PhD Program on Climate Change and Sustainable Development Policies

Class of 2021/2022 | Theories and Practices of Sustainable Development

FARMING SYSTEM IMPACTS IN SOUTHERN PORTUGAL

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Sustainable agriculture is key for sustainable development

“Intensively managed farming systems deliver mostly provisioning services (e.g., food and fiber), while low-intensity farming systems can support a wider range of ecosystem services and high levels of biodiversity”

Buchadas *et al*., 2022

Southern Portugal: Alentejo and Algarve

NUTS II	UAA (% in PT)	Average UAA by farm (ha)	Productive intensity (% of total country)
Alentejo	57,7	58,9 ha	33,4
Algarve	2,6	8,1 ha	4,6

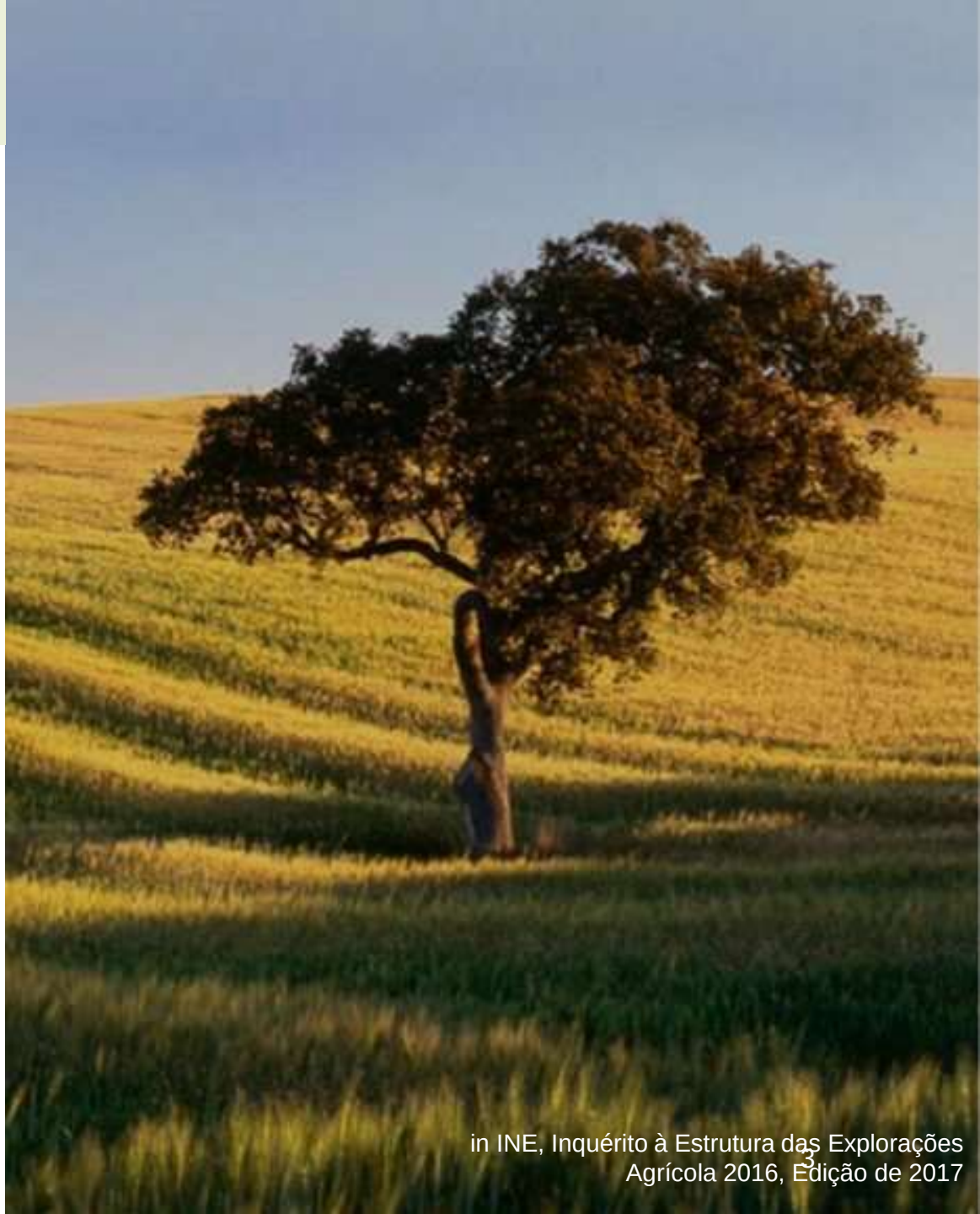
Alentejo is dominated by large farms with an average farm size of 58,9 ha, whereas the Algarve has smaller farms (8,1 ha average UUA/farm).

Utilized Agricultural Area (UAA) Composition in % of region

NUTS II	Arable land	Permanent crops	Permanent pastures
Alentejo	28,5	12,9	58,6
Algarve	27,6	50,1	21,8

Livestock distribution (% in PT)

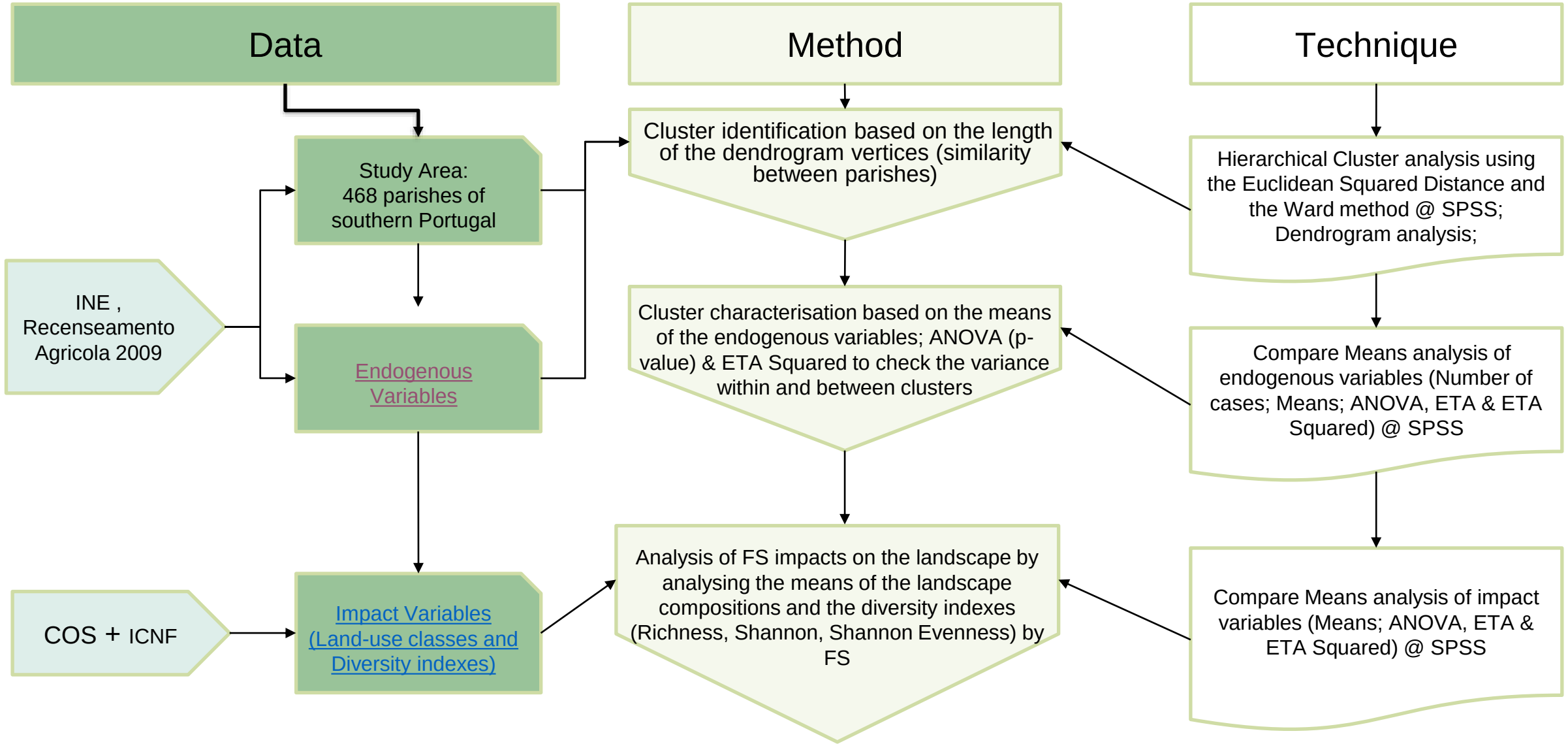
NUTS II	Bovines farms	Bovines CN	Ovines farms	Ovines CN	Goat farms	Goats CN
Alentejo	10,1	44	18,8	52,8	8,7	24,9
Algarve	0,6	0,5	1,7	2,1	2,4	3,8



in INE, Inquérito à Estrutura das Explorações Agrícola 2016, Edição de 2017

How do farming systems affect the southern landscape?

What are the FS practiced in southern Portugal and how do they impact the landscape, biodiversity and ecosystem services?



Endogenous variables

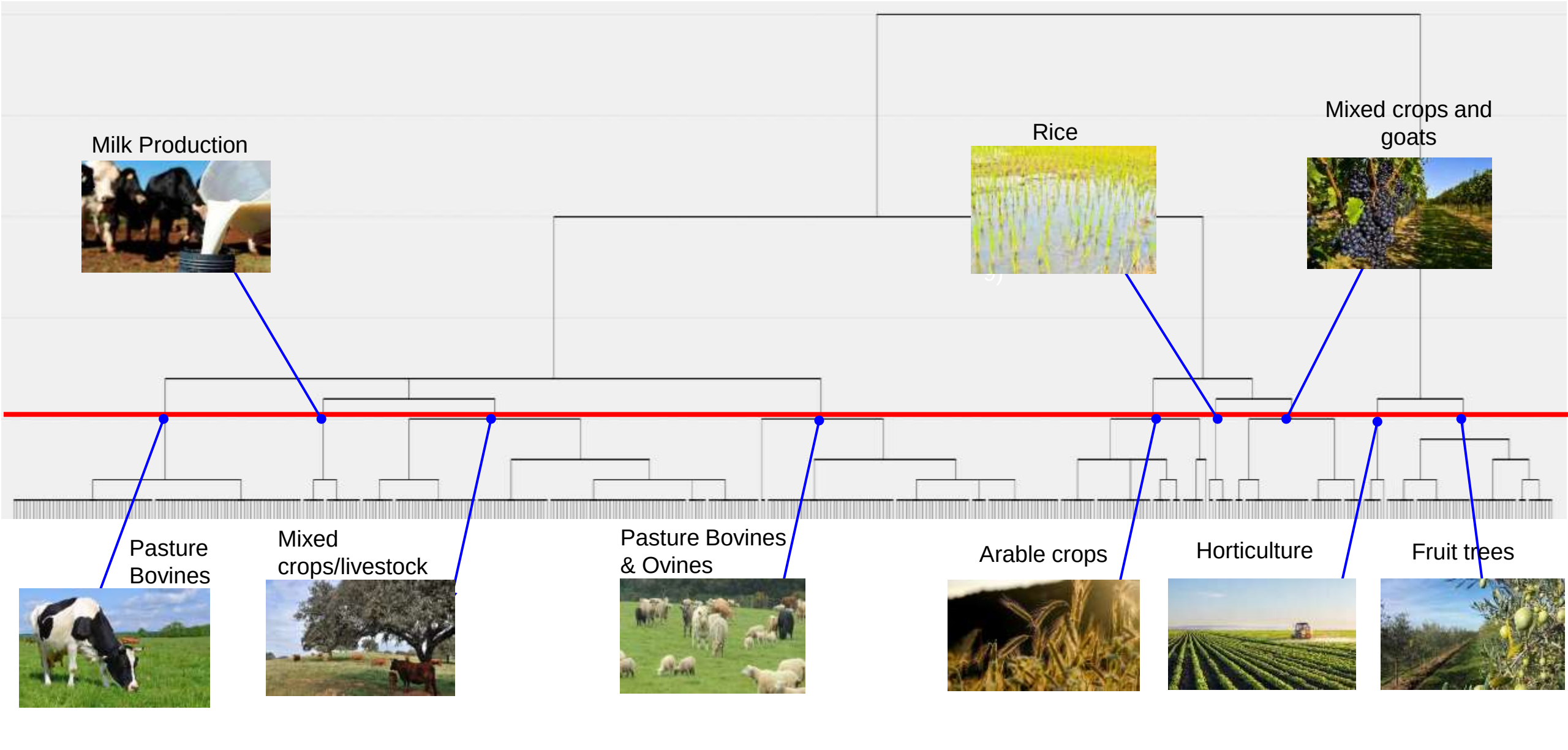
The following endogenous variables were calculated and used to characterize the FS:

