Environmental valuation by the local population and visitors for zoning a protected area

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Abstract

Protected natural areas have traditionally played an important role in tourist destinations. There are over one hundred thousand of these areas throughout the world and to date, their landscapes and biodiversity have constituted the main factor attracting visitors. Although these components have not lost their power to attract, many tourist destinations now highlight the relationship between nature and traditional culture. On one hand, the planning and management of natural areas have fundamentally been based on biophysical aspects; hence, their name. But, on the other, the socioeconomic perspective is of great importance and should be incorporated further into this management. The professional field of the sciences of 'nature', which so far has played a major role in these areas, along with the disciplines of social sciences and humanities, faces the challenge of integrating their analysis methods, which can be directly applied to an understanding of the dynamics of present-day tourism. This integration could consider protected areas and territories beyond their physical boundaries. Our team, with experience in the development of environmental analysis models applied to the zoning and subsequent declaration of these areas, has proposed a new procedure for evaluating carrying capacities and tourism potentialities, integrating environmental (landscape), anthropological (local society and visitors) and socioeconomic (living standard and quality of life of local population) perspectives. The research relates this kind of components through multivariate analyses, geo-referenced databases and questionnaires. The pathway

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of the model is landscape functioning (ecosystem) and its function for society (ecosystem services).
Keywords: carrying capacity, cultural landscape, environmental planning, landscape assessment, local population preferences, natural landscape, protected area, tourism, visitors' preferences.

1 Introduction

Environmental land planning constitutes a previous framework that should be available for administrative policies and, within these, for decision-making and specific protocols for managing natural resources. These resources are material ones, such as those relating to mining or agriculture, energy, like coal or wind, and spatial ones, such as the different manifestations of the landscape. Both the historical and current forms of use of these resources, as well as the socioeconomic relationships at play, provide the cultural resources of the territory. These forms and relationships constitute an 'added value' which can be of great importance in counties that are economically quite undeveloped, and they are unequivocal actors in the function of the landscape in territories developed under the auspices of different policies.

The present paper addresses the interaction of three scopes: environmental planning of a territory, zoning of a new protected area into the activities provided for this territory, and perception of this new activity by society. The territory (i) involves the island of Fuerteventura (Canary Isles), which is of great interest to tourists, mainly from Europe. The protected area (ii) will be a national park to be added to other protected spaces on the island. As for the society, (iii) considering that economic activities, in particular tourism, call for natural resources to be well safeguarded, we incorporated:

- perception of the resources of the island's landscape by its users, both native and resident, on one hand, and visitors on the other.
- the quality of life and standard of living of these local populations.

We considered the pre-existing socioeconomic activities, as well as the new ones, weighing up the pros and cons of their spatial localisation.

A territory is rarely homogeneous (Forman and Godron [1]) and each place presents different carrying capacities; thus, on the one hand, there is a need for a Cartesian, a cartographic, framework showing the natural and cultural features of the landscape and, on the other, decisions ought to contemplate the localisation of the new land uses. That is to say, the situation of each new activity should consider this capacity of the territory, foreseeing the environmental costs and benefits involved − see, for instance, the classical studies by McHarg [2] and Leopold *et al.* [3] or, among more recent ones, Montalvo *et al.* [4]. Among the socioeconomic activities, the tourism industry not only calls for increasing involvement by the economy of practically any given country; rather, the success of tourist destinations requires careful planning and management of the land uses. Conservationists are becoming increasingly vehement in calling for natural areas to be protected, given the different capacities of territories to harbour different activities, and there is increasing demand for cost and benefit analyses

(SCBD [5], Le Saout *et al.* [6]). Moreover, these areas are in themselves a tourist attraction (Schmitz [7]), are therefore constitute very important elements in planning and analysis of sustainability. Our research is related to the interest of the Canary Isles Regional Govt. in declaring a national park in Fuerteventura. For ecological and economic reasons, as well as the attractiveness of the island for tourism, there is a pressing need to protect the natural and, in general terms, landscape values of this territory.

