Management and Creation of a New Tourist Route in the National Park of the Sibillini Mountains using GIS Software, for Economic Development

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Abstract: This analysis is focused in a small portion of territory in central Italy where the National Park of Sibillini mountains is located. This Park strongly needs a tourist and economic development, so the possibility of creating a new tourist route has been considered. GIS software was used to create and manage the route, using orthophotos and digitizing the required data. The main goal of this study is represented by the creation of an evaluation system for the route, composed by numerous informations managed statistically through GIS software, assessing slope, type of route, road surface, hiking difficulties and passage through towns. This procedure allows a significant improvement in the local economy and a more rational use of available resources, including human ones.

1 INTRODUCTION

Tourism development is a crucial issue in some areas such as the National Park of the Sibillini Mountains. The National Park of the Sibillini mountains is not still able to attract the presences that there are in other national parks, especially in Northern Italy and this determines a willingness to implement the development of tourism always in a sustainable way. From the "Performance Plan" drawn up by the National Park of the Sibilline Mountains in March 2018, it is possible to observe the tourist situation in the area. Until 2015, the number of visitors to the area was around 300,000, after the earthquake they were reduced in 2016 to less than 250,000, worsening in subsequent years. Tourist numbers in parks and protected areas in Italy are about 100,000,000 (data from UNION CAMERE). This makes it easy to understand the need to attract visitors to the area of the national park of the Sibillini mountains. The aim of this study was to create a hiking trail that would touch the entire park of the Sibillini Mountains, passing through the most important villages. This path should complement and improve an existing path (GAS acronym of Grande Anello dei Sibillini) which, because of some technical errors, is not exploited for tourism purposes. In this New Tourist Route (NTR) the attention has been focused on the width of the routes, the possibility of maintenance and the assessment of the degree of difficulty with acclivity that should never be extreme. The innovation in this research is therefore substantiated in a detailed survey of routes, significant points and tourist strategies through the use of GIS software. The development of GIS software in recent years has allowed a significant increase in digital information, including for tourism purposes (Bunruamkaew and Murayama, 2012), even if the potential, especially at local level, is still unexploited. The use of GIS software makes it much easier to develop and manage tourism, even in areas with a low vocation for tourism (Lee et al., 2013; Wei, 2012). The identification of tourist routes is essential to ensure the development of areas of high naturalistic

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interest (Giaoutzi, 2017). The systemic approach to park management tends to be increasingly focused on the links between the physical environment and opportunities for visitors (Brown, Koth, Kreag, and Weber, 2006). The GIS application facilitates these connections (Brown and Weber, 2011). The use of GIS software allows the most rational creation of tourist paths that evaluate each route to attract the users (Gill and Bharath, 2013). GIS is usually used for tourism purposes to assess the cost of travel in terms of distance and time, however in this case even if considered (Bulai and Ursu, 2012) is not extremely relevant for this research. Some researches instead dealt with the environmental sensitivity to the use of routes in protected areas and this could be a further inspiration for future researches (Tomczyk, 2011), but undoubtedly subsequent to a possible tourist development. The research project in question cannot, of course, be treated in the same way as new transport routes (Papinski and Scott, 2011), precisely because of its different purpose, which make it innovative. It follows that this study is intended as a working method for the identification, definition and subsequent maintenance of tourist routes, without excessive expenditure of human and economic resources in the creation phase.

