

A GIS APPROACH REGARDING TOURISM SUITABILITY OF WETLAND AREAS OF ROMANIA

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Abstract: *Tourism suitability refers to a certain touristic potential development regarding an area, considering the natural environment resources, the existing infrastructure and the number of tourists that visit the area for a certain amount of time. Tourism suitability also indicates how tourism resources can be exploited in a given area. To determine tourism suitability of the wetlands a set of spatial and statistical data with various sources were used. In the purpose of creating a set of maps that can reflect the level of tourism suitability, there were used spatial and statistical data for every locality that has a wetland nearby, data such as: localities and wetland placement, transportation network, bird, fish and amphibian species distribution, accommodation, inhabitants, tourists. The results of the analysis offered a series of indicators for tourism activities such as wetland suitability per locality.*

Keywords: *wetland tourism suitability, GIS mapping, tourism indicators, statistical data, spatial distribution*

1. Introduction

Wetlands are among the most important and productive ecosystems in the world. They are the main suppliers of fresh water for human use, and provide water, habitat and refuge to thousands of animal and plant species (Australian Department of Environment, 2016). Also wetlands can play an important role in developing a strong tourist source of income for the nearby local communities. Also, wetlands can provide a large diversity of recreational activities, such as boating, diving, snorkelling, sport fishing, swimming, photography, birdwatching, trekking and simply enjoying the landscape. Tourism activities surrounding wetlands can be key for the local community economy prosperity (Chandrasekhar, 2013).

Cultural services represent the benefits that humans can obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation and aesthetic experiences. Also the ecosystems provide non-material benefits, offering multiple opportunities for tourism development, recreation activities, aesthetic appreciation, inspiration and education. (M.A, 2005). Benefits that people receive through cultural services are closely related to their experiences during on-site visits and indirect experiences (e.g. through watched films about nature). The evaluation of cultural services requires an estimation of the number of people benefiting from them and the type of interaction between person and the ecosystem (Hein et al., 2006).

Cultural services is the link between three major elements, first is the natural landscape itself, secondly the local community found around the wetland and the third element is represented by the tourists that visit the area. These three elements are closely related to each other. As an example, a wetland can offer raw materials, such as reed, or fish, or other natural resources that can be found and used by the local community, directly or indirectly, though activities such as crafts, local specific products, eco-tourism, etc.

Wetland tourism suitability (WTS) represents the development potential of a certain area though a touristic point of view, taking into account aspects such as natural environment resources, existing infrastructure and the number of tourists willing to visit the area for a certain period of time. The WTS also indicates how tourism resources can be exploited in a given area. In most situations the wetlands surfaces are considered negligible by the local community and tourist alike (Davis, 1993).

In this paper are presented the data and methods (2) used to obtain the WTS indicators, the results (3) at nationwide level and conclusions (4) regarding the characteristics of this indicator.

2. Data and methods

At national level wetlands cover a surface under 2% of the total Romanian territory, and the data used to define the wetland areas was obtained through Copernicus Land Monitoring Service, using the wetlands thematic layer, at a resolution of 20m (Langanke et al., 2016).

Other data used for this indicator was obtained from multiple data sources, such as spatial data presented in relation to the Romanian administrative territorial units. Also statistical data was used in relation with spatial indicators in order to aggregate WTS indicator. The first type of data used is represented by the primary dataset used to build the secondary set of data. The primary data set is composed of 6 elements listed in the table below (Table 1).

