Mapping of landscape attractiveness for the development of a monitoring indicator for Mediterranean wetlands: "Landscape perception indicator". Ichkeul protected area case study, Tunisia

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Introduction

Mediterranean wetlands are important components of the landscape, characterized by their specific biodiversity, water and atmosphere varying along seasonal factors. They also play vital functions for their habitats and surrounded ecosystems providing a highly diversified goods and services to humans. However, trends show that they are still threatened and destroyed because of human overexploitation and pollution, exacerbated by more recent global changes. Often considered as useless or unhealthy for a long time, a large part of these zones disappeared with the expansion of drainage, embankments, hydraulic installations and urbanization. For example, Tunisia has lost 28 % of its wetlands in the last 100 years (Mediterranean Wetlands Observatory (MWO), 2012).

To reverse this trend, we conducted an innovative study in 2013 and 2017 in an emblematic Tunisian protected wetland (Ichkeul), aiming at developing a new "social" argument, beside the "ecological" one, in favor of wetlands protection. Results from this new Social-landscape research angle aims at informing decision-makers about the various human and social benefits provided by wetlands to visitors (Chazee et al., 2017). Located in the sub-humid plain of Mateur, this wetland represents a very varied ecosystem in Tunisia. It occupies 12,600 ha, successively covering the Jebel (Mountain) of 1,363 ha, Ichkeul Lake of 8,500 ha, and swamps of 2,737 ha (El Ghezal, 1984).

Research Objectives

The aim of the study was to define visitor's perceptions of landscape attractiveness and to understand the cluster of factors that increase visitor's attraction to Ichkeul Lake. The methodology of the research was based on the ecosystem services framework of the Ramsar Convention, with focus to cultural (recreational and educational) services.

Methods

Data were collected through semi-structured interviews at Ichkeul National Park. These interviews were conducted in 2013 (100 interviews) and 2017 (70 interviews) among Ichkeul visitors at different places (trails, eco-museum, parking, Lake shore, mountain top), with a sample taking into account the diversity of visitor profiles, age and socio-professional categories. These interviews were conducted during weekends, school holidays, public holidays and working days to capture the highest diversity of visitor profiles. Interviews focused on perceptions of Ichkeul's landscape and the place occupied by the landscape in the attractiveness of the site. The interviews consisted of four main domains through the use of an index: (i) the most popular landscape element, (ii) the location where the landscape seems the most attractive, (iii) the most attractive colors and (iv) the period of the year when the wetland is the most attractive. The percentage of different indexes is calculated in relation to

the total of the visitors' responses, then GIS tools have been used to map the spatial localization of landscape perceptions related to Ichkeuls' wetland.

Results

Ichkeul wetland is characterized by its great diversity of landscapes (Figure 1). They are ranked in increasing order of land coverage: lake, marsh, cultivated, forest and urban landscapes. However, the comparison between the general survey results (2013) and the landscape perception mapping (2013 and 2017) shows that the combination of the Jebel (17% of total responses of visitors in 2013 and 19% in 2017) and the lake (20 % of total responses in 2013 and 2017) are the key landscape elements fostering visitors' satisfaction. The factors that influence the perceptions of this distinctive Ichkeul landscape are the geomorphological diversity and the mountain top view (66% of total response in 2013 and 70% in 2017) with a remarkable panoramic view of the lake. This Jebel-Lake relationship in landscape appreciation is also enhanced by the high altitude of the Jebel crest line providing impressive and wide angle of view. Green is the most appreciated color (56% in 2013 and 60% in 2017) followed by blue color (21% in 2013 and 23% in 2017). Spring (73% in 2013 and 69% in 2017) is by far the most attractive season to visit the site, especially early morning and at sunset (Figure2). We emphasize that social and individual perceptions did not realy change within the 5 years period, indicating the persisting value of both Lake and Jebel in Landscape appreciation among recreational visitors.

Landscapes make it possible, directly or indirectly, to appreciate nature and to enhance emotions created by a mix of esthetic, ecological, social and cultural dimensions. Detailed responses in qualitative surveys show that landscape and quietness play an important role in feelings of well-being, discovery, contemplation, spirituality and emotion. In Ichkeul, these levels of sensation originate from this Landscape integrity mainly structured by four elements: Lake, Jebel, flora and birds.

