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SUMMARY - Edafoclimatic, socioeconomic and strategic factors have favoured the existence of vast areas of extensive agricultural production in Extremadura. Of the total regional agricultural economy, this represents 47% of the total estimated agricultural production and they also classify one of the most peculiar ecosystems in the Mediterranean area, the "dehesa", in which the animal output, mainly autochthonous breeds of slaughter livestock ('Iberico' pig; 'Retinta', 'Avileña' and 'Morucha' cattle; 'Merina' sheep and 'Serrana' goats) exceeds both, crops and wood production (timber, cork, firewood). Other forest yields such as pastures and acorns, although economically important, are not included in the annual turnover of the agricultural sector since they are re-employed as feedingstuff for livestock. The productive ecosystem "dehesa arbolada" presents the highest average productivity (over 40,000 ptas ha^{-1}) against the 16,000 ptas ha^{-1} of both the "marginal dehesa" and grazing land and the 6,000 ptas ha^{-1} of timber forest.

Key words: Agriculture, extensive areas, Extremadura, Spain.

RESUME *- "Caractérisation agro-écologique et évaluation de la production agricole dans les zones extensives d'Estrémadure". Les facteurs édafo-climatiques, socio-économiques et stratégiques ont favorisé l'existence de vastes régions de production agricole extensive dans l'Extrémadure. Dans l'économie agricole régionale totale, celles-ci représentent 47% de la production agricole totale estimée et elles caractérisent aussi un des écosystèmes les plus particuliers de la région méditerranéenne, la "dehesa" dans laquelle la production animale, surtout de races autochtones de bétail d'abattage (porc 'Ibérique' ; bovins 'Retinta', 'Avileña' et 'Morucha' ; moutons 'Merina' et chèvres 'Serrana') dépasse la récolte des cultures et la production de bois (bois, liège, bois à brûler). D'autres productions forestières comme les pâturages et les glands, bien qu'économiquement importantes, ne sont pas comprises dans les recettes annuelles du secteur agricole car elles sont réemployées comme aliments pour bétail. L'écosystème productif "dehesa arbolada" présente la plus haute productivité moyenne (plus de 40.000 pts ha^{-1}) contre 16.000 pts ha^{-1} pour la 'dehesa marginal' et les pâturages et 6.000 pts ha^{-1} pour la forêt à production de bois.*

Mots-clés *: Agriculture, zones extensives, Estrémadure, Espagne.*

Introduction

Extremadura has an area of 41,601 km^2 (8.24% of the national territory). In 1995 its population was 1,068,140 inhabitants (2.73% of the Spanish population) which is a very low density (25 inhabitants per km^2, against the 77.7 of Spain).

Its location on a border affected by the armed conflicts of the XVII, XVIII and early XIX centuries, its remoteness from seaports and commercial, industrial and consumer centres, and its favourable environment for agriculture, have led to a model of development with relatively little participation of the industrial sector (16% of the GDP against 22% of Spain) and a high representation of the agricultural sector (12.2% of the GDP, against 4.7% of Spain). If we consider the local industry, excluding the electric sub-sector - which in Extremadura represents over 60% of the Industrial GDP, though it generates hardly any employment and additional income - we would obtain the real image of a region which is basically agricultural, with a service sector (excluding the civil service) depending on agriculture and on tourism.

The population of Extremadura is concentrated in the areas which are most suitable for farming and at the same time well linked. This is the case of the 2 main arterial roads, north-south (Plasencia - Cáceres - Mérida - Almendralejo - Villafranca - Zafra) and west-east (Badajoz - Montijo - Mérida - Don Benito - Villanueva de la Serena). The former extends along the historical road "Ruta de la Plata" and the latter follows the course of the river Guadiana across the best irrigated land in the region.

There are another 2 secondary arterial roads. One in the north of the region (Moraleja - Coria - Plasencia - Navalmoral de la Mata) and the other one in the south (Jerez de los Caballeros - Zafra - Llerena - Azuaga). Beyond these areas there are vast uninhabited areas suitable for extensive farming, where the livestock, mainly autochthonous breeds, takes advantage of the natural resources of the zone, i.e. grazing and acorns.

The aim of this paper is to classify the region's extensive agricultural areas and to assess their most characteristic produce.

