

## THE OLIVE MONOCULTURE IN THE SOUTH OF SPAIN

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### Abstract

Olive trees have been cultivated for thousands of years in their preferred climate, the Mediterranean, with Spain being the world's biggest producer of table olives and olive oil. The globalization of recent decades has intensified specialization in this crop in the south of the country where a significant geographic expansion of the olive groves has been accompanied by substantial growth in the total harvest, due to an increase in the intensity and productivity of olive farming. These swift changes have had serious social and environmental consequences many of which have been caused by poor management of basic natural resources. At the same time the introduction of new plantation systems and the variety of physiographical resources and economic structures on which the olive groves are based has enabled us to identify significant agricultural and landscape diversity. In this article we will be looking at the province of Jaén as an illustrative example of these changes.

**Keywords:** *monoculture, agriculture policy, globalization, agricultural landscapes, Andalusia, Jaén*

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### 1. INTRODUCTION

The expansion of the cultivation of olive trees in the province of Jaén can be seen as a paradigm for the increased specialization in this crop throughout southern Spain in recent decades. The territorial impact and importance of olive groves in Jaén is enormous, given their truly spectacular levels of agricultural land occupation. Rural society is almost entirely dependent on (and at the mercy of) the oscillating production levels that each year's harvest brings and on the fluctuations (often beyond the control of primary producers) in the market prices at which the fruits of the plant, in this particular case olive oil, are sold.

**Table 1. Importance of the monoculture of olive trees in the province of Jaén in terms of surface area (ha)**

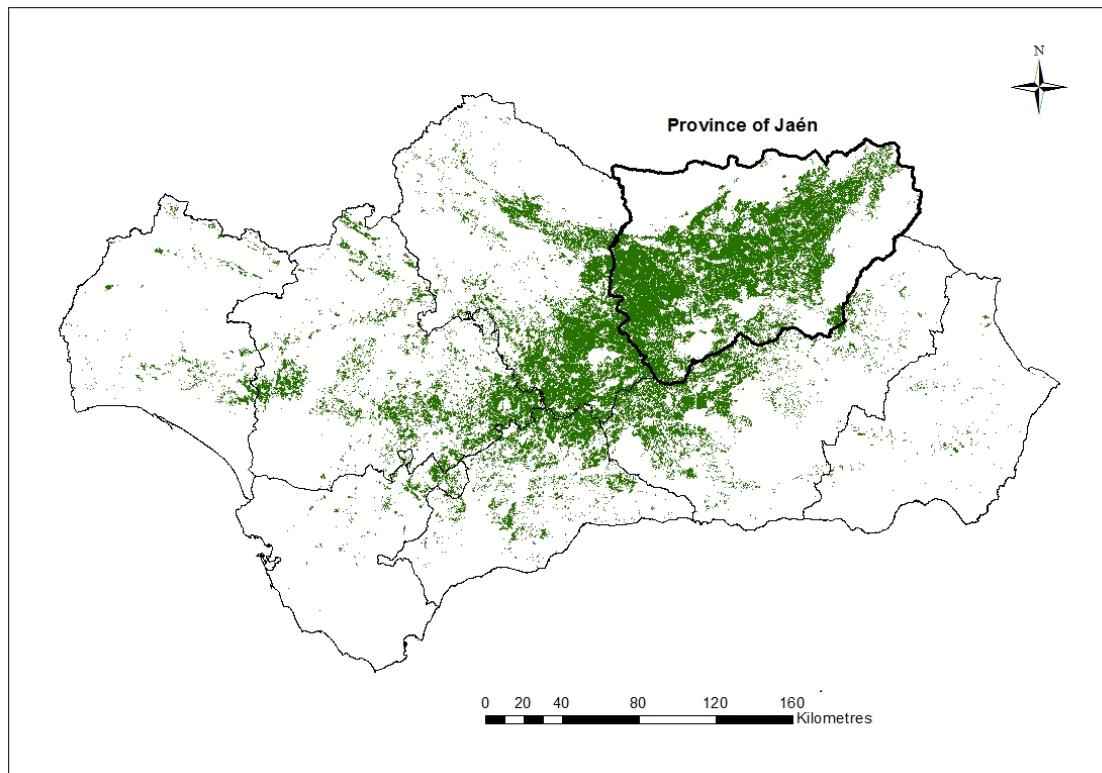
	<b>Jaén (x)</b>	<b>Andalusia (y)</b>	<b>Spain (z)</b>	<b>% (x/y)</b>	<b>% (y/z)</b>
Geographic area (a)	<b>1,349,810</b>	8,738,052	50,536,508	15.45	17.29
Agricultural land (b)	<b>641,774</b>	3,543,456	17,076,195	18.11	20.75
Area planted with olives (c)	<b>584,415</b>	1,542,640	2,504,261	37.88	61.60
% (b/a)	<b>43.30</b>	40.55	33.77	--	--
% (c/b)	<b>91.06</b>	43.53	14.67	--	--

