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Maria José González Amuchastegui, M. Enrique Serrano Canadas, Juan José
González Trueba, Maria González Garcia

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Abstract

This study shows the importance of geomorphologic analysis in landscape studies of natural protected areas in order to improve their management. Géomorphologie framework provides the basis of territorial organization in natural protected areas. Moreover there are some elements with special géomorphologie value that is necessary to consider for carry out proper land management : the geomorphosites. We have inventoried and analyzed eleven geomorphosites applying a methodology that includes new cartographic symbols and an assessment of each site. The aim of this work is to contribute for the inclusion of geomorphosite assessment in environmental management studies and tasks. The study is located in Valderejo Natural Park (Alava, the Basque Country, Spain).

Résumé

Le contexte géomorphologique constitue la base de l'organisation spatiale dans les zones naturelles protégées. Une bonne connaissance de la géomorphologie locale est donc fondamentale en soi mais aussi pour comprendre la distribution d'autres facteurs environnementaux. En outre, certains géomorphosites ayant une valeur particulière nécessitent la mise en place de pratiques de gestion appropriées. Pour cela, ils doivent faire l'objet d'une évaluation scientifique, culturelle et socio-économique en utilisant une méthodologie pouvant être comprise par différents publics : les scientifiques, les aménageurs mais également le «grand public».

Le territoire d'étude est limité au parc naturel de Valderejo, situé à Alava (Pays Basque, Espagne), dans la chaîne des Arcena. Sa surface est d'environ 3 500 ha au cœur d'une région karstique où les éléments géomorphologiques ont un rôle majeur dans le paysage. Onze géomorphosites y ont été inventoriés. Ils appartiennent à différentes catégories de géotopes : structuraux, issus de divers processus karstiques, glissement de terrain, dépôts de tuf, morphologies fluviales ainsi que des glaciers. La plupart de ces sites ont une grande valeur géomorphologique.

Le tourisme est un secteur économique important dans la région. Le parc naturel de Valderejo est, parmi les zones naturelles protégées du Pays Basque, celle qui a reçu le nombre le plus élevé de visiteurs. Certains géomorphosites de ce parc ont le potentiel pour devenir des sites touristiques et peuvent être considérés, en conséquence, comme des outils de développement local. Conscients de la valeur de la géomorphologie en tant que ressource paysagère, il est important qu'un équilibre soit trouvé entre la conservation et l'utilisation du point de vue de la durabilité. Dans ce but, une méthodologie appropriée a été utilisée afin de proposer un mode de gestion spécifique pour chacun des onze géomorphosites. Cette méthode comprend une évaluation qui prend en compte 3 catégories de valeurs : les valeurs intrinsèques, auxquelles sont ajoutés des valeurs d'usage et des valeurs de gestion.

GEOMORPHOSITES, A USEFUL TOOL FOR ENVIRONMENTAL MANAGEMENT IN NATURAL PROTECTED AREAS

ÁLAVA, THE BASQUE COUNTRY, SPAIN

LES GÉOMORPHOSITES, DES INSTRUMENTS UTILES POUR LA GESTION DES ZONES NATURELLES PROTÉGÉES ÁLAVA, THE BASQUE COUNTRY, SPAIN

MARIA JOSÉ GONZÁLEZ AMUCHASTEGUI ¹, ENRIQUE SERRANO CAÑADAS ²,
JUAN JOSÉ GONZÁLEZ TRUEBA ³, MARIA GONZÁLEZ GARCÍA ⁴

¹ University of the Basque Country, Francisco Tomás y Valiente, s/n 01006 Vitoria-Gasteiz (Spain).

² University of Valladolid, P^o del Prado de la Magdalena, s/n 47011 Valladolid (Spain).

³ CIESE-Comillas, University of Cantabria, av. de los Castros, s/n 39005 Santander (Spain).

⁴ University of Málaga, Campus de Teatinos, s/n 29071 Málaga (Spain).

Contact: mj.gonzalez@ehu.es

ABSTRACT

This study shows the importance of geomorphologic analysis in landscape studies of natural protected areas in order to improve their management. Geomorphologic framework provides the basis of territorial organization in natural protected areas. Moreover there are some elements with special geomorphologic value that is necessary to consider for carry out proper land management: the geomorphosites. We have inventoried and analyzed eleven geomorphosites applying a methodology that includes new cartographic symbols and an assessment of each site. The aim of this work is to contribute for the inclusion of geomorphosite assessment in environmental management studies and tasks. The study is located in Valderejo Natural Park (Álava, the Basque Country, Spain).

KEYWORDS: GEOMORPHOSITES, ASSESSMENT, VALDEREJO NATURAL PARK.

RÉSUMÉ

Le contexte géomorphologique constitue la base de l'organisation spatiale dans les zones naturelles protégées. Une bonne connaissance de la géomorphologie locale est donc fondamentale en soi mais aussi pour comprendre la distribution d'autres facteurs environnementaux. En outre, certains géomorphosites ayant une valeur particulière nécessitent la mise en place de pratiques de gestion appropriées. Pour cela, ils doivent faire l'objet d'une évaluation scientifique, culturelle et socio-économique en utilisant une méthodologie pouvant être comprise par différents publics : les scientifiques, les aménageurs mais également le « grand public ».

