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The Contribution of Organic Livestock to Sustainable Rural Development in Sensitive Areas

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Abstract: *Organic production may contribute positively to rural development. However, there is a gap of knowledge with regard to the livestock sector that the present work is aimed at filling by means of a multidisciplinary and participatory approach. The results suggest that 'fully organic' holdings (organic farms that sell products as organic) have the highest potential to contribute to the rural development in the area under study. Nevertheless, its implementation requires higher levels of education and implies higher costs. Due to these difficulties, public subsidies should support such production systems. Moreover, systems with low productivity but high environmental services should be also supported, such as those extensive (either conventional or organic).*

Keywords: *beef cattle, CAP, land use, agro forestry, dehesa.*

1. Introduction and Background

Nowadays, the development of rural areas has become a key point of social and agricultural policies at EU and world levels because of the negative consequences that the depopulation of these areas leads to (loss of traditional and agricultural culture and degradation of agro-ecosystems). This interest is reflected in the greater amount of resources and measures aimed at improving the environment and quality of life of rural areas, and at diversifying their economic activities on models of sustainable development (Zolin and Caldogno, 2012).

Although the concept of sustainable rural development has no clearly accepted definition, it fundamentally refers to a process of change and multidimensional evolution that depends on the interaction of the social, cultural, environmental, economic, and political subsystems. Its objective is to improve both the quality of life and the economic well-being of the residents of relatively isolated and depopulated areas, and their institutional, physical, and cultural environment by means of the active participation of the people themselves, the administration, and other external agents. According to Pugliese (2001) and Pauselli (2009), the concept of sustainable rural development combines the theories of sustainability with new trends in critical thinking about rural development which have resulted from the modernization of agricultural production, environmental awareness, and recognition of the interactions between economics, ecology, and society.

In this context, organic food production has been identified as a production model with a high potential to contribute to the development of rural areas, since organic farmers could benefit from the conservation of less developed areas through the perception of payments for ecosystem services (Tacconi, 2012). Moreover, due to the relationship between organic production and agro-ecotourism (Kuo *et al.*, 2006), this production model could also play an important role in the sustainable development of less-favoured areas, such as those located in the Mediterranean basin.

In fact, non-farming activities such as environmental education or agro-tourism have already shown a potential importance for rural areas because they increase the income of producers both directly and through the receipt of agro-environmental subsidies.

The Council Regulation (EC) No 834/2007 defines organic production as a system of farm management and food production that plays a dual societal role: on the one hand it provides food products to meet specific consumer demands; on the other hand it delivers public goods which contribute to the protection of the environment and animal welfare, as well as to the development of rural areas. Such contribution to the rural development has been addressed by several authors (Banks and Mardsen, 2001; Pugliese, 2001; Darnhofer, 2005; Espinoza-Villavicencio *et al.*, 2007; Lobley *et.al.*, 2009; Pauselli, 2009; Schäfer *et.al.*, 2009) who consider that organic farming generates positive externalities linked to the conservation of the agro-ecosystem, the creation of more jobs, the increase of farmers' incomes and the growth of local economy.

Thus, also researchers have proposed organic livestock production systems as models of sustainable rural development (Pauselli, 2009), there is a lack of studies assessing their potential role of in rural development from a holistic point of view (social, economic and environmentally) and in relation to public policies. Due to this, the assessment of the potential contribution of organic livestock systems to the sustainable rural development is of special interest in those defavoured areas which also are highly dependent on pasture-based livestock systems. Among them, the Spanish wooded rangelands ('dehesas'), an agro-forestry system with high environmental value and located in an unpopulated area with few job opportunities outside the agricultural sector, is a good example.

Dehesas are agro forestry systems whose origin is the human intervention in the Mediterranean forest. They are located in the SW quadrant of the Iberian Peninsula. Traditional dehesa livestock farming systems, based on a mixture of uses (various livestock species –mainly beef-, crops for animal feeding, hunting, and forestry) are essential for the maintenance of this ecosystem. The reason is that livestock contributes to the improvement of soil and pastures, ensures biodiversity, and controls coppice and woody scrub regrowth, thus reducing the risk of wildfire. From the socioeconomic point of view, the agricultural sector linked to dehesa farms is one of the main economic activities in the region under study (Extremadura, SW Spain). Moreover, organic livestock farms have an interesting future due to increased demand for traditional, natural, and organic products, and because this type of production allows the preservation of an environment of high ecological and landscape value. Indeed, these aspects are now supported and subsidized by new European Union policies.

