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Delimitation of BIOBIO Case Study Regions and the Selection of Case Study Farms

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Delimitation of BIOBIO Case Study Regions and the Selection of Case Study Farms

Final Version of Report

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INTRODUCTION

The EU FP7 research project BIOBIO - *Indicators for biodiversity in organic and low-input farming systems* aims at developing scientifically sound, useful and attractive biodiversity indicators for organic and low-input farming in Europe. In the first project phase, possible indicators for genetic, species and habitat diversity as well as for farm management practices were screened for their scientific soundness and ranked by stakeholders for their usefulness and attractiveness in WP2 (BIOBIO Deliverable 2.1, Dennis et al., 2009). This exercise resulted in a list of candidate indicators to be field tested. To this end, 12 case study regions were selected across Europe. The purpose of the case studies is to test the viability of the BIOBIO candidate indicators and the practical feasibility of indicator measurement in field surveys.

The current report (BIOBIO deliverable D3.1) summarises the characteristics of the case study regions and documents the process of selecting BioBio case study farms in each region. Eventually 10 to 20 farms per region were identified for a detailed assessment of biodiversity indicators in 2010.

Developing biodiversity indicators for organic and low-input farming systems is the overall research objective for BioBio. Figure 1 conceptualises the approach with respect to those two categories.

Organic and low-input farming systems are expected to have less environmental impact than intensive agriculture, which is dependent on the standard use of pesticides and inorganic nutrient applications in the production of crops and animals. Organic farming has been defined by the European Union as *"…an overall system of farm management and food production that combines best environmental practices, a high level of biodiversity, the preservation of natural resources, the application of high animal welfare standards and a production method in line with the preference of certain consumers for products produced using natural substances and processes."* (EC Regulation 834/2007).

Beside organic farming systems, low-input farming systems (LIFS) are found all across Europe. "LIFS can be defined as a way to optimise the management and use of internal production inputs (i.e., on-farm resources) ... and to minimise the use of production inputs (i.e., off-farm resources), such as purchased fertilisers and pesticides, wherever and whenever feasible and practicable, to lower production costs, to avoid pollution of surface and groundwater, to reduce pesticide residues in food, to reduce a farmer's overall risk, and to increase both short- and long- term farm profitability" (Parr et al. 1990). LIFS are often located in marginal areas or in areas which are at risk of marginalisation due to unfavourable natural conditions for agriculture. Frequently LIFS in Europe are grazing systems. The concept of BIOBIO accounts for this by including two pastoral and one silvopastoral system as low-input farming case studies. In those regions, the major part of farm holdings qualifies as low-input farming and this will also affect the occurrence and ecological quality of unfarmed habitats (e.g. hedgerows).

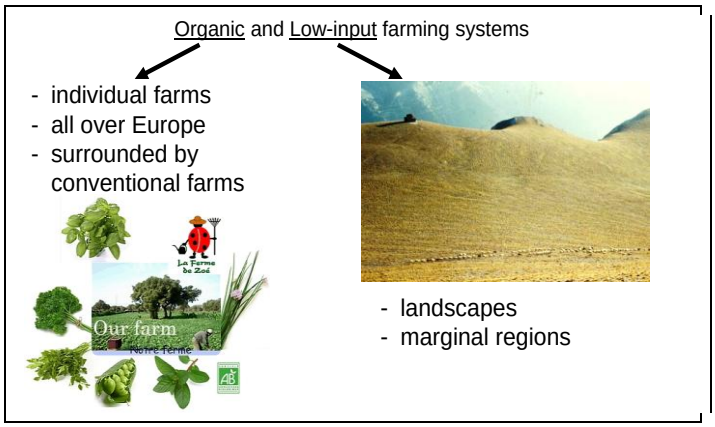

Figure 1 Conceptual difference between organic and low-input farming systems

DELIMITATION OF CASE STUDY REGIONS

BIOBIO case study regions have been selected to reflect major organic and low-input farming systems according to their relative importance and distribution across Europe. Based on the HNV farmland method (Andersen et al. 2003) and on statistical sources (EUROSTAT, Organic Farming in Europe – Country reports http://www.organic-europe.net/) case study regions representing the main farming systems and the variability of farming systems were selected (TABLE 1,2,3; Figure 2).

TABLE 1 Overview of BIOBIO Case Study Regions

No.	Code	European BioBio Case Studies		Case Study Design [1)]
1	A_ARA	Austria	Arable farming system (Marchfeld)	org/conv
2	F_ARA	France	Arable farming system (Gascony)	org/conv
3	D_MIX	Germany	Mixed farming systems (Southern Bavaria)	org/conv
4	B_GRA	Bulgaria	Semi-natural low-input grassland (Rhodope mountains)	low-input
5	H_GRA	Hungary	Semi-natural low-input grassland (Homokhatsag)	low-input
6	N_GRA	Norway	Grassland with sheep (Hedmark)	org/conv
7	C_GRA	Switzerland	Mountain grassland with cattle (Swiss Alps)	org/conv
8	W_GRA	United Kingdom	Mountain grassland with sheep or cattle or mixed upland farming (Wales)	org/conv
9	E_DEH	Spain	Mediterranean low-input dryland tree crops (Extremadura)	low-input
10	E_OLI	Spain	Olive plantations (Extremadura)	org/conv
11	L_HOR	The Netherlands	Horticulture	org/conv
12	I_VIN	Italy	Vineyards (Veneto)	org/conv

[1)] Case Study Designs:
org/conv = Organic and conventional farms (comparison).
low-input = low-input farms differentiated by a gradient of farming intensity

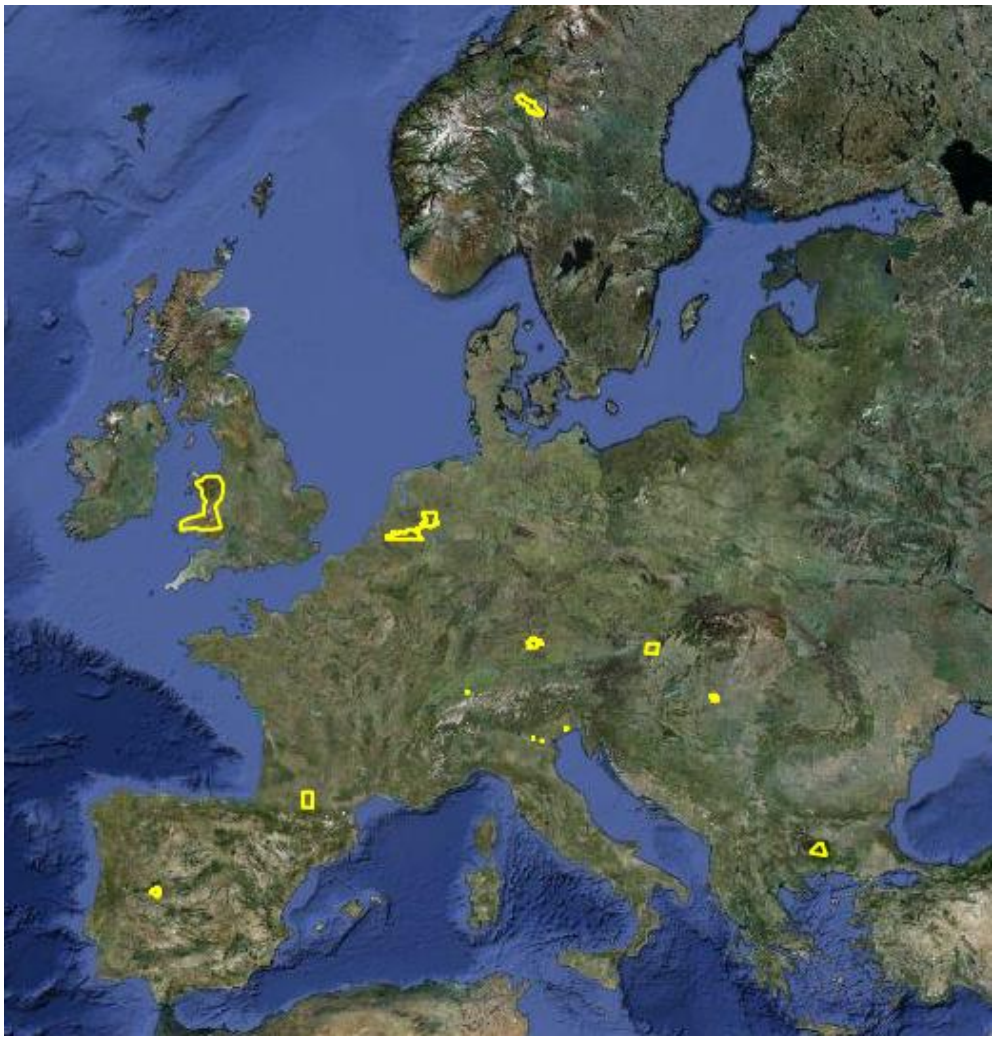

Figure 2 Map indicating the location of the 12 European case study regions.

TABLE 2 Bounding box latitude/longitude coordinates of case studies in decimal degrees

No.	Code	minlat	maxlat	minlong	maxlong
1	A_ARA	48.09	48.41	16.47	17.01
2	F_ARA	43.13	43.65	0.58	1.07
3	D_MIX	48.26	48.55	11.00	11.70
4	B_GRA	41.48	41.92	24.08	24.78
5	H_GRA	46.61	46.80	19.39	19.78
6	N_GRA	62.14	62.60	10.47	11.70
7	C_GRA	46.86	46.91	8.16	8.24
8	W_GRA	51.76	53.28	-4.98	-3.06
9	E_DEH	40.06	40.36	-6.39	-5.95
10	E_OLI	40.06	40.36	-6.39	-5.95
11	L_HOR	51.50	52.27	4.45	6.83
12	I_VIN	45.32	45.76	11.22	12.81

TABLE 3 Characterisation of BioBio Case study regions based on LANMAP classification system for climate, parent material and land cover (LANMAP2)

	Case study code	Climate	% Area	Parent Material	% Area	Land cover	% Area
1	**A_ARA**	Pannonian	100	Soft loam	74	Arable land	98
				River alluvium	26	Artificial surfaces	2
2	**F_ARA**	Mediterranean North	100	Calcereous rocks	76	Arable land	77
		Mediterranean Mountains	<1	River alluvium	14	Heterogeneous agric. areas	23
				Detrital formations	10		
3	**D_MIX**	Continental	100	Soft loam	97	Arable land	99
				River alluvium	3	Forest	1
4	**B_GRA**	Continental	87	Crystalline rocks and migmatites	72	Forest	100
		Mediterranean Mountains	13	Calcereous rocks	28		
5	**H_GRA**	Pannonian	100	Sands	100	Arable land	58
						Forest	40
						Heterogeneous agric. areas	3
6	**N_GRA**	Boreal	100	Glaciofluvial deposites	100	Forest	20
						Shrubs & herbaceous vegetation	80
7	**C_GRA**	Alpine North	100	Crystalline rocks and migmatites	86	Open spaces with little or no veg.	100
				Soft clayey materials	14		
8	**W_GRA**	Atlantic North	74	Crystalline rocks and migmatites	79	Pastures	62
		Atlantic Central	26	Glaciofluvial deposites	19	Shrubs & herbaceous vegetation	38
				Sandstone	3		
9 & 10	**E_OLI & E_DEH**	Mediterranean South	80	Crystalline rocks and migmatites	88	Shrubs & herbaceous vegetation	88
		Mediterranean North	19	River alluvium	6	Waterbodies	6
		Mediterranean Mountains	1	Glaciofluvial deposites	6	Heterogeneous agric. areas	6
11	**L_HOR**	Atlantic Central	89	Sands	85	Pastures	37
		Atlantic North	11	River alluvium	13	Arable land	2
				Soft loam	2	Artificial surfaces	2
						Heterogeneous agric. areas	59
12	**I_VIN**	Mediterranean North	90	River alluvium	62	Arable land	56
		Mediterranean Mountains	10	Sandstone	33	Heterogeneous agric. areas	44
				Glaciofluvial deposites	5		

FARM SELECTION IN CASE STUDY REGIONS – GENERAL CONSIDERATIONS

In order to properly address organic and low-input farming systems in the BIOBIO project, each BIOBIO case study had to be in line with either of two case study designs guiding the process of farm selection.

Case study design " Indicators for organic farming systems"

For each case study region, 8 to 10 organic farms were to be selected. In order to judge the validity of the indicators and to possibly span a gradient of management intensity, 8 to 10 conventional farms were also to be selected. The basic assumption was that the two strata "organic" and "conventional" are differentiated by farm management practices that affect biodiversity such as the use of mineral fertiliser and pesticides, restrictions in livestock density and external fodder purchase etc.

To qualify as a BioBio case study farm, an "organic" farm needed to have been certified since 2005, i.e. it must have been continuously managed according to standards of organic farming for a minimum of 5 years.

For the comparison of organic and conventional farms, we used stratified sampling: Farms were sampled in two strata, i.e. "organic" and "conventional". Two options were considered for the stratified sampling design:

	Randomized design (one-way layout)	Randomized block design
Selection of farms	takes place at random in the region One main factor, i.e. organic vs. conventional	takes place pair wise in sites (= blocks) to control for environmental heterogeneity: for each site there is 1 organic and 1 conventional farm. One main factor, i.e. organic vs. conventional, and the block
Advantages	Does not imply any consideration about environmental heterogeneity in the selection of farms	Controls for environmental heterogeneity, e.g. altitude
Disadvantages	May require a great deal more replications to achieve the same statistical power than the randomized block design when environmental heterogeneity is present	Implies consideration about environmental heterogeneity, e.g. altitude, in the selection of farms and can make the selection of farms in pairs difficult
Conditions	None except the obligatory conditions mentioned above	Pairs of farms (blocks) have to be found in the same environmental conditions, i.e. usually close to each other, at same altitude, etc.

At the WP3 workshop in Vienna, the situation in each case study region was discussed based on the preliminary analysis performed by each case study partner. It was concluded that the general sampling strategy in the comparison of organic and conventional farms should be the randomized design because this method is less susceptible to subjective or biased decisions.

3 BioBio Case Studies adopted the randomized block design due to the following reasons:

- W_GRA, Mountain Grassland, Wales, UK: The case study region is along a geographical and intensity gradient which makes it difficult to get an unbiased subset by random sampling of 10 + 10 farms only.
- N_GRA, Grassland, Norway: Organic farms were chosen randomly. Conventional farms were chosen in the same municipalities to avoid biogeographical variation.
- I_VIN, Vineyards, Italy: Case studies had to be performed in 3 separate areas because there were not enough organic farmers for BioBio within one single area. Efforts were made to select pairs of organic and conventional farms located in a homogeneous area.

Case study design "Low-input farms differentiated by farming intensity"

For each case study, one or two significant variables were chosen to define an intensity gradient for farm selection. Initially systematic sampling was considered; i.e. ordering farms along the intensity gradient and selecting at regular intervals. However, it became apparent that farm numbers were generally too small to take this approach. Therefore, randomised sampling was applied within a subset of farms that indicated reasonably large variation in the chosen variables.

Indicators of farming intensity in BIOBIO low-input case studies were suggested as follows:

- E_DEH Dehesas, Spain: Livestock density. Farm Size. Density of tree cover. Existence of shrub understorey.
- H_GRA Low-input grassland, Hungary: Livestock density
- B_GRA Low-input grassland, Bulgaria: Livestock density

Variation in sample size: Farm numbers per case study

The number of farms selected in both designs (organic/conventional and low-input) varied by case study. This is because the effort needed for farm visits and field surveys depends on local circumstances such as the size of the case study region, the farm size, the distribution of fields and the diversity of habitats. Generally, BIOBIO aims at a sample size of 20 farms per case study region with the option of reducing to 16 farms or ever less, if the effort for field assessment is not matching the allocated resources. Attention was paid to an even distribution of farms with regard to farming intensity in the final selection (equal numbers of organic and conventional farms; even distribution along the intensity gradient).

Three BioBio Case Studies operate with sample sizes of less than 16 farms:

- E_DEH Dehesas, Spain: Due to the large size of the farms (up to 1000 ha) the number of case study farms was limited to 10.
- L_HOR Horticulture, The Netherlands: During the selection process in March/April only 5 conventional farmers could be convinced to participate in the project. Therefore, the final selection comprises 5 conventional and 10 organic farms.
- N_GRA Grasslands, Norway: Due to the very short field season and relatively high number of plots per farm, the number of farms was reduced to 12 to ensure that three full rounds of recording could be achieved for both spiders and bees.

1.1. DEFINITION OF SELECTION CRITERIA

To ensure a sufficiently homogenous sample, additional selection criteria and factors to control for were discussed.

As far as possible, the factor of interest, i.e. the farming system, should not be confounded with other factors known to potentially affect biodiversity. When analysing the data, a possible difference between organic and conventional farms in terms of biodiversity should clearly be attributable to the farming system and not to other "confounding factors".

In BIOBIO, two sets of potentially confounding factors can be identified.

1) Environmental conditions:

biogeographical region, geomorphologic and soil features, landscape situation, altitude.

Preconditions for farm selection are:

- All farms should be in the same biogeographical region. Borders or overlap with other biogeographical regions should be avoided.
- There should be no major differences in geomorphologic or soil features. Generally they have similar soil types (TABLE 3).
- Regions or sites in particular situations should be avoided, e.g. city borders, island in forest, nature conservation areas at proximity, neighbourhood of major infrastructure (airports, motorways etc.).
- All farms should occur at the same altitude or, where farming systems are characterised by having fields at different altitudes, the case study farms should span the same range of altitudes.

2) Farm characteristics - type of farm (crops, forage, mixed farming, animal species)

Preconditions for farm selection are:

- All farms should be of the same type (crops, forage, mixed farming, animal species).

