Application of geographic information systems to the tourism enhancement of natural and cultural heritage. The study case of a scenic road in Canal de Navarrés (València, Spain)

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Abstract

A methodological proposal is developed for the creation of a tourism product, with the aim of enhancing the tourist development of the study area, using the capabilities of Geographic Information Systems and public geospatial information to carry out the operations for decision-making. To achieve this, a scenic road is designed using a regional road as its main axis, which passes through different areas included in the Natura 2000 network and alongside places included in the UNESCO World Cultural Heritage List. The final result provides a comprehensive understanding of the territory, identifying those resources that may have greater tourism value and suitability to be part of the proposed scenic road and identifying the weak points that could represent a drawback for the management of tourism in this place, obtaining at last, a comfortable and satisfying experience for visitors to this place.

Keywords: Scenic Road, Landscape Enhancement, Natura 2000 Network, UNESCO Site, Geographic Information Systems, Canal de Navarrés (Spain).

1. Introduction

This study focuses on the design of a scenic road in the Canal de Navarrés based on the interactions between a road and the landscape as a tourism product. Landscape is a complex concept that the Valencian law conceives as: "Landscape is any part of the territory, as perceived by people, whose character is the result of the interaction of natural and/or human factors" (Ley 5/2014, de 25 de julio de la Generalitat, de Ordenación del Territorio, Urbanismo y Paisaje, de la Comunitat Valenciana, 2014).

To reach the aim of the study, it approaches the landscape through one of the broad range of points of view that this conception allows: the public use enhancement point of view. Thus, this study focuses on the scenic attraction of a road, but goes beyond, and it also analyses and evaluates the different cultural and natural assets, as well as the public use facilities and tourism services, in order to obtain as a result a quality tourism proposal, feasible and sustainable in terms of tourism aptitude and level of attraction.

To do so, the study proposes and applies a methodological process designed ad hoc, based on the use of GIS to combine and adapt different published methodologies for each step of the process: first, an official methodology to create scenic byways; second, the landscape analysis tools and the geographic software applications; and third, the evaluation of the resources and services aptitude in terms of tourism enhancement, as well as the scenic value of the landscape. The methodological process designed implies the pass from the "road" concept, as a mere physical nexus, to a "route" concept, used in tourism to define the intellectual nexus that heritage interpretation (natural, cultural and landscape) provides to a sequence of organised concepts and ideas capable of enhancing the destination heritage. Despite this study focusing on turning "road" into "route", we will use the term "Scenic Road" in order to clarify that the core is a motorway road, and therefore, it focuses on cars.

The idea of this methodological process is not only to identify elements capable of welcoming visitors but also to propose a physically feasible visiting activity conceptually capable of enhancing the heritage of the area, and to dinamise the tourism activity, based on the concept of landscape.

This study case is developed in "La Canal de Navarrés", a territory whose managing authority has among its objectives the tourism enhancement, and it is specifically mentioned in the principles of this administrative organisation (Mancomunidad de Navarrés, 2020), and it is also mentioned in its Tourism Development Plan (Hermosilla, et al., 2018)

Thus, as part of this tourism strategic plan, this study uses the Study case of a Scenic road in La Canal de Navarrés to test the GIS methodology due to its landscape values and using the only road connecting the different towns and heritage elements as the axis of the proposal.

The study case consists of the analysis and proposal of a thematic route, combining facilities, attractions, services and other resources already existent in the territory. The scenic proposal includes three main steps:

- The assessment and evaluation of the natural and cultural assets, among others, the Natura 2000 Network and the Archaeological site - Rock Art included in the UNESCO list of Cultural Heritage, to determine their tourism aptitude as visitor attraction elements as well as their aptitude to support tourism activity, such as the state of conservation, fragility or the accessibility.
- The inventory and evaluation of the tourism services and facilities, also from the tourism aptitude point of view, as they support the visiting activity.
- The analysis of the obtained results and assembling of physical and intellectual components, which implies a decision-making procedure.

Finally, it is proposed a scenic route with the regional road acting as the main axis, with recommendations that must be implemented before launching the offer as a tourism product.

2. Aim and objectives

The aim of this study is to design, evaluate and propose a methodology based on GIS for the decision-making process and design of a Scenic road in order to increase awareness of the natural and cultural values of this area. Beyond this, the core methodology aims to use public geospatial information provided by official public administrations and regularly updated, and the capacity of the open-source Geographic Information Systems.