In this context, the objective of the present work is to determine whether organic livestock systems contribute to rural development in a higher degree than conventional ones. For this purpose, the authors reviewed the scientific papers addressing the topic, and then discussed the main findings with those of a case study of the organic beef cattle sector located in the dehesas.

2. Study: Potential Contribution of Beef Cattle Farms (Organic Vs. Conventional) to Sustainable Rural Development in the Dehesas (the Oldest and Most used Agro Forestry System in Europe)

2.1. Procedure

2.1.1. The Study Area

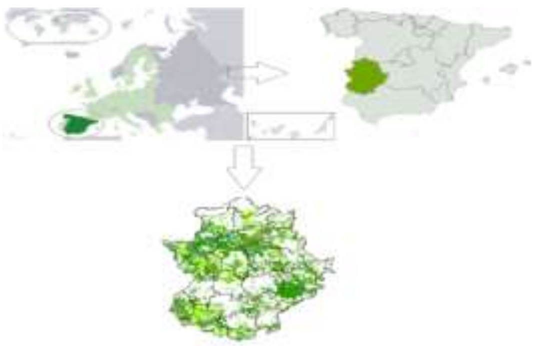

Figure1. *Location of dehesas in Extremadura (SW Spain)*

The study area was Extremadura, a region in South-West Spain (Figure 1), and one of the main areas of dehesa in the Iberian Peninsula. Approximately 50% of its utilized agricultural area (UAA) is considered to be dehesa, for a total of 2.2 million hectares.

The region has a low population density and the agricultural sector is an essential driver of its economy, as it happens in many rural areas of the European Union (Manos *et al.*, 2013).

2.1.2. Selection of the Sample, Selection of the Indicators, Questionnaire Design, and Data Collection

The data were collected from dehesa farms selected randomly from the data provided by agricultural cooperatives and producers' associations. They correspond to dehesa beef cattle farms (n=63; 30 conventional farms and 33 organic farms).

In an initial stage, indicators to be surveyed were selected on the basis of both scientific literature (Gaspar *et al.*, 2007 and 2008; Lobley *et al.*, 2009; Ryschawy *et al.*, 2012; Manos *et al.*, 2013; Lebacq *et al.*, 2013; Sturaro *et al.*, 2013) and the EU regulations on organic production.

Subsequently, a participatory research approach (a focus group meeting) was used with the aims of: (i) validating the indicators previously selected; (ii) proposing new indicators covering the full concept of sustainable rural development and; and (iii) selecting the final indicators that were used in the study. The focus group consisted of 5 experts in livestock (researchers), 1 expert in sustainable rural development (sociologist and researcher), 3 technicians (veterinarians and agronomists), and 4 livestock farmers. This type of participatory research approach has been used by different researchers with the aim of studying agro-ecosystems and rural societies. It allows taking into account both scientific and local knowledge that best describe the systems under study and therefore specific problems and needs can be identified (Whitfield and Reed, 2012). As a consequence, the action strategies defined will be more accurate and site-specific, thus increasing the effectiveness of the whole process.

The whole process allowed the selection of the indicators to use and the design of the questionnaire. Information was collected on livestock management, land use, herd size, breeds, installations, financial flows, environmental management, and sociological aspects. The questionnaire included both qualitative and quantitative variables, which are listed in Table 1 together with their units.

The data were obtained through direct survey interviews with dehesa farmers which were carried out in 2012. The surveys were conducted on site, and the interviewee was generally the farm's owner or manager. Figure 2 shows a flow chart of the methodological approach followed.

Once data were collected, the authors considered it could be interesting to group the farms into different production sub-systems. This classification was made on the basis of the condition of being organic and the type of beef sold (either conventional or organic). Thus, the authors decided to develop the analysis using three groups. The first group comprised 30 conventional farms (named 'Conventional'). The second group included 22 holdings certified as organic but which neither fattened their calves nor sold them as organic. This group was designated as 'OFWOOS' (Organic Farms without Organic Sales). The third group (called 'Fully organic') comprised 11 organic-certified farms that fattened their animals and sold all or part of them as organic.