Table 1. Primary data used to determine the tourism suitability indicator

No.	Spatial data	Statistical data
1	Wetlands location (EEA)	Population by localities (INSSE)
2	Boundaries of territorial administrative units in Romania (ANCPI)	Number of tourists per city – 2015 (INSSE)
3	Distribution of natural areas in Romania (Ministry of Environment)	Number of overnight stays per city – 2015 (INSSE)
4	Birds, fish and amphibians species distribution by cities (IUCN)	
5	Transport network (OSM, 2017)	
6	Accommodation establishments placement (hotels, guesthouses, motels, inns, etc. (Google Earth)	

Based on the above mentioned indicators, the secondary dataset was obtained as a result of spatial interactions with local touristic objectives, throughout each locality in Romania. The secondary dataset takes into account 2534 Romanian localities with wetland areas across their territories, resulting in a series of indicators referring to data regarding natural potential of the specific wetland area (wetland surface per locality, the total number of

species, type of protection), accessibility to the given wetland area (distance between the wetland and accommodation unit, the type of access) and tourism accommodation indicators (length of stay, tourists per 100 inhabitants) as it shows in the bellow table (Table 2).

Table 2. Secondary data resulting from the tourism suitability analysis

No.	Spatial data
1	Wetland surface areas at locality level
2	Total number of species of birds, fish and amphibians per localities
3	The type of protected area within the locality
4	Higher order access ways
5	Average positioning of accommodation units within 1 km of wetlands
6	Average length of tourist accommodation stay per locality
7	Number of tourists per 100 inhabitants

The methods used to obtain these indicators is present in the following pages. First step consisted in calculating the secondary dataset using primary data sources, for each territorial administrative unit. To aggregate this indicator, a qualitative assessment was made by including 6 classes regarding the quality of each indicator, defined though ranks. As an example, surface covered catalogued as wetland, was calculated as a percentage related to the total administrative surface of a specific locality, and then was divided into 6 classes (Figure 1). Further, the resulted indicators where averaged using ponderation to obtain the WTS indicator.

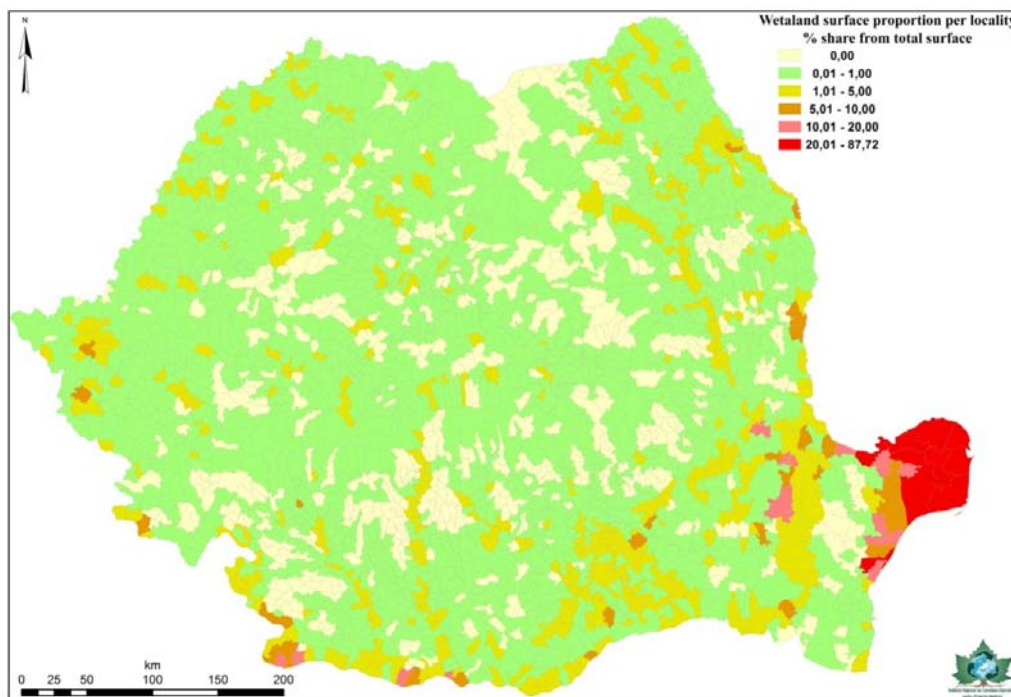


Fig. 1. Wetlands surfaces on the Romanian territorial administrative units

In the following paragraphs the other indicators used in the WTS aggregation are briefly presented.

