

## EFFECTS ON VEGETATION OF HISTORICAL CHARCOAL MAKING IN CENTRAL SPAIN: THE “MONTES DE TOLEDO” CASE.

Víctor González González de Linares<sup>1</sup>, Juan Ignacio García Viñas<sup>2</sup>, Leticia Carrero Díez<sup>3</sup>, Jorge Cuevas Moreno<sup>2</sup>, Inés González-Doncel<sup>1</sup> y Luis Gil<sup>4</sup>.

<sup>1</sup>Dpto. Economía y Gestión Forestal. UPM. Ciudad Universitaria s/n. 28040 Madrid (España). E-mail: [victor.gonzalez@upm.es](mailto:victor.gonzalez@upm.es).

<sup>2</sup> Dpto. Producción Vegetal: Botánica y Protección Vegetal. UPM. Ciudad Universitaria s/n. 28040 Madrid (España).

<sup>3</sup> Dpto. Ingeniería Forestal. UPM. Ciudad Universitaria s/n. 28040 Madrid (España).

<sup>4</sup> Dpto. Silvopascicultura. UPM. Ciudad Universitaria s/n. 28040 Madrid (España).

### Summary

A comparative analysis of the vegetation from 1830 to date is made on 5377 ha of Montes de Toledo region (Central Spain), based on historical documents, cartography and GIS applications. The changes are bounded up to charcoal making as this region was a key provider of charcoal to the towns of Toledo and Madrid from the XIII<sup>th</sup> Century until the second half of the XX<sup>th</sup> Century. Also the effect of the land property changes, including a massive reduction of common lands through public sales in the XIX<sup>th</sup> Century, is considered in the analysis.

After establishing the level of degradation in the existing vegetation in 1830, different historical maps and handwritten documents from 1859, 1862, 1883-85, 1901 and 1951-54 are analysed to obtain a diachronic sequence of the evolution of tree and bush species in the area and their coverage of the terrain. This information is compared to existing aerial photographs from 1956 and data from the latest National Forest Map (1997-2006). The methodology provides a good description of the landscape and a proper estimation of the plant stand evolution, as well as its link to the intensity of fuel wood harvesting.

A very intense degradation in the woods in 1830 is detected as a consequence of the previous charcoal making. The ownership changes that have occurred in the last two centuries have not affected significantly the land uses or the dominant tree species composition during the studied period, being *Quercus ilex*, *Quercus faginea* and *Quercus pyrenaica* the most common ones. But the area covered by coppice forest or bushes has increased regularly until 1956, associated to the charcoal making even if the harvesting pressure was lower during certain periods. The presence of high forest increases slightly since 1960 but sapling stands dominate the area still today. The effects of the previous strong degradation seem to be limiting the future recovery of the local vegetation to a great extent.

### Key words

*Mountains of Toledo, forest vegetation, charcoal making, landscape degradation, disentanglement process (Desamortización), diachronic sequence.*

### INTRODUCTION

The historical analysis of the forest areas through the changes taken place in their canopy is essential to determine the real effect of those human-induced and ecological factors which do have an influence on them (Mantilla & Allué-Andrade, 2003). The present communication analyses these changes with regard to a specific area of the Mountains of Toledo (Central Spain, figure 1). On the bases of historical documentation, it also assesses the current situation according to their exploitation in the past.



**Figure 1:** Location of Montes de Toledo, Central Spain.

### **Historical background.**

In the thirteenth century, Spanish king Fernando III sold a wide territory to the City of Toledo; this fact led to the creation of a Seigniorship called Mountains of Toledo (MoT). The existing descriptions of such purchase show that, after being a Christian/Arabian border for a long period, it was a sparsely populated zone, fully dominated by a dense forest of holm oaks (*Quercus ilex*), pyrenean oak (*Quercus pyrenaica*), lusitanian oaks (*Quercus faginea/Quercus lusitanica*), cork oaks (*Quercus suber*) and hazelnut trees (*Corylus avellana*) (Molénat, 1997).

This territory was assigned to its exploitation on behalf of the City of Toledo and its Civic Institutions, though some communal uses were allowed except for commercial purposes: extraction of timber, firewood and charcoal (Vassber, 1986). The entry of livestock and the establishment of hives were also permitted. By contrast, the ploughing and cultivation of this area were forbidden (Morollón, 2005).

Timber charcoal was one of the most remarkable exploitations in the MoT. The main species used were different kinds of oaks, heather, strawberry tree and a locally much extended plant: *Phillyrea angustifolia*. Its exploitation was regulated from the Ordinances of July, 1400, avoiding the coaling without licence, forbidding cutting the full tree and imposing the pruning or other ways of branch cutting that could guarantee the persistence of the forest.