To achieve this aim, it is necessary to accomplish specific objectives:

- To identify and choose the suiteable information sources and the open-source GIS software.
- To proceed with landscape analysis, identifying visual basins and potential panoramic observation points.
- To inventory and evaluate the heritage assets as tourism attractions and decide consequently those feasible to be included in the route, both natural and cultural, considering their aptitude to support public use.
- To assess the potential of existing tourism services in relation to their inclusion in the route.
- Identification and design of new facilities and improvements to the existing ones when necessary.
- Proposal of the Scenic road, with the resources and services to be included and the heritage-protected sites to be included due to their recreational value and aptitude.
- Proposal of the design and georeference of directional and information signage system.

3. Methodology

It is essential the design of a methodological process capable to turn a group of resources (landscape, cultural, natural and scenic assets, as well as tourism facilities) into a consistent scenic road proposal. The elaboration of the methodological process starts with the formal steps required to establish a scenic road under the US concept, published by the Forest Service as the Scenic Byways HandBook (USDA Forest Service San Dimas Technology and Development Center, 2002)(Figure 1). Beyond, this methodology works in parallel with landscape analysis techniques and tourism enhancement tools, adding value to the area and soundness to the proposal.
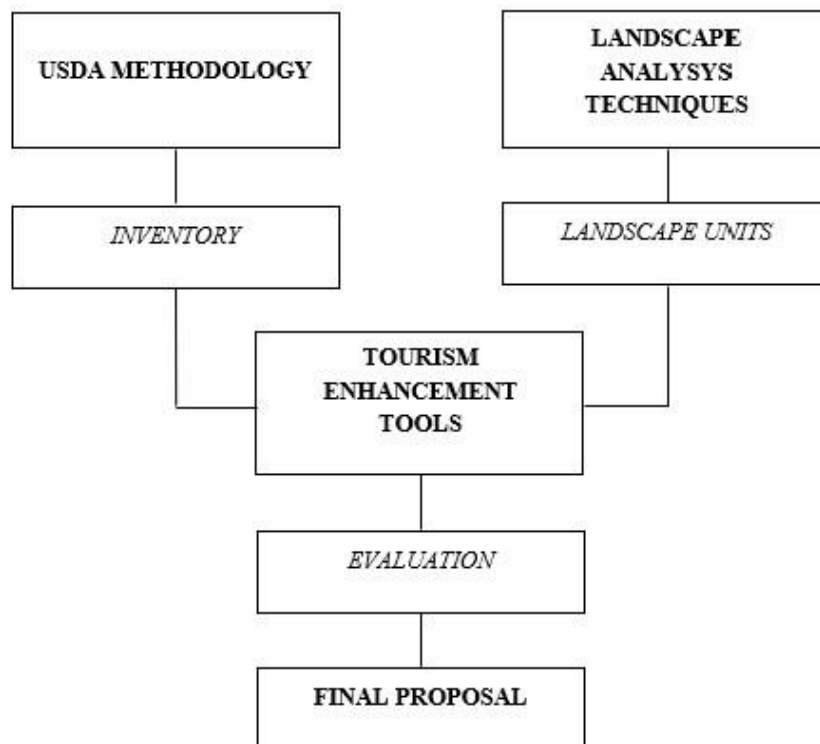

Figure 1. Outline of the proposed methodology. Source: Benito, R.M (2020)

An important part of this methodology has focused on the use of GIS tools, transferring the methodologies reference to GIS tools, basically to carry out spatial operations for the visualisation of the inventory of resources and services available in the study area (natural, cultural, etc.). On the other hand, other GIS spatial analysis tools were used to study and group different landscape units and to analyse the elevation profile of the road CV-580, very relevant to the study, as it shows the possibility of offering different alternatives to visitors to tour the area in more sustainable ways, using for example the bicycle.

The spatial data used to develop the analysis and processing information was obtained mainly from different public sources of geospatial information, official public sites, both regional (Institut Cartogràfic Valencià, 2020) and national (Instituto Geográfico Nacional, 2020). Other resources needed in the methodology were not available as georeferenced data, so it was carried out different georeferencing procedures beforehand in order to obtain this information as spatial data on GIS.

