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# Urdaibai Biosphere Reserve (Biscay, Spain): Conservation against development?

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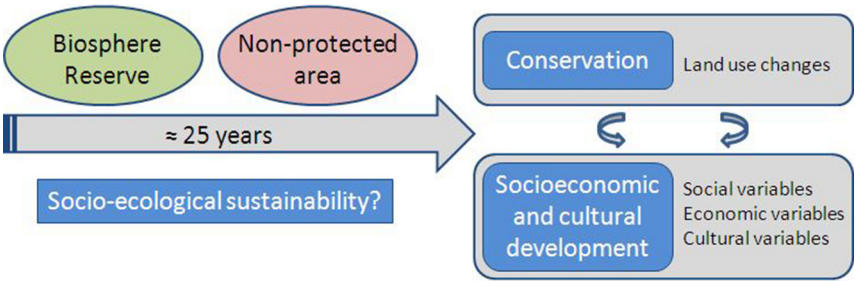
## HIGHLIGHTS

- Protected or not, landscape and socio-economic and cultural tendency hardly varies.
- The designation of the biosphere reserve helps to the conservation.
- The designation of the biosphere reserve has slow down the abandonment of rural activities.
- The biosphere reserve reinforces the local socioeconomics and cultural values.

## GRAPHICAL ABSTRACT

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## ABSTRACT

The protected area approach has extended from conserving biodiversity to improving human well-being. However, the relationship between conservation and socioeconomic and cultural development continues to be controversial. This paper combines land use variables with socioeconomic and cultural variables through multivariate ordination analysis and evaluates their evolution in two areas inside and outside a Biosphere Reserve since the approval of the Governance Plan for Use and Management in the Reserve. The results indicate a similar tendency in the two areas, from the abandonment of traditional rural activities and decline in pine plantations to naturalness, urban sprawl and the growth of the tertiary economic sector, welfare indicators and sustainability index. However, it can be broadly observed that the region included inside the protected area presents better conservation features (native forest) and rural systems (forestry and primary economic sector) than the region outside the protected area while maintaining similar socioeconomic and cultural conditions. We suggest that the designation of the Biosphere Reserve does not influence the local population negatively but does safeguard its conservation, which could have enhanced socioeconomic and cultural development. Thus, even though certain changes must be made to replace the conifer plantations and encourage agricultural activities, the designation of the protected area fulfills its sustainability goal and enhances the local population's quality of life.



## 1. Introduction

Ecosystems support all humans' activities and lives, and the ecosystem goods and services they offer are vital to human well-being and economic and social development (MA, 2005). Protected Areas (PAs) have become a key instrument for conserving biodiversity. To date, >15% of the world's land and 3% of the oceans are covered by PAs (IUCN, 2016). The primary aim of Pas is to protect particular species or habitats from the pressure of people. PAs are widely recognized to deliver (global) environmental benefits, such as carbon sequestration, biodiversity, and water regulation (Palomo et al., 2011; Castro et al., 2015), but they are also criticised for not being effectively managed to achieve their basic conservation objectives (Watson et al., 2014) and for having

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negative impacts on local populations (Oldekop et al., 2015). Furthermore, their surrounding lands may become degraded or intensified more than usually (DeFries et al., 2007; Martín-López et al., 2011), which increases the conservation and social conflicts inside and outside the PAs.

One of the most debated issues in conservation policy is the socioeconomic impact of PAs, either positive or negative, on neighbouring and local communities. Indeed, the relation between development and biodiversity is very complex. Some studies highlight that biodiversity protection and conservation contribute to one of the most important United Nations Millennium Development Goals, which is poverty reduction (Andam et al., 2010; Ferraro and Hanauer, 2014; Hanauer and Canavire-Bacarreza, 2015). In contrast, others claim that PAs amplify local poverty or that there is no clear effect (West et al., 2006; Upton et al., 2008; Brockington and Wilkie, 2015). Surprisingly, areas of high poverty and high biodiversity overlap globally (Fisher and Christopher, 2007), and it is widely acknowledged that biodiversity loss and poverty are linked problems (Adams et al., 2004). Biodiversity underpins the ecosystem services upon which society depends. Poor people especially often depend directly on such services on a daily basis for subsistence or income. Consequently, they live in a vicious cycle where the more biodiversity is degraded, the more the poor are affected.

Arguments against PAs hold that local population development is restricted due to limitations on some activities or the exploitation of natural resources (Pullin et al., 2013), evictions and land appropriation (Brockington and Igoe, 2006), and crop damage and livestock depredation (Mackenzie, 2012). However, these negative effects are balanced by others, such as the promotion of tourism (Sims, 2010), the improvement of infrastructures and facilities (Ferraro and Hanauer, 2014), an increase of local funding pathways, business and home values (Heagney et al., 2015), research and environmental education, and especially, the preservation and enhancement of the environment in general and in terms of ecosystem services in particular (Balmford et al., 2002; Eastwood et al., 2016). These final aspects do not have direct market price, so the economic value of these areas would be even higher.

Sustainable development has been a political catchphrase for almost 30 years; however, we are still far from reaching global sustainability (Helne and Hirvilammi, 2015; Rodríguez-Rosa et al., 2016). In light of this situation and considering the ongoing increase in the number of protected areas, the politics for implementing sustainable development much be based on studies of the biophysical, social and economic systems at appropriate scales (Le Blanc, 2015). Suitable environmental management requires the consideration of local people's needs. Certainly, as Oldekop et al. (2015) suggested, conservation targets are more likely to be achieved when PAs encourage socioeconomic benefits through sustainability instead of imposing strict protection. That is precisely what a Biosphere Reserve seeks. Biosphere Reserves focus on the involvement of the local communities in management with the aim of reconciling nature conservation and sustainable development (UNESCO, 2016). They represent a model for reinforcing a sense of place or a principle of solidarity between humans and nature (Bouamrane et al., 2016). Their integration in a network with common governance and management could contribute effectively to the solution of the global problems of species loss, the over-exploitation of resources and adaptation to climate change for the goal of global social-ecological sustainability (Lopoukhine et al., 2012). Many cultural landscapes and social-ecological systems closely linked to rural activities, protected or not, have been seriously impacted as a consequence of environmental and socioeconomic changes, such asagrarian intensification or land abandonment (Rescia et al., 2010; Schmitz et al., 2012), directly affecting the socioeconomic and cultural context of territories.