2 Planning with people

Fuerteventura is the second biggest island in the Canary Isles (1,731 km^2). Together with Lanzarote, its morphology is relatively flatter than that of the other islands, due to its geological age and the role played by the accentuated erosion in shaping the landscape (Hernández [8], Paredes and Rodríguez [9], Pineda *et al.* [10]). The climate, quite unaffected by the action of the Trade Winds, is more uniform than on the other islands (it is a desert climate and the key to a homogeneous landscape; Matos *et al.* [11]). In the last three decades, tourism has become an activity of growing importance in politics, orienting the island's current socioeconomic development, and notably influencing the character and personality of the rural cultural landscape, typical of an island with a desert landscape that to date has been quite unpopulated (Burriel [12]).

2.1 Planning and ecology

The different schools of geography have historically developed systems for sectoring a given territory by means of different methods. When ecologists have studied the carrying capacity of a region providing for new land uses, they have classically estimated this capacity by orienting the sectoring towards an analysis of the correspondence between the 'intensity' of foreseen disturbances (those of the new uses) and the 'severity' of these, that is to say, their incidence taking into account the ecological characteristics of the territory. This involves features resulting from mesoclimate, lithology, vegetation, hydric flows, etc., including cultural parameters such as existing agricultural uses, industrial facilities, etc. (McHarg [2], Leopold *et al.* [3], Pineda *et al.* [13], Roberts and Roberts [14]).

All these features can be considered as environmental 'themes' that can be mapped, and upon whose spatial units can be estimated the ecological reaction to new land use perspectives. The reaction provides information on the 'impact', ecological cost or benefit of each use in each theme (partial or thematic impacts of new uses; Leopold *et al.* [3], Pineda *et al.* [13], Hernández and Pineda [15]). Calculation of coefficients to characterise each thematic reaction to each hypothetical use enables us to weight the responses of the territory and to establish the magnitude as a weighted sum (the renamed 'environmental impact assessment'). This weighting enables us to estimate and map the carrying capacity of each of the sectors of the territory as objectively as possible (Montalvo *et al.* [4], Ruiz-Labourdette *et al.* [16], among other studies on ecological planning).

2.2 Planning and users of landscapes

In the planning process, inclusion of the local population, both native and resident, as well as visitors as users of the natural resources, constitutes an important goal of the present study and is therefore the focus of this paper. To date, there has been some interest in the theme, but rather methodological difficulties with regard to integrating locals or visitors in ecological assessments of the territory. However, there have been some studies in this sense (Díaz *et al* [17], Ruiz-Labourdette *et al.* [18], Rodríguez *et al.* [19], Aguilera *et al.* [20], Schmitz *et al.* [21, 22]). Even less common is the incorporation of the quality of life and standard of living into the above mentioned assessment of thematic and environmental impact. This is despite the fact that the planning attempts to manage the territories in which these people reside. In the case at hand, we address the incorporation of this society into the localisation and demarcation process of a national park as a new occupation and land use.

Considering social perception in the environmental assessment of the territory, the present paper incorporates appraisals and preferences of the landscapes by the local population, both native and resident, and by visitors, the latter being related to Fuerteventura's attraction as a resort, as well as the quality of life and standard of living of the local societies. The landscape served as a reference for the contrast between environmental values and carrying capacity; it was evaluated by means of questionnaires implemented through simple random sampling in relation to activities that are to form a part of the uses and maintenance of a territory harbouring a national park.

2.2.1 Landscape preferences of the local population and visitors: spatial interaction

The numerical relationship between the landscape preferences of the local population and visitors, on one hand, and the landscape features, on the other, enabled us to obtain spatial patterns of landscape assessment by the human society in the study area. We began with a spatial method involving quantitative and qualitative natural and cultural features, in a similar way as in previous studies (Schmitz *et al.* [22], De Aranzabal *et al.* [23, 24]).