1.2. TIME SCHEDULE OF THE SELECTION PROCESS

Definition of selection criteria and options for sampling design	November 2009
Draft of a farm selection questionnaire (Questionnaire 1)	November 2009
Preliminary analysis of farms in each case study region	November/December 2009
WP3 Workshop Vienna Presentation of results of preliminary farm analysis Decision on selection criteria and sampling designs	15- 16 December 2009
Contacting and selecting case study farms	January – April 2010

Deviation from the Document of Work and Justifications

At the WP3 Workshop in Vienna it became evident that most partners had sufficient information from official statistics about the farms in their regions. Therefore, interviews with farmers based on a common questionnaire prior to the actual selection were discarded. Each partner decided individually which additional information was needed from interviews with farmers during the selection process (e.g. confirming existing data, exploring willingness of farmers etc.).

The application of the drafted BioBio farm selection questionnaire (questionnaire 1) was not required. But it was retained as a guideline for the identification of an intensity gradient for low-input case studies.

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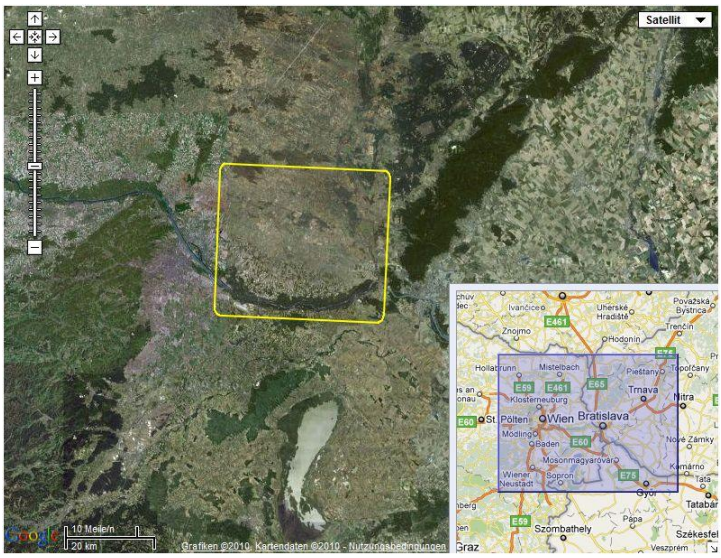
FARM SELECTION IN INDIVIDUAL CASE STUDY REGIONS

1.4. A_ARA Organic Arable Farming Systems, Marchfeld, Austria

Geographical delimitation, geomorphology and climate

The case study region "Marchfeld" is situated in the Eastern lowlands of Austria. It comprises approx. 1000 km^2 and is situated at 140 to 180 m above sea level (Fuchs, 2001).



The most common soil types are deep, fertile chernozem soils on loess and silty loam fine sediment or lighter, drier chernozems on calcareous sands (in Lassee and Aspacherfeld). Former wetlands are characterized by peaty soils and Gleysols (Rischbeck, 2007).

The Pannonian climate is characterised by an annual average temperature of 9.5°C (Minimum -30 °C, Maximum +35°C). The average total annual precipitation is 560 mm. During the growing season evaporation exceeds precipitation (Fuchs, 2001; Freyer et. al., 2000).

The Marchfeld is an intensively farmed cultivated landscape. Arable land use is prevailing. Hedges and wind belts are characteristic elements in the, otherwise, poorly structured landscape. Other landscape elements are afforested areas, small islands of natural deciduous forests as well as sand dunes and gravel pits in the sandy soil zone. Zones along the rivers (riparian forests, wetlands, agriculturally used land) were deliberately excluded as potential BioBio case study sites due to the differences in environmental conditions and land use pattern from the core parts of the Marchfeld (Freyer et al., 2000).

Farming structure

The Marchfeld is one of the major agricultural production zones for cereals and vegetables in Austria. More than 77 % of the total area is used for arable farming. The utilisation of agricultural land is shown in TABLE 4.

TABLE 4 Cropping on arable fields in the Marchfeld case study region.

Crop Category	% UAA**
Bread cereal	40%.
Field vegetables	13%
Feed grain	10%
Root crops	9%
Oil seed crops	5%
Maize	4%
Fallow	5%

**UAA: utilised agricultural area

The production zone is characterised by large scale farming and implies a high degree of mechanisation. Irrigation is routinely applied in vegetable production, but also in certain arable crops such as sugar beet, potato and maize. In 2007, 8 % of the cash crop farms in the Marchfeld were producing according to standards of organic farming (INVEKOS, 2007).

Criteria for farm selection

Based on the official agricultural statistics of the Austrian Ministry of Agriculture (INVEKOS) the identification of potential BioBio farms followed a step-wise approach (TABLE 5) by subsequently applying filtering criteria as follows:

- arable cash crop farms
- differentiation between conventional and organic farms
- conversion to organic farming in 2005 or earlier
- Surface area of field vegetable production below 10%
- livestock units less than 0.02 LU.ha-1 -> Random selection

TABLE 5 Summary of the filtering process from Austrian agricultural statistics (INVEKOS 2007).

Filtering criteria	Organic farms				Conventional farms			
		Farm size (ha)				Farm size (ha)		
	Number	Average	Min	Max	Number	Average	Min	Max
Cash crops farms	62	60.65	4.74	204.34	782	63.58	0.73	1088.91
Vegetables on < 10 % of UAA	26	68.56	4.74	204.34	451	53.18	0.73	749.80
Livestock < 0.02 LU/ha	23	72.80	5.56	204.34	389	61.66	0.73	1088.91
Final selection	**8**	**70.84**	**19.73**	**142.98**	**8**	**74.61**	**38.37**	**97.28**

Identification of case study farms

Subsequent to the pre-selection of potential BIOBIO case study farms, farmers were contacted by mail. They received information about the BIOBIO project (aims and implementation of field work). Subsequently each farmer was contacted by telephone. An interview based on a questionnaire was performed to confirm farm data (crops, year of conversion, status "organic' or 'conventional') and explore the availability of farm management data. An important aspect was to motivate farmers to participate in the BIOBIO project.

In total all 23 organic farms and 69 conventional farms were contacted. Conventional farms were randomly selected from the sub-sample of 389 farms meeting the selection criteria. From the sub-samples after the telephone interviews (confirmed farm data, readiness to participate) 10 organic and 10 conventional farms were randomly selected for the BIOBIO project. During the first phase of the BioBio field survey (habitat mapping and earthworm sampling), it became evident that it is reasonable to narrow down the sampling size of BioBio farms to 16 farms (8 organic, 8 conventional) in order match the sampling programme and the resources within the BioBio work package.

Description of case study farms

The selected samples of 8 organic and 8 conventional case study farms are comparable with regard to their average farm size: 70.84 ha (organic farms) and 74.61 ha (conventional farms) (TABLE 5). Compared to the average farm size of 60.1 ha for the Marchfeld area, more medium-sized and large farms tend to be represented in the BIOBIO sample.

TABLE 6 depicts the share of crops by categories on the 8 conventional and 8 organic case study farms in the case study region Marchfeld. The average mean of each crop group is of similar dimensions in both farming systems and corresponds to the cropping pattern of the area in general(TABLE 4). The main crops are bread and feed grain, making up approx. 45 to 50 % of the utilised agricultural area (UAA).

TABLE 6 Crop categories on the selected BioBio case study farms by farm type.

	% UAA (average of 8 farms each)	
	organic farms	conventional farms
Bread cereal	35.23	36.18
Feed grain	10.22	13.56
Protein crops	7.44	5.34
Oilseed crops	6.54	5.03
Field vegetables	5.97	3.74
Forage crops	13.66	2.06
Potatoes	1.53	5.32
Root crops	1.40	10.25
Maize	10.64	5.26
Fallow land	5.27	6.13
Other areas **	2.08	7.12

** Miscellaneous INVEKOS crop categories: other arable land, permanent grassland, wood fuel plantation, forest area, fruit plantation, vineyards

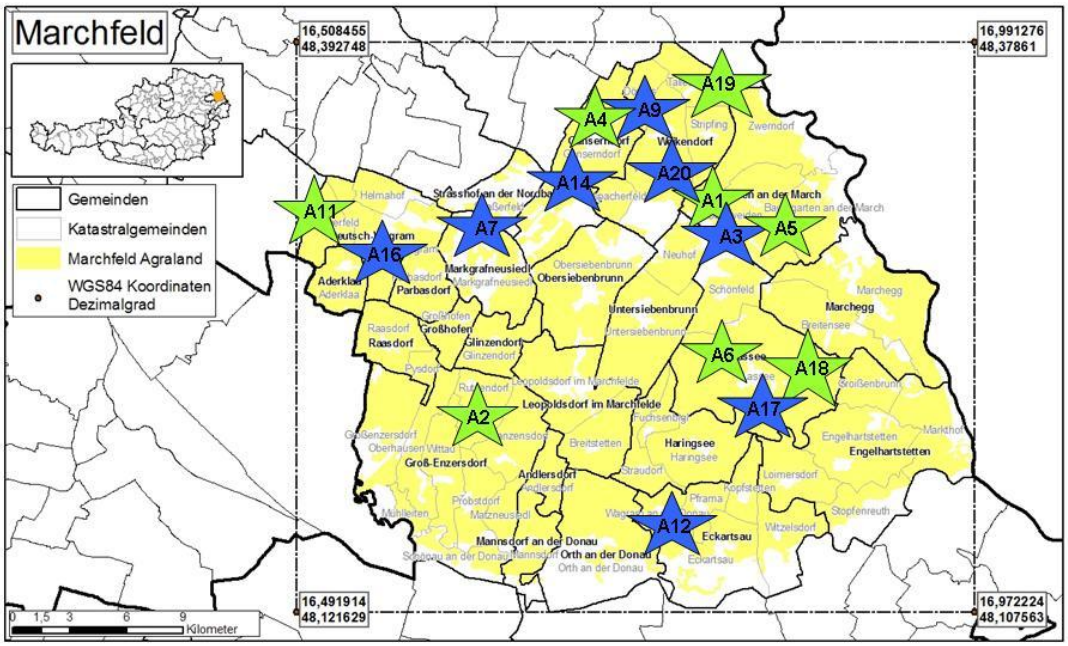


Figure 3 Distribution of 8 organic (green) and 8 conventional (dark blue) farms in the Marchfeld case study region.

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1.5. F_ARA Organic arable farming systems, Gascogne, France

Geographical delimitation, geomorphology and climate

Administrative boundaries: Midi-Pyrénées, Haute Garonne (FR 626) and Gers (FR 624)

The municipalities of the case study sites are situated between 197 m and 373 m.a.s.l.. Soils are characterized by clay-limestone hillsides.

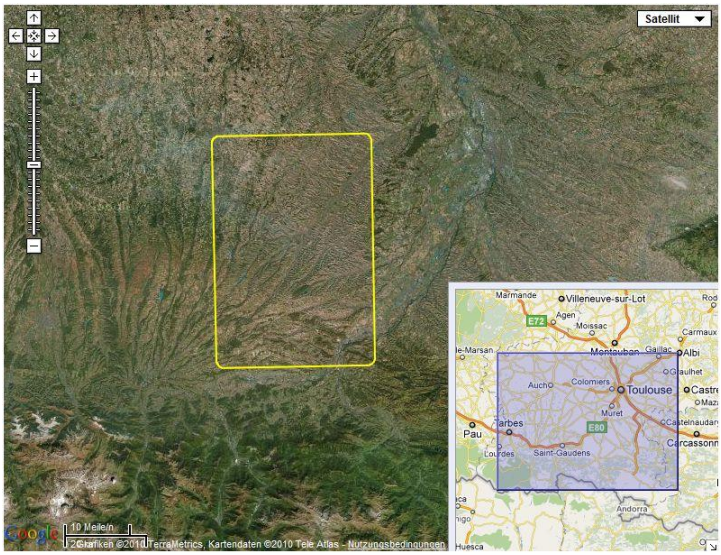

TABLE 7 Climate 2009– St André (source INRA).

Temperature			**Rainfall**	
Average	minimum	maximum	Total rain	Number of rain days
12.95°C	-8.47°C	38.9°C	680.6 mm	176

Farming structure

There are more than 18,000 farms in the 2 departments of Gers and Haute-Garonne. The average size of the farms is 45 ha with a great heterogeneity (TABLE 8).

TABLE 8 Farm size (year 2000, 2 Departments).

	Gers	Haute-Garonne	Gers	Haute-Garonne	Gers	Haute-Garonne
	N° Farms		Total area (ha)		Average Size (ha)	
Total n° farms	9632	8458	461947	346035	48,0	40,9
Less than 5 ha	1458	1985	3167	4106	2,2	2,1
5 - less than 20 ha	1596	2002	19612	23364	12,3	11,7
20 - less than 35 ha	1584	1262	43316	33741	27,3	26,7
35 - less than 50 ha	1333	861	56076	36062	42,1	41,9
50 - less than 75 ha	1672	892	102138	53981	61,1	60,5
75 - less than 100 ha	912	540	78456	46559	86,0	86,2
100 - less than 125 ha	485	333	53686	37014	110,7	111,2
125 - less than 150 ha	236	196	32089	26615	136,0	135,8
150 - less than 200 ha	226	206	38920	35485	172,2	172,3
200 - less than 300 ha	104	137	25091	32730	241,3	238,9
more than 300 ha	26	44	9396	16379	361,4	372,3

Source: Ministry of Agriculture (SSP) - Farm Structure Survey

Wheat, maize and sunflower are the main crops. They represent 83% of the cultivated area (TABLE 9).

TABLE 9 Area and yield of the crops (year 2008, 2 Departments).

Crops	Area (ha)	yield (tonnes/ha)
Common wheat	123780	5.80
Durum wheat	93990	5.05
Barley and winter barley	26480	5.25
Oats	2280	3.95
Maize	95870	9.65
Sorghum	7620	6.30
Triticale	6350	4.45
Rapeseed	33400	3.35
Sunflower	130160	2.55
Soybean	7030	3.00
Field beans (and broad beans)	1640	1.60
Field pea	4000	2.60

Agreste Midi-Pyrenees in June 2009

Criteria for farm selection

The selection was made following these criteria:

- Hills (farms located only on irrigated plains were not considered)
- No livestock
- For organic farms, the first organic harvest's date (2003 minimum)

Identification of case study farms

Organic farms:

We identified and selected 33 farms thanks to the extension services and the organic agency directory (Agence Bio). We then did a phone survey (questionnaire 1) with 20 farmers.

Conventional farms

We selected 33 farms after a selection based on crop areas and farming systems (see above) and M Jean-Pierre Sarthou's contacts. 5 farmers were selected from the Dynafor database and M Sarthou contacted 5 others to know if they agreed to participate to the program.

Description of case study farms

General presentation

Agriculture is the main income resource for 70% of the farmers. Half of the organic farmers sell their products directly, while conventional farmers sell 100% to the cooperative.

In the organic farms, one out of ten farmers uses irrigation (on 80 ha) and in conventional farms there are 2 farmers out of ten who irrigate, on 50% of their surface.

In organic farms, 90% use green fertilizer and specific crop rotation (such as alfalfa). 60% use bone, feather, blood and liver meals. We find hedges in 90% of cases.

In conventional farms: All farmers use mineral fertilizers and 9 farmers out of 10 have no agri-environmental measures.

The area of farms ranges from 14 ha to 230 ha, 81% of the area is arable (TABLE 10).

TABLE 10 Area, arable lands, field size of organic and conventional farms.

	Organic farms			**Conventional farms**		
	Area (ha)	Arable land (ha)	Field Size (ha)	Area (ha)	Arable land (ha)	Field Size (ha)
Average	78.57	64.16	8.8	91,5	75	2.1
Minimum	18.19	11.7	0.7	14	13	4.9
Maximum	230	226	16.9	200	175	18.3

Crop production is shown in TABLE 11. The majority of farms produce wheat and sunflower. 8 crops can be found on both, organic and conventional farms. Some crops are specific for one

farm type, e.g. triticale, alfalfa/clover and spelt wheat for organic farms; sorghum, rapeseed and corn for conventional farms.

There are between 4 and 7 crops per farm.

Yields are much lower on organic farms. Differences in yields are - 20% for sunflower, -47.2%, for wheat, -54% for faba bean, -42% for oats and -44% for soya.

TABLE 11 Crop production on organic and conventional farms (number of farms and yields).

	Organic farms		**Conventional farms**	
Type Production	Number / 10**	Yield (tonnes/ha)	Number / 10**	Yield (tonnes/ha)
Wheat	**8**	2.64	**10**	4.90
Sorghum			4	4.30
Rapeseed			6	2.40
Triticale	5	2.65		
Spelt wheat	3	2.80		
Field beans	3	1.06	3	2.30
Sunflower	**6**	1.70	**9**	2.10
Oats	2	2.80	2	4.80
Soya	3	1.80	3	2.70
Peas	1		1	
Alfalfa/Clover	6		1	
Barley	6	2.60	3	4.80
Maize			3	6.80

** Number of farms out of 10 farms.

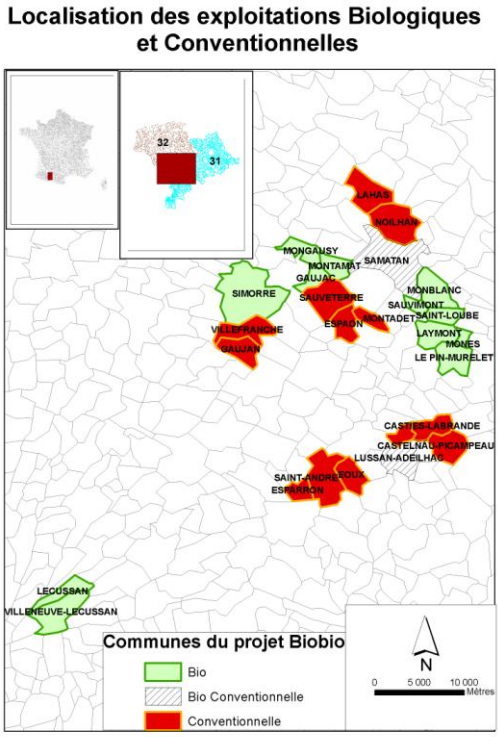

Figure 4 Localisation map of organic and conventional farms (municipalities).