The total number of species, provided by the IUCN data-base (fish, amphibians and birds) that are found in a specific wetland, is considered to be a key factor in determining a

wetland quality. The indicator regarding the total number of species is relevant in the current analysis because it indicates the food source potential (fish and amphibians) for avifauna in a wetland. Thus, a rich biodiversity area is characterized through a significant number of wildlife species (total number of species classified in table 3), being a key factor that is contributing to the tourists attractiveness concerning the area.

The next data set is referring to the type of protection within the administrative borders of localities (Figure 2). As an example, the localities with a Biosphere reservation or a RAMSAR site are considered to be more important in terms of tourism potential than those without a protection form within their territory, therefore the protected flora, fauna and landscape being a source of attraction for tourists. In the current paper, the database regarding the protected areas was obtained from The Ministry of Environment, which is a GIS database with the natural parks, national parks, RAMSAR sites, Biosphere Reserves, Natura 2000 sites and strictly protected areas, and in this study was classified according to their touristic importance (Table 3).

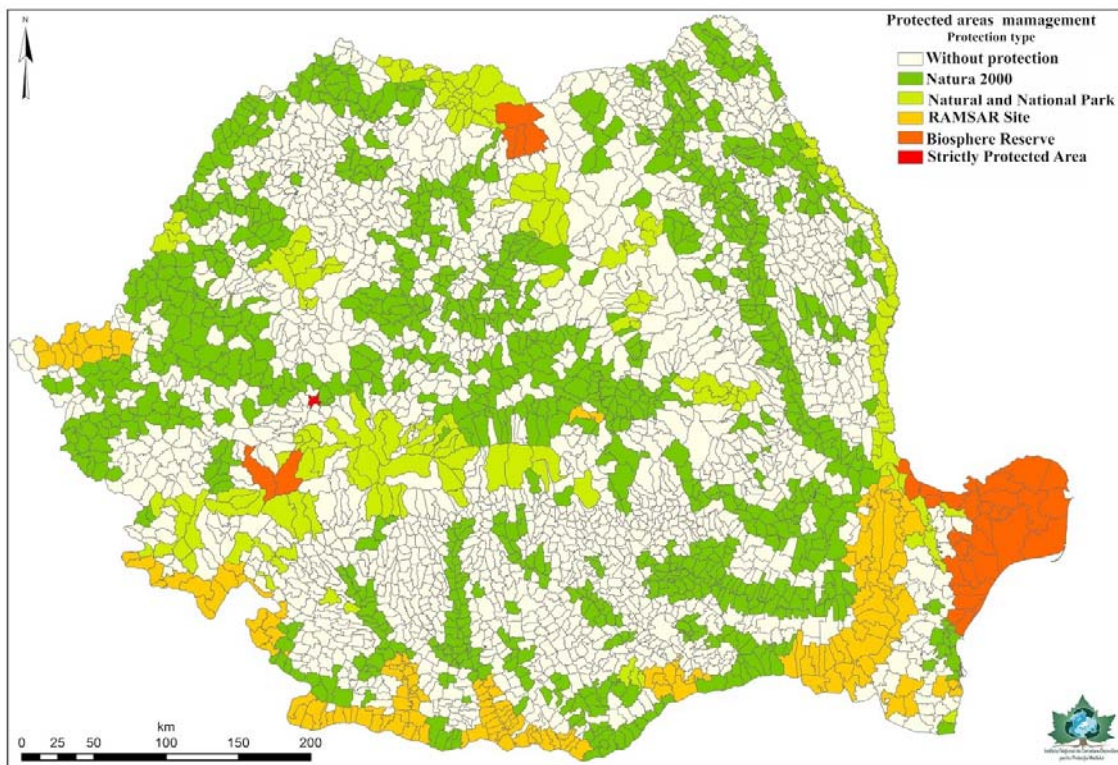


Fig. 2. Protected areas present on the territory of Romanian localities

The access type is another indicator used to establish the exploitation potential of a touristic site in general. In this paper, roads, railways and water navigation ways were taken into account as type of access, according to the information provided by the OpenStreetMap website, as described in table 3. The analysis did not include airline transport access.