The units for description of the territory were the population nuclei of the island (population sectors within the municipalities, Table 1), at which scale the socio-economic information is recorded (INE [25]). At this scale, we considered the landscape characteristics that can easily and rapidly be perceived by people and that facilitate the landscape evaluation process in relation to nature conservation, supply of natural resources, leisure, taking into account that the task involves zoning a national park (Schmitz *et al.* [22], Zee [26]). Landscape features are shown in Table 2.

The spatial influence area of the population nuclei was calculated by means of Thiessen polygons, based on Euclidean geometry. Each polygon defines an area of influence around each population nucleus (any location inside the polygon is closer to that point than any of the other sample points). For each polygon, we

Table 1: Population nuclei differentiated in Fuerteventura.

1. Agua de Bueyes	17. Parque Holandés	33. Puerto del Rosario
2. Antigua	18. Cardón	34. Puerto Lajas
3. Casillas de Morales	19. Latija (La)	35. Tefía
4. Triquivijate	20. Morro Jable	36. Tesjuates
5. Valles de Ortega	21. Pájara	37. Tetir
6. Caleta de Fuste	22. Toto	38. El Time
7. Betancuria	23. Ajuy	39. Estancos (Los)
8. Valle de Santa Inés	24. Esquinzo	40. Giniginamar
9. Vega del Río Palma	25. Pared (La)	41. Gran Tarajal
10. Caldereta	26. Solana Matorral	42. Playitas (Las)
11. Corralejo	27. Ampuyenta (La)	43. Tarajalejo
12. Cotillo (El)	28. Asomada (La)	44. Tesejerague
13. Lajares	29. Casillas del Ángel	45. Tiscamanita
14. Oliva (La)	30. Guisguisey	46. Tuineje
15. Tindaya	31. Llanos	47. Juan Gopar
16. Villaverde	32. El Matorral	48. Tequitar

calculated *(i)* the spatial cover of the variables of each thematic landscape feature. Thus, each point of the territory is a vector containing quantitative data on the landscape variables. A matrix (A), 48 observations (polygons) × 22 landscape variables (features) enabled us to order data representing the spatial cover of each landscape feature in each polygon. We conducted *(ii)* a survey based on questionnaires given to the local population and visitors (B, C). These questionnaires, based upon a limited number of questions regarding people's attitudes and preferences, also include aspects of their sociological profile.

We designed two matrices of 1,556 observations (local people interviewed) × 22 variables (local population answering the questions; matrix B), and 1,554 observations (visitors interviewed) × 22 variables (their answers to the questions; matrix C). We calculated *(iii)* the relationship between landscape features and landscape preferences, through the product of the matrices, A × D and A × E -being D the vector of weighted sums of local population preferences and E the corresponding vector of visitor preferences- which enables the spatial pattern of landscape preferences to be estimated by quantifying the valuation of the local

Table 2: Types of territorial variables considered in the survey.

1. Climatic comfort	12. Beaches and dunes
2. Warmth in winter	13. Desert steppes
3. Cool in summer	14. Volcano landscape
4. Autumn and winter temperatures	15. Mountains with rocks
5. Strong winds	16. Vegetation, flora
6. Sun, intense sunshine	17. Shrublands, cactus fields
7. Rural landscape, agriculture, *gavias*	18. Coastal vegetation, brine basins
8. Natural landscape (wilderness)	19. Lava fields (*malpaís*)
9. Large open valleys	20. Patent animal wildlife
10. Closed agricultural valleys	21. Patent avifauna, birdwatching
11. Valleys with palm trees	22. Traditional architecture

people and visitors - vectors product of locals and visitors, respectively - in relation to the spatial variables (Schmitz *et al.* [22]; De Aranzabal *et al.* [24]). Spatial expression on maps of the product matrices enables us to establish the patterns of preferential valuation of the territory -different kinds of landscapes have been evaluated by different target groups with their specific preferences and attitudes-. From the perspective of a protected area, this method is useful for landscape zoning based upon the content of paragr. 2.1, as all these different kinds of landscapes constitute mappable 'themes'.

