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TREES OUTSIDE FOREST IN THE AGRARIAN LANDSCAPE OF MEDITERRANEAN MOUNTAIN REGIONS: THE CASE OF SIERRA DE LA CONTRAVIESA, SPAIN.

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Abstract

The tree has been a constant feature in the structure and sustainability of agrarian landscapes in Mediterranean mountain regions. Our research focuses on trees that grow outside forests, important resources which due to their heterogeneity and multi-functionality have been studied from a variety of methodological perspectives without a clear integrated vision. In this context we have used the concept of 'Trees Outside Forest' (TOF) and the standardized methodological and assessment criteria proposed by the FAO in the Global Forest Resources Assessment (FRA) as a benchmark for our research, which deals above all with the current situation of the TOF in Mediterranean mountain regions. To this end, and always from a landscape perspective, we have carried out a diachronic analysis and an integrated assessment of the multi-functionality of these resources within the agricultural system of the Mediterranean mountainside, exemplified in the coastal massif of the Contraviesa in southern Spain.

***Keywords**: trees outside forest, Mediterranean mountain, landscape, land use*

1. INTRODUCTION

The coining of the term *Trees Outside Forest* (TOF) by the Food and Agriculture Organization of the United Nations (FAO) in 1995 (Bellefontaine et al, 2002) was a landmark in the specific study of these resources which it defined as "trees on land not defined as forest or other wooded areas". This term therefore covers the trees on agricultural, urban and periurban land and on land in which there is scarce tree cover and the vegetation cannot be defined as a forest (Kleinn, 2000).

In order to improve the disperse and segmented knowledge of this question and given the complex functions and services that such trees perform (food safety, carbon sink, the conservation of biodiversity, the maintenance of rural population, the fight against desertification, landscape conservation, etc), the FAO commissioned a number of specific reports that confirmed the findings of the main international forest assessments, such as the United Nations Framework Convention on Climate Change (UNFCCC), the Convention on Biological Diversity (CDB) and the Global Forest Resources Assessment (FRA) (Foresta et al, 2013; IFN, 2000). The aim of these reports was to create a specific clearly defined assessment methodology from which numerous studies aimed at creating an inventory of TOF in different countries have resulted. These include studies of Bolivia (Muñoz, 2001), Nicaragua (Chavarría, 2001), India (Pandey, 2008) and Bangladesh (Singh, 2000) among others.

The conceptual complexity and spatial heterogeneity of these resources has led to the use of the concept Trees outside Forest as a new point of reference for research from different perspectives (Porcel & Jiménez, 2013). Research has been done for example on the increasing tendency to plant trees as a means of improving the productivity of land with low agricultural potential (Sedjo, 1999) and its economic viability (Dogra, 2011).

Other researchers see TOF as a basis for sustainable development and for the enrichment of agro-forestry systems in very disadvantaged areas (Thaman, 2002). Specific studies in temperate regions are however more scarce with examples from France (Pointereau & Bazile, 1995; Bélouard & Coulon, 2001; Guillerme et al, 2009; Petit-Berghem, 2012) and Italy (Corona et al, 2009) among others. In Spain the first methodology put forward for the assessment of TOF was developed as part of an international project entitled "Les paisajes de l´arbre hors forêt: Multi-varolisation dans le cadre d´un développement local durable en Europe du Sud", which was jointly organized by the Universities of Toulouse (France), Genova (Italy) and Granada (Spain) (Guillerme et al, 2013).

In this project researchers analysed the TOF in certain mountain areas from the perspective of agrarian multifunctionality and sustainable development in the rural world (Guillerme et al, 2015). The main results presented in this article came out of this project. The general aim of our research was to create scientific knowledge about the state of the TOF in the Sierra de la Contraviesa (province of Granada) placing particular emphasis on the identification of the different types of landscape and their recent evolution.

2. TYPES OF TOF LANDSCAPE IN THE SIERRA DE LA CONTRAVIESA

The landscape of the Sierra de la Contraviesa is the product on the one hand of the spectacular geomorphology of its intricate hydrological network (García, 1973), and on the other of its original mosaic of groundcover plants. Its traditional agroforestry framework is based on a range of woody crops (almonds, vines etc) on non-irrigated land with a strong presence of trees and is responsible together with the physical medium in which it grows for the quality and diversity of its landscapes. The first attempts to define the various different general types of landscape in this mountain space include the Dobris Report (Comisión Europea, 1991) which offered a generic typology of Mediterranean cultural landscapes and various, more specific publications about the landscape in the area (Camacho, 1995), and different studies of the TOF in other adjacent mountain areas (Caballero & Jiménez, 2013; Porcel & Jiménez, 2013).