1.1 Area of Study

The National Park of the Sibillini Mountains was established in 1993 and has had since its creation the legal and administrative headquarters in the municipality of Visso. From the territorial point of view, the institution covers a very large area of about 70,000 hectares, divided into 2 regions (Marche and Umbria), 4 provinces (Ascoli Piceno, Macerata, Fermo and Perugia), as well as 18 municipalities in the Umbrian-Marche hinterland. In this area there is a vegetation and fauna of great importance, which see the proliferation of rare and protected species such as the edelweiss of the Apennines from the floristic point of view and the wolf or the Chirocephalus Marchesonii (a real rarity, endemic to Lake Pilate) from the faunistic one. Geographically, the Park of the Sibillini Mountains, has the shape of a hexagon, which contains within itself a great geographical variety, in a few kilometers you pass from a hilly landscape to a mountain one. In the middle of the Park territory there are the Sibillini Mountains, a chain about 30 km long with the most impressive peaks slightly shifted towards the East, among these you can find the Mount Vettore the highest of the Sibillini with its 2476m, Mount Priora 2332m, Mount Sibilla 2173m or even Mount Bove 2169m consisting of the suggestive rocky walls (dolomite) that recall typical landscapes of northern Italy (the Dolomites), as well as the Cima del Redentore 2449m and the Pizzo del Diavolo 2410m. As far as hydrography is concerned, the ridge that marks this territory is the one that cuts the Park almost halfway in the north-east to south-west direction, which represents a sort of division between the Tyrrhenian and Adriatic hydrographic basins. There are 4 rivers which flow into the Tyrrhenian sea (Nera, Ussita, Sordo and Campiano) and 8 rivers into the Adriatic one (Rio Sacro, Fiastrone, Ambro, Tenna, Aso, Fluvione, Chienti, Tronto). Among the lakes, it is also important to mention Lake Pilato, one of the few glacial lakes of the Alpine type in the Apennines, and the only lake of natural origin in the Marche Region.

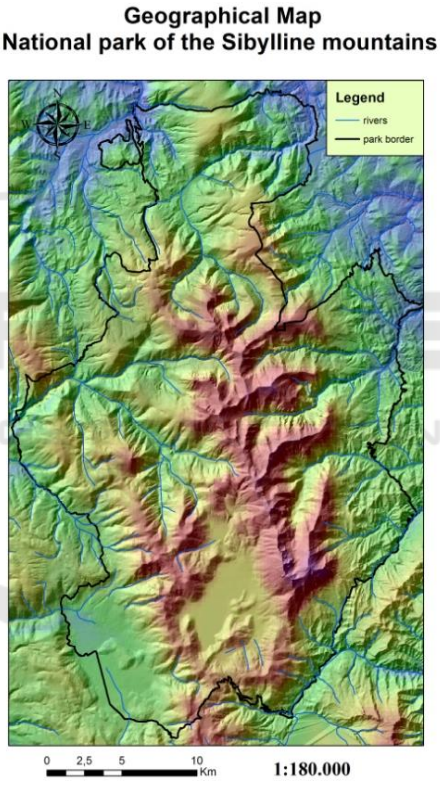

Figure 1: Geographical map of the National Park of Sibillini Mountains.

The geographical variability affects the climate (Gentilucci et al., 2018b); in fact, following the classification of Köppen-Geiger (1954), it is possible to isolate even 4 distinct bands (Fratianni and Acquaotta, 2017). The most distant and extreme part of the Park, is touched by Cfa-type climates in the parts up to 500m altitude, that is, with an average temperature of the hottest month higher than 22 ° C (Gentilucci et al., 2018a). Entering towards the

interior of the Park and going up in altitude, we pass to the classification Cfb, with the average temperature of the hottest month below 22 ° C. Approximately this situation is preserved up to 1100m, above which the climate becomes type Cfc and continues up to 1700m. Beyond 1700m, therefore on the highest peaks the climate becomes even more extreme, represented by the decrease in temperatures and the increase in precipitation, very often snowy, which classify the portion of land in question as belonging to type H. This is so identified because it is a climate of altitude that lies outside the latitude at which the area is investigated.

2 MATERIALS AND METHODS

In this study the Gis software used was ArcGis 10.2 and crucial was the interpretation of the 40cm spatial resolution orthophotos from AGEA (agency for agricultural supplies). In the National Park of Sibillini mountains there is a long path called GAS (Grande Anello dei Sibillini), it was carefully analyzed, then the needs of the operators in the tourism sector in the area (restaurateurs, hotels, traders in general) were evaluated. Every single point has been identified on the orthophoto and georeferenced through the creation of new feature classes. Subsequently, the line feature classes were created to map every single walkway in the park, assessing the width of them through the use of orthophotos. The road surface has always been assessed through orthophotos, while the regularity of the road surface was evaluated by on-site surveys and measured experimentally as a function of travel times (Balstrøm, 2002). The park's protection zones were analysed on the basis of the park plan and all the feature classes were mapped, evaluating the buildings, attractions and refreshment points. Then a polyline of the path has been created extracting from the digital elevation model (5 meters of resolution), obtained with the remote sensing, the height of each single vertex of the line. This line has been converted into points with coordinates by GIS software. Finally an additional polyline was created with each individual section of road differentiated through the analysis of ortophotos by type of road surface, practicability of the path and difficulty of the path. The selected route was then validated through a survey performed with GPS CS10 Leica by the software Leica Zeno Office and inserted in the GIS through open source softwares as Ozi Explorer and Ok Map.