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Agreste Midi-Pyrénées in June 2009

Agricultural census 2000

Bio Agency (Promotion and Development of Organic Farming) http://www.agencebio.org/

Dynafarm_coto Database

Ministry of Agriculture (SSP), France, Farm Structure Survey

BIOBIO Questionnaire 1 (v.2.2) (Telephone Interviews) (December-January)

www.lion1906.com/departements/hautegaronne

1.6. D_MIX Organic mixed farming system, Southern Bavaria, Germany

Geographical delimitation, geomorphology and climate

Area: 1064,51 km^2 Perimeter: 254,73 km

The Case Study Region is located in the south of Germany and belongs to the foothills of the Alps. The region is situated in the south-west of the Danube-Isar-Hills landscape unit, also referred to as the "Bavarian Tertiary Hillland".

The mean annual precipitation in the Case Study Region is about 800 mm per year with a maximum in June and July. The mean temperature is about 8.5°C. There can be frost from October till April. The climate is milder compared to the Munich Gravel Lowlands to the south and harsher compared to the Danube Valley to the north-east.

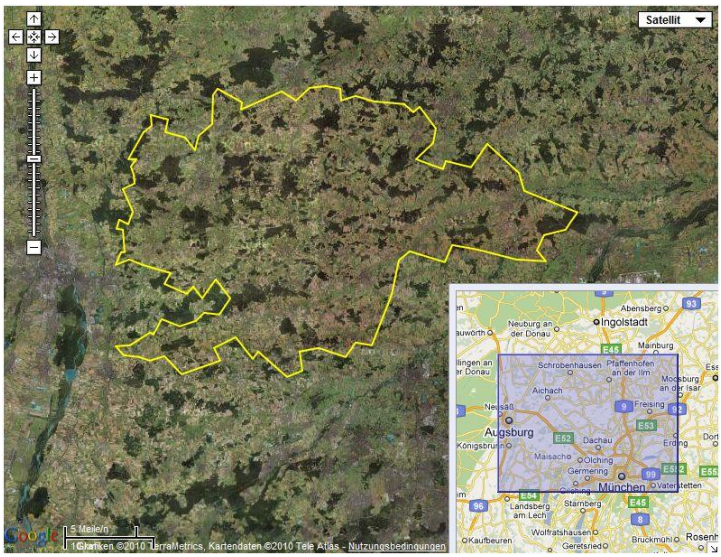

TABLE 12 Climatic Situation in the Case Study Region based on average per year Information of 3 Meteorological Stations.

Station	Hight [m NN]	Temp. (2 m) [°C]	Soil-temp. [°C]	Wind speed [m/s]	Precipi-tation [mm]	Sun hours [h]	Vegetation days (T Ø >= 5 °C)
Großberghofen	458	8.8	9.8	1.9	730	1692	240
Viehhausen	490	9	10.1	1.6	694.6	1816	238
Vogelried	485	8.3	9.9	1.5	787	1547	234

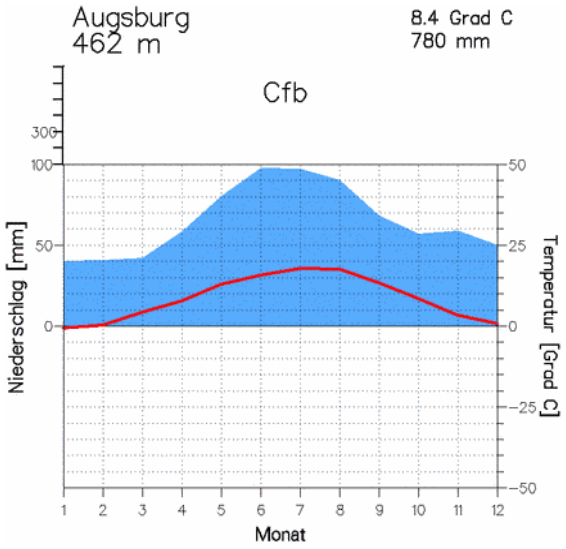

Figure 5 **Climatic diagrams of Augsburg (western border of the Case Study Region).**

The area has rolling hills with an elevation between 350 m and 500 m. The soils are "young" luvisols and cambisols. Soils consist of silt and silt loam mainly derived from loess.

In the sometimes small structured landscape, grassland is mainly found in the valleys, forests on the hills and arable fields on the slopes. The area is a cultural landscape mainly influenced by agriculture and small woody or forest patches.

The case study area is mainly agriculturally used. The high nutrient and pesticide input from agriculture is considered problematic. However, there are several other important land use types like forestry or the increasing settlement.

Farming structure

This region is typical for intensively used areas of continental Western Europe with increasing numbers of organic farms (3 % of farms). Although there was a change in the economic structure, agriculture is still an important enterprise. However the labor intensive dairy farming enterprises, which are under investigation in the German Case Study Region, are declining. Basic data on farming in the region are presented in Figure 6 to Figure 9.

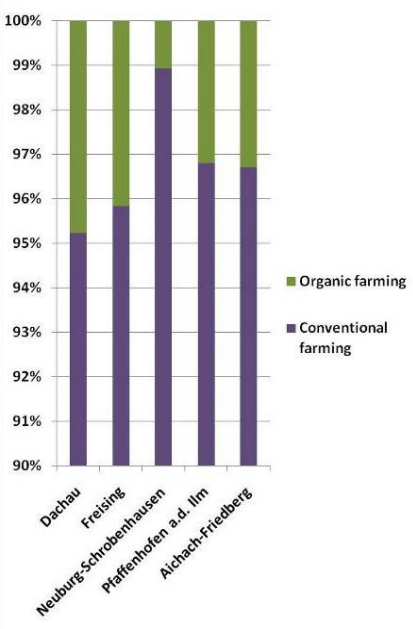

Figure 6 Proportion of organic and conventional farms based on county data

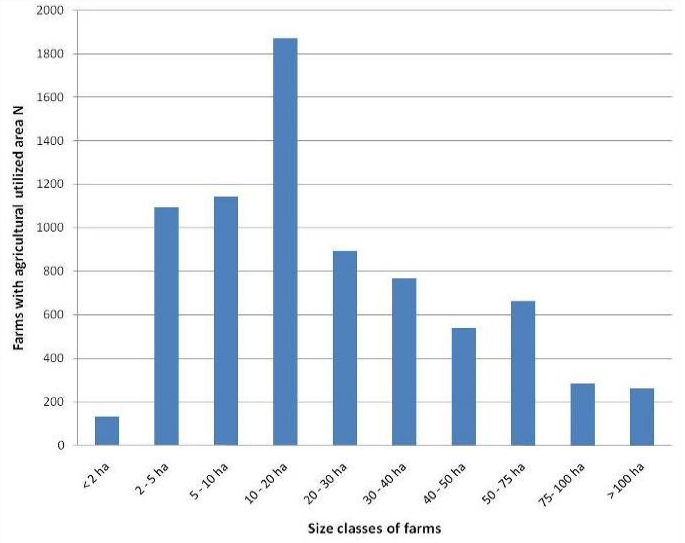

Figure 7 Distribution of farm sizes based on county data

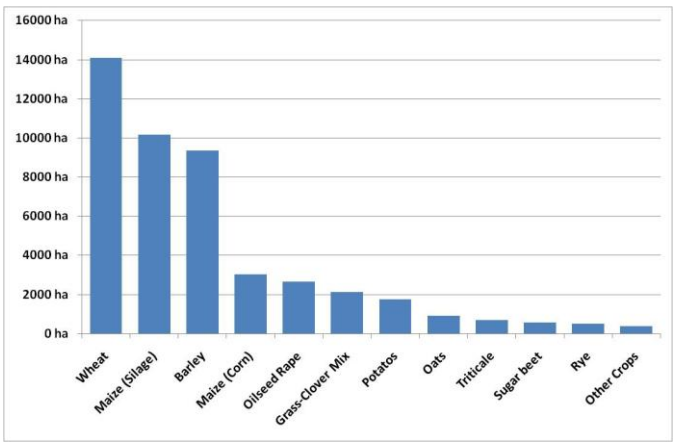

Figure 8 Crop structure and utilised agricultural area (UAA) by crops based on municipality data

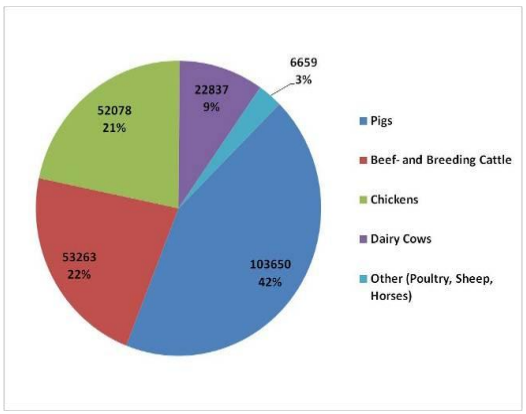

Figure 9 Livestock numbers and proportion based on municipality data

Criteria for farm selection

For the selection of the farms in the German BIOBIO Case Study Region, a stepwise approach with three stages was used to limit confounding factors for the final analyses:

1. In the first stage, a uniform landscape unit (Danube-Isar-Hills) was chosen for the Case Study
2. In the second stage, the following criteria on municipality level were used to select a homogeneous sub region of Danube-Isar-Hills municipalites for the farm selection:

- Regional Small Landscape Structure Index[1] (RKS) between 7,4 and 14,6 (mean for landscape unit ± 1 x standard deviation)
- Number of dairy cows per ha UAA > 0,15
- Proportion of vegetables per ha UAA < 2 %
- Proportion of hops per ha UAA < 5 %
- Proportion of settlement per ha UAA < 15 %
- Mean annual precipitation > 750 mm
- Not adjacent to the border of Danube-Isar-Hills landscape unit

3. In the third stage, criteria for the mixed farms that are suitable for BioBio were defined:
   - Farm enterprise is dairy production
   - Minimum of 30 % permanent grassland
   - Minimum of 30 % arable land
   - Minimum of 10 dairy cows per farm

Identification of case study farms

For the selected communities of the Case Study area basic data on all cow keeping farms were compiled and provided by the Bavarian State Research Center for Agriculture. The farms were randomly ordered. The farms on the first ranks were then contacted by the Offices for Food, Agriculture and Forestry, informed about the project and asked if they would generally take part in BIOBIO (a total of 58 farms were screened that way). The lists with the contact information were then transferred to the TUM project leader.

For a further interview and the final selection for each list the number of farms to select was chosen randomly. In the interview BIOBIO was introduced in more detail and then the following questions were asked:

- Type of enterprise: dairy or beef operation?
- Number of cows > 10?
- Description of farm enterprise and main crops?
- Amount of permanent grassland on the farm?
- Amount of arable land on the farm?
- If organic: more than 5 years since conversion?

All farms fulfilling the criteria and willing to take part were selected as BIOBIO farms. If the criteria were not met, the next farm on the list was contacted (40 farms were screened that way).

1 The German „Regional Small Landscape Structure Index" (RKS) was calculated based on municipality level land use information and provides information on the proportion of small, semi-natural landscape structures (e. g. hedges) within the municipalities' territories.

Description of farms

A total of 16 farms (8 conventional and 8 organic) were selected (see TABLE 13) for the assessment of the BIOBIO indicators. Those are all the organic dairy farms fulfilling the criteria. A detailed interview with these farmers on their parcel structure and crops in 2010 was conducted during the first contact in habitat mapping.

TABLE 13 Detailed information of the selected farms in the German case study

Farm number	Farm type	Farm-size [ha]	Parcel number	Parcel size			Mean Parcel Distance[2] [m]	Mini Convex Polygon[3] [ha]	Area Index[4] [-j- / -d-]
				Min [ha]	Max [ha]	Mean [ha]			
1	OF	88.60	31	0.03	10.42	2.86	710	369	0.24
2	OF	19.10	7	1.59	4.59	2.73	816	67	0.29
3	CF	39.70	27	0.09	6.13	1.47	4634	4129	0.01
5	CF	95.00	11	0.21	29.65	8.64	6080	1105	0.09
4	CF	76.10	29	0.42	9.55	2.63	5381	74	1.03
6	CF	18.60	14	0.39	4.70	1.33	648	103	0.18
7	CF	41.60	20	0.27	6.21	2.08	649	117	0.36
8	OF	52.40	31	0.29	11.69	1.69	1799	2572	0.02
9	OF	19.40	21	0.14	2.23	0.92	846	291	0.07
10	OF	39.10	40	0.07	2.38	0.98	902	356	0.11
11	CF	95.10	51	0.02	9.77	1.87	2822	2307	0.04
12	CF	65.30	39	0.05	4.89	1.67	1786	1643	0.04
13	CF	69.70	50	0.07	8.68	1.39	1004	1065	0.07
14	OF	51.50	23	0.02	21.06	2.24	3149	4318	0.01
15	OF	103.90	45	0.12	18.70	2.31	1684	3088	0.03
16	OF	55.90	17	0.17	12.22	3.29	470	55	1.03
Sum		**931.00**	**456**						
Mean		**58.19**	**28.5**	**0.25**	**10.18**	**2.38**	**2086**	**1354**	**0.23**

[2] The "Mean Parcel Distance" is the mean of the calculated distances between the farm site and the center of gravity of each field parcel on the farm.

[3] The "Minimum Convex Polygon" is the smallest possible area containing all the field parcels of the farm using the parcels' center of gravity for the calculation.

[4] The calculated „Area Index" is the ratio of the farms total size to the minimum convex polygon that was calculated for all the farms parcels using the parcels' center of gravity. The "area index" is a measure for the spatial aggregation of the farms parcels.

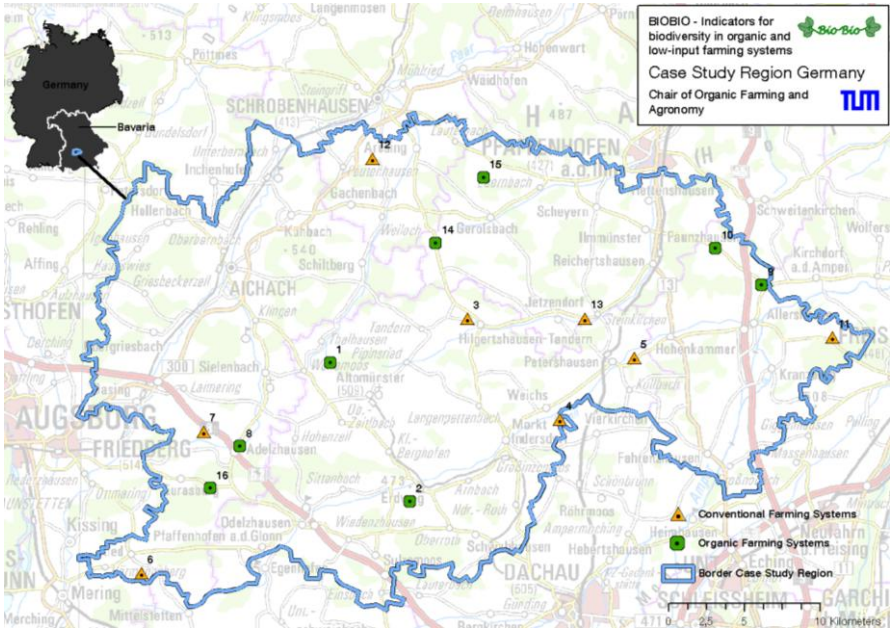

Figure 10 Overview of the case study region in Germany with BIOBIO farms

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German Remote Sensing Data Center: Corine Land Cover Information 2000

Mühr, B. 2010: Klimadiagramme von Deutschland (http://www.klimadiagramme.de/)

State Office for Land Survey and Geoinformation Bavaria (WMS data: digital Orthophotos)

Offices for Food, Agriculture and Forestry of Augsburg, Erding, Fürstenfeldbruck and Pfaffenhofen a. d. Ilm (for contact information of local farmers)

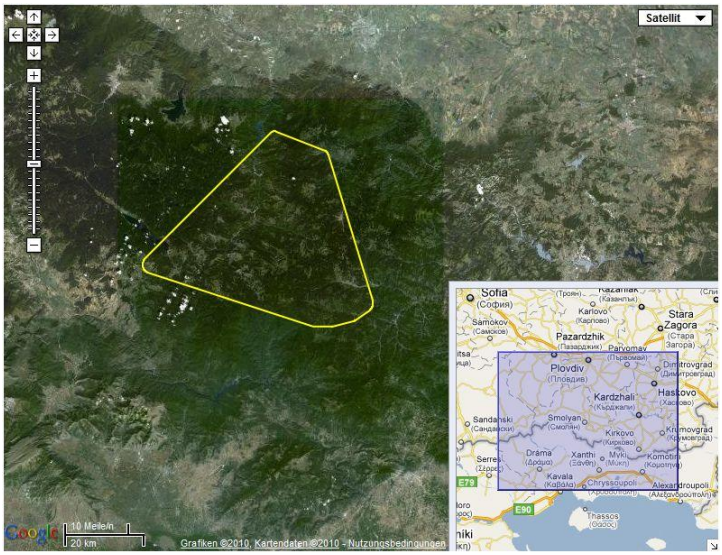
1.7. B_ GRA Semi-natural low-input grasslands in Smolyan region, Bulgaria

Geographical delimitation, geomorphology and climate

The Smolyan region is situated in South Central Region of Bulgaria, in the Rhodope mountains.

The landscape is mountainous with grasslands and woodlands (predominantly coniferous) prevailing.

Variation in altitude: 900 m to 1400m; Soil: predominantly brown forest soils; Climate: Contingent on the relief and altitude the average annual temperature in the region varies between 5°C and 10°C. The average annual rainfall is between 750 mm and 1100 mm. The average duration of snow cover is between 3 and 6 months.



Farming structure

Tourism is the priority branch in the regional economy. As a multi-sided re-creational activity, tourism influences production area, ecology, sociology and cultural traditions of the region.