Therefore, assessing the land uses and socioeconomic and cultural changes may explain the influence of protected areas in the maintenance of landscape structures and communities and local economies. However, most of the studies, some of which are mentioned above, have been applied to developing countries. By contrast, this paper examines the land uses and socioeconomic and cultural changes in two developed, contiguous and environmentally similar areas, one included in a protected area and the other one in a non-protected area; and evaluates their evolution to determine the effect of the designation of the protection figure and whether it has contributed to its principal objectives.

## 2. Materials and methods

### 2.1. Study areas

Designated as a Biosphere Reserve in 1984 because of its high naturalistic and cultural value, the Urdaibai Biosphere Reserve (Biscay, Northern of Spain) was also added to the list of Ramsar Wetlands in 1993 and the network of the European Union Natura 2000. It constitutes a rural social-ecological system, being the "caserío", a historic Basque Country farm, a socioeconomic organizing unit of an agro-silvopastoral mosaic landscape. This reserve's origin resides in the seventies as a consequence of the social mobilization against the implementation of a megaproject called "Special Plan for the Integrated Use of the estuary of Gernika-Mundaka", which, ultimately, intended to dry the marsh and transform the estuary into an area of large infrastructure and residential services (Arana, 1997).

The reserve's primary functions include the conservation of naturalistic values (ecological variety and complexity), sustainable socioeconomic development of the territory, and logistical support (research, training, and dissemination and interpretation of the area). To this end, among others, a Governance Plan for Use and Management (GPUM) was approved in 1993 (Basque Government, 2004) and reviewed this year, which articulates the guidelines for management and conservation to reconcile the conservation of natural resources with their sustainable use. It involves the classical zonation of a Biosphere Reserve corresponding to a core area of strictly protected ecosystems (coastal ecosystems, marshlands and green-oak forests), a buffer zone where human activity is limited, and a transition zone extended to the outside area where greater activity is allowed. Moreover, a Plan for the Harmonisation and Development of Socio-economic Activities (Basque Government, 1999), which was recently evaluated, and the Plan for the Interpretation, Research, Training and Education for the Sustainable Development of the Urdaibai Biosphere Reserve 2015–2025 (Basque Government, 2015) were also adopted.

The Urdaibai Biosphere Reserve (UBR) covers 22 municipalities totally or partially. Due to its complicated administrative division and considering that the study is based on the municipal level, the region of Busturialdea (Biscay) was taken as a reference (Fig. 1). The region of Busturialdea has an area of approximately 27,000 ha covering 20 municipalities, all of them included in the UBR except one (Fig. 1). It represents a complex social-ecological system where contrary interests coexist. As a result, its management can turn very conflictive and controversial (Onaindia et al., 2013a). Specifically, the almost complete predominance of *Pinus radiata* and *Eucalyptus* sp. monoculture plantations and their unsustainable management has brought about erosion, worsening water quality and a decline of fresh water supplies, and the loss of aesthetic values, among others (Onaindia et al., 2013b; Rodríguez-Loinaz et al., 2013).

In addition, the non-protected region of Uribe Kosta (Biscay) was selected for the purpose of comparison. This region is next to the region of Busturialdea and has similar characteristic in the sense that it has an important rural past from its Basque cultural heritage, a smaller but valuable (ecologically, social-culturally and economically) estuary and a similar population, although Uribe Kosta is smaller in size. This region has an area of approximately 21,000 ha covering 15 municipalities (Fig. 1).