Sources: Avance Anuario de Estadística Agraria 2013; <http://www.magrama.gob.es>

Informe anual del sector agrario en Andalucía 2012; <https://www.obrasocialunicae.es>

Avance de superficie y producciones agosto 2014; <http://www.juntadeandalucia.es>

The information set out in Table 1 shows that this is indeed an extreme case of monoculture with over 91% of agricultural land occupied by this single plant, forming a huge swathe of green that extends across neighbouring provinces, making it one of the highest concentrations of tree crops in the whole of the European Union.

**Figure 1.** Distribution of olive groves in southern Spain, 2007

23% of Spain's olive groves and almost 38% of those in Andalusia are concentrated in the province of Jaén. In years with favourable weather conditions, olive oil production in the province is similar to that of the world's second and third largest producers, Italy and Greece, added together (IOC, 2014, Regional Government of Andalusia, 2014). The olives harvested in the groves of Jaén are used almost exclusively for making olive oil, and the *picual* variety of olive is almost ubiquitous due

to its excellent results and the stability and quality of the oil extracted from it. The result is that within Jaén's agricultural monoculture there is also a high concentration in a single variety and with a single purpose. This concentration is just one more of a set of strategies implemented by a production sector in which producers compete by cutting costs as far as possible. This causes various logistical problems in that almost all the fruit reaches optimum levels of ripeness at the same time, with small differences in altitude being the only means of staggering the process to facilitate the organization of the harvest and the pressing of the fruit. The olives are normally pressed in cooperative olive mills with a large processing capacity, despite which the harvest periods almost inevitably extend beyond the ideal period in which the highest possible quality of the oil is ensured. As a result the oil for human consumption is graded according to quality into three main types, namely extra virgin, virgin and lampante in decreasing quality and price order.

Another interesting recent trend is the increasingly widespread use of irrigation. Traditionally the olive was considered a non-irrigated (*secano*) crop, which, like the other perennial plants so dominant in Mediterranean agriculture, had deep root systems that could withstand the severe hydric stress suffered by plants during the long, hot, dry summers in this part of the world. Traditionally irrigation was only used in mountain areas with springs or in vegetable gardens with a few olive trees. Nowadays however as a result of this excessive specialization in a single crop, a significant proportion of the olive groves of Jaén are irrigated, such that half of Spain's irrigated olive groves for oil production are located in the province (Ministry of Agriculture, Food and the Environment, 2014). Mainly, they are irrigated by trickle systems with an average of 1500 m<sup>3</sup>/ha.

The geographical and environmental conditions for growing olive trees are in general quite favourable on most agricultural land (Ministry of Agriculture, 1975), however it is clear that government promotion of certain crops (in particular as a result of Spain joining the European Economic Community, which at that time had a number of important market intervention mechanisms), and trends in the market itself (although in the last two years the prices received by farmers have stagnated at low levels) have intensified this process. Indeed the output levels obtained in the province on both non-irrigated and irrigated land are above both the regional and national averages (Sánchez and Gallego, 2011). This does not prevent however important contrasts in terms of production and performance within the province, in which the most productive olive groves can produce up to 20 times more per hectare of land than their least efficient counterparts. Despite their low output these uneconomic olive groves are often maintained even though on many occasions they were initially cultivated by ploughing up woodland or forest, something which should never have been allowed to happen.

In spite of all this, today's farmers, who sell their produce above all in the intra-industrial market, are trapped inside a production and distribution system that restricts their capacity to participate in the added value chain (Delgado Cabeza, 2014). Another unusual feature of this monoculture is that it is based on a small-scale land ownership structure, which means that a large number of farms are not managed by professional farmers. In addition the serious consequences of this intensive agriculture model in environmental terms, many of which were caused by the productivity-oriented application of the Common Agricultural Policy (CAP) have yet to be resolved, above all in the case of soil erosion (Beaufoy, 2001). This brings us to the strange paradox that despite having acknowledged benefits for our health, olive oil is based on a clearly unsustainable model of production (Scheidel and Krausmann, 2011).