- **Productive intensity** [VPPT/SAU (Euros per hectare); CN totals/SAU (total livestock unit per hectare)
- **Level and specialization pattern** (% livestock: cattle, sheep, goats and equines; Use of agricultural land: arable land, permanent crops and permanent meadows and pastures by SAU)
- **Area worked per unit of work** (SAU/UTA in ha/agricultural work unit)
- **Agricultural labour productivity** (VPPT/UTA in €/ha.year)
- **Fraction of the parish occupied by agriculture** (SAU/total area of the parish)

Impact variables

Impact Variable	Description
Landscape composition (5)	We have grouped the landscape composition in five categories: ▪ Native forests ▪ Production forestry ▪ Agroforesty ▪ Agriculture surface ▪ Ecological succession
Landscape diversity (3)	We have quantified the landscape heterogeneity by determining the following parameters: ▪ Richness ▪ Shannon Evenness ▪ Shannon
Proportion of burnt area in the parishes (1)	▪ Burnt area

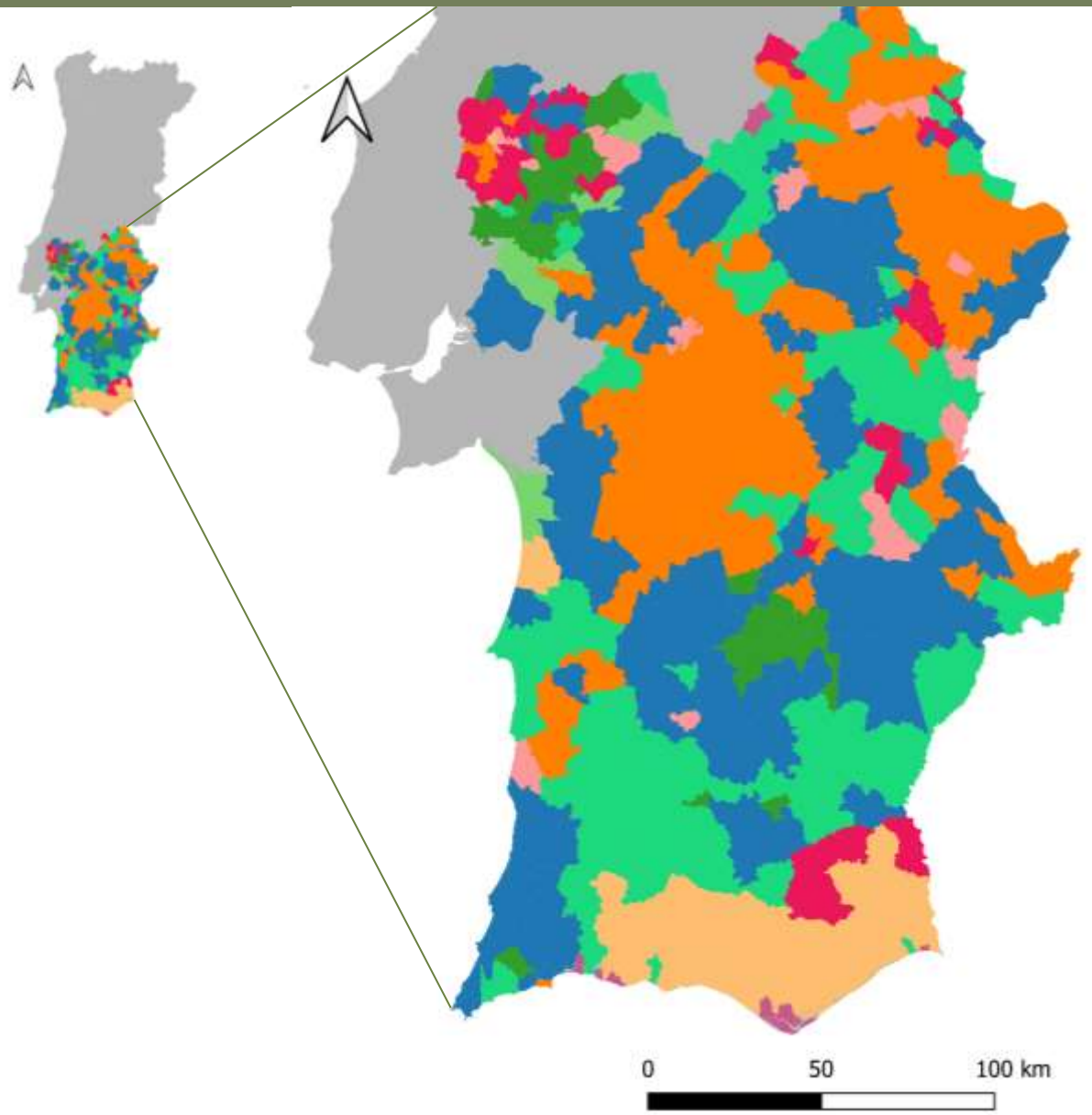
Farming systems | cluster analysis



Specialization | Use of agricultural land

Farming System	N	Productive intensity (€/ha)	Livestock density (CN/SAU)	Arable land (%)	Permanent cultures (%)	Meadows & Pastures (%)
BOVINE PASTURES	88	502	0,32	19,7%	8,9%	71,3%
OVINES AND BOVINES PASTURES	91	579	0,25	28,9%	10,0%	60,9%
MIXED CROP/LIVESTOCK	121	899	0,26	39,4%	21,6%	38,7%
MILK PRODUCTION	18	1 601	0,42	40,4%	10,5%	48,8%
RICE PRODUCTION	8	1 737	0,31	65,5%	4,3%	29,9%
FRUIT TREES	51	1 971	0,10	16,1%	74,2%	8,9%
ARABLE CROPS	39	2 383	0,15	73,2%	12,4%	14,1%
MIXED PERMANENT CROPS	45	2 585	0,24	39,7%	39,5%	20,1%
HORTICULTURE	7	4 960	0,27	46,4%	37,9%	13,8%

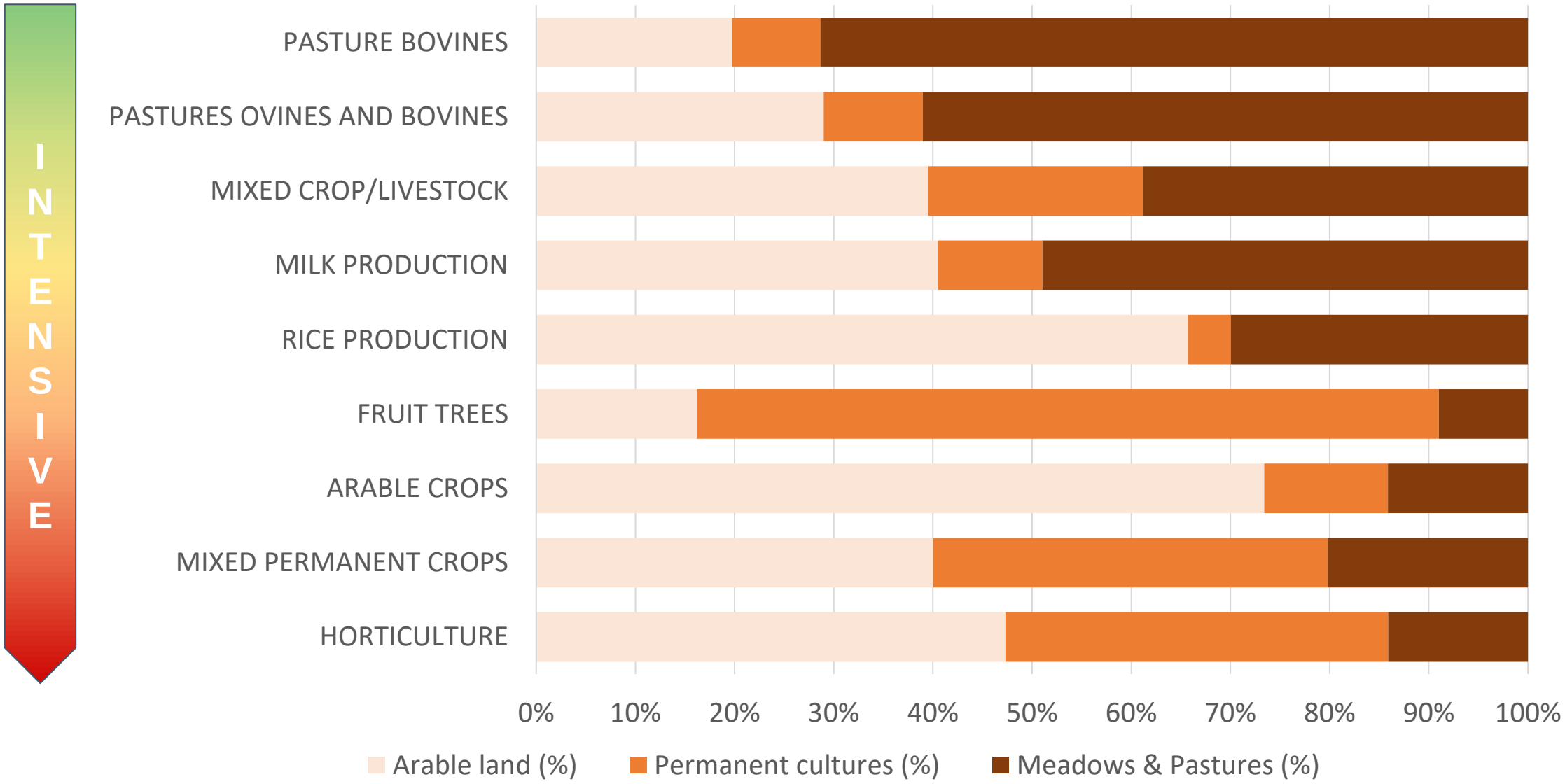
Farming systems in Alentejo and Algarve



- Bovine pastures
- Bovine and ovine pastures
- Mixed crops and livestock
- Milk production
- Rice production
- Fruit trees
- Arable crops
- Mixed permanent crops
- Horticulture

INTENSIVE

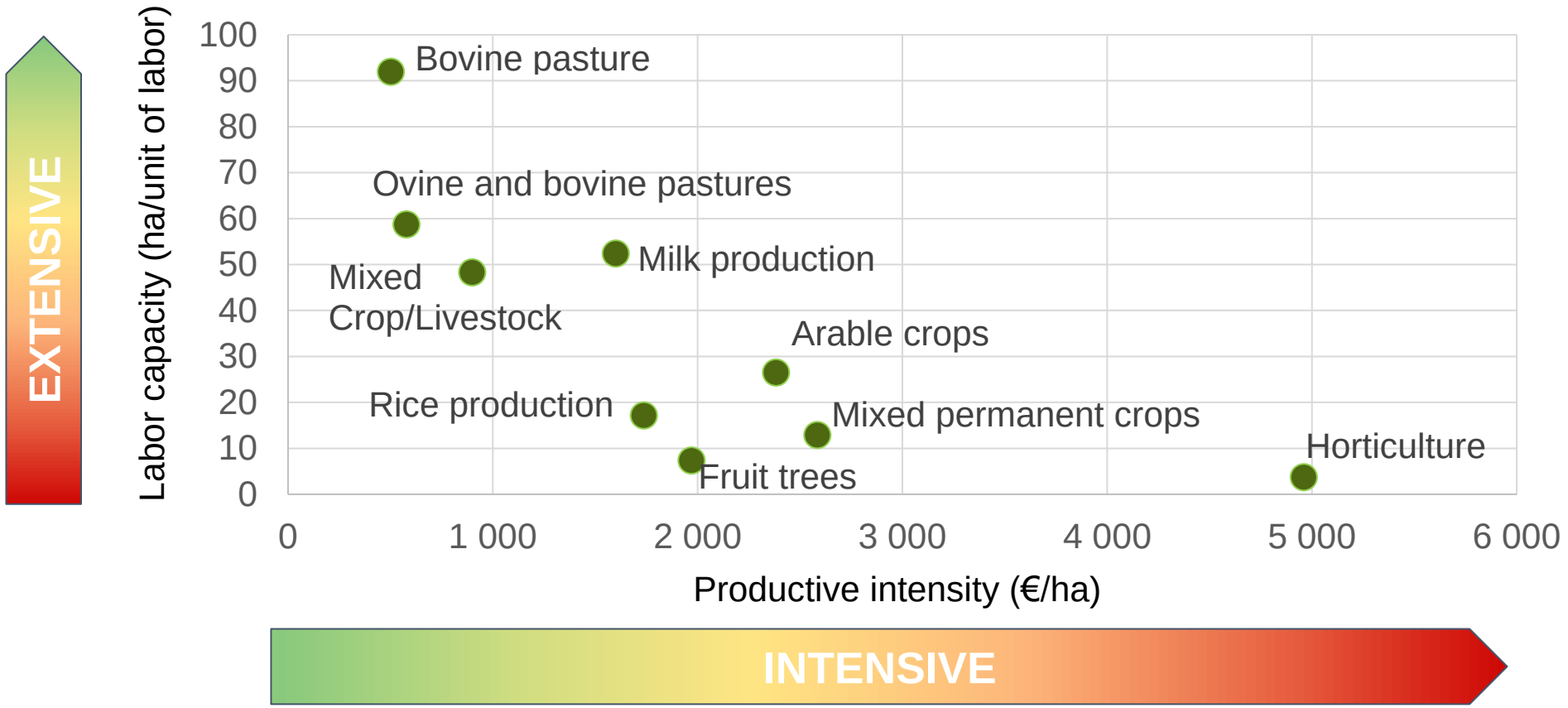
Specialization | Use of agricultural land per farming system