About 10% of the regional economy is dedicated to agriculture, forestry and food processing. Cattle-breeding and sheep-breeding are the basis for production of various original dairy products. The farm type could be described as 'low-input farming system' because of the limited (or non existing) use of fertilization and pesticides in grasslands.

About 30% of the Smolyan region is included in NATURA 2000 – birds protected areas.

Identification of case study farms and criteria for farm selection

Preliminary information for farms was collected by direct contact with farmers during three missions carried out in July-October 2009. This information includes: name of the farmer, address, telephone for contact, area of pastures and meadows (own and rented); species and number of livestock; other economic activities that could support farmer's household (eco-tourism: rest house keeping, food production, bee keeping, etc.).

The contacts with farmers were created with assistance of the Regional service for breed registration and the experimental station of thremmatology in Smolyan. 42 farms were visited in total, of which 34 confirmed their interest in the project BIOBIO. The number of case study farms was reduced to 32 because 2 of the interviewed farmers subsequently stopped farming.

Patterns of farms were observed using as major criteria: utilised agricultural area, species and number of livestock and other farm activities.

TABLE 14 Preliminary information for farms obtained by interviews

	Farm characteristics	**Number of Farms**	**Mean**	**Min**	**Max**
1.	**Utilized agricultural area** (ha)	32	43,96	4,8	120
2.	**Type and number of livestocks**				
	Sheep	28	321	5	800
	Cattle	5	35	2	120
	Goats	4	39	4	120
	Horses	6	45	1	200
	Ancient breed *Rhodope short horn cattle*	1	13	13	-
3.	**Other economic activities on the farm**				
	Bee keeping (number of bee hives)	4	--	1	25
	Number of dogs for work and for breeding *Bulgarian shepherd dog*	32	---	2	11
	Production of cheese, butter, yoghurt and milk on farm for retail	10	---	-----	-----
	Rest house keeping	2	-	-	-

All farms in the case study region can be considered as low-input farms. However, the selected farms differ in the livestock density per area of grassland. It should be pointed out that this parameter will be used to establish an intensity gradient for further analyses.

Description of 16 low-input case study farms

16 case study farms were selected randomly among 32 farms of the preliminary farm screening. Their geographical distribution is presented in Figure 11. We suggest that the main criteria for intensity in our case study could be the type and the number of grazing livestock per grassland area.

TABLE 15 Information on the BioBio case study farms in the Bulgarian case study region

Farm No	Farm type	Grassland area, ha	Grazing livestock type	Number of grazing animals	LU per area grassland	Other economic activities
Farm 1	Low input	80	sheep	150	0.53	1; 2
Farm 2	Low input	15	cattle	11	1.36	1; 2
Farm 3	Low input	60	sheep	120	0.5	-
Farm 4	Low input	20	sheep. goats	200; 20	0.09	-
Farm 5	Low input	100	sheep. horses. goats	200; 10; 4	0.47	2
Farm 6	Low input	80	sheep. cattle	250; 87	0.24	2
Farm 7	Low input	96	sheep	800	0.12	2
Farm 8	Low input	54	sheep	160	0.34	2
Farm 9	Low input	20	sheep	220	0.09	2
Farm 10	Low input	52	sheep	190	0.27	-
Farm 11	Low input	100	sheep	250	0.40	2
Farm 12	Low input	50	sheep	240	0.21	2
Farm 13	Low input	10	cattle	13	0.76	-
Farm 14	Low input	55	sheep. horses	270. 120	0.14	2
Farm 15	Low input	10	sheep	72	0.14	2
Farm 16	Low input	98	sheep	460	0.21	2

Other economic activities: 1 – Rest house keeping, 2 – Dairy produce

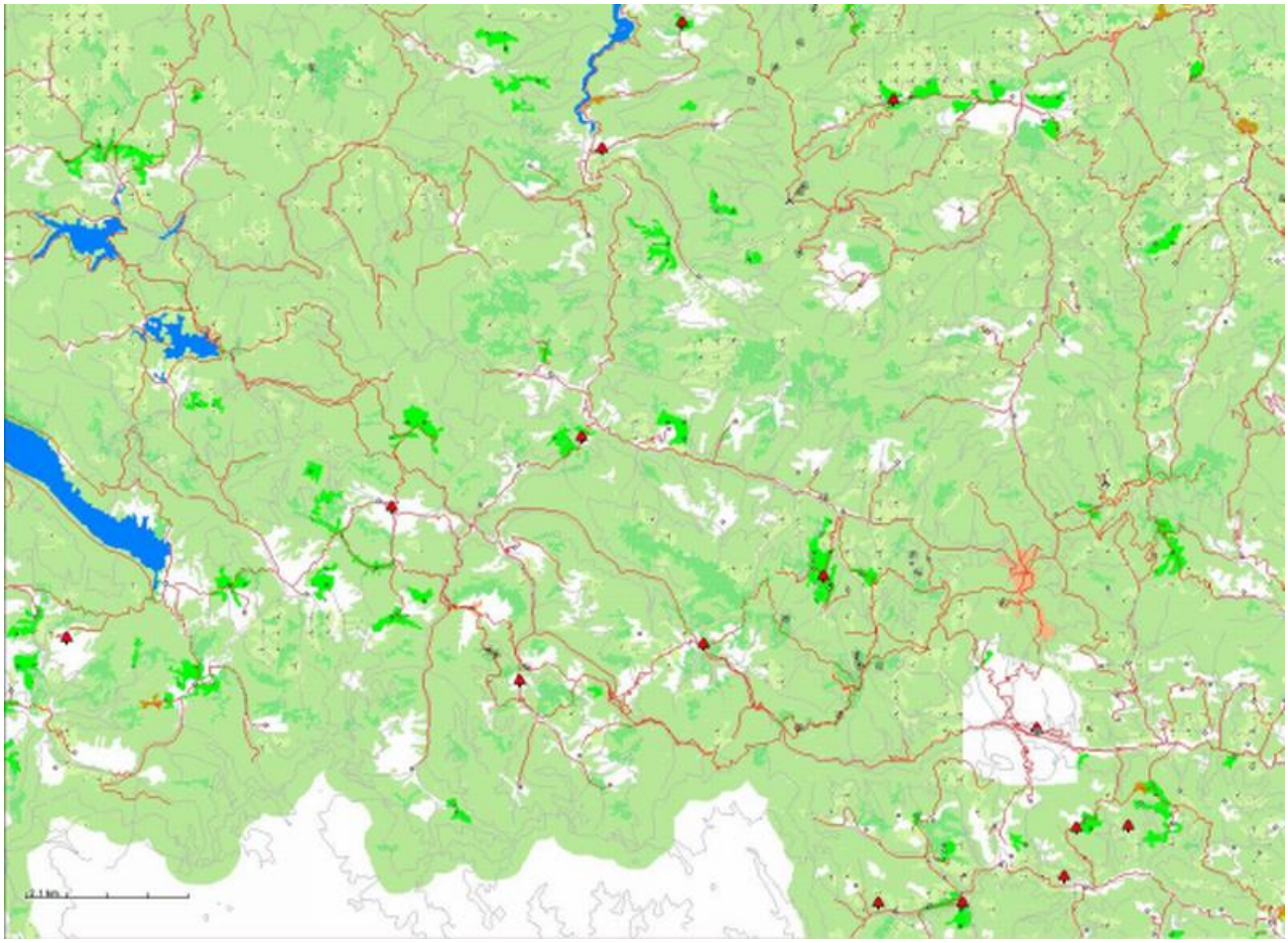


Figure 11 Bulgarian Case Study Region. Red triangles indicate case study farms

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Strategy for development of Smolyan Region 2005-2015. http://www.region-smolyan.org/prioriteti.php?id=59)

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Nikolov, Hristo (1999) The Bulgarian part of Rhodope Mountains: Concept for sustainable development and nature conservation. *Green Balkans*. 1999.

1.8. H_GRA Semi-natural low-input grassland, Homokhatsa, Hungary

Geographical delimitation, geomorphology, climate and land use

The case study site is situated in Central Hungary between the rivers Danube and Tisza. All settlements of the case study area belong to the administrative unit of Bács-Kiskun County (NUTS 3 level) and to the South Great Plain Region (NUTS 2). In a geographical sense the case study site belongs to the Kiskunság big landscape (1.4 million hectares) lying between the Danube and Tisza Rivers. The region is a part of the Homokhátság High Natural Value Area.

At the level of natural micro-regions (TABLE 16) most settlements belong to the Kiskunság Sand Ridge. It belongs to the areas with the highest number of sunlit hours (2100 hours). The aridity index in the southern part of the micro region is between 1.28-1.32. It has a mixed climate with a transition between moderate warm and warm dry types. The majority of the landscape is semi-fixed sand hillocks and fixed sandy plains. The dominant soil is moving sand that gives field for sand puszta meadows, fake acacia and black pine plantations, poplar-juniper vegetations and also to spacious vineyards and orchards. In the depression plains between the hillock ridges solonchak-solonetz soil types are dominant with extreme water management characteristics covered with natural pusztas, weak fertility arable lands and grazing lands.

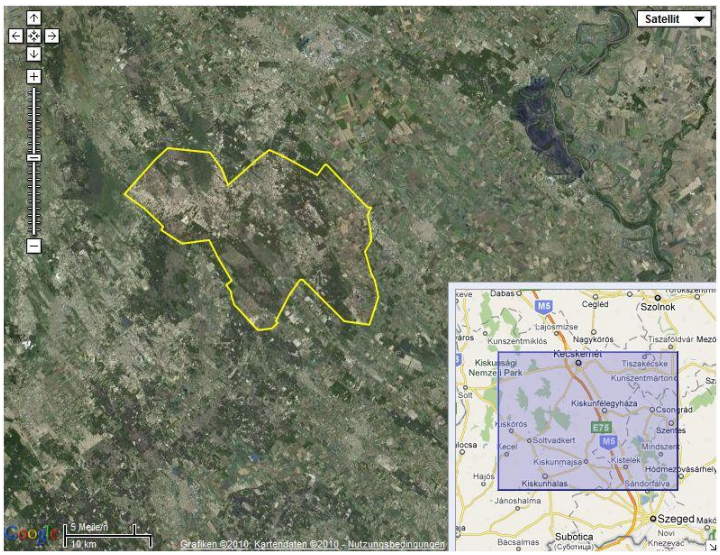

TABLE 16 Some characteristics of the natural micro-regions of the case study

Natural middle region	Natural micro-region	Settlements	altitude (m)	annual precipitation (mm)	precipitation in growing season (mm)	annual mean temperature (°C)	aridity index
Dunamenti-síkság (Plains near River Danube)	Csepeli-sík (Csepel plains)	Kunpeszér	95-168	530-550	290-330	10,2-10,3	1,21-1,32
	Solti-sík (Solt Plains)	Fülöpszállás, Szabadszállás	93-141	550-580	320-330	10,4-10,5	1,21-1,28
Duna-Tisza közi síkvidék (Plains between Danube and Tisza Rivers)	Kiskunsági-homokhát (Kiskunság Sand Ridge)	Ágasegyháza, Ballószög, Fülöpháza, Jakabszállás, Kunbaracs, Orgovány, Soltszentimre	94-139	530-550	310-330	10,2-10,3	1,24-1,32
Duna-Tisza közi síkvidék (Plains between Danube and Tisza Rivers)	Dorozsma-Majsai-homokhát (Dorozsma-Majsa Sand Ridge)	Jászszentlászló		570-590	310-330	10,5-10,7	1,19-1,24

A minority of settlements belongs to the natural middle region of the Danube River Plains and within that the Solt Plains natural micro-region. The climate in this micro-region is moderately warm and dry with high degree of water scarcity although its water management is helped by the close River Danube. Periodically appearing inland waters are evacuated by lengthy channels. Meadow management and grazing livestock farming is linked to solonchak areas.

The ecological significance of this landscape lies in its unique flora and fauna evolving through the continuous interaction between nature and humans. The Homokhátság is a particular combination of sand dunes shaped by the predominant north-western and south-eastern winds, saline lowlands and desiccating lakes as a result of shortage in water and fragile wetland areas remaining after harsh river control (Molnár, 2003). The whole process of succession on sandy soil can be followed-up here from the open grassland vegetation to the poplar-juniper forests comprising endemic plant species and an ample insect population. Wetland areas have an extremely rich birdlife based on nesting songbirds and waterfowls beside the rare fish species and mammals living in the reed and willow marshes (Tóth, 1996; Rakonczay, 2001).

Dominant soil types in the "Homokhátság" (Sand Ridge) include moving sand (21.6% of the area), peaty meadow soils (17.5%), humic sandy soils (10.1%) and Solonchak-Solonetz soils (9.9%). These four soil types cover 59.1% of the area .

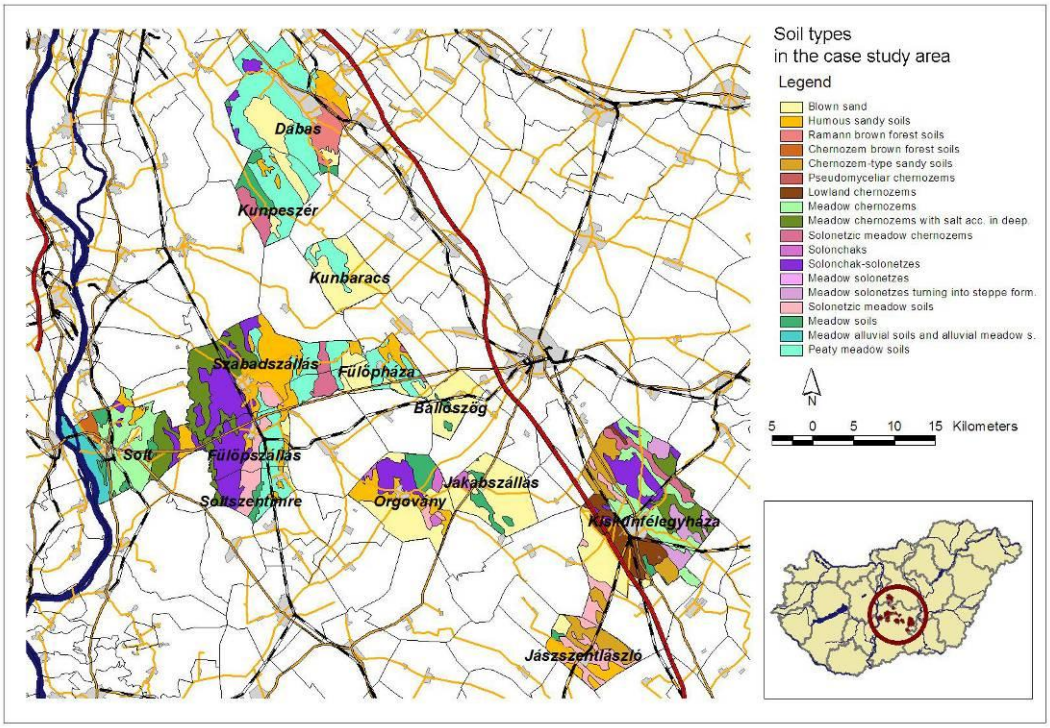

Figure 12 Soil types in the case study area

After examining all municipalities where farmers are participating in the project, we observed that soils are homogeneous except the western and eastern edge of the case study area where there is more soil mosaic. In the middle part of the case study area, one or two soil types characterize each municipality.

Farming characteristics

Thanks to previous research activities in the case study area we have detailed information on the farm characteristics of some of the designated settlements beside the general statistical data. Next we briefly summarize this information based the paper by Kelemen and Bela (2008).

Fülöpjakab is famous for its organic farmers' cooperative which produces a wide range of organic products (vegetables, fruits, jams, syrups etc,) and organises the "Fülöpjakab Organic Day" every year.

In Jakabszállás the extension of the cultivated area is around 7,000 hectares and the average number of registered farmers is 220-230. The average farm size varies between 1-23 hectares. Only 8-10 persons own or cultivate larger areas, while approximately 90% of the farmers farm on less than 5 hectares. The proportion of part-time farms and subsistence farms (especially homesteads run by retired people) is significant in the village. The cultivated area can be divided into five dominant branches: 2,000 hectares of the total cultivated land are arable land. 1,000 hectares are grassland. 400 hectares are orchards. 200 hectares are vineyards whilst the remaining land is forest plantation.

Orgovány has a cultivated area of 10,000 hectares, from which 2,000 hectares are grassland, 1,600 hectares are vineyards and 1,300 hectares are arable, while the remaining is forest plantation. The average number of registered farmers is around 600. Only 10% of the farmers farm on more than 20-50 hectares, while the majority of the farms are smaller than 5 hectares. Animal husbandry is still relatively important in the settlement, although the livestock decreased significantly in the last few decades. Beside cattle and sheep grazing there are few farmers dealing with piggery.

The privately owned land is generally small and divided into many plots, often far from each other. The Kiskunság National Park Directorate is an important actor as it manages the state owned protected land (the Kiskunság NP was declared by the State in 1975 as the second NP in Hungary) and set management prescriptions in the Homokhátság High Nature Value Area. The Directorate either leases the land to local farmers (defines the rules for cultivation) or uses the land itself and grazes grey cattle herds.

Criteria for farm selection

In order to choose the farmlands in the pre-selected study area and get information about how to get in touch with the farmers, we were supported by the following organisations: Kiskunság National Park Directorate, Bács-Kiskun County Agricultural Chamber, Biokontroll Hungária Nonprofit Ltd. All three organisations have a good relationship with the farmers on Homokhátság. Besides them we could rely on acquaintances from our earlier research projects and from personal relationships.

From the above mentioned organisations we requested a listing of farms with the following characteristics:

- farms dealing with livestock farming based on grassland
- farms located in settlements around: Bugac, Bugacpusztaháza, Fülöpjakab, Jakabszállás, Orgovány and anywhere nearby with „puszta" characteristics and grazing livestock.

After disregarding overlaps, we could get the contacts of 72 farms. Farm data included the size of farm area (arable, grass in hectares) and race and number of livestock.