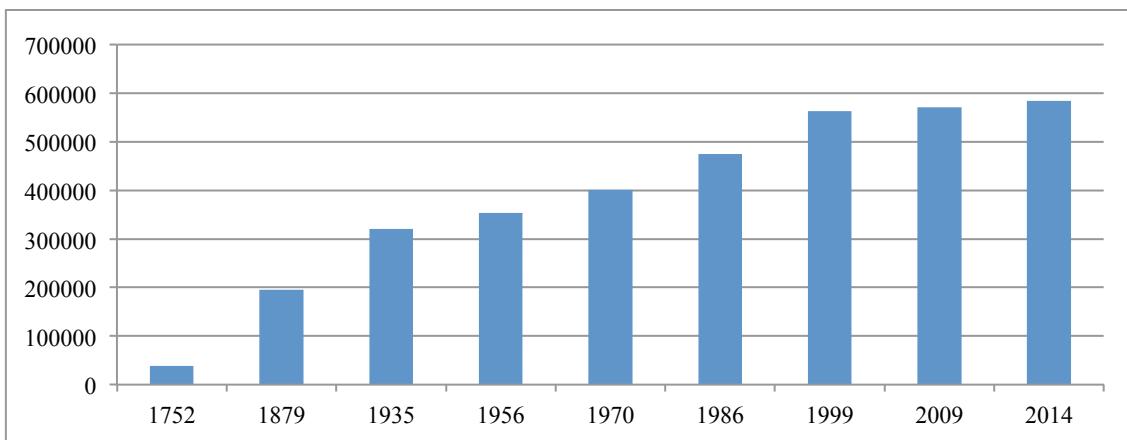
In the next sections we will be explaining how and where the expansion of the olive groves has been taking place; in what way the production levels have been increased, what effects these changes have had and what landscape and agricultural diversity can be identified in the midst of this monoculture.

## 2. THE GEOGRAPHICAL EXPANSION OF OLIVE FARMING

Although there are evident differences in many fundamental aspects between the olive grove and other monocultures around the world, certain common patterns can be identified in their spread and development. The expansion of soya and other plantation crops in South America could be a useful point of reference (Fernandes, Welch and Gonçalves, 2012). In South America as in Spain for example, there has been a move towards large-scale production and a reduction in the number of stakeholders involved in the value chain. New formulas of *conservative modernization* (green revolution) have also been tested. These are based on increasing harvests, reducing labour costs and externalizing the least desirable effects of the production process. Another shared pattern worth noting is the conflictive coexistence of farms with hugely different levels of return: in the case of tropical plantations this is the result above all of the relative size of the farms, while in the olive groves of Andalusia it is due also to varying cultivation methods.

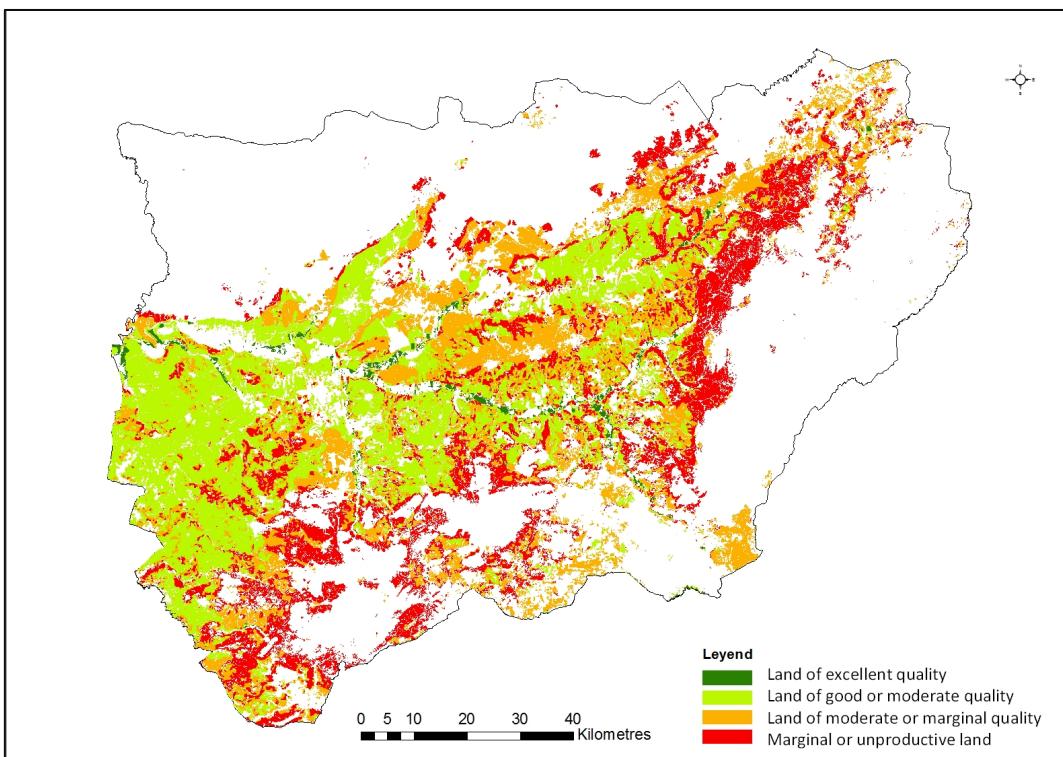
Although this is hardly a ground-breaking revelation, the reason why these similarities occur between such diverse crops and continents is the advance of the neoliberal-inspired globalization process. Put very simply and elegantly “one way of looking at globalization is to view it as a process in which the distances covered by materials, goods and people increase in order to resolve needs that could be sorted out at a local level without additional ecological and social costs” (Cembranos Díaz, 2011). In its broadest sense globalization involves the restructuring of capital to enable it to act at a worldwide level, something that has become possible with the deregulation of financial markets, the liberalization of trade and the boost to business activity produced by productive and technological innovation (Bernstein, 2011). These initiatives inevitably increase the trend towards monocultures and are a good context in which to understand what has happened in the case being analysed here.