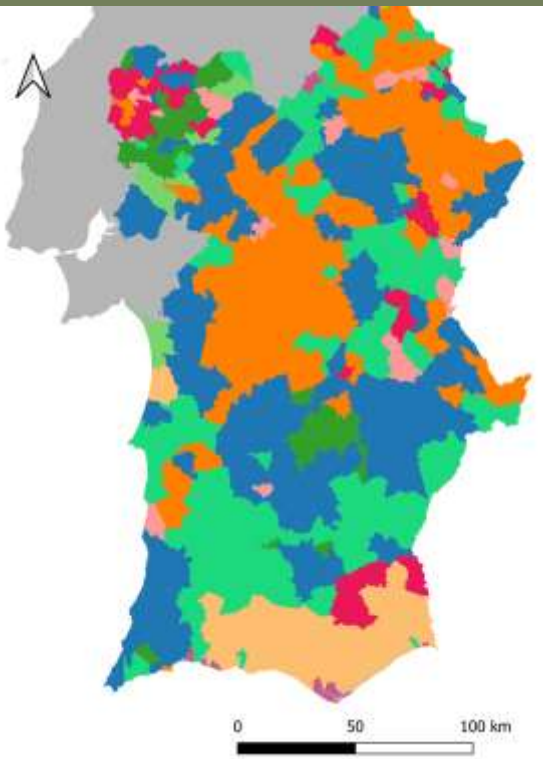
Productive intensity and specialization

Farming System	N	Productive intensity (€/ha) (VPPT/SAU)	Livestock density (CN/SAU)	Crop specialization	Livestock specialization
BOVINE PASTURES	88	502	0,32	15,94%	84,06%
OVINE AND BOVINE PASTURE	91	579	0,25	21,88%	78,12%
MIXED CROP/LIVESTOCK	121	899	0,26	42,12%	57,88%
MILK PRODUCTION	18	1 601	0,42	27,14%	72,86%
RICE PRODUCTION	8	1 737	0,31	62,76%	37,25%
FRUIT TREES	51	1 971	0,10	86,19%	13,81%
ARABLE CROPS	39	2 383	0,15	84,90%	15,11%
MIXED PERMANENT CROPS	45	2 585	0,24	70,16%	29,84%
HORTICULTURE	7	4 960	0,27	84,41%	15,59%

Labor intensity in the different farming systems



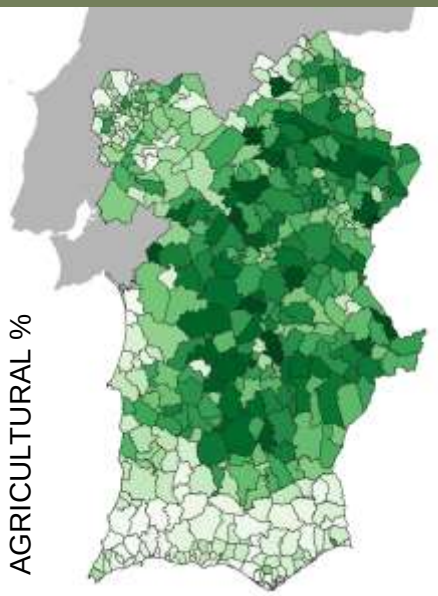
Alentejo & Algarve farming systems | endogenous variables



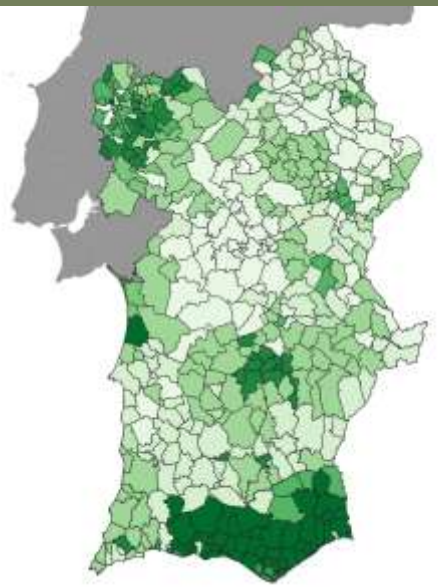
INTENSIVE

- Bovine pastures
- Bovine and ovine pastures
- Mixed crops and livestock
- Milk production
- Rice production
- Fruit trees
- Arable crops
- Mixed permanent crops
- Horticulture

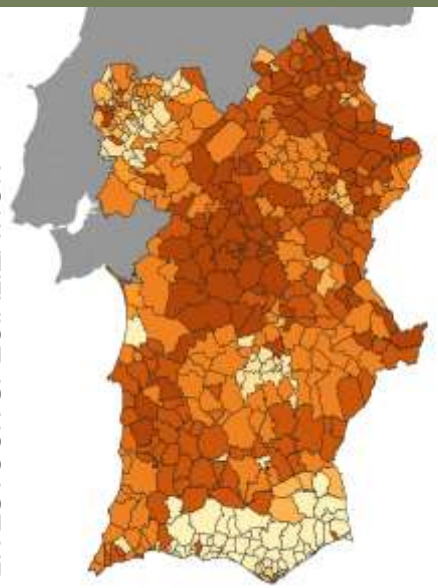
AGRICULTURAL %



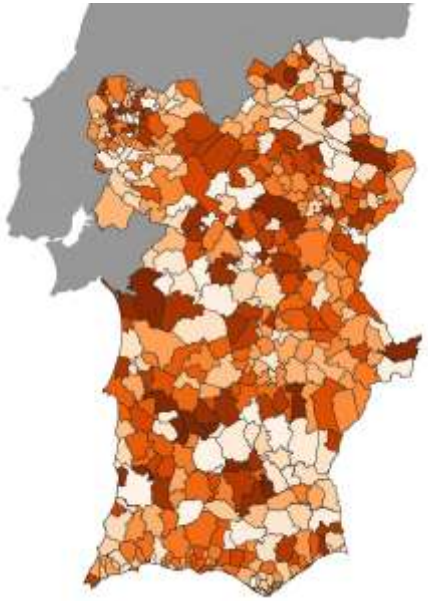
CROP SPECIALIZATION



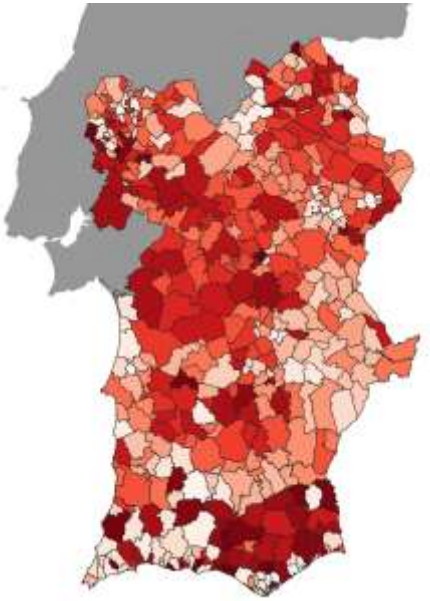
LIVESTOCK SPECIALIZATION



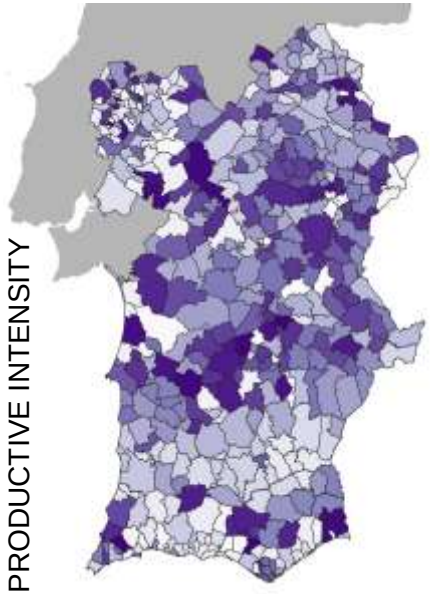
LABOR INTENSITY (SAU/UTA)



LABOR PRODUCTIVITY (VPPPT/UTA)



