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Multi-scale strategies in environmental education, that pursue appreciation of the natural and rural areas of the Mediterranean mountains, in southern Spain

Estrategias a múltiples escalas en la educación ambiental, para la valoración de los espacios naturales y rurales de la montaña mediterránea, en el sur de la península ibérica

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ABSTRACT

The meridional mountains of Europe are located in Andalusia, in the south of the Iberian Peninsula. In this region, orographic and climatic factors are the main circumstances that condition the landscape and cultural peculiarities. Nowadays, its ecosystems show a high vulnerability to climate change, its traditional ways of life are in crisis and its cultural heritage is endangered by abandonment and depopulation. This paper analyzes some of the main documents that include proposals of environmental education at European, national and regional levels from the point of view of its adaptation the territory of the Andalusian Mediterranean mountains. Some educational actions are also evaluated in order to detect the possible existence of dysfunctionalities or deficiencies among the different educational policies and projects. Finally, a series of actions are proposed to optimize environmental education programs.

RESUMEN

Las montañas más meridionales de Europa se localizan en el sur de la península ibérica, en la región andaluza. En dicha región, la orografía y la mediterraneidad se van a constituir en los principales factores de una gran diferenciación paisajística y cultural. En el presente, sus ecosistemas muestran una elevada vulnerabilidad al cambio climático, sus formas de vida tradicionales se hallan en crisis y su patrimonio cultural en peligro ante el abandono y la despoblación. Este trabajo analiza algunos de los principales documentos que recogen propuestas de educación medioambiental a escala europea, estatal y autonómica desde el punto de vista de su adaptación al territorio de la montaña media mediterránea. Igualmente se valoran algunas actuaciones educativas con el fin de detectar la posible existencia de disfuncionalidades o carencias entre las diferentes políticas y proyectos educativos. Asimismo, se proponen una serie de acciones para optimizar los programas de educación ambiental.

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1. INTRODUCTION

At the beginning of the 21st century, new perspectives have been added to the traditional ones to value rural and natural spaces in Europe. The European Landscape Convention (Council of Europe, 2000) includes ecological and environmental aspects together with social factors (cultural, patrimonial, and pedagogical, among others).

Strategies aimed to disseminating the values of natural spaces in mountain areas should involve the people living in or near these areas and those living in large cities, and both should appreciate the natural values of the mountain areas of their country and the ways of life of their inhabitants. Likewise, these strategies must have a regulated and stable character, so that the work started at school lasts and becomes the way of life of the student when he or she becomes adult.

The southernmost mountains of Europe are located to the south of the Iberian Peninsula. These land reliefs consist essentially of two complex morpho-structural units: Sierra Morena to the north and the Baetic System to the south, the former limiting to the north with the Plateau and the latter to the south with the Mediterranean Sea from the Straits of Gibraltar to the east of the Valencian Community. Some remarkable features of this area are its altitudinal gradient with several bioclimatic belts and the exceptional value of its biotic and abiotic natural components (Gavilán et al., 2013), which have led to declare a large part of its territory as Protected Natural Areas (*ENP: Espacios Naturales Protegidos*). Their ecosystems are climatic, hydrological and morphosedimentary regulators and also act as carbon storages; at the same time, they provide important natural resources and have become a support for tourism and leisure activities. In these mountains areas a traditional model of sustainable development still survives, although threatened by the abandonment of agricultural activities and the demographic decline. These mountain areas also conserve an ancestral vocation as extensive agricultural and livestock spaces, where agrarian, hunting and forest uses have been combined and still coexist. These spaces are depositories of an extraordinary peasant culture, and also keep an important cultural heritage –material and immaterial– that represent an element of identity and can act as a guarantee of conservation. The ecosystems of these mountains are highly vulnerable to climate change (Escudero, 2012) due to the fragility of their biotic, water and soil components (Vallejo et al., 2003); they are strategic territories to promote models of sustainable development, ensuring the permanence of their population and their quality of life, although they have been considered more as a protection than as a sustainable model.

This work aims to focus on this issue, the lack of a specific model of environmental education, highlighting the landscape and cultural values of these mountain areas and promoting the knowledge and appreciation of their values. With this purpose, a brief analysis is made of the proposals of educational and environmental regulations at european and national (Spanish Government) levels, before focusing on the regional level (Andalusian Autonomous Administration). Likewise, some educational actions are collected in order to detect the possible existence of dysfunctions, deficiencies between the different policies and educational projects. Finally, based on this analysis, a series of actions are proposed to enhance the environmental education programs in protected areas (especially of Sierra Morena and Baetic system) that allow improving the position of the spaces of the Mediterranean highland regions in front of other more dynamic territories such as those near the coast.

Thus, this theoretical-practical work aims to identify the environmental education strategies that exist at European, national, and regional levels, and analyze and detect the difficulties that these strategies present. In this analysis, we want to know if the environmental education plans are in accordance with open and active methodologies and if they offer a differentiated treatment of specific areas such as the Mediterranean mountains. We want to detect the relationships between the objectives of conservationists and educational administrations, and if the teaching staff is involved. Other entities involved with environmental education are investigated, together with their aims. Moreover, we focus on the educational materials that are being produced, the environmental education activities that are being carried out and the existence (or absence) of monitoring systems to assess the undertaken actions. Finally, and in view of the difficulties detected, we make a proposal in order to solve, as far as possible, these difficulties, within the framework of a process that empowers the population and makes it the protagonist of the definition of its own future, in congruence with the conservation of its environment.

2. PHYSICAL AND HUMAN FRAMEWORK

First of all, it is necessary to show the exceptional value of both the natural and human components that make up the Andalusian Mediterranean Mountain.

2.1. The physical environment

Sierra Morena and the Baetic System are well differentiated by their geological origin and particular morphology (Moreira, 2003), which are the basis of their diversity from a biogeographic and landscape point of view (Gómez, 2016).

Most of the territory of the Andalusian mountains can be included within the so-called Mediterranean sub-continental climate, a subtype of Mediterranean climate characterized by cold winters and dry and hot summers, with scarce rainfall (maximums in spring and autumn, between 300-600 mm per year). Because the altitude of this area, its average annual temperature is about 13º-15ºC, with long and cold winters (6ºC of average) and strong frosts, but summers are prolonged and warm, with an average of 25ºC (in depressions and lower areas, maximum temperatures can reach 40ºC). In all this area the intermediate stations tend to be shortened. The relief introduces a diversity of altitudes and orientations that gives rise to a mosaic of local climatic variants (Gómez et al., 2015).