In order to define the different typologies of TOF from a landscape perspective, we used a decision tree based on the sequential application of the criteria and categories defined by the FAO-FRA. This algorithm is based on seven decision criteria which enable us to distinguish

between the different operational categories. Once we had come to the conclusion that this area in no way meets the criteria to enable it to be considered a "Forest" (FOREST) or "Other Wooded Lands" (OWL) we analysed its fit with the different types of TOF. In this way we decided that the study area belonged to the subcategory of "Other Land with Trees Outside Forest" (OLwTOF) or more specifically "Other Land with Trees Outside Forest for Agriculture" (TOFAGRI), a sub-class that covers all land used predominantly for agricultural purposes, and in particular agro-forestry systems such as the one we are studying here. In this case, this space and the types of TOF we distinguished within it, fulfil the threshold levels for the biophysical variants of reference (surface threshold of more than 0.05 ha, trees of over 5 m in height, canopy cover of more than 5%...).

Two main types of TOF can be identified in the study area:

a) That made up of associations of extensive woody crops on non-irrigated land, the principal landscape feature of this massif. The dominant crop in these associations is the almond tree (*Prunus dulcis*) followed by others such as vines (*Vitis vinifera*), annual crops, fig-trees (*Ficus carica*) and to a lesser extent olives (*Olea europea*). Plantation density is low, with most farms lacking any clearly defined plantation systems (Rodríguez, 1985). Although most of the land in this type of landscape is not irrigated, there are some irrigated spaces located above all in traditional vegetable gardens with a wide variety of different plants on highly productive terraced land.

b) The association between the spontaneous plant communities that develop in ravines and river-beds. Due to their topographic complexity and/or very low agronomic potential, these spaces have traditionally not been used for agriculture although they have had some economic value as a source of firewood and aromatic plants and for grazing, hunting, etc. This human exploitation of land has resulted in a structural simplification and a generalized impoverishment of the Flora most of which are basic vegetation formations which conserve the arboreal stratum (Rivas, 1986). The tree species present in the form of small patches of woodland, include the holm-oak (*Quercus rotundifolia*), the cork-oak (*Quercus suber*), the hackberry (*Celtis australis*), the chestnut (*Castanea sativa*), the white willow (*Salis alba*), and the white poplar (*Populus alba*), etc.

3. STUDY AREA

The Sierra de la Contraviesa is in the SE of the province of Granada and forms part of the Penibetic coastal arc (see Figure 1). It is a medium altitude mountain range situated between the Sierra Nevada and the Mediterranean Sea, down to which it descends directly with steep slopes and an intricate hydrographic network. It has a dry Mediterranean climate, softened by its altitude and the orientation of its slopes due to its north-south layout. It has poor skeletal soils (eutric regosols, calcaric regosols and lithosols) affected by severe erosion processes (Proyecto LUCDEME, 1987). It is covered by an original agro-forestry system dominated above all by woody crops grown on non-irrigated land. In administrative terms, its area of almost 600 km² covers 12 municipal areas (Sorvilán, Rubite, Polopos, Albuñol, Torvizcón, Murtas, Albondón, Almegíjar, Cadiar, Cástaras, Lobras and Turón) either totally or partially, and it has a population of about 14,000 people. In socioeconomic terms it is a marginal area with an ageing population that has suffered drastic rural exodus (Remmers, 1998). For this research we selected the village of Murtas, which has a municipal area of 72 km^2 and 541 inhabitants (INE, 2014).