PRODUCTIVE INTENSITY



Farming systems by productive intensity

Ovine
and bovine pastures



Bovine pastures

Mixed crop and livestock

Milk productions

Fruit and nut trees



Rice

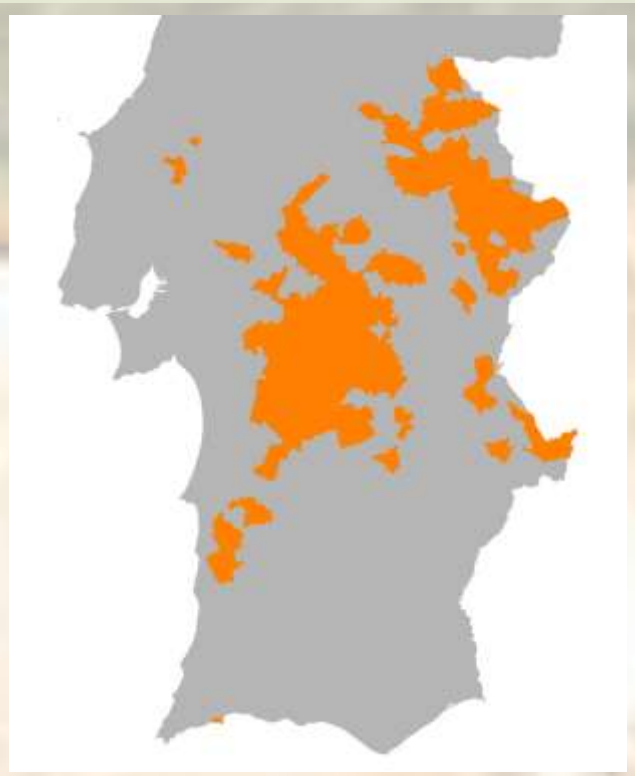
Arable crops

Horticulture

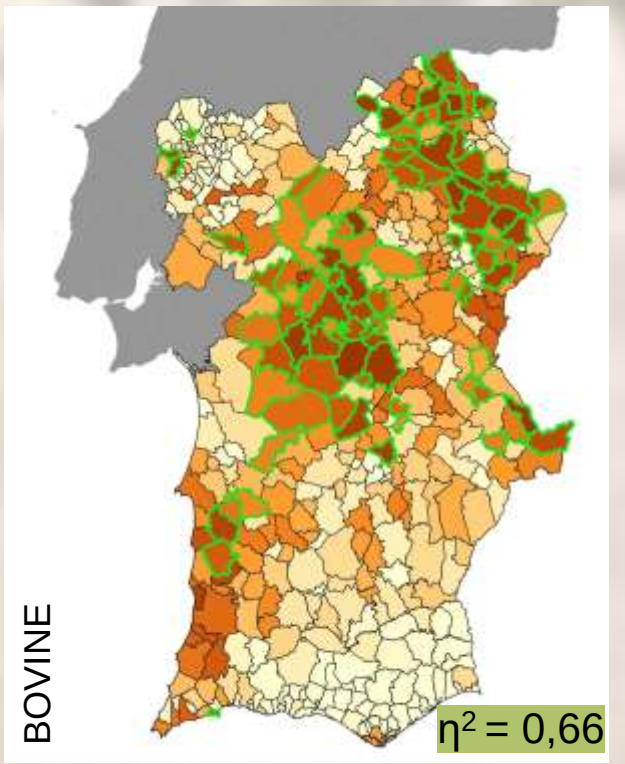


Mixed permanent crops,
some vineyard

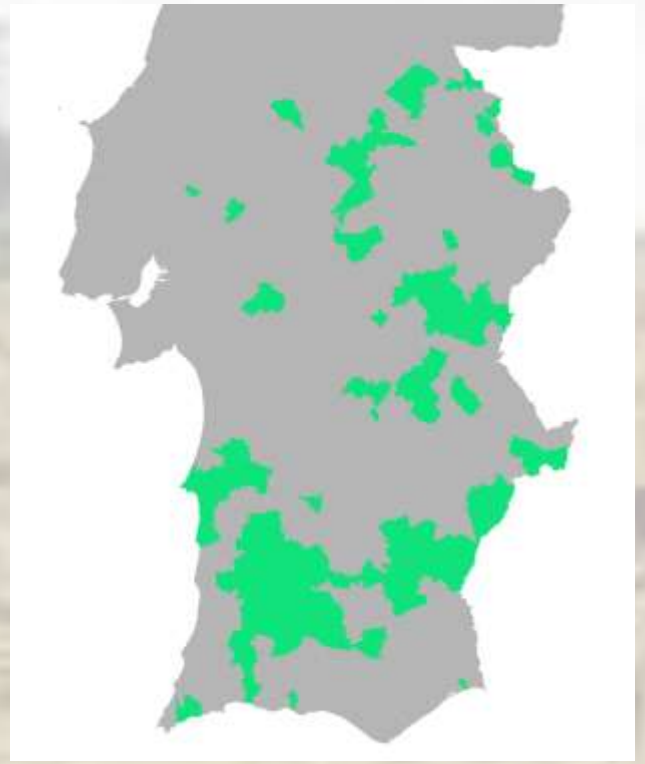
1 | Bovine pasture



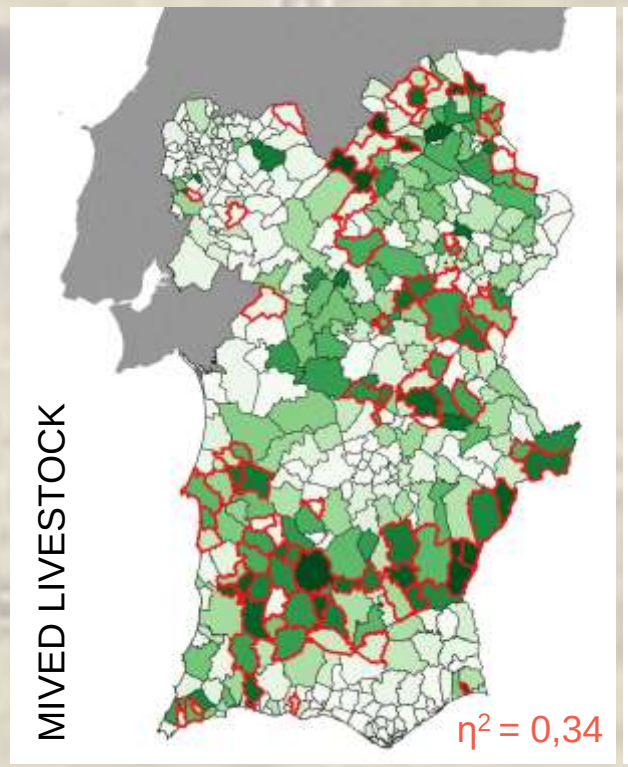
- N = 88
- Low intensity (502 €/ha.year)
- 71,3% pastures
- Specialized in bovines (57,7%)

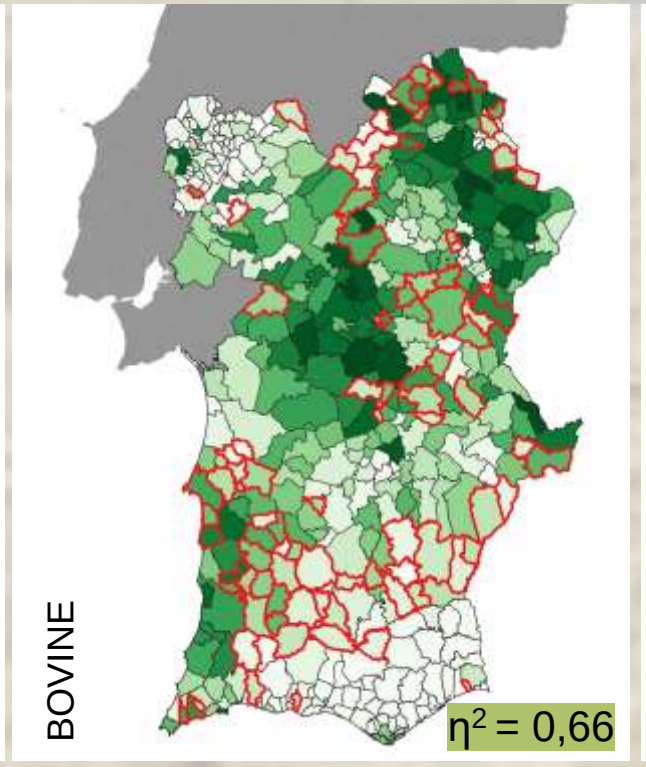


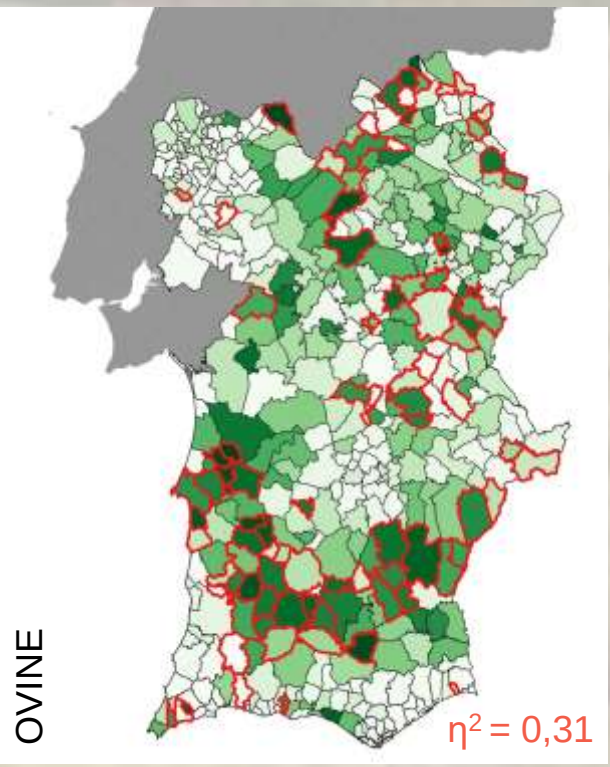
2 | Bovine and ovine pasture



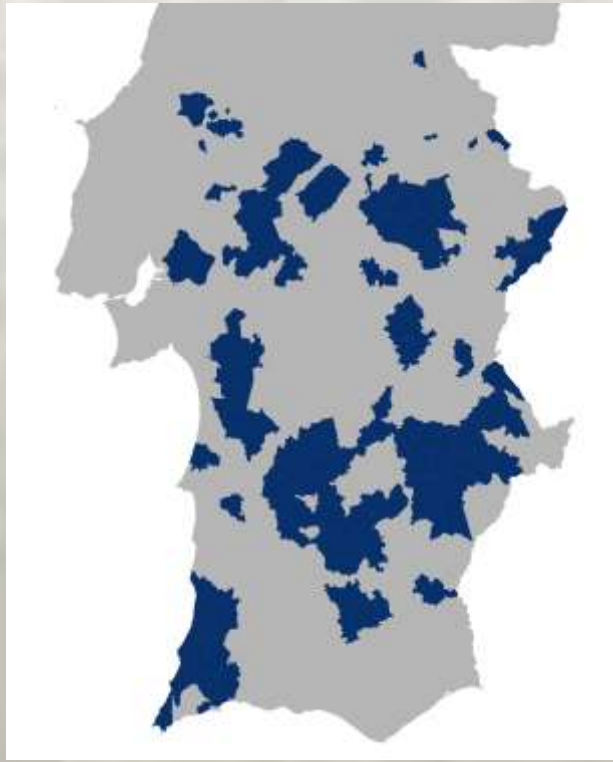
- N = 91
- Low intensity (579€/ha.year)
- 60,9% pastures
- Specialized in ovines (20,25%) and bovines (20,14%)



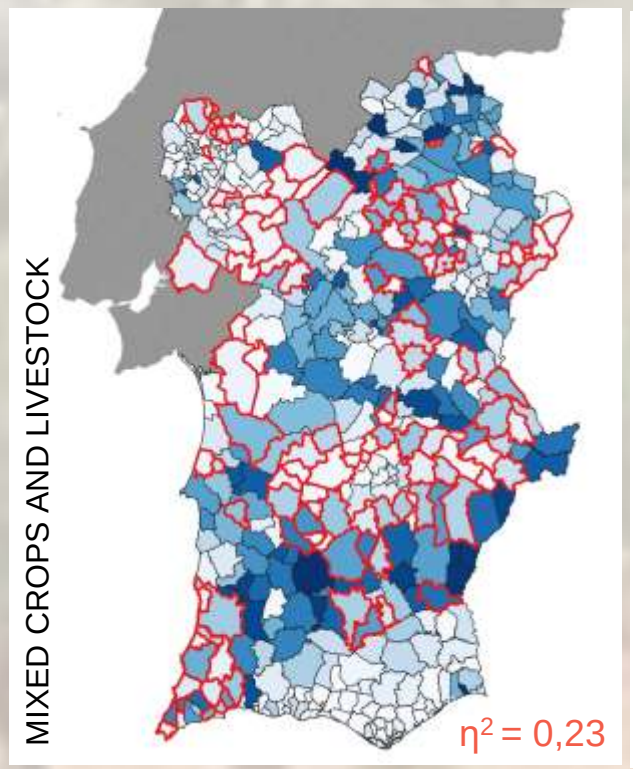


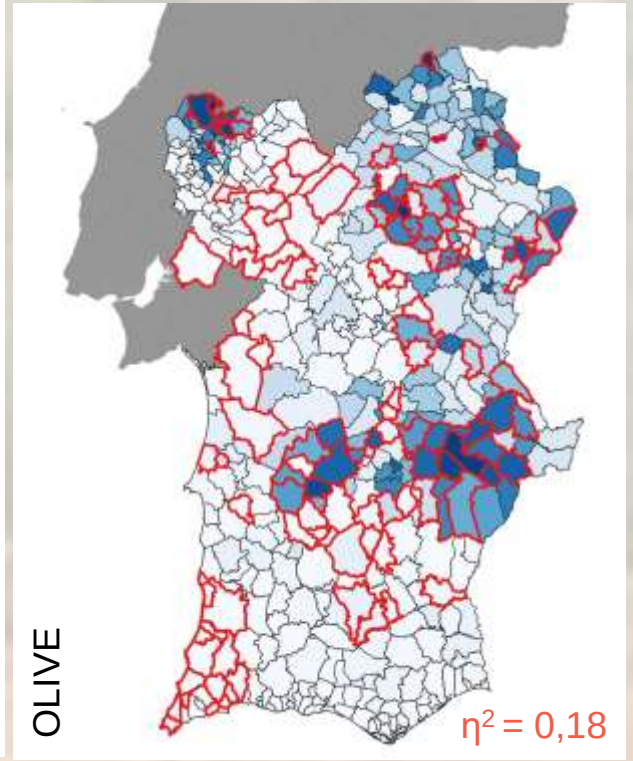


3 | Mixed crops and livestock

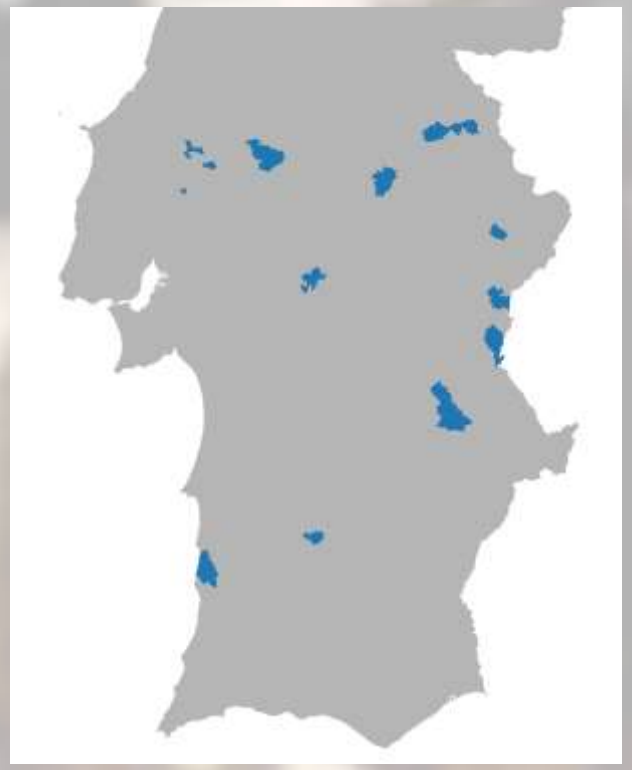


- N = 121
- Low intensity (899 €/ha.year)
- Even distribution of arable (39%), pasture (39%) land, fewer permanent crops (22%)
- Specialized in olive orchards (11%)
- Prevalence of mixed crops/ livestock farms (23%)

