Spatial characterization of sample landscapes

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1. Goals of the landscape approach

The AGFORWARD research project (January 2014-December 2017), funded by the European Commission, is promoting agroforestry practices in Europe that will advance sustainable rural development. The project has four objectives:

1. to understand the context and extent of agroforestry in Europe,
2. to identify, develop and field-test innovations (through participatory research) to improve the benefits and viability of agroforestry systems in Europe,
3. to evaluate innovative agroforestry designs and practices at a field-, farm- and landscape scale, and
4. to promote the wider adoption of appropriate agroforestry systems in Europe through policy development and dissemination.

This milestone (which forms part of work-package 7) addresses objective 3 in that describes the characterisation of socio-cultural catchments that will be used to determine the ecosystem services provided by agroforestry systems at the landscape scale. The ecosystem services (ES) to be assessed comprise provisioning services, biodiversity, regulating and cultural services. These services depend on land cover and land use. A habitat map can help to capture land use, which – together with additional spatial data (e.g. a soil map, precipitation, temperature, and terrain models) – can be used to evaluate some of these services. The different types of agroforestry can be mapped as different habitat types and thus their effect on ES provision in the case study regions can be evaluated.

In 12 European landscapes (Table 1) selected for landscape-level ES mapping, a larger "socio-cultural catchment" was defined, which is a coherent cultural area harbouring "agroforestry", "agriculture", "forestry" and urban areas. The socio-cultural participatory GIS mapping exercise was carried out within the entire socio-cultural catchment. Within this catchment, landscape test sites (LTS) of a defined size were selected for detailed biophysical ES mapping.

The goal is to compare the biophysical ecosystem services (and disservices) of agroforestry systems (herein referred to as AF) versus agricultural land without agroforestry (herein referred to as A), and forestry-only systems ("forestry"; herein referred to as F).

Within each socio-cultural catchment area, a number of landscape test sites (LTS) were selected. Each of these LTS should be representative of the landscape's agroforestry systems (AFS), agriculture without agroforestry (A), and forest (F) areas. These LTS were mapped in detail through the habitat mapping process. In each socio-cultural catchment area, the following LTSs were selected: four agroforestry sites (AF), four agriculture sites (A), and four forestry site (only if the forest can be regarded as a "control" with respect to the agroforestry system, i.e. consists roughly of the same tree species or tree type).

The habitat mapping is the exercise of creating a detailed habitat map of each LTS, including functional elements relevant to biodiversity and other ES, which can then be used to calculate and map relevant ecosystem services.

2. Criteria for selection of case study regions

2.1 Types of agroforestry landscapes

We decided to work on the four categories of agroforestry landscapes defined by four work-packages in the AGFORWARD project (WP2, WP3, WP4, and WP5). However sometimes the distinctions between them are imprecise and some types of agroforestry are difficult to find at a landscape scale. The four types are:

    a. Agroforestry systems of high nature and cultural value (WP2)

    b. Agroforestry systems integrating livestock and crops into high value tree systems (WP3)

    c. Agroforestry for arable systems (WP4)

    d. Agroforestry for livestock systems (WP5)

In AGFORWARD, WP2 and WP3 include some extensive agroforestry types that can be viewed at several spatial scales, that is at plot, farm and landscape scales. However, given the rarity of agroforestry for arable systems, and the non-existence of alley crops relevant at landscape scale, we agreed to consider fine mosaic of cultivated fields with small wood parcels (semi-natural habitats with woody vegetation in a broad sense) as example of agroforestry for arable systems (WP4). According to Corine Land Cover classification, within agricultural areas, lands labelled as *heterogeneous agricultural areas* (code 24 at level 2) can be viewed as agroforestry landscapes. More specifically, those labelled as *complex cultivation patterns* (code 242 at level 3) or *land principally occupied by agriculture, with significant areas of natural vegetation* (code 243) are potentially valid. The case studies of agroforestry for livestock systems included in the AGFORWARD project were primarily plot-scale experiments. Therefore, it was decided to move some high nature and cultural value (HNCV) agroforestry cases studies mostly devoted to livestock breeding from WP2 to WP5. Wood pastures included here as livestock-based agroforestry landscapes could be hence also viewed as HNCV agroforestry landscapes.

2.2 European biogeographical regions

The case studies were located in the main biogeographical regions present in Europe, taking into account the extent of the regions, the cover of agricultural areas (code 2 in level 1 of CORINE database), and the importance of agroforestry systems, defined here are any type of heterogeneous agricultural areas (code 24 in level 2 of CORINE database). Accordingly, case studies were located in Continental, Mediterranean, Atlantic and Boreal regions (Figure 1). The three former regions harbor most of the European agricultural land (*ca* 80%), and the three have important areas with heterogeneous agriculture (22%, 38% and 17% of the agricultural lands, respectively). The proportion of heterogeneous agriculture is also high in the Boreal region comprising 33% of the agricultural land. The Pannonian region was not used because of the scarcity of heterogeneous agriculture (7%). Other regions were excluded either because their low extent in Europe (Macaronesia and Steppic) or the low importance of agricultural lands (Arctic, Black sea, and Alpine). The Anatolian region was excluded because it is located exclusively in Asiatic Continent.
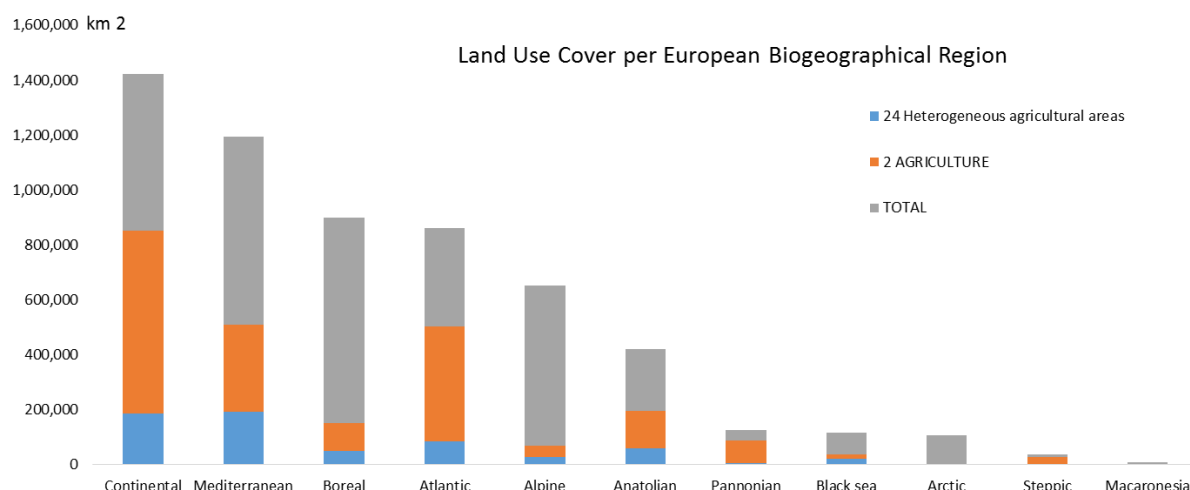
Figure 1. Extension of the European biogeographical regions (in km^2) showing also the cover of agricultural areas, and within them the areas with agroforestry landscapes (defined as heterogeneous agricultural areas). Data source: CORINE 2006 land use database.

2.3 Agroforestry landscapes selected

The study includes main European agroforestry practices taking into account the four types of agroforestry defined in AGFORWARD and the four biogeographical regions above mentioned. Combining both, four AF types x four regions, we could have up to 16 case studies taking a case per combination. Nevertheless, only 12 agroforestry landscapes were selected, four in the biggest regions (Continental and Mediterranean), where the four types of agroforestry systems are found, while only three were located in the Atlantic region, and one in the Boreal region (Table 1), in agreement with the importance of agriculture and agroforestry landscapes in those biogeographical regions.

Table 1. List of 12 AGFORWARD case studies classified by four agroforestry landscape types and by 4 biogeographical region categories. Responsible partner in brackets.

