**Report for Case Study “Sierra Mágina”**

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<table>
<thead>
<tr>
<th>Name of the Indication</th>
<th>Sierra Mágina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country</td>
<td>Spain</td>
</tr>
<tr>
<td>Category</td>
<td>Olive Oil</td>
</tr>
<tr>
<td>Protection Status under EC Regulation</td>
<td>PDO (C.E. N° 2107/1999 of 4 October 1999).</td>
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1. The Product and Product Information:

1.1. Product Description.

1.1.1. Olive Oil.

Olive oil is obtained from the fruit of the olive tree (Olea Europa, L). Olive trees have been grown in Europe since ancient times in the area surrounding the Mediterranean. This area, nowadays, accounts for 98% of the world’s production.

In the Jaén region, surrounding Sierra Mágina, the olives are harvested between the 1st of December and the 1st of February. The olives are taken directly from the tree manually or mechanically, by means of ‘comb’ devices or by shaking the tree such that the olives fall on nets which surround the tree. The olives are then transported to the mills by means of a trailer the same day as the harvesting. When the olives arrive at the mill a selection is performed to separate the good olives. Consequently, the olives are cleaned to remove leaves, dust, etc, and they are weighed and washed. Then, they are grinded with mechanical mills or grinders. In order to favour the extraction of the oil, the paste obtained from grinding is whipped. In the separation phase, the oil is separated from the rest of the components of the olive -alpechín (oil lees) and orujo (olive dregs)- by pressing or centrifuging. The latter system, integrating so called “continuous” systems (sistema continuo) consists of introducing the olive mass in a horizontal cylinder - that turns at high speed. In the absence of air, the separation of the aforementioned components will occur due to their difference in density. Finally, the oil is preserved in optimal conditions for the product, namely the adequate temperature, isolation, few light, closed tanks with pipes and taps made of stainless steel. The introduction of this system of decantation allowed a major increment in the capacity and speed for extracting oil, thus having a major effect on productivity and quality (since extra virgin oils depend on immediate processing).

1 In the case of extra virgin olive oils the processing is to be completed within 24 hours, to impede fermentation and an increment of acidity of the oil, which should not be over 0,5º (about the same acidity as the fruit has at the moment it is harvested).
1.1.2. Categories.

There are several categories of olive oils in the market today. Olive oil can easily be differentiated, since it is one of most regulated commodities in Europe, with very precise guidelines for production, marketing and labeling.

Six main categories, for human consumption, may be distinguished in the market and under classification in Community legislation:\(^2\):

Virgin olive oil are “obtained from the fruit of the tree solely by mechanical or other physical means under conditions, particularly thermal conditions, that do not lead to alteration in the oil…” \(^3\).

a) Refined olive oil, which is obtained by refining virgin olive oil.

b) Olive oil, which are blends of virgin olive oil and refined olive oil.

c) Crude olive pomace oil, which are obtained from olive pomace by treatment with solvents and other means.

d) Refined olive pomace oil. Obtained from refining pomace oil.

e) Olive-pomace oil, corresponding to a blend of refined olive pomace oil and virgin olive oil (other than lampante oil).

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\(^3\) Annex 1, ibid, full definition describes Virgin oils as “obtained from the fruit of the tree solely by mechanical or other physical means under conditions, particularly thermal conditions, that do not lead to alteration in the oil, which have not undergone any treatment other than washing, decantation, centrifugation and filtration, to the exclusion of oils using solvents or re-estrification processes and any mixture with oils of other kinds.”
The most praised variety is virgin olive oil, due to its properties and completely natural method of extraction (virgin olive oil is authentically the “juice” of the olive). Virgin oil is categorized as follows:

- Extra-virgin olive oil, having a maximum free acidity, in terms of oleic acid, of 0.8g per 100g.

- Virgin Olive Oil; having a maximum free acidity, in terms of oleic acid of 2g per 100g.

In addition to these categories, we must add “Lampante oil” which is not for human consumption; the lampante name comes from olive oil's ancient use as fuel in oil-burning lamps. Today it is mostly used in the industrial market

1.1.3. Sierra Mágina Olive Oil.

Sierra Mágina Olive Oil is exclusively extra-virgin oil, mainly obtained from the ‘Picual’ olive variety with marginal presence of the ‘Manzanillo de Jaén’ variety. The oil is obtained by way of mechanical processes or other physical means that do not alter the oil and “preserve the taste, aroma and characteristics” of the fruit, where it originates from. The olives of the authorised varieties are directly harvested from the tree, with a degree or ripeness allowing the obtention of characteristic fruity oils.

**Characteristics:** The oil presents the following analytical specifications: maximum degree of acidity of 0.5°; a maximum content of peroxides of 18; K 270 less than 0.20; maximum humidity of 0.1%; a level of impurity not higher than 0.1%, thus corresponding to an extra-virgin olive oil category of the lowest degree of acidity, close to the acidity that the olive bears when still on the tree.

The oils of this designation of origin are very stable and fruity, and slightly bitter. The color varies depending on the harvesting time and the geographical location within the region, and goes from an intense green to a golden yellow.
The Production of Olives.

The primary olive variety cultivated—as in most of Andalucía—is the “Piqual” variety, which according to the Sierra Mágina specifications code may be combined with minor quantities of Manzanillo de Jaén variety⁴, which can also be found in the region.

In traditional groves such as those to be found in Sierra Mágina, most of the trees are quite old—over 50 years—, so propagation occurs marginally and mainly in a few new orchards.

Olive Trees are separated by 9 to 10 metres. Most olive groves have trees of multiple trunks, except for new plantations which are normally of trees with one trunk. Multiple trunks correspond to the traditional production method; however present difficulties for mechanical harvest.

Fertilization, mainly nitrogen, is applied towards the end of the winter—when moisture of the soil is highest-. When irrigation replaces dry farming, this application of fertilizers is less dependant on climatic factors and may be carried out when the tree needs it most.

Fertilization, and soil nutrient content, seem not to influence the quality of olive oil.

Pesticides are used quite extensively to combat olive fly and verticillium wilt and herbicides are used to facilitate fruit collection on tarps under the tree.

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⁴ Variety, according to studies, has a major influence on the final quality of the product. The Piqual variety is high in fat and polyphenol (essential for oil stability) when picked at the right maturity. It is particularly fit for mechanical harvest by shakers.
Olives are harvested between the 1st of December and the 1st of February. Choosing the right harvest date is very important (Sutil-García et al., 2005), because delays may cause a drop in the content of polyphenol –important for oil stability–, as well as in the composition of certain acids. The olives are taken directly from the tree manually or mechanically, by means shaking the tree such that the olives fall on nets or cloth surrounding it. Attention is given to avoid damage on fruit skin, and to keep the olive away from the ground as much as possible.

**Olive Oil Production Process:**

Handling and milling: Olives are transported to the mills by means of a trailer within a few hours (for extra-virgin oil, processing has to take place within a few hours). When the olives arrive at the mill a selection is performed to classify and separate olives by quality (a small portion of bad olives can affect the whole batch). Next, olives are cleaned to remove leaves, dust, etc, and they are weighed and washed. Washing is avoided, and limited to olives harvested from the ground, as extra-moisture can affect extractability (when using hammer mills), and polyphenol content –affecting stability–, and flavor –because of contact with dirty wash waters.

Extraction: Then, olives are milled, with mechanical hammer mills. Then, an olive paste –containing the oil– is mixed, for up to 1,5 hours, in order to favor the extraction of the oil. Temperature in this stage should be warm (around 28º), to favor extractability.

Then, oil is separated from the paste: first, through oil is separated from vegetative waters (‘alpechín’) and the pomace (orujo), by pressing or horizontal centrifuging.

The most common system, which has replaced traditional presses, are the decanters. It consists of introducing the olive mass in a horizontal cylinder that turns at high speed (3000 rpm.). In the absence of air, the separation of the aforementioned components will occur due to their difference in density. The system has a double advantage: it increases efficiency, but also decreases the time oil is in contact with fermenting vegetation water (see Box 1).
Box 1: The decanter systems.

In a characterization of the decanter systems (Vossen, 1998), mentions two types:

- The three-phase system decanter, which separates the paste into a relatively dry solid, vegetation water and oil (ibid). A minimum quantity of water is added to separate the solid material better.

- The two-phase systems, introduced in the mid nineties and now widely extended in the Sierra Magina region, in which vegetative waters and solids exit together, and there is no need to add extra water. The advantages of the two phase system include a better retention of polyphenols, less loss of oils. From the environmental point of view, less contaminating vegetative waters are produced with the two phase system.