An increasing overexploitation was soon noticeable in the area. The main reference for the forest policy in the MoT until the nineteenth century was a law named “Pragmática”, established in 1518. It set up numerous conservation measures to protect the forest (Carrobbles, 2009). But despite that and the established fines, the pressure remained the same during the seventeenth and eighteenth centuries, period in which charcoal making became the most popular occupation in many villages. Moreover, it experienced a relevant increase after the obliteration of the control of Toledo in the second half of the nineteenth century. Later, it still kept as a key element of the economy until the second half of the twentieth century (Gómez Vozmediano & Sánchez González, 2005).

### **Apportionment and sale process.**

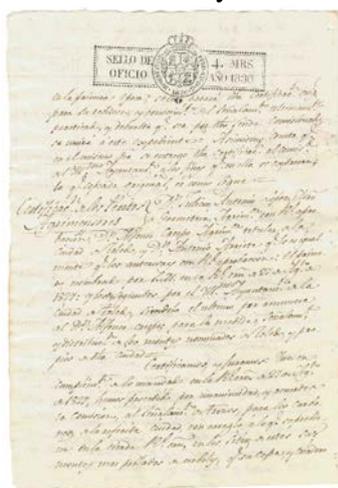
In the eighteenth century, together with the continuous breach by the neighbours of the regulations enacted to preserve the MoT, a new claim demanding independence of these territories from Toledo arose on the part of the villages (Redondo García *et al*, 2003). As a result, at the beginning of the nineteenth century, new political initiatives were developed promoting both the cultivation of this area and the modification of the property in order to allow its direct use and enjoyment by the neighbours from the adjoining villages (López & Martínez Robles, 1821).

Despite the opposition from the City of Toledo, which was obviously reluctant to losing its terrains, King Fernando VII ordered at last the repartition of these lands among the neighbours

of the villages (Sovereign Orders of 27 August 1827, and 27 January 1829), with the following objectives:

- The assignment of a certain surface of lands to every population that existed in the MoT, and the subsequent repartition of such portion among the neighbours “*for them to clear it and sow it*”.
- The destruction of the existing grazing community, which was considered as “*the main cause of the unproductive use of those lands*”;
- But also the safeguard of the strategic provision of charcoal to Toledo, essential to its citizens, by assigning the part of the MoT more suitable for this supply: “*To avoid the lack of the profits provided by the charcoal sector, it shall be assigned for this exclusive purpose, the part or parts of the mountain with more trees, and less suitable for cultivation*”.

For the performance of the fieldworks a commission was created under the name of “Commission of Assignment of Borders and Pasture of the Mountains of Toledo”. The Commission developed its work from 1829 to 1832, and its reports have been recently found (Cruz Arias, 2004). The analysis of these files and records is the starting point of this comparative study. It provides relevant information regarding the location and delimitation of the lands, as well as their condition at the beginning of the nineteenth century, moment in which they began the long path that will finally detach them from its seigniorial domain.



**Figure 2:** Front page of a Certification Report from 1830 made by the Commission of Assignment of Borders and Pasture of the Mountains of Toledo (Toledo Council Archive).

Along that way, the MoT was divided into 16 municipal districts. Within their limits the borders for cultivation were assigned and distributed among the neighbours for their plowing. Altogether, around 40% of the surface was classified as suitable for plowing (Redondo García *et al*, 2003). The rest ended up being divided and sold by means of public auction. The subsequent sale process took the whole XIX<sup>th</sup> Century.

It must be stressed that this apportionment and sale process constitutes a relevant action in the history of the forests in Spain. It transferred a huge public property of 377000 ha. to private tenant hands in an area considered by many, still today, a quite pristine forest. This was one of the key reasons for the declaration in 1995 of a National Park (Parque Nacional de Cabañeros, 40.856 ha.) in the core of the historical MoT domain.

## **OBJECTIVES.**

The general objective of this study is the performance of a comparative analysis regarding the state of the vegetation in the past and in the present days by means of historical documentation,

aiming to explain the differences or similarities detected in the landscape from the forest exploitation perspective. The concrete objective is to do it on a specific area of the MoT.

This communication also analyses both the real level of degradation in 1830 and the vegetation evolution since then. It links it to charcoal making, as it has been the main forest use of the lands until the second half of the XX<sup>th</sup> Century. And it focuses on the areas assigned to charcoal making in 1830 as they have remained more similar to the original conditions than the rest of the zone.