Agroforestry land-scape type	Biogeographical regions			
	Mediterranean	Continental	Atlantic	Boreal
AF systems of high nature and cultural value (WP2)	PT2. Cork Oak Montado, Portugal (ISA)	RO2. Wood pasture Romania (UBB)	FR2. Bocage France (INRA)	SW2. Fennoscandian oak wood-pastures Sweden (UCPH)
AF systems with high value tree (WP3)	GR3. Olive tree system Greece (TEI)	CH3. Fruit orchads (FDEA)	SP3. Chesnut soutos Spain (USC)	
AF systems for arable lands (WP4)	SP4. Intercrop oaks Spain (UEX)	GE4. Intensive arable system with trees/ woodlands Germany (UCPH)	UK4. Silvoarable landscapes at UK (CRAN)	
AF systesm for livestock (WP5)	SP5. Holm Oak Montado, Spain (UEX) (Cattle, Sheep and Pig)	CH5. Wood pastures Switzerland (FDEA) (Horse and Cattle)		

3. Criteria for selection of socio-cultural catchments

3.1 Definition of agroforestry landscapes and controls

Landscapes rarely compose of a single land use type but they are more or less complex combinations of land uses. Besides, agroforestry practices rarely go beyond of single plots/farms. Only for some specific traditional practices, agroforestry dominates the landscape. For this study, any landscape with > 25% of land cover by heterogeneous agriculture is defined as agroforestry landscape (*AF*). The CORINE database defines four types of land uses under this category:

241 - Annual crops associated with permanent crops,

242 – Complex cultivation patterns,

243 - Land principally occupied by agriculture, with significant areas of natural vegetation,

244 – Agroforestry (include almost exclusively Iberian dehesas and montados).

Ideally AF landscapes are compared with both forest and agricultural landscapes (this is the procedure for WP6 modeling exercises). However, to find triplets in the same area (agricultural (A), agroforestry (AF) and forest (F) landscapes) was difficult in many cases. Hence, the comparison of AF landscapes just with agricultural landscapes (or exceptionally with forest landscape) is decided as a minimum. For specific case studies F landscapes could be included in the study (this could be more valid for wood pastures cases).

An agricultural landscape was defined where the cover of arable lands (codes 21x), permanent crops (codes 22x) and pastures (codes 231) added up to more than 50% of the landscape, and the cover of heterogeneous agriculture (code 241 to 244) added up to less than 5% of the area. Finally, the control forest landscape was defined as where landscape is dominated (> 75%) by any combination of forest (codes 31x), shrublands (codes 322 and 323), and transitional woodland-shrubs (code 324).

If these land uses were not (or scarcely) present/mapped in a study area, alternatively AF was defined as a mosaic of other lands uses: > 35% of land devoted to Agriculture (A) and > 35% cover by Forest (F), and there are at least 4 plots of A+F (to exclude squares where just a sharp change from A to F is found). The same was applicable where a mosaic of herbaceous crops with tree-based crops (olive groves, fruit orchards …) was found. When CORINE did not identify heterogeneous agricultural landscapes because semi-natural features were not sufficiently mapped, an expert approach was followed to define agroforestry landscapes by visual inspection of orthoimages. The separation among AF and A or F landscapes was mostly based on the density of woody features. This was the case for bocage in France, but it could also be the case for intensive arable system intermixed with hedges of trees and/or shrubs, woodlots (which in many cases is poorly mapped in the CORINE database). Further habitat mapping confirmed the selection. Globally, for any type of AF landscapes, the A control was defined by the lower abundance of trees or the semi-natural features that define the AF landscapes (lines of planted trees, scattered trees and/or linear features such as hedgerows). The F control was defined by the higher abundance of these elements. Accordingly AF would occur at a point along a forest to open pasture/agriculture gradient.

In addition to the vegetation cover, the land use was also important. The main agricultural activity should be the same in both the AF and A systems. That is, where AF is devoted to livestock husband-

ry (WP2 and WP5), A should be also devoted to livestock husbandry (e.g. wood pastures vs open pastures); where annual crops are cultivated among trees (tree lines or sparse woodlots) (WP4), the A landscape should be used for annual crops. For AF landscapes dominated by high tree value systems (WP3), the definition of A control landscape can vary. For instance, grazed or intercropped olive groves or fruit orchards (AF) can be compared with either open grazed/cultivated lands, or preferably with intensively managed tree crops. In these latter cases, the definition of F landscapes could be impracticable. Where possible, the Forest landscape (F) was defined in the areas where the tree species present in the AF landscape are not associated to the farming practices (nor grazed or not intercropped). Besides, the tree density ideally should be higher in F than in AF, and the forest should cover at least 75% of the squares.

3.2 Experimental design

Each case study was completed within a unique socio-cultural catchment (SCC), defined as a territory with similar lifestyle, traditions, and land uses. For AGFORWARD each SCC was formed by four municipalities (or less if they include several villages) that have both AF and A landscapes (and F landscape if possible) in its territory. Ideally the two (three) landscape types should be as similar as possible in terms of ownership, topography (e.g. AF in the top mountain vs and A in the valley would not be comparable), and accessibility (e.g. distance to public roads). The four municipalities should be as close as possible although some flexibility was allowed. The whole territory of each municipality will be used for PPGIS data collection and other questionnaires (socio-cultural and provisioning services) as described in milestone 31.

For the evaluation of biophysical ecosystem services, within each municipality two (three) landscape test sites (LTS; 1 x 1 km) were randomly located (Figure 2), one LTS within a typically agroforestry landscape and paired LTS within a typically agricultural landscape and within a typically forest landscape (as defined above). Again the paired LTS was meant to be similar in terms of soil type and topography. If needed, the shape could change, perhaps even an irregular polygon (but always with 1 km^2). Smaller LTS would not include all the landscape components, and to define contrasted land use (AF *vs* A and F) could be difficult with bigger LTS, especially where farms are of small size.
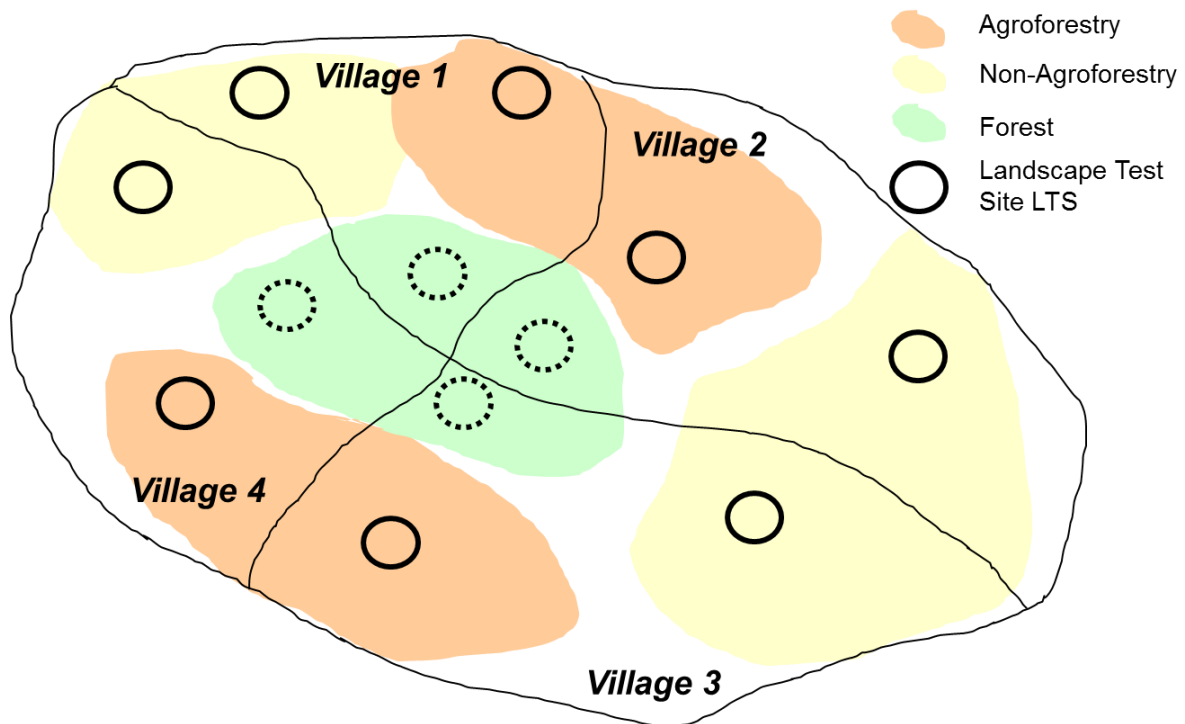
Figure 2. Conceptual sketch of a cluster of four villages, which together can be regarded as a socio-cultural catchment. Participatory GIS is carried out in those four villages. Ideally, in each village there are agroforestry and non-agroforestry areas. Those areas are randomly sampled with squares/circles of 1 square km which are termed landscape test sites (LTS). There is one LTS per stratum, i.e. four agroforestry LTS and four non-agroforestry LTS per catchment. If it made sense for the agroforestry system under investigation, additional LTS circles were located in the forest areas.