Le territoire d'étude est limité au parc naturel de Valderejo, situé à Álava (Pays Basque, Espagne), dans la chaîne des Arcena. Sa surface est d'environ 3 500 ha au cœur d'une région karstique où les éléments géomorphologiques ont un rôle majeur dans le paysage. Onze géomorphosites y ont été inventoriés. Ils appartiennent à différentes catégories de géotopes : structuraux, issus de divers processus karstiques, glissement de terrain, dépôts de tuf, morphologies fluviales ainsi que des glaciers. La plupart de ces sites ont une grande valeur géomorphologique.

Le tourisme est un secteur économique important dans la région. Le parc naturel de Valderejo est, parmi les zones naturelles protégées du Pays Basque, celle qui a reçu le nombre le plus élevé de visiteurs. Certains géomorphosites de ce parc ont le potentiel pour devenir des sites touristiques et peuvent être considérés, en conséquence, comme des outils de développement local. Conscients de la valeur de la géomorphologie en tant que ressource paysagère, il est important qu'un équilibre soit trouvé entre la conservation et l'utilisation du point de vue de la durabilité. Dans ce but, une méthodologie appropriée a été utilisée afin de proposer un mode de gestion spécifique pour chacun des onze géomorphosites. Cette méthode comprend une évaluation qui prend en compte 3 catégories de valeurs : les valeurs intrinsèques, auxquelles sont ajoutés des valeurs d'usage et des valeurs de gestion.

MOTS-CLÉS : GEOMORPHOSITES, EVALUATION, PARC NATUREL DE VALDEREJO.

INTRODUCTION

Geomorphosites are often important elements of Natural Protected Areas (NPAs) and may be assessed both as structural and functional elements of the natural system and for their social values. The conservation and study of the geomorphological values of NPAs may be approached from three points of view: as the infrastructure of habitats and ecosystems, as the landscape in general, and as an intrinsic value of the natural environment. Up to now the first view has been dominant and has resulted in a failure to consider geomorphic features as elements of value for conservation, investigation and management. From the second point of view, geomorphosites are defined in the context of the cultural landscapes with which they are interrelated and which they affect. In this sense, the geomorphosites represent cultural, economic, tourist, educational and environmental resources. Moreover, faced with regional or national inventories, NPAs have their own characteristics in defining geomorphosites since the interest is centred locally on their detailed territorial and cultural relationships and the protected area acquires heritage value. We focus our work in Valderejo Natural Park, located in Álava (Basque Country, Spain) in the Arcena Range. With a surface of around 3500 ha, the Park occupies a Karst area

where the geomorphologic elements have a major role in the landscape.

The aim of this study is to show the usefulness of a three assessment methodology with the example of a symbolic geomorphosite as the Purón river gorge (Purón valley 2^a section, gorge with tufa deposits). The method adopted allows the establishment of intrinsic (geomorphological), added (cultural) and use/management value. It could also represent a useful educational tool, and incorporate the geomorphological values in the management and conservation policies.

Tourism is a major resource in this area, in fact Valderejo is the Natural Park that has received the highest number of visitors of the natural protected areas of the Basque Country. In this sense it is important to note that some geomorphosites in Valderejo have the potential for becoming “tourist sites” and they can be considered as tools for local development. In fact the geodiversity is one of research priorities promoted by the documents of Natural Park (III PRUG, 2009), that organize different events related with geomorphology and its value together with the municipalities of the area; they are all aware of the value of geomorphology as a landscape resource (Figure 1).

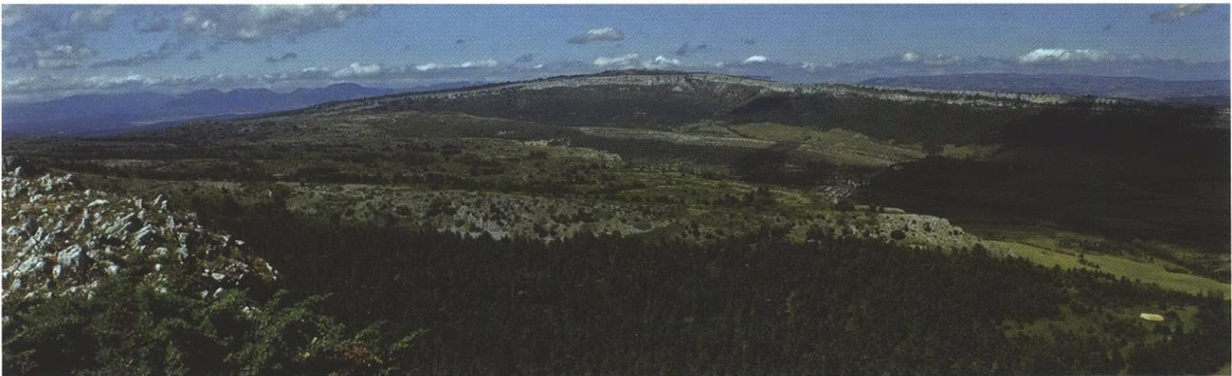


Figure 1 - Panoramic view of monoclinial peak of Arrayuelas from Vallegrull peak.