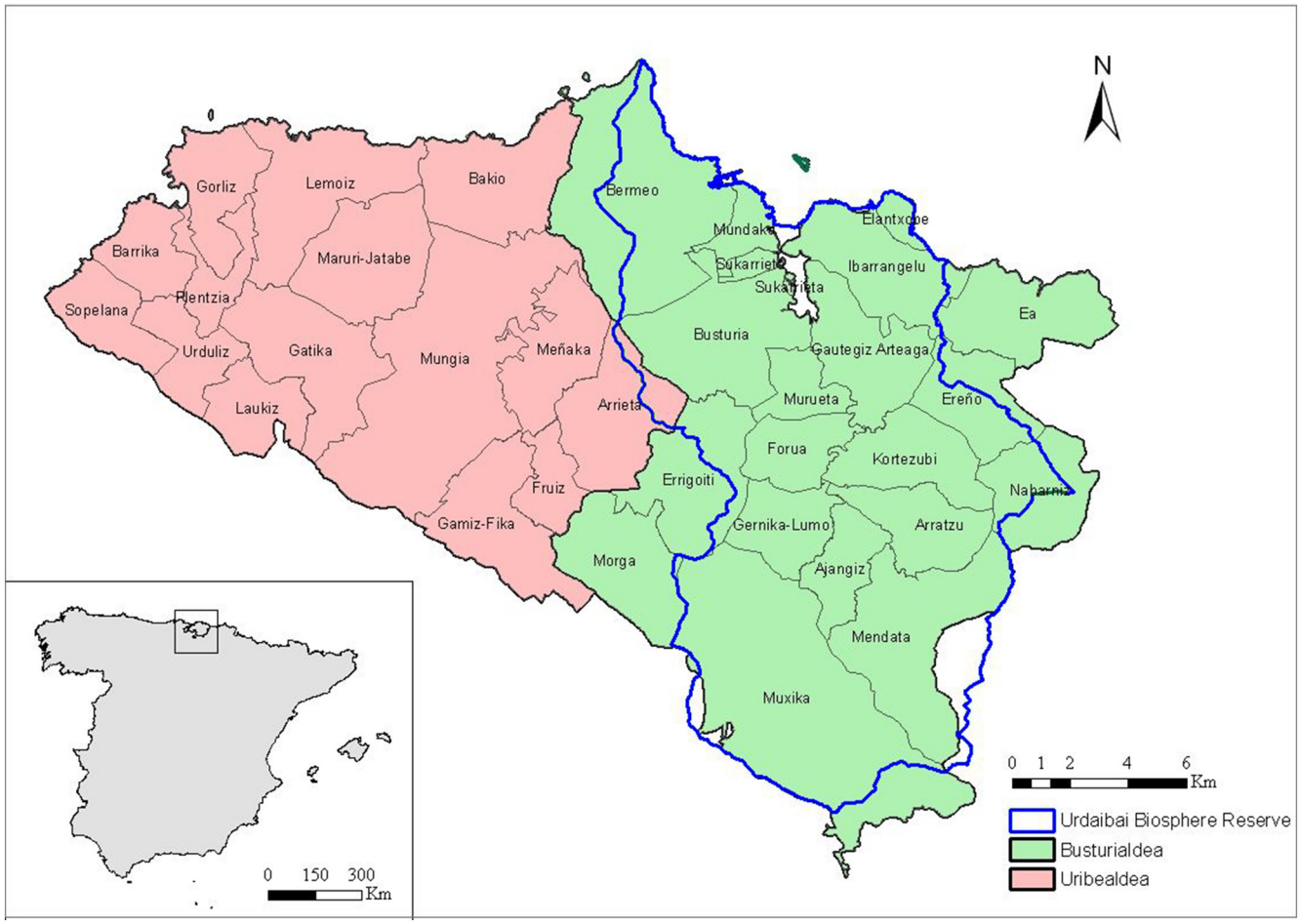


**Fig. 1.** Study areas. In green colour the region of Busturialdea, included in the protected area of the UBR, and in pink colour the non-protected region of Uribe Kosta. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

### *2.2. Landscape and socioeconomic and cultural evolution*

Land use and socioeconomic and cultural changes were analysed at the municipal level (Table S.1) for two time periods. Data for land use and socioeconomic variables vary from 1991 to 1997 and from 2008 to 2015 (for simplicity hereinafter, past and present, respectively). Although the protected area was designated in 1984, it was only feasible to go backwards until 1991 (1989 given the case) because of the lack of information about socioeconomic variables before that date. However, because the GPUM (Basque Government, 2004) was not approved until 1993 and thus land uses and activities started to be regulated that year, we consider that the used data are good indicators of the earlier and later landscape and socioeconomic situation of the protected territory, and consequently, of the impact of the Biosphere Reserve designation. However, regarding the cultural variables, there was no information preceding 1997; therefore, the two periods studied were established as before the year 2008 and from 2008 to 2015.

Information referring to land uses was obtained from forest inventories (Basque Government, 1996 and 2011), habitat EUNIS (European Nature Information System), a map (Basque Government, 2014) and aerial photographs (Basque Government, 2014). Based on the available data, 10 landscape variables were selected (Table S.2), and the frequency and diversity of uses (H′) were measured according to the Shannon-Wiener index (Shanon and Weaver, 1949).

$$H' = -\sum p_i \log_2 p_i \quad (1)$$

where $p_i$ is the proportion of land use i relative to the total number of land uses presented in each municipality. Low values of diversity mean that there are few land uses and/or low evenness (for instance, when one land use is predominant), whereas high values indicate that there are more land uses and they are distributed in an equal proportion in the territory.

For the socioeconomic and cultural analysis, 14 and 4 descriptive variables of the municipalities were selected, respectively (Table S.2). The information was obtained from the Basque Institute of Statistics (EUSTAT, 2015) and Udalmap Municipal information system (Udalmap, 2016) by calculating the means of each period of time.

To compare the landscape and socioeconomic and cultural evolution for each municipality and period of time, Principal Components Analyses (PCAs), multivariate ordination analyses, were performed, with previous standardization and log (x + 1) transformation of data to fulfil the requirements of normality and homoscedasticity. This technique reduces the dimensionality of the municipalities and projects them in two planes according to the importance of the variables used. Hence, it is possible to obtain the tendency of change of each municipality and region in space and time. Furthermore, to compare the displacement vectors of each region, which indicate the direction and magnitude of change, multivariate analysis of variance (MANOVA) was used. Finally, an analysis of variance (ANOVA) was applied to those key descriptive variables conforming to the PCAs to contrast the interaction of the evolution between time and region for each landscape and socioeconomic variable. All statistical analyses were performed in R (R Core Team, 2014).

## 3. Results

### 3.1. Landscape structure and evolution

The PCA analysis (Fig. 2, Table 1) enabled us to compare the landscape dynamic of the municipalities of both regions since the approval of the GPUM. The landscape structure change tendency on the first axis is determined mainly by urban zones on the positive side but also some natural land uses, such as scrublands, pastures and coastal beach and dunes, and eucalyptus plantations, whereas the negative side is exclusively defined by conifer plantations. Therefore, the first axis can be interpreted as a pine forestry trend, noting that pine plantations are away from urban areas and other land uses situated in lower zones. In turn, factor loadings of the second axis show a variation from cultivated lands and meadows to broadleaves; thus, it can be understood as a naturalisation/wilderness axis. The mean trajectories of change of the municipalities of Busturialdea and Uribe Kosta show a similar gradient of variation (the mean modules and angels are 0.443, 48.04° and 0.578, 57.10°, in Busturialdea and Uribe Kosta, respectively; $F = 1.47$, $p = 0.246$). Nevertheless, it can be observed that generally, the region of Busturialdea presents more pine lands (forestry) and natural characteristics (broadleaves) than the region of Uribe Kosta, which appears to have more urbanised and less natural land uses (Fig. 2).

**Table 1**
Factor loadings of the landscape variables and their contribution (%) (in bold, variables identified as key descriptors).

| Land uses | Axis 1 (32.81%) | | Axis 2 (21.98%) | |
|---|---|---|---|---|
| | F1 | Contribution | F2 | Contribution |
| Conifer plantations | **−0.852** | 22.142 | 0.193 | 1.698 |
| Eucalyptus plantations | **0.612** | 11.406 | −0.095 | 0.407 |
| Broadleaves | 0.184 | 1.034 | **0.729** | 24.196 |
| Scrublands | **0.779** | 18.495 | −0.269 | 3.287 |
| Pastures | **0.635** | 12.304 | 0.253 | 2.912 |
| Meadows | −0.032 | 0.031 | **−0.832** | 31.501 |
| Cultivated lands | −0.330 | 3.313 | **−0.649** | 19.185 |
| Urban areas | **0.713** | 15.485 | −0.415 | 7.827 |
| Coastal beach and dunes | **0.720** | 15.789 | 0.263 | 3.140 |
| Marshlands | 0.008 | 0.002 | 0.359 | 5.849 |