4. Socio-cultural catchments selected

The selected sites (socio-cultural catchments; SCC) covered a wide geographical range in Europe (see Figure 3) and climatic and physiographical characteristics (Table 2). Six of the sites are lowlands (mean altitude below 250 m), and only two are in the mountains (Galicia in Spain (SP3) and Jura mountains in Switzerland (CH5), with mean altitude of 849 and 1002 m, respectively).
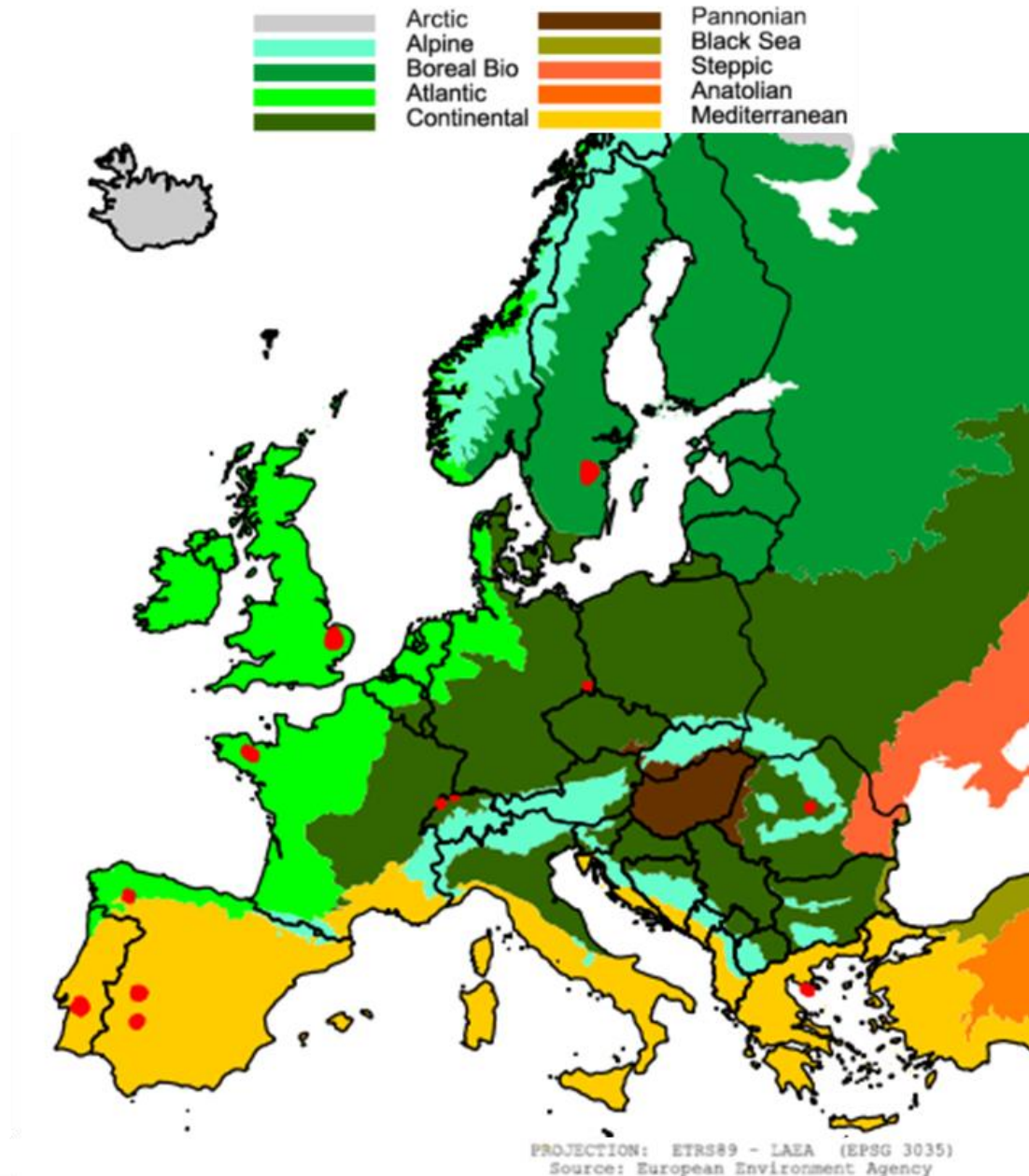
Figure 3. Map of European Biogeographical regions with 12 socio-cultural catchments (SCC) selected Note that SCC areas are not in scale (overrepresented to facilitate the visualization).

Differences in latitude and altitude created wide climatic differences among sites, with mean annual temperature ranging from 5.2°C in Swedish SCC (SW2) to 19.2 in Spain (SP5). Other Mediterranean sites also had a high mean annual temperature (>17°C).

The selections included sites with gentle orography (mean slope < 8%) and some steep sites, especially the Northern Spain site (SP3) and the two Swiss sites (CH3, CH5), with mean slopes of 30.0, 18.9 and 14.0 %, respectively. Mean slope agrees logically with the range of altitude within each site. For instance, SP3 shows the highest mean slope and the widest range of altitude (343-1623 m).

Each selected sites included a proportion of the area which was included in the European network Natura 2000 (Special Protection Areas (Birds Directive) and/or Sites of Community Importance (Habitats Directive). The largest proportional areas covered by protected sites were in RO2, SP3 and GE4 with 74%, 56% and 41% of the surface protected. The proportion of the area protected was lowest for FR2, GR3 and CH2 (Table 2). Maps with the location of the protected areas within each SCC are shown in Sections 6.1 to 6.12.

Table 2. Location and basic characteristic of the 12 study sites. Values here summarized are estimated from digital cartography at European scale, and can differ slightly from values presented in the detailed description on the SCC (Section 6.1 to 6.12).

Sites (LTS)	[1]Longitude (Decimal	[1]Latitude degrees)	Area (ha)	[2]Mean annual temperature (º C)	[3]Mean altitude and range (m)	[3]Mean and max slope (Degree)	[4]Natura 2000 (% area)
PT2	-8.29500	38.64703	123215	16.3	180 (17-413)	3.0 (0-37)	29.1
FR2	-2.79187	48.21696	73595	10.6	172 (49 09)	3.4 (0-37)	0.6
RO2	25.10984	46.0645	23761	7.8	574 (440-761)	6.9 (0-38)	67.9
SW2	15.60242	58.36402	156887	6.3	96 (27-240)	2.5 (0-37)	4.1
GR3	23.48359	40.010346	33706	15.8	94 (0-338)	7.8 (0-50)	1.0
SP3	-7.25907	42.66934	52742	10.6	849 (342-1623)	16.5 (0-54)	55.8
CH3	7.6632	47.44918	4983	8.3	597 (333-899)	10.6 (0-44)	No data
SP4	-5.75883	38.57548	63959	15.6	519 (354-840)	4.3 (0-31)	8.6
GE4	14.60612	51.16802	9249	8.2	231 (151-561)	3.0 (0-21)	41.0
UK4	0.67196	52.45923	163422	9.4	32 (0-110)	1.4 (0-30)	29.0
SP5	-5.93478	39.53094	94288	15.6	424 (209-781)	3.2 (0-41)	24.3
CH5	6.97554	47.21426	5209	6.1	1002 (519-1180)	7.8 (0-52)	No data

[1] Coordinates refer to the centroid of the Landscape Test Site (LTS).

[2] Extracted from Metz et al. 2014: Surface temperatures at the continental scale: Tracking changes with remote sensing at unprecedented detail. Remote Sensing. 6, 3822-3840 (http://gis.cri.fmach.it/eurolst-bioclim/).

[3] Calculated from the Digital Elevation Map of GMES RDA project (www.eea.europa.eu/data-and-maps/data/eu-dem)

[4] Protected area by Nature 2000 Network (www.eea.europa.eu/data-and-maps/data/natura-5#tab-gis-data).

The extension of the socio-cultural catchments ranged from some thousands hectares (ca 5,000 ha in the two Swiss SCCs) up to > 160,000 ha in the UK. All cases are mostly rural, with landscapes dominated by agricultural and forest land uses and moderate population density (usually 30-60 inhabitants/km^2). Nevertheless, there are important exceptions, with very low population density in Spain (11-13 inhabitants/km^2 in the three SCCs) and very high in Switzerland at CH3 (165 inhabitants/km^2). This is reflected in the proportion of soil occupied by artificial surfaces (Table 3), with 7.5 % for CH3 and 0.3 % in Spanish sites.

The ratio between farmland and semi-natural areas (natural grasslands, forests, shrublands and other semi-natural areas) varied greatly among sites, according to CORINE Land Use 2006 data. In

France, Germany, and the UK and to a minor extent in SP4, the landscape is clearly dominated by agricultural uses. In the other sites, the area of agriculture and semi-natural vegetation is more equally divided (Table 3). Within the agricultural land, there are also important differences among sites (Table 4). Open arable lands dominated the landscape in sites FR2, GE4, SW2, CH5, CH3 and GR3. In the latter two sites, permanent crops are also important (23 % in GR3, based on olive groves, and 17 % in CH3 based on fruit orchards). Pastures dominated the landscapes in RO2 and SP5.

Table 3. Main land uses of the territory in the 12 study sites, according to CORINE Land Use 2006. Data of land use express percentage of the total territory.