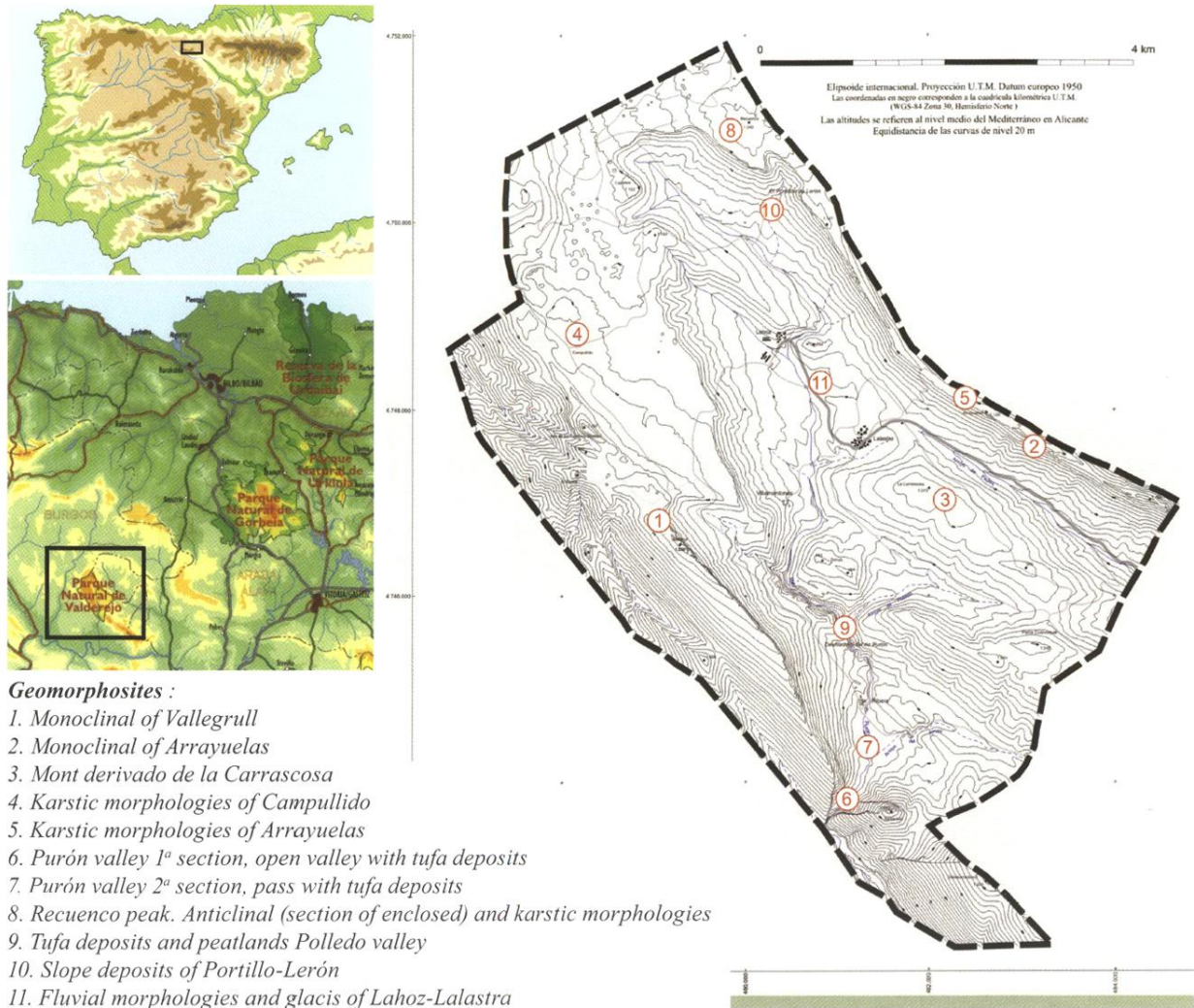
Figure 1 - Panorama du dôme anticlinal de Arrayuelas depuis le sommet de Vallegrull.

I - STUDY AREA

The study area is located in Valderejo Natural Park sited in the Arcena mountain range. This area is situated in the High Ebro Basin, in the northern of Iberian Peninsula (Figure 2). It is a relief of folded sedimentary units dominated by wide synclines and narrow anticlines; anticlines form the positive reliefs (Valderejo) that closes the wide syncline of Tobalina valley, which is drained by the Ebro River. Valderejo is mainly constituted by calcareous cover (limestone, marls) of Cretaceous age so karstic morphologies are dominant

in the area. The Park is drained by the Purón River, tributary of the Ebro, and goes through the Natural Park eroding deep gorges and wide valleys depending on the crossed lithologies. The Purón valley contains well-preserved relict and present tufa deposits, related to water fluxes saturated in calcite, supplied by the surrounding karstic aquifers (González Amuchastegui and Serrano, 1996, 2007).

The Valderejo Natural Park is a spatial and socio-economic subsidiary mountain area of 3.496 ha, located



Geomorphosites :

1. Monoclinal of Vallegrull
2. Monoclinal of Arrayuelas
3. Mont derivado de la Carrascosa
4. Karstic morphologies of Campullido
5. Karstic morphologies of Arrayuelas
6. Purón valley 1^a section, open valley with tufa deposits
7. Purón valley 2^a section, pass with tufa deposits
8. Recuenco peak. Anticlinal (section of enclosed) and karstic morphologies
9. Tufa deposits and peatlands Polledo valley
10. Slope deposits of Portillo-Lerón
11. Fluvial morphologies and glacia of Lahoz-Lalastra

Figure 2 - Location of Valderejo Natural Park and of its Geomorphosites.

Figure 2 - Localisation du parc naturel de Valderejo et emplacement de ses géomorphosites.

southern of the Cantabrian Range in the province of Álava in a transitional zone between the Atlantic and the Mediterranean climate. Valderejo was declared Natural Park in 1992. Its optimal preserved natural features (vegetation, cover forestry, wildlife and landscape) are related with its peripheral position respect to the main socioeconomic development axis. In these well preserved natural conditions, the geomorphologic features, high altitude, slope and topography, play an important role; in fact the Park's surface coincides with a major morphostructure: the *combe* of Arcena mountain range.