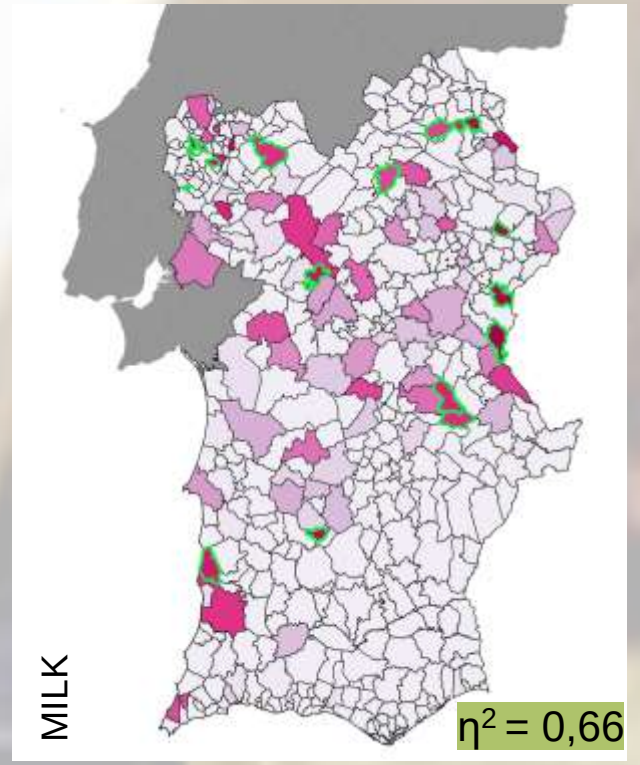




4 | Milk production

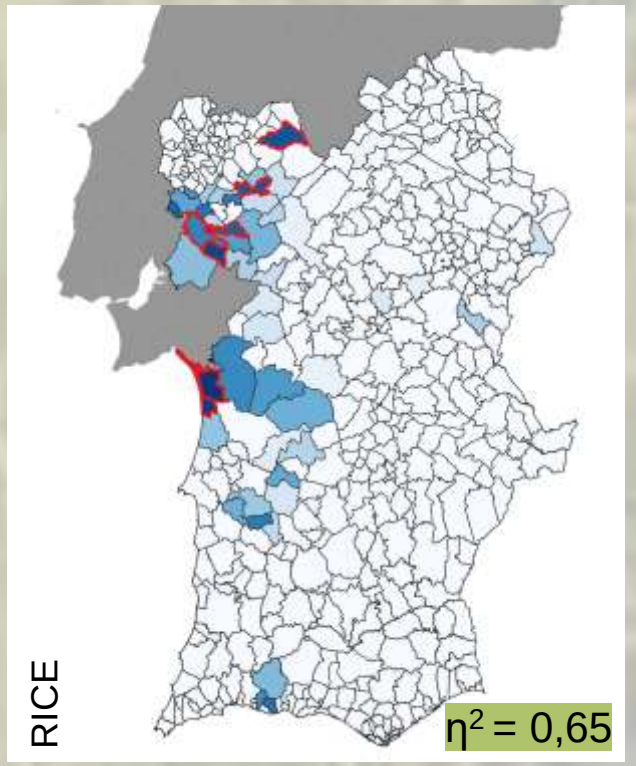


- N = 18
- Average intensity (1.601 €/ha.year)
- Even distribution of arable (40%), pasture (49%), with only 10% permanent cultures
- Specialized in milk production (15%), bovine (27%), other mixed livestock farms (15%)



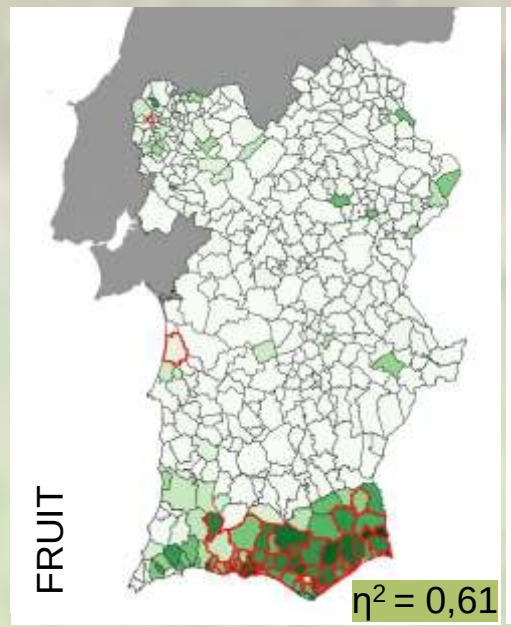
5 | Rice production

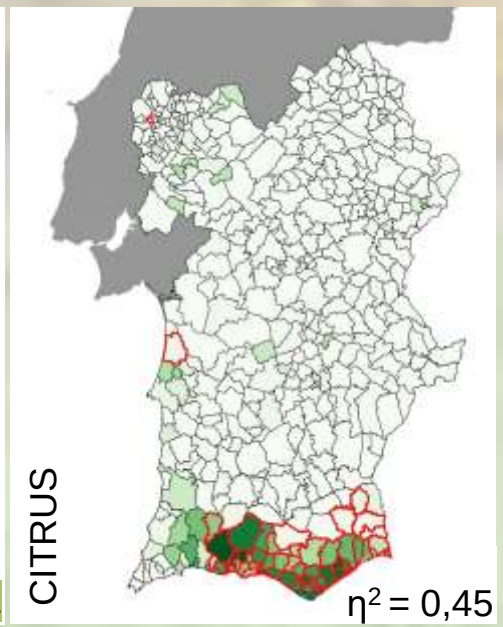
- N = 8
- Average intensity (1.737 €/ha.year)
- Mostly arable land (66%), some pasture (30%), with only 4% permanent crops
- Specialized in rice production (40%)

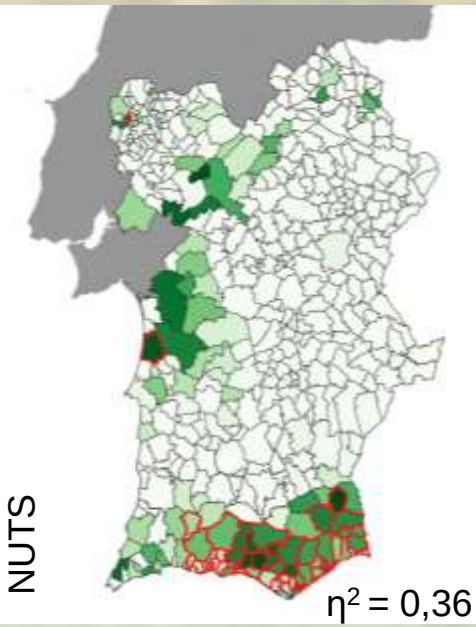


6 | Fruit trees

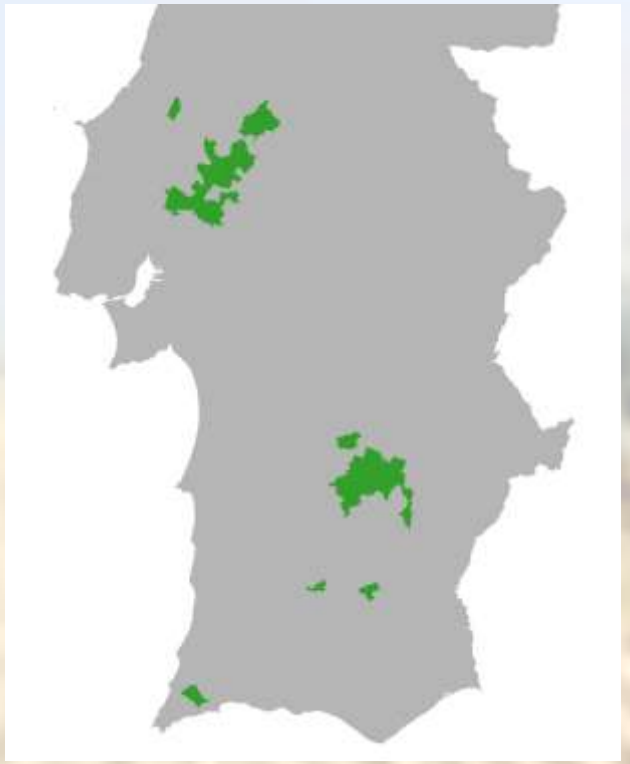
- N = 51
- Average intensity (1.971 €/ha.year)
- Mostly permanent crops (74%)
- Specialized in fruit (30%), citrus trees (22%) and nuts (18%)