3 RESULTS

The research project was developed experimentally, taking into account 3 main objectives in the identification of the route: the passing through the villages of the park of the Sibillini mountains to encourage tourism promotion of the area; the exploitation of existing paths to improve maintenance; the adaptation of the difficulties of the route to a wider public and not only for experienced users, mapping the most difficult tracks, suitable for a more trained user. The territory has been carefully mapped with particular care in the identification of points of interest, such as picnic area, parking, resting place, fountains, etc.. The choice of the optimal route was dictated primarily by the map of the park's protection zones, carefully avoiding zone A, characterized by integral reserve areas, in which the purposes of each intervention are exclusively on conservation and protection of environment.

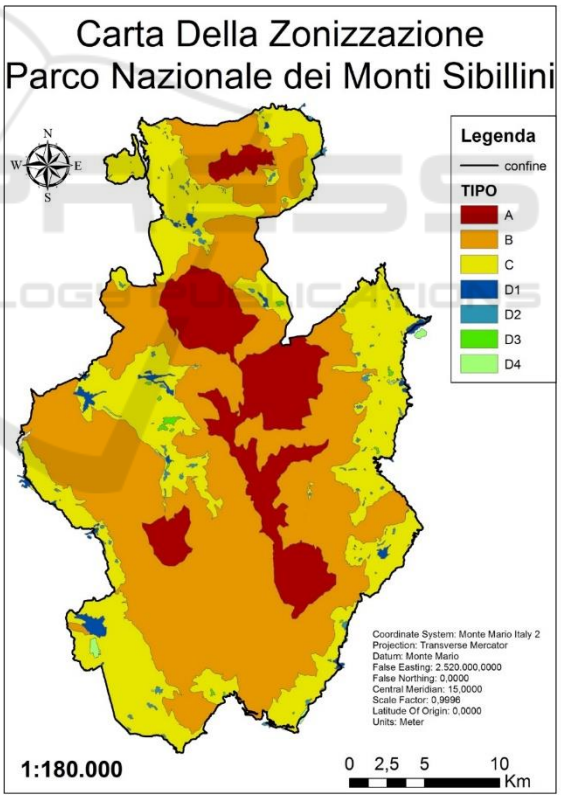

Figure 2: Map of the park plan for the differentiation of environmental protection areas.

Secondly, the refreshment and water points must not be more than 5 km apart and the route was privileged to pass through the most important towns, villages and points of interest. The increase in services such

as viewpoints, cultural heritage, water points, flower stations, car parks, monumental trees and rest stops of NTR (New Tourist Route) compared to GAS is about 40% (from 173 to 242 Point of Interest (poi)) for a section of equal distance. The increase in POIs makes the route easier, which may have to attract a greater number of visitors not only to cover the entire route but also to cover small sections of it.

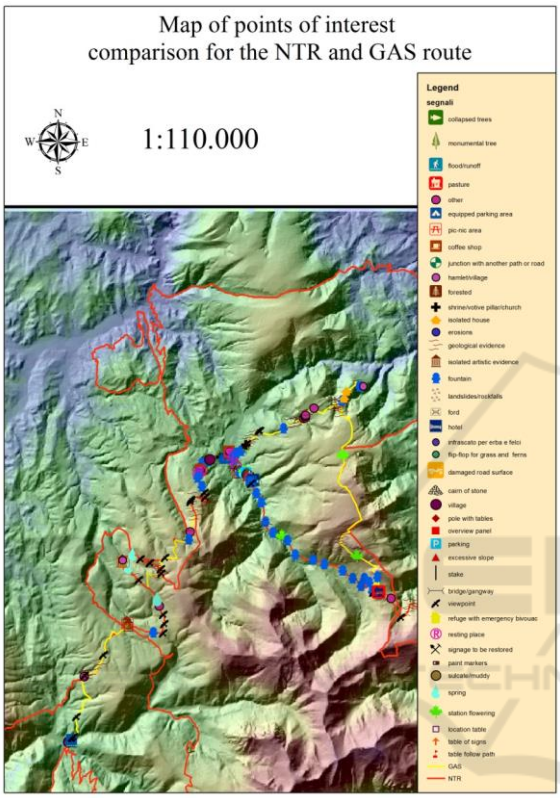

Figure 3: example of a POI (Point of Interest) map.