The Natural Park occupies a karst area where the geomorphologic elements have a major role in the landscape, in this way we have defined 11 geomorphosites. They have been inventoried during the last ten years in the context of the studies realized by the research team. These eleven geomorphosites illustrate different structural aspects (monoclinal peaks of Vallegrull and Arrayuelas), various karstic processes (limestone pavement, sinkholes and caves of Campullido and Arrayuelas), tufa deposits (Purón and Polledo valleys), slope deposits (Portillo-Lerón) and different fluvial morphologies and glacia (Lahoz-Lalastra).

II - GEOMORPHOSITES

The geomorphologic knowledge is necessary by itself and because it controls the distribution of other environmental factors: local climate, composition and distribution of vegetation and land uses, and usually geodiversity underlies their location. Moreover there

are some elements with special geomorphologic value that is necessary consider for carry out proper land management: the geomorphosites. They are suitable tools that allow achieve a quite scientific, cultural and socioeconomic assessment employing a methodology

that can be understood in different levels: scientific, from land assessment and by the public in general.

Geomorphosites play an important role in the development of tourism activities in Valderejo Natural Park; furthermore, it is important to note that many geomorphosites with high intrinsic and added values can be defined as “tourist sites” directly involved as one of the most important elements of geotourism. In this sense it is essential to show the geomorphosites by different ways; one of them are interpretative geotourism maps showing geomorphosites and their assessment; these maps can be a powerful tool for environmental education when made available to visitors of the Natural Protected Area, consisting of mountaineers, hikers and active tourist visitors kinds and students. Interpretative geotourism maps can be a useful tool for leisure and educational activities leading to abiotic nature interpretation, knowledge and leisure to not genuinely motivated visitors. It has an important function as a participating document in the valuation by visitors and local communities of abiotic elements of landscapes and geodiversity, and conservation of Natural Protected Areas as a tool for scientific outreach and geoconservation.

1 - Methodology

Landforms are the basis of territorial organization and the geomorphosites are landforms of special interest, which are also essential in morphological shaping, dynamics and territorial evolution. These have particular relevance for understanding the natural environment, earth history, climate or life, and include scientific, but also cultural, aesthetic and socioeconomic values (Panizza, 2001; Reynard, 2005). They are very interesting as structural and functional elements of the natural system, but also it must be added their social content and its potential economic value as a natural or cultural resource and in this sense they can be interpreted as heritage resources. Supporting this idea, it is necessary to provide methodological tools that allow to know the geomorphological aspects, to define the geomorphosites and to value them for enhance land management.

In Valderejo a set of geomorphosites have been defined by using a sequence that consists of three phases:

- inventory: recognition and definition of geomorphosite;

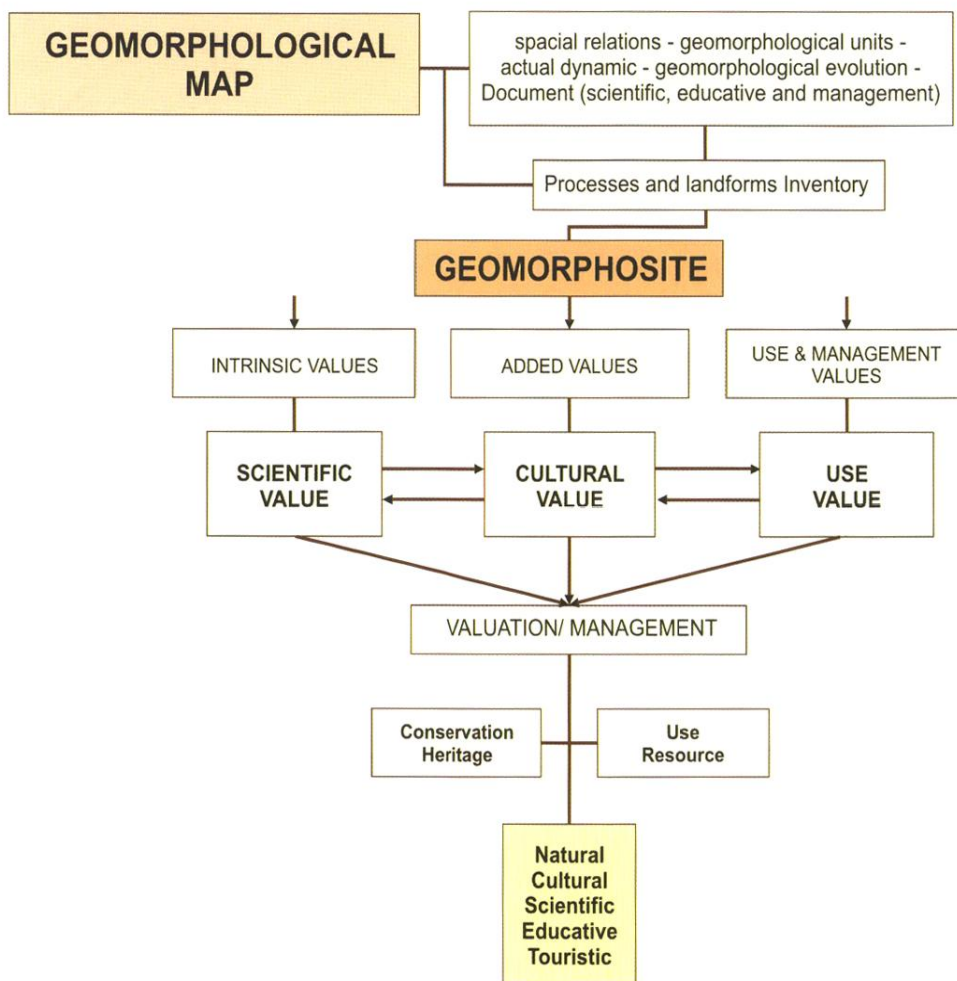


Figure 3 - Assessment methodology.