Figure 2 shows the gradual spread of the area occupied by olive groves since reliable data on this question became available. This is a continuous process which has been happening throughout modern times at a more or less constant rate with occasional peaks of activity produced by particularly favourable circumstances (Zambrana Pineda, 1987). It is also interesting to note that this expansion hardly declined at times when circumstances were not so favourable. During these lean periods the olive farmers tried to overcome the repeated crises with which they have had to cope by adapting and applying different strategies which we will later go on to examine.



**Figure 2.** Increase in the area planted with olive groves (ha) in the province of Jaén (1752-2014)

Previous researchers observed certain spatial patterns for this expansion in the surface area (Sánchez & Galiano, 2014). In short until the mid-20th century the preferred location for olive groves was on land with low agricultural capacity. Throughout this whole period total harvests increased due above all to geographic expansion than to other reasons. This does not mean that there were no olive farms on good or even excellent soils, but the norm was for this land to be used for cereal production for its higher profitability. This situation however changed drastically from the second half of the 20th century onwards (see Figure 3 and Table 2), when Spanish agriculture became increasingly market-orientated and above all when Spain joined the European Economic Community (1986).



**Figure 3.** Distribution of the olive grove in the province of Jaén in 2007 according to agricultural land quality (\*)

(\*) The areas in white on the northern, eastern and southern fringes of the province are mountain areas used for forestry in which agriculture is impossible.

By analysing the changes in land use between 1957 and 2007, a period in which the area covered by olive groves grew by over 60% (about 215,000 ha), we have identified the agricultural landscapes that have succumbed to this green *tsunami* sweeping across the country. In most cases olive trees were planted on non-irrigated land that had previously been used for cereal production. In other cases, expansion occurred by ploughing up land that had been used for livestock (scrub, pasture and even wooded areas). One would have expected that land of this kind would have been gradually abandoned, given the difficulties in working it for agriculture and the economic changes taking place in the agrarian economy at that time, and would have reverted to a more natural state without direct human intervention. At most, it could have been maintained for extensive livestock use. Spain's joining the EEC in 1986 changed deeply everything. The subsidies that began to flow from Brussels acted as strong incentives for steering agricultural production to a particular crop or type of farming to the detriment of others. They also enabled olive groves in agriculturally marginal areas to be maintained and led other complex agrarian landscapes such as several *dehesas* to be planted with olive trees. Fields around villages traditionally used for vegetable gardens were also often converted into olive groves. Another trend that we noted during this period is that the traditional association of olive trees with other herbaceous or woody crops (vines, almonds, fruit trees etc) has virtually disappeared. Diversified agriculture of this kind is apparently no longer viable in the context of increasing specialization, in which Spanish agriculture has come to focus exclusively on the market, a process that has coincided with a huge exodus from rural areas.

As we mentioned earlier, these changes also coincided with the progressive encroachment of olive groves onto the land with the best agronomic conditions. If we superimpose the areas covered by olive groves in 1957 and 2007 onto a map in which land is classified according to its capacity for agricultural production (excellent, good, moderate and low or marginal), we find that although expansion was indeed generalized, there was less growth on land with less natural fertility, so changing the traditional scenario in which olives were normally planted on poorer soil.