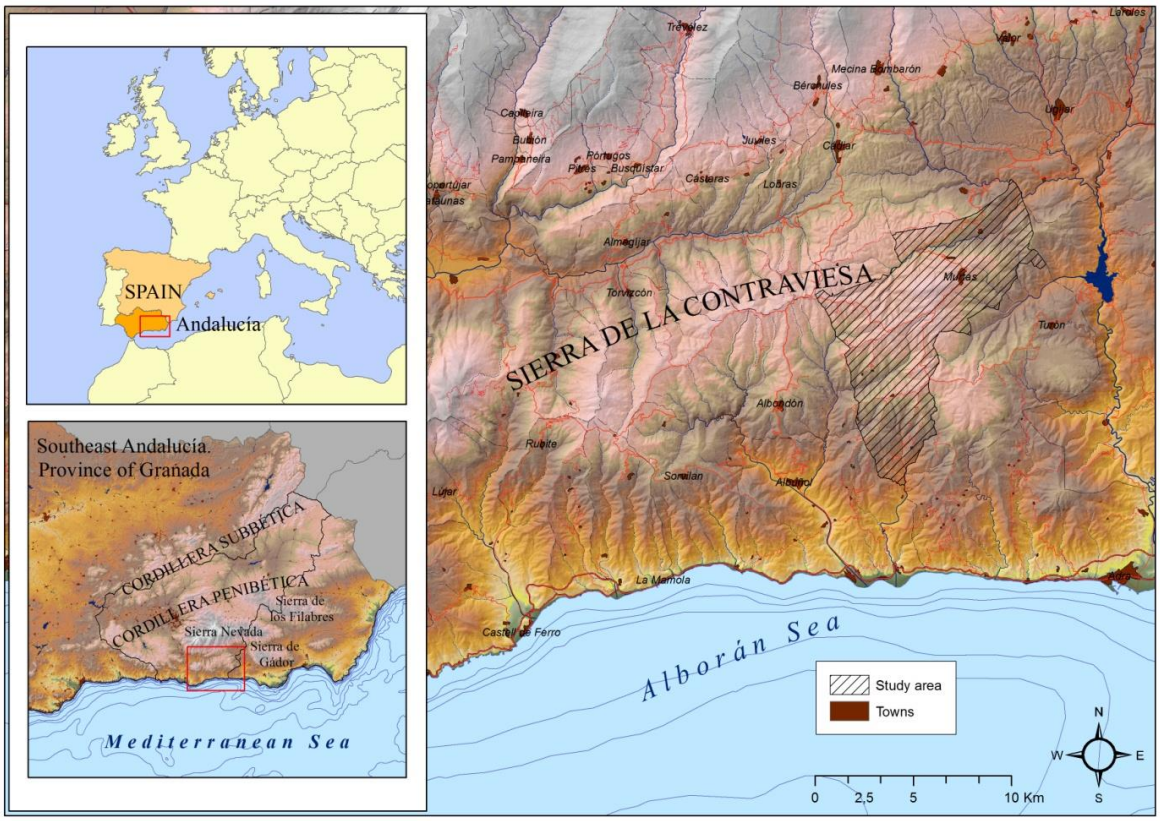

Figure 1. Situation of the study area (Source: Created by the author from some shapefiles downloaded of Instituto de Cartografía y Estadística de Andalucia IECA, 2015a)

4. METHODOLOGY

The method we used was based on a diachronic analysis and offers a global vision of the landscape via the quantification and modelization of its dynamics, and the differentiation of its different types of TOF and their component parts. Various sources were used: analogue cartography at various scales, topographic and thematic cartography in digital format, aerial photographs from various different years (1956-57, 2001 and 2006) and statistical information available in the Instituto de Cartografía y Estadística de Andalucía (IECA, 2015b), using the ArcGis 10 programme by Esri for the analysis and interpretation of the maps.

Land use and land cover change has aroused increasing attention from scientists worldwide since 1990, with a range of international projects, for example LUCC Land Use and Land Cover Change (Lambin & Geist, 2006) and a large number of publications on the subject and its different applications (Lambin et al., 2001; Lambin et al., 2003; Turner et al., 2003, among others). Basing ourselves on the diachronic model of analysis (Bolós, 1992) we considered two points of reference spanning the second half of the 20th century, 1956 and 2006, so as to study significant spatial transformations in the tree landscape of the Contraviesa over the intervening period using a reconnaissance or semi-detailed scale of 1:5000.

We opted not to use the biophysical variables of reference (altitude, area, degree of cover...) in the legends for the map as the whole area fell within the same TOF category (OLwTOF). Similarly we did not distinguish between particular species or productive associations given the lack of any defined pattern of crops. The main parameters we used when establishing the different categories were the origin (natural or cultivated), the type

(herbaceous- woody) and the associations between types of crop (trees, mixed, herbaceous). As a result in the legend we differentiate firstly between agricultural groundcovers, dividing them into three subcategories (tree-covered, mixed, herbaceous) and secondly, groundcovers of natural origin (small patches of wood). The main characteristics of these categories of TOF are:

1) **Small patch of woodland**: this groundcover is made up natural vegetation with arboreal stratum with a surface area of less than 0.5 ha thus meeting the definition of TOF established by the FAO.

2) **Herbaceous crops-vines**: this form of groundcover combines different types of plant. Although it is non-arboreal, we decided to consider it due to the historic importance of the two crops in the study area in terms of surface area and local tradition, and due to the scarce yet noteworthy presence of trees within them. These two apparently opposing types of crop (herbaceous crops are annual while woody crops are permanent) were grouped together because they are both very labour intensive and above all because of the difficulty in distinguishing between them in the old photographs.

3) **Mixed crops**: this combined category groups together spaces in which there is a productive association between tree crops and herbaceous/vines. These areas are rarely laid out according to defined spatial patterns.

4) **Tree crops**: this category refers to areas wholly occupied by trees typically planted in irregular low density distribution patterns, and covering a small percentage of the available ground.

5. RESULTS

5.1. Situation of Trees outside Forest landscapes in 1956 and 2006

The land uses in 1956 shows a traditional landscape in which primary activities predominate (see Figure 2), occupying almost 77% of the total municipal area.