To estimate the quality of life and standard of living of the island's population, we considered the parameters accepted by the OECD [27] as descriptors of the degree of material comfort (living standard) and personal wellbeing or satisfaction (quality of life). We adapted the explanatory variables according to their availability from the secondary sources (INE [25]) and to the results of the survey conducted by means of simple random sampling involving 1,556 people identified according to socioeconomic aspects, daily activities and environmental perception.

2.2.2 Appraisal of the quality of life and standard of living of the local population

We conducted the appraisal of the quality of life and standard of living in the population nuclei (sectors within the municipalities) according to the importance given by each local individual, native or resident in each entity to each descriptor of each category according to a Likert scale, using values of each of these two parameters for each one of the 48 polygons. Thus, these polygons are considered according to these two 'themes'. The resulting values were contrasted with data from ethnographic fieldwork (2008 and 2013).

3 Diagnosis: assessment for designing the protected area

The diagnosis, a set of tools and approaches providing a landscape assessment, must derive from analysis of the ecological structure and processes, as well as the cultural situation (social and economic characteristics; Haase [28], Bastian [29], Schmitz *et al.* [30], De Aranzabal *et al.* [23], Bastian *et al.* [31]). Our research was based on *(i)* the valuation of four socio-ecological 'themes' -the landscape character, valuated both by the local population living within each polygon and by visitors, and two socioeconomic aspects, standard of living and quality of life of the local population, also applied inside each polygon-. We *(ii)* analysed the compatibility of each theme with the land uses and activities associated with the proposed national park, according to Ruiz-Labourdette *et al.* [16]. Five steps were considered:

1. Thematic valuation. This involves valuation of the landscape sectors (polygons) pertaining to the different attributes and preferences of the local people and visitors, and the standard of living and quality of life. We expressed the units of each kind of valuated landscape on two thematic maps. The thematic units were hierarchically valued from 10, the highest, to 1, the lowest.

2. Land use hypotheses. We selected a set of seven outdoor activities and associated infrastructures in national parks (visitor reception centres, scenic viewpoints, roads, hiking routes, trails for motor vehicles and picnicking and camping areas). In selecting land use hypotheses and subsequently estimating their degree of severity, we took into consideration the actual situations generated by these types of land uses in the eastern Canary Isles, in counties that had undergone a real transformation.

3. Partial impact estimation. This consisted of estimating the severity of each of these activities for the units of each landscape attribute (partial impacts, paragr. 2.1), ΔV_{ij}, assuming that each of the planned use hypotheses was theoretically implemented in each spatial unit, *j,* of each of the themes or attributes, *i.* The relative change in value of each unit of each attribute was considered as the cost or partial impact of the use hypothesis in question. The impact was estimated in reference to a previous ordinal scale established in the appraisal of the units in each attribute (Pineda *et al.* [13], Ruiz-Labourdette *et al.* [16]): $\Delta V_{ij} = V_f - V_a$, where V_f is the value on the polygon *j*, of the theme *i*, estimated after being subjected to that use (the new position it would occupy on the hierarchical scale) and V_a the actual value on the same scale. For the estimation we considered type and intensity of the expected landscape disturbance and the foreseeable severity thereof, considering the ecological fragility and reversibility of each spatial unit and attribute, or loss of value in the case of standard of living and quality of life.

4. Calculation of socioecological impacts. This consisted of estimating the change in value caused by each of the activities in the themes considered. The impacts were calculated by means of multivariate ordination analysis. The loadings of the themes (weighting coefficients) serve as key references for zoning the territory according to conservation categories coherent with the landscape compatibility in relation to the above mentioned different activities. We analysed a data matrix containing 48 polygons × 4 partial impacts × 7 activities.