Site	Area (ha)	Artificial surfaces	Agricultural areas	Natural Grasslands	Forests	Rangelands	Wetlands and Water Bodies
PT2	123215	0.7%	58.9%	0.0%	34.9%	4.7%	0.8%
FR2	73595	3.6%	88.3%	0.0%	7.5%	0.3%	0.3%
RO2	23761	2.0%	67.3%	0.0%	27.5%	3.2%	0.0%
SW2	156887	4.9%	42.0%	0.0%	42.9%	1.4%	8.9%
GR3	33706	4.5%	63.3%	0.0%	20.1%	11.7%	0.4%
SP3	52742	0.4%	22.4%	0.1%	38.9%	38.0%	0.2%
CH3	4983	7.5%	44.6%	0.0%	47.9%	0.0%	0.0%
SP4	63959	0.3%	72.7%	7.3%	8.9%	10.8%	0.1%
GE4	9249	3.3%	85.4%	0.0%	11.2%	0.0%	0.0%
UK4	163422	5.7%	75.4%	2.6%	14.9%	0.9%	0.5%
SP5	94288	0.7%	44.3%	7.4%	3.3%	44.2%	0.0%
CH5	5209	3.7%	58.5%	0.0%	37.8%	0.0%	0.0%

Table 4. Main types of agriculture in the 12 study sites, according to CORINE Land Use 2006. Values express percentage of agricultural lands.

Site	Arable lands	Permanent crops	[1]Pastures	Agroforestry *sensu lato* (Heterogeneous agricultural areas)				
				Total	[2]Silvoarable	[3]Mosaics	Agriculture + [4]Natural veget.	Agroforestry *sensu strictus*
PT2	36.8	2.7	1.5	59.0	3.6	2.7	1.0	51.7
FR2	65.6	0.0	17.3	17.1	0.0	13.2	3.9	0.0
RO2	37.7	1.6	48.8	11.9	0.0	0.8	11.0	0.0
SW2	84.1	0.0	5.9	10.0	0.0	4.0	6.0	0.0
GR3	39.2	23.5	0.0	37.3	0.0	10.9	26.4	0.0
SP3	10.9	0.0	1.1	88.0	0.0	67.6	20.4	0.0
CH3	81.8	16.8	0.1	1.3	0.0	1.3	0.0	0.0
SP4	36.8	4.5	9.1	49.7	0.0	2.4	8.4	38.9
GE4	89.3	0.0	10.6	0.0	0.0	0.0	0.0	0.0
UK4	80.2	0.0	15.3	4.6	0.0	0.0	4.6	0.0
SP5	19.6	1.9	14.3	64.2	0.0	0.1	3.0	61.1
CH5	76.3	0.0	6.4	17.4	0.0	3.9	13.5	0.0

[1] Here included natural grasslands that in Table 4 are not included under the category of agricultural lands. [2] Annual crops associated with permanent crops. [3] Complex cultivation patterns [4] Land principally occupied by agriculture, with significant area not cultivated.

Although agroforestry *sensu strictus* is only important in Iberian Peninsula (PT2, SP4 and SP5 with dehesas and montados), agroforestry *sensu lato* is important in many cases (Table 4), being the dominant land use in PT2 with cork oak montados, SP3 with semi-natural chestnut groves and SP4 with dehesas. Agroforestry is also very important in SP5 with grazed dehesas, GR3 with intercropped and grazed olive groves finely mixed with semi-natural vegetation, and FR2 with mosaic of agricultural uses. Agroforestry seems negligible with CORINE data for CH3, although the importance of fruit orchard managed with grazed livestock makes silvopastoralism an extant agroforestry practices in this site (see Section 6.6). The combination of annual crops with permanent crops was generally minimal in the study sites, but local examination revealed the presence of this practice in some sites e.g. in SP4 where dehesas are periodically cultivated with cereals. For the area mapped as agroforestry by CORINE database for SP4 (Iberian dehesa), only 32.5% is mostly devoted to livestock husbandry, while 67.5% is mostly devoted to annual crops (intercropped oaks). Also a closer observation of the distribution of the arable lands with significant areas of natural vegetation, silvoarable landscapes can be envisaged.

Table 5. Distribution of land use reported by CORINE database for SP4, and the resulted values after a close correction done in site.

Label 1	Label 2	Label 3		CORINE Code	Land use surface, ha	
					CORINE 2006	Data corrected
Artificial surfaces	Urban fabric	Continuous urban fabric		111	199	199
Agricultural areas	Arable land	Non-irrigated arable land		211	19240	19064
	Permanent crops	Vineyards		221	2	2
		Olive groves		223	1431	1431
	Pastures	Pastures		231	319	319
		Complex cultivation patterns		242	2888	2887
		Land principally occupied by agriculture, with significant areas of natural vegetation		243	1227	237
		Agro-forestry areas	**Grazed**	**244**	**21691**	**7440**
			Periodical crops			**15417**
Forest and semi natural areas	Forests	Broad-leaved forest		311	5465	5465
	Scrub and/or herbaceous vegetation associations	Natural grasslands		321	3805	3805
		Sclerophyllous vegetation		323	3621	3621
		Transitional woodland-shrub		324	3850	3850
Water bodies	Inland waters	Water bodies		512	31	31

5. Selection of Landscape Test Sites

We selected four LTS of 1 km x 1 km per land use type (Agroforestry, Agriculture and/or Forest) in each case study. Ideally we should have selected a triplet (A, AF, F) or pair (A, AF) of LTS per munici-pality (at least randomly dispersed in the territory). To define each type of these three land use cat-egories, we first defined the agroforestry landscape, and then we defined the control reference.

The location of LTS was selected at random. The protocol for the selection of the LTS was:
1. To divide the study area in 1 km x 1 km squares (grid).
2. To measure within each square the area coded under different land use in the CORINE land cover database (codes are grouped in few main land uses; Annex A).
3. To record each square under the different categories above defined (A, AF, F, or none of them) according to the criteria described in section 3.1.
4. Within each category (and municipality where appropriate), squares were sorted by random.
5. The first square within each category (*A*, *AF*, and *F*) and municipality (where appropriate) was visually checked (ideally in aerial images) and selected if nothing rare was present (e.g. land use did not respond to CORINE code). If the first of the list was discarded, the 2nd square was checked, and if needed the 3rd, 4th and so on, until the square fitted well with the definition of the landscape category.

6. Description of the Landscape Test Sites

In this section the twelves socio-cultural catchments (SCC) are described, indicating the main charac-teristics of the LTS selected. For each case study the first map shows the spatial distribution of the LTS, and the second map shows the land use of a selected LTS according to CORINE database. The description also includes two tables for each SCC. The first table give details of the location of each LTS (coordinates) and the topographic conditions (mean altitude, slope and aspect) compared to the mean values of the whole SCC. These tables also give information about the intensity of the nature conservation (% of the territory protected under the European Natura 2000 network). The second tables summarize the proportion of the territory occupied by the main land uses for each LTS and the whole SCC.