## **MATERIALS AND METHODS.**

For the characterisation and the analysis of changes on the state of the vegetation included in the area of study, four reference periods were selected; 1830-1832, 1883-85, 1951-56 and 1997-2006. These periods are chosen according to the information available to develop the layers of types of land use and canopy. The initial information is:

- Historical Documents and Maps from the Commission of Assignment of Borders and Pasture of the Mountains of Toledo (1830-1832). Toledo Council Archive (**TCA**).
- Historical documents from the Toledo Municipality Archive (**TMA**): Manuscripts from different sections, XVII- XXth Centuries. Box Files 71, 181, 192, 1636.
- Historical documents from the Ciudad Real Provincial Archive (**CRA**): Manuscripts from different sections. Disentailment process. Box Files: 26, 86, 62, 1666.
- Historical documents from the XIX<sup>th</sup> Century Disentailment Process, General Archive of the Spanish Ministry of Finance.
- Catalogue of Public Forests, 1859-1862.
- Mapping from the Spanish Geographical and Statistics Institute, 1883-1885. Topographic works of the Province of Ciudad Real. Municipal District of Retuerta del Bullaque. Scale: 1: 25000.
- Mapping from the Spanish Geographical and Cadastral Institute, 1951- 1954. Topographic works of the Province of Ciudad Real. Municipal District of Retuerta del Bullaque. Scale 1: 25000.
- American flight from the year 1956, average scale 1:33.000. Contacts B/N on paper, 23x23 cm.
- Spanish Forest Map (MFE50) scale 1: 50.000 and Spanish Forest Map (MFE200) 1: 200.000, 1996.
- Topographic maps, MTN25 series, Spanish National Geographical Institute in digital format, which consist of a planimetry file and an altimetry file.
- Cadastre of the Spanish Ministry of Finance.

## **METHODOLOGY.**

### **Digitalisation of the patch layer of type of use and canopy for the period 1830-1884.**

Using the boundaries described in the historical records, all charcoal making areas from 1830 are traced and located on the surface. With the support of current mapping their edges are digitalised. Then, one area is selected according to the following criteria:

- (i) State of the mass in 1830,
- (ii) Existing species and uses,
- (iii) Intensity of the exploitation/use,
- (iv) Extension and value of the surfaces,
- (v) Economical relevance of the production.

To this selected charcoaling area the information obtained from the mapping of the years 1883-85 is added to determine species, surfaces and uses in order to identify and classify the patch of uses. The process of digitalisation and classification of the patches was carried out

with the program ArcGis 9.3, which allowed the creation of a database linked to such uses, besides its graphical representation.

### **Elaboration of the layer of use and canopy for the year 1956.**

Once the frames of the “American flight” from 1956 had been properly scanned and orthorectified, they were photo-interpreted for the comparative and rectification of the patch of land uses. The layer of uses from the period 1830-1885 was overlapped with the ortho-images from 1956, and those patches that had suffered any changes were rectified, adding to these layers information from the historical mapping related to the period of 1951-1954. The photo-interpretation was performed at a 1: 10.000 scale, to minimise the digitalisation mistakes and get closer to the original digitalisation scale of patches applied in the MFE50.

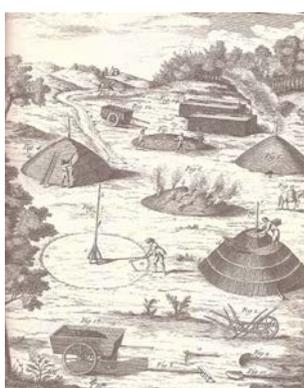
### **Composition and evolution of the patches of current type of use and canopy.**

Upload of the information provided by the Spanish Forest Map (MFE50), in order to establish a diachronic sequence to justify the current state of the vegetation according to its historical exploitation. The composition analysis was performed by means of summary tables with the percentage of surface covered by each type of use in the different dates. The analysis of the evolutionary process was carried out through the overlapping of the layers related to the three reference periods. Thus, we obtained the layers of changes for the periods 1830-1956 and 1956-2006, which lead to those containing the evolutionary processes according to the variations observed in the types of use and canopy.

## **RESULTS AND DISCUSSION.**

### **a) Assignment of coaling areas in the original files & records from 1830.**

As previously mentioned, the 1827-1829 Sovereign Orders stipulated the safeguard of the strategic provision of charcoal to Toledo. The analysis of the files from the Commission establishes that 9 areas were assigned with a total surface of 36000 fanega or 16920 ha, as for this place and time, 1 fanega was equivalent to 0,47 ha. (Gallego Anabitarte, 1998). The criteria for the assignment was to have more trees than the rest of the region, more production of charcoal and lower agricultural vocation. The main species in these zones were *Quercus ilex*, *Quercus pyrenaica* and *Quercus faginea*. The dominating structure is said to be low forest.