According to the Shannon-Wiener diversity index, most of the municipalities in both areas have increased their land use diversity, except for Busturia and Gautegiz Arteaga in Busturialdea, and Gorliz, Laukiz,

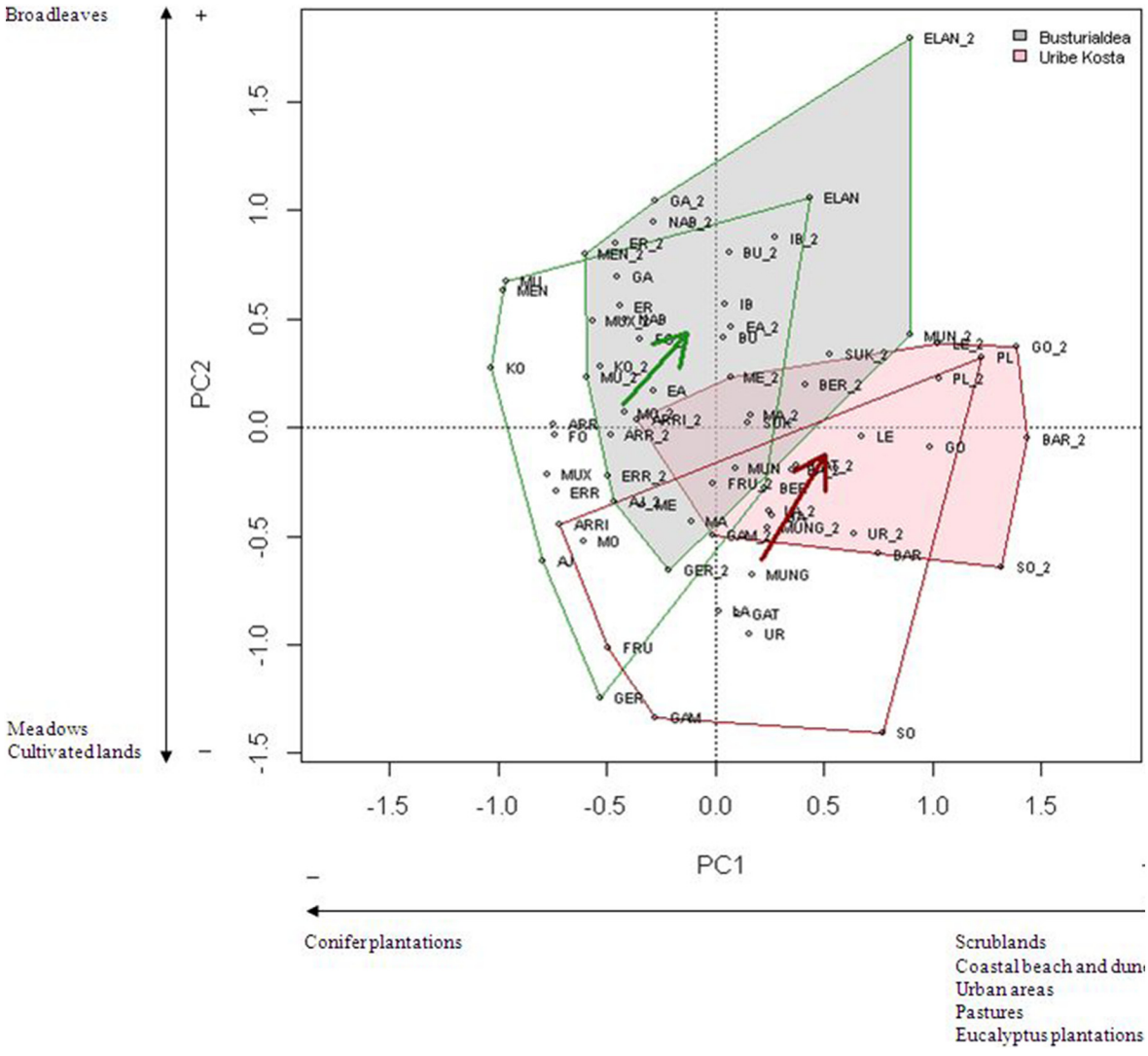


**Fig. 2.** PCA analysis. Coordinates of municipalities of Busturialdea (polygons with green colour border) and Uribe Kosta (polygons with maroon colour border) and the mean trajectories of change, represented by an arrow, from the past to the present (past and present are symbolised by uncoloured and coloured polygons, respectively). The principal landscape descriptive variables are at the end of the axes. See the codes of municipalities in App. 1. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Mungia and Plentzia in Uribe Kosta (Table S.3). However, it must be considered carefully because the principal reason of this rise in the diversity index could be the decrease in the area occupied by predominant land uses over time, i.e. conifer plantations in Busturialdea and meadows in Uribe Kosta (Fig. 3), leading to a more equitable distribution of land uses. Currently, both regions have decreased their conifer plantation' area, while increasing the area of eucalyptus plantations and broadleaf native forests. In addition, urban areas have also experienced an important increase, especially pronounced in Uribe Kosta, where the change in urban areas is duplicating that happening in Busturialdea (Fig. 3).

The ANOVA analysis shows a significant interaction of the evolution between time and region for conifer plantations and scrublands (Table 2). Both regions presents a decrease in conifer plantations, but it is more noticeable in Uribe Kosta, which has apparently changed its market to eucalyptus plantations, with lower periods of logging. Similarly, contrary to the tendency of the Basque Country but mildly in line with Biscay, both areas have diminished their area of scrublands, especially Uribe Kosta (Table S.4).

### 3.2. Socioeconomic and cultural evolution

Fig. 4 shows the socioeconomic and cultural evolution of municipalities in Busturialdea and Uribe Kosta since the designation of the GPUM. Considering the factor loadings (Table 3), the variables that contribute most in the first axis are related to human welfare (total personal income, GDP, population with higher education and employment), employment in the tertiary sector, the number of inhabitants and the sustainability index on the positive side and to the rural economy and employment in the primary sector, Basque culture and population > 65 years on the negative side. Likewise, the principal change in the secondary axis comes from variables related to the secondary sector towards a tertiary sector and second homes. Both regions present almost the same socioeconomic and cultural changes, as indicated by the main trajectories of change (the mean modules and angles are 0.907, 26.05° and 0.799, 25.45° in Busturialdea and Uribe Kosta, respectively; $F = 0.613$, $p = 0.548$). However, it can be broadly observed that at present the region of Busturialdea is slightly more heterogeneous than Uribe Kosta, with municipalities like Ajangiz totally characterized by the secondary sector and more vacation municipalities, such as Ibarrangelu (Fig. 4).