Typology of the farming areas. Surface evolution

Of Extremadura's 4 million plus hectares, 29% are crop land, 25% are grazing land and 38% woodland.

This general distribution which follows the criteria of the MAPA (Spanish Ministry of Agriculture) may lead to imprecise conclusions about the reality of agricultural land use in Extremadura. For example, cropland is considered to be not only the land dedicated to intensive or semi-intensive crops but also land that is exploited extensively, in which quite often livestock yield is economically more significant than the crop production itself. Another example is the so called "monte abierto" which in Extremadura coincides with our most characteristic productive ecosystem, i.e. the "dehesa arbolada" (wooded dehesa). In the wooded dehesa the typical wood production (timber, cork, firewood) has a low economic influence compared to the grazing exploitation and acorns which are utilised to feed livestock, mostly autochthonous breeds (cattle: 'retinta' 'avileña' and 'morucha'; sheep: 'merina' and 'talaverana'; goats: 'serrana' and 'verata'; swine: 'iberico').

The typology of these areas takes into account these and other peculiarities.

The zone for crops (AGRICOLA) expands over the most suitable arable areas and although it has a high economic influence, it contributes very little to determine what it is globally considered autochthonous of Extremadura.

The territory of AGRICOLA showed a regressive trend in the 1986-95 decade, since the marginal land was converted to other types of production.

The area used for extensive mixed production, crops and livestock (AGROGANAEX), with a steady extension during the same decade, showed an evolution towards meadows and non-wooded grazing land (GANAEX) which occupies vast extensions in the districts of La Serena and "Penillanura Cacereña", dedicated mainly to sheep production.

The zone of mixed production, livestock and forest, (GANAFOREST) is the 'dehesa arbolada', our most characteristic and diversified productive ecosystem. It occupies 887,500 ha and recent trends show a steady growth, taking advantage of the reduction of the marginal AGRICOLA land.

The "monte leñoso" (scrubland), not very productive, shows a dynamic surface stability. On the one hand it has increased its territory due to the abandonment of crop land, and on the other hand it has decreased it, since in the areas with the most favourable edaphic and topographic conditions, through the application of forest techniques, the scrubland has been transformed into dehesa.

Finally, the forest exploitation area (FOREST) presents hardly any variation in extension, as the pine and eucalyptus forestation, so popular in the past decades, have been discontinued.

Agroclimatic typology of the extensive production zones

Fig. 1 shows the areas of Extremadura dominated by extensive production. All of them have in common both the soil formed on acid rocks (granite, quartzite, slate), and the Mediterranean climate, with a dry season from June to October. The rainfall differences are determined by the influence of altitude and the physical features of the land in the damp winds coming from the Atlantic Ocean (west and southwest winds).