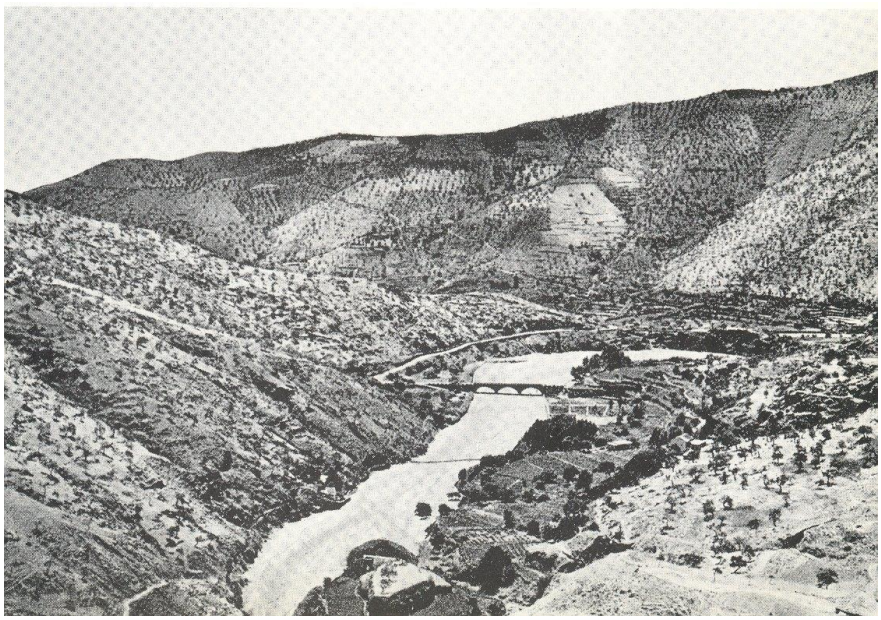

Figure 2. Photograph showing the high level of agricultural land use in the Sierra de la Contraviesa (Source: Spahni, 1983)

The three agricultural types of TOF differentiated in the map legend occupy similar surface areas, albeit with a slight dominance of tree crops, which make up 31.12% of the total (Table 1). The other two types of crop (herbaceous-vine and mixed crops) include a wide array of cereal-based crops, which are of vital importance in an agrarian economy in which people consume what they grow and have little interest in selling their produce on the market.

Groundcovers of natural origin such as the small patches of woodland occupy only 7% of the total municipal area (see table) in places with very limited or no potential for agriculture.

Table 1. Land use according to types of TOF (1956)

	Surface area (ha)	% of municipal area
Patches of woodland	460.86	6.43
Scrub	1177.18	16.43
Tree Crops	2229.63	31.12
Herbaceous-Vine crops	1945.92	27.16
Mixed crops	1330.62	18.57
Built-up areas	19.41	0.27

The situation in 2006 (Figure 3) shows the breakdown of the traditional agrosystem probably as a result of its inability to adapt to the market economy and its productive requirements. The generalized disappearance of traditional farming practices, the massive abandonment of certain crops and the extensification of the remaining crops seriously impoverish and damage the landscape.

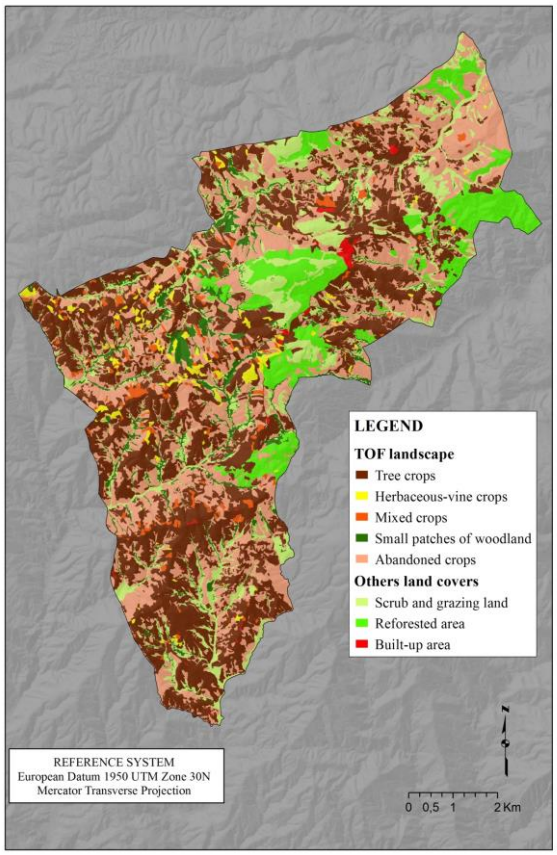

Figure 3. Situation of the TOF in 2006

In 2006, only 40% of the total municipal area of Murtas was used for agricultural purposes. Tree crops dominated, covering over 90% of the cultivated area, while herbaceous crops and vines and mixed crops had almost disappeared.

