CONAMA2014
CONGRESO NACIONAL DEL MEDIO AMBIENTE

Los productos y servicios de los paisajes de la sal, un modelo para un desarrollo rural sostenible

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Resumen

Las salinas y los humedales salinos son paisajes muy diversos y abundantes, sobre todo en la Península Ibérica, donde se han catalogado cerca de un millar de paisajes de la sal, muy por encima de lo que existe en cualquier otro país de Europa e incluso del Mediterráneo. Muchos de ellos están abandonados e incluso ya han desaparecido y otros, sin embargo, están siendo recuperados. Estos paisajes poseen una gran variedad de valores naturales, culturales y humanos, que se relacionan entre sí de manera muy compleja e interdependiente. La presencia de sal en el agua o en el subsuelo ha condicionado el aspecto físico del paisaje, la fitosociología asociada al terreno, la fauna residente o transeúnte y, en muchos casos, la actividad humana en torno a tan preciado recurso. Esta actividad ha influido a su vez en la historia y la demografía a escala local e incluso regional, por lo que se puede decir que los valores de la sal han llegado lejos tanto en el tiempo como en el espacio. Por todo ello, la recuperación duradera de estos paisajes no es tarea sencilla. En la presente comunicación, IPAISAL desea presentar ejemplos de buenas prácticas en el aprovechamiento contemporáneo de los productos y servicios que ofrecen estos paisajes (alimentación, salud, turismo, educación…) y cómo se contribuye con ello al desarrollo socioeconómico rural y a la conservación a largo plazo de los mismos. En esta comunicación se propone un modelo de gestión sostenible y autosuficiente que pueda servir de base para una gestión de los paisajes de la sal compatible con la conservación de sus valores y del fomento del desarrollo rural a medio y largo plazo. Este modelo no pretende servir como una plantilla común para todos los casos, sino que está diseñado para acompañar la idiosincrasia local y aprovechar los recursos que cada espacio tenga a su disposición, reforzando la identidad y el sentido de pertenencia entre la comunidad local. El modelo permitirá afianzar entre la población la motivación para aprovechar los recursos endógenos, generar nuevos productos y servicios a partir de los mismos y, finalmente, sentirse dueños de su futuro.

Palabras clave: salinas; gestión; conservación; paisaje cultural; alimentación; turismo; salud; educación

Abstract

Saltscapes and saline wetlands are diverse and abundant landscapes, especially in the Iberian Peninsula, in which almost one thousands of them have been catalogued, well above elsewhere in Europe or the Mediterranean. Many of them are abandoned and are in the process of disappearing and others are being recovered. These landscapes offer a great variety of natural, cultural and human assets, which are related to each other in a complex and interdependent manner. The presence of salt in the water or in the underground has influenced the physical features of the landscape, the associated phytosociology, the local fauna and, in many cases, the human activity around this commodity. This activity has in turn affected history and demography both at local and regional level, so that it can be said that the values of salt have reached far both in time as in space. Therefore, the sustainable recovery of saltscapes is no simple issue. In this contribution, IPAISAL offers a model of sustainable and self-sufficient management that may serve as a basis for a development of saltscapes compatible with the conservation of their values and long-term rural development. This model does not intend to fit all situations, but it should take into account the local culture and profit from the resources available in each site. It should thus strengthen the identity and sense of belonging of the local community, by motivating them to use the endogenous resources and generate new products and services from them and, ultimately, feel stewards of their own future.