Table1. *Selected indicators and their units*

Social indicators	
Farmer's age	< 40 years; 41-50; >50.
Educational level	1: No studies, or basic education; 2: Secondary and/or vocational education; 3: University degree.
Farm continuity/future plans	1: Abandon in 5 years and/or herd reduction next year; 2: Organic farms: conversion to the conventional system. Conventional farms: conversion to the organic system; 3: Increase the herd size.
Business diversification: number of activities	1: 1 activity; 2: 2 or more activities.
Social interaction: membership in cattlemen's associations	0: Neither; 1: One; 2: Two.
Direct sales to consumers	0: No; 1: Yes

Social indicators	
Accessibility	1: Good (adequate tracks and distance < 10 km.) 2: Medium (adequate tracks and distance 10-20 km.) 3: Bad (inadequate tracks and/or distance > 20 km.)
Total AWUs[a] per farm	AWUs
Permanent[b] AWUs / Total AWUs	%
Temporary[c] AWUs / Total AWUs	%
Family AWUs / Total AWUs	%
Annual salary per permanent AWU	€
Annual salary per temporary AWU	€
Economic and business indicators	
Total income / ha[d]UAA[e]	€
Profitability rate	Ratio between net surplus and the average capital assets, estimated from the value of total fixed capital and the value of capital. (%).
Yearlings sold per cow	
Cow productivity	Calves weaned per cow and year
Livestock sales / total income	%
Subsidies / total income	%
Land productivity	Total sales / ha UAA (€ / ha)
Net value added[f]	€/ha
Environmental and Land use indicators	
Integration of crop and livestock production	0: No; 1: Yes.
Natural heritage conservation	0: Farmers conserve neither the Mediterranean woodland nor the autochthonous breed (have less than 50% of the cattle); 1: Farmers converse the Mediterranean woodland and/or the autochthonous breeds (more than the 50% of the cattle must be autochthonous to comply with this condition).
Implementation of measures used to reduce erosion and to improve soil quality[g]	Qualitative scale: they implemented from 1 to 4 measures.
Dung management	1: Either there is no dung accumulation due to extensification or the farmer spreads immature dung; 2: There is a dung heaping period (whether it ensures the composting period is completely finished or not).
Use of pesticides, herbicides and/or synthetic chemical fertilizers	0: Neither; 1: Use of one of this products; 2: Use of two or more products.
Use of antiparasitics	0: The famer does not use them; 1: Yes, the farmer uses them.
Level of intensification	Low: <0.3 LU[h]/ha; Medium: 0.3-0.5 LU/ha; High: >0.5 LU/ha.
Total surface	UAA (ha)
Tree-covered surface	ha
Pastures	ha
Arable land	ha
Pastures available	ha pastures / LU
Arable land available	ha arable land /LU

[a] AWU: Annual Work Unit (224 workdays)
[b] Permanent AWU: Permanent hired worker AWUs
[c] Temp: temporary worker
[d] ha: hectares
[e] UAA: Utilized Agricultural Area (total area minus the area with presence of tracks, houses and fences).
[f] Measures the value created by all the agricultural output after the consumption of fixed capital. That output is valued at basic prices and intermediate consumption is valued at purchaser prices.
[g] Including: cover crops, mulching, intercropping, crop rotation, plot rotation and fallow.
[h] LU: The livestock unit is a measure of grazing livestock in agriculture. One LU is usually defined as the grazing equivalent of one adult dairy cow. Many different schemes exist, giving various values to the grazing effect of different types of animal. In this paper we use the following equivalents adapted to dehesa systems: 1 cow = 1 LU; 1 sheep = 0.12 LU; 1 sow= 0.37 LU.