Regarding accommodation units placed nearby wetlands, a database was built using Google Earth app, by searching the available accommodation units across the selected localities and creating a database using the extracted XML files with their geo-position. According to the created database there are a number of over 7000 accommodation units placed in a 1 km radius of all wetlands across Romania. Using this database the average distance between accommodation units and the closest wetland area was obtained, the classes of this dataset being presented in table 4.

The tourist activity along wetlands in Romania was measured throughout two indicators, namely the average length of stay for tourists in the territory of the localities and the number of tourists per 100 inhabitants for each locality (Table 4). Localities recording a higher number than 50 tourists per 100 inhabitants can be considered places where the tourism activity has a significant impact on the local economy, such as Călimănești, Mangalia, Sfântu Gheorghe (Tulcea), Techirghiol, etc, while the localities with a longer night's stay (more than 3 days – a weekend break) are considered important in terms of tourism activities. Each class of characteristics was assigned to a rank between 1 and 6, in inverse proportional order to the value specific to that class (Table 3-4).

Table 3. Ranks and classes of: Wetland share per locality; Total number of wetland specific fauna (fish, amphibians and birds); Instituted protection type within the locality territory; Type of access to the locality

RANK	Class Values	CHARACTERISTICS			
		Wetland share	Number of species	Protection Type	Access type
I	4.01 - 5	> 20%	> 100	Biosphere Reserve	Highway - Main Railway
II	3.01 - 4	10% - 20%	80 - 100	RAMSAR Site	European-National Road
III	2.01 - 3	5% - 10%	70 - 80	National-Natural Park	Secondary National Road
IV	1.01 - 2	1% - 5%	60 - 70	Natura 2000	County Road – Water way
V	0.01 - 1	1, % <	50 - 60	Strictly protected	County Road
VI	0	0,0%	50 <	Without protection	Commune Road

Table 4. Rank and characteristic class values for: distance between accommodation units and wetlands; Average length of accommodation stay for tourists per locality; Number of tourists per 100 inhabitants per locality

RANK	Class Values	CHARACTERISTICS		
		Distance between accommodation units and wetlands	Average length of sojourn for tourists per locality	Number of tourists per 100 inhabitants per locality
I	4.01 - 5	< 100 m	7 - 9,94 days	> 500%
II	3.01 - 4	101 - 200 m	5,01 - 7 days	100 - 500%
III	2.01 - 3	200 - 400 m	3,01 - 5 days	50,01 -100%
IV	1.01 - 2	400 - 700 m	2,01 - 3 days	5,01 - 50%
V	0.01 - 1	700 - 1000 m	0.01 - 2 days	0,01 -5%
VI	0	> 1000 m	0 days	0,0%

As a result of the secondary indicators reclassification into 6 ranks with values between 0 and 5, tables 3 and 4 were obtained. These ranks made possible the interoperability of terms, by bringing them at the same scale, different properties and measure units, such as the type of area protection and type of access.

3. Results

Based on all the indicators previously analysed, it resulted a series of ranks that classify the tourism suitability potential of every urban and rural locality that has in its borders a wetland area. The results of the study were divided in two categories, WTS index for urban

and rural areas from Romania. This separation was made due to the different role and usage of wetlands. In an urban area the wetland is considered leisure sites, and in many cases this type of places is benefiting of a more developed infrastructure in terms of access and hosting capabilities. In literature some different functions of wetlands were identified for urban areas, such as improving the quality of surface water by purifying the runoff water from cities, by eliminating the phosphates, nitrates, solid substances and heavy metals (Urban wetlands, 2005), therefore urban wetlands being used to maintain or improve surface water quality (Ehrenfeld, 2000), thus creating and maintaining a more pleasant space within urban landscapes, improving the well-being of city inhabitants. In rural areas of Romania the wetlands are in lesser degree used for touristic purposes due to lesser infrastructure development and a lesser promotion, despite that in the rural areas wetlands occupies a greater percentage of the total administrative area. Mostly, the wetlands are used as source of raw materials or food for the rural communities. Even so, in rural areas the wetlands have a greater potential in terms of touristic usage as it results from WTS index for rural environment.