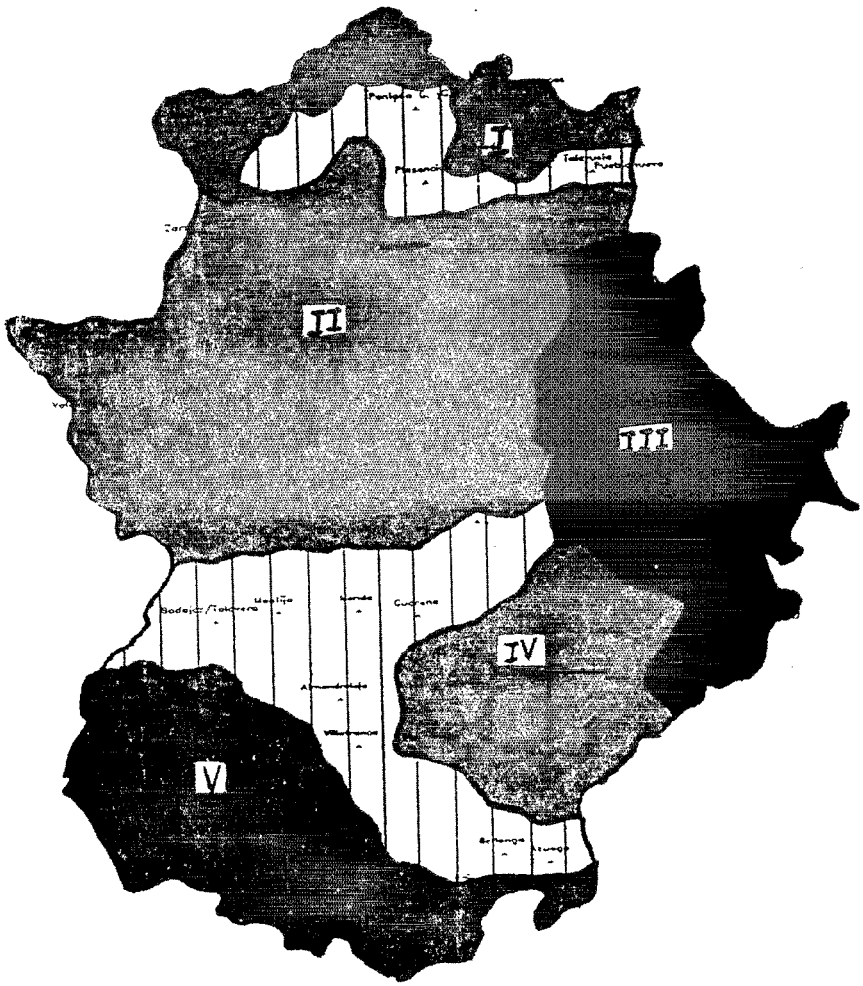

Fig. 1. Extensive Production Zones in Extremadura (white area). Zone 1: Northern Rangeland and Valleys; Zone II: Centre; Zone III: East; Zone IV: La Serena; Zone V: South.

The basic rainfall of the plains (between 450 and 575 mm of precipitation per year) is received in the Central zone (II) and in La Serena (IV). In the Southern Rangeland (sierra), with 600 m of average altitude, the precipitation rate is close to 700 mm, whereas in the east (III), the closeness of the Villuercas massif makes the rainfall increase to 900 mm.

The humid areas of Extremadura are near Sierra de Gata, Peña de Francia (1,800 m) and Gredos (2,400 m). Therefore, in the Northern Rangeland and Valleys the annual precipitation surpasses 1,200 mm.

Appendix 1 shows the agroclimatic characteristic of Extremadura's extensive production zones.

Assessment of the total agricultural output in Extremadura

Of the approximately 200,000 million ptas of the total agricultural output of Extremadura in 1996, 47% (over 94,000 million), corresponds to extensive production areas.

Among these extensive zones, pastures (GANAEX) and the "dehesa arbolada" (GANAFOREST) stand out.

In GANAEX the main output comes from sheep (9,000 million in this zone against the total 16,000 million) followed by cattle (4,000 million in this zone against the total 15,000 million).

In GANAFOREST, with a much more diversified production, there is a predominance of Iberian swine (21,000 million out of 23,000) and extensive cattle production (10,000 million out of 15,000 million).

Goats are mainly located in the marginal scrubland zones, the ones we have called MARGIN GANAFOREST (1,250 million out of the total 2,000 million).

Other elements of the final agricultural production - which are not reused in the way pastures and acorns are - are cork and firewood from the GANAFOREST and MARGIN GANAFOREST; wood from the FOREST and hunting and fishing, which are abundant in all areas of Extremadura. Although in isolation these productions are not relevant, together they reach remarkable values (7,000 million ptas) and in many cases they are the base of economic activities which do not belong to the agricultural sector, such as the car industry and hunting tourism.

The final agricultural output in the areas of extensive production surpasses 40,000 ptas ha^{-1} in the wooded dehesa, against 16,000 ptas ha^{-1} in the pastures, grazing land and marginal dehesa, and the 6,000 of the areas with exclusive forest production.

Appendix 2 shows the typology of the agricultural areas in Extremadura. Appendix 3 shows the agricultural output assessment in Extremadura.

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Appendix 1

Agroclimatic typology of the regional extensive production zones

Zone: Northern Sierra and Valleys

Rural Districts: Sierra de Gata, Hurdes, Valle del Jerte, Valle del Ambroz, La Vera.

Agricultural land use:

Forest: pine chestnut and oak woods, dehesa, scrubland
Meadows and grazing land: highland grass and "dehesa"
Herbal crops: very scarce
Ligneous crops: olive and cherry groves
Livestock (autochthonous breeds):
Goats: 'Verata'
Cattle: 'Avileña', 'Morucha', 'Retinta'

Soil types:

Inceptisols and entisols on acid parent rock (granite, quartzite and slate)
Alluvial entisols in the most depressed areas.