Keywords

salinas, management, cultural landscape, food, tourism, health, education

What and where are saltscapes

Saltscapes can be defined as “any landscape type whose elements are strongly influenced by the presence of salt and forms a defined ecosystem” (Hueso Kortekaas & Carrasco Vayá 2009a). Saltscapes are very diverse, not only due to the different ways salt may be present in them, but how the surrounding habitat, topography, climate and land use customs are in a given territory. When we look at coastal areas, salt is present in the nearby sea and may influence the landscape by the tides or sheer salt spray. If the seawater is further concentrated for the production of brine, the presence of salt at the coast becomes more prominent and creates a more distinct saltscape with specific salt-tolerating (*halotolerant*) or salt-loving (*halophile*) flora and fauna communities. When salt is present in the underground, whether as solid rock or in the form of brine, it needs to be brought to the surface in order to influence the landscape. This is usually done by mining techniques, by dissolving the rock underground or and/or by pumping the brine. Occasionally the brine or the rocksalts are found directly at the surface, as it happens with diapirs, natural brine springs, saline rivers or salt lakes. In any case, once the salt is present above the ground, these areas will host flora and fauna communities capable to cope with the salt. This type of landscape is less frequent and more vulnerable when found inland, away from the sea, as it is spatially confined to the area of influence of the salt, which is limited to its actual presence. In coastal sites, salt is somehow always there, but in inland sites, the halophile communities depend altogether on the local source of salt. If the salt ceases to be present, due to land use changes, management decision at watershed level, abandonment of salt making activity or even climate change, the saltscape and its distinct elements may disappear.

As mentioned above, other factors may influence the presentation of salt and its influence on the landscape. From a topographic standpoint, saltscapes can be found in flat country, valleys, depressions, hills or even mountains, thus virtually anywhere. The surrounding habitat can be very diverse, too, as the salt only affects the flora and fauna of its direct area of influence, at the most creating concentric bands of gradually or even abruptly decreasing salinity, until salt loses its relevance. These concentric bands can be rather narrow, so that salt ceases to influence the habitat while not being far from its source. From that point of view, saltscapes become small enclaves of salt-affected habitat surrounded by the rest of the territory, and therefore can be considered as islands of water in a sea of land. Saltscapes, especially when inland, can be surrounded by virtually any kind of habitat: forest, desert, steppe, mountain… the only constraint being climate. Since salt is easily washed away, saltscapes need relatively dry climates or, at least, with a distinct dry season. Hence, saltscapes shall be best found in arid, semiarid and Mediterranean climates, with a certain degree of toleration to humidity in coastal areas.

Despite their fragility and salt-dependence, saltscapes are ubiquitous (Williams 1981). The diversity of conditions in which they can be found, allows their presence in all continents and in a broad range of latitudes. However, saltscapes clearly thrive in certain regions in which the combination of geological, climatic and topographic features give rise to them. Large underground deposits of fossil salt, such as the Tethys or Zechstein seas (aprox. 200 MYA), the existence of flatlands or slight depressions in which evaporitic salts emerge and stay confined and a dry, semi-arid climate that allows the flow of these salts into endorrheic basins and ensures a water table level high enough to raise the salts to

the surface, are key features of a typical saltscape. Such conditions can be found in certain areas such as Central Asia, western Americas, northwest of the Sahel or the Iberian Peninsula (Fig. 1).

Most saltscapes are found in isolated areas with harsh climatic and agronomic conditions that logically result in a very low population density. The Iberian Peninsula is an exception to this, as these conditions manifest themselves at very local level, so that they did not especially affect the livelihoods of local communities. Hence, many of these sites have been exploited as inland solar evaporation saltworks. This type of saltscape, inland salinas, can be considered a typical Iberian phenomenon –even though it exists in many other regions of the world, but certainly in lesser amounts, geographical concentrations and diversity of technical solutions– with remains of over 500 solar evaporation salt making sites away from the sea (Carrasco Vayá & Hueso Kortekaas 2008). Otherwise, the Iberian Peninsula hosts many other types of saltscapes, such as inland saline wetlands (rivers, lakes, marshes, meadows…), with ca 250 of them, plus another ca 200 (former) coastal salinas (Hueso Kortekaas & Carrasco Vayá 2009b)

Figure 1: Location and abundance of the inland salinas (straight triangles) and saline wetlands (inverted triangles) in the Iberian Peninsula. In the upper right corner, a map depicting the most important saltscape areas in the world

Saltscapes under threat

Most saltscapes, except perhaps some geological formations of rock salt located at the surface, can be considered wetlands, and as such, share the global threats and challenges that affect them (Hueso Kortekaas 2012). During the 20th century, more than half of the world's wetlands have disappeared (Casado and Montes 1991, 1995; Barbier 1993, Pearce and Crivelli 1994, Schuyt and Brander 2004) and a number of scientists

have been drawing attention to the threats that specifically affect saltscapes and saline wetlands, many of which continue to be destroyed or irreparably damaged (Williams 1986, 1993, 1998, 2002). Table 1 summarizes the main threats to saline wetlands classified by the type of alteration to the wetland, namely those that affect the physical structure, the availability of water, the quality of the water and the biological communities. These threats may vary in importance and severity from one site to the other, but normally a few of them coincide or may even show synergic effects.