**Table 2**
Analysis of variance (ANOVA) for landscape changes over time from one region to the other region.

| | Sum. sq. | F value[a] |
|---|---|---|
| Conifer plantations | 0.372 | 27.969** |
| Eucalyptus plantations | 0.001 | 0.012 |
| Broadleaves | 0.010 | 0.212 |
| Scrublands | 0.766 | 7.420** |
| Pastures | 0.159 | 0.768 |
| Meadows | 0.005 | 1.203 |
| Cultivated lands | 0.508 | 2.407 |
| Urban areas | 0.006 | 0.171 |
| Coastal beach and dunes | 0.000 | 0.262 |

[a] Statistical significance at the ** = 0.01 level.

The ANOVA results reveal a significant effect of the interaction between time and region for total population and employment in the 1st sector (Table 4). In accordance with Biscay and the Basque Country, the total population has gone up in both regions, but especially in Uribe Kosta, where the total population has almost doubled and exceeded Busturialdea's. Similarly, and following the tendency of Biscay and the Basque Country, the employment in the first sector has decreased drastically in both regions, with Busturialdea, where the primary sector used to have a great weight, being the most strongly affected region. However, the employment rate continues to be higher than in Uribe Kosta and considerably higher than in Biscay and the Basque Country (Table S.4).

## 4. Discussion

Important landscape, socioeconomic and cultural changes have endured in both study areas, but their trajectory of change over time has followed a very similar tendency. Nonetheless, the results suggest a more rural, natural (native vegetation conserved) and heterogeneous

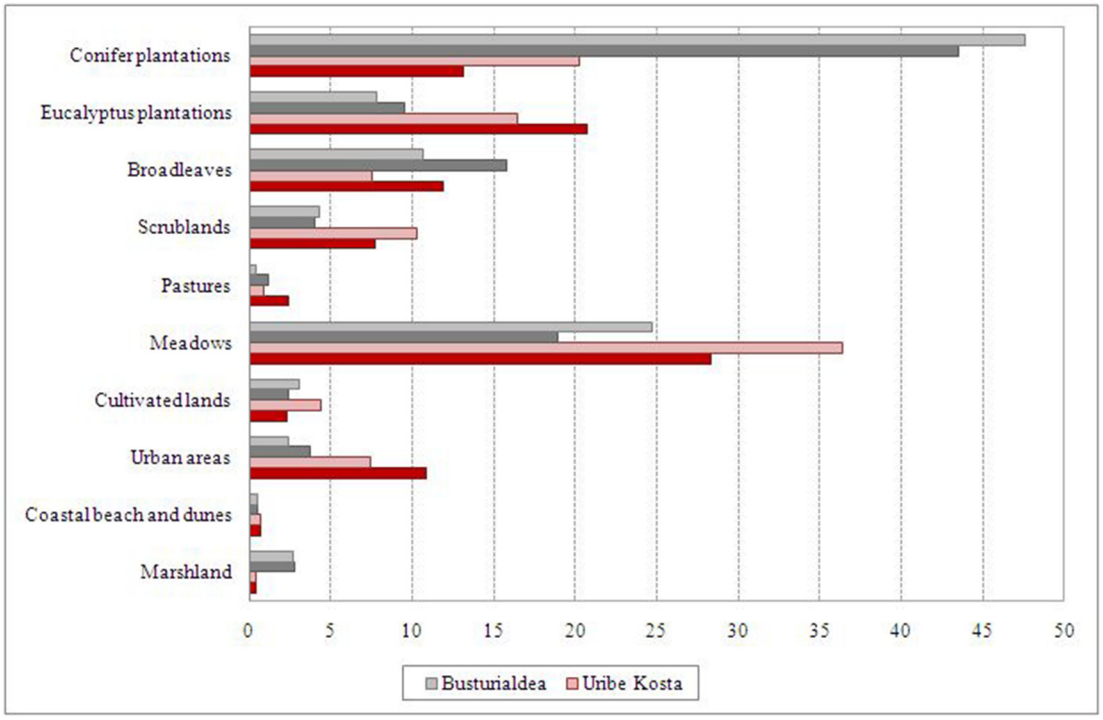


**Fig. 3.** Total area (%) of the land uses of Busturialdea and Uribe Kosta from the past to the present (higher colour intensities refers to the area of land uses in the present).