Identification of case study farms

Engaging farmers in a research project is always a critical issue in Hungary. Therefore the main driving factor for the sampling design was farmers' willingness to participate in the project.

First, a letter was sent to all farms together with the official BIOBIO project leaflet in Hungarian and also a datasheet in order to explore farmers' willingness to participate in the project and to collect basic data. As a result of the first approach 25 farms gave a positive answer. Further 10 farms were convinced to participate after we called them on the telephone.

Of the 35 potentially participating farms, 9 farms were keeping sheep and 26 kept cattle. The Hungarian case study in the BIOBIO project aims at low input grazing livestock farming systems in semi-natural grasslands with the investigations restricted to one type of livestock only. With regard to the higher number of cattle keeping farms among the potentially participating farms, we decided to concentrate on cattle keeping farms in the further selection process.

As a third step, the 26 cattle keeping farmers were invited to a workshop (26 March 2010) for locating their farming areas in IACS maps. 13 out of 26 farmers were present at the workshop and another 5 sent their maps via post. The basic characteristics of selected farms are shown in TABLE 17.

TABLE 17 Basic characteristics of selected farms

Settlement	farm type	total area (ha)	arable (ha)	grassland (ha)	nr. of plots	nr. of arable plots	nr. of grassland plots	grazing livestock type	nr. of grazing animals	LU	LU per ha grassland
Kunpeszér (hq.Dabas)	conventional	500,0	0,0	500	28	0	28	cattle, sheep	120, 350	75	0,150
Solt	organic	314,0	48,0	220	29	10	14	cattle	45	41	0,184
Orgovány	organic	62,8	8,8	54	10	5	5	cattle	15	14	0,250
Szabadszállás	conventional	82,4	12,0	51	21	8	10	cattle	15	14	0,265
Kunbaracs	conventional	247,0	76,0	171	42	21	21	cattle	50	45	0,263
Fülöpszállás	conventional	97,0	14,5	83	33	6	27	cattle	28	25	0,304
Kiskunfélegyháza	organic	285,7	24,8	261	18	8	11	cattle, sheep	70, 20	81	0,310
Fülöpháza	conventional	116,0	39,0	77	26	11	15	cattle	30	27	0,351
Jakabszállás	organic	108,0	0,0	108	3	0	3	cattle	43	39	0,358
Kunpeszér	conventional	100,0	4,5	96	14	2	12	cattle	40	36	0,377
Jásszentlászló	organic	42,8	11,3	32	5	4	1	horse, cattle	15	14	0,428
Jakabszállás	organic	80,4	47,9	32	28	16	12	cattle	16	14	0,443
Fülöpháza	conventional	23,0	7,0	15	10	7	15	cattle	10	9	0,600
Soltszentimre	conventional	196,1	47,6	149	27	17	10	cattle	100	90	0,606
Ballószög	organic	280,0	247,0	33	32	24	8	cattle	25	23	0,682
Jásszentlászló	organic	118,0	76,0	42	9	8	6	horse, cattle,	17, 10, 24	30	0,706
Kunbaracs	conventional	56,1	47,7	8	8	6	2	cattle	14	13	1,496
Kiskunfélegyháza	organic	362,1	63,2	299	50	19	31	cattle, sheep	560, 137	525	1,755

All farms in the case study region can be considered as low-input farms and among them organic and conventional farms can be differentiated (Figure 13). However, the selected farms clearly differ in the livestock density per area of grassland. Therefore this parameter will be primarily used to establish an intensity gradient for later analysis. During the farm interviews additional factors will be identified that describe differences in farming intensity among the selected farms. Since almost half of the farms are organic, as an additional factor it will be analysed later whether

any difference between organic and conventional systems regarding their impacts on biodiversity can be observed.

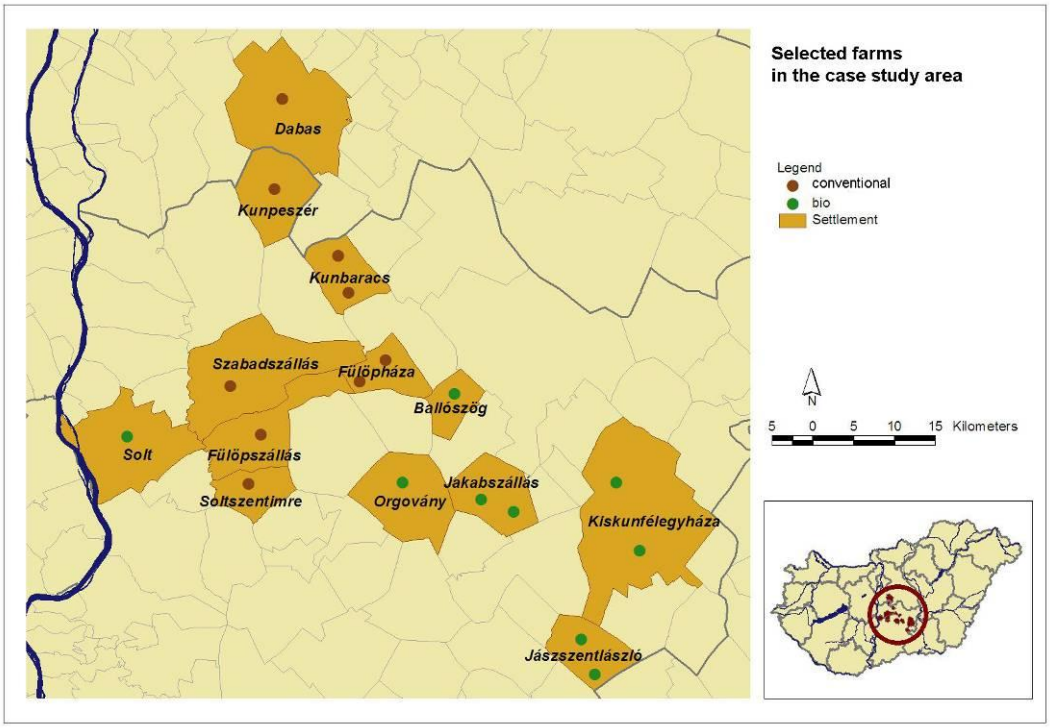

Figure 13 Location of organic (green) and conventional (brown) low input farms

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1.9. N_GRA Grassland sheep farming in northern Hedmark, Norway

Geographical delimitation, geomorphology and climate

The farms are located in the Nord-Østerdal region, in the municipalities of Os, Tolga, Tynset and Alvdal. The municipalities cover a total area of 4.871 km². The area has a continental climate, with low winter temperatures and relatively high summer temperatures considering the geographical location and height above sea level (TABLE18, TABLE 19).

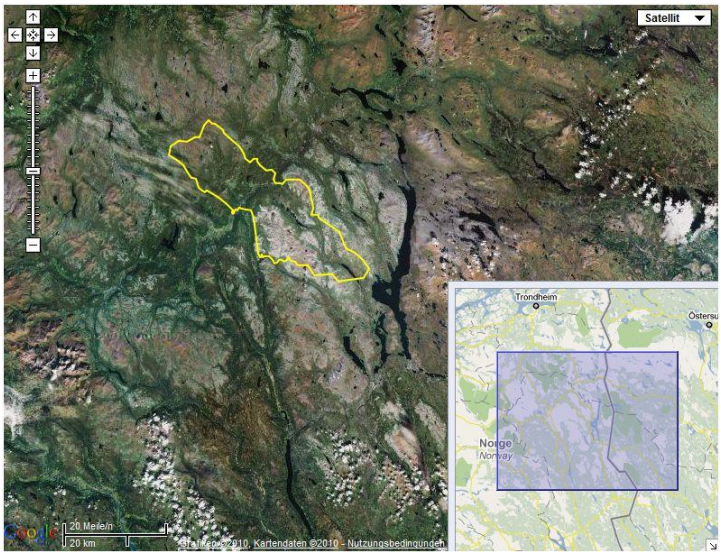

TABLE 18 Mean temperature (°C) - monthly normal values (Source: www.eKlima.no)

Weather station	Altitude m.a.s.l.	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
Os	600	-11.8	-10.2	-5.6	-0.5	5.8	10.3	11.6	10.5	6.1	1.7	-5.5	-9.7
Tolga	565	-12.5	-10.7	-5.7	-0.4	6.1	10.6	11.9	10.7	6.2	1.6	-5.8	-10.4
Tynset	482	-13.5	-11.1	-5.7	0.3	5.9	10.7	12.3	10.9	6.3	1.9	-5.3	-10.8
Alvdal	485	-11.4	-9.7	-4.3	0.6	6.7	11.3	12.5	11.4	6.9	2.3	-4.8	-9.5

TABLE 19 Precipitation (mm) - monthly normal values (Source: www.eKlima.no)

Weather station	Altitude m.a.s.l.	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	Sum Year
Os	600	30	25	26	21	29	53	75	62	53	40	35	26	475
Tolga	565	26	21	22	19	31	53	77	60	55	41	33	32	470
Tynset	482	20	15	15	15	30	50	75	60	50	35	25	20	410
Alvdal	485	24	18	19	22	40	67	76	66	58	50	33	27	500

The altitude in Nord-Østerdalen ranges from around 500 m.a.s.l. in the valley bottom to 1600 m.a.s.l. on the highest mountain tops. There is therefore great biogeographical variation within short distances. The farms are situated in the middle boreal vegetation zone (occurring in the valleys) and the northern boreal zone, with many farms having property in both zones. Outfield grazing resources in alpine areas are also used by some of the farms.

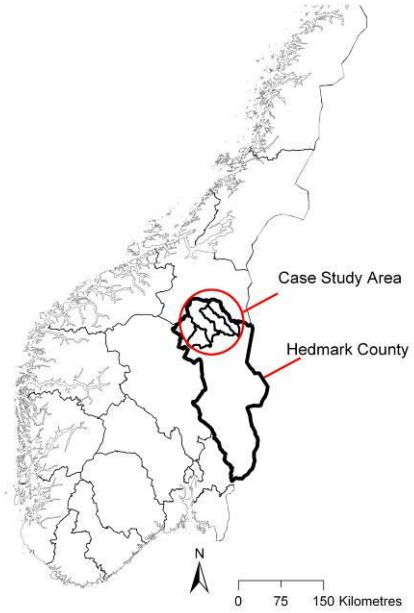

Figure 14 Location of the case study area in Hedmark County, South-Eastern Norway

Farming structure

Sheep farming in Nord-Østerdal, Hedmark County, is a good example of low-input agriculture in Norway. During the summer, sheep live outdoors, grazing upland and mountain areas that would otherwise have little economic use.

In 2009, there were 3674 farms in Hedmark County, of which 20% owned sheep. In Nord-Østerdal. in the municipalities of Os, Tolga, Tynset and Alvdal, the proportion of farms with sheep is higher (40%). In these municipalities, as has happened throughout Norway, the number of farms has declined in recent decades, and the number of farms with sheep has been reduced from 410 farms in 1989 to 258 farms in 2009 (a decline of 37 %). Nevertheless, the total number of sheep has remained relatively stable since numbers of sheep per farm have increased in the same period from an average of 44 to 67 winter-fed sheep per farm. In 2009, 12 % of the sheep farms in Os, Tolga, Tynset and Alvdal municipalities claimed subsidies for organically certified production (compared with a county average of 9 %).

Criteria for farm selection

Farms were selected that had a total of at least 50 sheep according to the national "Applications for Farm Subsidies" database, To qualify as "organic", farms had to have started to go organic no later than 2005 (information obtained from municipal Agricultural Offices or from the farmer).

Identification of case study farms

Using the national "Applications for Farm Subsidies" database, we identified all farms in Hedmark County that had more than 50 sheep and claimed subsidies for organic production. Starting in Tolga municipality, we telephoned the municipal Agricultural Office to obtain telephone numbers of the candidate farms. At this stage some farms were excluded due to recent changes in ownership, cessation of farming, or because the farm started to go organic less than five years ago, or had other types of organic production (e.g. herbs) but not organic sheep

production. We used random numbers generated in Microsoft Excel to decide the order of telephone requests. A written conversation guide was prepared to ensure that farmers received the same information. When all farms had been contacted we extended the search to Os, Tynset and finally Alvdal municipality to obtain ten farms. These neighbouring municipalities were chosen to minimise biogeographical variation. When we had received confirmation from ten organic farms, we matched each organic farm with a conventional farm, choosing randomly amongst farms in the same municipality. This stratification by municipality was done to minimise biogeographical variation between the set of organic farms and the set of conventional farms.

Description of 10 + 10 case study farms

TABLE 20 shows the number of sheep per farm according to the "Applications for Farm Subsidies" database from 2009. Numbers of other animals are also listed. The number of sheep per farm ranged from 61 to 459. The two farms with fewest sheep both have goats in addition to sheep. Two of the organic farms have hens and one has pigs. Virtually all of the sheep, both organic and conventional, are registered as grazing on the outfields.

TABLE 20 Number of sheep and other farm animals on selected farms

Org./ Conv.	Farm no.	Ewes, 1yr or older	Rams, 1yr or older	Lambs <1yr	Sum Sheep	No. of horses	Female Goats	Male goats & kids	Pigs	Hens
Conv.	1	123.0	20.0	248.0	391	.0	.0	.0	.0	.0
Org.	2	49.0	1.0	93.0	143	1.0	.0	.0	.0	.0
Org.	3	156.0	.0	303.0	459	.0	.0	.0	.0	.0
Org.	4	129.0	.0	240.0	369	.0	.0	.0	.0	.0
Conv.	5	139.0	.0	231.0	370	.0	.0	.0	.0	.0
Conv.	6	54.0	2.0	88.0	144	.0	.0	.0	.0	.0
Conv.	7	43.0	1.0	88.0	132	.0	.0	.0	.0	.0
Org.	8	84.0	10.0	141.0	235	2.0	.0	.0	.0	.0
Org.	9	42.0	1.0	87.0	130	.0	.0	.0	.0	.0
Org.	10	48.0	.0	80.0	128	.0	.0	.0	.0	.0
Conv.	11	76.0	2.0	144.0	222	.0	.0	.0	.0	.0
Conv.	12	42.0	.0	73.0	115	.0	.0	.0	.0	.0
Org.	13	60.0	.0	100.0	160	.0	.0	.0	.0	.0
Conv.	14	68.0	3.0	85.0	156	2.0	.0	.0	.0	.0
Org.	15	38.0	6.0	60.0	104	.0	.0	.0	.0	9.0
Conv.	16	38.0	.0	70.0	108	2.0	.0	.0	.0	.0
Org.	17	113.0	2.0	115.0	230	2.0	.0	.0	37.0	.0
Conv.	19	87.0	3.0	145.0	235	.0	.0	.0	.0	.0
Conv.	20	25.0	.0	36.0	61	2.0	24.0	15.0	.0	.0

The selected farms comprise scattered parcels of land, generally with a high proportion of forest. On the organic farms, forest covers from 37% to 91% of the property, compared with 41% to 85% on the conventional farms (TABLE 21). Most of the sheep grazing land is on communal lands that are not covered by these statistics.

At least fifteen of the twenty farms are members of outfield grazing associations. For the remaining five farms, we need to clarify the situation (some seem involved in disagreements about grazing right). Two of the organic farms and two of the conventional farms are members in Gjera & Busjødalen Havnelag; one of the organic farms and one of the conventional farms are

members in Hummelfjell Beitelag. The other farms do not share Grazing Association with other selected farms.

TABLE 21 Area (hectares) of different major land types per farm. (Source: Overlay of Digital Property Map and Land Resources Map)

Organic/ Conv.	Farm Number	Built-up	Trans-port	Fully cultivated	Surface cultivated	Infield pasture	Forest	Other open land	Wet-land	Wate r	Not mapped	Total
Conv.	1	-	0	7.3	-	0.7	12.9	0.3	0.5	-	-	21.8
Organic	2	-	0.2	5.3	-	-	12.2	0.6	0.4	0	-	18.7
Organic	3	-	1.9	24.8	-	1	269	8.8	43.2	0.6	-	349.1
Organic	4	-	0.5	17.5	-	0.6	195	36.6	27.9	0.1	-	277.7
Conv.	5	-	0.5	6.2	-	2.6	82.7	7.3	7.7	0	-	107
Conv.	6	-	0.5	4.6	-	0.4	86.7	2.7	11.5	0	2.1	108.5
Conv.	7	-	0.2	4.2	-	0.2	28.4	3.5	1.1	0	-	37.6
Organic	8	0	0.4	16	-	0.9	160	41.3	35	0.7	4.3	259.2
Organic	9	-	0.4	4.9	-	0.4	63.8	16.6	10	0	-	96.2
Organic	10	-	0.8	9.3	-	1.6	175	2.3	2.6	0.1	-	191.8
Conv.	11	-	0.4	7.5	0.5	0.3	93.3	18	14.4	0.1	-	134.5
Conv.	12	-	0.1	4.6	0.1	1	197	7.9	21.1	0.4	-	232.4
Organic	13	-	0.6	15.1	-	-	182	8.8	1.6	0	-	208
Conv.	14	0.1	0.7	5	1.3	0.4	110	56.9	2.2	0	-	176
Organic	15	-	0.8	14.5	-	2.3	165	92.7	20.6	0.9	-	296.5
Conv.	16	0	0.4	2.3	-	1.1	185	252.4	3.9	2.1	-	447.1
Organic	17	-	1.5	8.1	-	0.5	159	4.1	24.4	0.5	-	198
Organic	18	-	0.6	3	0	2	9.9	11.2	-	0	-	26.7
Conv.	19	-	0.2	11	-	3.4	81.8	8.9	12.7	0	1.6	119.6
Conv.	20	-	0.4	16.1	-	1.4	142	3.2	1.6	0	5.7	170.6

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1.10. C_GRA Organic mountain grassland with cattle (Swiss Alps), Switzerland

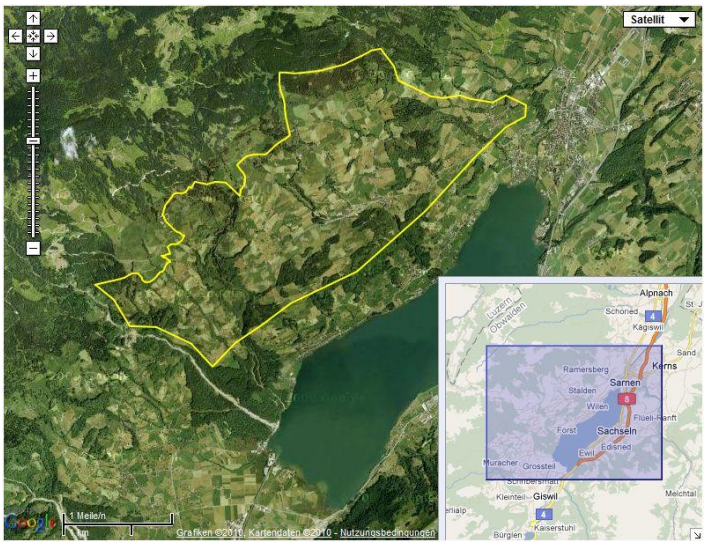
Geographical delimitation, geomorphology and climate

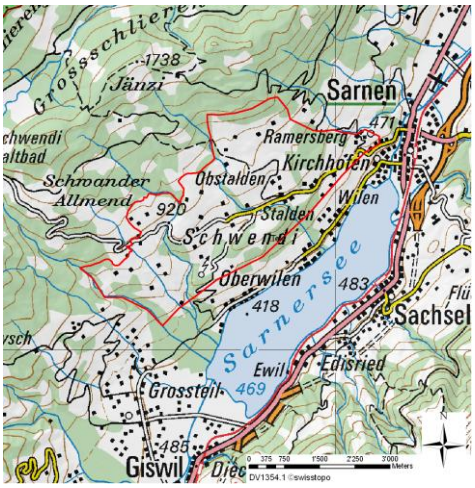
The case study of Switzerland is situated in Obwalden (OW), in the Northern Swiss Alps. All study farms are situated in the village of Stalden OW, on the southeast-facing hillside above Lake Sarnen. About 1100 inhabitants live there and have their own school, a church, a grocery shop and some restaurants.