Table 1: Possible causes of ecological change and wetland alteration. With asterisk, those changes that especially affect inland saline wetlands

Ecological change	Possible causes
Alteration of the physical structure	- *Drainage and filling for urbanisation, tourism or industrial uses, *Transformation into agriculture or aquaculture - *Building infrastructures (roads, airports, etc.) - *Waste dumping - Modification of morphology (dykes, excavations, channels, etc.) - Mining and other extractive activities - Occupation of the basin
Alteration of the amount of water	- *Reservoirs: hydraulic energy, irrigation, filling, sediment retention, evaporation of the water in the reservoir - *Modification of the hydrological network and riverbed regulation - *Water extraction and overexploitation of aquifers for irrigation, industry, human consumption - *Changes in ground use at watershed level: deforestation, erosion, filling - *Drainage and dessication - *Filling, cleaning and fragmentation - Transfer of water between basins
Alteration of the water quality	- *Nutrient, pesticide and herbicide runoff - *Salinization of surface and underground waters - *Changes in salinity and ionic composition - Dumping of wastewater - Industrial waste dumping - Waste from aquaculture and livestock breeding - Modification of the connection with the sea
Alteration of biological communities	- *Overhunting/Poaching - *Overgrazing - *Mechanic overexploitation of mineral resources - *Excessive recreacional pressure - *Introduction of exotic species - Destruction of riberine habitats - Overfishing and aquaculture

Source: Adapted from the Spanish Strategic Plan for the Conservation and Rational Use of Wetlands (Ministerio de Medio Ambiente 2000)

Besides from these specific activities affecting certain features of a wetland, there are threats that influence them as a whole and are found at a global scale. Climate change and especially global warming contribute to the alteration of ionic composition, eutrophication, hypersalinization or decreased availability of underground water or brine. These effects are stronger in inland saline wetlands of natural origin and may ultimately lead to their disappearance (Álvarez *et al.* 2005). With respect to constructed saltworks, the main threat is the abandonment of the salt making activity. The lack of profitability of the salt produced in smaller salinas during the 20th century, induced the cessation of their activity in most sites in Spain, leaving a few large industrial saltworks in operation.
In a salina, the brine is concentrated in successive ponds with increasing salinity, thereby creating a series of microhabitats with different concentrations of salinity and different trophic communities adapted to each salinity. When a salina ceases to operate, its water cycle stagnates and the richness of communities disappears. Also, the lack of seasonal water level control and of dyke and pond maintenance causes profound changes in the biota and in the ecosystem as a whole. Hence, the loss of salinas causes the disappearance of valuable halophilic communities, which are being replaced by generalist or opportunist species as soon as salinity decreases (Martins 2005, Carrasco and Hueso 2006, MultiAveiro 2007, Hueso and Carrasco 2008a, 2008b). Land use changes are another important threat. Often saline wetlands have been drained or desiccated in order to eliminate plagues or to transform them into pastures) or have been buried underneath infrastructures such as roads or dams (Comín and Alonso 1988, Casado and Montes 1991, Álvarez 2007, pers. obs.). The intensification of agricultural practices nearby these habitats has affected their communities by the runoff or deposition of fertilizers, pesticides, herbicides, etc. Free ranging livestock in saline pastures may also graze, trample and defecate on halophyte communities, destroying the plants, affecting soil composition and allowing the invasion of other species.

But perhaps the most damaging threat is the widespread ignorance of the values of saltscapes. Not useful for the provision of drinking water, the have often been left behind by policy makers, watershed authorities and even scientists (Williams 1981, 1986, 1998; Margalef 1983, 1994). This lack of interest from upper level stakeholders results in an indifference from the general public, some of which use the saline flatlands for recreation. Especially damaging, for instance, are the off-road vehicles that frequent them (pers. obs.). In addition, saltscapes often face complex regulations, both from a sectorial (nature conservation, agriculture, industry, tourism…) as from a geographical (national, regional, river catchment…) level, which may even contradict themselves, transforming the site's management into an administrative nightmare.

