design of W-f-W PES schemes. This method consist on modelling socio-ecological systems and widely used to assess the impact of land use change policies in the ecosystem. The model developed during the STSM consists of three submodels: the ecological, the social and the political. The ecological follows water-forest interactions; the social introduces the concepts of WTP and WTA; and the policy submodel compares different PES design options (i.e. time boundness, etc.). Currently, the ecological submodel has been tested and the social and policy submodels are being developed. Despite the final results of the ABM are expected for end of April and the submission of the manuscript is scheduled for May, we can advance the following results based on the current status of the ecological submodel: in the case study area, and without policy intervention, in 150 years the results suggest that the risk of forest fire and tree mortality would have escalated to ecological failure of both forest (mortality) and water resources (drainage). These results were obtained by using the climate change expectations for the area, that expect reductions in precipitation and increase in temperature, and modelling the water-forest interactions in a Mediterranean context. The model was validated against the results of an ecological model: GOTILWA. Second, we used a participatory approach to present the results of the ecological submodel to introduce the discussions during one of the stakeholder meetings. This is suggested by the literature on participatory ABM (PABM) and helped to raise awareness on the potential relevance of reaching consensus on a policy to alter the potential ecological

future. The PABM used a spatial-explicit model, which means that stakeholders say their region (the case study) and how it would become from green (current status) to several brown patches which indicated tree mortality or increased risk of fire due to dryness. From the social and policy submodels the current ABM version only contains the introduction of government subsidies for forest management favorable to water bodies. The results indicate that forest owners would be willing to change management towards the most favorable to water bodies, which is more expensive, if subsidies would not only equal but be greater than the expected costs of the change. In the following month after concluding the STSM, the ABM will integrate all three submodels. The ABM will be uploaded in Computational Modeling Platforms, which is a platform to share ABMs and which can allow other users to not only see the results of the model but also adapt the model for their own study regions.

The below figure displays a screenshot of a previous version of the context-specific ABM model (unfinished).

**Figure 1. ABM model for W-f-W PES schemes**



With respect the capacity-building purpose, this aspect is addressed in the next section on future collaborations.

### **FUTURE COLLABORATIONS (if applicable)**

This STSM has the possibility to open the door for future collaborations.

First, one likely collaboration is the joint participation in future projects related to water and forest and/or on the development of payment for ecosystem services policies together with the host institution and/or other project members met during the EU-funded project internal meetings. The human and sometimes team dynamics established during the STSM could be maintained through these desirable future collaborations, as there is compatibility of skills, as well as a good atmosphere with the team at the host institution and mentioned project members.

Second, the developed ABM, and as mentioned in the previous section, can be applied to different contexts for the study of the impacts of W-f-W PES on the ecosystem and help also with design decisions. This could involve the performance of capacity-building activities to interested practitioners or academics that would like to adapt the model for their own case studies.

Finally, presenting the manuscript in conferences or within the PESFOR-W project meetings if possible, could also allow to raise the interest on adapting the PES ABM to other scenarios.