The village centre of Stalden is situated about 300 m above the level of lake of Sarnen. The area of investigation covers 12 km2 (coordinates 46.8 N, 8.2 E) surrounding the centre. Most of the area is inclined. Patches of forest cover the steepest parts and occur along creeks. The primary land use is grassland. Minimum altitude of all investigated parcels is 605 m.a.s.l., maximum altitude 1133 m.a.s.l. and mean altitude 878 m.a.s.l. The 20 investigated farms manage 254 ha.

The lower boundary of the case study area is formed by flat intensively used grasslands and orchards. Open land above it is used as summer pasture or forms high nature value areas of bogs and wetland, sometimes used as litter meadow.

The case study region belongs to the environmental zone: Alpine South ALS (environmental strata ALS3) according to EBONE and to the Northern Alps according to Swiss biographical regions.





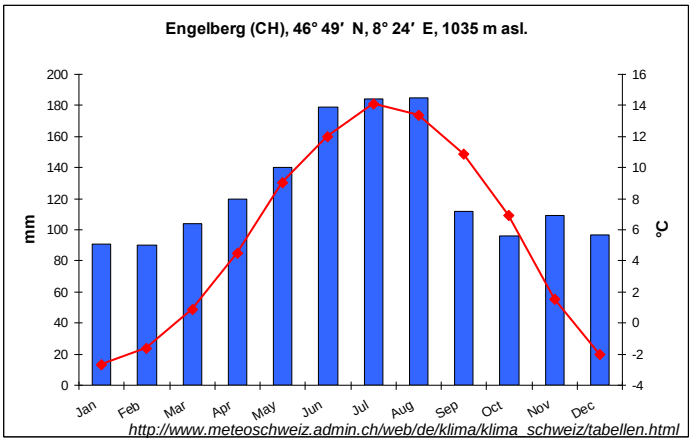


Figure 15 Boundaries of case study region Switzerland, Stalden OW, and, sum of precipitation for each month, mean values 1961-1990 (bars); mean temperature for each month 1961-1990 (line).

Farming structure

In Stalden OW, farms are grassland-based ruminant producers with cattle for milk production or breeding. 17 of 66 farms are organic (26%). Organic and conventional farms are well mixed. All farms are situated on the same hillside, i.e. share the same exposure (south-east). The strong topography limits mechanisation. Part-time farming is frequent.

Criteria for farm selection

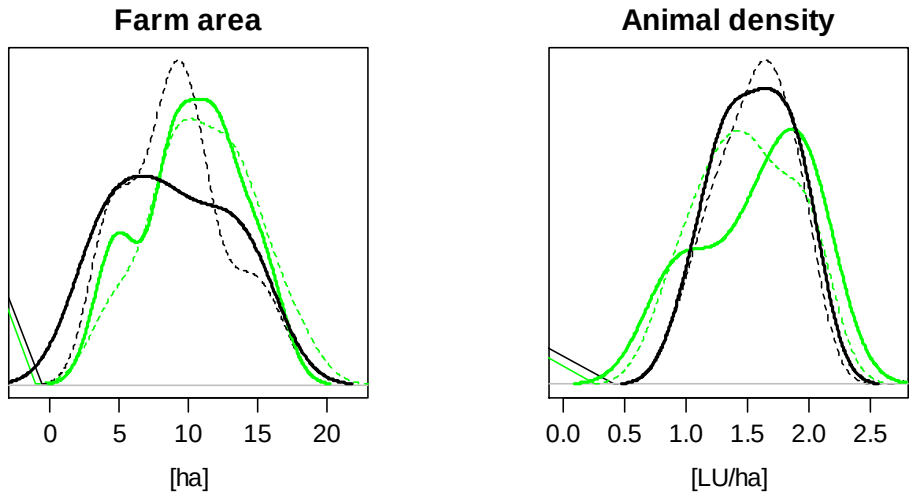
The cantonal authority provided a list of farms containing addresses, farming system (if organic with time of conversion), utilized agricultural area, livestock units. Farms with more than 80% of their utilized agricultural area in mountain zone 2, with cattle as livestock and without pigs were included into the set from which 10 conventional farms and 10 organic farms (conversion before 2005) were selected at random.

Identification of case study farms

In mid January, an extension event organized by cantonal authorities provided the opportunity to inform many farmers about BIOBIO. A few days later, an informative letter was sent to selected farmers with the request to contribute to the project. All farmers were subsequently contacted by telephone. If they refuse to be part of the project, other farms were randomly selected. In some cases farmers were visited personally, accompanied by a person of the cantonal authority. In February / March all selected farms were visited and the usual management schedule was discussed on the basis of parcel maps.

Description of 10 + 10 case study farms

Utilized agricultural area of the investigated farms is between 3.5 and 16 ha (mean 9.5 ha). At least 7% of the utilized agricultural area is managed as ecological compensation area. In average, investigated farms have 1.6 LU/ha, minimum is 0.9 LU/ha, maximum is 2.0 LU/ha (Figure 16).



a) b)

Figure 16 **Distribution of case study farms in comparison of all farms in the case study region. Bold lines: Case study farms, dashed lines: All farms in Stalden OW, black: Conventional farms, green: Organic farms. a) Distribution of farm area in ha. b) Distribution of animal density in LU/ha.**

References

WEBSITES

http://de.wikipedia.org/wiki/Flysch*, visited February, 16th 2010*

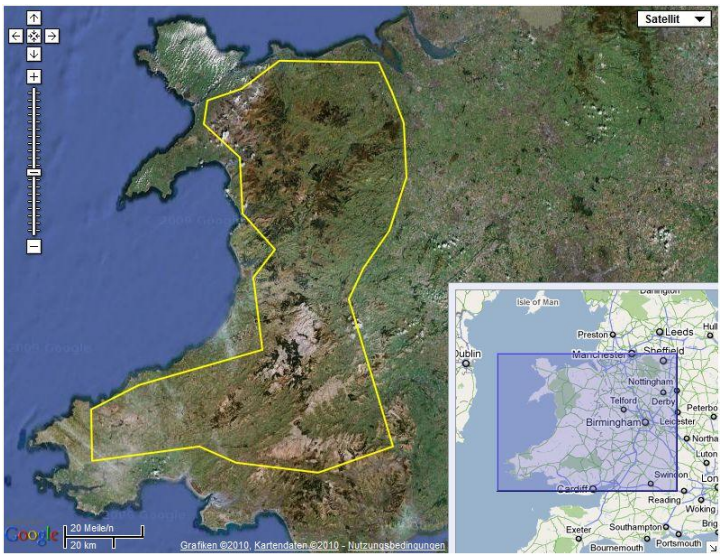
http://www.sarnen.ch/de/*, visited February, 16th 2010*

1.11. W_GRA Organic livestock production agriculture in Less Favoured Areas of hill and uplands, Wales, UK

Geographical delimitation, geomorphology and climate

Wales occupies an area of 2 million ha which is dominated by the Cambrian mountain chain which runs from the Snowdonia Mountains in the north west through the Cambrian Hills of mid-Wales to the Brecon Beacons in the south, in a curve which dominates the landscape. Most of the land area is over 150 m above sea level and much of this land area occupies an altitude range of 450-1085 m. The geology comprises ancient pre-Cambrian rock formed 540 million years BP and Jurassic rocks (200-145 million years BP). Extensive glaciation during the Pleistocene extended to the south coast of Wales and the retreat left glacial deposits (till of boulder clay) over much of the land such that soils often do not relate to the underlying parent rock (National Soils Resource Institute website). Wales is dominated by brown earths in the incised valleys and acidic, leached podzol soils on the extensive uplands. Dry heath dominated by Calluna vulgaris occupies 80 000 ha and wetter, deep peat soils occupy 70 000 ha as blanket bog. Internationally important wetlands occupy many of the valleys and coastal estuaries (29 506 ha) (CCW website).

The mountainous land and oceanic influence determine the climate. The maritime climate is cloudy, wet and windy but mainly mild. The average annual daily temperature is 9.5 – 10.5°C at sea level. This reduces to an average 5.5 – 6.5°C at 800 m. Mean daily maximum temperature is 17°C in July. Mean annual rainfall varies from 3000 mm in Snowdonia to 1000 mm in the eastern lowlands. Average wind speeds vary between 16 knots in January to 10 knots in July with 15 'gale' days a year on exposed western coasts and in the mountains (UK Meteorological Office website).



Farming structure

Much of Wales is marginal agricultural land due to the terrain and wet and cool Atlantic climate. Agriculture is practiced on 1.63 million ha, about 76% of the land area but most of this land area is permanent grassland (1.01 million ha). 23% of agricultural land is semi-natural, mainly calcifugous (acid) grasslands grazed for livestock production. The total of 0.38 million ha rough grazings divides into 0.20 million ha of sole grazing rights and 0.18 million ha of common grazed land (StatsWales website). Agricultural land of less favourable regions such as upland and

mountain areas can only be managed agriculturally as permanent grasslands due to steep slopes, short vegetation growth period and shallow soils. Organic farming resembles traditional farming systems. It ideally maintains grassland biodiversity. In the 2004 June agricultural census, there was a total breeding flock with lambs of 9 736 800 sheep and a cattle herd with calves of 1 281 400. The sheep numbers have been steadily declining each year (StatsWales website).

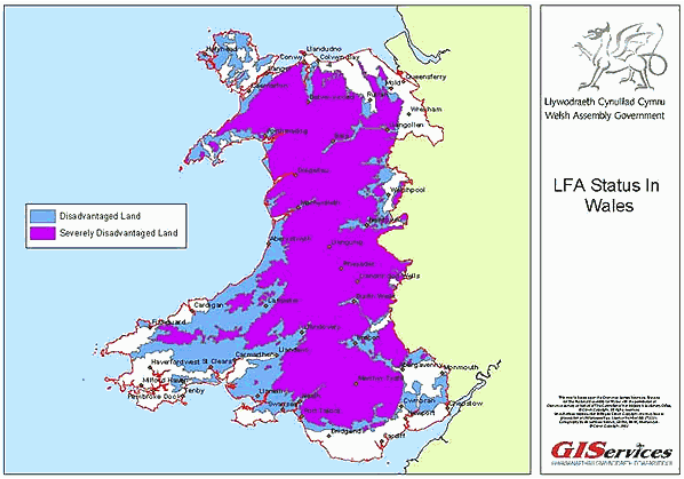


Figure 17 LFA Status in Wales

The Atlantic North regions of North and East Wales comprises extensive grazing systems on semi-natural pastures grazed by hefted sheep flocks and beef suckler systems. Transhumant systems are present locally with stock on semi-natural vegetation for the growing season and the rest of the year on enclosed improved pastures in valleys or coastal grassland. National surveys of farm sizes, enterprises and incomes are carried out annually (Farm Business Survey 2009) and classify the following major agricultural enterprises:

- Hill sheep
- Upland sheep
- Lowland sheep
- Lowland suckler cows
- Upland suckler cows
- Hill suckler cows
- Hill and upland dairy
- Lowland dairy.

TABLE 22 Summary statistics for Welsh hill and upland livestock farms in 2008-09 (after Farm Business Survey 2009)

Farm type	Total area per farm (effective ha)	Outputs: beef (£)	Outputs: sheep (£)	Total variable costs (£)	Profit after rent and finance (£)
Hill cattle and sheep farms (n = 125)	129.56	30 857	32 677	42 347	26 130
Hill sheep farms (n = 123)	147.79	12 080	39 079	35 631	25 942
Upland cattle and sheep farms (n = 95)	108.42	33 892	31 215	37 940	32 318

The Atlantic South grasslands of Southwest Wales include pastoralism and mixed farming, often converted to specialised dairy or beef systems. Organic systems return to rotations and mixed-farming conditions with lower carrying capacity for livestock and perhaps greater diversity of grazing species and breeds at lower stocking densities. Atlantic grasslands with sheep and cattle grazing under organic farming systems will be addressed via selected farms in the hill and upland areas of North, Mid- and South Wales.

Criteria for farm selection

Focus was on livestock production farms in Less Favoured Areas in Wales. Our strategy was to select 10 organic farms over a certain size and pair with nearby conventional farm of equivalent enterprise and geographic conditions (geology, soils and landform). The size threshold was determined after assessment of organic farms in the national database of Organic Centre Wales. We removed farms from the list which had no permanent pasture, temporary leys or fodder and protein crops. We also removed farms with permanent pasture < 5 ha (this excluded farms where the permanent pasture was effectively used for caravan parks and poly tunnel sites for horticultural production). This resulted in a sample of 935 farms of mean +/- SD of 132 +/- 147.8 ha. We excluded any farms falling below the 1st decile of 21 ha which includes 93 smaller units. The 93 farms above the 9th decile are 278 ha or larger with a maximum of 1397 ha and were kept available for selection to pair with larger neighbouring conventional farms because there is a skewed size distribution.

Identification of case study farms

1. Assess farms used in earlier Defra study of Organic. Organic conversion and Conventional farms in England and Wales (ie.. those in Wales).

2. Several Organic conversion farms from Defra study are now fully organic certified and qualify as organic for BioBio case study.

3. Top up numbers of organic farms using farms not selected in the Defra study.

4. Top up to 20 organic farms using data from Organic Centre Wales

5. Top up to 20 conventional farms using Farming Connect and Farm Business Survey for Wales.

Description of 10 + 10 case study farms

For BioBio direct indicator assessment, 10 pairs of farms will be surveyed for habitat mapping and vegetation survey, but just 8 pairs of farms to attain plots for invertebrate sampling.

TABLE 23 Summary of farm selection in Wales Case Study Ten organic livestock production farms in upland and hill categories, indicating code of paired conventional farm

Organic farm reference no.	County	Surveyed ha	Common grazing?	Organic start date	Cattle no.	Sheep no.	Paired conventional farm code
R1	Powys	154	No	1999	140	900	C209
R13	Ceredigion	309	No	1999	79	1830	CNew1
R54	Ceredigion	45	No	2001	65	0	C201
R33	Powys	137	No	1999	110	NA	C210
R12	Gwynedd	281	No	1999	48	934	CNew3
R24	Monmouth	56	Yes	2002	31	223	C204
R30	Gwynedd	76	No	2001	70	625	CNew2
R63	Gwynedd	71	No	2001	29	961	C207
R76	Flintshire	156	Yes	2001	65	300	C203
R202	Ceredigion	86	No	2005	40	450	C305

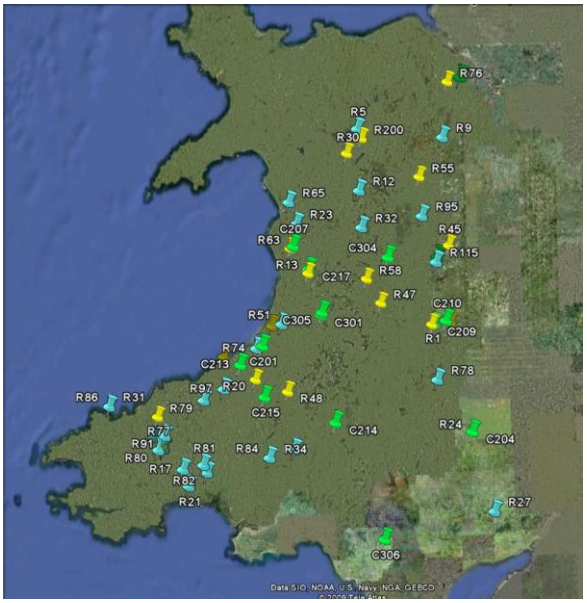


Figure 18 Organic livestock farms surveyed in Defra study (yellow), associated conventional farms (green) and initially surveyed organic farms that were not used in the study (blue) (base map: GoogleEarth)

References

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1.12. E_DEH Spanish Dehesa: Extensive low-input silvopastoral systems, Extremadura, Spain

Geographical delimitation, geomorphology and climate

The study is carried out in the district of „Tierras de Granadilla“ in the north of the region of Extremadura (Central-Western Spain). This district includes 14 municipalities with an overall area of 675 km2. The district is located in the north border of the environmental zone “Mediterranean South” and has as main land uses dehesas and olive plantations, the two farming systems to be studied in the Spanish case study. Most of the area is classified under HVN systems (HNV farming project, http://edepot.wur.nl/3918).