Mountain ranges are not only depositories of biodiversity but generators and suppliers of water. Due to the relatively dry climate, the annual water balance is negative in several areas of the Andalusian mountains, especially in the easternmost zone. Here, the courses of water are not continuous, and form flat-bottomed channels called ramblas, which only have flow in the rainy seasons. Endorheic areas are practically absent. Currently, the main permanent water masses in Andalusia are the reservoirs; dams are built mainly by taking advantage of the gorges of the rivers in the Baetic System and on the hard rocks of the tributaries of the Guadalquivir River in the Sierra Morena. Groundwater is more important in the Baetic Systems than in Sierra Morena since the substrate in this latter is predominantly impermeable (Instituto Tecnológico Geominero de España et al., 1998).

The variations of temperature with the altitude determine the existence of several bioclimatic belts (figure 1) that, in the Mediterranean region, are called: thermomediterranean (0 / 700 m), mesomediterranean (700 / 1200-1400 m), supramediterranean (1200-1400 / 1850-1950 m), oromediterranean (1850-1950 / 2650-2700 m) and crioromediterranean (above 2700 m), each one with a particular type of plant community. This sequence of belts was established by Rivas-Martínez (1983) and some details of their characteristic plant indicators in Sierra Nevada, where all the belts are present, were recently presented (Molero et al., 2016).

The vegetation of the mountains of Andalusia belongs, in general, to a community called Mediterranean forest, a formation characterized by the dominance of hard-leaf and evergreen species such as holm oaks (*Quercus rotundifolia*) and cork oaks (*Quercus suber*), which are adapted to heat and summer drought, but also to the possibility of frost in winter. The cork oak is mostly located in the first two belts, especially in siliceous soils and humid climate. Other species of the genus *Quercus* are present in specific microhabitats and substrates (*Quercus pyrenaica, Q. canariensis* and *Q. faginea* are the more remarkable).

In Sierra Morena and, above all, in the Baetic System, each mountain range and each bioclimatic belt has its particular community of herbaceous and shrubby plants; this results in an impressive mosaic of biodiversity. Most of the species of vascular plants reported in Andalusia (more than 4000) are present in their mountains. The greatest diversity is concentrated in the Baetic System; for example, in Sierra Nevada there are about 2000 species, representing the highest diversity of plants in a mountain range of the Western Mediterranean (Blanca et al., 1998). A high percentage of these plants (about 400 species) are endemic to Andalusian mountains. Flora and fauna species richness is high even in apparently unfavorable biotopes, such as screes (earthy-stony slopes called “canchales” or “pedrizas”) and fissures of vertical cliffs, etc.

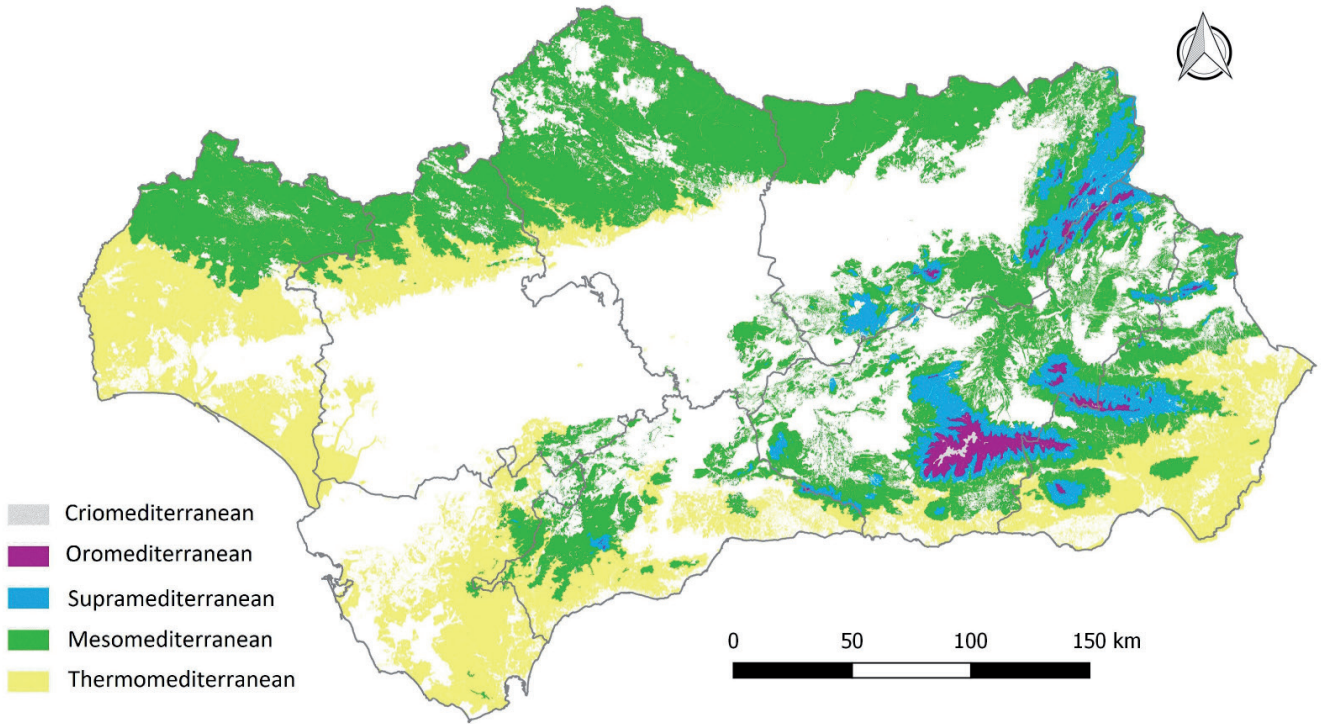

Figure 1. Bioclimatic belts of vegetation in Andalusia. Source: Ministry of the Environment. Andalusian Environmental Information Network (REDIAM), 2009.