I_k, being the global value of each polygon (hypothetical 'sacrifice scale' if each polygon has to be drastically transformed by consensus of the team), the coordinates of the polygons according to the ordination analysis indicate the importance of each theme in the value of the set of polygons in relation to each hypothesis, $I_k = b_{kl}\,\Delta V_l + b_{kv}\,\Delta V_v + b_{kst}\,\Delta V_{st} + b_{kq}\,\Delta V_{kq}$, where *b* represents the calculated weighting coefficients of the partial impacts of activity *k* (the relative contribution of the impact of activity k in each of the study area's polygons (*l:* landscape valuation by the local people, *v:* landscape valuation by visitors, *st:* standard of living, *q:* quality of life). The values for ΔVi were mapped for each 0 polygon and activity, standardized and ordered, and ranged from −1 (maximum impact; most severe activity for a theme) to +1 (maximum positive impact; best activity increasing the value). The co-ordinates of the polygons along the first axis of the analyses were considered as the values of *I*: the polygons with co-ordinates at the positive or negative ends of this axis represent the places most vulnerable or most resilient to each proposed land use, respectively.

5. Zoning process. The coordinates of the polygons on the first axis serve to differentiate the groups of polygons which, due to their sensitivity to the use hypotheses considered, should correspond to different protection categories.

4 Results and discussion

The zoning conducted considers incorporating the social component into procedures previously employed – above quoted – for planning the territory. Herein, the reason for declaring a national park in Fuerteventura is the high naturalistic values encountered therein (Hernández [8], Pineda [10], Lorenzo [32], Del Arco [33], Rodríguez-Delgado [34]), as well as the fact that the study area is a tourist resort that is attractive, but also classical (*four s* tourism), still presenting a low cultural value (Hernández and Pineda [15], Díaz *et al.* [17], Ruiz-Labourdette *et al.* [18], Rodríguez *et al.* [19]). This fact is recognised by the tourism industry.

These are all good reasons to include ecological and socioeconomic aspects in one single framework planning procedure. The present document addresses and describes an ecology-based procedure (consideration of partial territorial themes or aspects, paragr. 2.1), which is not elaborated upon in this book, due to issues relating to space. It therefore only deals with socioeconomic components, and the integration of both the ecological and socioeconomic aspects therefore remains to be addressed. This could involve global integration, incorporating as information into the aforementioned numerical analysis the different types of themes, or a procedure could be followed that involves comparison of the results obtained by the same method, but separating the ecological and social perspectives. This task remains to be tackled here. The method allows a certain degree of subjectivity in the evaluation of the standard of living and quality of life, depending upon the global parameters habitually accepted and used, and the conditioning caused by the existence of data provided by small-sized sampling units. This individualised information can be created by deducing it from certain valid descriptors at the local scale in order to avoid homogenisation of the datum for the territory and making use of a previous qualitative approach.

Correspondence between the results of a quantitative analysis and the final decision should always involve collective cabinet debate entailing participation by the Administration (who have ultimately to implement management of the natural resources) and the Academic Stakeholders (at least the team of investigators, who must provide conclusions, avoiding their own personal opinions). As results can clearly differ, the aim of this debate is to reach a consensus and to put forward a proposal, which is to be objective (scientific), and to facilitate a political decision which will also involve other dimensions (Ruiz Labourdette *et al.* [16]) that can all too often produce results that are not easily explained.

Studies such as most of those cited herein attempt to optimally localise a protected area considering almost exclusively biophysical features. Protecting an area can involve transformations in the perception of the landscape's

resources, changes in the day-to-day peculiarities of the people living in the area and its surroundings, and in their habitual practices. There are not many examples of local people's circumstances being taken into account (Schmitz *el al.* [35, 36]). The task described herein is based upon four socioeconomic thematic aspects, but it remains subordinate to the results of a considerable number of biophysical aspects not included in the analyses. Thus, Figure 1 shows the partial results of the procedure described. There are noteworthy