In this district, the dehesa area is flat and gently sloped (0-3%), mostly between 400 and 500 m altitude, lowering to 300 m in the main river courses (where slopes reach up to 12%). Geology is mostly granitic, Endoleptic distric Cambisols are generally developed over granites. Luvisol Chromi-Endoléptico and Distric Luvisol over slates, and more marginally Distric Leptosol are present along main river slopes. Soils are generally acid and poor in organic matter and nutrients.

Climate is typically Mediterranean, with mean annual temperature of 16.1ºC, rainfall and potential evapotranspiration of 756 mm and 850 mm respectively. Rainfall is mostly concentrated in autumn, winter and spring. Winters are moderately cold and summers are very warm. Water deficit is intense and usually lasts 3 months (Figure 20).

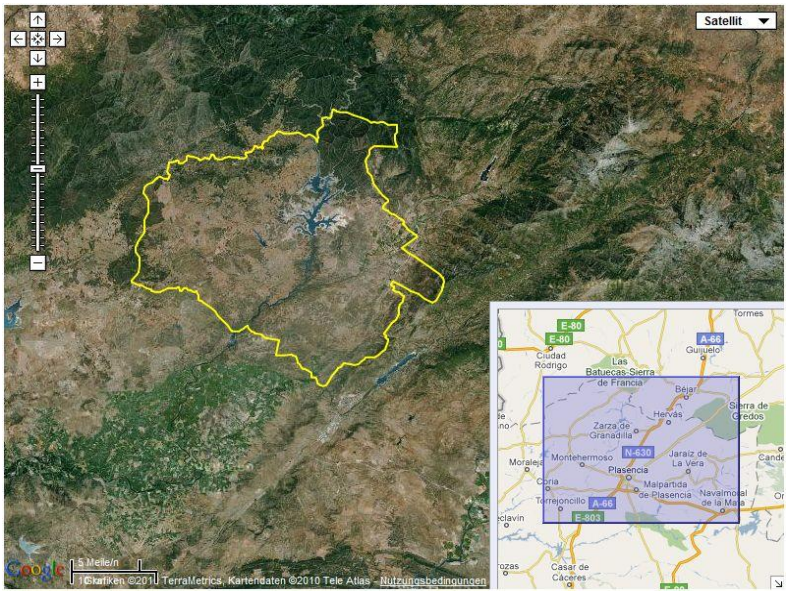


Figure 19 **Silvo-pastoral system (Dehesa)**

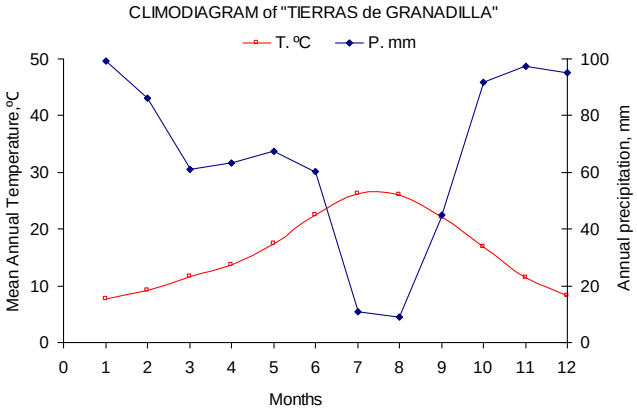


Figure 20 **Climodiagram of the study area (Tierras de Granadilla district). Source: SIGMAPA (www.mapa.es/es/sig/pags/sigmapa/intro.htm)**

Farming structure

According to Corine Land Cover, the landscape of the Tierras de Granadilla district is dominated by dehesas, with more than 20,000 ha of dehesas (30% of the surface), located predominantly in the southern part. In the northern part, the landscape is dominated by olive plantations (16%), the second farming system to be studied in Spain (Figure 21). Treeless natural pasturelands (11%) and shrublands (10%) are also present. Irrigation is applied in less of 5% of the croplands + pasturelands. Dehesas and treeless pastures are always based on large, extensive farms (100-1000ha).

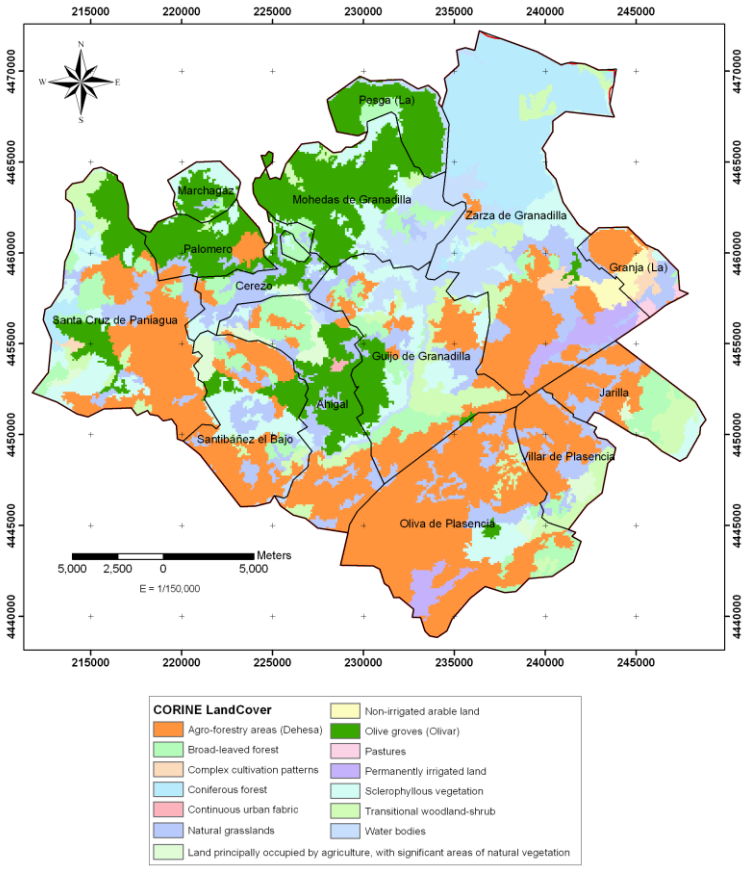


Figure 21 Map of distribution of land uses in the Tierras de Granadilla district, where dehesas (orange) located mostly in the south, and olive plantation (dark green) in the north. Source: Corine Land Cover.

Criteria for farm selection

There was not any database of dehesa farms available for this district neither for the region. Hence, we initiated the farm selection with two important constraints. First, we did not have a list of farms to do a random selection of farms. Second, we did not have a previous characterization and distribution of dehesa farms categories for this district. This would have facilitated the contrast of the 10 selected dehesa farms with the range of dehesa farm within the study area.

Given there was not previous information on dehesa farm size, structure and features specific for the study area, we did a fully random selection of dehesa farms, and the selection was contrasted with the general description of dehesas in Extremadura reported by Pulido et al (2009) for dehesa size, and Plienninger et al (2010) for stand structure. Each dehesa within the ranges reported by these authors was considered potentially valid for the study.

Identification of case study farms

Hence, we have followed a blind random approach based on Corine Land Cover map and the Cadastral map. From here we have generated a list of dehesa plots within the study area. We have randomly sorted the list and then we started to visit the selected plots by order, after confirming with aerial orthoimages that the land use of the selected plot was dehesa.

Given each farm is generally composed of several cadastral plots, once a plot had been selected, the whole farm that included that plot was selected. The first 10 farms whose owners agreed to participate with the project were selected. We needed visiting 18 farms. Five of them were discarded because the owner did not agree to participate or were not located and the other three were discarded because they were atypical according to the range reported by Pulido et al (2009) and Plieninger et al (2010).

Description of 10 case study farms

Main features of the 10 selected dehesa farms are given in TABLE 24. A comparison of the size-class distribution of the selected farms compared to size-class distribution given by Pulido et al (2009) is plotted in Figure 22. and finally the location of the 10 farms is shown in Figure 23.

TABLE 24 Main features of the ten selected dehesa farms.

Farm Number	Surface (ha)	Tree Species (*Quercus*)	Tree cover	Shrub understorey	Main Livestock
1	149	*Q. ilex*	Low	No	Cattle
2	824	*Q. ilex. suber. pyrenaica*	High	Yes	Cattle
3	746	*Q. ilex, suber*	Moderate	No	Cattle
4	307	*Q. ilex . suber. pyrenaica*	High	Yes	Cattle
5	186	*Q. ilex*	Moderate	Yes	Cattle
6	446	*Q. ilex*	Very Low	No	Cattle
7	418	*Q. ilex,* *Q.suber*	High	No	Cattle
8	550	*Q. ilex* *Q.suber*	Moderate	No	Cattle Sheep
9	361	*Q. ilex*	Moderate	No	Cattle
10	741	*Q. ilex*	Moderate & High	Yes	Cattle. Sheep. Pig

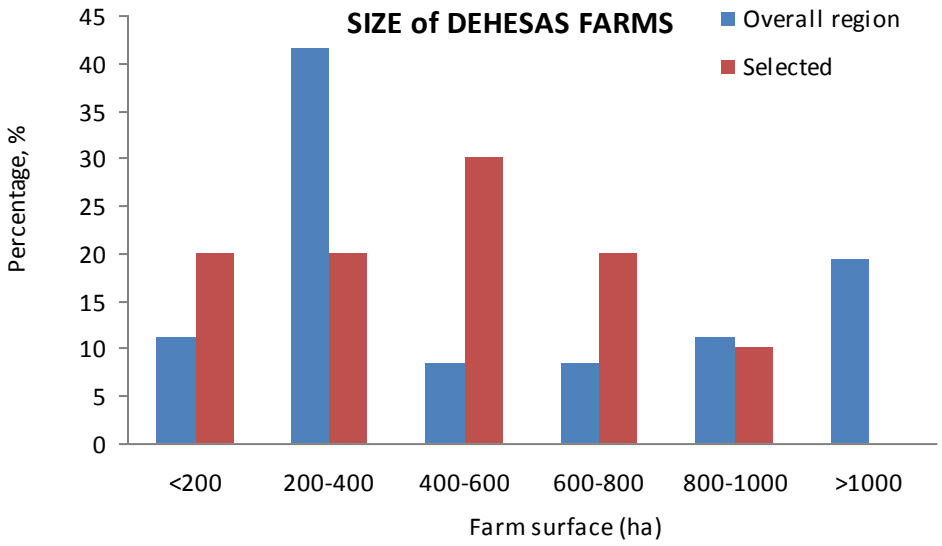


Figure 22 **Size-class distribution of selected dehesa farms (n=10) compared to the classification reported by Pulido et al (2009) for Extremadura region (n=36).**

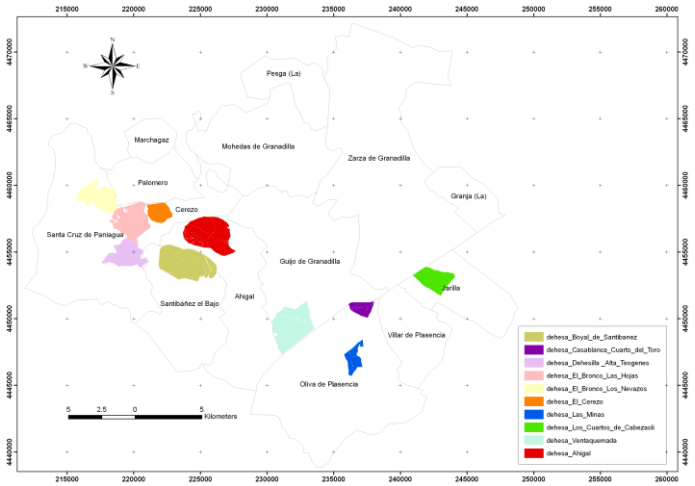


Figure 23 **Map of distribution of 10 selected dehesa farms in Tierras de Granadilla district (Extremadura Region, Spain).**

References

Jongman R.H.G., Shkaruba A.D., Bunce R.G.H., and Metzger M., 2009. The European Environmental Zones and Strata. ALTERRA, Wageningen; The Netherlands.

Plienninger T., Rolo V., Moreno G. 2010. Effects of land management and vegetation structure on Quercus ilex, Quercus suber, and Quercus pyrenaica regeneration in central-western Spain. Ecosystems (under revision).

Pulido FJ, Gurría JL, Hernández A, Abel D, and others. 2009. Estudio del estado ambiental y económico actual para el establecimiento de Planes de Gestión en las dehesas comunales de las comarcas de Almonte-Salor, Montánchez y Campiña Sur. Technical Report. Universidad de Extrermadura, Spain.

1.13. E_OLI Organic Olive Plantations, Extremadura, Spain

Geographical delimitation, geomorphology and climate

The study is carried out in the district of „Tierras de Granadilla“ in the north of the region of Extremadura (Central-Western Spain). In the same district, the dehesa farming system is also examined in the context of the BIOBIO project; therefore refer to E_DEH for the description of climate and soil conditions.

Farming structure

According to Corine Land Cover, the landscape in the northern part of Tierras de Granadilla district is dominated by olive plantations (Figure 21). With nearly 11,000 ha of olive plantations, this district is highly specialised in olive production, and 83% of the croplands are olive plantations (16.2% of the district surface). Above 7% of these olive plantations are organic (760ha).

Criteria for farm selection

Organic olive farms were randomly selected from the official database of organic olive farms (n=86 for Tierras de Granadilla district), facilitated by the Organic Farming Committee of Extremadura. There was no restriction in terms of farm size and fragmentation to be selected.

There was not any database of conventional olive farms available for this district neither for the region. Hence, we initiated the farm selection with two important constraints. First, we did not have a list of farms to do a random selection of farms. Second, we did not have a previous characterization and distribution of olive farm categories for this district. This would have facilitated the contrast of the 10 selected olive farms with the range of olive farm within the study area.

Given there was not previous information on olive farm size, structure and features specific for the study area we did a fully random selection of olive farms, and the selection was contrasted with the general description of olive farms in Extremadura reported by Llerena (2008) for olive plantations features.

Identification of case study farms

From the official database of organic olive farms in the district (n=86), we elaborated a randomly sorted list and farmers were visited by order to get the agreement of collaboration. The process was stopped once we got the agreement of 10 farms.

For conventional olive farms we have followed a blind random approach based on Corine Land Cover map and the Cadastral map. From this we generated a list of olive plantation plots within the study area. We randomly sorted the list and then started to visit the selected plots by order, after confirming with aerial orthoimages that the land use of the selected plot was olive plantation.

Given each farm is generally composed of several cadastral plots, once a plot had been selected, the whole farm that included that plot was selected. The first 10 farms whose owners agreed to participate with the project were selected. The only reason to be discarded was the disagreement of certain owners to collaborate.

Description of 10 + 10 case study farms

Main features of the 10+10 selected olive farms are given in TABLE 25. A comparison of the size-classes and level of fragmentation of selected conventional and organic farms is plotted in Figure 24, and finally, the location of the 10+10 farms is shown in Figure 25.

TABLE 25 Main features of the 10 organic +10 conventional selected olive farms.

	ORGANIC			CONVENTIONAL	
Farm Number	Size (ha)	Plot Numbers	Farm Number	Size (ha)	Plot Numbers
1	20.4	41	1	3.1	20
2	4.7	6	2	5.0	18
3	20.1	26	3	0.5	3
4	4.2	10	4	5.9	19
5	14.6	15	5	1.5	2
6	12.1	10	6	36.2	1
7	4.5	4	7	5.1	6
8	10.3	17	8	2.5	6
9	7.4	1	9	0.1	1
10	5.0	8	10	1.3	13

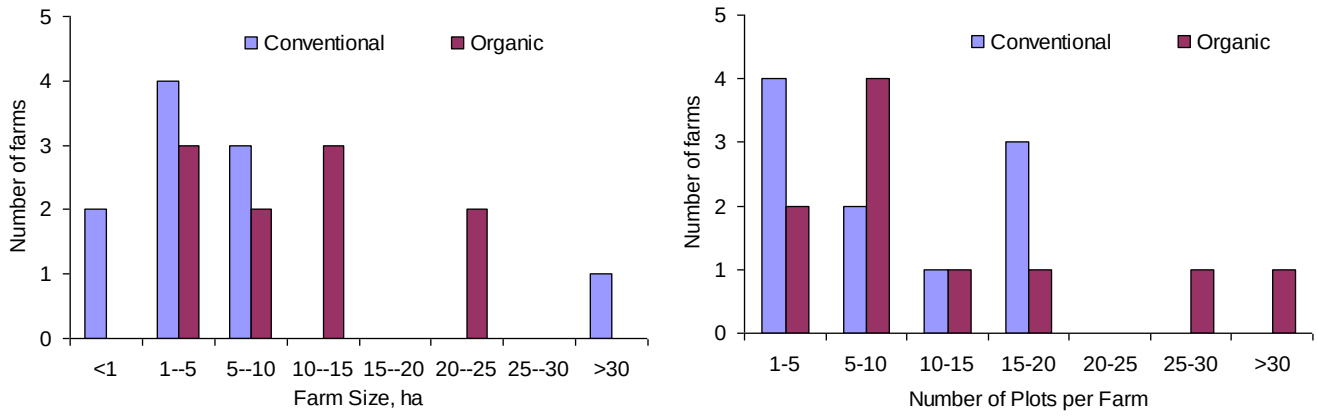


Figure 24 Size-class (left) and fragmentation-class (rigth) distribution of selected olive farms.