*Figure 3: Charcoal making sequence as per Duhamel's Recommendations (Duhamel, 1773)*

The existing mandatory regulations for the forest management were The Royal Ordinances from 1748 and the Duhamel Recommendations extracted from the Duhamel book published in 1773 (figure 3). In many places of the Commission reports it is stated that previous charcoal making practices have not respected properly these rules and have caused a very bad forest condition. Because of that, a new harvesting schedule is established for future activities with a rotation period of 10 years instead of the previous 5 years. Also a minimum of 16 stadles

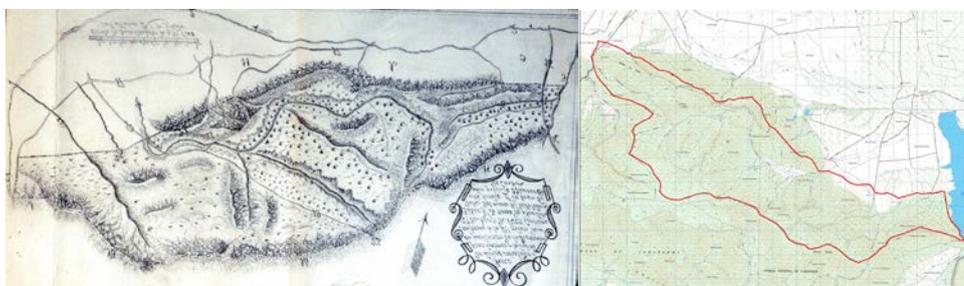
should be kept per fanega in order to guarantee the development and persistence of the forest stand.

The new criteria allowed a ten years extraction of 1859000 arrobas of coal for Toledo's own use. One arroba is a traditional Spanish unit of weight, equivalent to approx. 11500 kg or 25 pounds. The average consumption of the City in the previous five years had been 131784 arroba/year. Therefore, the new objective was aligned with such demand taking into account unexpected risks.

### b) Evolution of the forest vegetation in the area under study.

#### Selection of the area under study.

This communication focuses in one of the 9 areas chosen for charcoal: the biggest one, whose name was "Trozo del consignado y adyacente" (Consignado). Its surface is 11440 fanega (5377 ha), height goes from 713 to 1047 m.a.s.l. Administratively belongs to Retuerta del Bullaque (Ciudad Real) (figure 4).



**Figure 4:** Original map of "Trozo del consignado y adyacente" made by the Commission in 1830 (Toledo Council Archive) and correspondent location on a modern map (MTN25-IGN).

#### Description 1830.

The 1830 report considers Consignado to be the best area for charcoal making among all of them. Charcoal from this place had the highest commercial value: 9 maravedí/arroba *ex-forest site* whereas in the others lots it ranks from 4 to 7. Once delivered to the towns, the final price was around 25-30 maravedí. This is low if compared with the average prices documented in Madrid for charcoal, which were 28 to 56 maravedí/arroba (Gómez Vozmediano y Sánchez González, 2005). This very probably implies a low quality of this charcoal compared to the supply from other regions.

The main characteristics of the forest at that time are shown in table 1. There is a clear prevalence of *Quercus pyrenaica*, *Quercus faginea* and *Quercus ilex*, in similar proportions. "Consignado" was the best conserved forest and it was valued in the Commission reports 40% above average. The reasons for this were a better conservation state, soil productivity and lower hauling off costs for its products. It also had the biggest potential production: 87 arroba/fanega or 150-180 arroba/ha (1140000 arrobas in coming 10 years). The rest of the charcoal making zones had, as average, 63 arroba/fanega.

Nevertheless, these figures do not imply that the conditions of Consignado were good. Right on the contrary, the total charcoal quantity elaborated could reach 9000-11000 kg of firewood/ha, or 900-1100 kg of firewood/ha-year. This value is much lower than the average one for *Quercus* forests of similar age and structure: 30.000-35.000 kg of firewood /ha (Ximénez de Embún, 1971). In many standard *Quercus* forests, only pruning provides already 500 kg/ha-year of firewood; a similar amount of browse for the cattle can also be easily obtained.

An obvious conclusion is that Consignado and the whole area were under strong degradation and overharvested in 1830.

**Table 1:** Characteristics of the area named “Consignado”, devoted for charcoal making in 1830 (compilation by the authors based on the original 1830 files & records, Toledo Council Archive).

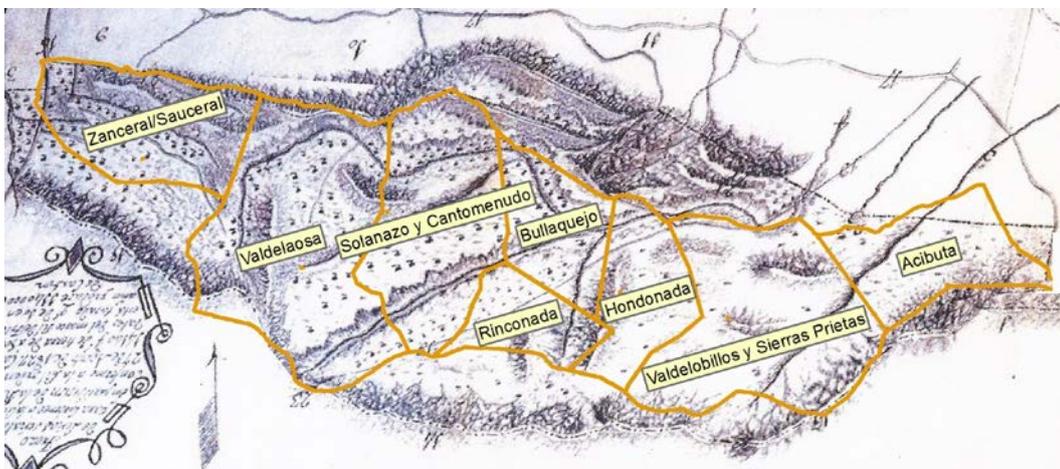
Area	Surface (Fanegas 1830)	Economic value (reales 1830)	Year Rent (reales 1830)	Charcoal (weight in arroba & unit price in maravedí, 1830)	Species	Apiary
Consignado	14140	1575000	31500	1140000 arroba 9 m/arroba	<i>Q. faginea/Q. ilex/Q. pyrenaica</i>	7