Natural cover and/or spontaneous groups of trees occupied almost 9% of the total municipal area (see Table 2). As a result of forestry work in the river basin of the Benínar reservoir there was also a new groundcover in the form of areas reforested with pine trees (*Pinus pinaster*, *Pinus sylvestris*), which covered about 10% of the municipal area.

Table 2. Land use according to different types of TOF (year 2006)

	SURFACE AREA (HA)	% OF MUNICIPAL AREA
Patches of woodland	609.92	8.51
Reforested land	680.12	9.49
Scrub	2968.40	41.44
Tree Crops	2609.81	36.43
Herbaceous-Vine crops	124.19	1.73
Mixed crops	138.66	1.94
Built-up areas	32.52	0.45
Total	7163.62	100

5.2. Dynamics of the TOF landscapes (1956-2006)

The evolution of this landscape and its component parts over the study period shows that whereas in 1956 agriculture was the main land use, by 2006 the picture had changed dramatically with a dominance of natural facies made up above all of scrub formations without a tree layer, occupying almost 60% of the municipal area. Over the 50-year period from 1956 to 2006 the percentages of all the various kinds of groundcover have increased to the detriment of the cultivated area, which has lost almost half its area occupied in 1956, due especially to the almost total disappearance of herbaceous-vine crops and mixed crops. Within the cultivated area there has been a relative increase in tree crops over this period (see Table 3).

Table 3. Comparison of different forms of land use 1956-2006

	SURFACE AREA (HA)			% OF MUNICIPAL AREA		
	1956	**2006**	**2006-1956**	**1956**	**2006**	**2006-1956**
Forest	460.86	609.92	149.06	6.43	8.51	2.08
Reforested land	0.00	680.12	680.12	0.00	9.49	9.49
Scrub	1177.18	2968.40	1791.22	16.43	41.44	25.00
Cultivated area	5506.18	2872.66	-2633.51	76.86	40.10	-36.76
Built-up area	19.41	32.52	13.11	0.27	0.45	0.18

A total of 2633.51 hectares of cultivated area has been lost in absolute terms, a significant change in land use, as can be seen in Figure 4 and Table 3. The abandoned fields have been recolonized by wild plants especially scrub (Table 4).

Table 4. Transformation of the cultivated area in 2006

	HA.	% OF THE TOTAL
Scrub	2040.25	72.92 %
Reforested land	495.24	17.70 %
Forest	248.81	8.89 %
Built-up area	13.46	0.48 %

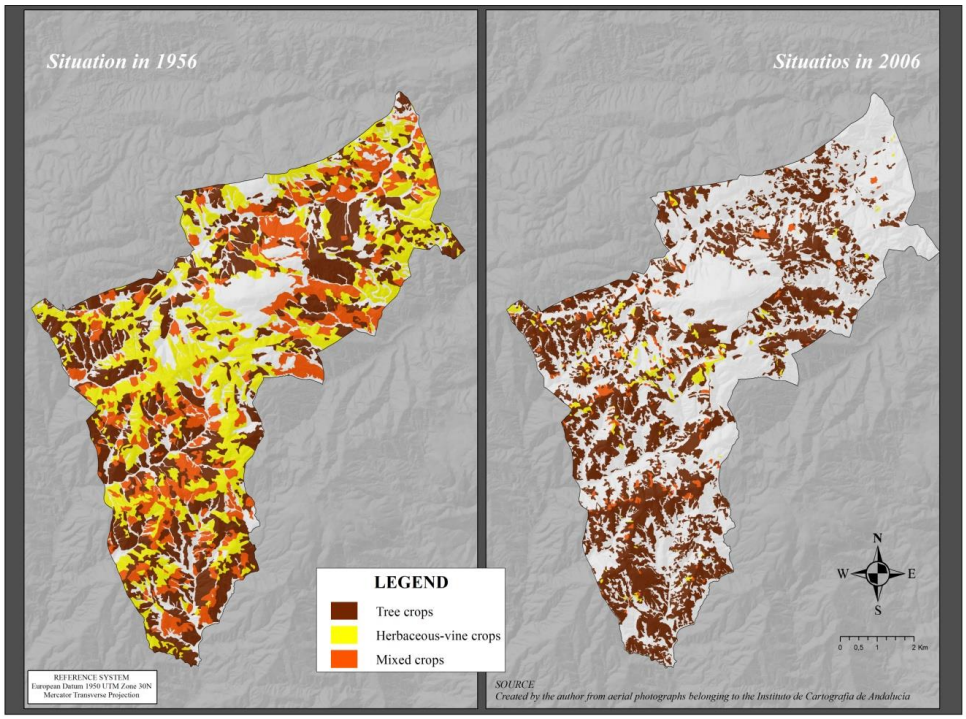

Figure 4. The situation of the cultivated area in 1956 and 2006

The area covered by tree crops has increased over the period we analysed by 380 ha. This is the type of crop that has remained most stable over the period 1956 to 2006, with over 50% of the original area still devoted to this kind of crop (Table 5).