Subsequently, the walkability of the route with on-site reconnaissance was evaluated in order to assess the state of the road surface (eliminating impracticable paths: dangerous, deeply eroded or particularly impeded), while through the orthophotos and altimetric profiles, the paths were differentiated on the basis of 3 main features:

1. type of route:
a. vehicular road (easily accessible by cars)
b. mule track (dirt, soil or rock road surface, with a minimum width of 1.2 meters)
c. path (with a width of less than 1.2 m)
d. trail (grassy path marked by herds)
e. cycle path
f. forest roads (roads for pastural use)
2. type of road surface:
a. dirt
b. asphalt
c. paved stone
3. hiking difficulties:
a. T - touristy (comfortable paths and no orientation problems)
b. E - excursion (steep slope and orientation problems)
c. EE - medium-difficulty excursion (slippery and impervious routes at high altitudes)
d. HEE - high-difficulty excursion (the use of climbing insurance devices is necessary)

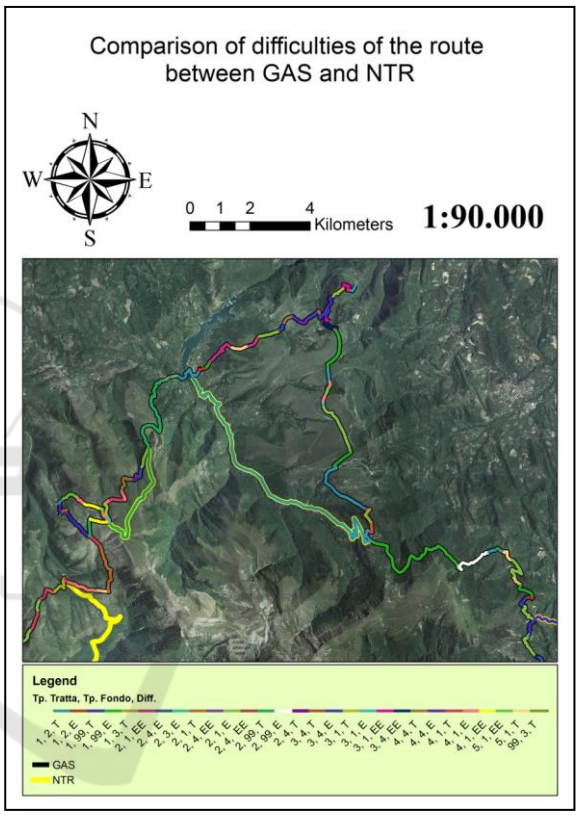

Figure 4: Map of hiking difficulties.

Finally the two routes (GAS and NTR) were compared, from a graphic point of view considering villages and for the hiking difficulties. The new tourist route has proved to be easier, more complete and without a doubt with more services. In particular the path with a medium difficult excursion “EE” were replaced in touristy “T” as far as possible. in addition, a greater number of stages, from 9 to 12 was created, given the longer length of the NTR (60 Km more). Detailed height profiles have been drawn up, one for each of the 12 routes. The twelve routes have been chosen for territorial proximity and to allow the user to complete even small parts of the new touristic route, in fact each route connects two major towns of

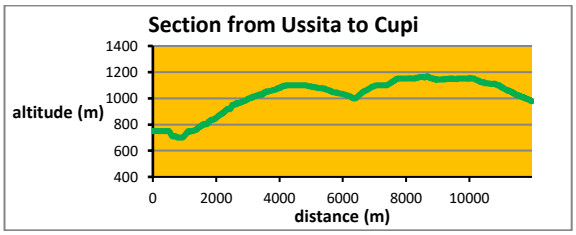

Figure 5: Third section of the route New Touristic Route.

