Solar Salt Works Integrated Management - SSWIM

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ABSTRACT The SSWIM project aimed to ensure improved governance for solar salt works sustainable development. It should set the bases for a new production paradigm through marine salt production optimization, a relationship between integrated activities with bio-, environmental and market models. It should provide an ecosystem services evaluation and explore the role of such evaluation. Consequently, it should contribute to coastal and natural environmental protection, and heritage maintenance.

1. RESUME

In the middle of the 20th century, the marine salt production from solar salt works in Europe suffered a decline due to (i) high production costs in comparison with other salt productions styles, (ii) global competition with an increased market liberalization scenario [1], (iii) land pressures in a tourism driven demographic change context, (iv) lack of technological innovation, v) the appearance and development of semi-intensive and intensive aquaculture in the same areas, vi) changes in hydrological regimes and vii) the lack of the idea of environmental integration.

Some of these factors turned the land more expensive and inaccessible for solar salt works exclusive use. In consequence a coastal heritage is being lost, followed in some cases by the anthropic degradation of the surrounding natural environmental areas. However, new projects based in biological production, the concept of ecosystem services and land rehabilitation, environmental education and other integrated activities could generate higher profits to solar salt works [2] and consequently their sustainability and their development. For that there is a necessity to articulate traditional know-how with scientific knowledge as well as to match research capabilities with technology and product demands. The SSWIM project should set the bases for a new paradigm of production models and ultimately for successful sustainable development of the solar salt works. The project intends to develop a solar salt works integrated management, with the following objectives: (i) to describe exactly what has happened and is happening in the specific case area; (ii) to provide

background research and join producers and stakeholders for the development of policies at different levels aimed at achieving solar salt works sustainable development through conservation value, taxes and production regulation; (iii) to consider solar salt works in the context of ecosystem service evaluation (economic and non-economic) and to explore the role of such evaluation in ensuring improved governance for sustainable development; (iv) to describe autochthonous species with market value which can be produced in solar salt works as complementary activities which are able to raise the profitability of solar salt works; (v) to quantify the production of these species according to environmental parameters and the areas of the involved solar salt works through laboratory and field bio-essays; (vi) To analyze the relationship between experience tourism/ecotourism and the specific solar salt works; (vii) to elaborate models of marine salt production optimization; (viii) to provide seasonal models to marine salt production and complementary activities in order to change from un-qualified to qualified work.

2. PROJECT BACKGROUND

Coastal solar salt works activities are normally present in wetlands, more specifically in salt marshes rich in biodiversity and represent unique biological systems [3,4], which make them environmentally relevant [5]. Many species live, feed and reproduce in a salt marsh and in a solar salt works area [6]. They provide biological diversity, including plants, birds, reptiles, fish and invertebrates and contribute to flood prevention and improved water management [6,7]. Usually, even salt producers do not appreciate their activity as an environmental friendly one, ignoring its ecological value, which is difficult to estimate in economic terms. The presence of solar salt works tempers the hydrological regime, promotes environmental preservation, controlling natural and anthropic factors and increase water quality [8]. One successful example of environmental protection is the case of the solar salt works of Margherita di Savoia (South of Italy), where an artificial solar salt works located in a protected area with natural interest, belonging to the Natura 2000 and Ramsar lists, became the home to rare endangered species able to proliferate there. Migratory species make the area a "stopover" for food and shelter. There is an integrated management, species inventories, naturalistic, biological, microbiological and geological studies and all the stakeholders agree with the role it plays in conservation, due to the lack of negative impacts [9]. Other examples of Ramsar areas, with traditional solar salt works are the cases of Ria Formosa (Portugal), Songor Keta lagoon (Ghana) [10], Yucatan (Mexico) [11] and Rajasthan (India) [12].

However, without integrated activities small solar salt works are sentenced to transformations or decline. Provided by the appearance of semi-intensive and intensive aquaculture, the constant increase of coastal tourism, the changes in hydrological regimes and the idea of environmental integration turned the land to be more expensive and legally inaccessible exclusively for solar salt works. Also there is a lack of scientific knowledge and available research on integrated activities. Existing

ones are not being transferred to practice and solar salt workers are scarcely receptive to changes. So, there is a need to connect stakeholders and research centers, as well as to gather more information through structured fieldwork.