Therefore, the methodological process and tools used were as follows (Figure 1):

1. The study of the area and their characteristics from a physical **geography** point of view (geomorphology, hydrology, and vegetation), and the human geography. For this it was developed a cartographic and bibliographic review.
2. Resources and attractions **inventory**: natural, cultural, scenic and recreational facilities inventoried as the USDA methodology establishes (USDA Forest Service San Dimas Technology and Development Center, 2002). Beyond, it was combined with the methodology for the inventory of the tourism services providers, adding restaurants, guiding and information services and accommodation services, as they turn the tourism activity into local economic and social dynamisation (Viñals, et al., 2017).
3. **Visual** Analysis/Landscape Units: Landscape analysis techniques are necessary to obtain those areas visibiles from the road, combined with the typology of landscape and elements of interests, to define the landscape units. The tools used to develop the visual analysis were cartographic research and available GIS tools, mainly ArcGIS software.
4. **Tourism aptitude** evaluation of the attractions, facilities and services: the methodology used for the evaluation of the elements inventoried in this study is the one proposed by Viñals et al. (2017). And for the tourism evaluation of the scenic resources, it was applied the methodology proposed by Zuccarini & Geraldi (2019).
5. **Results and proposal** of the scenic road. The final process was to define the scenic road capable of connecting the space not only physically but also intellectually, with a distinctive and evident link between the nature, the culture and the landscape, capable to transmit the connection existing between these elements in the specific context of the Canal de Navarrés, and also feasible in terms of tourism activity.

3.1. Study Area. Resources and Attraction Inventory

The Mancomunidad de Navarrés is a group of municipalities (Bicorp, Bolbaite, Chella, Anna, Quesa, Estubeny and Navarrés) in the province of Valencia, a region located in the middle of the Valencian Community (Figure 2).
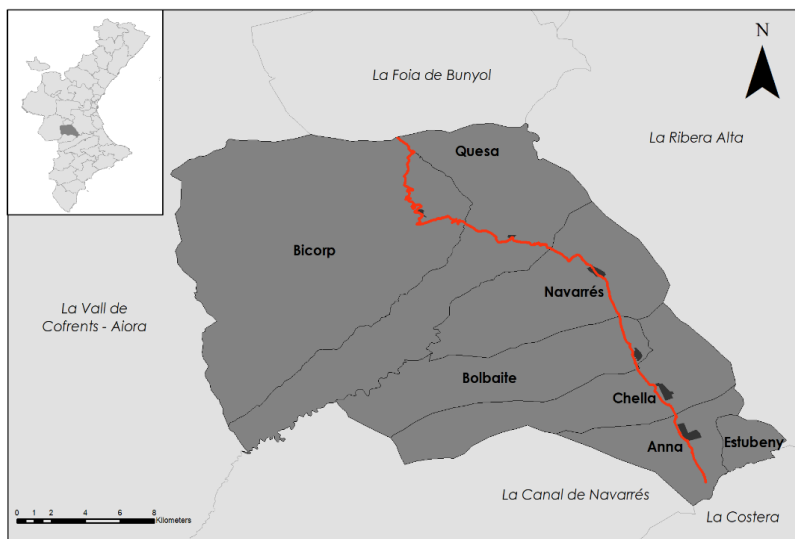
Figure 2. Map of the Study Area. Source: Benito, R.M. (2020)

Mancomunidad's aim is to share the management of certain public services such as waste or tourism. Those listed municipalities are part of the county of La Canal de Navarrés, except Estubeny which is part of the county of La Costera (fig.2). The municipality with the largest area is Bicorp (136.50 km²), followed by Quesa (73.20 km²), Navarrés (47.00 km²), Chella (43.00 km²), Bolbaite (40.40 km²) and Anna (21.40 km²) (INE, 2019). In total, the study area is 368,4 km².

3.1.1. Physical Geography

Physical geography is a relevant element in order to understand the configuration of the landscape in scenic studies. In this section, it is necessary to study tree elements: geomorphology, hydrology and vegetation.

Geomorphologically, this area represents a tabular relief, which is formed by the erosion of geological materials and the influence of the hydrological system. This area is a flat-bottom valley, approximately 1 to 2km wide, decreasing the height and smoothening the relief from west to east, heading the coast. In the western part, there are the highest points, with the calcarean formation of Macizo del Caroche in the North-West direction and La Muela de Cortes in the South-West direction, in which is the highest peak; from the western part the relief descends eastwards, until the conformation of the Júcar River and the mountains of Sumacàrcer (Viñals, M., Morant, M., Alonso-Monasterio, P., & Teruel, L., 2015).