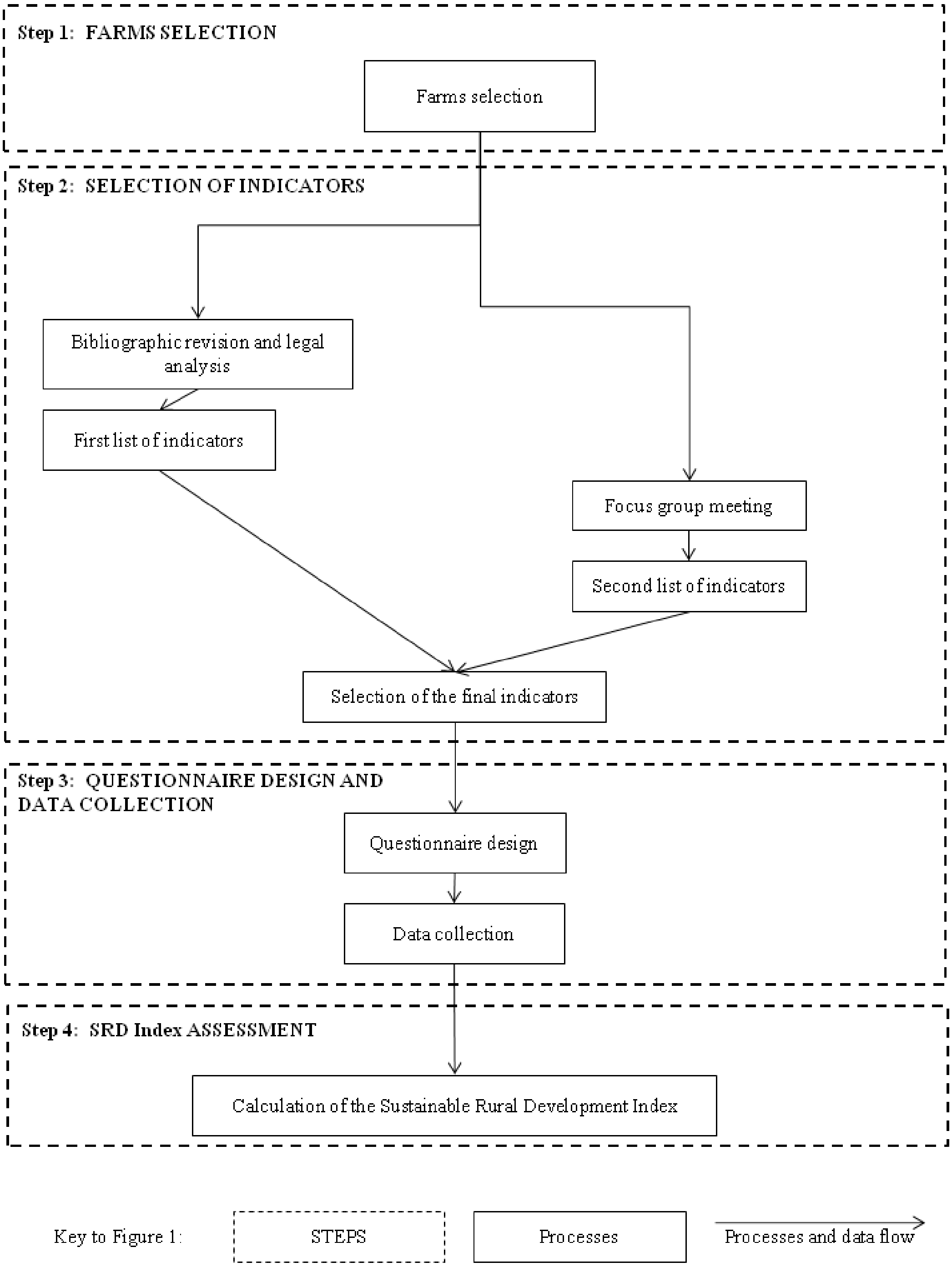

Figure2. The *methodological process followed to acquire the data*

2.1.3. Statistical Analysis

Descriptive statistics and frequencies for the quantitative and qualitative variables were calculated, in order to find significant differences among the three farming systems. All the analyses were performed using the SPSS (v.20.0) statistical package.

2.2. Results and Discussion

2.2.1. Dehesa's Livestock Production Systems and Organic Livestock Farming

Generally, the traditional dehesa livestock farms are characterized by their low stocking rates and small dependence on pastures, as well as the integration of different livestock species, crops and trees. As a consequence of such management, these systems usually show both low dependence on external resources (such as feedstuff and/or veterinary medicines) and the use of environmentally friendly agricultural practices. Therefore, great similarities between organic and conventional dehesa livestock farming systems can be found, with some differences mainly related to antiparasitic treatments and to the use of chemical fertilizers. On the one hand, livestock is systematically given 1 or 2 anti parasitic preventive treatments in conventional dehesa farms. On the other hand, chemical fertilizers are used in the majority of conventional dehesa farms growing crops. Both practices are banned in organic farming by the regulation on organic farming in Europe (EU Council Regulation EC No. 834/2007 and the Commission Regulation EC No. 889/2008).

2.2.2. Social Analysis

Due to the abovementioned similarities among dehesa farms, no significant differences were found between the groups of farms analyzed, as can be observed in table 2. However, other researchers have found that managers of organic farms tend to show different age, education and/or motivations than those of conventional farms (Flaten *et al.*, 2006; Lobley *et al.*, 2009). Our findings can be explained by the fact that OFWOOS farms are less professional than those of the other groups. In fact, these farms do not fatten their calves nor sell any product as organic, since the farmers' main motivation is the perception of subsidies related to organic farming production (farmers get around 120 € per livestock unit[1] and year).