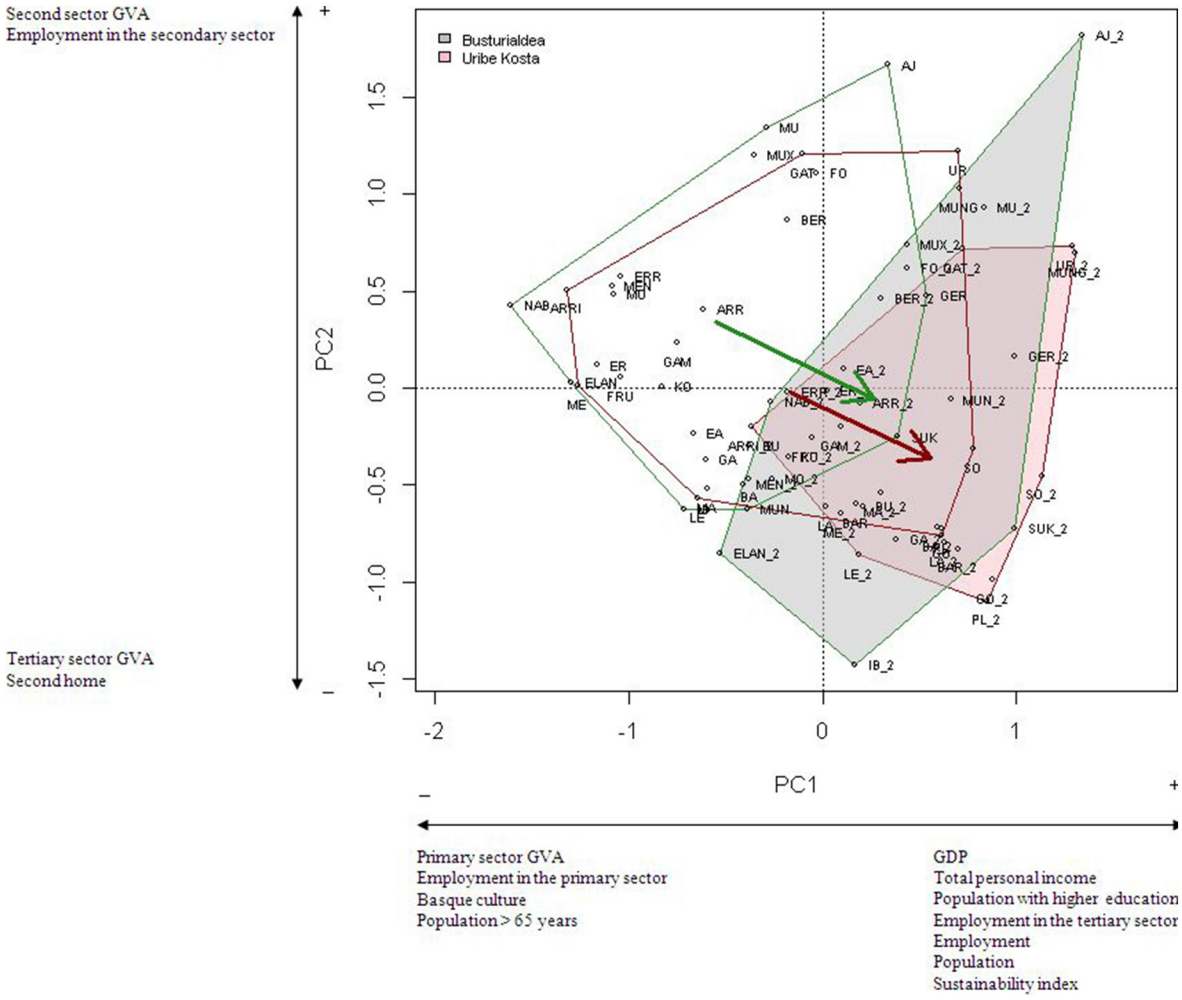


**Fig. 4.** PCA analysis. Coordinates of municipalities of Busturialdea (polygons with green border) and Uribe Kosta (polygons with maroon border) and mean trajectories of change, represented by an arrow, from the past to the present (past and present are symbolised by uncoloured and coloured polygons, respectively). The principal socioeconomic and cultural descriptive variables are at the end of the axes. See the codes of municipalities and socioeconomic and cultural descriptive variables in App. 1 and 2. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

**Table 3**
Factor loadings of the socioeconomic and cultural variables of municipalities and their contribution (%) (in bold, variables identified as key descriptors).

| | Axis 1 (30.54%) | | Axis 2 (21.16%) | |
|---|---|---|---|---|
| | F1 | Contribution | F2 | Contribution |
| Total population | **0.575** | 6.016 | 0.003 | 0.000 |
| Population > 65 years | **−0.649** | 7.655 | −0.028 | 0.020 |
| Second home | −0.048 | 0.041 | **−0.509** | 6.812 |
| Population with higher education | **0.689** | 8.646 | −0.477 | 5.963 |
| Employment in the 1st sector | **−0.845** | 12.980 | 0.328 | 2.824 |
| Employment in the 2nd sector | 0.394 | 2.820 | **0.810** | 17.238 |
| Employment in the 3rd sector | **0.627** | 7.156 | −0.100 | 0.260 |
| Employment | **0.621** | 7.008 | 0.575 | 8.683 |
| Unemployment rate | 0.179 | 0.581 | −0.048 | 0.060 |
| Total personal income | **0.668** | 8.111 | −0.341 | 3.053 |
| GDP | **0.748** | 10.172 | 0.358 | 3.358 |
| 1st sector GVA | **−0.871** | 13.813 | 0.013 | 0.004 |
| 2nd sector GVA | 0.142 | 0.367 | **0.866** | 19.679 |
| 3rd sector GVA | 0.013 | 0.003 | **−0.882** | 20.406 |
| Basque culture | **−0.656** | 7.824 | 0.376 | 3.706 |
| Social cohesion index | −0.294 | 1.573 | 0.301 | 2.383 |
| Good relations index | −0.151 | 0.415 | −0.428 | 4.805 |
| Sustainability index | **0.515** | 4.817 | 0.168 | 0.743 |

character of the region of Busturialdea, included in the protected area, and a more urban, less natural and homogeneous one of the region of Uribe Kosta, outside the protected area. Actually, Busturialdea seems to be characterized by its rural life, understood not only as the exploitation of the land (conifer plantations mostly) but also as the protection and conservation of broadleaf native forests. Consequently, as our

**Table 4**
Analysis of variance (ANOVA) for socioeconomic and cultural changes over time from one region to the other region.

| | Sum. sq. | F value[a] |
|---|---|---|
| Total population | 0.463 | 54.076*** |
| Population > 65 years | 0.003 | 0.157 |
| Second home | 0.741 | 2.671 |
| Population with higher education | 0.041 | 1.680 |
| Employment in the 1st sector | 0.546 | 4.301* |
| Employment in the 2nd sector | 0.397 | 1.336 |
| Employment in the 3rd sector | 0.098 | 1.274 |
| Employment | 0.069 | 1.172 |
| Total personal income | 0.000 | 0.029 |
| GDP | 0.018 | 0.405 |
| 1st sector GVA | 0.079 | 0.607 |
| 2nd sector GVA | 0.004 | 0.017 |
| 3rd sector GVA | 0.003 | 0.110 |
| Basque culture | 0.004 | 0.572 |
| Sustainability index | 0.004 | 0.800 |

[a] Statistical significance at the * = 0.05 and *** = 0.001 level.

findings suggest, a wider range of economic sectors is possible in this region, including timber production and other rural and industrial activities, as well as a (rural) tourism linked to the conservation area (protected landscape quality).