More than half of the approximately 600 species of vertebrates of the Spanish fauna are present in the mountains of Andalusia, although unfortunately many of them are threatened and included in the Red Book of the Threatened Vertebrates of Andalusia (Franco & Rodríguez, 2001). Although most of vertebrates of Andalusian mountains cannot be considered endemic or exclusive to this geographical area, the high conservation value of these animals is unquestionable because Sierra Morena and the Baetic System often represent the main refuge for many of these species in Spain and even in Europe. However, the higher contribution to animal biodiversity in ecosystems is provided by invertebrates (Ruano et al., 2013).

The soils of mountain areas are less developed in general than those of plain areas, such as the Guadalquivir valley. Only the soils of intramontane depressions and bases of slopes are suitable for agricultural activities. The rest of the land, due to its high slope, has shallow soils (a high proportion of inceptisol type) in which the geological substrate has a high prominence. In the Internal Zones of the Baetic system, soils are developed mainly on limestone rocks, in some areas also on loam and gypsum. In Sierra Morena and some areas of Penibaetic mountain range, where the siliceous substrate predominates and the soils are acidic, some suitable uses are the exploitation of cork from cork oaks and extensive livestock associated with Mediterranean grasslands ("dehesas"). All these mountain areas are also suitable for other forestry activities (timber logging, harvesting aromatic and medicinal plants and fungi), hunting, conservation areas of nature, recreational expansion, beekeeping, etc.

Agricultural activities in these mountain areas have often been managed inadequately. The vegetation does not regenerate as quickly as in other areas of the Atlantic slope climate variables. Agriculture in high slope areas has led to the degradation of vegetation on many hillsides of these mountains. However, the regression of the vegetation that has occurred in these areas during the last centuries has favored soil erosion, leading this fertile layer to be washed away by the rains. To the inadequate agricultural and forest management has been added the overgrazing (especially with goats, that particularly hinder plant regeneration). Recently, other activities have added to the degradation of mountain ecosystems, such as the overexploitation of aquifers, the excess of fertilizers and pesticides that have contaminated these bodies of groundwater, clogging of many reservoirs as a result of accumulation of materials from erosion of their basins, etc. (Ledesma, 2017).

Finally, it is worth highlighting the high vulnerability of the Mediterranean mountains to global change (Escudero, 2012). Their ecosystems act as carbon storage and are climatic, hydrological and morphosedimentary regulators, at the same time that they provide important natural resources and have become as supports for tourism and leisure activities. Climate change constitutes a threat to the livelihoods of the population and its important contribution to the conservation of biodiversity and the conditions that allow mountains to play the valuable role of water sources. Climate models predict for Mediterranean mountains a reduction of precipitation, mainly during spring (Nogués et al., 2008), representing an evident concern for the future of ecosystems and the population settled in these areas.

Considering the exceptional natural values of these mountains ranges (Gavilán et al., 2013), it is not surprising that they have been a preferred objective of nature conservation policies. The protection policies became effective as of 1989, when the Inventory of Protected Natural Areas of Andalusia (ENP) was approved, and several natural sites and habitats were designated.

The most important category of ENP in Andalusia is the Natural Park, a large territory that can include natural reserves, but also towns and areas modified by human activities. In Sierra Morena there are currently six Natural Parks that form a practically continuous band following the axis of the mountain range from west to east, with some empty spaces which are proposed as Sites of Community Importance (SCI) that correspond to the spaces integrating the European network Natura 2000 (figure 2), including Special Protection Areas (SPA) for Birds (ZEPA) and Special Areas of Conservation (SAC). Recently, the category of Biosphere Reserves has been incorporated with the declaration in 2002 of *Dehesas de* Sierra Morena, which extends over 424 400 ha.