the National Park, not from the point of view of population but as historical or naturalistic beauties. The individual routes were also selected on the basis of an appropriate distance to be covered during the day by walking and no one of them exceeds 24 Km (with an average of 4 Km/h no more than 6 hours of walking time). In addition, the passage through further villages allows the early abandonment of the route, as well as ensuring greater safety and accessibility to rescue vehicles. Having more frequent inhabited centres also determines a considerable facilitation in the maintenance of the route which, however, has been chosen following the already existing historical routes. In order to be able to pass through the numerous villages of the national park of the Sibillini mountains, the NTR has been extended compared to the GAS, in fact it measures a length of 188 km compared to 125 km of the previous route.

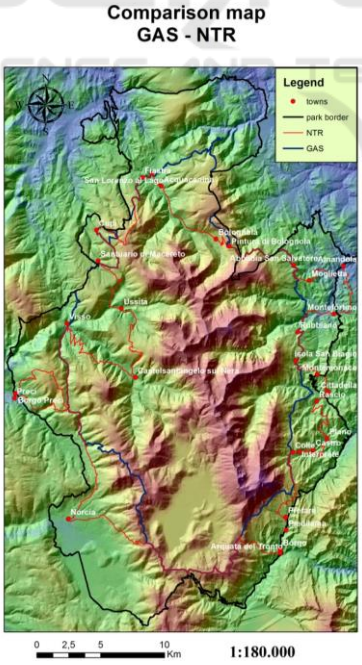

Figure 6: Comparison between GAS (the existing route) and NTR.

The 26% increase in the number of sections with tourist difficulties leads to a decrease in the hiking difficulty, this change makes it a route that can also be used by families. The most difficult parts of the GAS could in the future become the site of a deviation of the NTR, properly signposted and suitable for more experienced users.

From the image (Figure 6) it is possible to observe a considerable increase in the passage through the main population centres of the Park. In fact, the New Tourist Route passes through 29 towns compared to 13 ones of the previous route GAS, with an increase of about 120%.

4 CONCLUSIONS

The National Park of the Sibillini Mountains took to obtain real benefits from its tourist routes should take care much more of the signage. In fact following the paths of the Park, there are only the paint markings, however the signs that indicate the place are very rare. Moreover, for tourists it would be equally attractive, and useful for orientation, the indication in which mountain you are on, which river you cross, with discursive parts such as to provide information on the natural and historical characteristics of the territory (also through QR codes read by smartphones). Another novelty not to be underestimated would be the merchandising activity, through the houses of the Park that could invest in useful equipment for hikers, or through incentives from the public administration for the development of a more articulated commercial system, exploiting the shops already present in the proximities. Moreover, it would be important to take more care of the computer part, so as to make available any type of information, interesting for tourism and hiking purposes (significant points, historical and cultural information), in an immediate way to query via smartphone or GPS. Finally, the main results achieved by the New Tourist Route in this analysis are the following:

1. On the basis of the zoning, the NTR is a route more careful than the Grande Anello dei Sibillini, to the areas that need more environmental protection.
2. Greater historical and cultural promotion of the territory of the National Park of the Sibillini Mountains, through the visit to all the most important villages and towns within the park, despite all this should be assisted by a special signage, within each individual urban center. This is reflected in a more widespread positive economic impact of the flow of tourism on local urban communities.

3. Decrease in difficulty, so that you do not face many km of hiking type for experienced users. This aspect allows for greater social inclusion in access to the park.
4. Increased easiness of maintenance of the route through the use of existing roads and paths. In fact, the use of existing roads and paths allows therefore a saving in the costs of management and maintenance of the routes.
5. Detailed mapping of elevation, in order to allow the user an informed choice.

So far as our analysis is concerned the NTR as compared to the Grande Anello dei Sibillini is not only economically feasible but also have potential to generate direct and indirect employment opportunities for the local people. The New Tourist Route is more secure and risk free that need to be promoted to attract more and more number of domestic and international tourists. Therefore, from a tourism policy point of view, the New Tourist Route must be promoted to enhance the socio-economic development of the locality.

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