3. PROJECT IMPLEMENTATION

The project combines several tasks attached by stages. The first stage should produce a global overview over all the topics to be worked and collect global information about the area to start to build the project draft. Similar activities in the area should also be located for comparisons through available data in the next stages.

At a second stage solar salt works history should be collected and the analysis of policies should be done in cooperation with the regulators and stakeholders. Geographical location and altimetry will be a natural consequence of mapping to produce precise ponds surface areas and volumes numbers.

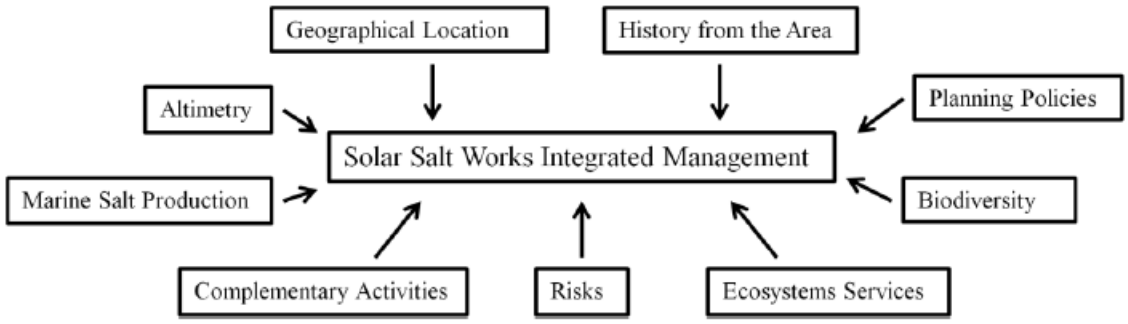

Figure 1: Subjects to have into account in the planning of the SSWIM in a specific solar salt works.

At a third stage an ecosystem services evaluation should be carried out. These ecosystems provide a range of services which can be used by humans that include food production, wood production, soil protection, water quality regulation and hydrological control, carbon sequestration, natural and cultural landscape value, recreation and tourism. At the base of all these services is biodiversity and so, part of the process is to make an identification and quantification of biodiversity and ecological relationships.

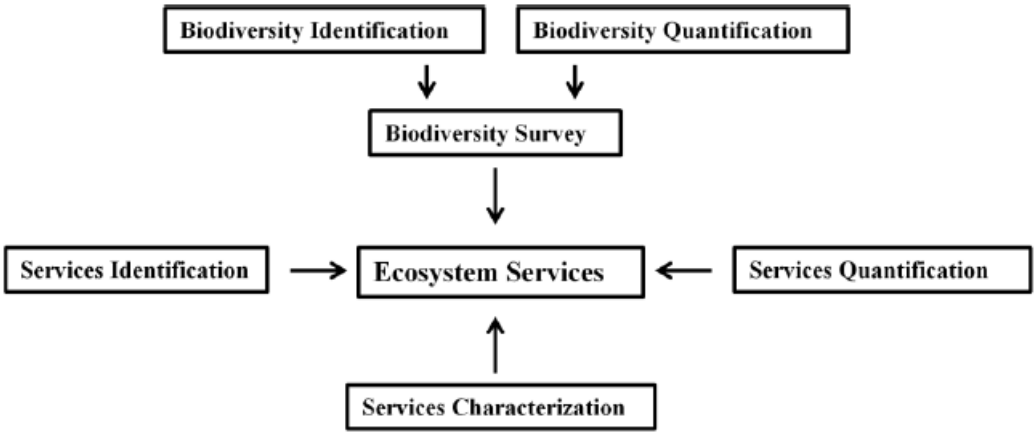

Figure 2: Ecosystems Services and variants.

At a fourth stage, the risks should be evaluated through a tide characterization to understand the salinity profile variations, statistical analysis from environmental data to predict effective evaporation rates, coastal and river (if it is the case) sediment transport to realize the possibility of water collection and (if it is the case) inlet closure, water analysis to know the content of heavy metals and develop water management pressure, calculating the risk of flooding to design or re-design the structure and the height of the ponds.