Table 5. Area covered by the different types of crops in 1956 and 2006.

	Surface area (ha)			% of municipal area		
	1956	**2006**	**2006-1956**	**1956**	**2006**	**2006-1956**
Tree crops	2229.63	2609.81	380.18	31.12	36.43	5.31
Herbaceous-vine crops	1945.92	124.19	-1821.73	27.16	1.73	-25.43
Mixed crops	1330.62	138.66	-1191.96	18.57	1.94	-16.64

In spite of this growth in surface area in absolute terms this type of landscape has undergone significant spatial transformation in that a total of 1066.19 hectares of the original surface area has been lost giving way in most cases to scrub formations (see Figure 5). This

has been compensated for by planting in other areas, hence the net increase in the surface area over the study period.

Figure 5. Contact between landscapes of agricultural land (left) and abandoned land (right) in sloping areas (Source: The Author)

The area occupied by tree crops has increased by 1446.36 hectares over the study period, as can be seen in Figure 6. This is by and large the result of the reconversion of herbaceous-vine crops and mixed crops, with few tree crops being planted on previously natural areas.

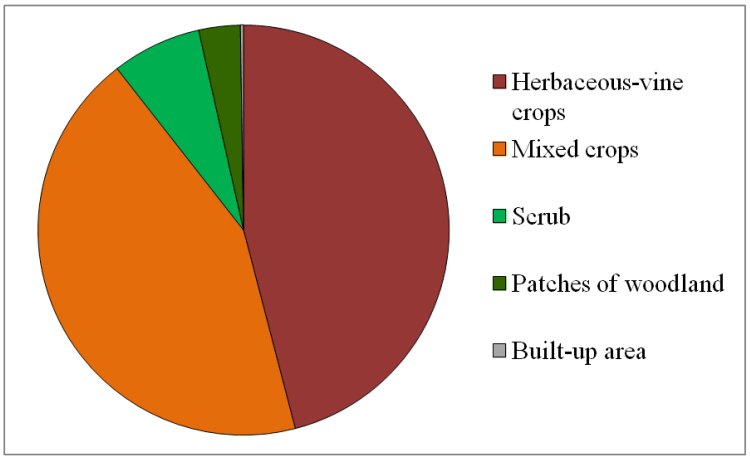

Figure 6. Previous land use of the land occupied by new tree crops in 2006

The type of landscape that has suffered most over the period is herbaceous-vine crops which have lost about 96% of their original area. These crops were one of the most characteristic forms of agricultural landscape in Murtas in 1956, extending over 1,945 hectares. The drastic abandonment of this kind of production has caused it to shrink to a mere 124 hectares. Table 6 shows the current uses of the spaces it once covered.

Table 6. Current use (2006) of the areas originally planted with herbaceous-vine crops

	Hectares	% of the total
Scrub	726.08	38.91
Tree crops	664.58	35.62
Reforested land	283.42	15.19
Forest	96.75	5.19
Mixed crops	90.03	4.83
Built-up area	4.99	0.27
Total	1785.77	100.00

The area covered by mixed crops has also fallen sharply over this period, dropping from 1,330 hectares in 1956 to 138 hectares in 2006, a reduction of almost 90% of the area devoted to these crops. This has led to a simplification of the landscape with the almost complete disappearance of traditional associations of different crops with significant repercussions on the landscape. These typically included combinations of fig trees and vines and the mixed crops grown on irrigated terraces. See an example of mixed crops in Figure 7.

Figure 7. Mixed crops: combination of tree and herbaceous crops. In this case almond trees and barley (Source: The Author)

The land covered by patches of woodland has increased considerably over the study period. Almost 70% of new areas have been gained at the expense of agricultural land. The abandonment of crops has led to the recolonization of these natural spaces by trees, something that can be observed above all in ravines and shaded areas. The conversion of scrub into patches of woodland according to a process of "natural succession" has affected only 30% of the total area.

5. DISCUSSION AND CONCLUSIONS

Trees have always been a constant feature of the landscape of the Sierra de la Contraviesa. Dominated by natural facies in the first stages of human occupation, the gradual ploughing and cultivation of this space has led agricultural land uses in general and tree crops in particular, to become essential components of the configuration, sustainability and legibility of the landscape of this agro-system. The crisis of traditional agriculture has meant that since the 20th century there has been a progressive abandonment of this space. The costly and effective implementation of the conventional agriculture model has led in landscape terms to two complimentary processes of abandonment and/or conversion to other forms of production as a result of their very limited economic value.