The hydrology of this area becomes very important due to the abundance of water-related forms, such as rivers, ravines, natural sources, etc. It is included in the Júcar river basin, and in this part, it forms a semi-endorheic basin, and consequently, the water tends to accumulate in the lowest levels of this area. The hydrological forms generate a double positive impact; on one hand, they confer the identity to the territory as a shaping element of the landscape units, and on the other hand, they increase the intrinsic value, contributing to social use as a recreative element.

3.1.2. Human Geography

This area has a population of 10,711, who inhabit a total of 368,4 km2, and an average density of inhabitants is around 43 inhabitants/km2 being Bolbaite and Quesa are included in the demographic challenge programmes.

This data is relevant to the European standards that define the "rurality" degree of the territories being 43 inhabitants/km2 is a high level of rurality according to the definition established by the Organization for Economic Cooperation and Development (OECD) (Ministerio de Medio Ambiente, Medio Rural y Marino, 2009). This classification is useful in order to apply for certain European funds to develop initiatives, for example, Leader instrument, under de CAP (Common Agriculture Policy), that includes tourism dynamisation actions, even EU Recovery and Resilience Facility.

The level of rurality of the territory, when focusing on tourism planning, is relevant due to the need of certain services linked to visitors, such as hospitality ones or tourist info, so the evaluation of the working-age population is considered a main factor to be included in the development of a tourist area since it is an estimation of the capacity to develop local or regional projects related to promote services. Fortunately, in the case of the study area, there are some service companies.

3.1.3. Natural heritage

Natural resources included in the area belong basically to those characteristic of the forest areas: rivers, ravines, caves, slopes, and fountains. In general terms, the importance resides in the water bodies and geomorphological formation created because of this hydrological system but also due to its social use, as the study area is well known at the regional level for the public access to these rivers in summer.

Other geological elements of interest are caves and ravines; examples of them are Abrigo de Voro, natural caves in Quesa and Barranco Moreno in Bicorp (ravine). Many of these caves are included in Lists of protection.

The area has an outstanding natural value, so for this reason, La Canal de Navarrés is included in the Natura 2000 Network to protect this heritage. As shown in Figure 3, all towns are included as SPA (Spatial Protection Areas), named Sierra de Martos-Muela de Cortes; however, only Bicorp, Quesa and Anna are the municipalities in which the SCI (Sites of Community Importance) surface is high, named SCI of Muela de Cortes - El Caroche.
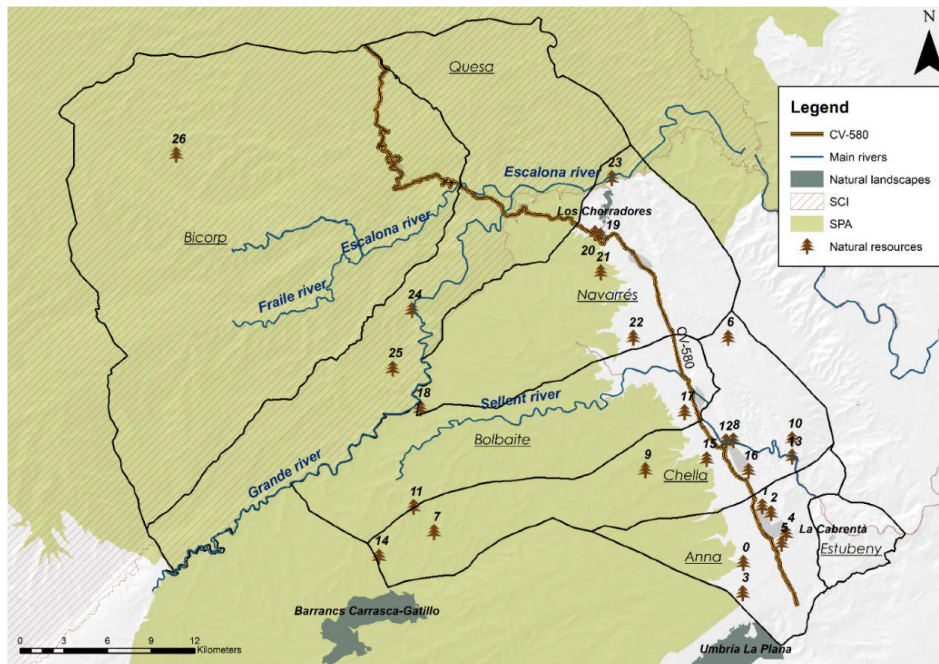

Figure 3. Natural heritage map. Source: Benito, R.M. (2020)

Regional protection sites included in the area also contribute to this area's high natural value and, therefore, its attraction: The "Paratges Naturals Municipals" (Local Natural Landscapes) are established in two towns of this study area, the first under the name of "The Estubeny Forest" or also called "La Cabrentà"·located in Estubeny, and the second one is in the locality of Navarrés named "El paraje de los chorradores".