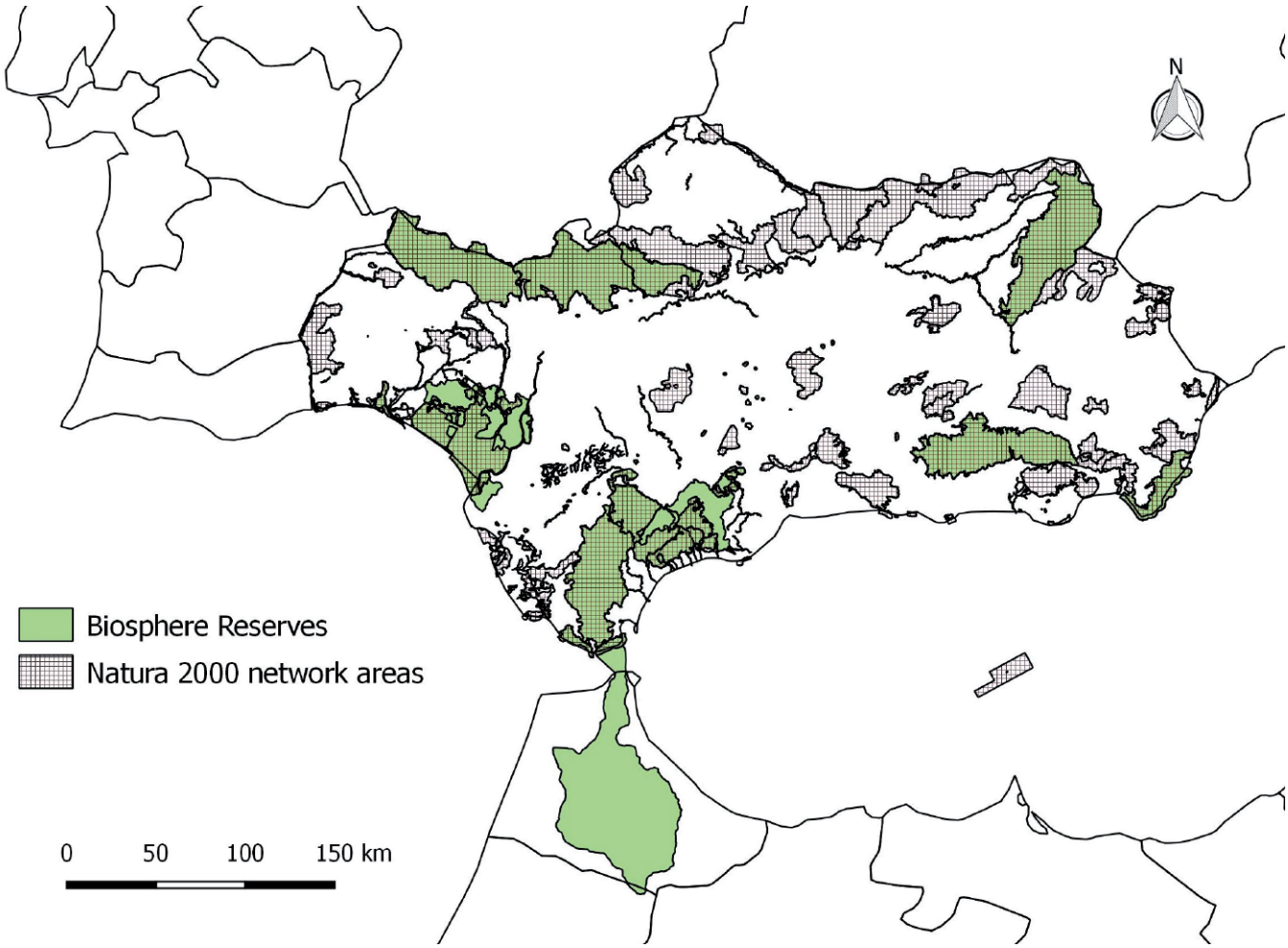

Figure 2. Map of the Protected Natural Areas of Andalusia (Southern Spain). Source: Ministry of the Environment. Andalusian Environmental Information Network (REDIAM), 2009. Modified from RENPA (web of Environmental Agency of the Andalusian regional government).

Likewise, a rosary of protected areas with different categories is established in the Baetic mountain ranges; among them, the existence of the Sierra Nevada National Park stands out, which occupies 86 208 hectares and where the two largest peaks of the Iberian Peninsula are located: the Mulhacén (3479 m) and Veleta (3392 m). Another National Park, Sierra de las Nieves, has been established recently (June 2021). The areas declared as Natural Parks are eleven and, as in Sierra Morena, other protection categories like the SCI, ZEC or ZEPA are superimposed. In 2006, the UNESCO Bureau of the MaB Program (Man and Biosphere) established the Intercontinental Biosphere Reserve of the Mediterranean (Spain-Morocco) including western areas of the Baetic mountains.

2.2. Cultural landscapes and current challenges

The Mediterranean mountains are not only natural ecosystems, but socioecological systems, constituted by the productive activities that human societies have developed in them, such as agriculture, livestock, forestry, or mining. Thus, in addition to biodiversity, the Mediterranean mountains contain an enormous cultural capital that increases natural values.

The population keeps and applies a wealth of knowledge and practices that has allowed living and producing for centuries in ecosystems of great climatic stress. In these spaces, diverse cultures converged, thus the Baetic System area has an extended Muslim heritage, with white villages strategically located in valleys and mountain ranges of difficult access and that formed regions of Mudejar and Moorish roots such as the Axarquía or the Alpujarra. Others, such as Sierra Morena, established, after the weak Christian repopulation, an extensive exploitation of its agricultural resources. In both cases, the agro-sylvo-pastoral uses that were implemented in other times are still observed (Valle, 2016).

However, these cultural landscapes are severely compromised, as traditional activities and the population that was their sustenance are disappearing, either because of the loss of economic profitability of these activities or because of the migration of their inhabitants from the villages of the mountain to the cities of the valleys or the coast.

Paradoxically, the decrease in human pressure on these mountains has generated changes in the use and coverage of the soil. Two examples are the recovery of forest areas (Jiménez, 2015; Gutiérrez, 2016) under the institutional environmental protection and the spread of less humanized landscapes such as hunting areas, and the extension of the mountain olive grove, or even the degradation of nearby lands closer to the towns due to their intensive use or the urban pressure related to the extension of second residences.

Thus, nowadays we meet spaces where new uses related to conservation values are promoted, compared with the past where anthropic action was more intense. These values acquire new points of view since The European Landscape Convention and the new perspectives introduced by the consideration of cultural landscapes, the appreciation of biodiversity or the tendencies of neo-rurality. So, the maintenance of the protected areas of the southernmost Mediterranean mountains in Europe must be complemented with strategies for preserving traditional agricultural landscapes through conservation mosaics that protect biodiversity. In this sense, Perfecto & Vandermeer (2012) defend the position of the integration of conservation-production from an agro-ecological perspective.

These spaces are depositories of an extraordinary peasant culture, of the existence of an important cultural heritage –material and immaterial– that represent an element of identity and, also, can act as a guarantee of conservation. They are strategic territories to promote models of sustainable development, ensuring the permanence of their population and their quality of life, although they have been considered more as a protection than as a sustainable model.

Despite such spaces have exceptional resources and an important cultural heritage, this has not led to reverting the recent recessive demographic dynamics (Luque, 2006) in a sustainable local development (Gómez, 2016) or in the existence of an adequate model of environmental education, given the extraordinary value of example that these spaces have as a model for teaching (Ojeda, 2001) and the design of educational strategies at different levels.

Taking what is discussed in this section, it is remarkable the notable geographical disparities, so that an important imbalance between the isolated mountain areas and the most populated centers in Andalusia is a fact, even from an educational point of view. This imbalance is widespread also over most areas of Spanish mountains (Collantes, 2004) and over many other European mountains (McNeill, 1992).

In conclusion, people living in these places are the real social agents of the territory and have the key to promote a sustainable development and stop the cultural degradation to which the populations and their surrounding landscapes are subjected. It is essential to induce endogenous processes of dynamization, associationism and promotion of the local entrepreneurial culture. However, an economic synergy must run parallel to encourage an educational and cultural dynamism, based on different cultural identities that depend on the recognition of the region's particularities. The integration of women in the socio-economic and cultural sphere or the increasing social integration of the foreign population (particularly large in regions such as the Alpujarra or the Axarquía) are other social aspects that should not be forgotten.

3. METHODOLOGY

Even though educational administrations have tried to value the natural and sociocultural heritage of these areas in the curricula, shortcomings have been detected in practice, such as the reduction of core content in environmental matters in Andalusian educational system or the underutilization of many environmental infrastructures within protected areas. In this sense, the Andalusian Education Law (2007) and the subsequent legislation that develops the curriculum of Secondary Education barely contain any references to the natural landscapes of Andalusia and none to the Andalusian mountain areas.