Taking together all the case studies, we confirmed the similarity of the three categories of LTS (A, AF and F) in term of altitude ($F_{2,110}$= 0.221; p=0.802; Figure 4) and aspect ($F_{2,110}$= 0.034; p=0.967; Figure 5), but not for slope ($F_{2,110}$= 7.594; p<0.00; Figure 6). The mean slope was higher in LTS dominated by forestry (mean slope (%) = 8.7±1.6 S.E.) than in LTS dominated by agroforestry uses (5.0±0.7 S.E.) and this was higher than in agriculture LTS (3.8±0.4 S.E.). With respect to the intensity of the protec-tion, there are not significant differences among the three categories of LTS ($F_{2,90}$= 0.181; p=0.834; Figure 7).
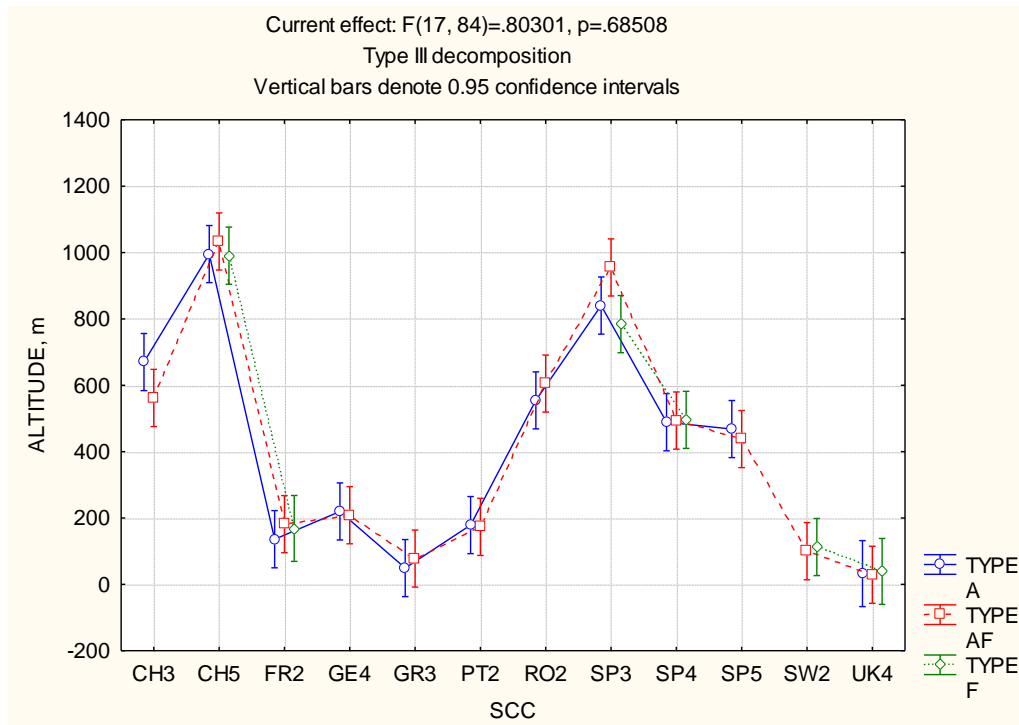
Figure 4. Mean values of the altitude for the three types of LTS (A, AF and F) in the twelve socio-cultural catchments (SCC)
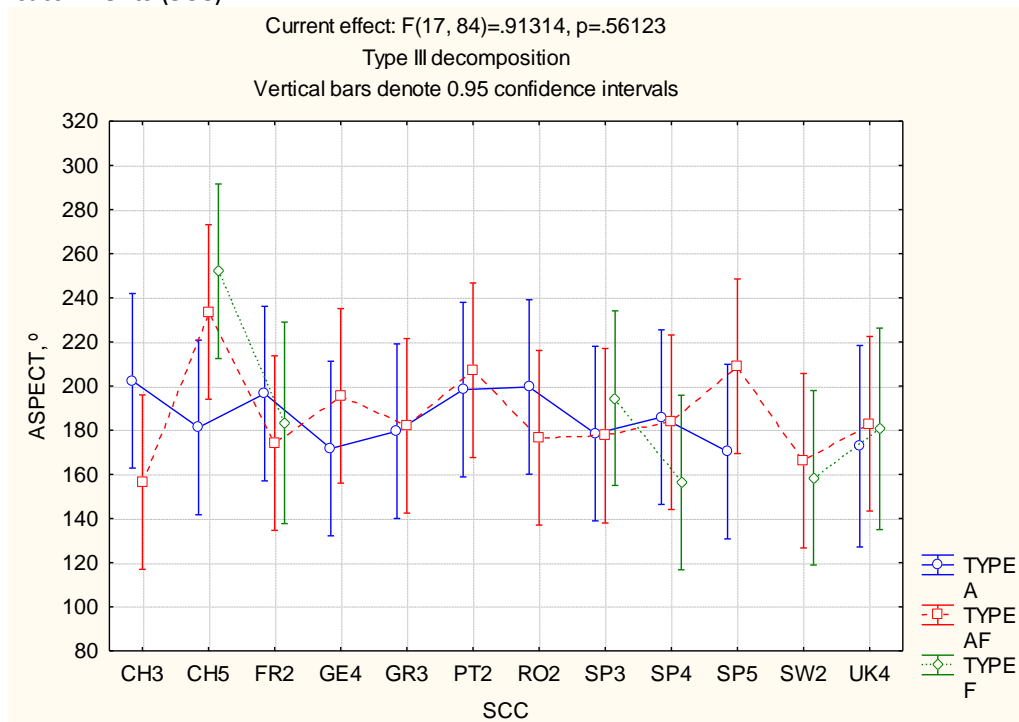

Figure 5. Mean values of the aspect for the three types of LTS (A, AF and F) in the twelve socio-cultural catchments (SCC)
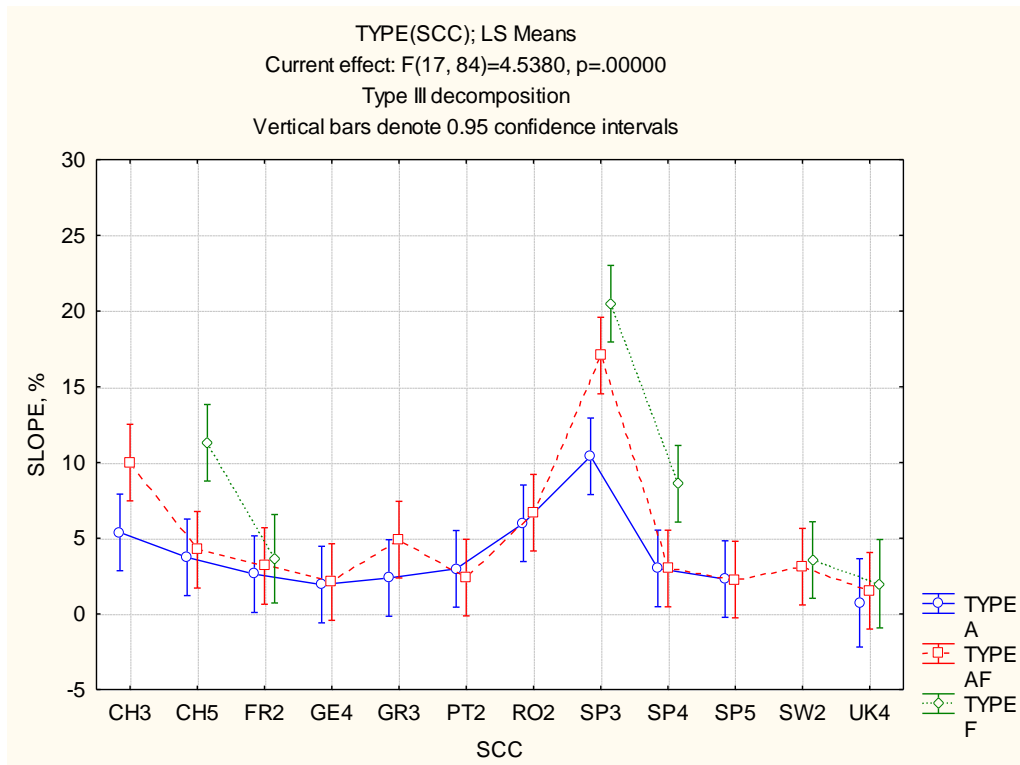
Figure 6. Mean values of the slope for the three types of LTS (A, AF and F) in the twelve socio-cultural catchments (SCC)
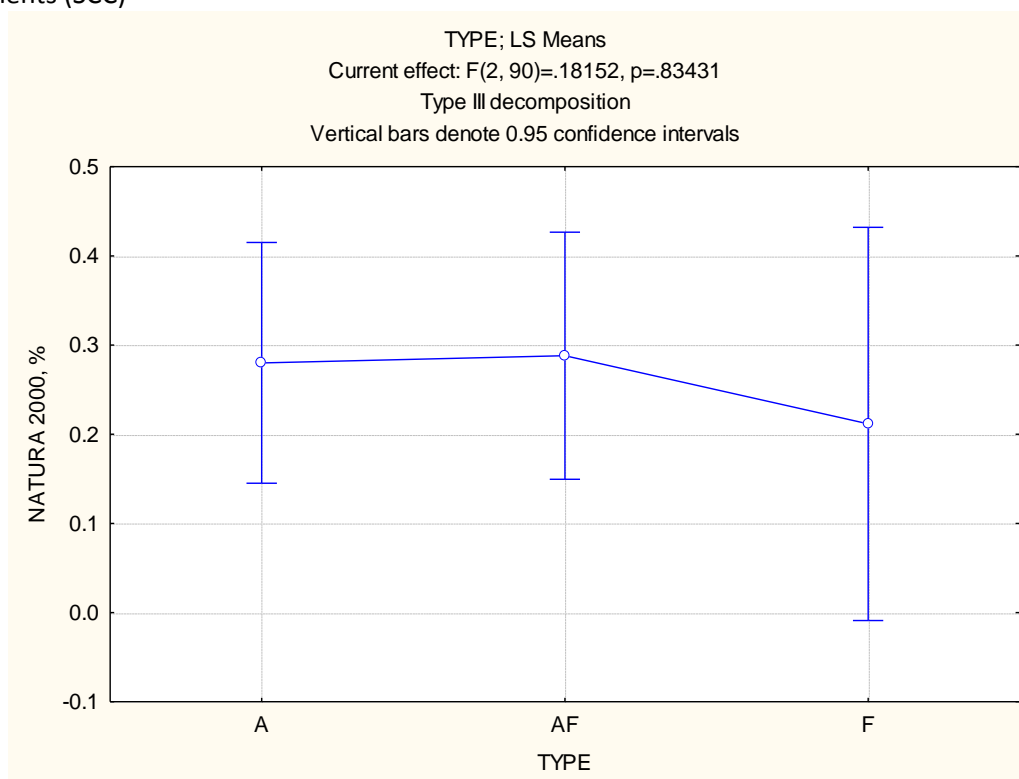