**Table 2.**  
**Changes in the area occupied by olive groves in relation to land use capacity**

Type	Province of Jaén		Olive Grove 1957		Olive Grove 2007		$\Delta$ 1956-2007	
	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)	Area (ha)	(%)
Excellent	24,015.41	1.78	5,055.70	21.05	8,324.89	1.46	3,269.19	64.66
Good	279,749.86	20.76	126,527.30	45.23	218,242.00	38.24	91,984.70	72.85
Moderate	375,488.14	27.86	105,068.96	27.98	183,274.00	32.12	78,205.04	74.43
Marginal	668,306.20	49.59	118,996.56	17.81	160,814.00	28.18	41,817.44	35.14
Total	1,347,559.62	100.00	335,378.52	24.89	570,654.89	100.00	215,276.37	60.58

Source: REDIAM, <http://www.juntadeandalucia.es/medioambiente/site/rediam> (accessed 10 April 2015).

### 3. THE INCREASE IN PRODUCTION

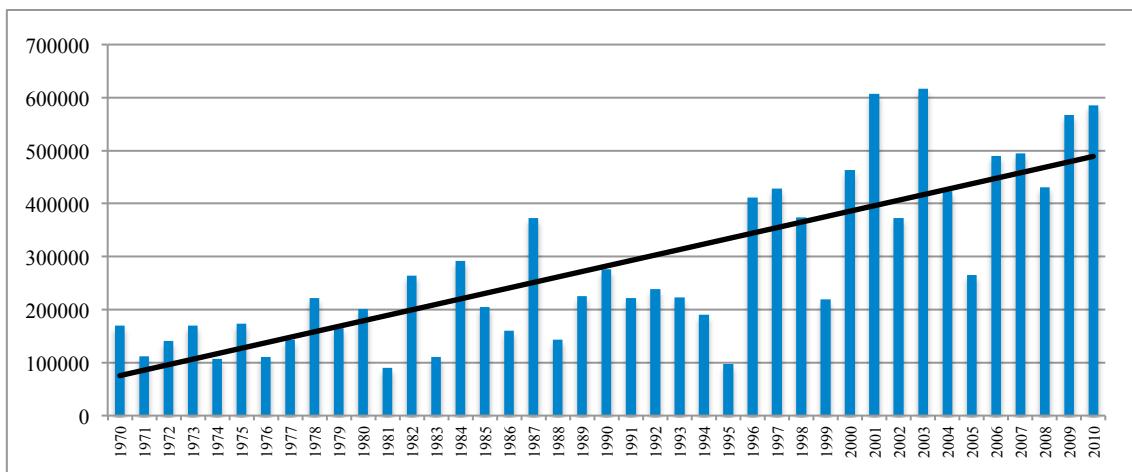
Olive production in Andalusia on both irrigated and non-irrigated land has increased by around 4% a year over the last 40 years. This rise is due to the increase in intensity (fertilization and irrigation) and productivity (increased density of plantation and improved care). In the 1950s and 60s the only effective way of increasing harvests was to increase the area under cultivation, however this began to change in the 1970s when a genuine productive revolution began (Berbel and Giannocaro 2013). Instead of the traditional plantations on non-irrigated land with a capacity of about 80 trees per hectare, the new olive groves were generally irrigated and much more intensive (with practically twice the number of trees on the same piece of land), with the most modern

being laid out in hedge formation with up to 1500 plants per hectare. These intensive plantation systems can only be found in recently planted groves, although many traditional olive groves have also been made denser with new trees filling in gaps. As a result the current average in the region is 130 trees per hectare (Regional Ministry of Agriculture, Fishing and Rural Development, 2015).

Irrigated land now accounts for half of all the olives produced in Andalusia. This is because as well as increasing production, irrigation makes it more stable, in that in years with adverse weather conditions, such as drought, irrigated olive groves achieve significantly higher harvests than those obtained in non-irrigated fields. This happened because at least until 2006 olive trees were the best option in economic terms for both non-irrigated land and irrigated land compared with the other possible alternatives and they still are today for intensive farming on irrigated land (Berbel and Giannocaro, 2013). An easy way of demonstrating this fact is to study land prices over this period, in which olive groves (both on non-irrigated and irrigated land) have always performed much better than the weighted average for all the different crops as a whole, particularly when compared to the other two crops with which olives have traditionally competed, namely vineyards and cereals (Regional Government of Andalusia, 2013).

All these figures and trends are even more pronounced in the province of Jaén. While in 1970 only 7.35% of olive groves in the province were irrigated, by 2012 this figure had jumped to 46.8%. Almost half of the province's olive groves therefore have access to sufficient water supply or at least benefit from what is known as "deficit irrigation". This is land which receives less than the optimum annual amount of water (around 1,500 m<sup>3</sup>/ha/year), but receives some irrigation at certain precise moments during the year to make a significant difference compared to olives growing on non-irrigated land (Pastor, Vega & Hidalgo, 2005). Another spectacular change is the rapid growth in recent years of a process in which irrigated land that was hitherto unregulated by the administration has been given official sanction. This began in the mid-1990s, a period of sustained drought, and has gathered pace more recently in statistical terms, such that over 80,000 new hectares of irrigated land appeared in the statistics for 2012.