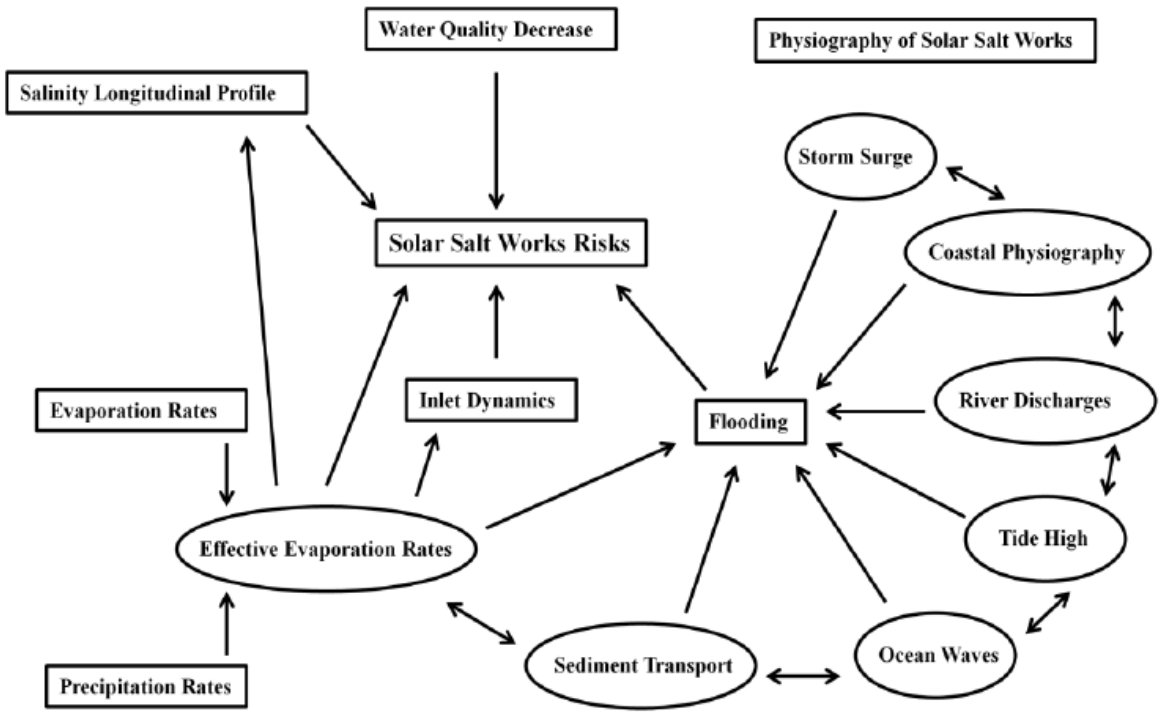

Figure 3: Solar Salt Works Risks Evaluation.

As for the fifth stage the analysis of the marine salt qualification and quantification should be performed and for that physical-chemical, hydrological and biological parameters will be monitored. The approach will not take into account all the factors that are related with marine salt production with the objective of simplification. Not only to simplify estimated production but also to simplify future values in a production optimization approach.