In the final phase, olive oil is preserved in optimal conditions for the product, namely the adequate temperature, isolation, deem light, in closed tanks with pipes and taps made of stainless steel. Virgin-oils, with the characteristics meeting PDO requirements, are kept separately, in sealed rooms, controlled by the Consejo Regulador Sierra Máinga (Sierra Máinga Regulating Council-SMRC) When finally bottled –in recipients of less than 5 litres.- the extra-virgin olive oil is given the corresponding PDO seal.
1.2. History

1.2.1. The History of Olive Oil Production in Andalucía and the Jaén Region.

The origin of olive trees and their produce, olives and olive, are lost in time. Fossils coming from olive trees show that perhaps the olive tree originates before the twelfth millennium BC. Olive oil was used for nutrition, for rituals and for cosmetic purposes as far back as 4000 BC in the middle east, in vast regions situated somewhere between Palestine, Crete and Egypt. It’s historical and cultural importance is certified by the archaeological findings of tools used for harvesting and milling as well as references found in sacred texts such as the Bible and the Coran.

The Olive Tree is one of the maximum exponents of agricultural production of the Mediterranean. Together with cereal and vegetable rotations, and the vine, it been the basis of the dry-farming agricultural system for more than two thousand years, based on the excellent adaptation of the plant to dry surroundings (Tardáguila et al, 1996).

In the Andalusian region, in particular, special references to the cultivation of the olive tree exist since prehistoric times. Stepping into the recent history of this product in Andalucía and the Jaén region, where Sierra Mágina is located, one observes the high incidence of the olive and olive oil in social, economic and environmental terms. Olive production has always had a high social impact in Andalucía, since the harvest of olives has always employed an important workforce. It has been an important factor which has avoided both demographic and ecologic desertification of the south of Spain, mainly because of the high adaptability of the olive tree to the dry lands of this geographical area (CAP, 2002).

Up to the Spanish Civil war, the Andalusian landscape, economy and culture were marked by the expansion of the olive and olive oil production. This expansion of the olive may be explained by the continuous growth of the demand for olive oil, an optimal productivity in dry farming conditions and the existence of populated areas – hence of abundant labour- in the areas of production (CAP, ibid; Tardáguila, ibid).
In the following decades after the war liberalization and industrialization, migration from rural areas towards the cities and the emergence of competing vegetable oils -in particular those extracted form soy bean and sunflower seed- to meet the increasing consumer demand for fats, all had an effect in the traditional olive oil producing sector: less availability for labour led to an increase in costs of production, which together with increased competition and stagnated productivity showed the way to a major crisis of the sector in the nineteen seventies, with a consequent abandonment of agricultural activity: cultivated lands showed a decrease of over 11% occurred between 1964 and 1988 (CAP, *ibid*).

The olive oil sector’s crisis evidenced the competitive weakness of the traditional manner of production, based on very extensive systems, but with a technological lag for the collection and processing of the olive. In the absence of competition for the olive oil product from other oils and fats, olive groves –even while maintaining such traditional systems of production- were still profitable. Under the change of circumstances previously mentioned, however, this was no longer so. Another reason behind the important seventies crisis was due to the relative lack of quality of the Spanish olive oil and security for consumption, all of which obliged the Spanish government to revise its general policy on “fats”.

Overcoming the crisis meant addressing the main problems that the industry of that time had to affront, i.e., increasing labour costs, lack of appropriated technologies and fault of quality-oriented policies (Tardáguila, *ibid*). Some changes were introduced in the immediate years following the crisis, with a general plan (“Plan de Restructuración y Reconversión Productiva del Olivar”) seeking to increment productivity of olive groves, through intensification of production. The principal means were to the increment of irrigation, a major density of trees per hectare and the planting of new trees, with one trunk, to allow mechanization of recollection.

However, the most important changes in the olive oil sector began after the Spanish accession to the European Community, with the progressive application of Community aids stemming from the CMO for Oils and Fats (Carpio-Dueñas, 2003).
Modes of agricultural production have varied, somewhat, with a slight movement towards intensification. Towards the end of the 1990s production was based, predominantly, on what is called “intensified” traditional systems. Notwithstanding, the increment in lands under cultivation led to augmentation in production.

Another crucial transformation, concurrent to Spain’s accession to the ECC, involved deep technological modernization of the oil-“extraction” industries. Traditional stone mills and presses were switched for hammer mills and the three-phase system of decantation first –in the mid eighties- passing on to the two phase system later (see 1.1.3. supra). This introduction allowed for continuous flow production systems, incrementing productivity. Quality is also directly affected, since the time of fermentation of the olive -leading to more acidity and therefore less quality- is reduced because of the augmentation in capacity of transforming olives in oil in less time.

As a consequence of these important transformations, the production of olive oil increased dramatically in Andalucía from an average\(^6\) of 370 TN., recorded during the

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\(^5\) Fully intensive new olive groves, in 1996, represented no more than 3% of total production (Tardáguila et all., 1996).

\(^6\) Averages for five year periods are used, in light of the great variations on yields which may occur from year to year, depending –above all- on climatologic factors.
five years between 1980 and 1984, to 730 TN. between 1995 and 2000. During the same period, the Jaén region passed from 191 TN. to 379 TN., accounting for over half of the production of olive oil.

Today, the production of Andalucía represents over 90% of the total Spanish production, which amounts to around 38% of the world production. Jaén, where more than half of the Andalusian production takes place, represents almost 20% of the world olive oil agro-industry.

1.3. Geographic Information

The ‘Sierra Mágina’ region is situated in the central part of the southern zone of the Jaén province, the North of the park borders to the towns of Ubeda and Baeza; in the South it borders to the Granada province; in the East to the town of Quesada (Jaén) and
in the West to Jaén and Valdepeñas de Jaén. It contains fifteen municipios or town districts covering an area of around 1,338 km².

**Table Nº 1: Area of Sierra Mágina region, distributed by Town Districts –Municipios- (in Km²).**

<table>
<thead>
<tr>
<th>Municipalities</th>
<th>Area (Km2.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albánchez de Ubeda</td>
<td>38.83</td>
</tr>
<tr>
<td>Bedmar y García</td>
<td>118.80</td>
</tr>
<tr>
<td>Bélmez de la Moraleda</td>
<td>49.44</td>
</tr>
<tr>
<td>Cabra del Santo Cristo</td>
<td>187.03</td>
</tr>
<tr>
<td>Cambil</td>
<td>139.89</td>
</tr>
<tr>
<td>Campillo de Arenas</td>
<td>116.72</td>
</tr>
<tr>
<td>Cárcheles</td>
<td>40.50</td>
</tr>
<tr>
<td>Huelma</td>
<td>250.29</td>
</tr>
<tr>
<td>Jimena</td>
<td>48.04</td>
</tr>
<tr>
<td>Larva</td>
<td>41.76</td>
</tr>
<tr>
<td>Mancha Real</td>
<td>97.70</td>
</tr>
<tr>
<td>Noalejo</td>
<td>49.66</td>
</tr>
<tr>
<td>Pegalajar</td>
<td>79.95</td>
</tr>
<tr>
<td>Torres</td>
<td>80.04</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>1,338.65</strong></td>
</tr>
</tbody>
</table>


The morphology of Sierra Mágina presents a great number of caves and breaches, due to a high presence of calc rock. The ground, therefore, shows a high degree of permeability, explaining the presence of ground-waters and aquifers, which may surface in the form of fountains, creeks and small rivers.

Most of the territory is at an altitude somewhere between the 600 m of the Guadalquivir valley and the 2,167 m of the Pico Mágina summit. The terrain of Sierra Mágina is mountainous (sierra means “mountain range” in Spanish), with more than half of the territory on slopes which are superior to 7%, as may be observed in table Nº 7 (see 3.2.2. infra). Over one third of the lands correspond to steep slopes, with an inclination over 45%. 
The climate is continental Mediterranean, with temperatures which may fall below 0°C in winter, but may well go above 35° in summer. Rainfalls average 900 mm in the higher lands, falling with the altitude and reaching arid levels in the lower lands of the east.

The special orography of Sierra Mágina results in a great diversity in landscape, with singular flora and fauna. This has led to the declaration in 1989 of the Natural Park of Sierra Mágina, covering more than 20,000 hectares of land.

More than half (51%) of the total territory of the Sierra Mágina is dedicated to agriculture, of which 44% -over 60,000 hectares- are for tree-crops and the rest to ground vegetables. Of the first, the greatest part corresponds to olive groves. The rest of the territory of Sierra Mágina is divided in brae (23%), grasslands (18%), fallow (6%) and unproductive soil (3%).
Table Nº 2: Sierra Mágina: Area of land dedicated to agriculture, according to different crops (in Hectares).