In both formal and non-formal education, learning is more significant when direct contact is made with reality than when the contents are developed in the classroom. The reality closest to the student is their physical, natural, and social environment. But often, the didactic resources that transmit information to him come from very distant places. Contacting the physical environment motivates students and stimulates their diverse abilities. Because its potentiality for multidisciplinary assessment of the learning process of students, teachers can take advantage of outdoor and active learning for developing multiple skills (or intelligences, according the multiple intelligences theory of H. Gardner) that are usually ignored in the routinary work in the classroom, such as activate the visual-spatial or naturalistic intelligences (Gardner, 1999). Such skills are suitable for being developed in outdoor didactic experiences since information arrives to the student by different channels.

In this work we start from the great didactic potential (De Castro, 2016; Jerez, 2017; Alcalá del Olmo, 2020) of the natural and cultural resources that occur in Andalusian mountains. It is also necessary to outline the methodology that allows responding to the current socio-educational situation.

An inductive research strategy has been followed to obtain qualitative information to understand the realities constructed by the different actors that take part in the development of educational policies in the studied region. Given the great multitude and heterogeneity of the factors that intervene in the analyzed facts, a broad approach has been used to include postulates from both the Experimental Sciences and the Social and Human Sciences. The sources of information used have been very diverse depending on the different stages of the investigation.

The literature consulted focuses mainly on the protected natural areas that have been the most valued in terms of their educational potential in Andalusia (Consejería de Medio Ambiente & Consejería de Educación y Ciencia, 1998; Consejería de Medio Ambiente & Consejería de Educación, 2007; Ojeda, 2001; De Castro, 2016; Jerez, 2017), both from the natural spaces of Sierra Morena (Roselló & Muñiz, 1996; Pedrera et al., 2003), and from the Baetic System (Cuello, 2000; Cabrera et al., 2010; Pérez-Muñoz, 2017) or coastal areas (Mendoza et al., 1997; González, 2010; Castaño & Agudo, 2013). On a national scale, the works of Cuello (2006), Carrero et al. (2011), Serrano de la Cruz et al. (2016), Serrano Gil & Fernández (2016), Jerez & García (2017) and Fernández et al. (2020) have been considered. Finally, with an international scale, the following works have been consulted: Pellegrini (2002), Oonyu (2009), Ferreira (2012), Stern & Powell (2012) and Martínez & Márquez (2015).

For the identification of the environmental education strategies that concur at the european, national and regional levels, bibliographic sources have mainly consulted (table 1). We have also used at the regional level some statistical and cartographic sources, most of them available in the websites the Regional Ministry of Agriculture, Livestock, Fisheries and Sustainable Development of the Regional Government of Andalusia, especially the REDIAM website.

Table 1. Bibliographic sources of information at different scales consulted for this study.

Scale	Documents	Year
European	2030 Strategic Framework for Education and Training	2021
European	8th Environment Action Programme (EAP)	2020
National	Guidelines of the National Center for Environmental Education of the Ministerio para la Transición Ecológica y el Reto Demográfico	1987-2022
Regional	Environmental Information Network of Andalusia de Consejería de Agricultura, Ganadería, Pesca y Desarrollo Sostenible	2006-2022
Regional	Andalusian Strategy for Environmental Education	2004-2010
Regional	Aldea Environmental Education	1997-2022

Source: Own elaboration.

Field work was necessary for the analysis and detection of the difficulties presented by these strategies and programs, so different facilities of the Natural Parks (public use areas) managed by the Regional Ministry of the Environment were visited, especially the Visitor Centers and educational facilities (Nature Classrooms) (table 2). The Nature Classrooms located within the Andalusian Mediterranean Mountain are only nine and are concentrated in the Baetic System; they are absent in Sierra Morena (figure 3).

Oral interviews without questionnaires were conducted with the staff of the nine Nature Classrooms represented in figure 3 and several of the Public Use Facilities were also visited. Oral interviews with the workers of these spaces, the analysis of very diverse materials such as brochures, printed programs, posters, or the information collected in the respective websites constituted the main sources for a critical analysis of the educational strategies related to the Mediterranean scrubland.

Table 2. Nature Classrooms visited for this work in the Mediterranean mountain areas of Andalusia (their location is given in figure 3).

Name	Mountain Area	Municipality
Paredes	Sierra Nevada	Abla (Almería)
Higuerón de Tavizna	Sierra de Grazalema	Benaocaz (Cádiz)
Narváez	Sierra de Baza	Baza (Granada)
Humedales del Padul (El Aguadero)	Sierra Nevada	Padul (Granada)
Ermita Vieja	Sierra Nevada	Dílar (Granada)
Las Contadoras	Montes de Málaga	Málaga
El Hornico	Sierras de Cazorla, Segura y Las Villas	Pozo Alcón (Jaén)
Vadillo	Sierras de Cazorla, Segura y Las Villas	Cazorla (Jaén)
El Cantalar	Sierras de Cazorla, Segura y Las Villas	La Iruela (Jaén)

Source: Own elaboration.

The final section of the discussion and assessment is based on hypotheses and similar experiences in the educational and environmental field, as well as the evidence collected by the authors. In this section, proposals and designs of educational strategies are given to solve the difficulties detected.

4. RESULTS AND DISCUSSION

4.1. Strategies for the appreciation of areas of the Mediterranean mountains

Although the educational and cultural dynamization in the Mediterranean mountains does not receive an individualized treatment, it is included in a set of guidelines capitalized by different national and regional organisms that have as reference the educational and environmental directives of the European Union. In this section, the existing environmental education strategies at European, national, and regional levels are analyzed and assessed.

The *2030 Strategic Framework for Education and Training* considers with an integrated perspective on lifelong learning as a priority, which must encompass all education and training systems at all levels and contexts, including non-formal learning and continuing education. It must be remarked that these aspects are transcendental in the search for ecologically and ethically sustainable models (Novo, 1996), particularly in those where the school population has been considerably reduced. This strategy seeks to maximize human resources and local agents in the management of natural spaces. This entails strengthening educational policies, with the aim of making equity, social cohesion, and active citizenship a reality. In addition, a full incorporation into the digital era would facilitate the development of synergies between the different sectors involved.