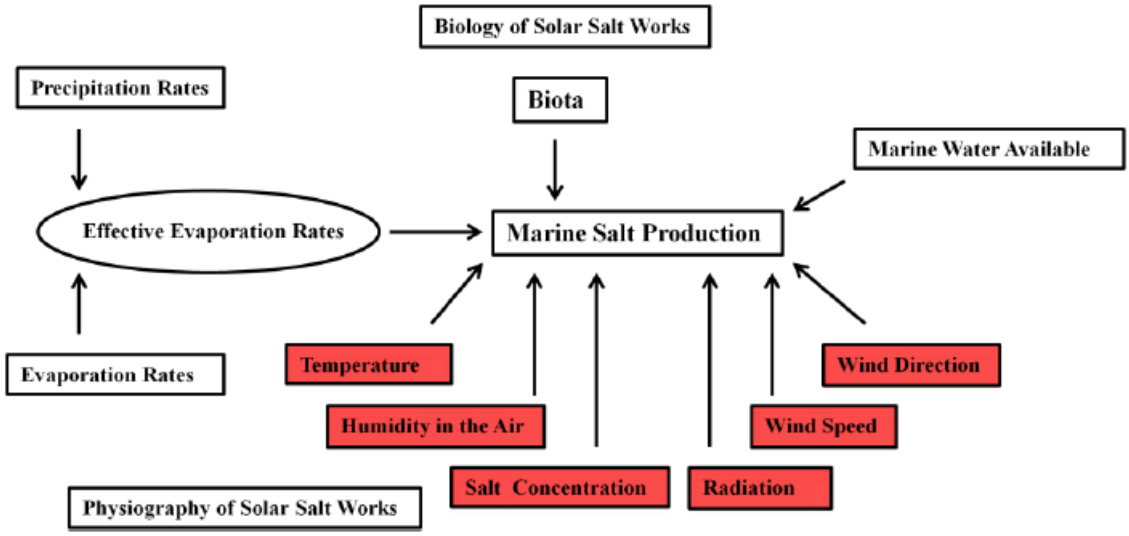

Figure 4: Marine Salt Production

A relationship between ponds surface areas and volumes with effective evaporation should be done to understand the marine salt production in the solar salt works specific case. To develop an optimization of production fluctuations in the surface areas and volumes should be promoted to achieve different amounts of marine salt production and different types of marine salt taking into account the size of water columns, different crystallization layers and organism populations.

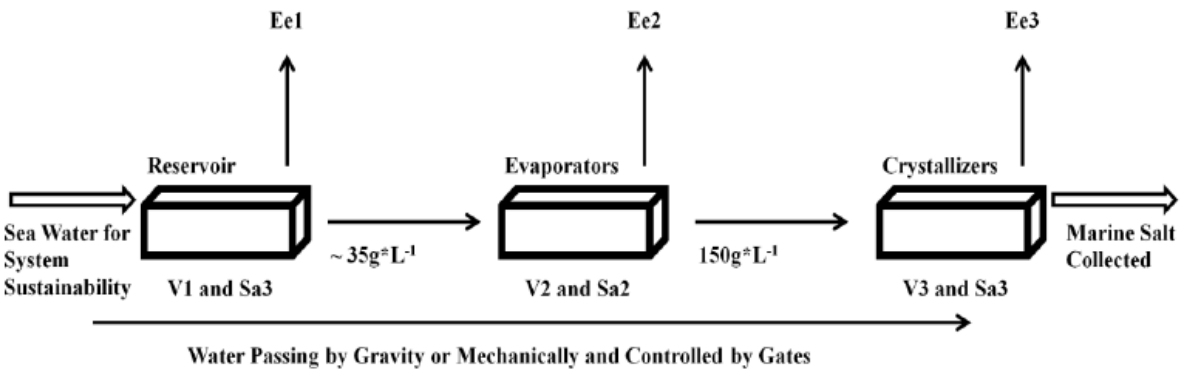

Figure 5: Relation between Surface Areas, Volumes and Effective Evaporation for Salt Production Optimization

At a sixth stage the analysis of the potential integrated activities should be done. For that markets will be analyzed always with a focus on their needs in a global market and what is possible to insert in local and regional markets through innovation. Then laboratory experimental cultures will be conducted and environmental studies involving field monitoring of physical-chemical, hydrological, biological parameters and local species in the specific solar salt works case. These will be followed by the transfer from laboratory cultures to the solar salt works area case to model their functioning. The potential for ecotourism and other complementary activities will be explored through document analysis and interviews with local actors and example cases.

4. EXPECTED RESULTS

The following specific results are expected: i) development of policies to support marine salt producers, at local, regional and state levels; ii) development of social history and the impact of solar salt works in the social development and in the landscape as a traditional and eco-friendly activity and heritage ; iii) development of the concept of ecosystem service in solar salt works in an economic and non-economic level; iv) development of marine salt production optimization to increase marine salt production; v) prediction and quantification of risks; vi) identification of the main integrated activities; vii) elaboration of bio-models to calculate biological mass production; viii) description of the potential of eco-tourism and tourism experience for a solar salt works itinerary.

5. INNOVATIVE ASPECTS OF THE PROJECT

The establishment of the project SSWIM will provide know-how and scientific knowledge transfer between producers, research institutions and stakeholders, thus achieving not only a theoretical but also a practical knowledge to apply in solar salt works and adjacent areas. SSWIM tasks will contribute to the description of ecosystem services provide by solar salt works and promote the concept of sustainable development of this industry. There is scientific material describing some potential uses of solar salt ponds for limited integrated activities, most of them theoretic and generalist. SSWIM will establish their feasibility through field assays and optimization of biomass production as well as their impact on salt production.

The concept of integration developed will be a complete modern and unique support to solar salt works in Europe, in order to incorporate integrated activities with potential market with marine salt production.

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