The growth in harvests, oil production and the increasing role of more intensive olive groves (as represented by irrigated olive groves) is presented in Figure 4 and Table 3. The graph in Figure 4 shows that production has increased much more than the amount of land occupied by olive groves and illustrates perfectly the varying annual output of a crop that is very sensitive to the amount of rainfall it receives during the winter. It is very easy therefore to identify the drought periods that occurred at the beginning of the 1980s and from 1992 to 1995, as well as periods of optimum meteorological conditions which led to bumper harvests such as that of 2003, which was 6.3 times the minimum harvested in 1995.

**Figure 4.** Total virgin olive oil (tn) production in the province of Jaén, 1970-2012

In order to avoid the distortions produced by the high variations in production resulting from the different annual weather conditions in Table 3 we have calculated the average for the last four 10-year periods for which we have reliable data. As we can see, the production of virgin olive oil has increased continuously with the figure for the last decade being 2.85 times higher than that for the first one. We can also chart the increasing amount of olives produced in irrigated groves as a proportion of the total harvest, which rose from an average percentage of 16% in the 1990s to more than 43% in the last decade.

**Table 3.**  
**Average production of virgin olive oil by decades, 1973-2012**

Ten-year period	Production on non-irrigated land		Production on irrigated land		Total Tn
	Tn	%	Tn	%	
1973-1982	139,109	84.63	25,273	15.37	164,382
1983-1992	186,707	84.00	35,574	16.00	222,281
1993-2002	241,165	71.86	94,417	28.14	335,582
2003-2012	263,214	56.13	205,746	43.87	468,960

Source: Anuario de Estadística Agraria. Ministerio de Agricultura, Alimentación y Medio Ambiente.  
<http://www.magrama.gob.es/es/estadistica/temas/publicaciones/anuario-de-estadistica/>

As mentioned earlier, the continuing success and growth of olive farming was reflected in the price of land. Farms with olive groves in the province of Jaén have always been more expensive than the average for Andalucía as a whole and for Spain. For example in 2013 the price for 1 ha of irrigated olive grove was €44,500 while purchasers of a hectare of non-irrigated olive grove would have had to pay €26,000. These figures were in any case substantially lower than the maximum observed some years earlier when speculation drove prices to levels that were out of step with the real value of the farms. It is evident however (see Figure 5) that since the bursting of the building bubble and the generalized spread of the economic crisis in Spain (2008) there has been a progressive decline in these prices.

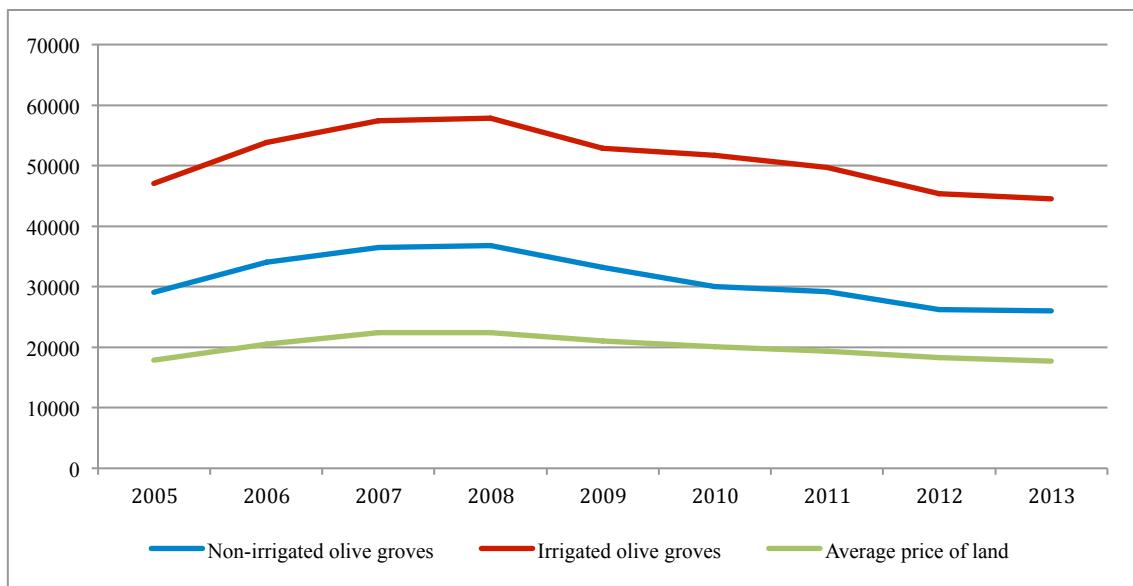


Figure 5. Prices of olive groves (€/ha) in the province of Jaén, 2005-2013

#### 4. AGRONOMIC AND LANDSCAPE DIVERSITY

The massive occupation of agricultural land by the olive groves does not disguise the fact that farms of very diverse kinds continue to coexist. This is due mainly to the fact that olives have been planted on land of very varying quality in terms of agricultural potential, one of the reasons also for the high variation in output per hectare. If we look at Table 2, we can see that in spite of the shift towards land with better soils, the olive groves planted on soils with limitations (moderate and marginal capacity) still account for over 60% of the total.