The abandonment and generalized shrinkage of agricultural land has caused high fragmentation and a loss of compactness, with large extensions of crops being abandoned. In close association with this process, the extensification of land uses and the progressive specialization of production seek to increase the economic viability of farms by reducing costs and maintenance.

Our analysis has shown the importance of TOF in the landscape in the Sierra de la Contreviesa as one of the dominant features that defines and gives identity to the landscape bestowing it with structure, diversity and quality. Although their presence in terms of surface area has grown, many trees are now useless in productive terms and no longer serve their original purpose, while others have been replaced or have gradually disappeared in favour of other more extensive, more commercially viable agricultural species. This results not only in the homogenization and simplification of landscape but also in the territorial degradation of the area brought about by environmental, economic, cultural and other kinds of losses. However and in spite of what we have said, the agricultural model based on traditional crops should not forget its prime original function, in that there are substantial margins for improvement by converting these crops to an ecological, organic system of production that respects the sustainable development of the territory and the conservation of the traditional landscape.

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REFERENCES

Bellefontaine, R., Petit S., Pain-Orcet, M., Deleporte, P. and Bertault, J.G. 2002. *Los árboles fuera del bosqu*e. Hacia una mejor consideración. Guía FAO: Conservación nº 35. Roma, FAO.

Bélouard, T., and Coulon, F. 2001. Los árboles fuera del bosque: el caso de Francia. In *Los árboles fuera del bosque. Hacia una mejor consideración. Guía FAO: Conservación nº 35*, Bellefontaine, R., Petit, S., Pain-Orcet, M., Deleporte, P., Bertault, J.G., 149-155. Roma, FAO.

Bolós i Capdevilla, M. 1992. *Manual de Ciencia del Paisaje. Teoría, métodos y aplicaciones*. Barcelona: Ed. Masson.

Caballero Calvo, A. and Jiménez Olivencia, Y. 2013. Evaluación de recursos locales: Los paisajes del árbol fuera del bosque en el municipio de Válor. In *Desarrollo Local en tiempos de crisis. ¿El retorno de los recursos endógenos?*, coord. Rodríguez Martínez, F., 279- 293. Granada: Universidad de Granada.

Camacho Olmedo, M.T. 1995. Cartografía de los paisajes erosivos de la Sierra de la Contraviesa (provincias de Granada y Almería). Granada: Universidad de Granada.

Chavarría Sacasa, M.R. 2001. Arboles fuera del bosque en Nicaragua. In *Proyecto Información y análisis para el manejo forestal sostenible: Integrando esfuerzos nacionales e internacionales en 13 Países tropicales en America Latina (GCP/RLA/133/EC)*. Chile: FAO.

Comisión Europea. 1991. Medio Ambiente en Europa. El Informe Dobrís. Grupo de Trabajo de la Agencia Europea de Medio Ambiente, DG XI & PHARE. Luxemburgo: Oficina de Publicaciones de las Comunidades Europeas.

Corona, P., Chiriacò, M.V., Salvati, R., Marchett, M., Lasserre, B. and Ferrari, B. 2009. Proposta metodologica per l'inventario su vasta scala degli alberi fuori foresta. *Italian Journal of Forest and Mountain Environments:* 64 (6): 367-380.

Dogra, A. S. 2011. Contribution of Trees Outside Forests Toward Wood Production and Environmental Amelioration. *Indian Journal of Ecology*: 38 (Special Issue): 1-5.

Foresta, H., Somarriba, E., Temu, A., Boulanger, D., Feuilly, H. and Gauthier, M. 2013. Towards the Assessment of Trees Outside Forests. *Resources Assessment Working Paper* 183. Rome: FAO.

Garcia Manrique E. 1973. El viñedo en la costa Alpujarreña. *Estudios geográficos*: vol. 34 nº 132-133: 501-538.

Guillerme S., Alet B., Briane G., Coulon F.and Maire E. 2009. L'arbre hors forêt en France. Anciens usages et nouvelles perspectives. *Revue Forestière Française:* 5 nº spécial Les nouveaux usages de l'arbre: 543-560.

Guillerme S., Jiménez, Y. and Moreno, D. 2013. Les paysages d´arbres hors forêt, des paysages porteurs des enjeux du développement durable. In *Paysage et développement durable*, coor. Y. Luginbühl & D. Terrasson, 37-47. France: Editions Quae.

Guillerme, S., Jiménez, Y. and Moreno, D. 2015. Landscape of non-woodland trees: landscapes which reveal the challenges of sustainable development. In *Landscape and Sustainable Development: The French Perspective*, coor. Y. Luginbühl, D. Terrasson & P. Howard, 27-36. UK: Ashgate Publishing.

Instituto de Cartografía y Estadística de Andalucia (IECA). 2015a. DERA. Datos Espaciales de Referencia de Andalucía para escalas intermedias. Sevilla: Consejería de Economía, Innovación, Ciencia y Empleo.