3.1.4. Cultural heritage

Cultural resources are outstanding in the study area, as they are one of the main tourist attractions. This group includes the most abundant and traditional, those who belong to religious buildings or castles, but those of greater relevance are the Cultural World Heritage List sites of "Rock-Art of the Mediterranean Basin on the Iberian Peninsula" in 1998 (UNESCO, 1998). Some of these listed representations are located in the towns of Bicorp, Quesa and Navarrés. Among the Rock Art representations in the study area, the most important is La Cueva de la

Araña (Spider's Cave). Its paintings were drawn by the ancient inhabitants of these territories between 9,000 and 14,000 BC.

Not only international figures of protection confer to this area its important cultural value, but also a couple of cultural resources catalogued by regional figures of protection in the Valencian Community:

- Group A: Element of Cultural Interest (Bien de Interés Cultural or BIC):ie: Palacio Condes de Cervellón.
- Group B: Element of Local Relevance (Bien de Relevancia Local or BRL's): i.e. Iglesia de San Antonio Abad (San Antonio Abad Church)

On the other hand, it has also been included in this study the traditional cattle routes of "Vías Pecuarias". Those paths had been used to move livestock, but they are still bearers of historical values, as there are numerous paths in this area due to the ancient Iberian Commerce Routes. In the Valencian Community, those elements form a network of more than 14,000 kilometres, and all of them are under the management of the Valencian Government, and they provide the territory an extra historical-cultural value as well as recreational one (Conselleria d'Agricultura, Desenvolupament Rural, Emergència Climàtica i Transició Ecològica., 2015).

3.2. Landscape Evaluation

As the name of the scenic road establishes, one of the most important characteristics to study is the analysis of the areas visible from the road, the scenery; for this reason, in this section, it is explained the procedure designed for the analysis, using as a tool a GIS, in this case specifically through the ArcGIS software.

The first step was to obtain the delimitation and characterisation of viewsheds in order to set the number of viewpoints. In this case, it is important to remark that the viewpoints were the nodes of the line forming the road axis of CV-580 in the cartographic information.

The basic operational procedure (Figure 4) to obtain the viewsheds starts by adding to the CV-580 line a value of 1,50 meters in height to represent the average height of a passenger car according to the height of the most purchased cars in Spain during 2019 (MAPFRE, 2019) from which an observer (visitor or tourist) in a car will be looking to the landscape. Then, with the tools Viewshed and Digital Elevation Model (DEM) in raster format and this line, the visual analysis was done. As a result, a raster map was obtained with information on the visible and non-visible areas of the car.
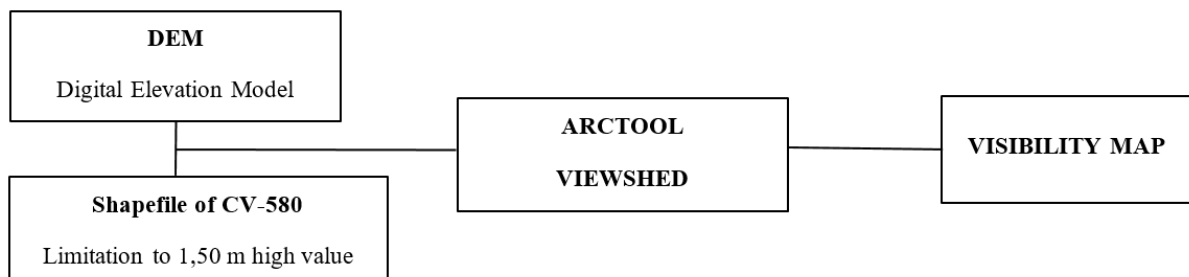

Figure 4. Process to obtain visibility map. Source: Benito, R. (2020)