Figure 7. Mean values of the percentage of territory protected under the Europen network Natura 2000 for the three types of LTS (A, AF and F). Data average the intensity of the protection of 10 study cases (Switzerland not included)

With respect to the differences among the three categories of LTS (A, AF and F) in terms of land use, the statistical comparison of the data inventoried in the CORINE land use database confirm the significance of the differences ($F_{9,340}= 10.31$; $p<0.001$ for the land use x type of LTS interaction; Figure 8). As Figure 8 shows, arable land (annual crops) and open pastures were more important in the agriculture (A) LTS and less in the forest (F) LTS, with an intermediate position for the agroforestry (AF) LTS. As expected, a contrasting pattern was found for forests, with again an intermediate situation for AF LTS. Agroforestry land uses and woody crops dominated the AF LTS.
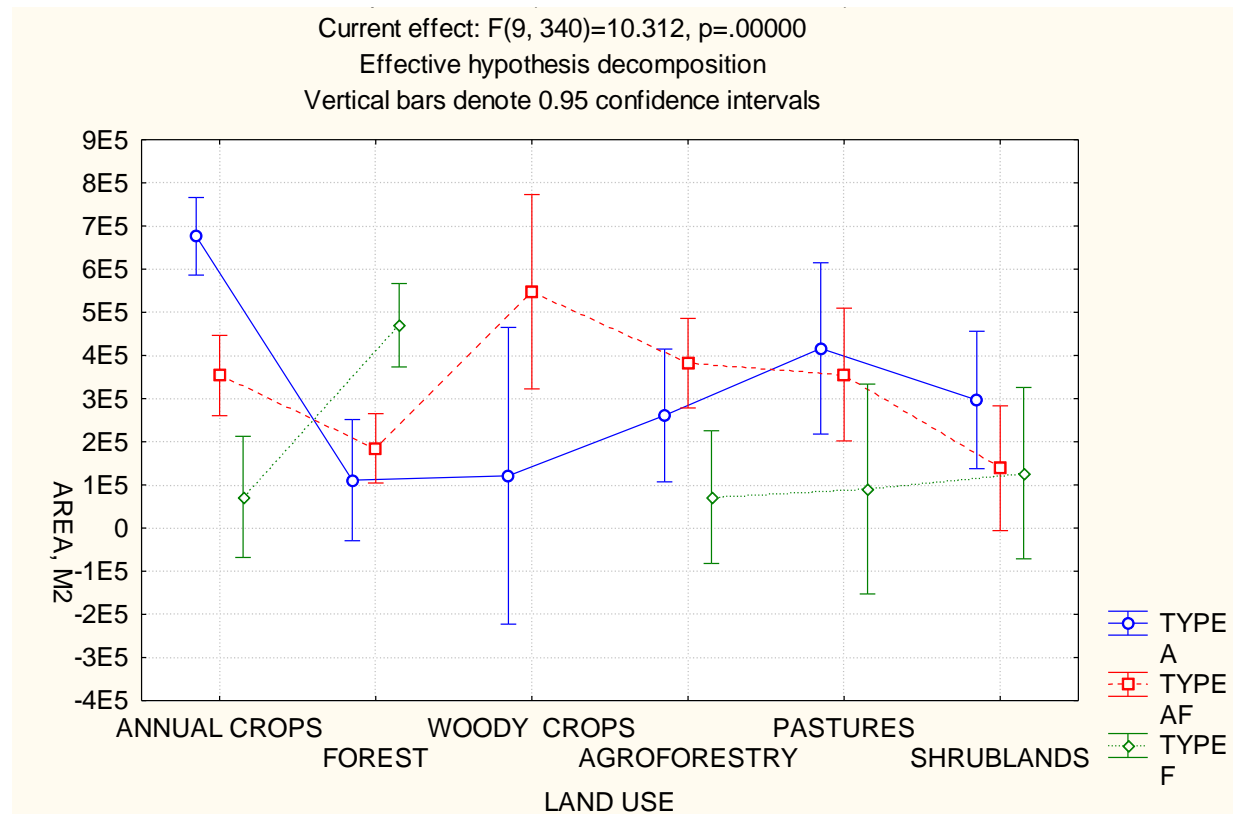

Figure 8. Mean values of the area devoted for main land uses in the three types of LTS (A, AF and F). Values averaged for the twelve case studies.

6.1   Agroforestry of high nature and cultural value in the Mediterranean region
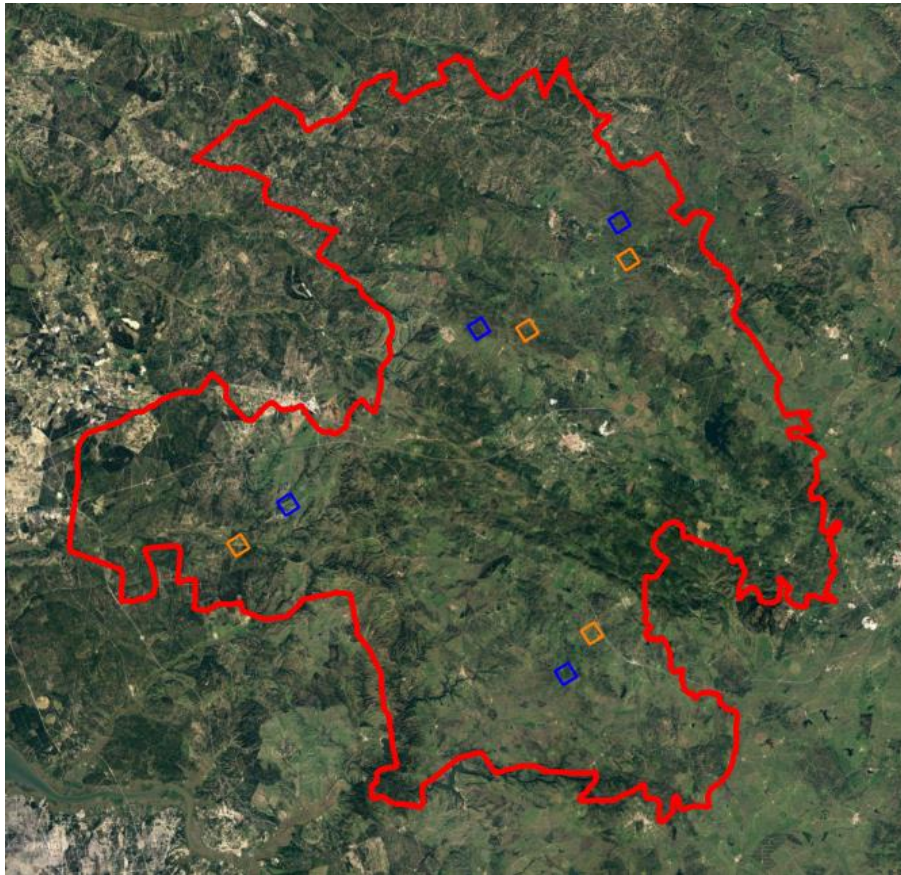
Case study: Cork oak Montado in Portugal

Figure 9. Location of the 8 LTS (Landscape Test Squares) selected (1 x 1 km). In orange, LTS dominated by monocultures and in blue LTS dominated by agroforestry combinations. Original scale 1:400.000.

Table 6. Location and main physical characteristics of the LTS selected (A= LTS dominated by agriculture land uses; AF= LTS dominated by agroforestry land uses) compared to the whole socio-cultural catchment.