### 4.1. Evolution of the landscape in protected and non-protected areas

Although land use change trajectories are almost the same in the two areas, their magnitude of change has been quite different. Natural ecosystems like broadleaf native forests have increased their area, but marshlands (core area of the UBR) have been recovered only in the protected area, being lost in the non-protected one. This evolution on natural ecosystems is seemingly due to the status of conservation in the Biosphere Reserve. In fact, there have been developed different conservation measures for core zones through the GPUM, focused mainly on wilderness and involving conservation and the active and passive restoration of ecosystems in the protected area (Basque Government, 2004).

Likewise, coniferous plantations, currently occupying a large extent in the protected area, have decreased in both areas, but contrary to what could be expected, the magnitude of decrease has been lower in the protected area. Moreover, both protected and non-protected areas have increased their expansion of eucalyptus plantations, especially the non-protected area, probably as a consequence of global timber markets. In the Basque Country, and the province of Biscay mostly, pine and eucalyptus plantations have been highly financially supported and among forest managers, "a pine and eucalyptus culture" has developed thanks to their relatively easy management, high productivity and favourable market demand (Rodríguez-Loinaz et al., 2013). Certainly, the forestry sector continues to receive subsidies (Rodríguez-Loinaz et al., 2013; County Council of Biscay, 2015) in spite of the recognized environmental impacts caused by the unsustainable management of these forest plantations (Atauri et al., 2004; Rescia et al., 2010). Although the situation nowadays is improving, the pine timber sector is involved in a deep crisis, and timber prices fell by 80% in the 8 years after 2003 (EUSTAT, 2013), which could be one of the reasons for the growing popularity of eucalyptus plantations. This situation should be taken into account to promote a more sustainable forest management in the Basque Country in general and especially in the UBR, where the fact that the 92% of the territory is privately owned complicates its management even more.

The spreading of anthropic forest plantations has been historically linked to rural landscape abandonment. From the 1960s, as an effect of the process of industrialization in Spain, the abandonment of rural space began, creating not only the displacement of the population towards the urban areas but also the interruption of agrarian activities. In Northern Spain, in areas where an agro-silvo-pastoral culture prevailed, this phenomenon was particularly intense (Iriarte-Goñi, 2013). To recover the production of abandoned agricultural and grazing lands and to mitigate the human exodus, regional governments promoted forestry, particularly fast-growing plantations such as *Pinus* and *Eucalyptus* sp. (Groome, 1990). Thus, a decrease in croplands is also a trend in both areas, as well as in the whole region of Biscay, even if the decrease has been less in the protected area.

All in all, we can say that the management of the UBR has been quite successful in conserving and regenerating natural core areas, whereas rural activities that have contributed to its maintenance and socioeconomic throughout the twentieth century have been relegated to second place. Therefore, it is necessary to take more measures to encourage agriculture and rural development, as in some other protected areas in Spain (Martín-López et al., 2011; Schmitz et al., 2012; Palomo et al., 2014). Besides, rural landscapes are considered very valuable, mostly due to their cultural heritage, and maximising multifunctional landscapes by enhancing local food production and reinforcing food security can also contribute to decreasing the local ecological footprint (Palacios-Agundez et al., 2015).

However, it should be pointed out that despite the decrease in cultivated lands, the Gross Value Added (GVA) of the primary sector, in contrast to the non-protected area, has increased in the protected area, which may be due to the measures taken to encourage agriculture (Basque Government, 2009) and/or be the consequence of a specialization of the sector and technology improvement. Indeed, the region of Busturialdea has a quality label known as "*Beans and piper of Gernika*", which together with the "*txakoli*" (a white wine), makes the region a benchmark of quality of agricultural products. These products have their own certificate of origin and therefore, are legally protected. Moreover, we cannot forget the importance of the fishing sector in the area, although the decline in almost a third of offshore inshore fishing in the last 10 years in such municipalities as Bermeo is notably disquieting (EUSTAT, 2015).

Regarding changes in urbanised land areas, it must be emphasised that urban zones have increased in both areas, and almost doubled their extent in the protected area, which is not in keeping with the local population's perception. The approval of the GPUM in 1993 has created a limitation of certain activities, and as an earlier report states, inhabitants of the UBR considered themselves damaged, understanding the designation of the Biosphere Reserve as a restriction of their economic and cultural (in terms of recreation) development. Most of the complaints refer to limitations in the exploitation of natural resources and homebuilding, principally around the rural-coastal zone (Basque Government, 2005). Residential growth has mainly been located in the areas classified by the GPUM as a *Population Centre* but also in those lands called *Areas of Agricultural Interest and Common Rustic Lands*, where residential uses linked to agricultural activity are allowed (Basque Government, 2004). Nonetheless, far from promoting rural purposes, it has led to the construction of dwellings with non-real farms, which over time tend to disappear (Abelairas-Etxebarria and Astorkiza, 2012). What is more, the high prices of land caused by urban pressure (Abelairas-Etxebarria and Astorkiza, 2012) have created difficulties in accessing land, preventing people from working the land. Thus, in part, it could be accepted that the designation of the status of a Biosphere Reserve has limited urban growth, or in other words, made it much lower than in the non-protected area, but at the same time, it has also had a negative impact in the promotion of agriculture due to the difficulties accessing land.

In addition, we must note that both regions have incremented landscape diversity due to the decrease in predominant land uses (conifer plantations and meadows, respectively). However, this result should be considered prudently because only one diversity index has been used and other indices, such as the structural heterogeneity of the landscape and spatial complexity or functionality are necessary to better understand the landscape changes of the territories (see e.g. Rescia et al., 2010); besides, it should be kept in mind if e.g. urbanisation is a desired condition.

### 4.2. Balancing conservation and socioeconomic and cultural development

The changes in socioeconomic and cultural indicators over time have also followed a similar tendency in both study areas probably due to the general socioeconomic and cultural conditions in the region. However, for some of the indicators the magnitude of change has been different.