<table>
<thead>
<tr>
<th>Crop</th>
<th>Dry Farming</th>
<th>Irrigation</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ground</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vegetables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oats</td>
<td>4,947</td>
<td>107</td>
<td>5,054</td>
</tr>
<tr>
<td>Sunflower</td>
<td>2,049</td>
<td>30</td>
<td>2,079</td>
</tr>
<tr>
<td>Wheat</td>
<td>564</td>
<td>14</td>
<td>578</td>
</tr>
<tr>
<td>Beans</td>
<td>286</td>
<td>0</td>
<td>286</td>
</tr>
<tr>
<td>Others</td>
<td>509</td>
<td>657</td>
<td>1,166</td>
</tr>
<tr>
<td>TOTAL Ground</td>
<td>8,355</td>
<td>898</td>
<td>9,163</td>
</tr>
<tr>
<td>Tree Crops</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Olives</td>
<td>37,793</td>
<td>18,534</td>
<td>56,327</td>
</tr>
<tr>
<td>Almonds</td>
<td>1,545</td>
<td>0</td>
<td>1,545</td>
</tr>
<tr>
<td>Cherries</td>
<td>99</td>
<td>419</td>
<td>518</td>
</tr>
<tr>
<td>Others</td>
<td>151</td>
<td>94</td>
<td>245</td>
</tr>
<tr>
<td>TOTAL Tree</td>
<td>39,588</td>
<td>19,047</td>
<td>58,635</td>
</tr>
<tr>
<td>crops</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>47,943</td>
<td>19,855</td>
<td>67,798</td>
</tr>
</tbody>
</table>


A greater part of the agricultural production is carried out using dry-farming methods. However, irrigation is used in practically as much as one third of the land dedicated to farming.

Table Nº 3: Percentage of Land Corresponding to Dry Farming and Irrigation.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Dry Farming</th>
<th>Irrigation</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>12%</td>
<td>1%</td>
<td>14%</td>
</tr>
<tr>
<td>Tree Crops</td>
<td>58%</td>
<td>28%</td>
<td>86%</td>
</tr>
<tr>
<td>Total</td>
<td>71%</td>
<td>29%</td>
<td>100%</td>
</tr>
</tbody>
</table>


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7 According to the Consejo Regulador de Sierra Mágina the land dedicated to olive tree groves has augmented to 63,575 Hectares in 2006.
1.3.1. The Sierra Mágina PDO Territory

The olive oil production zone is constituted by the terrains located in the towns of Albánchez de Ubeda, Bedmar-Garcíez, Bélmez de Moraleda, Cabra del Santo Cristo, Cambil-Arbuniel, Campillo de Arenas, Cárcheles (Carchel y Carchelejo), Huelma, Solera, Jimena, Jódar, Larva, Mancha Real and Pegalajar and Torres, well in the heart of the Sierra Mágina region.

Figure N° 4: Sierra Mágina Region and Limits of the Sierra Mágina PDO.

Source: website of the SMRC, Consejo Regulador de Sierra Mágina. www.sierramagina.org

In the case of the olive oil production, which occurs entirely in the delimitated and protected area, it occupied 56,000 hectares in 2001 (Table 2), meaning that 83% of the agricultural lands of the Sierra Mágina region corresponds to olive tree orchards.

Most of the olive trees are labored using dry farming methods (57 %), although -year by year- the use of irrigation seems to have incremented, due to the positive results in terms of productivity (see section 3. “Environmental Effects”, infra).

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8 This figure contrasts with other sources which indicate that the average total area dedicated to olive production in Sierra Mágina, for the period between 1987 and 1994, was of well over 100,000 hectares (see, for example, Parras Rosa, M. et all. “El Sector del Olivar y el Aceite de Oliva Jiennense. Situación retos y Estrategias” in Observatorio Económico de la Provincia de Jaén, cited in Jimenez et all, 2002: 11.
2. Legal Framework.

2.1. Laws and Regulations related with PDO Protection.

Denominación de Origen Protegida (Protected Designation of Origin) in Spain, according to the Royal Decrees 1573/1985, of the 1\textsuperscript{st} of August, regulating the generic and specific designations of alimentary products, and 728/1998, establishing the rules for specific and generic designations of origin of agricultural alimentary products, except for wines. The Sierra Mágina olive oil, initially protected on EU level on the basis of the Regulation (CEE) N° 2081/92 of the Council of 14 July 1992, is now protected as PDO according to E.C. Regulation N° 510/2006 and is inscribed in the register created according to Article 7.6. of this regulation.

The Regulation that governs the Designation of Origin ‘Sierra Mágina’ and its Regulating Council was approved on the following levels:

- Community of Andalucía: by Order of 29 November 1995 of the ‘Consejería de Agricultura y Pesca’ of the ‘Junta de Andalucía’ (the Regional Ministry of Agriculture and Fishery of the Andalucian Community).

- Spain: Ratification by Order of 25 February 1997 of the ‘Ministerio de Agricultura, Pesca y Alimentación’ (Ministry of Agriculture, Fishery and Nutrition)

2.1.1. PDO Rules:

Rules related with the Protected Designation deal with two main subjects: the product specification, indicating product varieties, qualities and processes, as well as geographical areas of production, which are admitted to obtain the PDO.

Although the geographic areas, the product characteristics and the processes for oil production have been described in the previous chapters, it is useful to highlight some elements of the specifications.

In relation to the **geographic area**, it is defined as those lands within the Counties of Albánchez de Úbeda, Bedmar- Garcíez, Bélmez de la Moraleda, Cabra del Santo Cristo, Cambil, Campillo de Arenas, Cárcheles (Cárcel y Carchelejo) Huelma, Jimena, Jódar, La Guardia de Jaén, Larva, Mancha Real, Pegalajar, Solera y Torres –all located in the Jaén Province- which the RCSM considers apt for olive oil production. Once the RCSM has qualified the territories, records of geographic information must be kept in the RCSM seat. Producers who disagree with such qualification may appeal to the competent authority (the Agriculture Department of the Andalucía Autonomous Community).

The **olive varieties** which are appropriate for qualification are Picqual and Manzanillo de Jaén. However, the **principal variety**, which is to compose at least 90% of the Sierra Mágina Olive Oil and which use the RCSM “will promote” is the Picqual. New varieties could be eventually authorized, previous tests, showing that they are compatible with traditional oil production standards.

The regulation dedicates one article to cultural measures where –very generally- it is established that “**traditional practices**” of cultivation shall be applied. What seems a measure aiming at preserving traditional methods, however, is subdued by the aim of preserving quality. In this sense, the same article new “cultural” practices could be

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9 Reglamento de la Denominación de Origen «Sierra Mágina» y de su Consejo Regulador. (BOE, Nº141, June 14 2005: 20517).

10 Art. 6, ibid.
authorized, if they represent sensitive technological advances which do not affect olive and olive oil quality.

In the section dedicated to the regulation of the production processes (see the detail of the process, *supra*), it is interesting to note that a detailed regulation is combined with *flexibilities* which allow certain phases to be modified year by year, to allow adaptability to changing conditions and fruit properties which may present differently each year. One such phase is the maximum time allowed between harvest and milling, which will be fixed by the RCSM yearly, although never exceeding 48 hours.

The other two principal subjects dealt with are the **rights and obligations** of the members of the RCSM, and the functions of the Regulatory Council itself, in terms of control, certification, promotion and defence of the GI.

The first refers to the right of registered holdings, which obey and comply with specification rules and which are involved in the production chain, to use the PDO “Sierra Mágina” in commercial transactions. Bottling and packaging rules are also laid down (recipients above 5 liters are not admitted as commercial packages), as well as measures for controlling intermediate supplies (tagging) of certified olive oil susceptible of being labeled and final labeling.

The **RCSM** has, as its principal task, the **responsibility** of ensuring that the PDO regulation is respected and observed, which means it has the power to monitor registered producers and production processes. As a complementary responsibility, it must promote the PDO in order to expand commercial markets. It may also carry out other complementary tasks contained in the regulation, which amount basically to cooperation in technical areas to serve producers of methods which enhance their production and adapt processes to evolving agricultural and environmental standards.

### 2.1.2. Monitoring

The Regulating Council of the D.O. “Sierra Mágina” (RCSM) carries out the control of the requirements set out in the Regulation. The main task is to certify that the quality of olive oil meets the standards laid down in the code of practice, and to guarantee that
certified olive oil is produced and stored independently from other qualities. This includes measuring physical and chemical properties, as well as establishing if organoleptic standards are met.

The RCSM is a Certifying Organism in accordance to the EN-45.011 norm\(^\text{11}\). In its seat, the RCSM has a laboratory, as well as a facilities used for “Tasting Panels”. The tests are carried out twice, first when the oil is produced and first certified and secondly at the moment when the product is finally bottled and counter-tagged before being sold by bottling-distributing firms.

2.1.3. Other functions carried out by the RCSM

Technical assistance is also granted by the Regulating Council. A technical team formed by two or three agricultural experts and biologists controls the olive groves to counter possible plagues and diseases, giving continuous advice to the farmers. Furthermore, the whole of the vegetative development is supervised, such as the health of the olive grove, inspecting all the cultivation techniques, such as irrigation, fertilization, treatments, etc.