Implications

Clearly, aesthetical landscape and quietness are keys for a successful visit and social satisfaction of general public. Based on this study, Landscape approach could be further developed to measure and monitor social and human benefits provided by ecosystems to visitors. To sustain the attractiveness and value addition of Ichkeul for the well-being of visitors, decision-makers and site managers need to protect landscape integrity and in particular the four key elements indicated above. A landscape perception index and its mapping can help managers of protected areas, local authorities and sector planners to decide their land-use planning and client-oriented services where recreational visitors are targeted. In addition, the use of GIS tools helps to create a wetland database and the results of thematic maps produced (such as the landscape perception map) plays an important role to assess and monitor these areas for a better sustainability. As a perspective, it would be appropriate to set up a wetland platform where all informations are listed and where visitors can indicate their perceptions following their site visit. Their responses can become a monitoring indicator to better convince local and national decision-makers of the social benefit that nature provide when taking into account visitor's criteria of well being..

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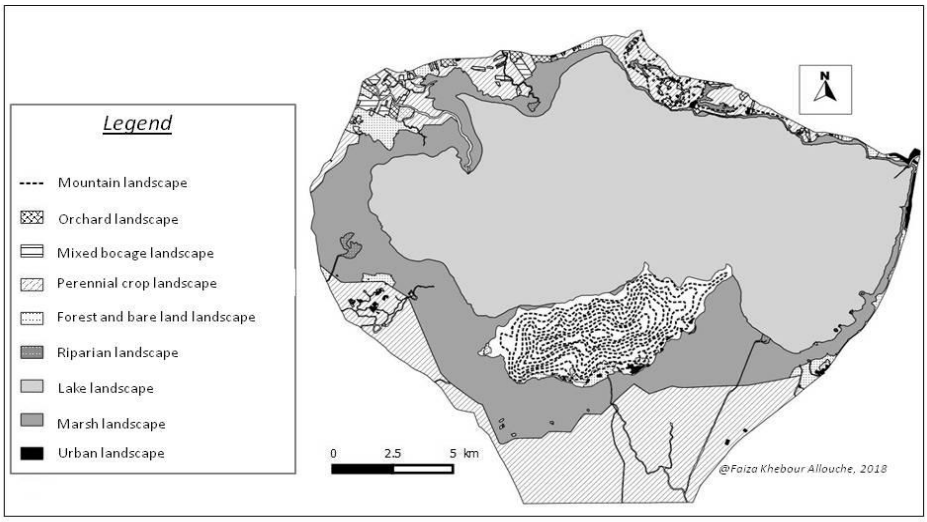

Figure 1. Landscape typology map of Ichkeul wetland, Tunisia

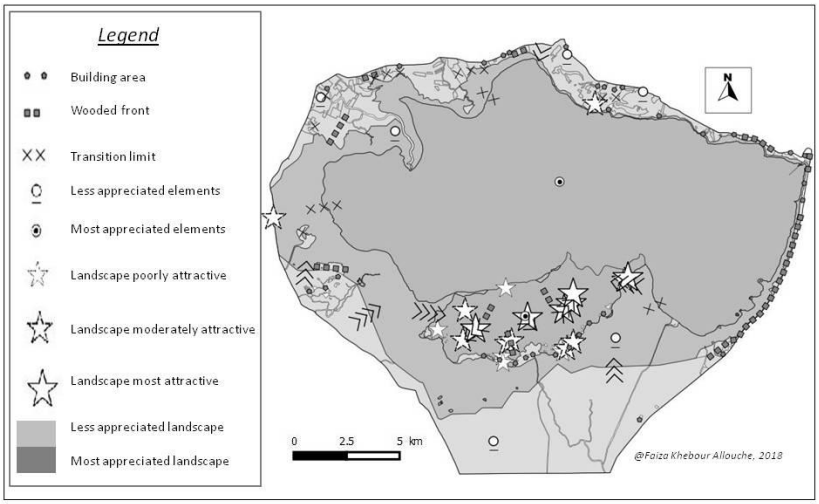

Figure 2. Landscape perception map of Ichkeul wetland, Tunisia