Figure 3 - Méthode d'évaluation.

- diagnose: current situation;
- assessment, proposed use and management.

Implementation of these three phases has been carried out in the Natural Park of Valderejo by applying a methodology (Figure 3) already used by the research team in other high mountain and rural areas (Serrano, Gonzalez-Trueba, 2005; Serrano *et al.*, 2009; Serrano, Gonzalez-Trueba, 2011).

Anyway some modifications have been implemented in order to improve previous proposals. The methodology follows the following steps:

- Development of geomorphological mapping (Figure 2): This is the basic tool in the inventory and location of the landforms and processes in the study area and their spatial relationships.
- Selection of the geomorphologic elements and definition of Geomorphosites.
- Geomorphosite valuation: For each Geomorphosite is made on a card (Figure 4) that includes its most representative features. The method developed relies on a triple assessment of the geomorphosite, which are evaluated separately
 - Scientific (or intrinsic) values, mainly geomorphological one's including an assessment of the structural, morphological, and dynamic values, and their diversity. Their assessment is objective.
 - Added or cultural values. Consideration of cultural elements affecting the intrinsic values; and include the landscape, aesthetic, cultural, didactic and scientific values.
 - Use and management values. Territorial components and potential use of the Geomorphosite; including among others, the analysis of aspects such as fragility, accessibility, intensity of use and its potential.
 - Finally, a new section is included referring to the orientation of the use and management of LIG and a set of proposals for action on the geomorphosites.

The information is presented in a card in that also adds cartographic information of location, structural context, a geomorphological map of detail and an interpretative block of geomorphological-didactic character.

2 - Geomorphosites of Valderejo Natural Park

In the area of the Valderejo Natural Park eleven geomorphosites have been defined, each of them characteristic of the geomorphology of the Park. They include structural, geomorphologic and hydrologic elements. The most interesting are karstic and sedimentary ones, specially the Purón valley fluvial systems, in which it is possible to emphasize the spectacularity of tufa deposits.

The assessment of LIGs has been established on a maximum of 5 points for each of the analyzed values. The five most representative LIGs (Table 1) present a high intrinsic value and they have more differences between the added and use values. The most highlighted case is the Puro River valley (Gorge river Purón 1 and part 2), where the accessibility is easier than other sites.

Geomorphosites play an important role in the development of tourism activities in Valderejo Natural Park; furthermore, it is important to note that many geomorphosites with high intrinsic and added values can be defined as "tourist site" (geomorphosites 3 and 4) directly involved as one of the most important elements of geotourisme. In this sense it is essential to show the geomorphosites by different ways; one of them are interpretative geotourism maps showing geomorphosites and their assessment; these maps can be a powerful tool for environmental education when made available to visitors of the Natural Protected Area, consisting of mountaineers, hikers and active tourist visitors kinds and students. Interpretative geotourism maps can be a useful tool for leisure and educational activities leading to abiotic nature interpretation, knowledge and leisure to not genuinely motivated visitors. It has an important function as a participating document in the valuation by visitors and local communities of abiotic elements of landscapes and geodiversity, and conservation of Natural Protected Areas as a tool for scientific outreach and geoconservation.

Nº	NAME GEOMORPHOSITE	INTRINSIC VALUES	ADDED VALUES	Fragility/ Vulnerability	POTENTIALITY USE	AVERAGE
1	Vallegrull	3,2	3,7	1,12	2,7	2,68
2	Arrayuelas	3	2,8	1,37	2,49	2,41
3	Purón, 1	3,8	3,9	2,8	3,7	3,55
4	Purón, 2	3,7	3,9	3	3,7	3,57
5	Recueno-Portillón-Lerón	3,3	3,3	1,12	2,7	2,60

Table 1 - Assessment of Valderejo Natural Park geomorphosites.

Tableau 1 - Évaluation de l'inventaire des géosites du parc national de Valderejo.

GEOMORPHOSITE: PURON VALLEY SECOND SECTION, GORGE WITH TUFA DEPOSITS

GEOMORPHOSITE: DESCRIPTION CARD			
Identification	Name: Purón valley 2ª section, gorge with tufa deposits	Place: Gorge of Purón river	Nº: 7
Situation	Tº municipal: Valdegobia	Coordinates: 42°50'25.31"N/3°13'58.69"W	Altitude: 700 m
Geomorphology	TYPE	REPRESENTATIVE PLACE -The tufa accumulation play a key role given its climatic and paleoenvironmental significance. -Tufa deposits valley bottoms of large thickness (25 m).	
	Genesis	Fluvio-karstic	
	Morphology	- Fluvio-karstic gorge -Tufa deposits valley bottoms	
	Dynamic	Current dynamic: Tufa formation processes (river), fluvial processes, slope dynamic.	
	Chronology	Only one growth phase tufa attached to Holocene, periodo of intense tufa sediment in the study area.	
	Main interest	Fluvio-Karstic model.	
	Secondary interest	Aesthetic value: valley bottom, gorge with vegetation characteristic and waterfalls small.	
Uses	Attribution LIG	FLUVIO-KARSTIC RELIEF, SCIENTIFICAESTHETIC.	
	Cultural content	Old path of communication between villages.	
	Accessibility	Very good	
	Level of interest	High (scientific-didactic, landscape, aesthetic)	
	State of conservation	High	
	Current uses	Hiking, go for a walk, to take pictures	
	Communications	No road, only path	
	Infrastructure	Footbridge of wood to cross the river.	
	Impacts	Low impact	
	Legal Status	Natural Park (III PRUG and PORN). This element hasn't special protection into the natural park area.	
Bibliography	González Amuchastegui, M.J and Serrano Cañadas, E. (2007). Geomorphologic evolution, environmental changes and human activity during Holocene in Upper Ebro Basin: tufa complexes in Purón and Molinar Rivers. Estudios Geográficos, LXVIII, 263.		