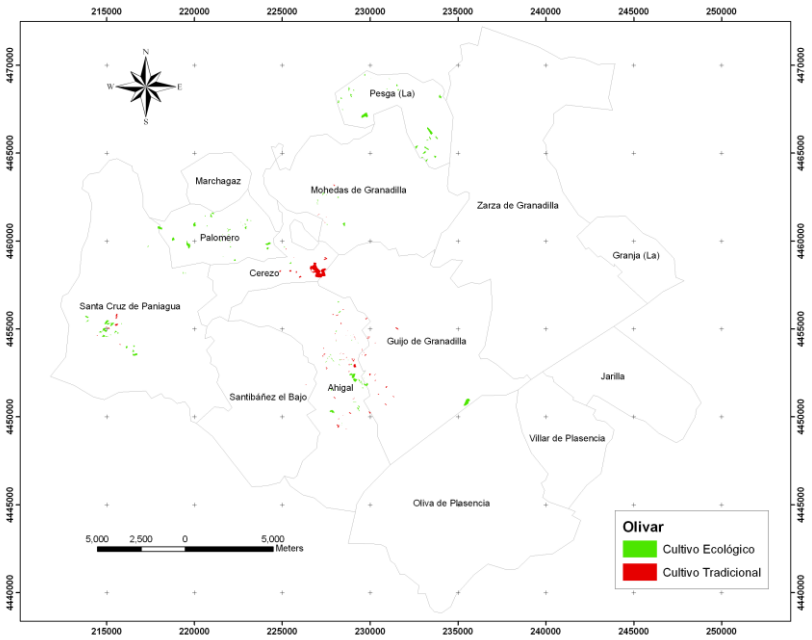


Figure 25 **Map of distribution of 20 selected multi-plots olive farms in Tierras de Granadilla district (Extremadura, Spain).**

References

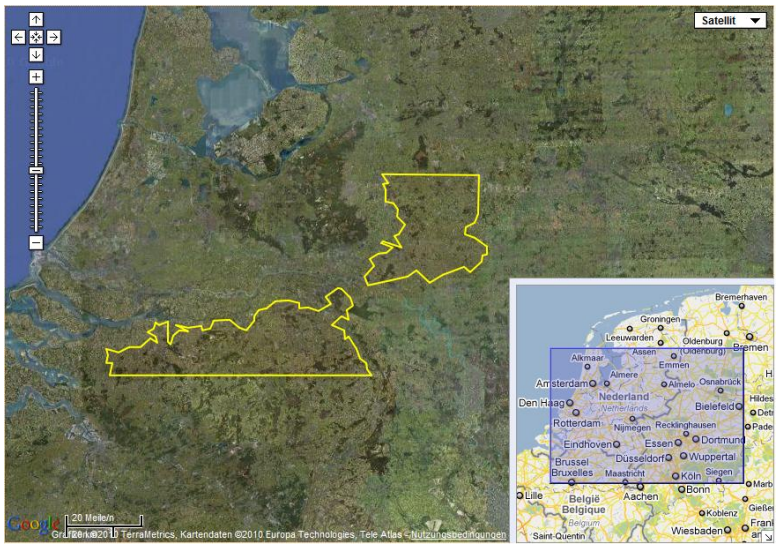
Jongman R.H.G., Shkaruba A.D., Bunce R.G.H., and Metzger M., 2009. The European Environmental Zones and Strata. ALTERRA, Wageningen; The Netherlands.

Llerena J.L. 2008. Estudio del sector olivarero y de trasformación de la aceituna en Extremadura. Doctoral Thesis. Universidad de Extremadura.

1.14. L_HOR Organic Horticulture, The Netherlands

Geographical delimitation, geomorphology and climate

The case study region is situated in the eastern part of the provinces of Gelderland and Noord Brabant. It is part of the Environmental Zone Atlantic Central and within Stratum EnS2. The whole area is pleistocene covered with podzolic soils and locally gleyic soils in the stream valleys. It is a flat area with an altitude of 35 m in the east and 9 m above sea level in the west. The climate is Atlantic, with annual precipitation between 650 and 750 mm.



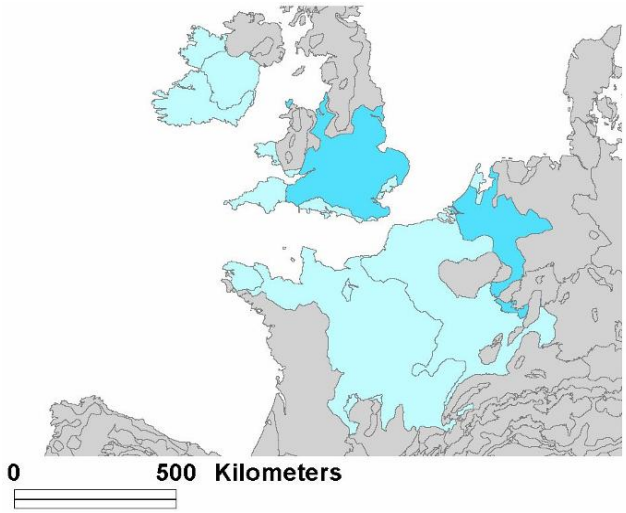


Figure 26 Location of EnS2 (bright blue)

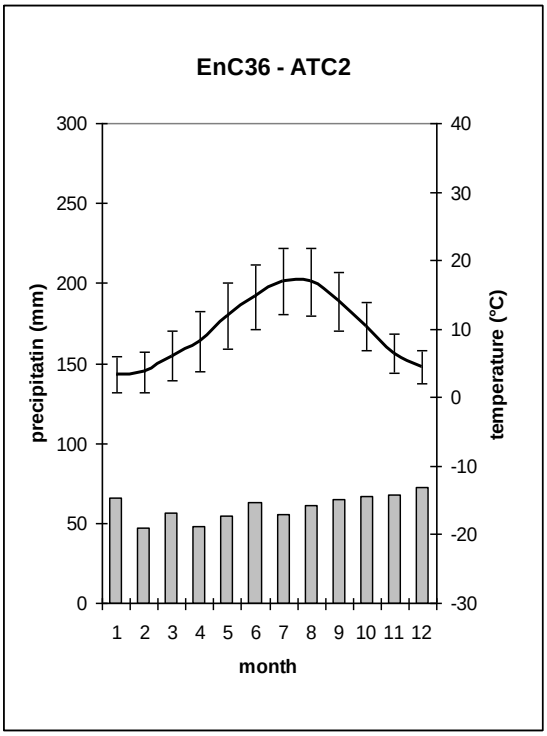


Figure 27 Climate diagram of EnS2

Farming structure

66 % of the study area is under agricultural use. Horticulture is only 5% of the agriculture in the area, far the most is dedicated to dairy farming.

TABLE 26 Land use in the study area

Land use (LGN5) 1	area (ha)	rel. area
Agricultural	329,094	66%
Urban	64,274	13%
Infrastructure	11,209	2%
Forest	70,830	14%
Nature	14,164	3%
Surface water	7,887	2%
Total	497458	

1) Hazeu, 2005.

TABLE 27 Agricultural land use and main farm types in the study area

Type (LEI)	***Farm type***	area (ha)	rel. area	count	rel.count	av. Size (ha)
1	*arable farming*	31,983	12%	2,318	15%	14
2	***Horticulture***	**12,981**	**5%**	752	5%	17
	greenhouse farming	1,559	1%	479	3%	3
3	*fruit production*	1,285	0%	110	1%	12
	tree nursery	6,993	3%	516	3%	14
	perennial plants	398	0%	91	1%	4
4	*dairy farming (grazing)*	142,145	55%	6,910	44%	21
5	*Animal breeding (inside)*	22,567	9%	2,716	17%	8
6	*Mixed crops*	6,685	3%	245	2%	27
7	*(mixed) dairy farming*	12,510	5%	496	3%	25
8	*animals/crops*	19,111	7%	1,208	8%	16
	Total	**258,218**	**100%**	**15,841**	**100%**	**16**

TABLE 28 Farm types in horticulture in the study area

Horticulture farm type	farm (ha)	farm (#)	avg. size (ha/farm)
Vegetables	7,911	397	19.9
Floriculture	3,832	212	18.1
Mixed horticulture [1]	1,186	36	32.9
Mushrooms	52	107	0.5
Totals	**12,981**	**752**	**17.3**

[1]) Mixed horticulture farms are a mixed form. They cannot be classified to either vegetables nor floriculture, due to their mixed profit out of both or other horticulture. The mixed horticulture farms are almost twice as large as the non-mixed specialised farms.

Farm selection

The criteria for farm selection have been the following:

- All farms should be in EnS2, to guarantee the same environmental conditions
- All farms are horticulture farms
- They must all be on Pleistocene soils in the south or eastern part of the Netherlands
- No glass house farming
- No size restriction
- No farms in low situated wet areas (dominated by permanent ditches).

The farm selection process was as follows:

- Writing potential farmers through Biologica (20 organic farms)
- Farms have been targeted after a general request
- Conventional farms have been asked through the ministry of Agriculture, Nature and Food Quality as there is not much willingness among them to cooperate in a project on organic farming.

Description of Case Study Farms

In the Netherlands the number of case study farms has been 16, of which only five are non-organic. The reason for the low number of non-organic farms is unwillingness of the conventional farmers to cooperate in a project for organic farming. The total number of farms has been determined by calculation of costs required to do the sampling on habitats, vegetation and species in a way that it would fulfill the requirements of the project and the procedures as prescribed for field work.

All farms are conform to the criteria used. They all are on Pleistocene sandy soil, are specialized in horticulture with some a small grassland for a hobby horse. There are no farms with permanent high water table. Therefore the selection can be considered homogenous in physical terms.

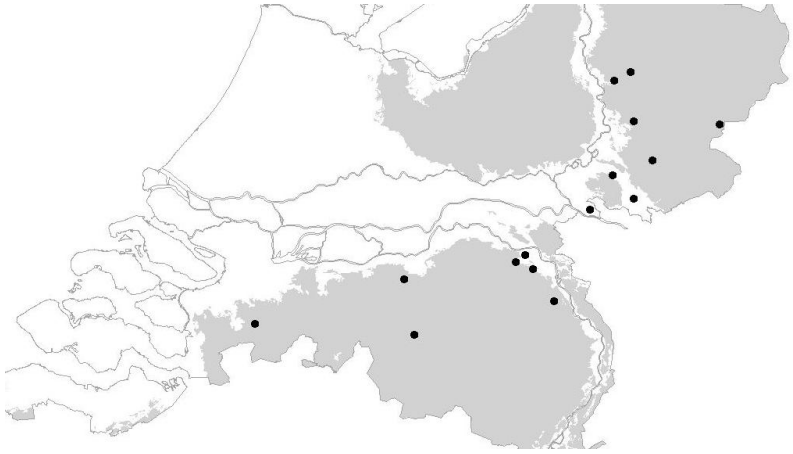


Figure 28 **Selected farming region and selected farms. In the grey area sandy podzolic soils with an average water table in summer below 40 cm. Three farms seem to be outside the sandy soils, but they are mixed or on smaller sandy areas in the river area.**

TABLE 29 Data of BioBio farms in the Dutch case study region

Organic				**Conventional**			
Farm nr	Type	Area (ha)	Parcels (N)	Farm nr	Type	Area (ha)	Parcels (N)
NL-3	Hort	?	?	NL-21	Hort	?	?
NL-4	Hort	15.50	10	NL-22	Hort	7.7	6
NL-5	Hort	22.40	13	NL-24	Hort	21.6	12
NL-9	Hort	14.00	8	NL-25	Hort	24.3	6
NL-10	Hort	23.80	16	NL-26	Hort	20	14
NL-12	Hort	5.60	5				
NL-13	Hort	46.10	16				
NL-14	Hort	13.50	5				
NL-15	Hort	44.30	15				
NL-19	Hort	6.90	4				
NL-23	Hort	13.70	9				
Average		**20.58**	**10.1**			**18.4**	**9.5**

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1.15. I_VIN Organic and conventional vineyards in Veneto region, Italy

Geographical delimitation, geomorphology and climate

The area chosen for the case study is located in North-east Italy, in the Veneto region.

In Veneto Region, soils and environmental characteristics are very heterogeneous, both concerning the geological and pedological, and the environmental characteristics. This is due to the geographical and geological characteristics of the region which include: plains, hilly lands, the Alps, lagoons and a long coastal belt (ARPAV, 2004; 2005).

The soils of Veneto are characterised by two main sub regions. Soils are rocky in the Alps and hilly land, and mainly alluvial in the plains, but always with a large variability within even nearby areas. Soave is a hilly area about 30 km East from Verona. Soils are generally basaltic (paleo-volcanic soils) with alluvial clay and calcareous areas. Colli Euganei is a hilly area, located about 20 km to the west of Padua. Soils are calcareous and marna, in some areas clay (Haplic Luvisols). Lison-Pramaggiore is located in the Far East of the region, on an alluvial plain. Soils are characterised by sandy-silt or clay-silt (ARPAV, 2004; 2005).

Climate can vary significantly among areas: continental on the inner plains, the climate is milder along the Adriatic coast (Lison-Pramaggiore), around Lake Garda and in the hilly areas (Soave and Colli Berici). Fog is present in the lowlands (Lison-Pramaggiore) during fall or late winter. Precipitation is scarce (750 mm/year) next to river Po, more abundant (750-1.100 mm/year) at higher altitudes; up to 3.200 mm/year in the Bellunese Prealps (ARPAV, 2004; 2005).

Farming structure

In 2005, there were about 143,000 agricultural holdings in Veneto accounting for 900,000 ha of utilised agricultural area (UAA), distributed as follows: 47% specialised in cereal crops, oil crops and protein crops, 13% in vineyards, and 8% in horticultural and woodland crops.

TABLE 30 Agricultural land use in Veneto (Regione Veneto, 2008)

Annual crops ha (%)	Perennial crops ha (%)	Permanent pasture ha (%)	Woodland/ plantation ha (%)	Agricultural area not utilised ha (%)	Total Agric. Area ha (%)
561,697 (50)	106,922 (10)	151,583 (14)	170,597 (15)	130,587 (11)	1,121,386 (100)

Veneto is one of the regions known as "tre venezie". It is the third largest region of Italy in wine production. Veneto's 25 Controlled and Designation of Origin (D.O.C.) and 3 Guaranteed Designation of Origin (D.O.C.G.) wines cover a production area of more than 25,000 hectares (3% of regional UAA) and involve about 30,000 wine-growing businesses and 44 wine cooperatives. More than 85% of UAA is devoted to the eight main designations: Soave, Conegliano-Valdobbiadene, Valpolicella, Bardolino, Piave, Colli Berici, Bianco di Custoza and Lison Pramaggiore (Regione Veneto, 2008). It has to be pointed out that the organic vineyard in Lison-Pramaggiore is the largest organic vineyard area in the world.

Table 31 Conventional and organic vineyard area in the three selected sampling areas.

Sampling area	Geographical area ha	Vineyards cultivation ha (% total area)	Organic vineyards ha (% of vineyards)
Soave	27,917	7,265 (57)	n.s.(< 0,0..%)(**)
Colli Euganei	18,694	2,050 (11)	n.s.(< 0,0..%)(**)
Lison-Pramaggiore	-*	3,250	450 (14)

Data from: AVEPA (2008); Regione Veneto-Bioveneto (2010); Consorzio Tutela Soave (2010); Consorzio Volontario Tutela Vini DOC Lison Pramaggiore (2010).

(*) No official data about the total area are available. The region covers 9 municipalities and parts of other 9 municipalities in Venezia and Pordenone province.

(**) Hectarage of organic production could not be quantified. No official data available. There are only very few organic farms in each region.

Criteria for farm selection

Three production areas have been identified: Soave (Verona province), Colli Euganei (Padova province), Lison-Pramaggiore (Venice province).

Within the three production zones the group of farms were selected on the basis of their proximity and homogeneity, that is, the potential in each area to find organic next to conventional farms, whilst having more or less homogeneous soil and climatic characteristics. The specific farms that have been selected were based on the following criteria:

- farms that brand their own production
- long term experience of the owner
- representativeness of the production for the area
- willingness to join the project

Identification of case study farms

A list of organic wine producers was obtained from local producer associations, institutional database (websites) and booklets, as well as from local experts (technicians) and from AIAB (Associazione Italiana Agricoltura Biologica/ Italian Association for Organic Agriculture). Information was also collected attending wine producer fairs.

A list of suitable organic and conventional farmers was made based on the following criteria:

- location of the farm within the area of interest.
- farmers have to carry out this activity as a full time job and branding their own wine.
- farmers have to be experienced (to secure that farmers properly manage organic practices).
- reliability and willingness of the farmers to take part in the project, including the follow up activities with participation in the focus groups and stakeholder meetings.

Farmers were contacted via telephone and farm visits were carried out for a preliminary survey of the areas and the farms. We selected pairs of organic and conventional farms located in a homogeneous area, even if this was not an easy task due to the complex geomorphological characteristics of the landscape.

Description of 9 + 9 case study farms

For each of the three areas selected (Soave, Colli Euganei and Lison-Pramaggiore), paired farms have been selected close to each other, for as much as possible. The farm pairs are located as follows: Soave, 4 pairs; Colli Euganei, 2 pairs; and Lison-Pramaggiore, 3 pairs.

The farms are specialised in wine production with vineyard being the only, or the main culture. The vineyards sampled are more than 10 years old and thus are in full production. Farm areas range from 10 to 130 ha (TABLE 32).

Organic farms use manure and pellets as fertilisers and copper sulphur as the main fungicide. Mulching is used for weed control along with various forms of soil tillage. Conventional farms use synthetic fertilisers and pesticides. Herbicides are used for weed control.

TABLE 32 Farm characteristics in the sampling areas. Verona Province (VR), Padova Province (PD), Venezia Province (VE).

Area	**Vineyards ha average (Min.& Max.)**	**Vineyards as % UAA**	**Other crops % UAA**
Soave (VR)	Av. 18 (Min.12; Max. 30)	95	Olives – 5%
Colli Euganei (PD)	Av. 15 (Min.10; Max. 25)	100	-
Lison-Pramaggiore (VE)	Av. 90 (Min.10; Max. 90)	98	Wheat – 2%

UAA: Utilised Agricultural Area

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