Dehesa livestock farms are usually multipurpose systems (Gaspar *et al.*, 2007), and this feature plays an important role in both their environmental and socio-economic sustainability, as diversification increases the resilience of ecosystems and production systems (Kremen *et al.*, 2012).However, in this study it was found that conventional dehesa farms were mainly specialised holdings. This could be an adaptative response to the pressures under which farmers run their business, trying to improve the farms' efficiency and profitability. On the other hand, organic farms showed a higher level of diversification, with also increased rates in social interaction and some participation in short marketing channels (direct sales to consumers). Thus, it could be said that organic production systems potentially offer opportunities for producers and consumers to reconnect (Conner *et al.*, 2008). Moreover, the involvement of organic producers in selling their products is a key to the profitability and survival of their farms since it allows them to sell at a higher price (Seyfang, 2006; Wittman *et al.*, 2012). However, a weak relationship was found between the condition of being organic and direct sales, which is in accordance with other studies (Green and Maynard, 2006; Lobley *et al.*, 2013). Moreover, demand and willingness to pay for organic products is really low in many countries, such as the European countries located in the Mediterranean basin (Mesias *et al.*, 2011; Olivas *et al.*, 2013), especially with regard to beef (Mesias *et al.*, 2008). However, other strategies could be used to increase organic products willingness to pay, such as payments, Protected Designation of Origin for pesticide reduction (Bazoche *et al.*, 2014) or local food logos (Hu *et al.*, 2012), and focus the defence of organic products also on fairness and equity, since consumers have shown an increasing interest in not only how their food is produced, but also who benefits from their food purchase –'emotional motives' (Verhoef, 2005; Briggeman and Lusk, 2011).

Table2. *Social indicators*

Variable	Categories	Conventional	OFWOOS	Fully organic
Farmer's age		45.94	46.59	50.73
Educational level	1: No studies, or basic education	30.00	40.90	27.30
	2:Secondary and/or vocational education	33.30	36.40	36.40
	3: University degree	36.70	22.70	36.40
Farm continuity/future plans	1: Abandon in 5 years and/or herd reduction next year	10.00	4.50	9.10
	2: Organic farms: conversion to the conventional system. Conventional farms: conversion to the organic system	60.00	81.90	72.70
	3: Increase the herd size	30.00	13.60	18.20
Business	1 activity	86.70	60.90	50.00

[1] The livestock unit (LU) is a measure of grazing livestock in agriculture. One LU is usually defined as the grazing equivalent of one adult dairy cow. Many different schemes exist, giving various values to the grazing effect of different types of animals. In this paper we use the following equivalents adapted to dehesa systems: 1 cow = 1 LU; 1 sheep = 0.12 LU; 1 sow= 0.37 LU.

Variable	Categories	Conventional	OFWOOS	Fully organic
diversification: number of activities	2 or more activities	13.30	39.10	50.00
Social interaction: membership in cattlemen's associations	0: Neither	3.30	9.10	0.00
	1: One	23.30	22.70	0.00
	2: Two	73.30	68.20	100.00
Direct sales to consumers	0: No	100.00	100.00	90.90
	1: Yes	0.00	0.00	10.10
Accessibility	1: Good	43.30	27.30	9.10
	2: Medium	46.70	72.70	90.90
	3:Bad	10.00	0.00	0.00

With regard to the workforce, and as can be seen in table 3, organic farms are the group that use more labour. This implies a greater potential for rural development, and it could be explained both by the higher degree of business diversification and the higher integration of crop and livestock production, as those aspects increase the need for labour. Indeed, diversification may be the cause of the discrepancies between these results and those of other authors (Köhnem and Köhn, 1998; Butler, 2002) who found no increased presence of labour in organic livestock farms when compared to conventional holdings.

Table3. *Work force indicators*

Variables	Conventional	OFWOOS	Fully organic	Sample (±SD)	Sig.
Total AWUs per farm	1.58	1.30	2.10	1.57 (±0.97)	*
Permanent AWUs / Total AWUs (%)	8.92	7.68	37.82	13.54 (±25.73)	***
Temporary AWUs / Total AWUs (%)	7.12	12.41	13.45	10.08 (±18.57)	n.s.
Family AWUs / Total AWUs (%)	83.96	79.91	48.73	76.40 (±31.75)	***
Annual salary per permanent AWU[a]	10 395.65	7 186.67	8 354.88	9057.77 (±1697.15)	***
Annual salary per temporary AWU	8 199.27	10 117.33	7 989.33	8617.62 (±2637.19)	n.s.

*SD: standard deviation. n.s.: not significant; *p<0.1; **p<0.05; ***p<0.01. [a]1 AWU: 224 workdays*

When analysing the type of labour present in each group, 'fully organic' farms had a greater percentage of non-family workers (either permanent or temporary), which is in accordance with other studies (Lobley et al., 2009).The ratio permanent/temporary workers was also substantially higher in these farms, which could be considered as an indicator of job stability. Therefore, organic farms provide more jobs and better quality jobs to the surrounding society, thus contributing to the development of rural areas.