The results for the first ten urban areas (Table 5) brought some interesting results, WTS index scores high values for some well-known touristic sites with wetland areas in their territories, such as Sulina, Tulcea cities located in (or near) Danube –Delta, Moldova Nouă, Orșova located on the Danube River bank, cities visited for their wetland attractions. Other cities with high values of WTS index are Constanța, Mangalia, Techirghiol placed on the Black Sea coast, and are visited for the sea side beaches. Călimănești city is a prestigious balneal resort, with curative waters, on the Olt River bank. The last four cities are visited for different reasons than their wetlands, but despite this fact, the wetlands is part of their landscape and is used indirectly. The most surprising result are for Mărășești (near Siret River) and Săcele (Near Olt River) cities, that are not known as touristic sites for wetland, but mostly for their historical features for the first city and as mountain resort for the last one. Therefore WTS index identified the potential of these two cities in developing tourism activities related to wetlands.

Table 5. Top 10 urban localities in the general rank of wetland tourism suitability

No.	Urban locality	County	Class value	Rank
1	Sulina	Tulcea	4.02	I
2	Mangalia	Constanța	3.79	II
3	Tulcea	Tulcea	3.66	II
4	Călimănești	Vâlcea	3.53	II
5	Moldova Nouă	Caraș-Severin	3.3	II
6	Mărășești	Vrancea	3.26	II
7	Constanța	Constanța	3.25	II
8	Orșova	Caraș-Severin	3.24	II
9	Techirghiol	Constanța	3.21	II
10	Săcele	Brașov	3.13	II

Overall, at a national level (Figure 3), the urban areas are classified below Rank I, except Sulina city (Rank I), which is the most suitable city for touristic activities related to wetland. The most common rank for the urban environment being . The first rank (Rank I) corresponds to high class values of all inputs mentioned in Tables 3-4. Another important aspect is that generally, most of the urban localities with a high values of the rank are placed on the banks of the Danube or the Black Sea coast, except Mărășești, Săcele and Călimănești cities.