At the same time technical advice is given in order to improve efficiency and productivity of the mills that make the olive oil, performing analysis of the oils and its by-products for them to attain an optimal return.

**Integration of environmental-friendly methods**\(^\text{12}\) are proposed by the technical experts working in the RCSM. Support is given to implement rational methods to

\(\text{11} \) Royal Decree N\º 2.200/1995 (Aprobación del Reglamento de la Infraestructura para la Calidad y la Seguridad Industria) decided that certifications of agricultural products should be granted by organisms which comply with requisites of European Union EN 45000 norms. The basic criteria set out in Norm 45.011, which are to be met by certifying organisms, are independance, competence and reliability in the certifcation of products.

\(\text{12} \) Integrated Production has been promoted among producers from the RCSM, however, this form of production is not imperative to meet quality standards and to qualify for PDO certification. Technical experts from Sierra Mágina note that –in practice- integrated forms of production are achieved in many of the producing groves (Interview with RCSM monitoring experts; June 2006).
combat the olive-fly\textsuperscript{13} and control of biological systems combat of the olive Prays. The RCSM aims at aiding producers to meet the standards of the ATRIAs (Official Plan Associations of Producers for Integrated Production Systems), through controls of the harvesting, from the 1\textsuperscript{st} of December to the 1\textsuperscript{st} of February, and inspections held in all the mills with the fundamental objective not to alter the quality of the oils.

Finally, in the framework of the functions attributed to it by the PDO rules, the RCSM has a fundamental role in facilitating communication among members. This is normally achieved through actions such as concerting meetings among members with the objective of constructing common grounds for cooperation and elaborating competitive strategies for the PDO.

2.2. Environmental Management and Conservation. The Natural Park of Sierra Mágina.

The Natural Park of Sierra Mágina was declared protected natural environment by the Law 2/1989 which approved the Inventory of Protected Natural Areas of Andalucía, establishing additional measures for their protection.

The Natural Park, which forms part of the environmental network “NATURA 2000\textsuperscript{14},” has been declared as Special Protected Area (SPA), a designation under the European Union directive on the Conservation of Wild Birds\textsuperscript{15}.

In 1994, the Plan de Ordenación de los Recursos Naturales (PORN) and the Plan Rector de Uso y Gestión del Parque de Sierra Mágina (PRUG) -which together govern zoning, conservation, uses and management of resources of the park- were approved by national decrees\textsuperscript{16}. The plans, initially in force for eight years- were renewed in 2000\textsuperscript{17}.

\textsuperscript{13} As of June 2006, fight against the Bactrocera oleae Gmel is obligatory and authorized methods, areas of application and official financial aids available are contained in an Ordinance of the Junta de Andalucía. The methods basically consist in air propagation of insecticides of low toxicity and bates. The main target users of these aids are Associations of Producers of Integrated Production Systems (ATRIAs).

\textsuperscript{14} Directive Nº 92/43/CEE, of May 21 1992.

\textsuperscript{15} Directive Nº 79/409/CEE.

\textsuperscript{16} Decree Nº 63/1994 of the Junta de Andalucía.

\textsuperscript{17} Decree Nº 73/2000 of the Junta de Andalucía.
In 2004, therefore, the Junta de Andalucía approved through Decree Nº 57/2004 a new PORN and PRUG, adapted to the evolutions of the environmental conditions of the Park.

The PORN, which characterises different environmental areas of the Park, and describes land uses and principal socioeconomic activities, dedicates one chapter to elaborate a socio-environmental diagnosis of the area. In this diagnosis it is manifested that agriculture had expanded in the lower areas of the Park, notwithstanding existing agronomic limitations. This expansion, attributable to the last decades of agricultural subsidy policies, has led to the intensification of agriculture with visible prejudices for soils (erosion) and the excessive use of water due to increments in irrigation. Dangers for ground waters, coming from the washes of fito-sanitary products, are also mentioned.

The PORN proposes the establishment of sustainable agriculture, proposing –among other measures the promotion of traditional productions, organic farming and recycling of sub products of mills and olive groves.

The PRUG also includes references to for agricultural production in general and to the olive in particular. It sets out criteria for producing agricultural products which should be followed within the territory of the Park. Such criteria includes inter-alia- the application of techniques which will reduce environmental impacts, the application of fertilization plans which are adapted to the particular environment, an adaptation of irrigation programs to the characteristics of soils and water availability, rational and integrated systems to control plagues and reforestation of lands on slopes which are superior to 20%.

The PRUG also proposes specific measures to be achieved with the collaboration of the Regulatory Council of Sierra Mágina, such as the promotion of integration of producers into Associations for Integrated Production (API) and the draft of a Good-Practice

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18 The Hidrologic unit of Pegalajar-Mancha Real, for instance, is reported to be over exploited in the Hidrologic Plan of the Guadalquivir (cited in PORN, *ibid*: 37).

19 Acronym in Spanish.
Code. Also, the use of less aggressive technologies will be taken into account in the allocation of subsidies aiming at establishing irrigation systems. In reference to Olive groves on pronounced slopes (over 15%) the PRUG establishes the obligation to use one of several soil conserving techniques, based on the use of natural covers.


The Common Market Organisation (CMO) created for oils and fats in 1966 was implemented\(^2\) in a situation of shortage in the newly created European Community. The system, at its creation, aimed at developing the national production while encouraging importations to meet the European demand. Ever since, many important technological and political changes have taken place, including the accession of Greece, Spain and Portugal, all of which have placed the EU as the foremost producer of Olive Oil.

Despite this, the main elements of the regulation, which remained essentially valid until 1998, were:

- The application of reference prices for the purpose of Community intervention on the market;
- Production aids (a subsidy per tonne of oil produced).
- Consumption aids (paid to bottling companies);
- Arrangements for intervention storage (acting as a minimum price guarantee for producers);
- Protection for the internal market, firstly through a levy on imports, later by customs duty;
- Refunds and export subsidies for exporters.

These measures, which produced a drive towards incrementing production quantities – in particular because of the benefits of the aids linked to production levels, were supplemented – and balanced somewhat - in 1986 by the instauration of a Maximum

\(^2\) Regulation 136/26/CEE.
Guaranteed Quantity (MGQ). If the MGQ was exceeded by Community olive oil output, the rate of production aid was reduced proportionally for all producer Member States.

Even if a common olive oil policy was necessary as a start to develop the market, it has driven the producers to systematically increase their production. In addition, it has also encouraged fraudulent behaviours which have been costly to the Common Agricultural Policy (CAP) budget. From the environmental point of view, the system has led to intensification of production with higher impacts on soils (erosion and contamination from agrochemicals) and water (probable contamination and incremented use of water reserves in dry areas). This has lead to propose and successively reform the system of domestic support and border protection.

In June 1998, the present system was meant to be trimmed by linking the aid to actual output of producers, thus limiting the aids that were linked to the number of the trees. Furthermore, consumption aid was abolished, the common “buffer” stocks were replaced by private stocks and the MGQ was extended. These modifications were effective by November 1998 for an interim period of three years that was intended to lead, ultimately, to a free-market. At the end of the three years it would have been decided to adopt a new subsiding system (conditioned by the number of trees) or to go on with the then prevailing arrangements.

Council Regulation No 1638/98/EC was, therefore, designed as a transitional measure. However, in 2001 the regime was extended until the end of the 2003/2004 marketing year in order to allow a thorough review of the needs sector and the market, taking into account the experience of the first years of transition, the fact that there was a deficit in

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21 The European Commision already reported the expansion of production, intensification and fraude, as well as environmental impacts as major problems of the Olive regime in 1997 (see COM [97] 57, reported in Beaufoy, 2001.

22 Regulation No 1638/98/EC.

23 In a more detailed list, the reform of 1998 included the following measures:
Reference prices were abolished; intervention storage was abolished, but the possibility of granting Community aid for private storage under certain conditions was kept open; consumption aid was erradicated, export refunds were mainained; aid was linked to actual output for all producers; Maximum Guaranteed Quantities were replaced with National Guaranteed Quantities specific to each producer country. Finally, it was established that that production from olive groves planted after 1 May 1998 would not be eligible for aid. (See Council Regulation No 1638/98/EC).
the data on the sector and the impacts of the OCM. A special focus was to be given to
the examination of matters related with the “quality enhancement” strategy.24

- The 2003 CAP reform.

Olive oil forms part of the “second wave” of the last CAP reform decided in 2003,
implemented in 2005, affecting all the sectors of the European agriculture. The 2003
reform25 of the CAP introduces a new system of single farm payments and cuts the link
between support and production, in a process called “decoupling”.