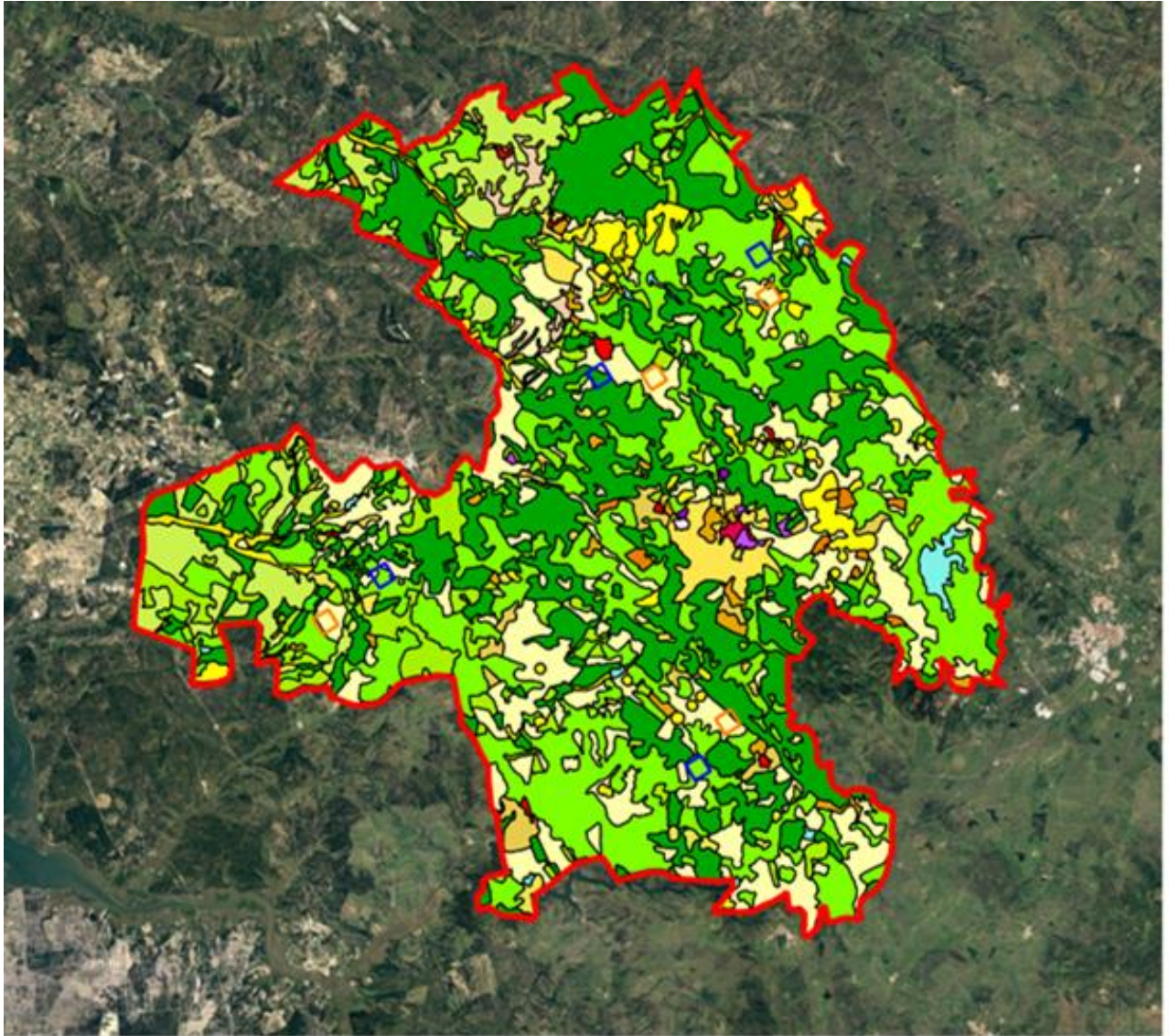| LTS	X	Y	Altitude(m)	Slope (%)	Aspect (°)	Natura 2000 (%)
A_1	-8.28520	38.71325	187	1.5	216	0.0
A_2	-8.45412	38.55594	97	3.1	192	100.0
A_3	-8.19328	38.55558	256	5.4	198	44.2
A_4	-8.22541	38.76573	175	1.9	221	0.0
AF_1	-8.42557	38.58514	134	3.2	239	100.0
AF_2	-8.20553	38.52977	198	2.3	184	0.0
AF_3	-8.23722	38.78485	185	2.5	218	0.0
AF_4	-8.31927	38.70749	177	1.6	150	0.0
Socio-cultural catchment			180 (17-413)	3.0 (0-37)	191 (0-360)	29.1

Figure 10. Map of land use based on CORINE database. Legend of colours can be consulted in Annex A (page 53). Original scale 1:400.000.

Table 7. Mean percentages of land uses in the different types of LTS compared to the whole social catchment

Land uses	Socio-cultural catchment	Agriculture LTS	Agroforestry LTS	Forest LTS
Artificial	0.7%	0.0%	0.0%	n.a.
Agriculture	23.3%	91.3%	13.9%	n.a.
Agroforestry	34.7%	3.9%	67.4%	n.a.
Grasslands	0.9%	0.0%	0.0%	n.a.
Forestlands	39.7%	2.9%	18.7%	n.a.
Others	0.8%	1.9%	0.0%	n.a.

Figure 11. Example of Landscape Test Squares (LTS). Blue: agroforestry LTS; Orange: agriculture LTS.

6.2 Agroforestry of high nature and cultural value in the Continental region

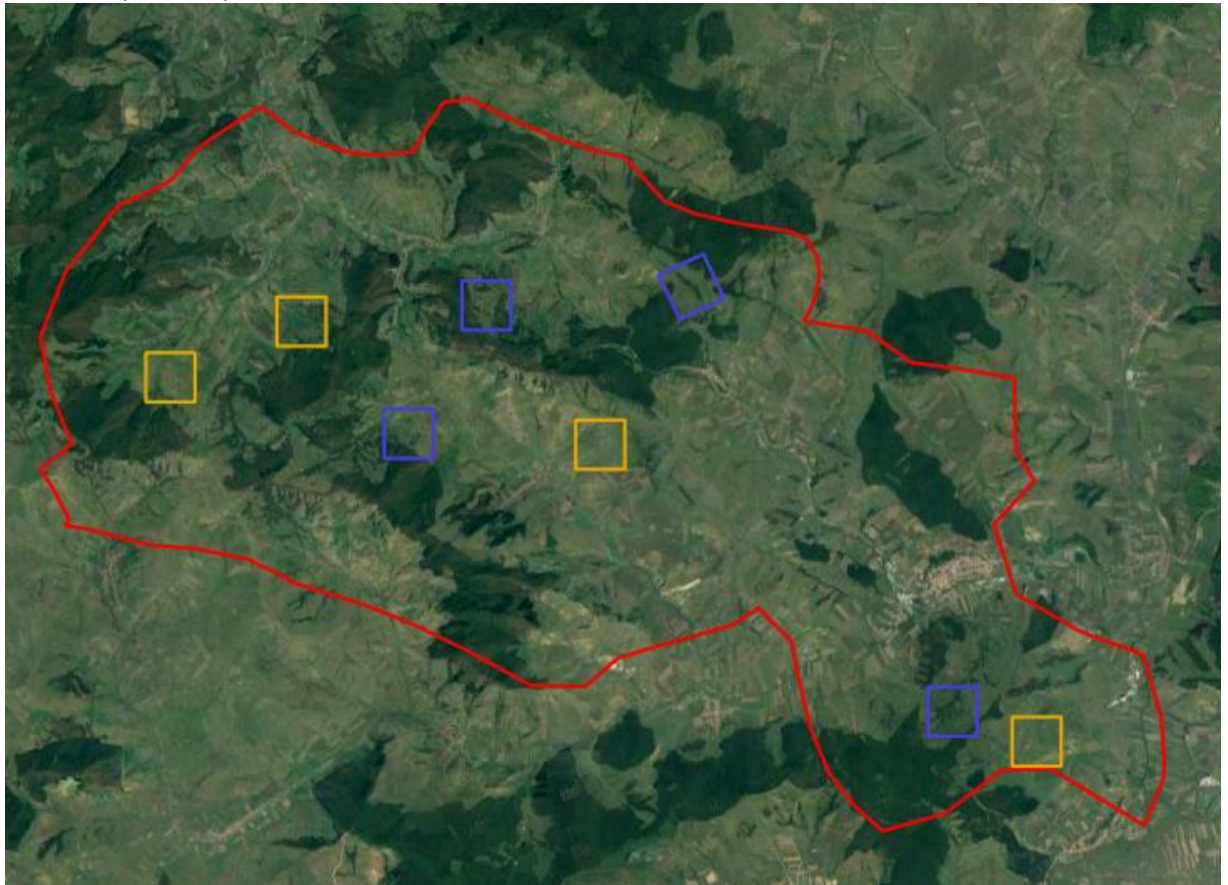Case study: wood pasture in Romania

Figure 12. Location of the 8 LTS (Landscape Test Squares) selected (1x1 km). In orange, LTS dominated by monocultures and in blue LTS dominated by agroforestry combinations. Original scale 1:200.000.