### Description in 1859 & 1862.

On top of the apportionment and sale process, during the XIX<sup>th</sup> Century an intensive sales disentailment process (known by its Spanish name as “Desamortización”) took also place. Its objective was to provide money for the Government by selling all kinds of public domains.

As the property of the charcoal making areas was in Toledo City hands, they were included in this disentailment process as well. The disentailment law established that grazing lands and scrublands should be sold. Also were for sale woodlands of other species than oak, pine or beech, and even those with these dominant tree species if the total surface was under 100 ha.

A list of the forests that should not be sold was published by the Ministry of Agriculture as Catalogue of Public Forests in 1859 and 1862. In them we can find new information about “Consignado”: it is split up in 8 new lots (figure 5), and 4 of them are appointed for sale.



**Figure 5:** Boundaries of the 8 forest lots created from the original “Consignado” forest during the disentailment process (reconstruction by the authors using the information existing in the original disentailment process files, Ciudad Real Province Archive).

The description of the 8 new forest lots refers big areas covered by bushes and *Quercus*. Among them, *Quercus pyrenaica* and *Quercus faginea* appear more frequently than *Quercus ilex* (table 2). One of the forests is dominated by *Q. faginea* while the rest seem to be mainly *Quercus pyrenaica* forests.

Even if the State Forest Engineers defended firmly the public property of the enlisted forests, the Ministry of Finance encouraged its sale. In 1862 one of the forests explicitly excluded from sale in the 1859 Catalogue is already sold (Bullaquejo), and in the Catalogue of Public Forests from 1901 none of the forests appear anymore (table 2): all 8 have finally been sold to private owners. Nowadays, the former “Consignado” forest is fragmented into five different private properties.

**Table 2:** Description of the forests split from the original “Consignado”. MF: Medium Forest/High&Low forest; LF: Low forest; HF: High forest; C: farming land (Source: adapted by authors from the 1859&1862 Catalogues of Public Forests and the 1883-85 Cartography, Ministry of Agriculture).

YEAR		Name	Dominant specie	Other species	Surface ha	Structure 1883-85
1859	Not for sale	Solanazo y Cantomenudo	<i>Q. faginea</i>	<i>Q. ilex, Cistus ladanifer y Rosmarinus officinalis</i>	128,79	MF
	Not for sale	Valdelobillos y Sierras Prietas	<i>Q. faginea</i>	<i>Q. ilex, Cistus ladanifer y Rosmarinus officinalis</i>	193,19	MF
	Not for sale	Bullaquejo	<i>Q. faginea</i>	<i>Q. ilex, Cistus ladanifer, Rosmarinus officinalis</i>	141,67	LF
	Not for sale	Zanceral	<i>Q. pyrenaica</i>	<i>Cistus ladanifer</i>	225,38	LF/C
	For sale	Hondonada	<i>Cistus ladanifer</i>	<i>Erica australis, Rosmarinus officinalis y Phillyrea angustifolia</i>	70,84	MF
	For sale	Acibuta	<i>Q. ilex</i>	<i>Cistus ladanifer, Rosmarinus officinalis y Phillyrea angustifolia</i>	128,79	MF
	For sale	Rinconada	<i>Cistus ladanifer</i>	<i>Erica australis, Rosmarinus officinalis y Phillyrea angustifolia</i>	96,59	MF
	For sale	Valdelaosa	<i>Cistus ladanifer</i>	<i>Erica australis, Rosmarinus officinalis y Phillyrea angustifolia</i>	96,59	MF
1862	Not for sale	Solanazo y Cantomenudo	<i>Q. sessiliflora</i>		129	MF
	Not for sale	Valde Lovillos y Sierras Prietas	<i>Q. sessiliflora</i>		193	MF
	Not for sale	Zanceral	<i>Q. lusitanica</i>		223	LF/C
1901	No public forests in the area.					
2013	No public forests in the area.					