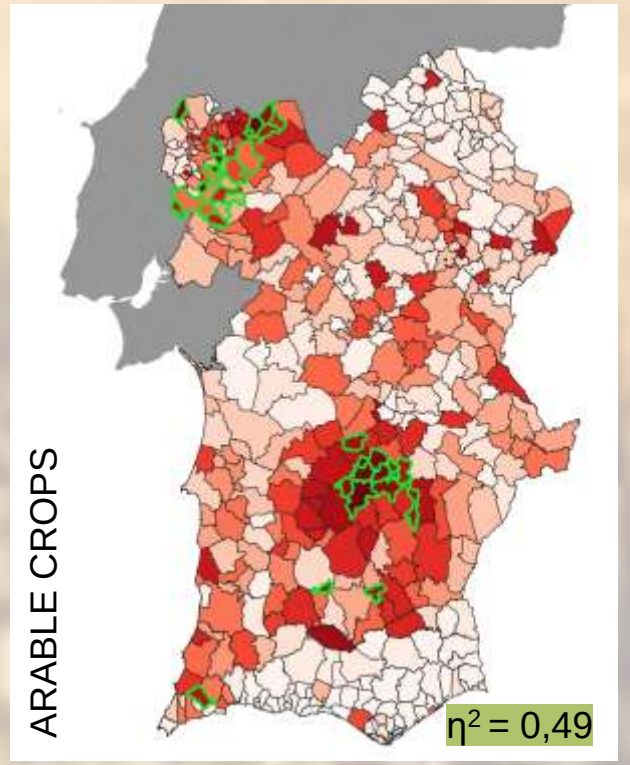


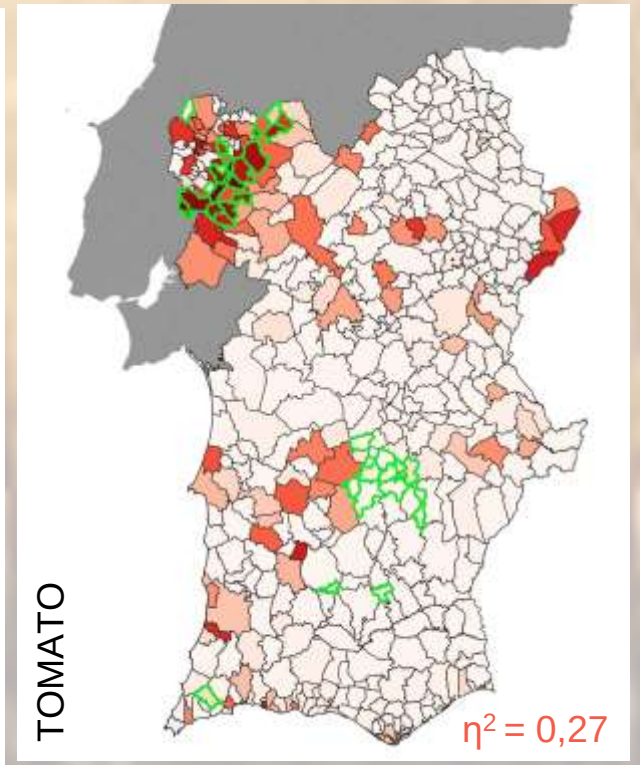


7 | Arable crops



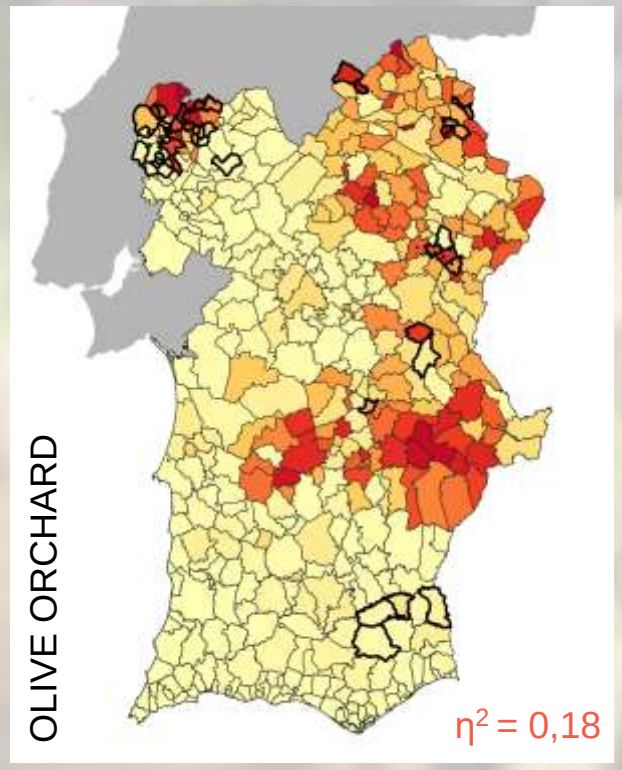
- N = 39
- Average intensity (2.383 €/ha)
- Mostly arable land (73%)
- Specialized in arable crops (47%), with some tomato (16%)

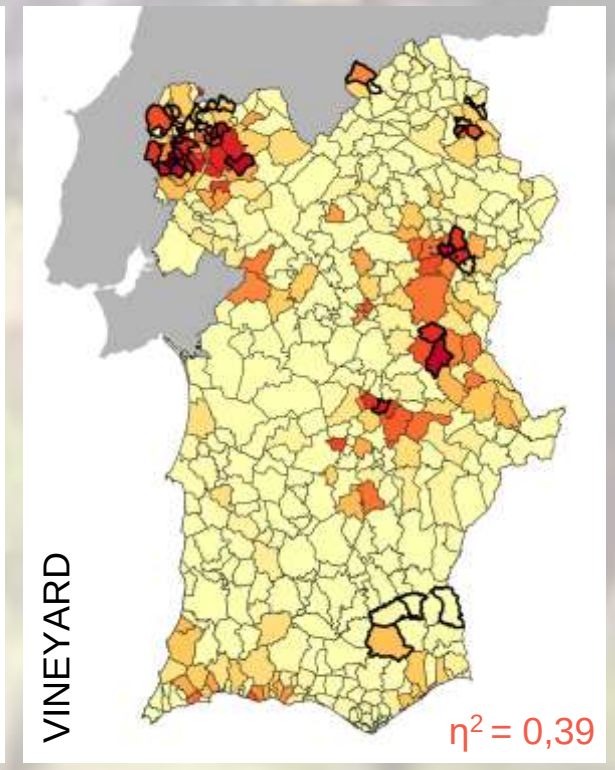


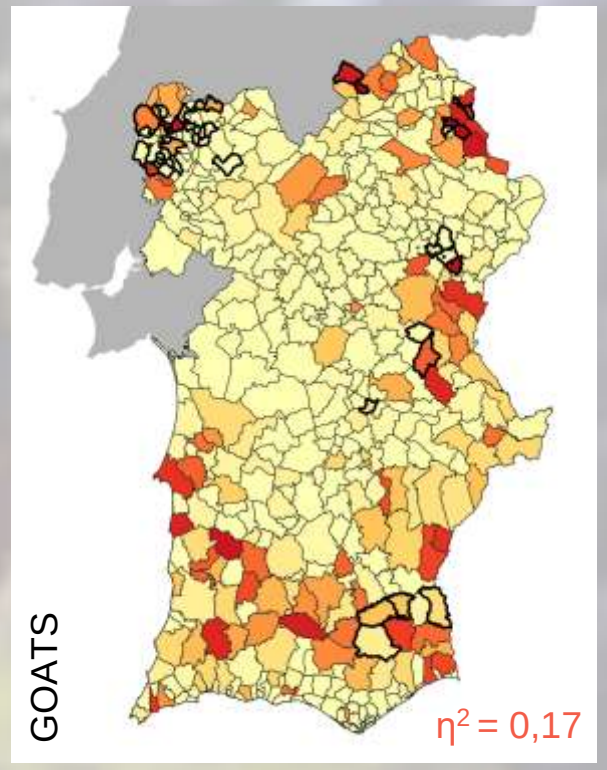


8 | Mixed permanent crops

- N = 45
- Average-high intensity (2.585 €/ha.year)
- Even distribution arable land (40%) and permanent cultures (39%)
- Specialized in vineyard (22%), some olive orchards (8,91%), some goats (5%)

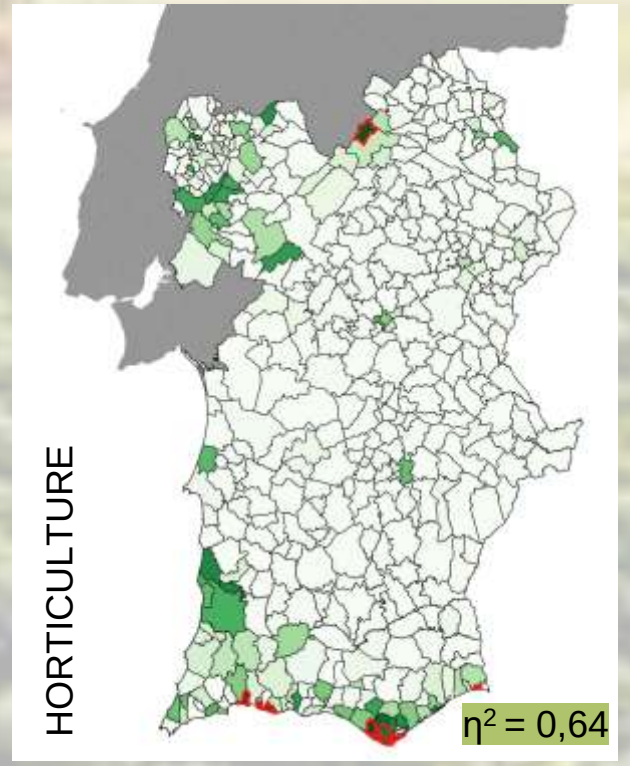






9 | Horticulture

- N = 7
- High intensity (4960 €/ha)
- Mostly arable land (46%) and permanent cultures (38%)
- Specialized in horticulture (29%)

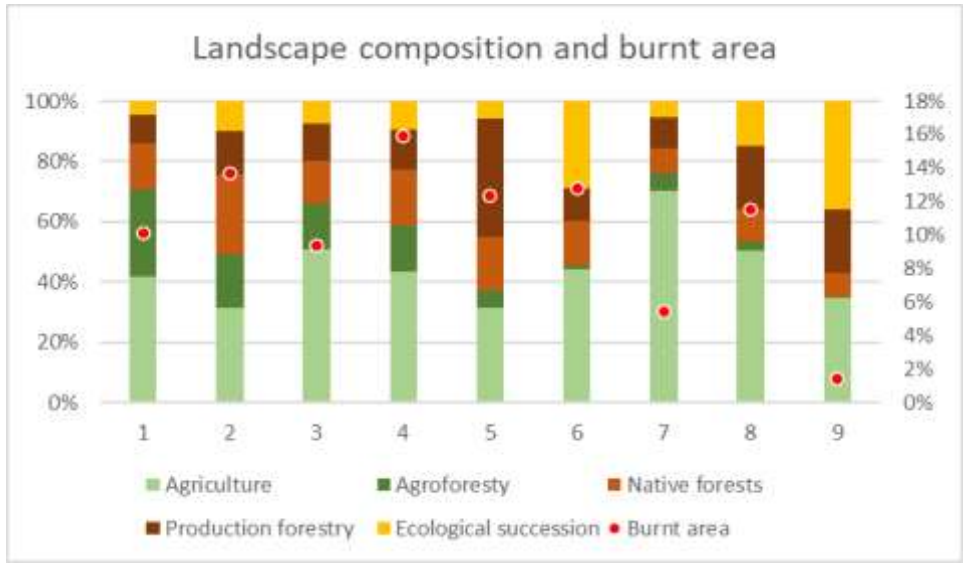


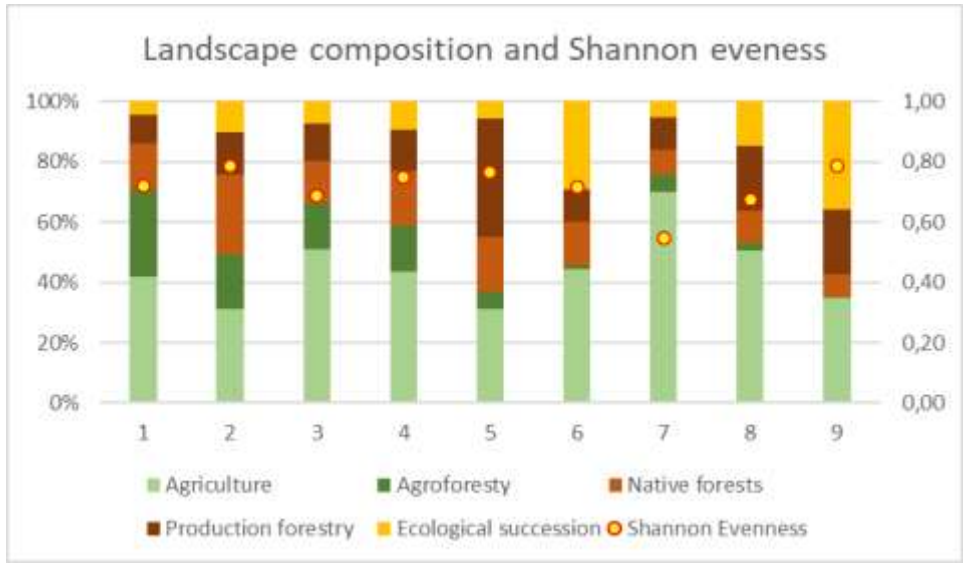
Landscape composition per farming system

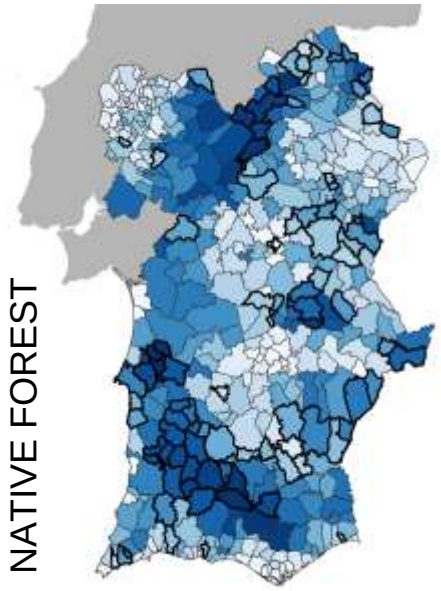
INTENSITY

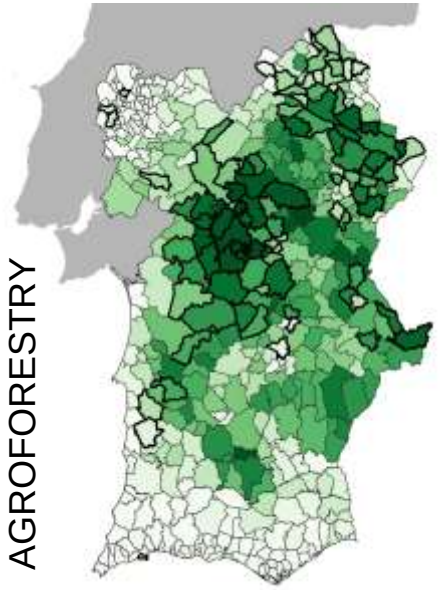
Farming System	N	Agriculture	Agroforesty	Native forests	Production forestry	Ecological succession
PASTURE BOVINES	88	41,9%	28,9%	15,1%	9,7%	4,4%
PASTURES OVINES AND BOVINES	91	31,4%	17,8%	26,4%	14,4%	10,0%
MIXED CROP/LIVESTOCK	121	51,0%	15,3%	14,0%	12,3%	7,4%
MILK PRODUCTION	18	43,4%	15,4%	18,2%	13,6%	9,3%
RICE PRODUCTION	8	31,3%	5,8%	18,1%	39,3%	5,6%
FRUIT TREES	51	44,3%	1,1%	14,7%	10,8%	29,1%
ARABLE CROPS	39	70,2%	5,7%	8,2%	10,4%	5,4%
MIXED PERMANENT CROPS	45	50,5%	2,7%	10,8%	21,2%	14,8%
HORTICULTURE	7	34,8%	0,4%	7,7%	21,1%	36,0%