However, the salaries paid by the organic farms were lower than those of conventional ones, either for permanent or temporary workers. The results found by Lobley et al. (2009) and Lampkin and Padel (1994), showed the opposite trend, with organics farms paying higher wages than the conventional farms. In this study, the explanation for these conflicting results may lie in the intensification of conventional farms, which require more skilled workers (because of the use of more machinery and new technology) than organic farms.

It is important to note that, the benefits of the organic farms are highly dependent on their business structure and marketing strategies (Lobley et al., 2009) and, contrary to the widespread belief, such marketing strategies (either ‘short’ or long) have not been observed to be clearly linked to the condition of being organic (Lobley et al., 2013).

2.2.3. Economic and Business Analysis

As it can be observed in Table 4, some differences were found among the three production systems. OFWOOS showed the lowest total income per ha and the lowest profitability. It can be explained by the fact that OFWOOS did not fatten their calves, thus reducing the income they get from this activity.

Moreover, the differences between conventional and fully organic farms (the latter showed a lower income/ha UAA) were partially due to fact that fully organic production system takes longer than the conventional one. This fact makes that these organic farms produce less fattened calves per hectare although they reach prices up to 25% higher than those of the conventionally fattened calves. The final result is a lower income per area. However, and also because of the higher costs of the organic feedstuff, fully organic farms neither reached conventional farms' profitability nor their total revenues.

Regarding the profitability of the farms, no significant differences were found among the groups. This is coherent with some previous findings which showed that there was a similar profitability in organic and conventional farms (Offermann and Nieberg, 2000). However, and according to other studies, organic cattle farms tended to be less profitable than conventional ones due their larger productive period, their overhead costs (especially those related to the feedstuffs), and their lower revenues, whether under the CAP's conditions (Blanco-Penedo *et al.*, 2012) or not (Gillespie and Nehring, 2013).

Table4. *Economic and business indicators: mean values, standard deviation and level of significance for the farms*

Variables	Conventional	OFWOOS	Fully organic	Sample (±SD)	Sig.
Total income / ha UAA	460.15	324.09	419.52	405.54 (±315.70)	n.s.
Profitability rate (%)	4.43	4.20	4.35	4.34 (±2.69)	n.s.
Yearlings sold per cow	0.07	0.00	0.45	0.11 (±0.23)	***
Cow productivity	0.81	0.71	0.65	0.75 (±0.21)	*
Livestock sales / total income (%)	60.50	53.14	51.27	56.32 (±17.98)	n.s.
Subsidies / total income (%)	38.97	44.32	46.91	42.22 (±17.76)	n.s.
Land productivity	642.40	470.25	586.65	572.55 (±410.82)	n.s.
Net value added	388.43	338.63	383.35	370.15 (±249.94)	n.s.

*SD: standard deviation. n.s.: not significant; *p<0.1; **p<0.05; ***p<0.01.*

Organic farms tended to be more dependent on subsidies, especially those belonging to the fully organic group. This fact reduces both their market competitiveness and their resilience, and therefore, increases their vulnerability. However, in other beef farming systems (Hrabalová and Zander, 2006), there were no differences in this regard between organic and conventional farms. Our finding was mainly due to several factors: first, conventional farms were focused just on beef production, trying to improve their productivity and economic results by increasing their level of intensification; second, this low degree of diversification along with the condition of not being organic reduced the amount of subsidies they received, therefore becoming less dependent on them.

2.2.4. Environmental and Land use Analysis

In order to study the relationships between the three production systems and the physical characteristics of dehesa farms, indicators of environmental management and land use were analysed (tables 5 and 6). As shown in table 5, organic farms (especially the fully organic ones) had a higher degree of integration between crops and livestock species, as well as a greater level of natural heritage conservation. This is consistent with the abovementioned increased diversification of the organic systems. The implementation of diversified (integration of crops, livestock and trees) and low-input systems in rangelands, is a recommendable option for a sustainable land use management (Jose, 2009; Kremen *et al.*, 2012; Smith *et al.*, 2013; Cook and Ma, 2014) that deserves to be taken into account by policymakers due to their positive agro-environmental and socio-economic externalities, including their 'economic sense', as stated by Sipiläinen and Huhtala (2013).