Ecosystem functions and services of saltscapes

Saltscapes, similarly to other wetlands with a strong cultural component, offer a broad range of ecosystem services and resources for socioeconomic development. These services and resources are intimately related to the functions of the saline (wetland) ecosystem, which are listed in Table 2.

Table 2: Functions of wetlands (with asterisc, the functions of saline wetlands)

Regulation
*Nutrient storage and recycling *Aquifer recharge and discharge *Flood and erosion control *Salinity control *Maintenance of habitats for roosting, feeding and nesting *Maintenance of the integrity of other ecosystems *Maintenance of genetic and biological diversity Sediment retention Waste storage and recycling Pollution clean-up Climate stabilization and carbon sequestration Maintenance of ecosystem stability
Support
*Tourism and leisure *Hunting and fishing *Habitat and nutrient source for flora and fauna Agriculture, pastures and irrigation Transportation (Hydraulic) energy production Human settlements Soil formation
Production
*Mineral resources (salt!) *Resources for medicine and biotechnology *Genetic resources Water Food (aquaculture) Biomass and fiber Raw materials for building and industry
Information
*Research and training *Monitoring *Intrinsic value (rarity, fragility) *Tangible cultural heritage (paleonthologic and archaeologic registries, buildings, artifacts, tools, historic devices, management systems of collective waters…) *Intangible cultural heritage (oral traditions) *Traditional know-how (to obtain resources) *Source of spiritual inspiration (religious symbols, beliefs, legends; e.g. great symbolic power of water and salt) * Source of artistic and literary inspiration

Source: Adapted from Millennium Ecosystem Assessment (2005), Schuyt & Brander 2004, Skinner & Zalewski 1995, Viñals 2002

A model of sustainable management of saltscapes

Salinas and natural saline wetlands can ensure their survival and, as a consequence, the conservation of their values, if these are used soundly. To this end, a sustainable model of saltscape management is proposed below.

The most obvious productive activity in a salina or even in a natural saltscape, is the harvest of salt. Of course, there are many different types of salt with different degrees of quality and end markets (fine or coarse salt for culinary uses, *fleur du sel* for "foodies", saltlicks for cattle, brine for pickles, etc.). In order to be as profitable as possible, there are two main business choices: to specialize in a certain type of salt and offer the best quality within this category (artisanal gourmet salt being an epitome of this option) or to have a large production with a broad range of sub-products. Artisanal salt production seems to be the most sustainable option from all three points of view: ecologic, because it respects the habitat and contributes to the conservation of the trophic communities present in the area; economic, because this type of salt is highly valued and can be sold with margins of profit; and social, because it creates employment and provides a livelihood for saltmakers. Although the second choice seems less risky on the short run, on the long run it seems less sustainable with respect to the landscape, its resources and, ultimately, to the business model. Having said this, there are many other products and sub-products compatible with the sustainable harvest of salt (Petanidou 1999, Petanidou *et al.* 2002, Forum des Marais Atlantiques 2004):

- Salt as a product for cosmetic, wellness and health-related products
- Halophyllic algae and their subproducts (i.e. beta - carotene) for the food industry
- Halophyllic microorganisms for bio-/nanotechnology and medicine and other emerging sectors and applications (production of polymers & enzymes, enhanced oil recovery, biodegradation of waste, biofuels or even the study of extraterrestrial life)
- Brine, muds and *eau mère* for cosmetic and therapeutic uses
- Brine shrimp as fish food
- Fish hatchery
- Salt handicrafts: Lamps, sculptures, maquettes, etc.
- Halophytes for food (e.g. *Salicornia*) or other uses (*Suaeda* sp.)
- Other minerals present in the brine that may be of use and worth extracting

On the other hand, saltscapes may cover other functions that may prove essential for their survival and even offer opportunities for local development. Aside from production, saltscapes may fulfill the functions of education and dissemination of their values; as well as research and innovation on (the use of) their resources. Raising awareness of the natural, cultural and human values of saltscapes to the public, via formal education, heritage interpretation or other means of knowledge transfer, will contribute to their conservation. Salt is a multidisciplinary study object; it can be linked to geography, geology, ecology, economy, history…. and as such has the power to engage the public with very different areas and degrees of interest. If the dissemination efforts are being made on site, including the use of facilities such a museums, interpretation centres, panels, guided tours, activities, etc., the revenues from visitors may contribute to the economic sustainability of the conservation and maintenance efforts of the site.