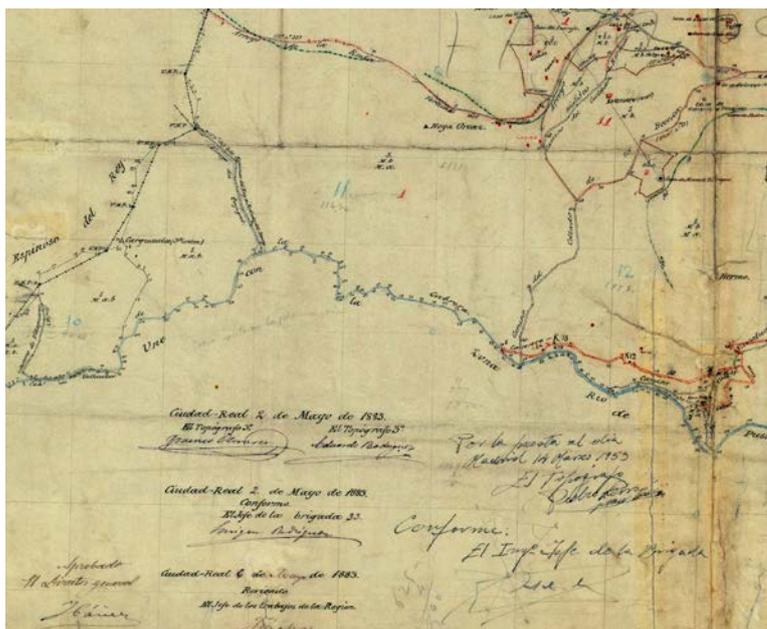
### Situation in 1884.

The forest structure reflected in the maps and cartography confirms previous descriptions. The whole area is classified in one of the following classes: “high & low forest” (*Mab* in the original map), “low forest” (*Mb*), and “areas for cereal and farming” (*C* or *SC*), reaching a total surface of 4743 ha with the following surface distribution:

- The main structure represented is “high & low forest”: 3074 ha;
- “Low forest” represents 1576 ha.
- Cereal lands cover 67 ha and farming areas 25 ha.

The difference between “low forest” and “high and low forest” seems to be based in the external appearance, being the first one more similar to bushes or closed forests. “High and low forest” represents an evident presence of some grown up and mature trees, but still being the low forest structure dominant. A resume of this can be seen in the last column of table 2. All structures reflect a very strong pressure for charcoal making in this period.

Some of these maps were still used by the Forest Service in 1951-1954, and have been updated then (figure 6). The corrections in them clarify some confusion areas of *Q. pyrenaica* or *Q. faginea*, and provide information about new plantations and infrastructures.



**Figure 6:** Cartography from 1883-85 and corrections from 1953 (Source: cartography from the Spanish Geographical and Statistics Institute, 1883-1885, Ministry of Agriculture Files).

### Aerial photographs, 1956.

Some important changes are detected using these photographs.

- Bushes cover 80% of the surface previously considered “Low and High forests”, being the new forest coverage reduced to only 20% of the previous area.
- Bushes cover 76% of the surface previously considered “Low forests”, while only 22% keeps forest coverage.
- There are no evidences of changes in the tree species.
- The cereal and farming areas are still marginal, but have increased.

### Forest Map (1997-2006).

The analysis of the Spanish Forest map (1997-2006) shows:

- High and low forest:
  - o The biggest real forest surface recovery from 1880 has occurred in this area: 62% surface.
  - o Bushes are still very much present, but have decreased if compared with the 1956 figures.
  - o Farming areas and pastures inside the central zones have increased as well. There are signs of evolution of many trees that are in the process to become high forest, with a better state than the degraded one existing in 1880.
- Low Forest:
  - o 37% of the “Low Forests” from 1880 are now forest while 32% are bushes.
  - o 18% of the total has been planted with pines.
  - o 2% is a light forest of Quercus, dehesa type (open woodland of trees and pasture).
  - o Forest has recovered 84% of the cereal and farming areas.

As the charcoal making has dissapeared almost completely in the area since the middle of the XXth century, this could be an effect of the cease. A comparative summary of the different data is shown in table 3.

**Table 3:** Estimation of the surface covered by each forest type and structure between 1830 and 2006 in the original Consignado area.