Then, with the visibility and the scenic resources map, the whole area was divided into sub-areas with homogeneous characteristics (Figure 5). These sub-areas are called landscape units (LU), which appear in the Valencian law, and it is necessary to establish landscape units in all projects or studies whose aim is to promote an action related to landscape (Ley 5/2014, de 25 de julio de la Generalitat, de Ordenación del Territorio, Urbanismo y Paisaje, de la Comunitat Valenciana, 2014).
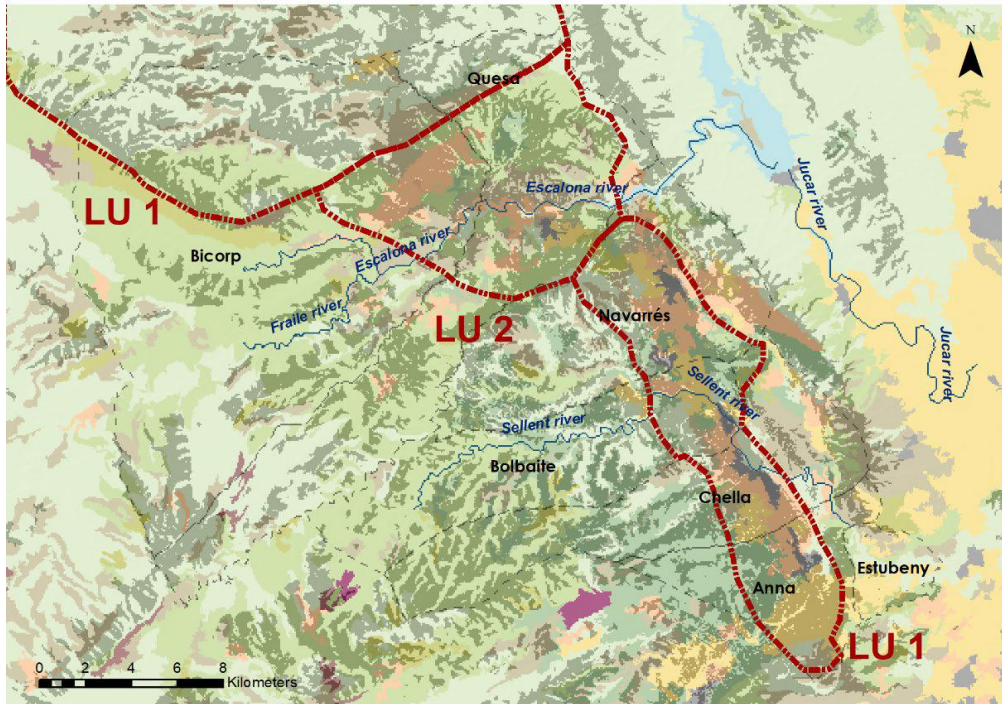
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Figure 5. Landscape Units map. Source: Benito, R. (2020)

3.3. Evaluation of the Scenic Value From the Tourism Perspective. Tourism Aptitude.

The tourism evaluation methodology to design this proposal of a scenic road has been adapted from the Tourism Aptitude concept, which is related to the recreational evaluation of natural and cultural resources, considering the attractions that motivate the movement of the visitors but also the services, facilities and infrastructures capable to give the necessary support to the tourism activity.

Hence, tourism aptitude evaluation focuses on identifying those resources capable of offering the visitor of this area the visit to the most suitable elements after and while driving through the scenic road. Thus, this evaluation it is also an opportunity to identify those resources that have been unnoticed as important, but that for the specific proposal of a scenic road and the activities and visits linked to it, can be relevant and act as connectors, both physical and intellectual. The tourism aptitude is defined as the "*capacity of a territory and its elements to attract, host and manage visits under conditions that guarantee both the conservation of the resources and the visitor comfort while devevoping a proposed activity, or a group of activities*" (Viñals, et al., 2017).

To develop the evaluation of the Tourism Aptitude of each municipality (Figure 6) it was created a methodology, based on the work of Viñals et al. (2017), proposing the following basic combination of variables to be analysed:

$$TAM = AV + RE + TS$$

VARIABLE	Definition	Components included
TAM	Tourism aptitude of the municipality	-
AV	Attraction Value	Natural and cultural elements
RE	Recreational Facilities	Walking trails and MTB TRAILS
TS	Tourism Services	Elements that offers services to tourists

Figure 6. Tourism Aptitude Variables. Source: Viñals, et al., (2017).

3.3.1.Evaluation of the Attractions Aptitude

The first element in the Tourism Aptitude of the Municipality "equation" is the intrinsic evaluation of the resources existing in the area, in this study the elements evaluated (Figure 7) are those:

$$AV = NR + CR + ACR + L$$

The result of the equation was given thanks to the use of tables and the handling and management of data in Excel software. In total were evaluated: 34 natural resources, 30 cultural resources, 31 ancient cattle routes, and 3 landscape units.