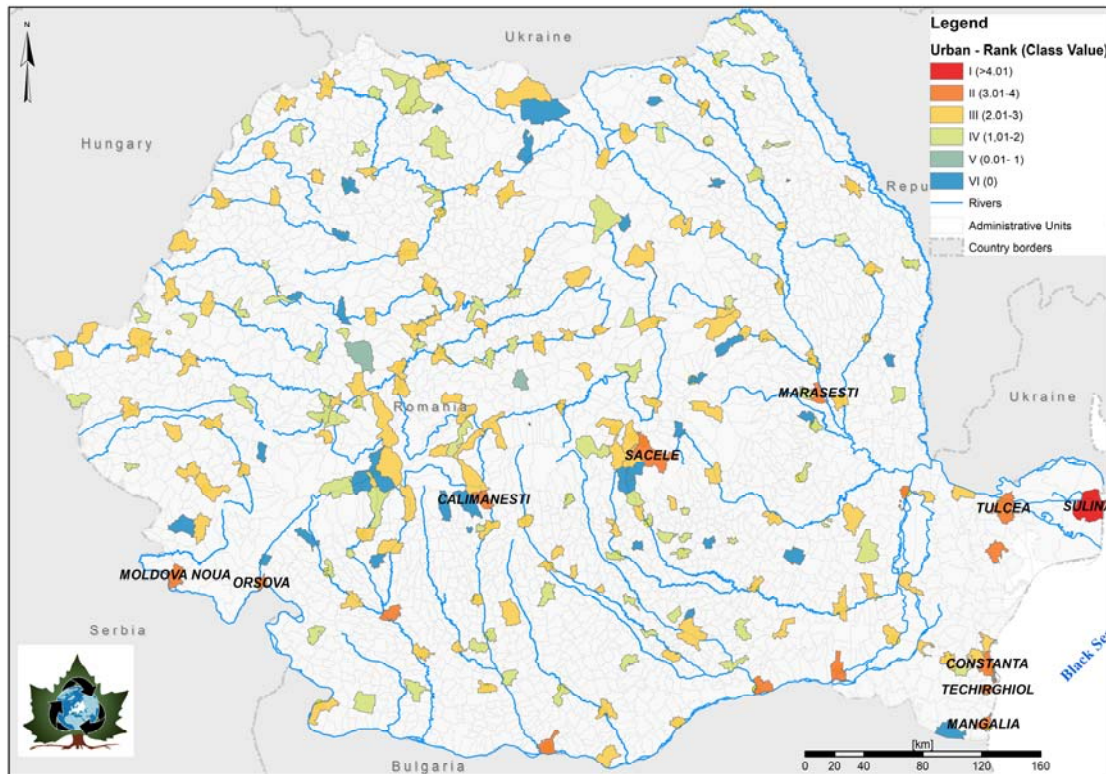


Fig. 3. Wetland suitability at urban level

Based on the general rank of tourism suitability potential in **rural areas**, it can be observed that in the top 10 positions (Table 6 are 6 rural localities placed in Tulcea County, especially in or nearby the Danube Delta (Figure 4). The village of Sfântu Gheorghe is the locality in Romania with the largest rank regarding wetland tourism suitability, with a percentage of 87.7% of the total administrative territory covered by wetlands. Generally the rural localities have a better rank, and potential than the urban areas mostly due to their natural landscape and to a greater .

Table 6. Top 10 rural localities in the general rank of wetland tourism suitability

No.	Rural locality	County	Class values	Rank
1	Sfântu Gheorghe	Tulcea	4.16	I
2	Maliuc	Tulcea	4.16	I
3	Crişan	Tulcea	4.04	I
4	Murighiol	Tulcea	3.92	II
5	Socol	Caraş-Severin	3.55	II
6	Pojejena	Caraş-Severin	3.55	II
7	Beştepe	Tulcea	3.51	II
8	Somova	Tulcea	3.51	II
9	Malu Mare	Dolj	3.5	II
10	Şigheviţa	Caraş-Severin	3.41	II