A number of other activities can be carried out on site without interfering with the salt making activity or the conservation of the site. Synergies with other heritage assets in the area, similar sites elsewhere or other businesses or institutions in the region may help develop activities that contribute to the sustainable use and development of saltscapes. Using the saltscape as a venue for respectful, creative activities may also give visibility to its values and engage a new type of public.

From the point of view of management, a key issue is to cooperate with the local community and to respect the identity of the site. The sustainable management of heritage is most efficient when designed and driven by local stakeholders, whether or not with assistance from outside. This approach will ensure that their identity and sense of belonging to the site is respected or even enhanced, so that they are encouraged to feel proud of their heritage and become its ambassadors. In addition, the motivation to find the necessary human, financial and technical resources is much higher when the ideas rise from the local stakeholders, rather than when they are being imposed by upper level officials. These may however be of good help to secure funds or to coordinate actions when there is a risk of confrontation between stakeholders' interests at the lower levels. Participation is also a key element in management. Local stakeholders are likely to respect and support those decisions in which they have been able to participate. There are many different styles of participation, from restricted meetings to open discussion groups, and it can have several degrees of commitment, from mere information sessions to a co-management model. The choice of participation model will of course depend on the local circumstances, but should not solely depend on the manager's time frame or ideological preferences.

On the other hand, heritage management needs assessment to evaluate its suitability and performance and eventually improve it. Even though sponsors will probably force managers to assess any recovery project, it is a good idea to use several (internal) assessment tools to use while on the road. Examples of such tools are SWOT analysis, project cycle management, logical framework or indicator sets. An example of these is the tool to assess the ecotouristic potential of Atlantic salinas, developed by IPAISAL (Carrasco & Hueso 2014).

Protection of saltscapes as a tool for development

The protection of saltscapes has been a quite recent phenomenon and is still far from representative, as will be argued bellow. The first batch of declarations of protected areas in the world, by the end of the 19th century, focused on romantic, scenic and wild mountainscapes. Decades later, attention was finally placed on wetlands, mainly thanks to the 1972 Ramsar Convention on Wetlands. Again, many lesser –especially inland– wetlands were missed by Ramsar, as one of the main requisites to belong to the Convention was to host bird species or communities of international importance. Many saline wetlands lack this feature, due to their small size or fluctuating character. Years later, the European Commission launched an ambitious programme to protect the most representative species and habitats of the EU by creating the Natura 2000 network. To this end, among other actions, a comprehensive catalogue of European habitats was prepared.

Some of the habitats were considered in danger of disappearing and enjoy a special priority status when it comes to their protection. The final list of habitats contains six that are typically found in saltscapes. Of the 2,056 Natura 2000 sites in Spain, almost one third (n=590) include saline habitats, but less than 3% (ca. 50) of the network sites can clearly be identified as saltscapes (see Table 3).

Table 3: Protection measures of Iberian saltscapes

Type of protection	Coastal salinas	Inland salinas	Other saltscapes	All saltscapes	% protected saltscapes
Total	182	517	278	977	N/A
SAC[1]	4	8	23	35	3,6
SPA[1]	3	7	12	22	2,3
Ramsar[2]	6	0	6	12	1,2
GCI[3]	11	6	0	17	1,7
Museum[4]	13	8	7	28	2,9

[1]Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) form the so-called Natura 2000 network, stemming from the Habitats and the Birds Directives, respectively.
[2]Ramsar sites
[3]Good of Cultural Interest (GCI), stemming from the Spanish Historical Heritage Law (1985)
[4]Museums and visitor facilities devoted partially or totally to salt in Spain (IPAISAL, unpublished data)

A completely different way to look at the protection of saltscapes is their conservation as cultural heritage. The Spanish legislation allows to designate historic buildings, sites or other tangible heritage as “Good of Cultural Interest” (GCI), which confers them with a protection status and enforces their owners or, subsidiarily, the local and regional authorities, to protect and maintain them. Most GCIs are churches, monasteries, castles and fortifications. Of the almost 16,000 declared GCIs, 17 are salt making sites (see Table 3). The declaration of a site as a GCI normally only affects the man-made structures (buildings, engines, infrastructures) and not its surrounding landscape or natural values. In fact, only two cases (Salinas de Añana, in the Basque Country, and Salinas de Saelices de la Sal, in Castile – La Mancha) show an overlap in cultural and natural protection (SAC and GCI).

