VÍCTOR LALLANA LLORENTE
Departamento de Geografía, Urbanismo y Ordenación del Territorio. Universidad de Cantabria
<https://orcid.org/0000-0002-9840-2600>

The footprint left by uses and management changes in vegetation of Polaciones Valley (Cantabria), 1953-2014

I. INTRODUCTION AND OBJECTIVE

The composition and structure of current mountain landscapes, is the result of combining physical elements and human actions, these last ones essentially focused on the use of space. If physical factors are left aside, what is perceived is the inheritance of human exploitation in the past based on a system of traditional exploitation. In this case, both the economy and the maintenance of society start from an efficient use of resources, defining a distribution of landscape units where the biological potential of each space stands out: mowing meadows and crops in valley bottoms, a broad forest area and a supra-forestry space of grassland and summer grass. A system of exploitation that, moreover, has historically supported intense livestock pressure.

Since the mid-twentieth century, these spaces are suffering an important transformation associated with changes in the demographic structure, social organization and use of space by humans, defined in the literature as a change towards a recent land management system. This greatly simplifies the relationships within the areas that compound its territory, intensifying the most fertile and better connected areas, while leaving the less profitable ones aside.

The variations in the use and management of the agricultural area, the main and almost only activity of the valley, lead to significant changes in the landscape composition, highlighting especially the phenomena of natural plant succession, of both forests and shrubs.

The valley of Polaciones (Cantabria), object of the present work, constitutes a clear example of this evolution. Located in the central Cantabrian mountain range, the depopulation, the forsaking of agriculture and the changes in the livestock management, give place to substantial transformations in landscape structure and dynamics. Changes that can be restored and this is precisely our initial hypothesis, from the footprints left on the vegetation cover, in the mosaic vegetation-land uses (from now on LCLU). Based on this hypothesis, the following objectives are proposed:

a) Examine the periods in which there is an inflection in the population dynamics, as well as the associated changes in livestock structure, in relation to the mechanization of the rural environment, the opening of new tracks and access to the mountain.
b) Identify the impact that the processes of change of use and management of livestock spaces have introduced in plant formations through the photointerpretation analysis of the LCLU between 1953 and 2014.

II. METHOD

The methodology proposed and the sources used for this study can be structured in several work phases, in accordance with the objectives set:

2.1. DEMOGRAPHIC EVOLUTION AND AGRARIAN SPACE ANALYSIS

In the first phase of work, it is proposed, on the one hand, the study of the population of the area to identify

those periods in which there has been an inflection of the demographic dynamics. The data offered by the National Statistics Institute allows us to examine its trend since the mid-nineteenth century.

Meanwhile, a second aspect related to the agriculture's area evolution is considered. For this purpose, information is drawn from the different statistical yearbooks (2004, 2005, 2006, 2007, 2008, 2009 and 2010) and agricultural censuses (Agrarian Census 1865, 1962, 1982, 1999 and 2009). From them it is possible to appreciate the livestock management changes in recent decades, the number of farms and their size, as well as the evolution in the number of cattle heads according to species.

2.2. Evolution and dynamics associated with the LCLU

This work´s phase aims to verify and combine the impact that the changes in the management and use of the agricultural space introduce in the vegetation cover. Once the evolution has been typified and the key periods identified in both the demographic and agrarian evolution, the available photogrammetric information is selected. For this purpose, the election of The Rustic Wealth Cadastre of 1953 (CGCCT, 1953) has become the starting point, taking 1986 as an intermediate reference and the orthoimage as the most current period from the National Plan of Aerial orthophotography 2014 (PNOA).

We proceeded to the previous georeferencing of the images and the subsequent photointerpretation and digitization of LCLU for the three specific dates: 1953, 1986 and 2014. Two levels of photointerpretation have been established: a first level (Level 1) that classifies 6; (Level 2), which establishes a mainly morphological gradation, obtaining a total of 11 categories. Once the vector cartography has been developed, GIS overlaying techniques have been applied to obtain change surfaces between the different mapped periods.

III. RESULTS

3.1. The descent of the rural population and changes in the agrarian space structure

Arising at the fifties decade, there is a general rural population decline. This process shows two very clear stages: the first one, begun between 1940-1950 and it extended into the eighties and nineties, characterized by a rapid demographic loss coinciding with the demand for employment in industry and services. The second one, from the nineties to the present, where stabilization occurs. To this depopulation of rural areas, we must add that it was the younger population that emigrated, leaving the rural population remarkably aged.

This process of depopulation of rural areas, in turn led to a dismantling of social organization, highly conditioned by the abundance of depreciated labour as well as the organization of space, for its link to the demographic and social structure.

Despite the outstanding importance of livestock in this area, the influence of demographic decline was also noted in the reduction and structure change of agricultural holdings. If in 1962 there were 252, the number had already decreased significantly in 1982 to 111, continuing to decline up to date, with 65 in 1999 and 52 in 2009.

Depopulation not only results in a reduction in the number of farms, but has also affected the size and fragmentation of the plots. During the 1962-2009 period, 92% of the farms under 20 ha had disappeared. The medium-sized farms, between 20 and 50 ha, also suffered significant variations with a considerable increase in the period 1962-1999, where they almost tripled their number and a subsequent reduction of 66.3%, between 1999-2009 where it seems that they were incorporated into larger farms (> 50 ha). However, despite the increase in the number of medium-sized (20-50 ha) and large (> 50 ha) holdings, a smallholder structure with excessive fragmentation of land is still maintained.