GEOMORPHOSITE: VALORATION CARD				
Identification	Name: Purón valley 2ª section, gorge with tufa deposits	Place: Gorge of Purón river	Nº: 7	
Situation	Tº municipal: Valdegobia	Coordinates: 42°50'25.31"N/3°13'58.69"W	Altitude: 700 m	
LIG type	REPRESENTATIVE PLACE: -The tufa accumulation play a key role given its climatic and paleoenvironmental significance. -Tufa deposits valley bottoms of large thickness (25 m)		VALUATION	
Intrinsic values	Morphostructure	Lithology (significance, representativeness, rarity) (1-5) Tectonics (significance, representativeness, rarity) (1-5)	2 3	
	Variety of other elements of geological interest (other geological elements are considered: tectonic, stratigraphic, paleontological, mineralogical, petrological, hydrogeological ...). (1-5)		2	
	Morphology	Erosion landforms: significance, representativeness, rarity. (1-5) (*2) (maximum 10) Landforms of accumulation: significance, representativeness, rarity. (1-5) (*2) (maximum 10)	8 10	
	Dinamic	Inherited: significance, representativeness, rarity. (1-5) Active: significance, representativeness, rarity. (1-5)	5 3	
			Valuation	33/45 (3,7)
Landscape and aesthetic value: (1-5) (*4) (maximum 20)			16	
Added values	Cultural elements	Relation to elements of patrimonial value: (1-5) Historical and cultural content: (1-5)	2 3	
	Didactic character	Value as a teaching resource (ease of understanding and appreciation of the level): (1-5) Association with other elements of the environment: (1-5)	5 3	
	Scientific character	Scientific discipline: significance, representativeness, rarity. (1-5)	4	
		Information that contributes to the reconstruction of the geomorphological evolution (paleoenvironmental significance, chronological ...): (1-5)	5	
	Tourist content	Tourist, historic, artistic, scenic, recreation contents: (1-5) Tourist attraction: international, nacional, local: (1-5)	4 3	
				Valuation