With respect to soil and crop management, fully organic farms implemented more measures to reduce erosion and to improve soil fertility, also developing better dung management, which avoids nitrogen fluxes and allows to elaborate compost. This is consistent with similar results found in organic beef cattle farms in Spain (Blanco-Penedo *et al.*, 2012). Unlike fully organic farms, OFWOOS scarcely implement such techniques, despite being organic. This again shows that farmers' main motivations were not related to environmental aspects.

Table5. *Environmental and Land use indicators*

Variable	Categories	Conventional	OFWOOS	Fully organic
Integration of crop and livestock production	0: No	60.00	40.90	18.20
	1: Yes	40.00	59.10	81.80
Natural heritage conservation	0: Farmers conserve neither the Mediterranean woodland conservation nor the autochthonous breeds (more than 50% of the cattle)	70.00	59.10	18.20
	1: Farmers conserve the Mediterranean woodland conservation and/or the autochthonous breeds	30.00	40.90	81.80
Implementation of measures used to reduce erosion and to improve soil quality[a]	Low level implementation	26.70	54.50	16.70
	Medium level of implementation	70.00	40.90	45.50
	Moderate-high level of implementation	3.30	4.50	18.20
Dung management	1: Either there is no dung accumulation due to extensification or the farmer spreads immature dung	86.70	81.90	45.50
	2: There is a dung heaping period (whether it ensures the composting period is completely finished or not)	13.30	18.10	54.50
Use of pesticides, herbicides and/or synthetic chemical fertilizers	0: Neither	63.30	100.00	90.90
	1: Use of one these products	10.00	0.00	9.10
	2: Use of two or more of these products	26.70	0.00	0.00
Use of antiparasitics	0: The farmer does not use them	6.70	63.60	36.40
	1: Yes, the farmer uses them	93.30	36.40	63.60
Level of intensification	Low: <0.3 LU/ha	23.30	22.70	18.20
	Medium: 0.3-0.5 LU/ha	40.00	45.50	45.50
	High: >0.5 LU/ha	36.70	31.80	36.40

[a]*Number of measures/agricultural management practices implemented to reduce soil erosion and to improve soil quality. These include: cover crops, mulching, intercropping, crop rotation, plot rotation, fallow, and use of compost.*

Additionally, organic farms and particularly OFWOOS, used less pesticides, herbicides and/or mineral fertilizers than the conventional holdings. This finding is in line with those of Zhengfei *et al.* (2005), who reported that conventional farms rely substantially more on pesticides for damage abatement than organic farms, which rely more on cultural practices. These differences were due to the ban in use such chemical products by the EU's organic production regulation on organic farming. However, the scarce use of such products in OFWOOS farms was owing not only to their organic condition, but also because they did not fatten nor sold their calves. Thus, their feedstuff needs were lower and, as a consequence, they did not require to grow crops.

With regard to herd health management, organic farms resorted to the use of antiparasitic treatments more rarely than conventional farms, in accordance with the previously cited study (Blanco-Penedo *et al.*, 2012). It might seem surprising that OFWOOS farms used less veterinary drugs than the fully organic ones, since they did not carry out a full range of organic practices. Therefore, this reduced use of antiparasitics is markedly linked to the absence of fattening period in OFWOOS farms.

Table6. *Environmental and Land use indicators*

Variables	Conventional	OFWOOS	Fully organic	Sample (±SD)	Sig.
Total surface	275.51	223.72	337.84	268.44 (±223.34)	n.s.
Tree-covered surface	147.90	140.49	271.08	166.82 (±206.23)	n.s.
Pastures	118.78	69.82	39.09	87.77 (±128.69)	n.s.
Arable land	11.96	23.03	40.32	20.78 (±32.33)	**
Pastures available	1.16	1.04	0.31	0.97 (±1.23)	n.s.
Arable land available	0.12	0.24	0.30	0.19 (±0.27)	n.s.

*SD: standard deviation. n.s.: not significant; *p<0.1; **p<0.05; ***p<0.01.*

Tree-covered surface had a stronger importance in the fully organic farms than in the other types, with around 80% of their average surface, as compared to 54-63% for conventional and OFWOOS (table 6). The presence of trees in dehesa farms is of great relevance, as they are the basis of their sustainability also providing different types of benefits (economic, social and environmental ones). From the economic point of view, trees provide feed, leading to both an increase of self-reliance and to a higher capability of business diversification. The conservation of trees is of vital importance from a social perspective, as they are part of the traditional landscape. Finally trees provide several ecosystem services, such as carbon sequestration, reduction of erosion, and habitats creation, among others (Jose, 2009).