Average climatic (weather) parameters (1951-94)

Months	P (mm)	Tm (°C)	ETP (mm)	R (mm)
January	165	6.0	10	100
February	170	6.8	12	100
March	149	11.4	35	100
April	97	13.8	50	100
May	110	14.9	54	100
June	60	21.2	100	50
July	10	25.4	146	0
August	11	24.6	138	0
September	64	18.2	86	0
October	125	15.2	56	69
November	144	11.8	35	100
December	164	7.3	14	100
Total	1,259	14.8	736	

* P (mm) - Precipitation; Tm (°C) - Average Temperature; ETP(mm) - Potential evapotranspiration; R(mm) - Soil reserves

Vegetative Period Time: 9 months (October-June)

Thermic influences: grass growth is severely slowed down by winter frosts

Zone: Centre

Rural Districts: Campo Arañuelo, Riberas del Tajo, Penillanura de Salor, Meseta Cacereña. Baldíos de Alburquerque, Sierra de Montanchez y Sierras de San Pedro.

Agricultural land use:

Forest: vast cork oak "dehesa" areas
Grazing land: abundant
Herbal crops: extensive dry farming
Ligneous crops: olive groves and some fig groves
Livestock (autochthonous breeds):
Sheep: 'Merina', 'Talaverana'
Goats: 'Serrana'
Cattle: 'Avileña', 'Morucha', 'Retinta', 'Bravo'
Swine: 'Iberico'

Soil types:

Inceptisols and entisols on quartzite, slate and granite parent rock, ,****
Limestone inclusion near Cáceres. Occasionally alfisols are found in the most fertile areas.

Average climatic parameters (1951-93)

Months	P (mm)	T (°C)	ETP (mm)	R (mm)
January	71	7.9	15	100
February	72	8.8	17	100
March	73	13.1	45	100
April	47	14.1	52	95
May	42	17.2	81	56
June	25	23.1	131	0
July	6	26.6	162	0
August	5	26.1	155	0
September	27	20.2	92	0
October	57	17.4	82	0
November	70	13	45	25
December	72	9.2	20	77
Total	567	16.4	897	

Vegetative Period Duration: 7 months (November-May)
Thermic influences: grass growth is slowed down by winter frosts

Zone: East

Rural Districts: Villuercas, Ibores y Siberia Extremeña

Agricultural land use:

Forest: vast cork oak dehesa areas, some pine, chestnut and oak woods; extensive scrubland
Grazing land: woodland pastures
Herbal crops: extensive dry farming
Ligneous crops: olive and fig groves and some fruit trees in dry land
Livestock (autochthonous breeds):
Sheep: 'Merina'
Goats: 'Serrana'
Cattle: 'Retinta'
Swine: 'Iberico'

Soil types:

Inceptisols and entisols on quartzite or slate parent rock; small limy areas in Las Villuercas

Average climatic parameters(1951-93)

Months	P (mm)	T (°C)	ETP (mm)	R (mm)
January	116	6.8	14	100
February	129	7.5	15	100
March	108	12.5	43	100
April	72	14.5	53	100
May	68	16.5	72	96
June	37	23.3	133	0
July	8	27.6	180	0
August	9	26.4	165	0
September	35	19.1	90	0
October	88	16.8	72	16
November	100	12.8	44	72
December	116	8.1	14	100
Total	886	16.0	895	

Vegetative Period Time: 8 months (October-May)
Thermic influence: grass growth is slowed down by December, January and February frosts

Zone: La Serena

Rural Districts: La Serena

Agricultural land use:

Forest: scarce. Some "dehesa" areas with scrubs
Grazing land: vast
Herbal crops: extensive dry farming
Ligneous crops: some olive groves
Livestock (autochthonous breeds):
Sheep: 'Merina'
Goats: 'Serrana'
Swine: 'Iberico'

Soil types:

Inceptisols and entisols on acid parent rock (slate, quartzite and granite); some alfisols in the most fertile areas.