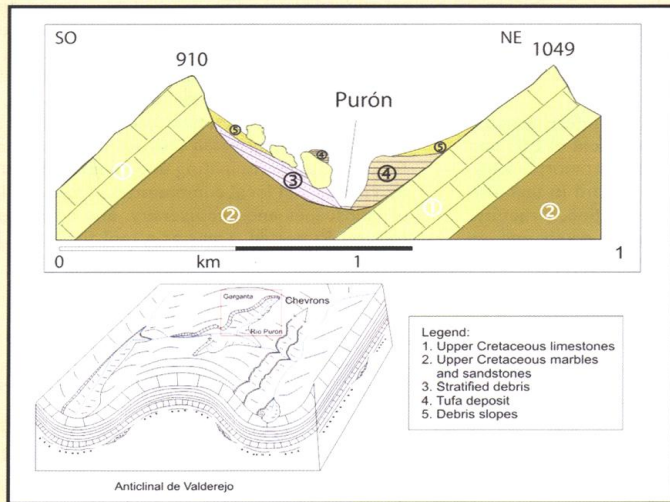


Figure 1. Geomorphological profile of the Purón valley

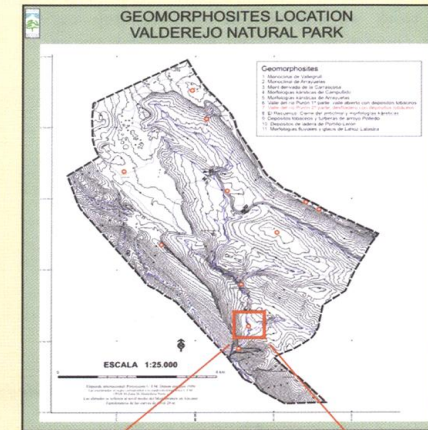


Figure 2. LIG location

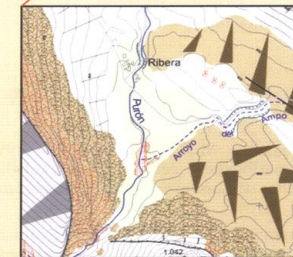


Figure 3. Geomorphological map of geomorphosites

Use and management assessment (or usability and management / sensitivity-fragility)	FRAGILITY/ VULNERABILITY /DEGRADATION-RISK/ LIMITATIONS.	Accessibility: (1 very low - 5 very high)	3	
		Attendance: (1 very low - 5 very high)	4	
		Intrinsic fragility (i.e. the fragility of the geomorphological landform): (1 Very Low - 5 very high)	5	
		External fragility/threats (Elements of the environment of LIG which can submit irreversible changes in their intrinsic and extrinsic values: (1 Very Low - 5 Very high)	2	
		Type and intensity of use: (1 Very Low - 5 Very High)	2	
	Impact: (1 Very Low - 5 Very High)	1		
			Valuation	17/30
	USE POTENTIALITY	Intrinsic Value: (1-5)*3	11,1	
		Added value: (1-5)*3	11,4	
		Meaning landscape: (1-5)	4	
Conservation conditions: (1-5)		4		
Accessibility: (1-5)*2		6		
Observing conditions (use LIG like resource)(1-5)	4			
		Valuation	40,5/55	
DIRECTIONS FOR USE AND MANAGEMENT: remarkable characters of each of the values: intrinsic, added, use and management and PROPOSALS: Due to its accessibility, to high attendance and the high intrinsic fragility that make it an element vulnerable, through management and conservation must attend these criteria and additional factors management. An increase in the current use intensity, can cause serious disruptions in their values.				
GLOBAL VALUATION		3,7-3,8-17/30-40,5/55		

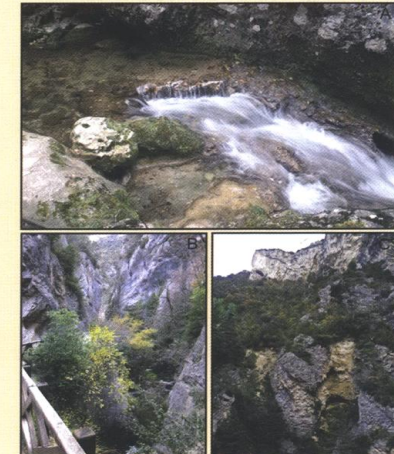


Figure 4. a. Waterfall; b. Fluvio-karstic Gorge; c. Tufa deposits valley bottoms

Figure 4 - Geomorphosite detailed description sheet of the Purón Valley.

Figure 4 - Fiche de description détaillée du géomorphosite de la vallée du Purón.

GEOMORPHOSITE: PURON VALLEY SECOND SECTION, GORGE WITH TUFA DEPOSITS

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Geomorphology	TYPE	REPRESENTATIVE PLACE -The tufa accumulation play a key role given its climatic and paleoenvironmental significance. -Tufa deposits valley bottoms of large thickness (25 m).	
	Genesis	Fluvio-karstic	
	Morphology	- Fluvio-karstic gorge -Tufa deposits valley bottoms	
	Dynamic	Current dynamic: Tufa formation processes (river), fluvial processes, slope dynamic.	
	Chronology	Only one growth phase tufa attached to Holocene, period of intense tufa sediment in the study area.	
	Main interest	Fluvio-Karstic model.	
	Secondary interest	Aesthetic value: valley bottom, gorge with vegetation characteristic and waterfalls small.	
Uses	Attribution LIG	FLUVIO-KARSTIC RELIEF, SCIENTIFIC, AESTHETIC.	
	Cultural content	Old path of communication between villages.	
	Accessibility	Very good	
	Level of interest	High (scientific-didactic, landscape, aesthetic)	
	State of conservation	High	
	Current uses	Hiking, go for a walk, to take pictures	
	Communications	No road, only path	
	Infrastructure	Footbridge of wood to cross the river.	
	Impacts	Low impact	
	Legal Status	Natural Park (III PRUG and PORN). This element hasn't special protection into the natural park area.	
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GEOMORPHOSITE VALORATION CARD			
Identification	Name: Purón valley 2 ^a section, gorge with tufa deposits	Place: Gorge of Purón river	Nº: 7
Situation	Tº municipal: Valdegobia	Coordinates: 42°50'25.31"N/3°13'58.69"W	Altitude: 700 m
LIG type	REPRESENTATIVE PLACE:		VALUATION
	-The tufa accumulation play a key role given its climatic and paleoenvironmental significance. -Tufa deposits valley bottoms of large thickness (25 m)		
	Morphostructure	Lithology (significance, representativeness, rarity): (1-5) Tectonics (significance, representativeness, rarity): (1-5)	2 3
	Variety of other elements of geological interest (other geological elements are considered: tectonic, stratigraphic, paleontological, mineralogical, petrological, hydrogeological ...): (1-5)		2
	Morphology	Erosion landforms: significance, representativeness, rarity. (1-5) (*2) (maximum 10) Landforms of accumulation: significance, representativeness, rarity. (1-5) (*2) (maximum 10)	8 10
Intrinsic values	Dinamic	Inherited: significance, representativeness, rarity. (1-5) Active: significance, representativeness, rarity. (1-5)	5 3
	Valuation		33/45 (3,7)
Added values	Landscape and aesthetic value: (1-5) (*4) (maximum 20)		16
	Relation to elements of patrimonial value: (1-5)		2
	Cultural elements	Historical and cultural content: (1-5)	3
	Didactic character	Value as a teaching resource (ease of understanding and appreciation of the level): (1-5) Association with other elements of the environment: (1-5)	5 3
	Scientific character	Scientific discipline: significance, representativeness, rarity. (1-5)	4
		Information that contributes to the reconstruction of the geomorphological evolution (paleoenvironmental significance, chronological ...): (1-5)	5
	Tourist content	Tourist, historic, artistic, scenic, recreation contents: (1-5)	4
Tourist attraction: international, nacional, local: (1-5)		3	
Valuation		45/60 (3,8)	