VARIABLE	Definition	Components included
AV	ATTRACTION VALUE	-
NR	Natural Resources	Resource Condition Management and Availability Legal Status
CR	Cultural Resources	Resource Condition Ownership and availability Legal Status
ACR	Ancient Cattle Routes	Legal Status Ownership Resource Condition Importance Distance to the scenic route
L	Landscape	Zuccarini & Geraldi, 2019

Figure 7. Variables for the evaluation of the Attractions aptitude. Source: Viñals, et al., (2017).

3.3.2 Recreational Facilities Aptitude

The recreational facilities, 45 included in the study area, were evaluated using a strategy similar to the attraction elements. The level of attraction (LA), the user profile (UP) and the distance to the road CV-580 (D) were the requirements to evaluate each recreational facility (Table 1).

$$RF = LA + UP + D$$

The level of attraction (LA) evaluated the attractions existing in the routes and ways, giving more value to those ways with three or more cultural or natural elements and the minimum value to those routes which had none of these elements.

On the other hand, the user profile (UP) consisted of making a separation between the roads who had multiuser profile (minimum score) from those who only had one user profile (maximum score). Giving a higher score to the single-user equipment is because of the conflicts that can arise in multiuser paths due to those differences between each user profile, provoking discomfort and unsafety.

Finally, the evaluation distance (D) was introduced to give more value to those secondary roads next to the main road and decrease the value for those facilities far from the main road.

Table 1. Variables for the evaluation of the recreational facilities aptitude. Source: Viñals, et al., (2017).

Level of attraction	User profile	Distance
5 = 3 or more attractions	5 = Only pedestrian	5 = At the scenic road/town
3 = 1or 2 attractions		3 = 15 minutes from the scenic road/town
1 = No attraction identified	3 = Multiuser (BTT shared with pedestrian)	1 = More than 15min from the scenic road/town

3.3.3 Tourism Service Aptitude.

A total of 92 tourism services (TS) were evaluated (Figure 8) according to the number of elements included in each municipality of the different typologies (A-accommodation, FAB – food and beverage, TSC- tourism companies). Those areas with more of these elements will bring the tourist or visitor a better experience.

$$TS = A + FAB + TSC$$

Accommodation	Food and Beverage	Tourist Services Companies
Total number of beds per municipality and accommodations typology.	Total number of bars, restaurants, and other companies offering this services.	Summatory of tourism services companies per municipality.

Figure 8. Variables for the evaluation of the tourism service aptitude.Source: Viñals, et al., (2017).

4. Results

The methodological process used during the study is a combination and adaptation of different procedures, so the results obtained are shown separately for each methodological process step. Thus, showing the USDA methodology results and the landscape techniques results, and afterwards, those results (USDA and landscape) are the inputs for the next methodological step, tourism aptitude evaluation, whose results are also shown in this section.

The USDA methodology results show that this area has all the elements to be considered as a scenic route; according to landscape analysis methodology revealed that the three different typologies of the landscape visible from the road are included in the Natura 2000 Network as well as the UNESCO World Heritage-listed elements (Rock-Art Paints). In addition, the inventory revealed that there is a dense network of ancient cattle routes, so all of these aspects can be linked to promoting intellectual connections to enhance the territory, and also could serve as a basis to design and develop the parallel non-motorised routes such biking or hiking ones, with lower Carbon emissions.

According to the results of the tourist aptitude evaluation, the municipality with the higher attraction value is Navarrés, as it combines numerous natural and cultural attractions, followed by Anna with outstanding natural values and Bicorp, with a high value due to the cultural elements, particularly the UNESCO Site. Moreover, Bicorp is also rated as the higher value in the existence of recreational facilities, such as MTB and hiking trails. According to the tourism services, the municipality with more capacity to offer tourism services is Anna, followed by Chella.

The analysis and combination of all the partial results obtained in this tourism approach step of the methodological process shows the following tourism aptitude scoring for each resource typology, grouped by municipalities (Table 2):

Table 2. Final results of tourism potential.Source: Benito,R.M (2020).