For the Olive sector, at least 60% of all production aid -paid during the 2000-2002
reference period- will be transferred to the single payment scheme. The remaining
funding (a maximum therefore of 40%) will become an area aid for the upkeep of olive
groves of environmental or social value.26

An important point of this reform is that all direct aids will be continued until 2012, but
will now be subjected to the compliance with certain conditions (“conditionality”). The
environmental sphere is now introduced and linked to aids, i.e. “cross-compliance”,
subduing all payemwnts to the manutention of land in good agricultural condition and
the observation of standards on public health, animal and plant health, the environment
and animal welfare. However, all direct payments will be gradually reduced, year by
year, and the savings will be reallocated to rural development measures (“modulation”).


25 Income support to farmers maintaining olive groves is provided for in Council Regulation (EC) No 1782/2003 of 29
September 2003 establishing common rules for direct support schemes under the common agricultural policy and
establishing certain support schemes for farmers through the single farm payments as well as an aid for maintenance of olive
groves. The new Common Market Organization was established through Council Regulation (EC) No 865/2004 of 29 April
2004 on the common organisation of the market in olive oil and table olives and amending Regulation (EEC) No 827/68.

26 The system works as follows: a minimum of 60 % of the average production-linked payments of the reference period 2000-
2002 will be converted into entitlements under the single payment scheme for holdings larger than 0.3 ha. The remaining aid
paid (40%) can be retained by the member states as national envelopes to be granted to producers of olive groves of
environmental interest. To avoid market imbalances, access to the single payment scheme will have to be limited to olive-
growing areas existing prior to 1 May 1998 and to new plantings provided for under the programmes approved by the
Commission. For Spain, the national budgetary envelope has been increased by € 20 million. Olive farms smaller than 0.3 ha
will see their payments completely decoupled from 2006.
In Andalucía, the system has been implemented with 95% of the payments disacoupled, and 5% which will be applied as an aid per area. Conditionality implies the maintenance of olive groves in good state, with the necessary labor for cultivation being performed. Removal of Olive Trees is not admitted, except if substituted by new trees and in the areas and conditions which are be established27.

Concerning trade, the protection is high and almost all preferences useless and more time and money consuming than really effective and will remain even after the reform.

3. Environmental Effects

3.1. Agricultural Model for the Production of Olives.


In the Mediterranean region, where almost 90% of the world production of olives takes place, olive groves show a variety of traits, which may be classified taking into account several elements:

- Size of the cultivation lands: varying between very small groves (less than half a hectare) and the bigger groves, reaching around 500 hectares.
- Old and young trees: An important part of olive groves are composed by old trees, reproduced using graft techniques (some may be kept in production for over 500 years). Another system is based on small, recently planted, varieties. These are planted in dense rows and are replanted every 25 years.
- Density: density of the groves varies- The newly planted groves tend to have the highest density, normally reaching a number of 400 trees per hectare (in a few super-intensive orchards, up to 2000 trees per hectare). Older orchards, producing under the traditional system, tend have a much lower density –as low as 40 to 50 trees per hectare-.

27 Orden de la Consejería de Agricultura y Pesca de 23 de junio de 2005.
Intensiveness of production: Traditional orchards tend to be less intensive, with little use of agrochemicals, low density of the orchards and little to no irrigation. On the other extreme, modern intensive plantations tend to use more agrochemicals, present high densities of trees per hectare and imply the use of irrigation. A third category is that of traditional orchards, with trees older than 50 years, which use intensive management of the orchards, especially in the systematic use if pesticides and fertilizers, frequently recurring to irrigation.

3.1.2. The Sierra Mágina Model.

Olive Groves in Sierra Mágina produce under the traditional method, but introducing intensive management methods. According to samples taken by the organism administrating the PDO, the RCSM, the major part of the trees in Sierra Mágina are over 50 years old, with around 60% well above 75 years.

Groves tend to show a moderate level of density, ranging between 100 trees per hectare (at 10 * 10 m spacing between trees) and 110 trees per hectare (at 9 * 9 m spacing). However, since a fair quantity of the trees have two trunks, according to long standing tradition in Andalucía, the volume of the tree tops, per hectare, is higher.

Olive groves are perhaps preferable to available land alternatives: its high adaptability to dry Mediterranean environments leaves this form of production as an economic and environmentally valuable alternative as compared to land abandonment and desertification.

However, there may be risks for the environment which stem from causes such as inappropriate treatment for soils, leading to soil erosion, and intensification of production, which may have a negative impact soils and waters (due to the increased use of inputs). Increased use of irrigation, which together with intensification of the production to achieve higher yields, are practices likely to have environmental consequences (see 3.3.1, infra).
3.2. Effects on Soil.

3.2.1. Soil erosion is one of the worst problems affecting the South of Spain. Erosion reduces the productivity of the soil, making it necessary to increment fertilization methods. When fertilizers and other agrochemicals such as herbicides and pesticides are carried to waters, extended contamination may be caused.

Because of the characteristic cultivation of olives on slopes, erosion in olive groves tends to be a major problem due to hillside or gully erosion. In extreme cases, erosion conduces to desertification, which has been quantified in 80 TN/hectare each year according to studies carried out in the final part of the nineteen eighties. This figure, which is even higher in soils on steeply sloping land, exceeds by far the regenerative capacity of the soil, such as many of the groves to be found in the Sierra Mágina region.

The main reasons for soil erosion, paradoxically, come from traditional cultivation methods which, by tilling the land, would keep the soil free of weeds which would compete with the olive for water and nutrients. This method, however, destroys the natural ground-cover and bares the soil to the erosive action of the elements.

Another important cause increasing soil erosion is the intensification of production, which –in general in Andalucía- has occurred in the past years, because of the incentives created by EC subsidies and aids. Up to the CAP reform of 2003 the subsidies scheme the olive sector was based on subsidies based on production. According to some studies, profitability of intensive production models, under such a scheme, was far higher than of traditional farming, leading to a drive towards more intensified systems. This has occurred even in areas such as that of Sierra Mágina, where traditional olive groves prevail. After the 2003 reform, this system was replaced system by a single payment scheme, which disacouples aids from production. This scheme will only be in force starting in 2006.

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29 For example, Beaufoy, 2001.
Methods to combat soil erosion include the use of natural ground covers, which are left during the winter and moist seasons and then removed during the dry seasons, to keep competition with olive trees for water and nutrients under control.

For Sierra Máquina PDO products, no such methods are imperative as no specific measure included in the product specifications relate specifically to soil preservation. However, for the production taking place within the boundaries of the Natural Park there is an obligation to use one of several soil conserving techniques based on the use of natural covers (see 2.2., *supra*). Furthermore, in practice, the RCSM is active in granting technical collaboration to producers and promoting the implantation of natural ground covers.

Regarding the intensification of production, the trend in Sierra Máquina is similar to other parts of Andalucía, fitting the “intensified” traditional groves model described above.

Except in groves where organic olives are produced, for the “Ecologic” oil such as that produced by members of the ‘Trujal de Máquina’ cooperative, fertilization and control of plagues imply the use of agrochemical products. However, although few firms apply officially integrated systems of production, technical experts of Sierra Máquina affirm that the great part of the producers of the region are arriving to a *de facto* situation in which production is close or identical to integrated systems.

3.2.2. Hillside erosion and floods.

A common problem related with olive production is hillside erosion and floods, due to the great number of groves located on slopes. This is the case of Sierra Máquina, where an important proportion of groves are located on pronounced slopes (Table 4).

Another consequence connected to the horography of regions dedicated to olive production is that eroded soil is carried to lower lands, provoking water reservoirs to fill-up. This has economic consequences as well as environmental impacts, due to the need to construct new reservoirs.
A common technique used to prevent hillside erosion is the construction of terraces. However, terraces are rarely used in Sierra Máagina, because of the high costs in manpower implicated. In general, as mentioned before, soil erosion is combated through the application of natural grass and plant covers.

Table Nº 4: Area of Sierra Máagina County: land distribution within intervals corresponding to the inclination of slopes (%).

<table>
<thead>
<tr>
<th>Municipio</th>
<th>Area in sq. Km. corresponding to each interval.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3%</td>
</tr>
<tr>
<td>Albánchez de Úbeda</td>
<td>29%</td>
</tr>
<tr>
<td>Bedmar y García</td>
<td>32%</td>
</tr>
<tr>
<td>Bélmez de la Moraleda</td>
<td>0%</td>
</tr>
<tr>
<td>Cabra del Santo Cristo</td>
<td>7%</td>
</tr>
<tr>
<td>Cambil</td>
<td>0%</td>
</tr>
<tr>
<td>Campillo de Arenas</td>
<td>0%</td>
</tr>
<tr>
<td>Cárcheles</td>
<td>0%</td>
</tr>
<tr>
<td>Huelma</td>
<td>2%</td>
</tr>
<tr>
<td>Jimena</td>
<td>25%</td>
</tr>
<tr>
<td>Larva</td>
<td>6%</td>
</tr>
<tr>
<td>Mancha Real</td>
<td>46%</td>
</tr>
<tr>
<td>Noalejo</td>
<td>0%</td>
</tr>
<tr>
<td>Pegalajar</td>
<td>0%</td>
</tr>
<tr>
<td>Torres</td>
<td>0%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>10%</td>
</tr>
</tbody>
</table>


In any case, fault of alternative agricultural land uses, and difficulties for reforestation, olive groves do provide relative protection against hillside erosion, as compared to abandoned lands, or shrub, with little presence of vegetation.