The structure of land ownership is also wide-ranging. Olives have traditionally been grown on small farms and, despite the increasing monoculture, this remains true today in which the average farm size is 4 hectares. 92% of farms have less than 10 ha and these represent 56.6% of the total area. By contrast only 2.8% of the farms have more than 20 ha although these account for 21.6% of the total area. Large estates (those above the 100 hectare threshold) are very few and far between, accounting for only 0.21% of the farms and 6% of the total area (Sánchez, Gallego and Araque, 2011). All these figures show that despite intensification olive farming remains a predominantly family business and even a part-time form of agriculture.

The cultivation systems are also very varied. There are two main models:

- Traditional olive groves with broadly spaced trees (80-120 trees/ha), on non-irrigated land, with medium or low harvest performance (from 2,000 to 4,000 kg of olives/year), with trees that are always over 25 years old. In this category it is important to distinguish between the olive groves that are planted on a slope of more than 20%, above which it is impossible to mechanize all the related farming tasks. These groves are referred to as “*olivares de sierra*” (mountain olive groves).
- Densely planted olive groves normally on gently sloping or flat land that is completely mechanized and irrigated, thereby obtaining high levels of production (from 8,000 to 12,000 kg of olives/year). Within this category we can distinguish between intensive olive groves (200-600 plants/ha) and super intensive or cane-trained olive groves (1,000 to 2,000 plants/ha).

A third category could be added with those farms which have opted for ecological methods of farming. This option has however not proved very popular in the province. At present Jaén has only 7,000 of the 58,000 ha in Andalusia as a whole. So far the only appreciable advance in this direction is the increase in so-called integrated production groups. Under this system farmers can continue to use conventional chemical products, but only in appropriate quantities and with technical advice, so preventing the abuse that until recently was so common.

The cultivation systems therefore also have extremes ranging from complete ecological and economic marginality (olive groves which occupy land once covered by forest with very poor soil or topographically very steep or uneven land with outputs of around 500 kg/ha), which are not profitable even when the different CAP subsidies are taken into account; to the most modern intensive systems of production in which the olives are planted in continuous lines of bushes or hedges which can be harvested mechanically and quickly at the optimum moment of ripeness of the fruit. In these intensive groves record production levels of 17,000 kg/ha can be obtained, making them profitable even if government subsidies were to come to an end. This means that a hectare of super-intensively farmed olive grove can produce 30 times more than a marginal olive grove (in economic terms the difference is even greater as mechanization significantly reduces the cost of harvesting, the most expensive part of olive farming).



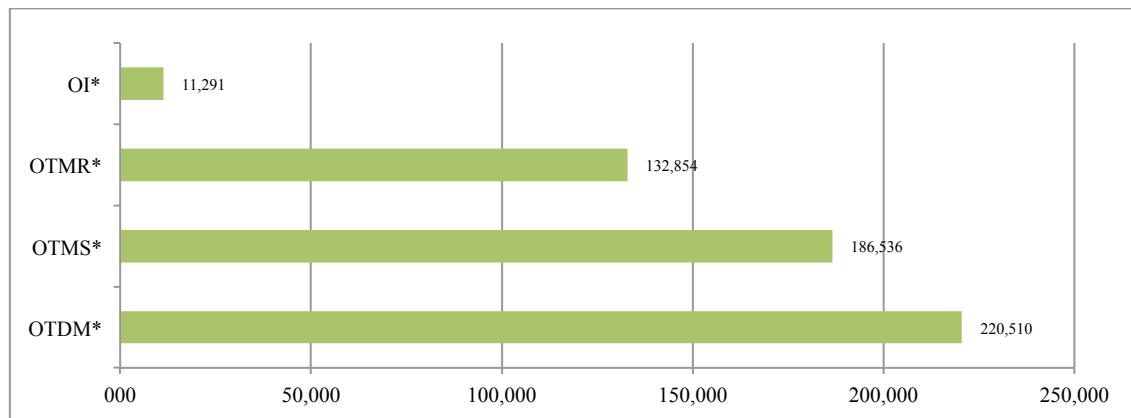
Photos 1 and 2. Contrast between super-intensive and mountain olive groves

Most farms however operate at mid-range production levels and their survival depends both on market prices for olive oil and on the institutional support they receive. It is important to remember nonetheless that almost 70% of farms in Andalusia produce less than 4000 kg of olives per year (Regional Government of Andalusia, 2008).