Average climatic parameters (1951-94):

Months	P (mm)	T (°C)	ETP (mm)	R (mm)
January	55	7.4	14	88
February	56	8.2	16	100
March	53	13.6	48	100
April	45	14.8	54	91
May	36	18.4	86	41
June	27	24.6	138	0
July	3	27.6	182	0
August	6	27.2	178	0
September	24	20.9	95	0
October	52	18.2	86	0
November	57	14	51	6
December	64	9.6	23	47
Total	478	17.0	971	

Vegetative Period Time: 7 months (November-May)
Thermic influence: grass growth is slowed down by January and February frosts

Zone: South

Rural Districts: Llanos de Olivenza, Sierras de Jerez, Sierra Morena.

Agricultural land use:

Forest: abundant holm oak "dehesa" with some cork oaks
Grazing land: included in the wide "dehesa" areas
Herbal crops: extensive dry farming
Ligneous crops: olive groves and some fig groves
Livestock (autochthonous breeds):
Sheep: 'Merina'
Goats: 'Serrana'
Cattle: 'Retinto'; 'Brava'
Swine: 'Iberico'

Soil types:

Predominance of entisols and inceptisols over slate or quartz rocks; important granite areas; some alfisols and even some vertisols on the edge of the zone.

Average climatic parameters (1951-94):

Months	P (mm)	T (°C)	ETP (mm)	R (mm)
January	94	7.9	16	100
February	91	8.6	17	100
March	86	14.9	47	100
April	53	13.1	52	100
May	42	17.0	80	62
June	27	23.4	133	0
July	6	25.8	151	0
August	5	24.8	138	0
September	28	19.4	88	0
October	76	16.6	75	1
November	82	13.4	48	34
December	90	9.2	20	100
Total	680	16.2	865	

Vegetative Period Duration: 8 months (October-May)
Thermal influence: grass growth is slowed down by winter frosts

Appendix 2

Typology of the agricultural areas in Extremadura

Table 1. General distribution of the land (x10^3 ha) in Extremadura (1995)

Land use	Arid zones	Irrigated land	Total
Herbal crops	436.7	197.1	633.8
Fallow and unused land	214.1	27.2	241.3
Fruit crops	329.5	9.4	338.9
Total crop land	980.3	233.7	1,214.0
Meadows	15.0	2.0	17.0
Grazing land	1,025.1		1,025.1
Total meadows and grazing land	1,040.1	2.0	1,042.1
Timber land	273.0	5.0	278.0
"Dehesa"	887.5		887.5
Scrubland	400.0		400.0
Total Forest land	1,560.5	5.0	1,565.5
Total farm and forest exploitation land	3,580.9	240.7	3,821.6
Other land	338.5		338.5
Total geographic extension	3,919.4	240.7	4,160.1

Source: Author's research; data from the Secretaría General Técnica de la Consejería de Agricultura y Comercio de la Junta de Extremadura

Table 2. Typology of the arable zones in Extremadura. Land distribution (x10^3 ha) in 1995

Cultivated areas (AGRICOLA)	- Herbal crops in dry land	190.8
	- Herbal crops in irrigated land	224.3
	- Fruit crops	338.9
Total		754.0
Mixed areas : crops and livestock yields (AGROGANAEX)		460.0
Extensive livestock production areas (GANAEX)	- Pastures and Grazing land	1,042.1
Mixed areas: livestock and forest production (GANAFOREST)	- Wooded "dehesa"	887.5
Marginal areas of livestock and forest production (MARGIN GANAFOREST)	- Scrubland	400.0
Forest production (FOREST)	- Timber forest	278.0
Total crops, livestock and forest production land		3,821.6

Source: Author's research

Table 3. Surface changes ($x10^3$ ha) of the agricultural areas of Extremadura during 1986-1995

Agricultural zones	1986	1990	1995	Trend
AGRICOLA	1,038.9	978.5	754.0	∇
AGROGANAEX	438.2	450.4	460.0	Δ=
GANAEX	931.0	964.9	1,042.1	Δ
GANAFOREST	701.5	725.5	887.5	Δ
MARGIN GANAFOREST	313.3	305.7	400.0	Δ=
FOREST	281.6	279.5	278.0	=

Source: Author's research

Appendix 3

Agricultural output assessment of Extremadura

Table 4. Estimate of the total agricultural production value ($x10^6$ ptas in 1996) of the subsectors in Extremadura