3.3. Effects on Water.

3.3.1. Irrigation.

In a dry region such as the South of Spain, where certain areas suffer desertification, water is a valuable resource. Although the olive is traditionally a product of dry
farming, due to the high adaptability of the olive tree to the dry regions of Andalucía, irrigation rates have increased significantly in the past few years, based on productivity and employment creation oriented policies, and favored by subsidies aiming at prizing production volumes.

Increased yields that come from irrigated fields, as compared to dry farms, may increase productivity –in kgs.- by 15% to 40% , depending on the actual area which is irrigated and the rainfall registered in the previous season (CAP, 2002, Beaufroy, 2001)\textsuperscript{30}.

The main consequences of the expansion of irrigation, on production, are therefore the increment of production and the decrease of variability between yearly campaigns. Irrigation not only leads to an increment in the number of olives harvested, but also in the weight and fat content of each olive, which are crucial for the elaboration of the oil. The actual multiplier effect of irrigation, compared to the quantity of olive oil produced per hectare could be as much as 1.8 (Jimenez et al., 2002: 24-25).

In 2005, up to 43 % of groves of the Sierra Máquina PDO territory declared to use irrigation. The greater proportion remains under dry farm regime, although the tendency is that the proportion of irrigated groves has not ceased to augment in the past few years (Table 7), following a trend to be observed in the rest of the province of Jaén since the mid nineteen eighties (\textit{Ibid:} 19)\textsuperscript{31}.

Around 89% of the irrigation of Sierra Máquina comes from superficial waters, 14% from ground-waters and the rest from recycling of residual waters, according to data from the Andalucía Administration (Junta de Andalucía, 1999). According to the same source, water needs seem to be superseded by factual consumption\textsuperscript{32}, leaving a margin for eventual rationalization although, when considering these estimations, we need to

\textsuperscript{30} Beaufroy mentions that in intensive and irrigated groves, productivity per hectare may amount to 6500 Kg. As compared to 4500 kg. obtained from intensive dry farming. A study from the Consejería de Agricultura y Pesca of Andalucía reveals that in 2001 the average production for non-irrigated olive groves was of 2.477 kg/ha. 13% less than the 2.805 kg./ha. produced in average in irrigated farms.

\textsuperscript{31} According to Jimenez et al, Jaén concentrates 68% of the irrigated groves of Andalucía (Jimenez et al, 2002).

\textsuperscript{32} In Sierra Máquina, estimated consumption for water amounts to around 3.800 m³ per hectare, while the estimated water needs are of around 2600 m³ per hectare (Junta de Andalucía, 1999).
take into consideration that increments in intensification will certainly lead to higher demands of water.

The expansion of irrigation adds stress to one of the environmental problems of the Jaén region, common to most of the southern part of Spain: water reserve deficits. In the Guadalquivir Basin, including the Jaén region, Regional Administration (*Consejería de Medio Ambiente*, 1997) already pointed out a yearly deficit of 480 million m$^3$ to meet the region's needs. It is true that the water needs of olive cultivation are inferior to other crops, however, the expansion of irrigation occurred in the last twenty years seems to signify a rupture, from an agro-environmental point of view, in regard to traditional dry farming.

### Table Nº 5 and Figure Nº 4: Sierra Máquina: % of area of olive groves using dry farming.

<table>
<thead>
<tr>
<th>Year</th>
<th>1994</th>
<th>2000</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>70.7%</td>
<td>67.7%</td>
<td>57.7%</td>
</tr>
</tbody>
</table>


3.3.2. Superficial and Ground Water Pollution.

Agrochemicals carried in eroded soils are an important source of contamination of superficial waters. For instance, “Simazina”, a herbicide widely used in traditional
groves, may be retained in the superficial layers of the ground and later carried to rivers, creeks and water reservoirs.

Ground water pollution is scarcely monitored in Andalucía. However, intensive use of fertilizers such as nitrogen is likely to have an impact in ground waters.

3.4. Landscape and Biodiversity.

Olive trees belong to the landscape of Andalucía since ancient times. Traditional groves have been a valuable element of local biodiversity, providing food and shelter for wild fauna.

In traditional agriculture, the farming related to the olive was integrated with other productions into one system, which was justified by a strict ecologic need. In Sierra Mágina, for example, oil residues provided potassium and were used as herbicides in cereal production (as well as other vegetables). Cereal and cattle were complementary productions and cattle provided what was necessary for fertilizing olive groves. Thus, the traditional model favoured a system which maintained bio-diverse agriculture.

Intensification, due to economic constraints, however practically erased such system from Andalucía. Today, most of the region is under a system of mono-cultivation of the olive. Agricultural bio-diverse schemes –with several interdependent agricultural activities– have been replaced by more intensified modes of producing the olive. This has also led to the predominance of the most efficient varieties, such as the Picual, which constitutes 90% of the production of Sierra Mágina, as mentioned previously.

Conservation of certain traditional factors of cultivation in the Sierra Mágina region, however, seem to have worked on favor of biodiversity: for example, preservation of old trees have helped preserve the habitat of a great variety of insects that –together with the fruit of the tree- are a source of nutrition for bigger species. New practices also have had a positive effect: natural “covers”, used to prevent erosion, are the habitat of species of flora and invertebrates.
3.5. Health/Air (pollen allergies)

Due to the great extensions of plantations, pollen coming from olive trees are a reported problem for allergic reactions, representing a significant problem to a portion of the local population. During the flowering season, the television news -within the sections reserved to weather forecasts- regularly informs the public on the levels of pollen found in the air in different areas.

4. Economic Data.

4.1. Significance of Spanish and Sierra Mágina Productions.

4.1.1. Spain is the world leading country in olive oil production. The over 1,050 thousand tons, produced in average during the five year period between the campaigns finished in 2000 and 2005, have represented more than 38% of total produced-world wide during the same period\(^{33}\).

<table>
<thead>
<tr>
<th>Producer</th>
<th>Average 000 TN 93/94 - 98/99</th>
<th>% on World</th>
<th>Average 000 TN 99/00 – 04/05</th>
<th>% on World</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greece</td>
<td>373.7</td>
<td>17%</td>
<td>394.2</td>
<td>14.39%</td>
</tr>
<tr>
<td>Italy</td>
<td>496.9</td>
<td>23%</td>
<td>683.1</td>
<td>24.94%</td>
</tr>
<tr>
<td>Spain</td>
<td>707.3</td>
<td>33%</td>
<td>1051.3</td>
<td>38.38%</td>
</tr>
<tr>
<td>EC</td>
<td>1618.7</td>
<td>75%</td>
<td>2171.1</td>
<td>79.26%</td>
</tr>
<tr>
<td>WORLD</td>
<td>2144.8</td>
<td>100%</td>
<td>2739.3</td>
<td>100.00%</td>
</tr>
</tbody>
</table>


Together with Italy, Greece, Portugal and other Member Countries, it situates EU production in a commanding position, totaling almost 80% of the world volumes for the last five years.

<table>
<thead>
<tr>
<th>Producer</th>
<th>Average 000 TN 94/95 – 99/00</th>
<th>% on World</th>
<th>Average 000 TN 00/01 – 04/05</th>
<th>% on World</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jaén</td>
<td>379.3</td>
<td>18%</td>
<td>525.44</td>
<td>19.18%</td>
</tr>
<tr>
<td>Andalucía</td>
<td>729.7</td>
<td>34%</td>
<td>1008.70</td>
<td>36.82%</td>
</tr>
</tbody>
</table>

Source: Based on data from Consejería de Economía y Hacienda. Junta de Andalucía and IOOC.

\(^{33}\) This includes production of total olive oil, in all categories.
Comparing this data with the figures related to the production Jaén, the main producing region of Andalucía and location of Sierra Mágina, we observe that it holds a significant importance in terms of the percentage of the total volumes produced worldwide. According with this information, around one fifth of the world production comes from Jaén.

### 4.1.2. Sierra Mágina.

Sierra Mágina produced an average of 58.5 thousand tons\(^{34}\) of olive oil between 2003/2004 and 2004/2005, in a proportion which represents over 10% of the production of Jaén. However, this total corresponds to all olive oil categories, including oils which are meant to be refined, virgin oils which are not of superior quality and blends. Extra-virgin olive oils, possessing all requisites to meet PDO standards, are only a fraction of this production as we will see below.