The environmental policy of the EU up to 2030 is guided by *the 8th Environment Action Programme (EAP)*. This program is reduced to six main objectives with respect to its homonym of 2020 and does not reflect the promotion of knowledge of the environment that was included in the fifth objective of the nine that were incorporated in the 2020 EAP. However, in both EAPs priority is given to the transfer of knowledge of environmental changes, not only to political managers, but also to the entire citizenry, which is required to commit to the transition to an inclusive green economy. This promotes a shared interaction between science, environmental policy and citizenship that allows accessibility of data and the intensification of international cooperation in this area.

At the national level, the Ministry for Ecological Transition and the Demographic Challenge of Spain's government is involved in environmental issues and promotes environmental education through CENEAM (National Center for Environmental Education). Among the different programs that it foments, those related to environmental training in the National Parks can be highlighted. Dedicated to the students, several educational programs are offered: "CENEAM with the School", "Recovery and Educational Use of Abandoned Villages" or "Volunteering in National Parks". With the aim of facilitating environmental awareness, there are programs such as *Hogares Verdes* ("Green Homes") and a good number of itinerant exhibitions as didactic resources. Although the objective of these programs tries to cover a national scope, only few of them are developing within the territory of Andalusia, since the Andalusian regional government has split the environmental and educational policies and strategies into two separate institutions (Regional Ministry of Environment and the Ministry of Education).

The Ministry of Agriculture, Livestock, Fisheries and Sustainable Development of the Andalusian government has developed since 2007, the Environmental Information Network of Andalusia (REDIAM), which aims to integrate, normalize, and disseminate all information on the Andalusian environment. Through the Andalusian Strategy for Environmental Education (EADEA), the regional government promotes recommendations to the public administration, the education system or companies and organizations. As instruments to promote these goals, it has different Environmental Education Centers, such as the Nature Classrooms and different Farm-Schools, which act fundamentally as supports of educational resources for the school community (figure 3); in addition to an Environmental Volunteer Program. In the same Visitor Centers of the protected areas (ENP), the companies that tender these facilities design in their respective Management Plans their own dynamization projects, which include not only routes, but workshops, courses or exhibitions related to traditional ways of life, conservation of habitats, etc.

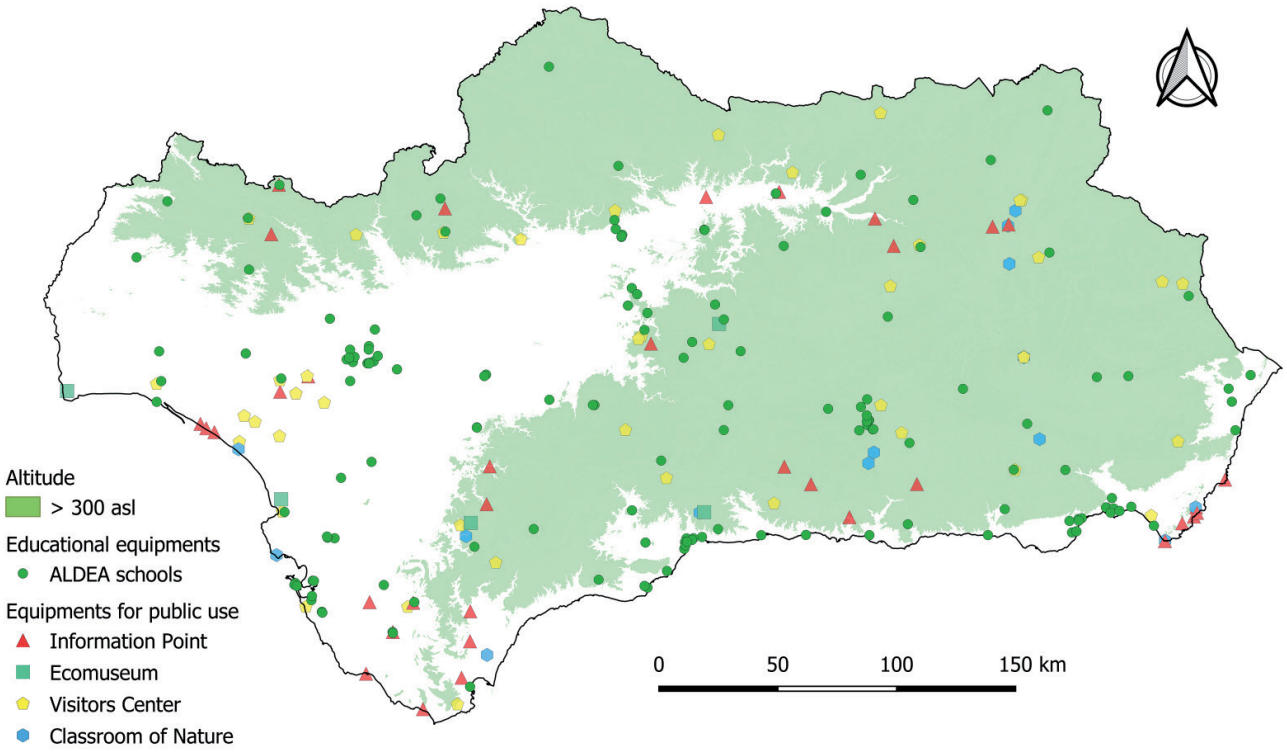

Figure 3. Map of educational equipments and facilities for public use and for the school community in Andalusia. Source: Own elaboration.

But the most ambitious and important program is the *Aldea* plan (Environmental Education for the Educational Community). It is a tool for the development of competences in the field of environmental education, through the development of contents related to climate change, the conservation of biodiversity or the knowledge of the ENP of Andalusia in the center projects of the schools and institutes. Currently, the following projects and actions are being carried out, among others:

- Climate change (Terral Project)
- Waste and recycling (Recapacicla Project)
- Organic school gardens (Ecohuerto Project)
- Forest ecosystems and wild flora (Seed Project)
- Conservation of birds and their habitats (Educaves Project)
- Environmental Education in Sierra Nevada (Sierra Nevada Project)
- Knowledge of the protected areas of Andalusia (Nature and you)

School participation and the implication of teachers in the *Aldea* plan have been growing gradually, since the early 90's when this program started, so that during the school year 2016/2017 the Regional Ministry of Education reported that 936 schools were involved with 20 805 teachers and 249 024 students. Figure 3 shows the distribution of equipments with an educational purpose that the Regional Ministry of Environment has available for public use. On the other hand, the educational centers that carry out environmental activities are located and publish them in their respective blogs, within the *Aldea* educational website. The elevation of 300 m.a.s.l. marks in the map the beginning of the Mediterranean mountains within the thermo-Mediterranean bioclimatic belt and, both public facilities and centers located above this level are scarce within the Sierra Morena. In the Baetic System, a greater density appears, although the existence of wide empty spaces is observed. Undoubtedly, the smaller number of educational centers is related to the distribution of population settlements, lower in Sierra Morena.