3.2. Changes in the livestock management and administration

The cattle activity in the past was organized around communal norms of use and management, where the exploitation of the cattle consisted in taking care of the cattle and its livestock by the town's shepherd by his own, or helped in turns by the different cattlemen in the system of «vecería». There was a balanced exploitation of communal pastures by different species of cattle (cattle, sheep and goats) and was based on an exchange of pastures between the high and low areas of the valley according to the eras.

At the present time and under this new economic and social situation, pastoral activity is more unstructured and farmers have their own faculties with a more marked individualism and without coordination between management strategies. The widespread use of machinery

has mitigated in some aspects the impact of depopulation. Thus, jobs such as mowing and collecting grass and firewood have been able to continue to be done with less population.

The current systems of extensive exploitation (fewer farms, but with a larger number of troops) mean less control over the cattle at the time when they use the ports, being generalized to the individual care of each owner and where the livestock are guarded only sporadically by their owners. In addition, there is an increasing tendency to intensify those areas considered better because they present more fertile soils and with less limitation to work with agricultural machinery and usually happen to meet with communal forests near the villages, where cattle are left in summer, meaning an incomplete use of resources whose maximum production is staggering in time according to altitude and orientation.

3.3. Characteristics of livestock feeding: cabins and their access

The number and evolution of the winter cabins, as well as the opening of new forest tracks that ascend to the port grasslands, are a faithful reflection of the change experienced in terms of population evolution and changes in the agrarian system.

The evolution of the cottages state and associated lands throughout more than 60 years of analysis reflects a generalized decrease in the use and maintenance of them and entails the scrubbing of the adjacent spaces previously dedicated to mowing and pasture of the cattle. Of 363 cabins initially active in 1953, now there are only 190, which represent a reduction of 47.7%.

On the other hand, human pressure and the change in livestock management over the environment are also reflected in the organization of road networks and forest tracks. The greatest activity is concentrated not only in the most fertile areas, but in those with better accessibility with motor vehicles, marginalizing the hillsides with a very lax use by the cattle which gradually will be completely abandoned.

3.4. Temporal evolution: Polaciones valley LCLU changes

The changes analysed between 1953 and 2014 represent 22.72% of the territory total's area, a figure close to 2,150 ha over almost 11,200 mapped areas studied. Succession processes dominate over those of regression, with the course of 1953-1986 standing out, where 68.5% of the changes take place, compared to 32.5% in the time period 1986-2014, being mostly located in the most depressed sectors of the valley, as well as in the middle slopes.

The most marked loss of extension corresponds, as we have mentioned before, to the herbaceous cover, being mainly attributable this backward movement although not in a unique way, to the social and management changes analysed. The shrubby LCLU appear to have certain stability in terms of their surface in the three periods, which responds to their central situation in the succession, being the resulting stage of the evolution on the herbaceous surfaces, but also of the regression result of the forest increase surface. The arboreal LCLU, with progressive gains in the three moments analysed, becomes the dominant unit over the territory in 2014, with a total representativeness of 42.4% (4,738 ha).

IV. DISCUSSION

The contrasted studies of the LCLU since the mid-twentieth century, allow us to affirm that since the last decades there have been processes of revegetation and evolution of plant succession. This phenomenon, according to authors such as Sitzia, Semenzato and Trentanovi (2010), currently reaches a global dimension, which in Spanish territory can be considered common from the decade of the forties-fifties. Other authors have indicated the thermal increase as the main cause of the positive evolution of plant biomass. However, and without diminishing importance to this possible cause, in the Spanish mountain it seems more justifiable to attribute the main responsibility to changes in management and land use. The processes of revegetation experienced have to do with the reduction of meadows mowing areas, mountain pastures, grasslands and open thickets, opposite an extension of the area of dense thickets and tree formations.

The spatial tendency of changes seems to follow a common logic also observed in other studies, where more productive pastures and grasslands are exploited and harnessed more (meadows located around the nuclei, in the best soils or better connected by tracks forest) while the more distant or topographically less suitable ones are abandoned more quickly, initiating their invasion by shrub species.

In fact, many of the structures of the old organization of the rural area (dehesa boyales, high ports, etc.) are

being lost, which, in the absence of labour and the lacking "pastoral culture" of the current farmers, are deriving in the extension of large areas of heath (Erica spp.) and argomales (Ulex gallii) triggering frequent and random fires.

V. CONCLUSIONS

The territory that constitutes Polaciones Valley has been and still is an important pastoral land. As we have seen, during the 20th century and more marked since the second half, this mountain area, like the rest of the Cantabrian and Spanish mountains, is suffering deep changes in the demographic structure, economic organization and land use, which have given rise to what the literature calls the Recent System.

Its traditional organization, in "brañas" and ports, respond to the seasonal exploitation during the summer months of resources that were considered strategic within the framework of traditional livestock exploitation, made according to the ecological conditions of the mountain that the environment offered. A vegetal landscape of grasslands was result of this area managed by humans, where brañas and ports had come to replace all the natural vegetation of birch and beech forest and subalpine scrub.

As the emigration of the rural population in search of the economic attractiveness of the cities increased, a large part of the space tended progressively to an abandonment and change in the traditional management systems, concentrating in the most fertile areas and also with better accessibility and marginalizing most of the less accessible hillsides and ports, which has generated important and rapid changes in the landscape. The natural dynamics of the vegetation, recovering these pastures spaces, now colonized by a dense "substitution" scrub and densification of new trees. Hence, we can affirm that the process of revegetation is the main recent feature of the natural and landscape dynamics of the central Cantabrian mountain range.

From this, we can highlight the importance that the systems of exploitation and livestock management in extensive regime have in other to maintain the biodiversity and the cultural or traditional landscape on which they settle.