Data of the SMRC shows that the surface dedicated to the olive tree has expanded somewhat in the last five years, incrementing its share in cultivated lands in Jaén and Andalucía.

#### Table Nº 7: Sierra Mágina: Área dedicated to olive production.

<table>
<thead>
<tr>
<th>Year</th>
<th>2001</th>
<th>2006</th>
<th>Var</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sierra Mágina</td>
<td>56.327</td>
<td>63.575</td>
<td>12.8%</td>
</tr>
</tbody>
</table>

Based on figures from CAP, 2001 and SMRC.

Regarding olive oil which may be qualified under the PDO, the data provided by the RCSM shows that there has been a strong tendency to increase certified production.

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\(^{34}\) According to data of the Andalucía Administration (CAP, 2005: 14) the estimated production of olive oil for 2004/2005 was of 46.28 Tons, based on a production of 200,067.369 kg. of olives. Based on this data, we have estimated the 2003/2004 levels of olive oil at around 70,800 thousand tons (based on a production of 306,000,000 Kg. of olives for 2003/2004) and calculated an average production for both years.
“Certified” Olive Oil, i.e. oil which is susceptible of being labeled with the PDO logo once bottled, duplicated between the 1998/1999 campaigns and 2003/2004,
representing today more than one third of the total olive oil produced in the region. Although important volumes of this oil s still not bottled and sold in bulk, this augmentation is an indication of a gradual shift towards quality which is occurring in Sierra Mágina.

<table>
<thead>
<tr>
<th>Table N° 8: Production of Olives, Certified Olive Oil* and PDO Olive Oil.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production of Olives from registered olive groves (000 TN.)</td>
</tr>
<tr>
<td>Bottled Olive Oil with Sierra Mágina PDO (000 Lts.)</td>
</tr>
</tbody>
</table>

| Production of Certified Olive Oil (000 TN.) | 9.33 | 6.08 | 14.82 | 14.11 | 16.39 | 16.60 |
| Bottled Olive Oil with Sierra Mágina PDO (000 Lts.) | 166 | 863 | 1,412 | 1,651 | 1,745 | 2,009 |

Source: SMRC.

In this sense, the evolution of the production of PDO olive oil itself, corresponding to the 2003/2004 campaign, tends to reinforce this assumption: the production in 2003/2004, was more than 12 times that of 1998/1999. This is not so meaningful if we consider that the former was the year when the PDO came into force, but the statistics exposed below show that this growth has been steady and robust all along the six year period, including yearly increments of 17%, 5%, and 15% for three last campaigns, respectively.

However, the participation in the total quantities of PDO oil sold in relation to the total volumes produced is still quite low (5%). This is due to the fact that important volumes of oil are mixed or sold to refineries to produce olive oils of different qualities (virgin olive oils, pomace oils, refined oils, etc.). On the other hand, taking into account only the production of extra-virgin olive oils, the incidence of sold PDO labeled olive oils may amount to around one fifth of the total.
4.2. Employment

Below, a range of estimated person months necessary to work the olive fields of Sierra Mágina are presented.

Table 9: Persons/year employed for olive production in SM.

<table>
<thead>
<tr>
<th>Range of persons/year estimated for Sierra Mágina</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 HA = 1 ALU*</td>
</tr>
<tr>
<td>20 Ha = 1 ALU</td>
</tr>
<tr>
<td>4238.33</td>
</tr>
<tr>
<td>3178.75</td>
</tr>
</tbody>
</table>

Source: Based on data and estimation coefficients in CAP, 2002

*ALU: Agricultural Labor Unit. One Agricultural Labor Unit (ALU) is the equivalent of 240 days of eight hours of work, that is, approximately the equivalent of 12 persons/months.

The range is based on calculations using two coefficients of employment per hectare, included in a document produced by the Department of Agriculture of Andalucía. As employment depends on many factors, in particular the slopes and possibilities of mechanization, a minimum and a maximum hypothesis were developed.

The figures, showing that employment in the primary sector vary between 4238 and 3178 ALUs, are significant in relation to local population, which was 54,686 in 1998.

35 Steeper slopes are an impediment for mechanized recollection and has the effect of increasing the need for manpower. The same occurs with the quantity of trunks which compose the tree (see 1.1.3. supra): the more trunks, mechanization becomes more difficult and manpower needs increase.

36 It must be taken into account that primary production represents the greater portion of the manpower employed in producing olive oil, as mills will employe between two and twenty employees maximum—with a great seasonal variation-. However, total employment—including men and women employed in mills—would increase the figures shown above.
4.3. Prices Premiums and Profitability

Price premiums
Based on information provided by the Fundación para la Promoción y Desarrollo del Olivar y del Aceite de Oliva a reliable series of first sales prices of PDO Sierra Mágina and non PDO, local extra-virgin Olive-Oil, allowed a comparison of price premiums for a period of time of eight years.

Chart 3: First Sales Price (PDO and non-PDO Olive Oil) for 5 lt. Cans.

From the comparison, established for two different packages (5 litre cans and 0.5 litre bottles) we have observed that prices of PDO products have been higher for almost the whole period studied, except for a short laps between 2001 and 2003, for 5 lt. cans, and 2003-2004 for sales in small bottles. Both PDO and non-PDO products have registered increases in the sales price in the last years, reflecting a general situation of the sector.

Source: Fundación del Olivar.

37 http://www.oliva.net/
In the graph below, a comparison of the evolution of price premiums for both types of packages (5 litre cans and 0.5 litre bottles), including the lineal tendency for both cases.

Source: Fundación del Olivar.
Source: Fundación del Olivar.

- Price premiums have tended to diminish over time. This may be due to increased competition, including from the surge of other PDO corresponding to extra virgin olive oils.

- Price premium evolution and margins show a difference in favor of smaller packages (bottles). PDO in small bottles is sold as a deluxe product, for instance in specialized shops, airports or bought by tourists as presents. Differential prices are larger and show a greater stability in these cases, reflecting the importance of high-end consumer market niches. Also, the decreasing tendency is less pronounced in this case.

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38 There are twenty Indications (PDO and PGI) for Extra-Virgin Olive Oils in Spain. Nine in Andalucía.
- Regarding prices for 5 lt. cans of Sierra Mágina and those of neighboring PDO Sierra Segura, we see that sales of Sierra Mágina oils are at currently at higher prices, reversing the tendency shown in the final years of the nineties.39

Table 10: Price Comparison with PDO Sierra Segura.

<table>
<thead>
<tr>
<th>Period of Sales</th>
<th>Price In Euros</th>
<th>Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PDO Sierra Mágina</td>
<td>PDO Sierra Segura</td>
</tr>
<tr>
<td>15/04/1998 - 20/04/1999</td>
<td>16.21</td>
<td>17.99</td>
</tr>
<tr>
<td>21/04/1999 - 01/05/2000</td>
<td>18.63</td>
<td>19.63</td>
</tr>
<tr>
<td>06/11/2000 - 31/08/2001</td>
<td>17.81</td>
<td>17.08</td>
</tr>
<tr>
<td>01/09/2001 - 31/08/2003</td>
<td>15.33</td>
<td>15.50</td>
</tr>
<tr>
<td>01/09/2003 - 31/08/2004</td>
<td>17.87</td>
<td>15.55</td>
</tr>
<tr>
<td>01/09/2005 - 15/01/2006</td>
<td>20.54</td>
<td>19.60</td>
</tr>
<tr>
<td>15/01/2006 - 15/05/2006</td>
<td>26.40</td>
<td>24.66</td>
</tr>
</tbody>
</table>

Source: Fundación del Olivar

Profitability: Incidence of subsidies and potential of GIs to reduce dependence of farmers on public aids.

As explained in previous sections, the market for olive oil is regulated in the European Union under a specific Common Market Organization regulation (see 2.2. supra).
Payments to farmers, under this scheme, have been an essential element for an activity that –other wise- would result scarcely profitable at current prices and costs. A study, performed by the Government of Andalucía in reference to the subsidy scheme of 1998 (i.e. previous to the 2003 CAP reform) shows that 61% of the olive groves of this region would not be profitable without subsidies(CAP, 2002: 110).

39 This information should be nuanced from the fact that the study lacks information on production costs, therefore it is not possible to determine how much of price differentials are actual benefits.
The measure in which price premiums originating in the implantation of quality based strategies, such as the expansion of GIs, would contribute to reduce farmers dependency on subsidies is still to be explored.