Arable land in extensive farms play an significant role in this area due to both the strong dependence of extensive livestock systems of the Mediterranean basin on pastures (Ripoll-Bosch et al., 2013) and to the restrictions that these systems are going to suffer due to climate changes (Segnalini et al., 2013). It is remarkable the higher proportion of arable land in organic farms (especially in the fully organic ones). This result is especially relevant, as it allows farms to reduce production costs related to organic feedstuff.

2.2.5. Final Remarks on the Relationship between Organic Livestock, Rural Development and the CAP

Fully organic farming systems should be supported by the rural development measures of the EU's CAP, since they play a greater role in the conservation of traditional landscapes and ecosystems by means of a “greener” agro-environmental management. Moreover, this conservation cannot be despised, since sustainable rural development of less-favoured areas is based on it. In dehesa cattle farms, farmers received payments mainly for cattle head and disfavoured area, being these payments of great importance for the survival of such farms (Franco *et al.*, 2012).

In this sense, fully organic farms also receive extra payments for organic farming. However, environmental management and land use are not sufficiently taken into account in these schemes. CAP reforms and market pressure have therefore led to a reduction of both extensive production systems and traditional landscapes. As a consequence of the above, a steady reduction in livestock farms’ sustainability has occurred (Gaspar *et al.*, 2009). Furthermore, such schemes should be improved in order to reward systems that produce positive externalities (socially and environmentally), since the agricultural sector remains an essential driver of the rural development of this area (Manos *et al.*, 2013).

As proposed by Gómez-Limón *et al.* (2013), agricultural subsidies could be reassigned so that environmental externalities are taken into account in farming systems whose economic performance is low but that show ecologically friendly practices (as OFWOOS). This is coherent with the study of Peerlings and Polman study (2004), who stated that increases in production driven by the CAP, had a negative effect on wildlife and landscape production in dairy cows farms.

However, some results suggest that decreasing output prices and increasing direct subsidies trigger the switch to organic farming in the livestock sector. Moreover, the switch is also more likely on farms having large land areas and low yields (Pietola and Lansink, 2001), such as dehesa’s farms.

Regarding the specific case of the dehesa ecosystem, Franco *et al.* (2012) claimed the necessity to recognize in a higher degree the value of dehesa’s extensive livestock systems due to their environmental and cultural services, since the agro-environmental subsidies account for a small percentage of the total CAP payments. In summary, despite sustainability and land use management being priority objectives of the CAP, the measures put in place have not provided sufficient incentive to implement more sustainable production systems.

As a consequence, and given the variability of agro-ecosystems and managements embraced by the Regulations and certification bodies for organic livestock farming, models must be developed for determining a socially optimal hectare payment for any given level of public services, such as that of Feinerman and Gardebroek (2007). In this regard, CAP subsidies should be better adapted to both local conditions and current management practices, especially in sensitive ecosystems strongly linked to the rural society. Additionally, it would be interesting to carry out annual calculations of the subsidies perceived by both organic and conventional farmers, because this could provide useful information about developments in support (Gay and Offermann, 2006).

3. CONCLUSIONS

The present study has allowed a deeper understanding of the comparative contribution of conventional and organic production systems to rural development by means of an indicator-based approach. The light shed by this study is especially important for disfavoured, semi-arid and sensitive ecosystems, since the socio-economic and environmental dimensions are really linked and their stability is really sensible to disturbances.

In general terms, the production models analysed were found to be very similar, especially with regard to the social and the economic and business analysis. According to the social analysis, organic farms seem to have a higher contribution to the sustainable development of the surrounding areas. Regarding the environmental and land use indicators, organic holdings displayed management practices that were more respectful with the environment. However, from an economic point, organic farms and especially those belonging to the OFWOOS group, showed the poorest results.

Overall, fully organic farms showed the best results. Calves fattening, on-site meat processing and direct selling contribute strongly to the benefits of the organic livestock farming on sustainable development. However, these practices are costly, time-consuming and require high levels of knowledge and bureaucracy handling, and therefore not being accessible for all holdings. Moreover, consumers' willingness to pay towards organic meat is really low.

One can conclude from the results that it is necessary to combine the organic status and farm characteristics to identify the production systems with the greater effect on sustainable rural development, since comparison between organic and conventional farms is too simplistic an approach.

Environmental and land use management should be taken into account in a higher degree when designing agricultural policies, so that public subsidies compensate and support organic production systems, due to the value of their environmental and social services. Additionally CAP cross-compliance could be reinforced and subsidies reassigned in systems with low productivity but providing high environmental services in order to take into account the positive externalities they create.

Further research must address the potential contribution to the rural development of the different livestock species under their respective context. Moreover, the development of models to determine the optimal payments strategy will help policymakers in their decisions.

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