1830	1883-85	1956	1997-2006		
<b>Low Forest</b> <i>Q. faginea</i> , <i>Q. pyrenaica</i> & <i>Q. ilex</i>	Low Forest (1576 ha)	<b>76% Bushes</b>	<b>20% Q. forest/ low forest</b>		
			15% Q. forest/ high forest		
			7% Pine forest		
			<b>47% Bushes</b>		
		22% Quercus Forest	<b>82% with canopy cover 5-20%</b>		20% Q. forest/ low forest
					<b>50% Q. forest/ high forest</b>
					<b>25% Bushes</b>
			18% with canopy cover >20%		27% Q. forest/ low forest
					<b>50% Q. forest/ high forest</b>
					4% Pine forest
		<b>18% Bushes</b>			
<b>Medium Forest</b> (3074 ha)		<b>80% Bushes</b>	8% Q. forest/ low forest		
			<b>48% Q. forest/ high forest</b>		
			<b>35% Bushes</b>		
		20% Quercus Forest	31% with canopy cover 5-20%		17% Q. forest/ low forest
					77% Q. forest/ high forest
					3% Bushes
			69% with canopy cover >20%		10.5% Q. forest/ low forest
					<b>80% Q. forest/ high forest</b>
					6% Bushes

### c) Diachronic sequence of the forest vegetation in every forest lot.

The estimation of the evolution can also be done satisfactorily for every of the 8 forest lots created by the disentailment process along the XIX<sup>th</sup> Century. As an example, figure 8 resumes the evolution in one of them, called Valdelaosa, whose detailed story could be sequenced as follows (table 4):

- In 1781 it is covered by *Quercus ilex*, other oaks and *Arbutus unedo*, without other particulars than the presence of *Ilex aquifolium* (TMA, Box File 1636). This plant is extremely rare in the area nowadays.
- In 1830, still being this area part of the Consignado whole forest lot, the area is said to be a low and deteriorated forest of *Quercus ilex*, *Quercus faginea* and *Quercus pyrenaica* (TCA, Commission Records & Files, 1830). Most probably the presence of bushes is low and the forest cover is dense.

- In 1833 a logging permit for charcoal making is documented but the amount harvested is small (TMA, Box File 71). This seems to be due to the reduced availability of small size trees. Still an important deterioration is reflected.
- In 1859, a worsening can be detected. It is described as a bush area with *Erica australis*, *Cistus ladanifer*, *Rosmarinus officinalis* and *Phillyrea angustifolia* (CRA & Ministry of Finance Archives, Disentailment process Files, Catalogue of Public Forest). This is the composition of the typical regional heather formation, in which the presence of oaks is irrelevant. The reasons were probably the excess of charcoal making and the pressure of an important cattle livestock.
- In 1956, the deterioration of the area is clear still: 70% of it is composed of bushes while only 30% is covered by trees. The species are *Quercus ilex*, *Quercus suber* and *Quercus pyrenaica* with some minimum amount of *Quercus faginea*.
- At present, 30 % of the forest coverage is made of *Quercus pyrenaica*, *Quercus faginea* and *Quercus ilex*. The rest (40 %) is a Pine forest of *Pinus pinaster*.

**Table 4:** Evolution of the vegetation by structure, composition and surface coverage in Monte Valdelaosa, one of the 8 that were split up from the original Consignado area during the disentailment process. MF: Medium forest/High&Low forest; LF: Low forest; HF: High forest; C: farming land.

1830			1859-62			1956			2010		
Commission files & records			CRA & Ministry of Finance Archives & Catalogue of Public Forest			Aerial Photog.			MFE50		
Vegetation			Vegetation			Vegetation			Vegetation		
Struct.	Comp	Surface	Struct.	Comp.	Surf.	Struct.	Comp.	Surf	Struct.	Comp.	Surf.
LF	<i>Q. ilex</i> <i>Q.pyrenaica</i> <i>Q. faginea</i>	100	Bush	<i>Cistus ladanifer</i>	100	LF	<i>Q. ilex</i>	30	LF	<i>Q.pyrenaica</i> <i>Q.faginea</i>	30
				<i>Erica australis</i> <i>Arbutus unedo</i>			<i>Q.Pyrenaica</i> <i>Q. Faginea</i>			<i>Q. ilex</i>	
				<i>Phillyrea angustifolia</i>		<i>Q. Suber</i>		HF	<i>P. pinaster</i>	40	
						Bush	70	Bush		30	

As a conclusion of the diachronic analysis for Valdelaosa, its evolution from the first third of the XIX<sup>th</sup> Century until present indicates:

- A first period of progressive deterioration, reaching its maximum around the middle of the XIX<sup>th</sup> Century (100% surface covered by bushes)
- A second period (from approx. 1950 onwards) where a relative recovery in tree presence takes place (30% becomes high forest) based in the disappearance of charcoal making and the plantation of Pine trees (40% surface). It is important to express that the pine plantation is made in an area previously covered by bushes.
- There is also a slight trend to increasing the presence of hardwood species, but this must be taken cautiously as can be affected by the different observation scales used in the original sources used. The abundance of *Quercus suber* that is shown in data from 1956-66 can be provoked by this.