Instituto de Cartografía y Estadística de Andalucia (IECA). 2015b. Localizador de Información Espacial de Andalucía. Last access june 2015. Available in http://www.juntadeandalucia.es/institutodeestadisticaycartografia/lineav2/web/

Instituto Nacional de Estadística (INE). 2014. Encuesta de Población Activa. Last access may 2015.Available in http://www.ine.es/dynt3/inebase/es/index.html?padre=517&dh=1

Inventaire Forestier National (IFN). 2000. Les arbres hors forêts en France - une ressource inféodée à l'agriculture. A case study in contribution to the FAO Forest Resource Assessment Programme. Rome: FAO.

Kleinn, C. 2000. On large-area inventory and assessment of trees outside the forest. *Unasylva,* 200(51): 3-10.

Lambin, E. and Geist, F. 2006. *Land-use and Land-cover change*. Berlin: Springer-Verlag.

Lambin, E.F., Geist, H.J. and Lepers, E. 2003. Dynamics of land-use and land-cover change in tropical regions. *Annual Review of Environment and Resources:* vol. 28: 205-241.

Lambin, E.F., Turner, B.L., Geist, H.J. et al. 2001. The causes of land-use and land-cover change: moving beyond the myths. *Global Environmental Change*: vol. 11, nº 4: 261-269.

Muñoz Rodríguez, T. 2001. Arboles fuera del bosque en Bolivia. In *Proyecto Información y análisis para el manejo forestal sostenible: Integrando esfuerzos nacionales e internacionales en 13 Países tropicales en America Latina (GCP/RLA/133/EC)*. Chile: FAO.

Pandey, D. 2008. Trees Outside the Forest (TOF) Resources in India. *International Forestry Review:* 10(2): 125-133.

Petit-Berghem, Y. 2012. L'arbre hors forêt en domaine littoral (ouest de la France) : mise en scène de l'objet, gestion et patrimonialisation. *Vertigo-la revue électronique en sciences de l'environnement:* Volume 12, nº 1: Online.

Pointereau, P. and Bazile, D. 1995. *L'arbre des champs: haies, alignements et présvergers ou l'art du bocage.* Toulouse: Editions Solagro.

Porcel Rodríguez, L. and Jiménez Olivencia, Y. 2013a. Hacia una metodología aplicada a la evaluación y seguimiento de los recursos paisajísticos locales. In *Desarrollo Local en tiempos de crisis. ¿El retorno de los recursos endógenos?*, coord. Rodríguez Martínez, F., 297-317. Granada: Universidad de Granada.

Porcel Rodríguez, L. and Jiménez Olivencia, Y. 2013b. Los paisajes del árbol fuera del bosque en el contexto del desarrollo local sostenible: el caso de los policultivos de sierra en el valle del río Lanjarón (Sierra Nevada). In *Desarrollo Regional Sostenible en tiempos de crisis*, ed. Camacho Ballesta, J.A. y Jiménez Olivencia, Y., nº. 2, 201-224. Granada: Universidad de Granada.

Proyecto Lucdeme. 1987. Mapa de suelos escala 1:100.000. Albuñol hoja nº 1056. Madrid: Ministreio de Agricultura, Pesca y Almnentación and ICONA.

Remmers, G.A. 1998. Con cojones y maestría : un estudio sociológico-agronómico acerca del desarrollo rural endógeno y procesos de localización en la Sierra de la Contraviesa (España). Amsterdam: Thela Publishers

Rivas Martínez, S. 1986. Memoria del Mapa de series de vegetación de España. Madrid: Ed. ICONA, Ministerio Agricultura, Pesca y Alimentación.

Rodríguez Martínez, F. 1985. Granada: medio físico y desarrollo. Granada: Servicio de Publicaciones de la Universidad de Granada.

Sedjo, R.A. 1999. The potential of high-yield plantation forestry for meeting timber needs. *New Forests:* 17: 339-359.

Singh C.D. 2000. Valuation and evaluation of trees outside the forest (TOF) of Bangladesh. Draft paper for a regional study for Asia and Pacific in contribution to the Forest Resource Assessment (FRA) 2000. Rome: FAO.

Spahni, J.C. 1983. La Alpujarra, la Andalucía secreta. Granada: Diputación Provincial de Granada.

Thaman, R.R. 2002. Trees outside forests as a foundation for sustainable development in the Small Island Developing States of the Pacific Ocean. *International Forestry Review,* Volume 4, Nº 4: 268-276.

Turner, M.G., Pearson, S.M., Bolstad, P. and Wear, D.N. 2003. Effects of land-cover change on spatial pattern of forest communities in the Southern Appalachian Mountains (USA). *Landscape Ecology:*, nº18: 449–464.