Now, relating the total of centers located in the mountain areas with those that carry out environmental activities, a high proportion of those located in the mountain is found, since approximately half of them (63

of 148) develop environmental activities, unlike the rest of the Andalusian centers, which in a much lower amount (85 of 3716) participate in these programs. However, it should be considered that, although half of the centers offer these activities, they are a limited percentage, considering that, in mountain areas, where urban areas are scarce and agrarian or forest uses predominate, education environmental should occupy a more relevant place, but without overlooking environmental education of urban students Ferreira (2012). But this difficulty detected, together with some others, will be discussed in the next section.

4.2. Difficulties detected

After reviewing the budgets of environmental regulations, the complexity of environmental education is first noticed, where physical, human, and pedagogical elements of a different nature are interwoven and require a broad and multidisciplinary treatment. Problems of an epistemological nature are also evident, even in the very definition of what are plans, projects or programs (Lasalle, 2017) and which cause difficulties when analyzing environmental policies and actions.

Trying to solve the initial questions warns that all the answers to them can't be found in the available information.

In the first place, it is noticed that the guidelines of the public administrations are very general and from them, a list of numerous and extensive plans arises in terms of their subject matter and the levels of population that they reach. Given the main strategies in environmental education (European, state, and regional) it can be concluded that there is a convergence in terms of the objectives pursued and, above all, the priority consideration of the extension of environmental training to all contexts, with an integrated perspective of lifelong learning. But, although there is similarity in the programs and projects that are promoted, there is no connection between them, or even between the institutions that promote them. The Andalusian Strategy for Environmental Education has had little development in the area of the Regional Ministry of Education, with the exception of the *Aldea* plan.

Regarding to the existence of a differentiated treatment in terms of the educational planning of specific protected areas, such as those of the Mediterranean middle mountain, it is found that there is no such spatial differentiation. Thus, the Regional Ministry of Education does not differentiate in its educational planning any specific proposal centers that are located on the mountain or to other environments, for example, the urban areas.

An attentive analysis of the curricular designs of the different educational stages deserves a separate study, since the differentiation of the Andalusian landscapes, and particularly the mountain ones, do not take their rightful place either. Thus, there is a shortage of specific educational plans that act with specific objectives and contextualized activities in curricular areas. That is why, sometimes, it can be said that many activities that are organized have a merely recreational purpose, decontextualized from a wider educational framework.

On the educational level, there seems to be more and more coincidence between conservation groups and educational administrations, not only in the achievement of general objectives. There is a greater confluence in common spaces, such as schools, nature classrooms, etc. On the other hand, the figure of a committed faculty (Stern et al., 2012) with environmental education in the classroom and who, at the same time, militates in conservation groups has been increasingly frequent. These relations can be considered within an informal educational context, although they also overlap with formal education in the type of extracurricular or complementary activities that are common to different groups. A lack of interdisciplinary and inter-institutional teams and a deficiency of specific and qualified personnel have been detected. Also, there is an absence of common agendas and the efforts dedicated to teacher training can be improved.

And although this study has not considered the analysis of environmental education at a scale as small as the municipal one, it can be verified that initiatives at this scale do not propose long-term programs or broad territorial development. This has been verified through various communication channels such as the press, institutional portals or dissemination lists, municipalities, agrarian associations, companies, and

other entities involved with environmental education. They usually limit themselves to proposing short term and reduced scope activities, such as the development of local or regional days or campaigns that also coincide with the defense of their interests. The recognition of environmental education as a relevant factor for change by the respective social and administrative agents is scarce, and the environment is referred to as essential, but the necessary economic or political support is not given.

Regarding the diverse educational materials and informative products (educational didactic units, brochures, documentaries and audiovisual pieces, exhibitions, and panels, etc.), it can be said that they are very heterogeneous and sporadic, and do not cover the complete the extension and the diversity of the Andalusian mountains. There is also no adequate registry and distribution channels, except for scientific works, and this results in the low transcendence of these materials, many of them with only repercussion at the local or provincial level.

The focus of actions and programs of the administration is excessively directed to naturalism and oriented towards the school population and visitors of protected areas (ENP). Many activities are punctual, they do not have permanence in time. Neither is a connecting thread that relates the plans, projects or programs with the edition and dissemination of educational didactic units or other informative products: workshops, audiovisuals, panels, and other supports, although this difficulty is very common because it is detected in other spaces education, not only in Andalusia (Carrero, 2011). In addition, the activities organized by the different institutions often lack sufficiently explicit objectives, so that those attending them are not always aware of their purposes (Cuello, 2006). Nor are cultural itineraries worked in the sense proposed by ICOMOS, Charter of Cultural Itineraries, prepared by the International Scientific Committee of Cultural Itineraries (CIIC). This Charter highlights a new ethic of conservation that considers the values of cultural heritage as a resource for sustainable social and economic development.

Finally, environmental education programs have no continuity in the lives of people, and although they are usually effective at school age (Alcalá del Olmo, 2020), their influence is diluted as adulthood increases the pressure of the consumerist society. Another consideration is that the community does not understand the objectives, neither the effectiveness of the activities carried out because the benefits generated by environmental programs are rarely explained. There is also a lack of monitoring and continuity in the implementation of proposals and programs carried out in different education levels.