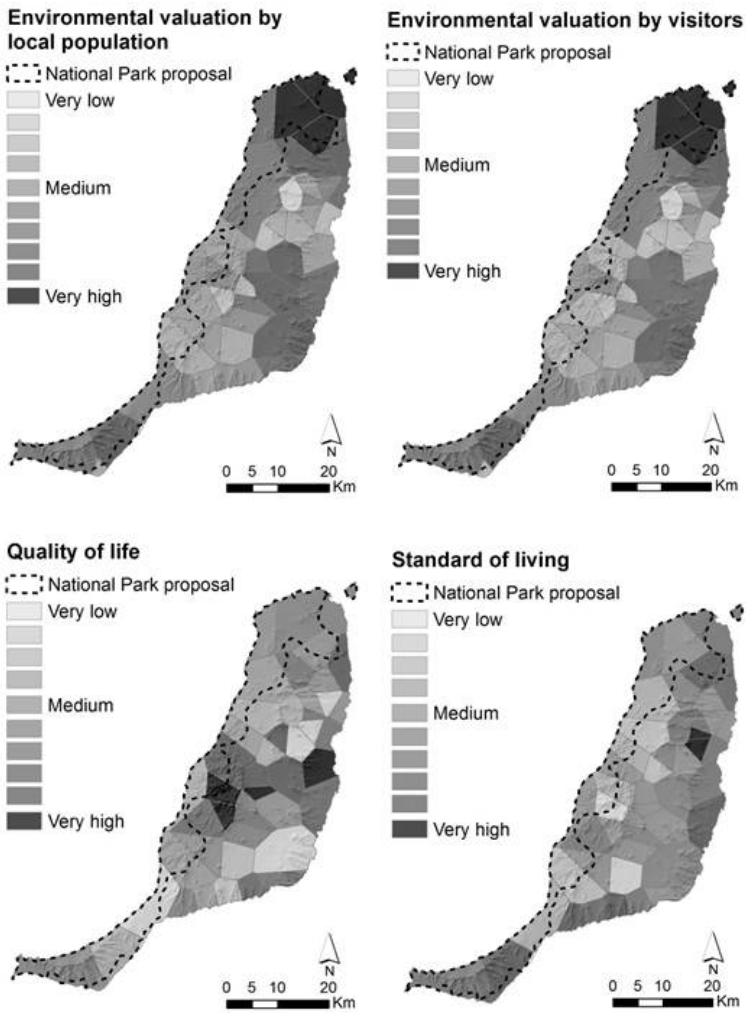

Figure 1: Maps of the four themes considered for the valuation of the island according to socioeconomic variables recorded in population nuclei (polygons). The Administration proposed the area in the West (dashed line) as a national park.

differences in the standard of living and quality of life of the populations. The high values of the former correspond to more urbanised places with more tourism, with better public services and tertiary production activities. The higher quality of life generally corresponds to the more ruralised character and, although these populations can constitute tourist attractions, there are much fewer and more temporary residents and visitors. This avoids costs to the traditional values caused by tourism (loss of privacy, identity, overcrowding,..) and urban development (pollution, stress, prices,...), but key infrastructures tend to be lacking, including those associated with tourism. The poor quality of life reported in the questionnaires by some rural populations reveals indifference by the institutions in relation to infrastructures, health or education, because these aspects do not respond to the profitability of tourism.

Furthermore, the preferences of local people and visitors for the landscape present significant similarities. There are interesting areas in the surroundings of the better developed tourism nuclei, which accounts for the fact that tourists know these areas better and for the incidence of classical sun-and-sand stereotypes projected beyond the island by the tourism industry, which includes studied images of the local population. Local people, however, value the island much more positively than visitors.

5 Conclusion

We have employed the aforementioned previous methods of ecological planning, now incorporating socioeconomic perspectives (social perception of the landscape and the natural resources, standard of living and quality of life of local population). With this in mind we have valued the territory and, in particular, we try to zoning a national park.

We found very marked differences between zoning the national park initially proposed by the Administration and the result of incorporating these perspectives. Zoning a protected area according to purely ecological considerations would be fine, but Canary Islands are a prime tourist destination and the perception of the local community and visitors is essential and inescapably must be taken into account in planning.

References

[1] Forman, R.T.T. & M. Godron, Patches and Structural Components for a Landscape Ecology. *BioScience* 31(10): 733–740. 1981.

[2] McHarg, I.L. *Design with nature*. Doubleday & Company INC: Garden City. NY. 1969.