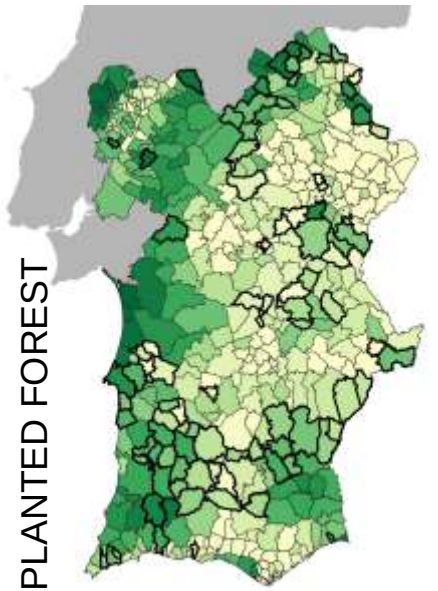
Landscape composition and fire hazard

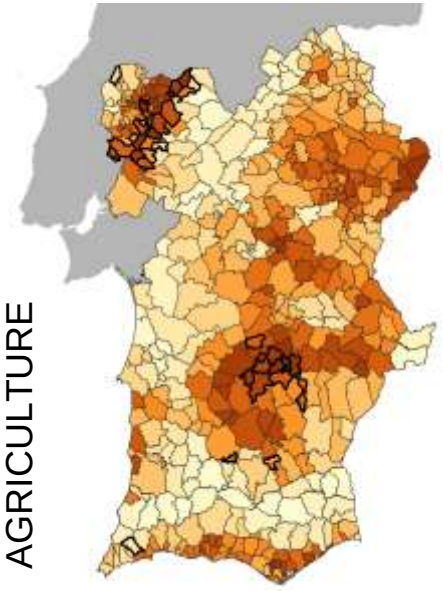


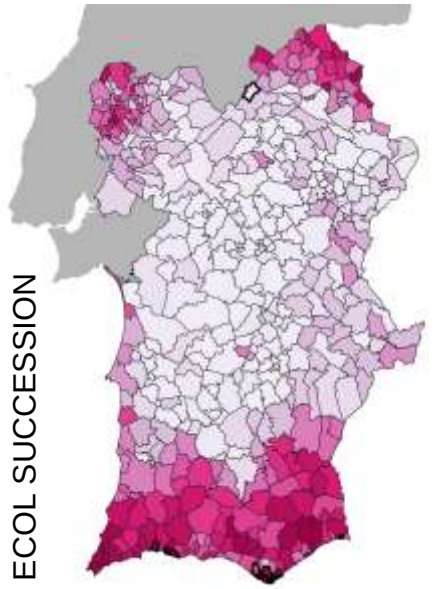


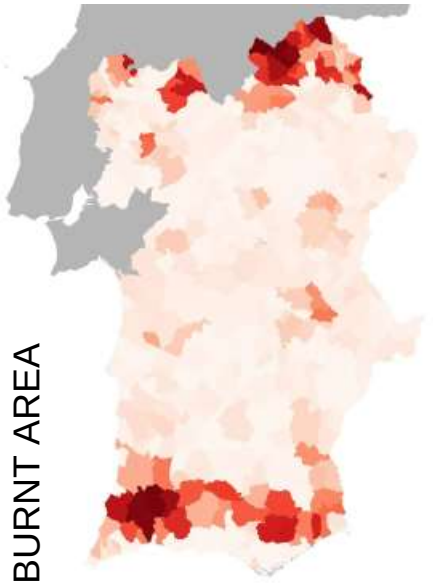








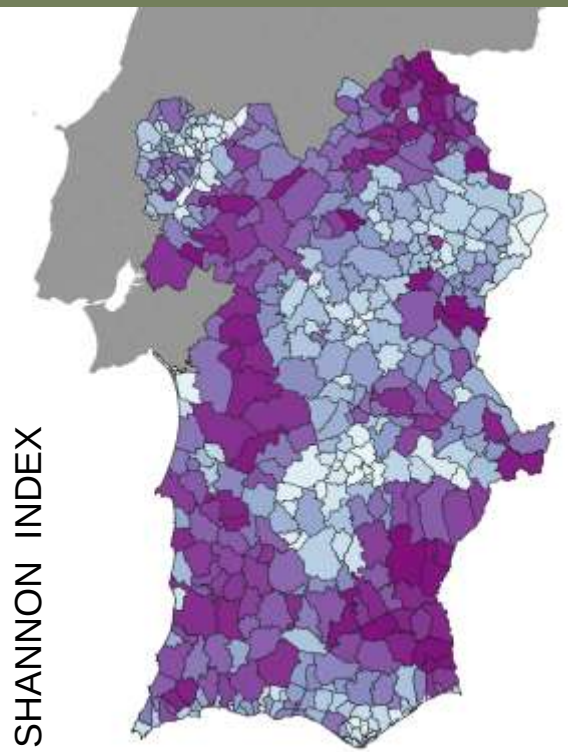


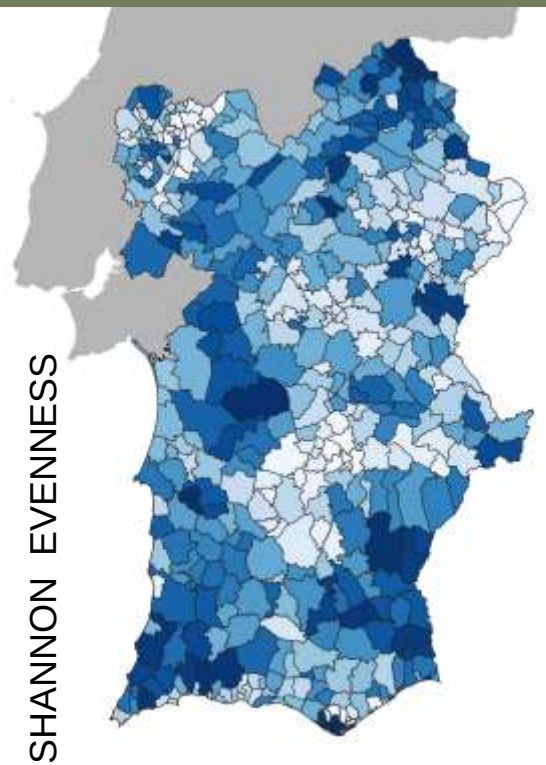


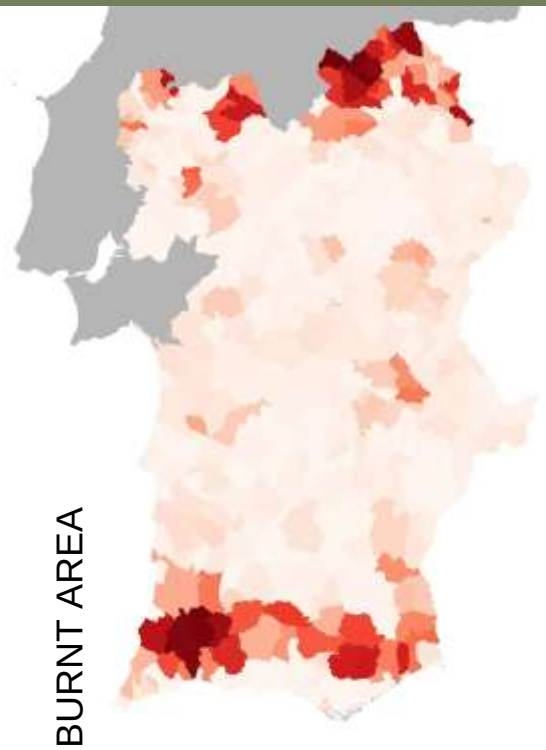
Landscape diversity and fire hazard

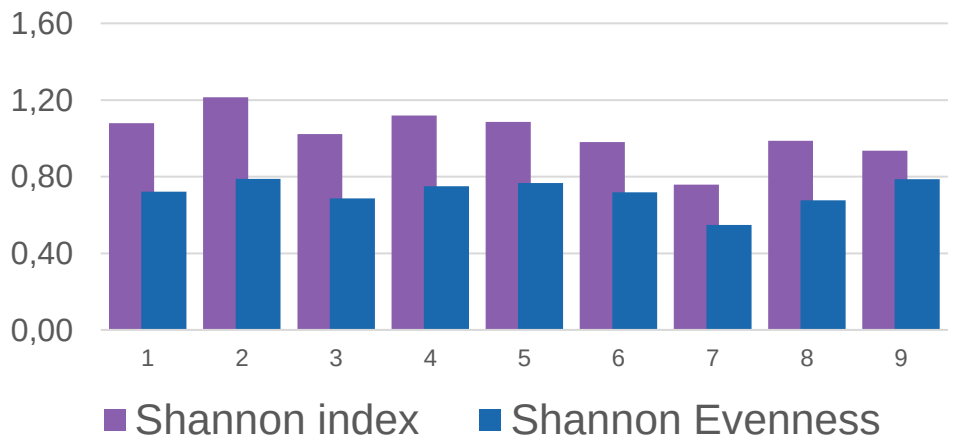
Farming System	N	Productive intensity (€/ha) (VPPT/SAU)	Burnt area	Richness	Shannon index	Shannon Evenness
PASTURE BOVINES	88	502	10,1%	4	1,08	0,72
PASTURES OVINES AND BOVINES	91	579	13,7%	5	1,21	0,79
MIXED CROP/LIVESTOCK	121	899	9,4%	4	1,02	0,69
MILK PRODUCTION	18	1 601	15,9%	4	1,12	0,75
RICE PRODUCTION	8	1 737	12,4%	4	1,09	0,77
FRUIT TREES	51	1 971	12,8%	4	0,98	0,72
ARABLE CROPS	39	2 383	5,5%	4	0,76	0,55
MIXED PERMANENT CROPS	45	2 585	11,6%	4	0,99	0,68
HORTICULTURE	7	4 960	1,4%	4	0,94	0,79