Municipality	Tourism aptitude	Resource type with higher score
Anna	196	Tourism services, Natural resources and Recreational water bodies (LU 1)
Estubeny	32	Non-remarkable resources (LU 1)
Chella	156	Tourism services, Natural resources (LU 1)
Bolbaite	141	All the resources are resent but any remarkable (LU 1)
Navarrés	183	Cultural and natural resources (LU1)
Quesa	171	Cultural resources, Recreational facilities and Landscape (LU 2)
Bicorp	219	Cultural resources, Recreational facilities and Landscape (LU 3)

Thus, the results show the appropriateness of dividing the scenic route into three sections, coinciding with the three landscape units that were determined with the analysis of the road CV-580 viewshed. Beyond, the results identify the most recommended types of activities to be developed in each section (Figure 9) :

Landscape unit associated to road's viewshed	Municipalities	High-scored resources accessible
1-Agricultural landscape	Anna-Estubeny-Chella-Bolbaite-Navarrés	River and ravine public use sites. Tourism Services
2-Hydrological transition landscape	Quesa	Landscape-Ravines/Recreation Facilities/Cultural-varied typology
3-Forest Landscape Muela de Cortes	Bicorp	Cultural resources, Recreational facilities and Cultural-Rock Art and Museum.

Figure 9. Most recommended activities per Landscape Unit.

After assessing all resources and analysing the results established by the geographic information systems combined with the results of operational procedures, it was proposed to create the scenic route as a tourism product (Figure 10).
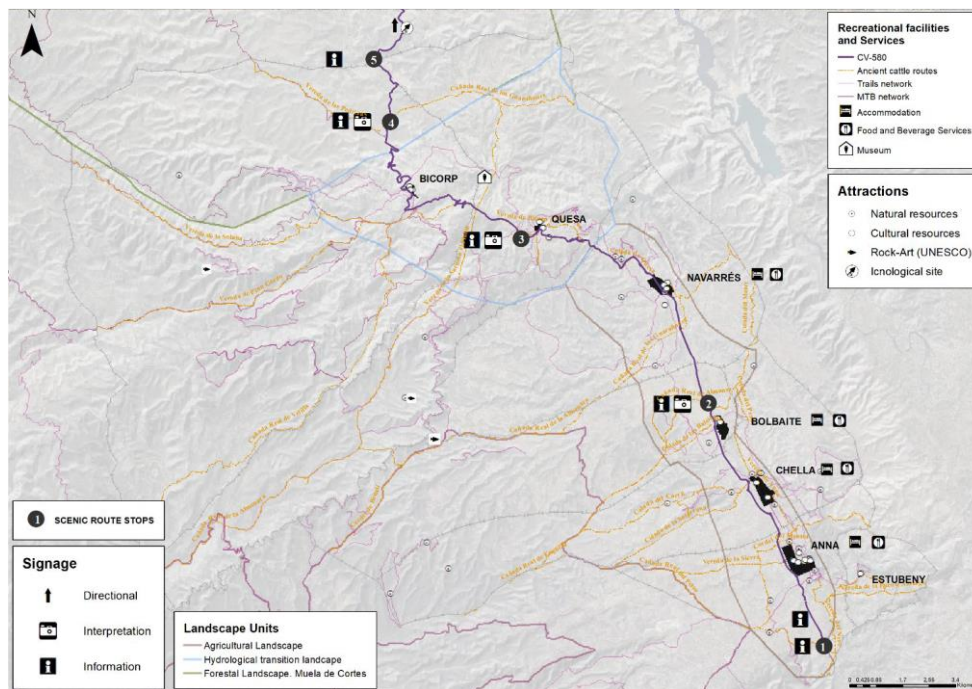

Figure 10. Scenic route elements. Source: Benito, R. (2020)

5. Conclusion

The main innovation of this methodology relies on the combination of three dimensions using GIS potential: first and more relevant, the incorporation of tourism aptitude criteria in the public use enhancement of the landscape, second to combine the aptitude with landscape evaluation methodology and third with the parameters of Scenic Route stablished by USDA.

However, the methodology is complex in terms of a number of elements to combine and the relative weights that need to be assigned to the variables. These make it essential for the processing that researchers have sound

experience and background in both cultural and natural resources and the tourism activity planning and managing necessary to guarantee the good proceeding of the evaluation steps.

Though, the methodology results are flexible and appropriate to evaluate and proceed with the decision-making on the public use enhancement linked to the landscape. Beyond, the methodology uses mainly as inputs those informations of public use available and official databases, both cartographic and statistical, that are regularly updated by public administration, which gives an added value to the methodological proposal of the study.

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