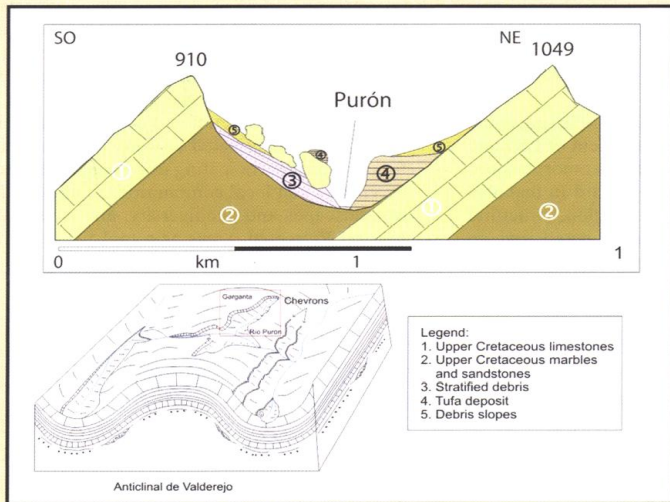


Figure 1. Geomorphological profile of the Purón valley

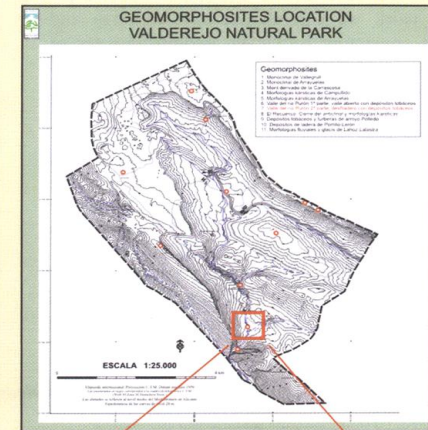


Figure 2. LIG location

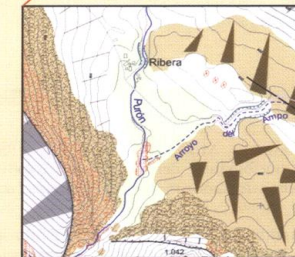


Figure 3. Geomorphological map of geomorphosites

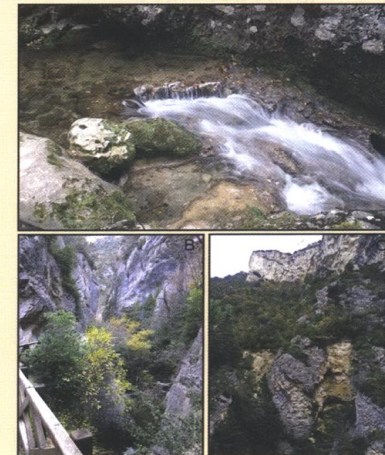


Figure 4. a. Waterfall; b. Fluvio-karstic Gorge; c. Tufa deposits valley bottoms

Use and management assessment (or usability and management / sensitivity-fragility)	FRAGILITY/ VULNERABILITY /DEGRADATION-RISK/ LIMITATIONS.	Accessibility: (1 very low – 5 very high)	3
		Attendance: (1 very low – 5 very high)	4
		Intrinsic fragility (i.e. the fragility of the geomorphological landform): (1 Very Low - 5 very high)	5
		External fragility/threats (Elements of the environment of LIG which can submit irreversible changes in their intrinsic and extrinsic values: (1 Very Low - 5 Very high)	2
		Type and intensity of use: (1 Very Low - 5 Very High)	2
	Impact: (1 Very Low - 5 Very High)	1	
	Valuation		17/30
	USE POTENTIALITY	Intrinsic Value: (1-5)*3	11,1
		Added value: (1-5)*3	11,4
		Meaning landscape: (1-5)	4
Conservation conditions: (1-5)		4	
Accessibility: (1-5)*2		6	
Observing conditions (use LIG like resource)(1-5)		4	
Valuation		40,5/55	
DIRECTIONS FOR USE AND MANAGEMENT: remarkable characters of each of the values: intrinsic, added, use and management and PROPOSALS: Due to its accessibility, to high attendance and the high intrinsic fragility that make it an element vulnerable, through management and conservation must attend these criteria and additional factors management. An increase in the current use intensity, can cause serious disruptions in their values.			
GLOBAL VALUATION		3,7-3,8-17/30-40,5/55	

Figure 4 - Geomorphosite detailed description sheet of the Purón Valley.
Figure 4 - Fiche de description détaillée du géomorphosite de la vallée du Purón.

CONCLUSION

In this work we carried out an inventory and assessment consisting by eleven geomorphosites of Valderejo Natural Park, all of them were classified according to intrinsic value, added value and use and management value; of the eleven, five geomorphosites were selected as the most important and representative at regional geomorphology level; all this five have a high intrinsic value highlighting those located in the valley bottom. Furthermore, they have a high added value and use potentiality related with their high accessibility but also with high vulnerability values because of high human pressure.

Tourism is one of the main economic resources of Valderejo Natural Park, and actually, some of the

geomorphosites defined (number 3 and 4) can be considered as "touristic sites" so they would taken into account for local development planning. However, it is necessary to achieve the balance between conservation and use, in order to ensure their preservation.

The methodology applied in this study aimed for simplicity, comprehensiveness and applicability. All of these objectives have been reached since the methodology proposed certainly facilitate the assessment of geomorphosites in Natural Protected Areas, but could also represent a useful educational and management tool, opening up new perspectives in of geoheritage conservation and management.

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