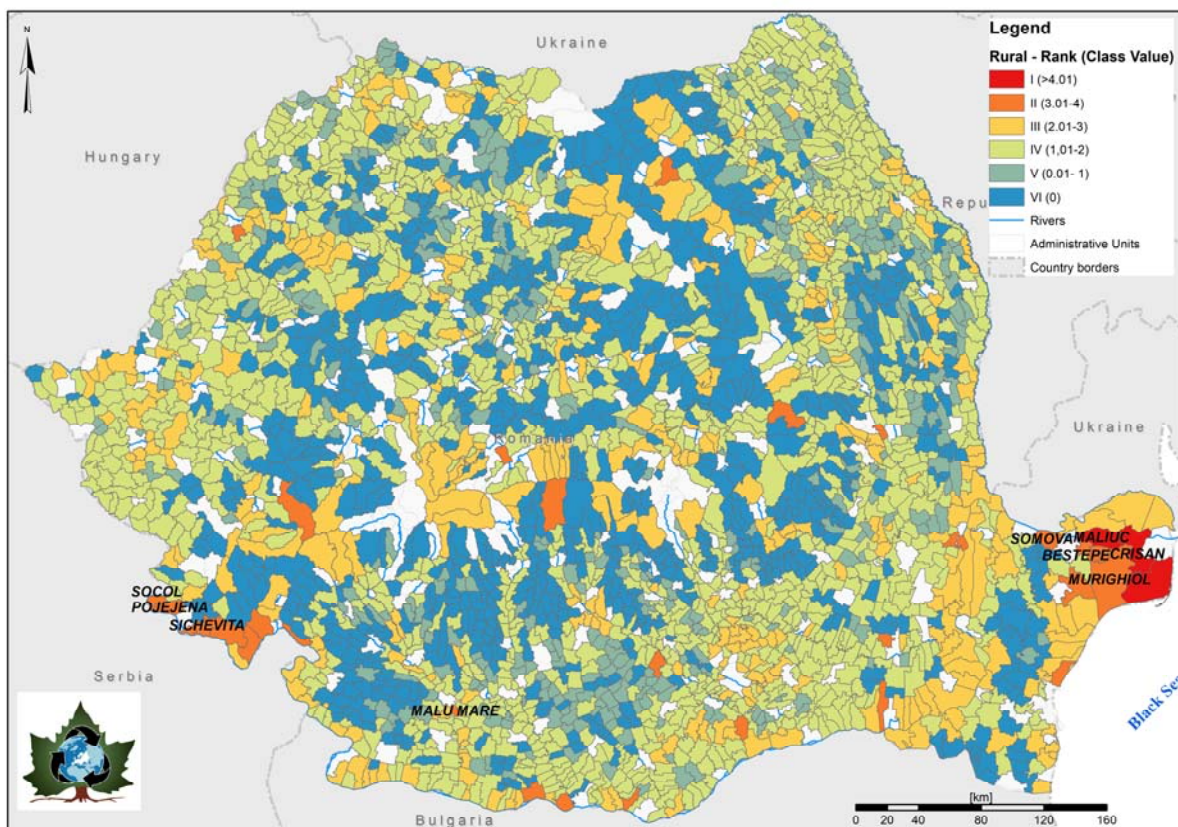


Fig. 4. Wetland suitability at rural level

Tourism suitability can be on a different level, when we refer to urban or rural areas, especially based on the level of infrastructure development, when referring to transport network, accommodation units. Thus a wetland attractive landscape can be more accessible to tourists if they have a way to get to that specific place, either through personal car, or public transport, and also if they have accommodation units to spend the night at and also establishments that serve food.

Accessibility is a key factor in today's world, when time is precious, and people want to move fast and safe to their destination, this meaning a well-maintained and efficient transport network, combined with a wide range of accommodation and dining options. All these amenities are more appealing to tourists and they tend to stay a longer period of time, this resulting in an larger income for the local community. The income could be used in maintaining and developing the existing infrastructure, and also improving and diversifying conditions that tourists would find when visiting.

It should be taken into account the fact that with the increasing number of tourists there is a greater risk of damaging the natural surroundings, so a sustainable approach is necessary to preserve the natural environment and maintain its balance with a minimal mark of human presence upon wild species in the protected areas. Informative panels explaining the rules of visiting these protected areas will help in still in those who want to visit the responsibilities they need to keep this natural objective in the best possible condition. Other facilities such as bird and animal observation points, informational centres, are other effective ways of contributing to a pleasant experience of tourists in the area.

A good factor for attracting tourists, especially in rural areas, is the preservation of local authenticity values, referring to the local architectural patterns of houses, the promotion of culinary specialties and local traditions.

4. Conclusions

Mapping wetlands and the elements linking these areas to tourist attractiveness is a way of drawing attention and observing their current dimensions and conditions, and can lead to a better understanding of the methods that need to be applied in order to make them become a source of income for the surrounding local community. This paper results can stand as a wetland tourism factor of attention, taking into account that this natural areas have diverse and varied plant and animal species.

WTS index could be consider either an indicator of tourism potential of wetlands either an indicator of utilisation as touristic site. For the places with no touristic activities in wetland areas it indicates the potential, while for the localities with intense touristic activities it indicates the suitability of tourism activities.

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