- Winter Cereals	11,000
- Rice	4,000
- Corn	11,000
- Industrial crops (Sunflower, tobacco, sugar-beet)	20,000
- Horticultural crops (potato, asparagus, melon, tomato)	23,000
- Fruit trees (cherry, pear and peach trees)	9,000
- Vineyard	7,000
- Olive grove	10,000
- Fodder crops	6,000
- Fallow and stubble fields	4,000
Total Agricultural output	105,000
- Meat yield (production):	
Extensive cattle	15,000
Intensive cattle	2,000
Sheep	16,000
Goats	2,000
Swine ('Iberico')	23,000
Swine ('Blanco')	3,000
Poultry	2,000
- Other production (Milk, eggs,wool, etc.)	12,000
Total livestock output	75,000
- Wood and firewood	1,500
- Cork	1,500
- Acorns	2,500
- Pastures	10,500
- Hunting and fishing	4,000
Total forest output	20,000
Total agricultural output	200,000

Source: Author's research

Table 5. Estimate of the total agricultural production value (x10^6 ptas in 1996) in the crop exploitation areas

Winter Cereals	8,000
Rice	4,000
Corn	11,000
Industrial crops	18,000
Horticultural crops	23,000
Fodder crops	2,000
Fruit trees	9,000
Vineyard	7,000
Olive trees	10,000
Fallow and stubble fields	4,000
Hunting and Fishing	250
Total	96,250

Source: Author's research

Table 6. Assessment of the agricultural production value (x10^6 ptas in 1996) in non-cultivated zones

Intensive cattle ; swine ('blanco')	12,500
Industrial poultry and other yields	

Source: Author's research

Table 7. Estimate of the value (x10^6 ptas in 1996) of the agricultural production in AGROGANAEX (460.000 ha)

Non-forage herbal crops	5,000
Forage crops	3,000
Fallow and stubble	2,500
Hunting and fishing	500
Extensive cattle	1,000
Sheep	2,500
Other production	500
Total	15,000

Source: Author's research

Table 8. Assessment of the agricultural production value (x10 ^{6} ptas in 1996) in livestock exploitation zones (GANAEX) (1,042,100 ha)

Grazing	7,500
Hunting and fishing	1,000
Extensive cattle	4,000
Sheep	9,000
Goats	250
Other yields	2,000
Total	23,750

Source: Author's research

Table 9. Assessment of the agricultural production value (x10^{6} ptas in 1996) in mixed exploitation (livestock and forest) zones (GANAFOREST) (887,500 ha)

Forage crops	1,000
Fallow and stubble	1,000
Pastures	2,500
Acorns	2,250
Cork	1,250
Wood and firewood	250
Hunting and Fishing	1,250
Extensive cattle	10,000
Sheep	4,000
Goats	500
Swine ('Iberico')	21,000
Other yields	2,000
Total	47,000

Source: Author's research

Table 10. Assessment of the agricultural production value (x10^{6} ptas in 1996) in marginal zones (MARGIN GANAFOREST) (400,000 ha)

Pastures	500
Acorns	250
Cork	250
Wood and firewood	250
Hunting and Fishing	750
Sheep	500
Goats	1,250
Swine ('Iberico')	2,000
Other yields	1,500
Total	7,250

Source: Author's research

Table 11. Assessment of the agricultural production value (x10^6 ptas in 1996) in forest exploitation zones (FOREST) (278,000ha)

Wood and firewood	1,000
Hunting and Fishing	250
Other yields	500
Total	1,750

Source: Author's research

Table 12. Surface distribution and estimated agricultural production in different zones

Zones	Surface x 10^3 ha	%	Yield x 10^6 ptas	%
Non-agricultural areas	-	-	12,500	6.25
AGRICOLA	754.0	19.73	92,750	46.37
AGROGANAEX	460.0	12.04	15,000	7.50
GANAEX	1,042.1	27.27	23,750	11.88
GANAFOREST	887.5	23.22	47,000	23.50
MARGIN GANAFOREST	400.0	10.47	7,250	3.62
FOREST	278.0	7.27	1,750	0.88
Total	3,821.6	100.00	200,000	100.00

Source: Author's research