## CONCLUSIONS:

As general conclusion:

- The comparative analysis among the existing information from 1830 historical files, 1883-85 & 1951-54 vegetation cartography, the reinterpretation of the aerial photographs from 1956 and the overlapping of the data from the Spanish Forest map 1997-2006 provides a

good description of the evolution of the vegetation and landscape uses in the area. It also proves to be a useful tool in order to relate it with the forest harvesting in every period.

- The methodology can be downsized to smaller forest lots appeared during the historical period analyzed, providing good results in vegetation analysis and in the effects of the uses.

As particular conclusions:

- The estimation of the 1830 charcoal production in the area, even for the best forest, is very low; this seems to be a consequence of the high level of degradation of the vegetation at that time.
- From the second half of the XX<sup>th</sup> Century evidences can be found of a progressive and moderate improvement in the vegetation, particularly in its density and age structure. But the effects of the previous strong degradation seem to be limiting the future recovery of the local vegetation to a great extent.
- In the area under study and according to the analyzed data, there are no reasons to establish any change of forest species as a consequence of charcoal making since 1830 to date. If any changes occurred, they happened before this period.
- Change in land property, mainly from public to private hands, has taken place in the last two centuries in the zone; but it has not affected significantly neither the land uses nor the general vegetation composition.

### Acknowledgements

We are grateful to Mr. Roberto Vallejo, from the Spanish Ministry of Agriculture, for providing the 1883-85 and 1951-54 cartography; to M. J. Cruz Arias, archivist from the Toledo Council Archive, for publishing the original 1830 files; to Mariano García Ruipérez and all the personnel from the Toledo Municipality Archive; to Manuela Infante Prieto, from the Ciudad Real Provincial Archive; to María Maestro, for her support in translating.

### BIBLIOGRAPHY:

- CARROBLES, J.; 2009. El cuidado del monte. Evolución de la política de protección de la masa forestal en Toledo entre los siglos XIV y XVI. In: "Actas de la III Reunión sobre Historia Forestal", SECF. Madrid.
- CRUZ ARIAS, M. J.; 2004. Fondo de Intendencia de la Provincia Conservado en el Archivo de la Diputación de Toledo. Archivo Secreto: Revista Cultural de Toledo nº2, Pp 6-35.
- DUHAMMEL DU MONCEAU, MR; 1773. Del aprovechamiento de los montes. Junta de Castilla y León y SECF, 2009.
- GALLEGO AZNABITARTE, A.; 1998. Reparto y venta de tierras concejiles. Ilusión y derecho (Los Montes de Toledo). Editorial Montecorvo. Madrid.
- GARCÍA BARGUEÑO, A.; Montes de Toledo. Repartición de bienes comunales en el s. XIX. Bol. Infor. de Régimen Interior. Montes de Toledo 7: 11-12.
- GÓMEZ VOZMEDIANO, M.F Y SÁNCHEZ GONZÁLEZ, R.; 2005. La apicultura en los montes de Toledo. Cultura y tradición. MAPA. Madrid.
- HAMILTON, E.J.; 1947. War and prices in Spain, 1651-1800. Cambridge, Massachusetts.
- JIMÉNEZ DE GREGORIO, F.; 1981. Los Montes de Toledo según las Actas de su Ayuntamiento en los años 1809-1814. Revista Toletum, 11: 375-407.
- LÓPEZ, J.A Y MARTÍNEZ ROBLES, F.; 1821. Memoria sobre la pertenencia, extensión, cantidad de tierras, población y administración de los Montes de Toledo por el Ayuntamiento de esta Ciudad y sobre el sistema que deberá adoptarse en su repartición y enajenación presentada a Cortes Generales. Facsímil As. Cult. Montes de Toledo, 1984.
- MANTILLA, J Y ALLUÉ-ANDRADE, M.; 2003. Incidencia de los aprovechamientos forestales y ganaderos seculares en la estructura y composición específica de los montes: el caso de la "Dehesa Vieja" (Pedraza, Segovia). In: "Actas de la II Reunión sobre Historia Forestal", SECF. Madrid.
- MOLÉNAT, J.P.; 1997. Campagnes el Monts de Toléde du XII au XIV siècle. Madrid.
- MOROLLÓN, P.; 2005. Las Ordenanzas municipales antiguas de 1400 de la Ciudad de Toledo. In: Espacio, Tiempo y Forma, serie III. Historia Medieval 18.
- REDONDO GARCÍA, Mª.M; FERRERAS CHASCO, C; GONZÁLEZ BASELGA, I.; 2003: Breve cronología histórica forestal de Hontanar y San Pablo de los Montes. In "Actas de la II Reunión sobre Historia Forestal". SECF, Madrid.
- VASSBERG, D.E.; 1986. Tierra y sociedad en Castilla. Señores poderosos y campesinos en la España del siglo XVI. Barcelona.
- XIMÉNEZ DE EMBÚN, J & GONZÁLEZ ARNAO, J.; 1971. El Monte bajo. Ministerio de Agricultura, Madrid.