[3] Leopold, L.R., Clark, F.A., Henshaw, B.R. & Balsey, J.R. *A Procedure for Evaluation of Environmental Impacts*. US Depart. Interior. Geological Surveys Circular 645. USGS, IANA S 946 L45, Washington. 1971.

[4] Montalvo, J., Sanz, L.R., De Pablo, C.L. & Pineda, F.D. Impact Minimization through Environmentally-based Site Selection: a

Multivariate Approach. *Journal of Environmental Management* 38(1): 13–25. 1993.

[5] SCBD. COP 10 Decision X/2. *Strategic Plan for Biodiversity 2011–2020* (Secretariat of the Convention on Biological Diversity, Nagoya, Japan). 2010.

[6] Le Saout S., Hoffmann M., Shi, Y., Hughes, A., Bernard, C., Brooks, T.M., Bertzky, B., Butchart, S.H.M., Stuart, S.N., Badman, T. & Rodrigues, A.S.L. Protected areas and effective biodiversity conservation. *Science* 342: 803–805. 2013.

[7] Schmitz, M.F. (ed.). *Tourism and Natural protected Areas.* WIT Press, Southampton. 139 pp. 2013.

[8] Hernández, C.C. *La evolución del relieve de Fuerteventura*. Cabildo Insular, Puerto del Rosario. 1992.

[9] Paredes, R. & Rodriguez, R. (eds.) *Fuerteventura*. RAI Ediciones, Antigua. 2002.

[10] Pineda, F.D. (dir.). *Estudio para el Plan de Ordenación de los Recursos Naturales (PORN) de la propuesta de Parque Nacional de Fuerteventura. Primera Fase.* (Proy. 314/2006; 228/2008, UCM). Puerto del Rosario-Madrid-La Laguna, Cabildo de Fuerteventura. 2010.

[11] Matos, D.G.G., Ruiz-Labourdette, Schmitz, M.F. & Pineda, F.D. Ecological zoning of a homogeneous territory. *Ecological indicators*, 2014 (reviewing).

[12] Burriel, E. *Canarias: población y agricultura en una sociedad dependiente*. Oikos-tau, Barcelona. 1981.

[13] Pineda, F. D., Escudero, J. C, Hiraldo, F., García-Novo, F., Bernáldez, F. G., Merino, J., Ramírez, L., Ramos, A., Ribero, J. C., Sancho, F. & Sainz, H. *Terrestrial ecosystems adjacent to large reservoirs. Ecological survey and impact diagnosis*, in *XI Congress of Internatational Commission on Large Dams: "ICOLD 73"* Dirección General de Obras Hidráulicas. Centro de Estudios Hidrográficos: Madrid. p. 38. 1974.

[14] Roberts, R.D. & Roberts, T.M. (eds.) *Planning and Ecology.* Chapman and Hall, London, 1984.

[15] Hernández, S. & Pineda, F.D. (dirs.). *Escultura de Eduardo Chillida "Montaña de Tindaya" (Isla de Fuerteventura).* Informe para la Consejería de Medio Ambiente y Ordenación Territorial, Gobierno de Canarias, Santa Cruz de Tenerife. 2007.

[16] Ruiz-Labourdette, D., Schmitz, M.F., Montes, C. & Pineda, F.D. Zoning a protected area: proposal based on a multi-thematic approach and final decision. *Environmental Modeling and Assessment* 15: 531–547. 2010a.

[17] Díaz, P., Ruiz-Labourdette, D., Darias, A.R., Santana, A., Schmitz, M.F. & Pineda, F.D. Landscape perception of local population: the relationship between ecological characteristics, local society and visitor preferences. In: C.A. Brebbia & F.D. Pineda (eds.). *Sustainable Tourism IV.* Wit Press, Boston: 309–317. 2010.

[18] Ruiz-Labourdette, D., Díaz, P., Rodríguez, A.J., Santana, A., Schmitz, M.F. & Pineda, F.D. Scales and scenarios of change in the anthropology-

landscape relationship: models of cultural tourism in Fuerteventura (Canary Isles). In: S. Favro & C.A. Brebbia (eds.). *Island Sustainability*. Wit Press, Southampton: 51–63. 2010b.