4.3. Proposals for improving detected shortcomings

These proposals are listed in the same order as the difficulties detected:

It is necessary a coordination of public resources and institutions, both from the horizontal point of view, between different Councils of the Regional Government of Andalusia, as vertical, between different administrations, without forgetting the promotion of strategic alliances with other public and private institutions, connecting regional, national, and international planning. This coordination should focus on general educational policies that encourage not only recreational uses of mountain areas, but also scientific knowledge that should be extended to the entire population at different educational levels (Pellegrini, 2002; Oonyu, 2009), incorporating formulas for citizen participation that enable points of union with the Administration and its officials. It is also necessary that the curricula of the different educational stages explicitly include the differentiation of Andalusian landscapes, and particularly mountain landscapes, so that the y occupy their rightful place, given not only their superficial extension but also their scientific importance. From there, specific educational plans that act with specific objectives and contextualized activities in curricular areas would be proposed. The training proposals should be adapted to the peculiarities and needs of rural environments, in line with the needs of the territory and its local production systems. Regulated training must be integrated with specialized complementary training that could allow the creation of local employment with low impact socio-productive activities that can be linked to local ancestral activities (agricultural and livestock production, handicrafts, etc.).

Educational strategies should adhere to conceptual bases that promote:

- Permanent and open environmental education processes, which include all stages of life and areas of education, not just regulated or formal.
- Development of differentiated and specific educational plans for different areas of the Andalusian mountains, based on previous studies that consider the local problems and shortcomings of each one of them.
- Educational strategies that start from a multidisciplinary approach, considering the cognitive, procedural, and attitudinal dimensions.
- From the conceptual point of view, we must contribute to renew traditional contents, incorporating knowledge of the concepts of sustainability and the impacts of climate change.
- At the procedural level, it is necessary to promote learning through conflict resolution that allows the identification of problems, gaps or needs so that specific educational plans can be designed in different protected areas such as mountain areas.
- The transmission of knowledge is not enough; it is necessary to emphasize environmental education as an individual and collective value, thus facilitating environmental governance and the citizen's participation, seeking the assumption of agreed commitments. In this way, identities are created and relationships with the territory are translated into a series of behaviors and attitudes. Population becomes empowered by renewed educational policies and can feel anchored to their territory and act in defense of their identity and traditional ways of life.

Educational policies should include teacher training as a fundamental pillar, together with training for people involved in environmental education, technicians, and administration staff. All these groups may be involved in promoting social dynamization and participation, so that there is a much greater impulse in the appreciation by citizens of mountain areas and their cultural heritage, considering this a vital part of its territory, and as an important asset of rural development in harmony with nature. The local community must also be involved in the design of these educational programs. In this point, it should not be forgotten the role of the urban population visiting these ENP.

Collaboration between local (public or private) entities, with regional, national, and European institutions, with universities and research centers, in common projects that allow improving the position of these spaces compared to other more dynamic territories is essential. The promotion of R&D&i and research for sustainable development in mountain areas is essential in collaboration with universities, companies and other institutions in common projects that allow improving the position of these spaces and also their endogenous potential in front of other more dynamic territories, such as urban or coastal areas.

Regarding educational materials and informational products, it is proposed that the public and educational services of Andalusia incorporate into their facilities the necessary means to host these productions, adding to their functions to become documentation centers for the spaces they make up. This could solve the difficulties derived from not having adequate registries and distribution channels.

Carrying out environmental education activities, even if they are abundant and involve the transmission of information on knowledge related to the Andalusian mountains, are insufficient without the design of educational strategies that maintain a common thread that relates the activities published, offered, and disseminated with plans, projects or programs promoted by local, public, and private entities. The objectives of these activities must be sufficiently explicit and must include as a priority the purpose of creating affective ties with the territory and that they translate into a series of behaviors and attitudes of a population that, having been empowered by renewed educational policies and make the territory yours and act in defense of your identity and traditional ways of life. It is also necessary to promote a new conservation ethic in activities that considers the values of environmental and cultural heritage as a resource for sustainable social and economic development in the sense proposed by ICOMOS.

In order for environmental education programs to have continuity in people's lives, they should be directed to schoolchildren and their families, involving adults in the definition of future scenarios as proposed by the model called "scenario planning" developed for environmental management by the James Hutton Institute in the framework of the COMET-LA project of the seventh EU framework program. The absence of

monitoring and evaluation plans, as well as the lack of continuity in the activities and programs carried out in different schools, could be alleviated by incorporating the necessary facilities and personnel into the educational infrastructures and basic equipment, located in mountain areas. This does not only make effective the teaching-learning processes related to the appreciation of the particularities of its territory but is also capable of undertaking follow-up measures of the actions initiated, with the appropriate measures and indicators of the achievements obtained.

Among the main expected results of the proposed educational strategies must be found to have led to a social change in mountain areas that promotes the synergistic definition of development and conservation in a self-sustained way over time. It is about putting into operation new social processes, for example, local participatory forums open to all ages, that empower the population and make it a participant and protagonist of the definition of its own future in congruence with the conservation of its environment.

If the start-up is achieved, these processes should continue after the project itself in the nonstop work of the community school that we can involve with actions and strategies that are projected in a long-term systematized scenario, with guarantee of permanence and continuity.

This is not possible only on the educational level if a transition model is not promoted. The change should start in the underdeveloped and decadent mountain communities that, at the present, follow a regressive economy based on the consumption of resources and the generation of negative environmental impacts. The transition should lead to an efficient economy based on fixed assets and resilient to changes of external origin that allows address the degradation of the ecosystems.

5. CONCLUSIONS

The Mediterranean mountain spaces in the south of the Iberian Peninsula have an incalculable value from the scientific point of view as well as in the economic, social, and cultural level. Some aspects of their natural diversity remain undiscovered, they include unique cultural landscapes and have great educational and environmental potential.

From the perspective of environmental education, and considering the dysfunctionalities or shortcomings detected in educational policies and projects that focus on the Andalusian Mediterranean mountains, this study has revealed the lack of integration of the different scales of action and, as a contribution to scientific and integrated knowledge, proposes a series of actions to improve the position of these spaces in the region as a whole.

The educational strategies are a fundamental instrument for the resolution of any kind of environmental, social, or economic problems of the territory, and therefore they must be present in each plan, project or norm intended to mountain areas. These strategies should try to be specific, considering each space, according to its recipients, according to the needs or problems that are intended to be resolved. For this, a novel territorial policy with a renewed institutional management is essential.

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