More recently, the European Geoparks initiative protects geological heritage and aims at bringing sustainable territorial development to its geoparks, primarily through the development of geotourism. This protection status was inspired by UNESCO’s Global Geoparks Network programme. Of the 10 Spanish Geoparks declared up to date, three include saltscapes, although none of them as the main geological heritage asset within its borders. Two of them (Cabo de Gata and Alto Tajo) were already natural protected areas.

Up to now, all the protection measures affecting Spanish saltscapes have a sectorial character, specialising in one feature or another of their heritage (cultural, botanical, ornithological, geological…). As mentioned above, these measures may overlap, but still do not seem to cover all aspects of their heritage, having usually neglected the most essential one: man. Previously in this article the role of man in safekeeping the landscape,

mainly through the sustainable salt production, was discussed. Only two formal protection measures actually acknowledge the contribution of the active participation of human activities to the improvement of the landscape: UNESCO's World Heritage Programme and Man and Bioshpere Programme. In Spain, none of the sites belonging to any of these programmes includes protected saltscapes. The Salado Valley in Álava recently withdrew its candidateship to World Heritage due to a number of flaws found by reviewers in the files presented to UNESCO. At a more modest level, the Natura 2000 network also considers the role of man in the construction and maintenance of landscapes and is making efforts to support sustainable human activity within their sites by stimulating participation and engagement in the site's management. Alas, this approach is meeting some reluctancy from the local communities, which still perceive that the protection of their territories as a burden rather than as an opportunity.

To this end, recent legislative developments in the recognition of artisanal salt –as opposed to industrial salt– may give a headstart to actually protect and enhance sustainable development in saltscapes. The recent legislation in Europe (partially) distinguishes artisanal salts by certain physico-chemical features (*Real Decreto 1634/2011* in Spain; *Decreto-Lei n.º 350/2007* in Portugal or *Décret no 2007-588* in France), allowing salt makers to benchmark themselves. However, little is regulated on how artisanal, traditional or hand-harvested salt should actually be produced, except when described by labels based on voluntary agreements (Nature et Progrès 2005) or by professional entities (Necton 2006, Aprosel 2008). In Europe, six artisanal salt making areas have registered or are in the process of registering their salt under protected designation of origin (PDO), none of which is in Spain. Efforts are being started by the Andalusian Artisanal Salt Makers (ANDASAL) and the Association of Salt Producers of Majorca (AMASAL) to register theirs.

Also, some Spanish regional nature protection authorities (Andalucía, Castilla y León…) have created the brand "marca parque natural", to be applied to products and services offered or produced within protected areas, with the aim to enhance the development of local businesses within these areas. On the other hand, however, the legislation on how to label salt does not oblige to include the geographical origin or the method of production of salt, offering too little information to the public. Therefore, there is still a long way to go with respect to the regulation of the protection of geographic origin, production method and labelling of artisanal salts. This is a relevant issue, since formal recognition of artisanal salt not only allows salt makers to sell their salt as such, with higher profit margins and a contribution to a stronger socioeconomic development in saltscapes, but also helps consumers to decide if we want to buy artisanal salt and to be aware of the consequences of our choice. It remains thus to be seen how effectively protection measures in general and could contribute to a sustainable development of salt making landscapes.

Conclusions

The sustainable development of saltscapes need a complex, multidisciplinary approach and the cooperation of all stakeholders involved. A combined and coordinated effort to protect their natural, cultural and human assets, as well as a strategy to promote endogenous, self-driven development, is needed. Instruments such as overall heritage protection measures, strategic planning, participatory management and legal regulations to support sustainable economic activity, may be helpful as well.

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