[19] Rodríguez, A. J., Díaz, P., Ruiz Labourdette, D., Pineda, F.D., Schmitz, M. F. & Santana, A. Selection, design and dissemination of Fuerteventura's projected tourism image (Canary isles). In: S. Favro & C.A. Brebbia (eds.). *Island Sustainability*. Wit Press, Southampton: 13–24. 2010.

[20] Aguilera, P., Schmitz, M.F., de Aranzabal, I., Castro, H. & Pineda, F.D. Characterization of visitors to natural areas in the Southeast of Spain. In: F.D. Pineda & C.A. Brebbia (eds). *Sustainable tourism*. Witt Press, Boston: 333–340. 2004.

[21] Schmitz, M.F., Ruiz Labourdette, D., Sañudo, P.F., Montes, C. & Pineda, F.D. Participation of visitors in the management design of protected natural areas. In: C.A. Brebbia & F.D. Pineda (eds.). *Sustainable tourism II*. WIT Press, Boston: 139–148. 2006.

[22] Schmitz, M.F., de Aranzabal, I. & Pineda, F.D. Spatial analysis of visitor preferences in the outdoor recreational niche of Mediterranean cultural landscapes. *Environmental Conservation* 34(4): 300–312. 2007.

[23] De Aranzabal, I., Schmitz, M.F., Aguilera, P., Pineda, F.D. Modelling of landscape changes derived from the dynamics of socio-ecological systems.A case of study in a semiarid Mediterranean landscape. *Ecological Indicators* 8: 672–685. 2008.

[24] De Aranzabal, I., Schmitz, M.F. & Pineda, F.D. Integrating landscape analysis and planning: a multi-scale approach for oriented management of tourist recreation. *Environmental Management* 44: 938–951. 2009.

[25] INE. Instituto Nacional de Estadística de España (INE). *Censo de Población y viviendas*, Madrid. 2010.

[26] Zee, D. The complex relationship between landscape and recreation. *Landscape Ecology* 4(4):225–236. 1990.

[27] OECD (Organisation for Economic Co-operation & Development). *How's Life? 2013. Measuring Well-being*. 2013.

[28] Haase, G. Approaches to, and methods of landscape diagnosis as a basis of landscape planning and landscape management. *Ekológia* 9: 11–29. 1990.

[29] Bastian, O. Landscape classification in Saxony (Germany) – a tool for holistic regional planning. *Landscape and Urban Planning* 50: 145–155. 2000.

[30] Schmitz , M.F., De Aranzabal, I., Aguilera, P., A. Rescia & Pineda, F.D. Relationship between landscape typology and socioeconomic structure. Scenarios of change in spanish cultural landscapes. *Ecological Modelling* 168: 343–356. 2003.

[31] Bastian, O., R. Krönert, & Z. Lipský. Landscape diagnosis on different space and time scales – a challenge for landscape planning. *Landscape Ecology* 21: 359–374. 2006.

[32] Lorenzo, J.A. (ed.). *Atlas de las aves nidificantes en el archipiélago canario*. M. Medio Ambiente- SEO/Birdlife, Madrid. 2007.

[33] Del Arco, M. (ed.). *Mapa de Vegetación de Canarias*. GRAFCAN, S.C. de Tenerife. 2006.
[34] Rodríguez-Delgado, O. (ed.). *Patrimonio Natural de la isla de Fuerteventura*. Cabildo de Fuerteventura, Puerto del Rosario. 2005.
[35] Schmitz, M.F., Sánchez, I.A. & De Aranzabal, I. Influence of management regimes of adjacent land uses on the woody plant richness of hedgerows in Spanish cultural landscapes. *Biological Conservation* 135: 542–554. 2007.
[36] Schmitz, M.F., Matos, D.G.G., De Aranzabal, I., Ruiz Labourdette, D. & Pineda, F.D. Effects of a protected area on land-use dynamics and socioeconomic development of local populations. *Biological Conservation* 149: 122–135. 2013.