Landscape diversity and fire hazard

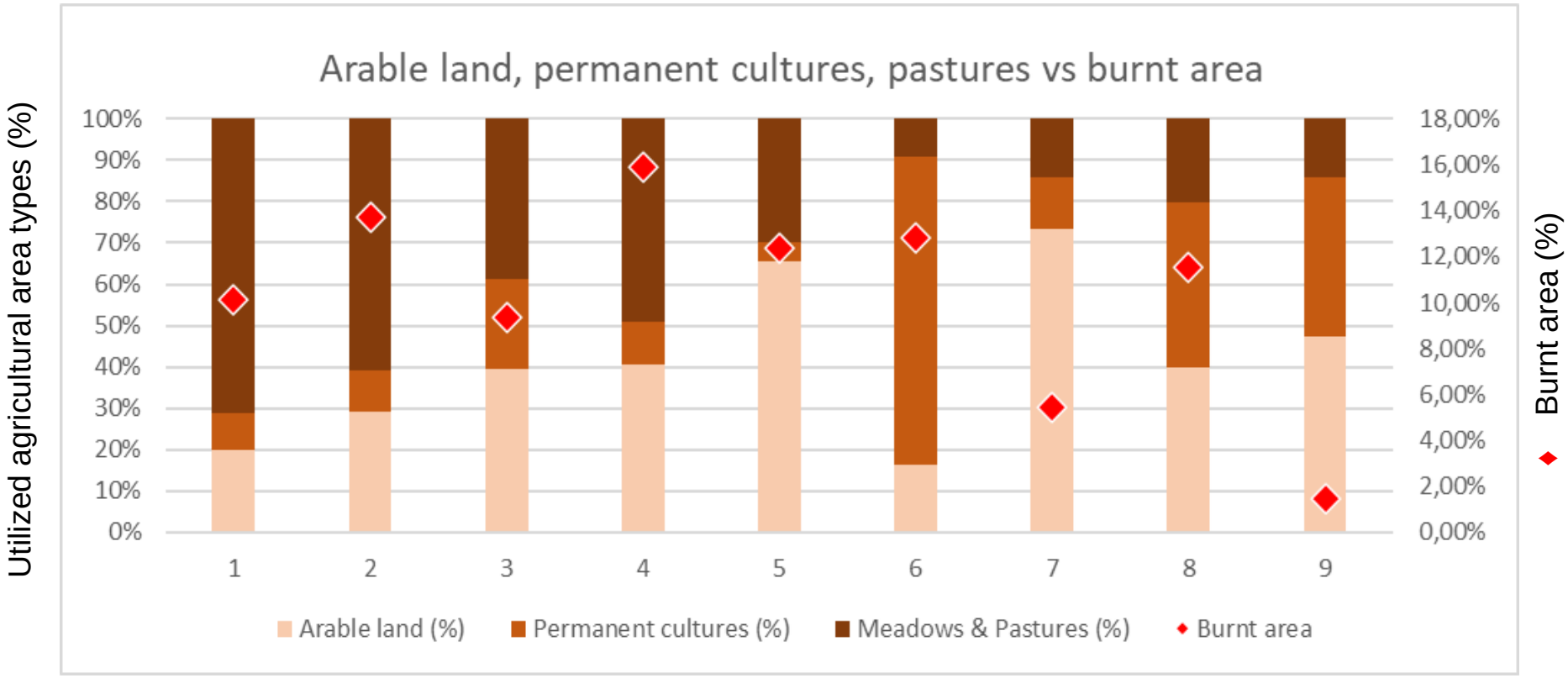




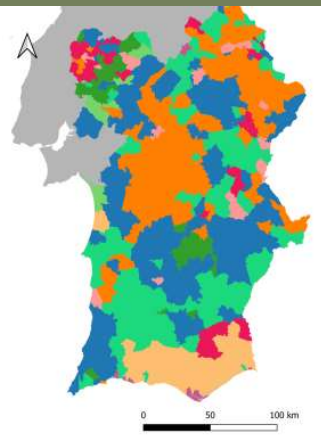




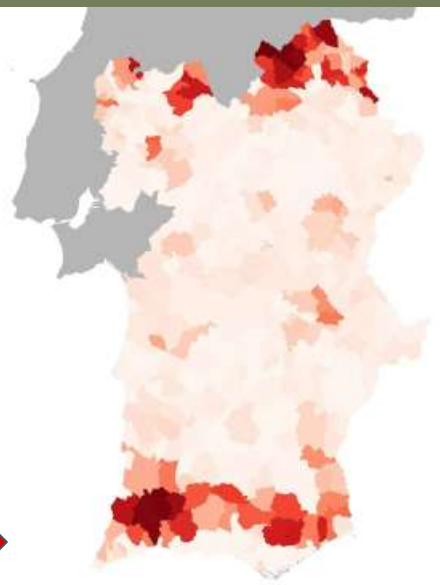
Utilized agricultural area and fire hazard



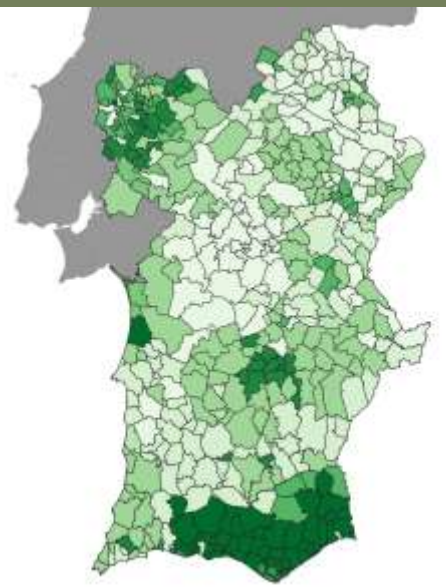
Farming systems and fire



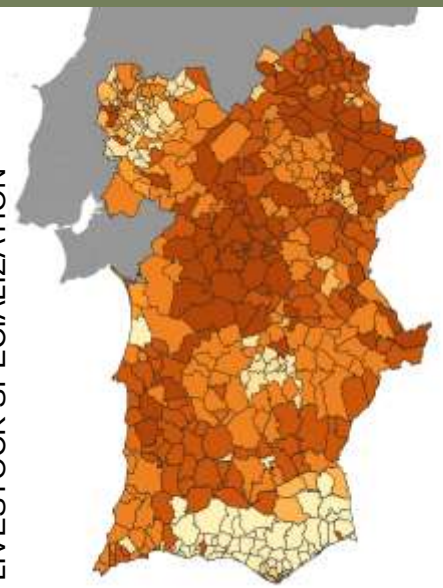
- Bovine pastures
- Bovine and ovine pastures
- Mixed crops and livestock
- Milk production
- Rice production
- Fruit trees
- Arable crops
- Mixed permanent crops
- Horticulture



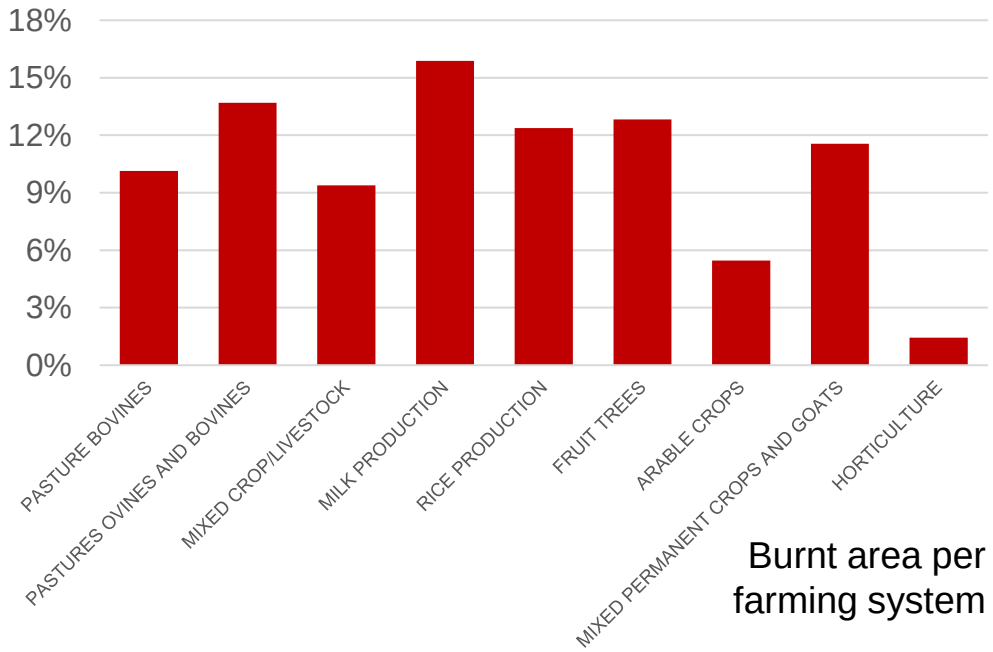
CROP SPECIALIZATION



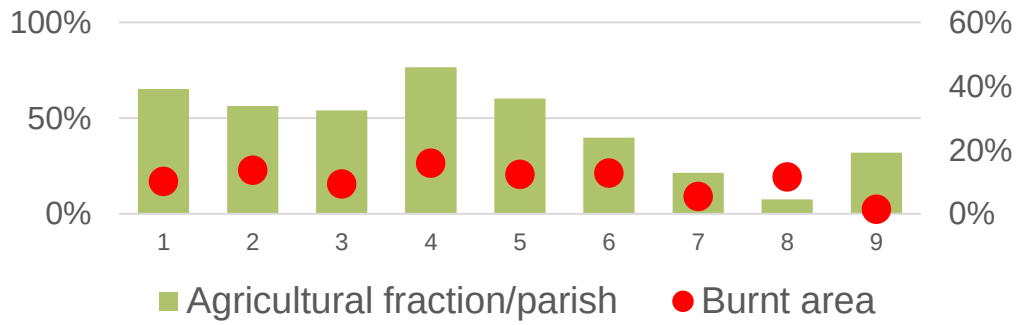
LIVESTOCK SPECIALIZATION



INTENSIVE



Burnt area per farming system



Agricultural fraction vs Burnt area

Thank you!

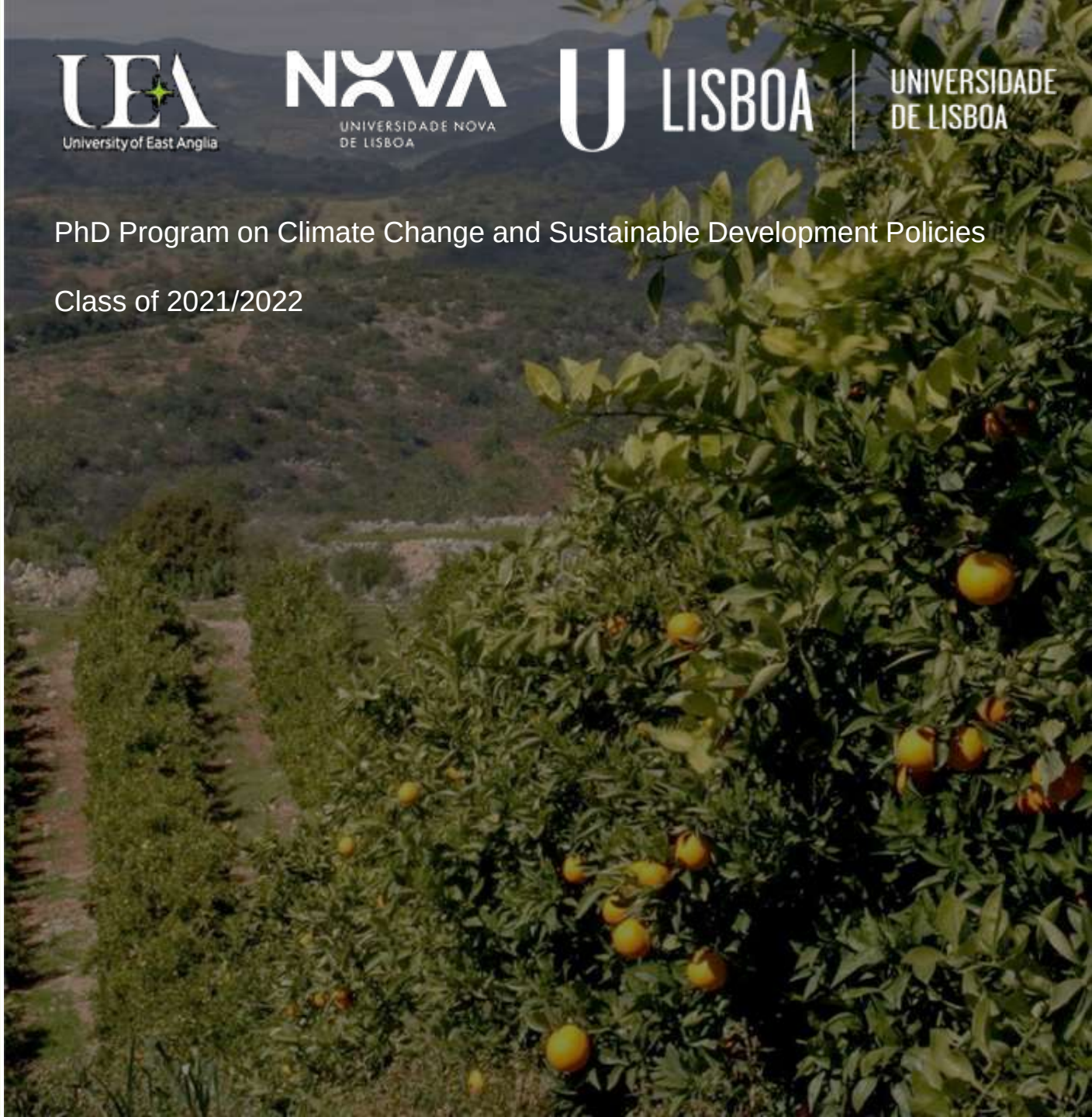
Mariana Campista **Chagas**

Sofia **Cordeiro**

Vanessa Azevedo **Domingos**

Beatriz Costa **Oliveira**

Miguel Silva **Rodrigues**



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