Significant differences have been observed in relation to employment in the primary sector. In fact, although the population working in the primary sector has fallen more in the protected area, it is much higher than in the non-protected area. Likewise, contrary to what has happened in the non-protected area, the production of the primary sector has increased in the protected area and is much higher. Employment in the industrial sector has been maintained, and the tertiary sector exceeds that of the non-protected area. Thus, in accordance with other studies (Ferraro et al., 2011; Canavire-Bacarreza and Hanauer, 2013; Bonet-García et al., 2015), the designation of the figure protection cannot be considered as a limitation to economic development. Certainly, the amount of employment with respect to the active people in the

protected area has increased notably while decreasing in the non-protected area. Moreover, other indicators, such as land prices (Abelairas-Etxebarria and Astorkiza, 2012), tourism (tourist offices, personal communications, 2015), research and environmental education, and special funds (Technical Service of the UBR, personal communication, 2015) have raised more in the UBR than in other regions in Biscay.

Besides, previous studies on the UBR suggested that biodiversity and ecosystem services are positively correlated (Onaindia et al., 2013b), which in turn, results in economic benefits (European Union, 2013; Costanza et al., 2014a). Hence, the economic and cultural growth of the protected area could also be associated with the conservation of biodiversity and landscape beauty, mainstays for (eco)tourism and recreation, which are indeed the main economic motor and attraction in the region. Therefore, the conservation of biological and cultural diversities seems imperative for sustainable development (Rajeswar, 2001); that is, considering that development entails a change to a more favourable situation and that economic and cultural growth in the area may depend on its biodiversity, if the territory is to remain in the future, it must be diverse and for that, biological and cultural diversities must be conserved. Several authors (Brebbia and Pineda, 2004; Schmitz et al., 2007) have demonstrated that one of the greatest attractions for rural tourism is a landscape mosaic based upon traditional uses and provided some examples of tourism as a sustainable economic alternative.

In this sense, the regions appear alike in terms of sustainability and other cultural variables related to social cohesion, good relations and Basque identity. Nonetheless, the higher good relations index in Busturialdea reinforces the importance of tourism and recreation in the region, resulting from its biodiversity and landscape beauty. Likewise, the decrease of Basque people in Busturialdea could be a consequence of this social cohesion and good relations, whereas the considerably higher proportion of Basque people could be due to rural living and the high importance of the primary sector, connected at the same time with the larger population > 65 years.

It could also be expected that the designation of the UBR has affected the municipalities included inside it to different degrees and in different ways. With the approval of the GPUM, the territory was zoned depending on its environmental importance and socioeconomic interests. Thus, it was likely that the GDP, traditionally used as a measure of economic performance and well-being, would be unequally distributed. Nevertheless, although some considerable differences are observed from one municipality to other, it seems that they are not related to the regulation of the activities. Roughly, the number of people with higher education and total personal income in all municipalities of each region are practically the same, and the GDP, with some exceptions, is very similar because each municipality bases its economy on different sectors, such as tourism and industrial activity. If we compare the GDP of the protected area and the non-protected area, it can be observed that it is much higher in the first one, but lower than in Biscay and the Basque Country. In any case, these results are not unambiguous. Recently, the adequacy and misuse of GDP as an economic development index, and even more, as a wellbeing index has been contested (Stiglitz et al., 2010; Costanza et al., 2014b). GDP mainly measures market production, so nonmarket good and services and the depletion of natural resources are excluded. More relevant indicators of social welfare, with additional information are being demanded, and different alternatives have been measured (Kubiszewski et al., 2013; Li and Fang, 2014; Giannetti et al., 2015), including ecosystem services in GDP accounting. The challenge is to change from growth to a sustainable development indicator. Indeed, human welfare is closely related to the environment; thus, valuing ecosystem services and incorporating these values in decision-making are fundamental for ensuring sustainable conservation policies. A more integrative indicator including cultural aspects (health, education, and recreation) would contribute to achieving the set of Sustainable Development Goals proposed by the United Nations in 2014 as the new global reference goals for the international development community until 2030 (Le Blanc, 2015).

To enhance the management effectiveness of the protected area, greater effort in the protection of the rural activity, a hallmark of the territory, is necessary, as is allocating funding aimed at conifer plantations to broadleaves species. Replacing forest plantations with native broadleaves was suggested, at least in areas with slopes higher than 60% or with an erosion risk (Rodríguez-Loinaz et al., 2013). All this could help to stimulate economic growth as a result of an increase in the tourism sector, linked to the higher supply of ecosystem services (Onaindia et al., 2013b; Palacios-Agundez et al., 2013; Rodríguez-Loinaz et al., 2013), at the same time that other economic and cultural benefits are also obtained from the market and non-market services that cultivated lands' and natural forests' provide (De Groot et al., 2012; Costanza et al., 2014a). However, to achieve these objectives, and considering that most of the territory in the UBR is private, it is necessary to involve the affected local populations, adopting participatory and active conservation policy decisions and integrating the PAs and the priorities of the local population and the socioeconomic and cultural context. Management expenses, conservation and protection costs, must be regarded as an investment that ensures direct economic profits and benefits in term of avoided costs because they prevent environmental damage and loss of biodiversity.

At this point, we should ask ourselves what would have happened if the UBR had not been designated. Surely, the region of Busturialdea would have followed a developmental trend with the previously mentioned megaproject as a dominant paradigm; consequently, important environmental and socioeconomic changes would have occurred. However, as this study suggests, the socioeconomic and cultural development of the protected area has been similar to that of the non-protected area, so in terms of conservation, the project could be hardly argued.

## 5. Conclusions

Our results suggest that the designation of a biosphere reserve does not influence the local population negatively but does safeguard nature conservation, which could have enhanced socioeconomic development. The most important success of the designation of the UBR is that it prevented the construction of urban megaprojects that would have dramatically impacted the current natural core areas. The conservation of natural ecosystems and the status of the biosphere reserve have given local communities the opportunity to maintain social welfare and to develop an economy based fundamentally on the tertiary sector but also on the primary sector and local industry.

Among the most relevant future challenges are the urgency of taking measures to achieve sustainable forest management and the need to promote further development of local food production. Thus, more effort seems to be necessary to promote more sustainable forest management and support traditional rural activities, which in decline.

In addition, because biosphere reserves have the vocation to be pilot sites towards sustainability and pioneers in the implementation of actions towards sustainable land management, suitable measures suggested for biosphere reserves should also be recommended for the sustainable management of the entire region.

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## Appendix A. Supplementary data

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