In the case of the province of Jaén, taking into account the age of the trees, the cultivation system, the planting density and the slope of the land, 16 different types of olive groves can be identified, of which the most dominant are traditional plantations of adult trees on non-irrigated land (66.89% of the farms and 59.89% of the area). By contrast, the most intensive farms form an almost negligible fraction. Various categories have been grouped together (Figure 6) in order to analyse the economic viability of olive farms in the present context of stagnant low prices that has affected recent harvests (Economic and Social Council of the Province of Jaén, 2011).

According to this study, when the price at source is around 1.75 €/Kg, the norm in recent years, 97.95% of the total cultivated area and 99.47% of the farms are selling their olives at below production cost price, although when EU subsidies are taken into account this figure is reduced by about half. In any case what is clear is that only the

most intensive forms of production, which are the least common (Figure 6), can withstand adverse market situations and the reduction in subsidies resulting from the application of the recently modified CAP.



**Figure 6.** Area (ha) occupied by the different forms of olive production in the province of Jaén(\*)  
OTDM: Traditional olive grove difficult to mechanize. OTMS: Traditional mechanizable olive grove on non-irrigated land. OTMR: Traditional mechanizable olive grove on irrigated land. OI: Intensive olive grove.

## 5. CONCLUSION

The olive groves of Jaén are the quintessential example of agricultural monoculture in southern Spain. In their expansion across the province, olive producers have adapted to changing circumstances in different ways by setting up cooperatives for the transformation of the olives into oil (Hernández, 1999), incorporating new machinery (Parejo and Zambrana, 1994), inorganic fertilizers and irrigation (Garrido, 2004), changes that have become generalized over the last 20 years (Sánchez et al., 2009), albeit gradually and always with the aim of increasing harvests and reducing production costs. This has enabled the province to become the world leader in olive oil output (Rodríguez and Parras, 2011), most of which is sold in bulk rather than being bottled and distributed by local producers. The fact that producers depend on distribution channels that they do not control together with an increasing supply of oil on the world market has led to the fall in prices observed in recent years. There is also increased awareness of other problems related to this model of production, such as the non-sustainability of some of the farming practices which have led in particular to serious problems with soil erosion and increased demand for water.

We are currently immersed in a period of institutional changes in a sector that is trying to adapt to this new environment. Various options are being considered such as the abandonment of less profitable farms, the intensification of those best suited to compete in terms of increasing harvests/reducing costs, diversification of activities within farms (olive oil tourism, use of biomass waste products for energy production and agricultural supplies), the formation of producer-controlled distribution channels etc.

As regards this last option, the essential condition is that part of the harvest be set aside for making oils of the highest quality, so breaking with a tradition in which too often quantity was more important than quality. The government has been working in this direction for over three decades but it was not until bulk oil prices slumped to below cost price that the message really began to sink in amongst many producers. Initial steps in this direction involved the setting up of protected designations of origin

(PDO), although these initiatives have met with only limited success (Sanz and Macías, 2005) in the selected areas, which cover a total of 140,000 ha. As mentioned earlier, the strategy of promoting ecological olive oil has not proved particularly successful either, in spite of the fact that experience has shown that a sufficient price differential can be obtained to offset the additional costs arising from ecological production (Barea and Ruiz, 2002).

Instead in recent years numerous producers have emerged, who are opting for top of the range extra-virgin oil which they bottle and distribute at source. The decisive move towards a product of this kind requires an almost revolutionary transformation of the customs and attitudes of producers, which begins with the work on the farm itself. In fact perhaps the most important change required in this form of production is bringing forward the olive picking season by almost two months (from December to October) to a time in which the fruit is not fully ripe. At this point the olive's organoleptic qualities are at their peak, although output in terms of oil volume is lower. These oils, which have won many awards in national and international competitions and are now highly regarded on the market, are at the opposite end of the spectrum to the traditional strategy of bulk sale and fit much better with the idea of olive oil as a quality product that is beneficial for health. As this philosophy spreads the production of high quality olive oils can bring about change at all levels and stages of the business process from the care of the plant to the harvesting process, from the training of employees to the development of locally-controlled distribution and internationalization strategies (Rodríguez, Sánchez and Gallego, 2013). This would be a good start towards harnessing all the potential of the province in an ambitious programme of endogenous development.

## ACKNOWLEDGEMENTS

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