Converting the previously exposed prices of PDO olive oil, for 1998, to the amount paid per kg. (1 litre = 0.916 kg. of olive oil) we find that both the prices paid for olive oil sold in cans and bottles (3.54 kg and 5.76 kg respectively), was superior to the average price paid for extra virgin olive oil that same year (around 2.05 Euros/Kg  

In light of the limited quantities which were sold under the PDO labels, and in the absence of information regarding the additional costs which producers wishing to obtain PDO qualification must incur in, it is difficult to draw conclusions on the potential of GI indications to increment profitability to levels that would reduce farmers dependency on subsidies. However, the high price differentials indicate that detailed and deep study of the potential for a GI based strategy, including market conditions for an expansion of PDO sales, is pertinent.

5. Supply Chain Organization and Market Channels.

The Olive Oil supply chain of Sierra Mágina shows different characteristics which may summarized as follows:

Primary production is atomized, with a great amount of farmers which produce on small holdings of between 1 and 5 hectares. In order to maximize economies of scale in olive oil processing and commercialization, starting from the middle of the 20th century, farmers have grouped into cooperatives and other associative groups, such as Sociedades Agrarias de Transformación (SAT  

40 Source, Fundación de Promoción del Olivar – www.oliva.net

41 The SAT is a society with economic and social objectives, constituted to achieve transformation and trade of agri-products. Other activities include the improvement of rural areas, promotion and rural development including the supply of services for those purposes.
More than 8,000 farmers join into the 24 Cooperatives and SATs which produce around 70% of the total production of olive oil of Sierra Mágina. The rest is produced by the existing seven private firms, of family ownership, some of which also possess olive groves. Today, most of the mills, cooperatives or private, possess bottling facilities. These are essential for the qualification of PDO olive oil, since only bottled oils are certified by the SMRC. Mills are primarily responsible for the commercialization of the oil.

Once more, it seems relevant to point out that cooperatives in the olive oil sector of Sierra Mágina only dedicate a little more than one fifth (23%) of their production to high quality olive oils (extra-virgin). An inferior portion of this production is bottled and sold, corresponding with the total quantity of certified PDO oil (see Table 8, supra). In this section direct sales and auto-consumption are predominant (around 80%). The rest is sold to retailers, gourmet shops and restaurants.

Regarding the sales of the rest of the olive oil produced, they correspond to bulk sales which are directed, mainly, towards refineries and towards commercial agents which bottle and distribute the product.


The low share of high quality oils in the production of Sierra Mágina, and the orientation of bulk sales towards refineries (where lower quality, refined and blends are produced) reflect a situation which is extendable to the whole of Andalucía in this sector. It is referred to as the “commercialization problem”42 and its characterizing elements are:

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42 In this section, the work of Manuel Parras Rosa, of the Universidad de Jaén, has been of great utility. See “Los Aceites de Oliva: Cambios del Entorno y Marketing (Parras, 2002).
- Deficiencies in consumer knowledge on the existence and advantages of high-end quality oils.
- A general lack of consumption of quality (virgin and extra-virgin) oils, which only have 20% of the market share of the olive oil market and 10% of the total vegetable oil market (Parras Rosa, 2002).
- A deficient presence of producers in the bottled olive oil sector, in particular in the marketing phases, considered the weak part of the supply chain.

However, certain changes seem to be taking place, favoring practices which are more market oriented. On the production side, the PAC reforms (see section 2.3.) imply that the producer’s sales will no longer be guaranteed as reference prices and intervention mechanisms will vanish. On the consumption side, the growing world demand for olive oil –driven by incrementing EU consumption⁴³- is united to new consumer tendency towards natural, safe and quality products.

Thus, there is a situation of risks and opportunities for the olive oil sector, in which Geographical Indication oriented strategies, are inserted.

The basic problem for the Sierra Mágina cooperatives marketing PDO olive oil is to create a demand in the Spanish market for such products. For this, producers should increment their presence in the latter stages of the supply chain (marketing). However, there are-in happens in general- deficiencies in these actions, due to structural problems –atomized production, lack of market oriented incentives and difficulties in coordination.

In this context, where cooperative structures fail to assume necessary marketing and promotion measures to increment consumer demand for quality products such as PDO

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⁴³ World consumption of olive oil (all categories) has shown an increase of 54% between 1990 and 2001 (EU, 53.9%; Spain, 49.7%), while consumption per capita of olive oil has increased 27% during the same period (EU, 37.9%; Spain, 44%). (Based on data recovered by Parras Rosas, 2003).
labeled olive oil, the role of specific intermediate institutions, and in particular the Sierra Mágina Regulatory Council, may play a more important role.

In marketing SMRC has contributed with the creation of an online shop (tienda virtual) for the products of registered firms. Most of the products and trademarks marketed with the PDO logo are available and may be ordered on the Sierra Mágina website www.sierramagina.org.

Moreover, the RC has been active in numerous and varied promotion activities such as keeping a web site with complete information on Sierra Mágina olive oil, organizing stands in national and international fairs and exhibitors –Feria Internacional del Aceite de Oliva e Industrias Afines “Expoliva” (Jaén), Feria Salicat (Rioja), Feria Bilboliva (Bilbao), Semana de la Alimentación (Madrid), etc- co-sponsoring sport events (Vuelta Ciclista a Andalucía). Moreover, the SMRC organizes the Fiesta del Olivar y del Aceite de Oliva de Sierra Mágina, an event during which the best olive oils of that year are chosen and awarded a prestigious prize.

The SMRC attempts to emphasize on the quality and traceability of Sierra Mágina olive oil, as well as to highlight the health benefits of consuming extra virgin olive oil. In communicating PDO product qualities to consumers, these aspects seem to have more importance than exploiting the “singularity” or “typicity” of the product. This seems logical considering that in Andalucía, and even in neighbouring lands, there are other PDOs for olive oils of similar characteristics.

In fact, the PDO label is used simultaneously and in a way similar to other quality labels, such as “Andalucía Calidad Certificada”, reinforcing the communication of a message of “guaranteed quality” over one signifying “singularity” to consumers.\footnote{This policy is opposed to that of other PDO or PGI which deliberately separate the use of the origin labels to that of other public quality labels (see Case study report of Idiazábal, for example). Therefore, members of the Geographical Indication club are not allowed to accumulate quality logos in addition to the PDO or PGI sign.}
An interesting finding is that despite that the production zone of Sierra Mágina is located on a National Park—a fact which certainly characterizes the origin/product—this location is hardly exploited for promotion purposes.

Overall, thanks to the intense activity of the SMRC, the name of PDO Sierra Mágina seems to be acquiring a defined reputation in a sector commercially traditionally dominated by trademarks. This is occurring simultaneously with a gradual shift towards quality—symbolized by the increasing consumption of extra-virgin olive oil.\textsuperscript{45}

7. Synergies

The Andalucía administration (Junta de Andalucía) and the Jaén Province administration (Diputación de Jaén) both have an active role in promoting quality products, including Geographical Indications.

The conversion of Jaén into a world reference in terms of quality olive oils, with a special mention for the Protected Designations, is on of the four main axes of the “Strategic Plan of Jaén” (see \url{http://www.ujaen.es/huesped/planestra/index2.html}), supported by a wide array of public and private stakeholders of the Jaén province and Andalucía.

8. Stakeholders.

\textsuperscript{45} In 1990, extra virgin olive oil had a market share of 1.5\% of the total vegetable oil market and 3\% of the olive oil market. In 2000 this share had grown to 9.2\% and 19\% respectively (source, Parras Rosas, 2002).
Regulating Council of the PDO ‘Sierra Mágina’. [www.sierramagina.org](http://www.sierramagina.org)

Fundación del Olivar. [http://www.oliva.net/](http://www.oliva.net/)


Asociación para el desarrollo rural de la Comarca de Sierra Mágina. [www.magina.org](http://www.magina.org)

The producers of the ecologic variant of the oil protected by the PDO:

- Aceites Atenea S.A.L.: [info@aceitesatenea.com](mailto:info@aceitesatenea.com)
- Agropecuaria El Puerto S.L: [calairis@inicia.es](mailto:calairis@inicia.es)
- Almazara El Picón: [marianoj.martinez@juntadeandalucia.es](mailto:marianoj.martinez@juntadeandalucia.es)

Centro de Investigación y Formación Agroalimentaria (C.I.F.A.).

Instituto de Investigación y Formación Agraria, Alimentaria, Pesquera y de Producción Ecológica (IFAPA): D. Juan Castro, researcher (rational use of herbicides)

COTECNISUR, S.L. (agricultural consulting enterprise): Da. María Dolores Humanes, agricultural expert (use of herbicides and machines for application of fitosanitary products)

Consejería de Agricultura y Pesca de Andalucía, Junta de Andalucía.


CSIC: Consejo Superior de Investigaciones Científicas

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2. **(April 2006) Staff of Trujal de Mágina Cooperative**, (Cambil, Spain)
4. (June 2006) Monitors-technical experts of Consejo Regulador de Sierra Máginga (Bedmar, Spain).