Table 8. Location and main physical characteristics of the LTS selected (A= LTS dominated by agriculture land uses; AF= LTS dominated by agroforestry land uses) compared to the whole socio-cultural catchment.

| LTS	X	Y	Altitude (m)	Slope (%)	Aspect (°)	Natura 2000 (%)
A_1	25.02824	46.08979	549	5.9	226	100.0
A_2	24.98934	46.07825	572	5.1	244	100.0
A_3	25.11700	46.06434	587	6.2	191	100.0
A_4	25.24660	46.00293	510	6.7	138	21.7
AF_1	25.08320	46.09312	647	8.4	147	100.0
AF_2	25.06015	46.06661	583	5.6	204	100.0
AF_3	25.22163	46.00914	550	5.7	206	100.0
AF_4	25.14412	46.09699	642	6.9	150	94.7
Socio-cultural catchment			574 (440-761)	6.9 (0-38)	170 (0-360)	67.9
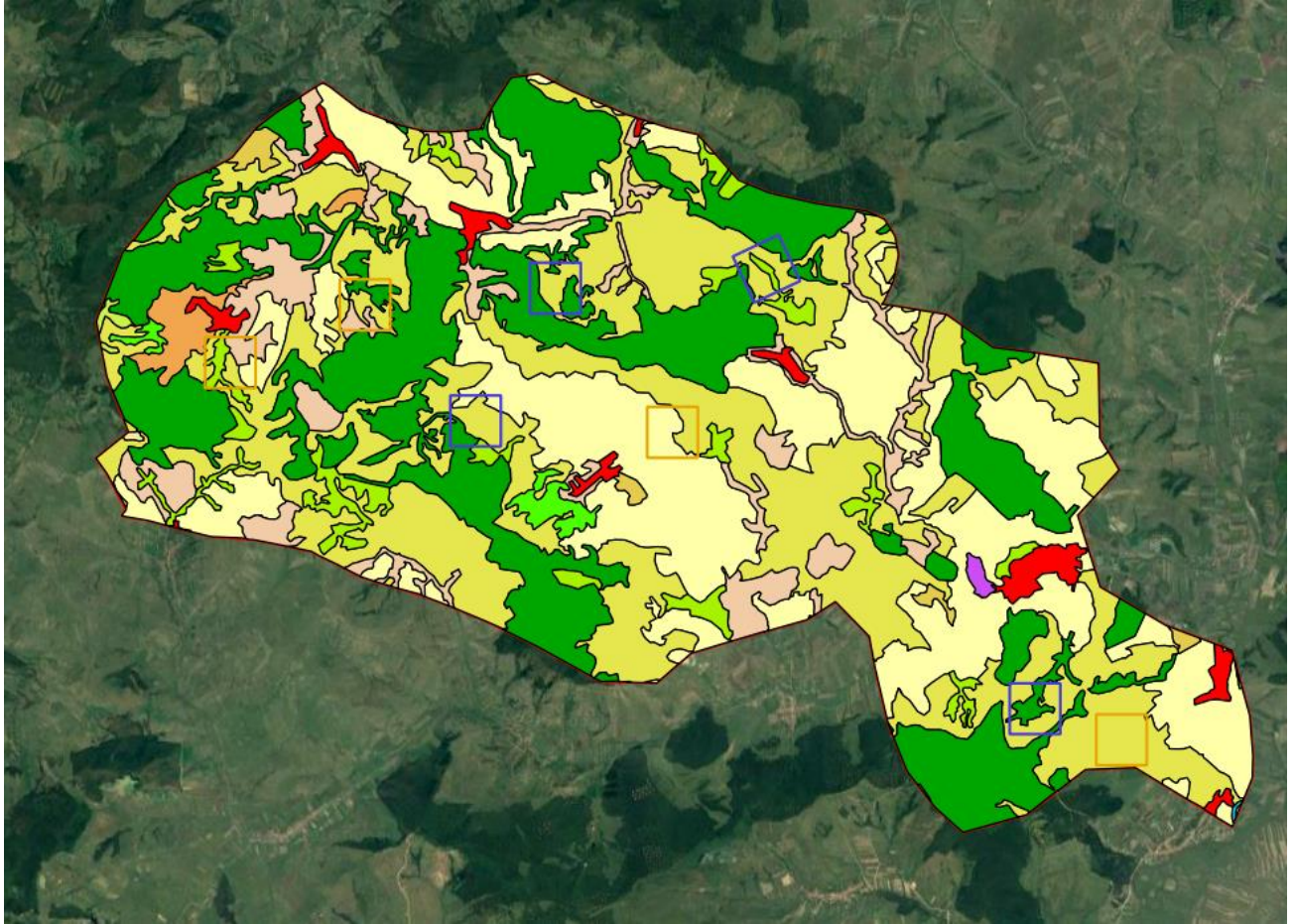
Figure 13. Map of land use based on CORINE database. Legend of colours can be consulted in Annex A (page 53). Original scale 1:200.000.

Table 9. Mean percentages of land uses in the different types of LTS compared to the whole social catchment.

Land uses	Socio-cultural catchment	Agriculture LTS	Agroforestry LTS	Forest LTS
Artificial	2.0%	0.0%	0.0%	n.a.
Agriculture	26.4%	22.3%	3.9%	n.a.
Agroforestry	8.0%	11.6%	0.0%	n.a.
Grasslands	32.9%	53.8%	61.7%	n.a.
Forestlands	30.7%	12.3%	34.4%	n.a.
Others	0.0%	0.0%	0.0%	n.a.

Figure 14. Example of Landscape Test Squares (LTS). Blue: agroforestry LTS; Orange: agriculture LTS.

6.3 Agroforestry of high nature and cultural value in the Atlantic region
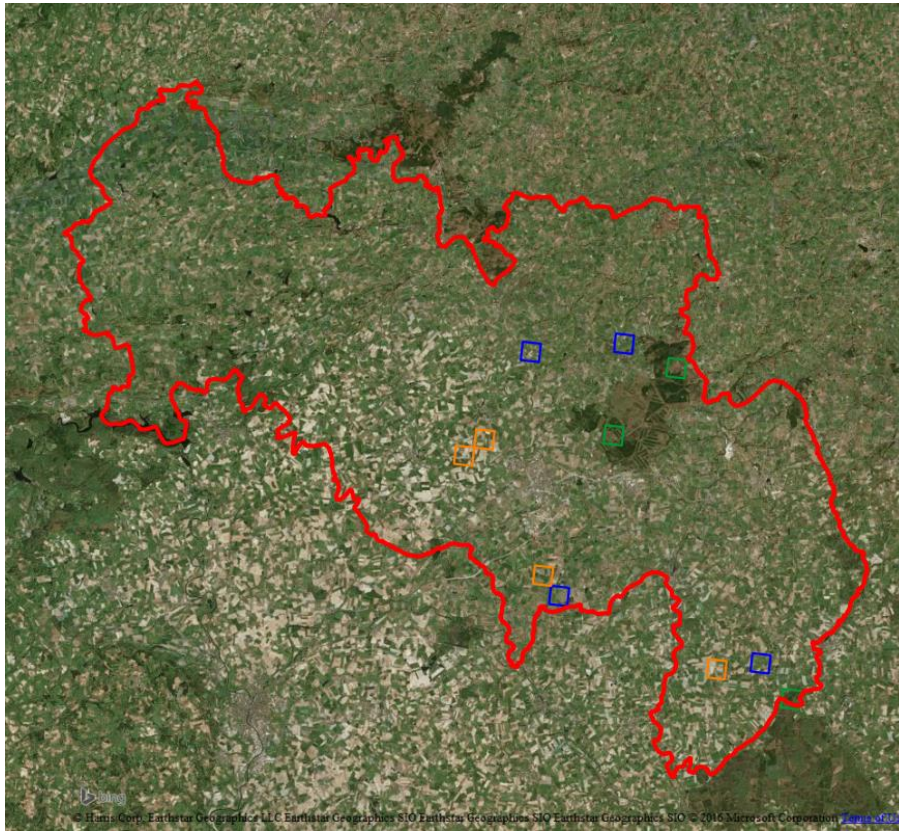
Case study: Bocage in France

Figure 15. Location of the 8 LTS (Landscape Test Squares) selected (1x1 km). In orange, LTS dominated by monocultures and in blue LTS dominated by agroforestry combinations. Original scale 1:400.000.

Table 10. Location and main physical characteristics of the LTS selected (A= LTS dominated by agriculture land uses; AF= LTS dominated by agroforestry land uses) compared to the whole socio-cultural catchment.

| LTS	X	Y	Altitude (m)	Slope (%)	Aspect (°)	Natura 2000 (%)
A_1	-2.62483	48.08548	130	1.6	188	0.0
A_2	-2.75229	48.13125	118	3.1	203	0.0
A_3	-2.81023	48.18982	140	2.6	154	0.0
A_4	-2.79535	48.19776	157	3.1	266	0.0
AF_1	-2.59246	48.08836	122	1.2	135	0.0
AF_2	-2.74044	48.12131	124	4.5	260	0.0
AF_3	-2.69283	48.24442	241	4.7	222	0.0
AF_4	-2.76122	48.24046	239	2.2	188	0.0
F_1	-2.57005	48.07088	107	2.1	139	0.0
F_2	-2.70032	48.19975	213	3.5	132	0.0
F_3	-2.65422	48.23248	187	5.4	144	0.0
Socio-cultural catchment			172	3.4 (0-37)	184 (0-360)	0.6
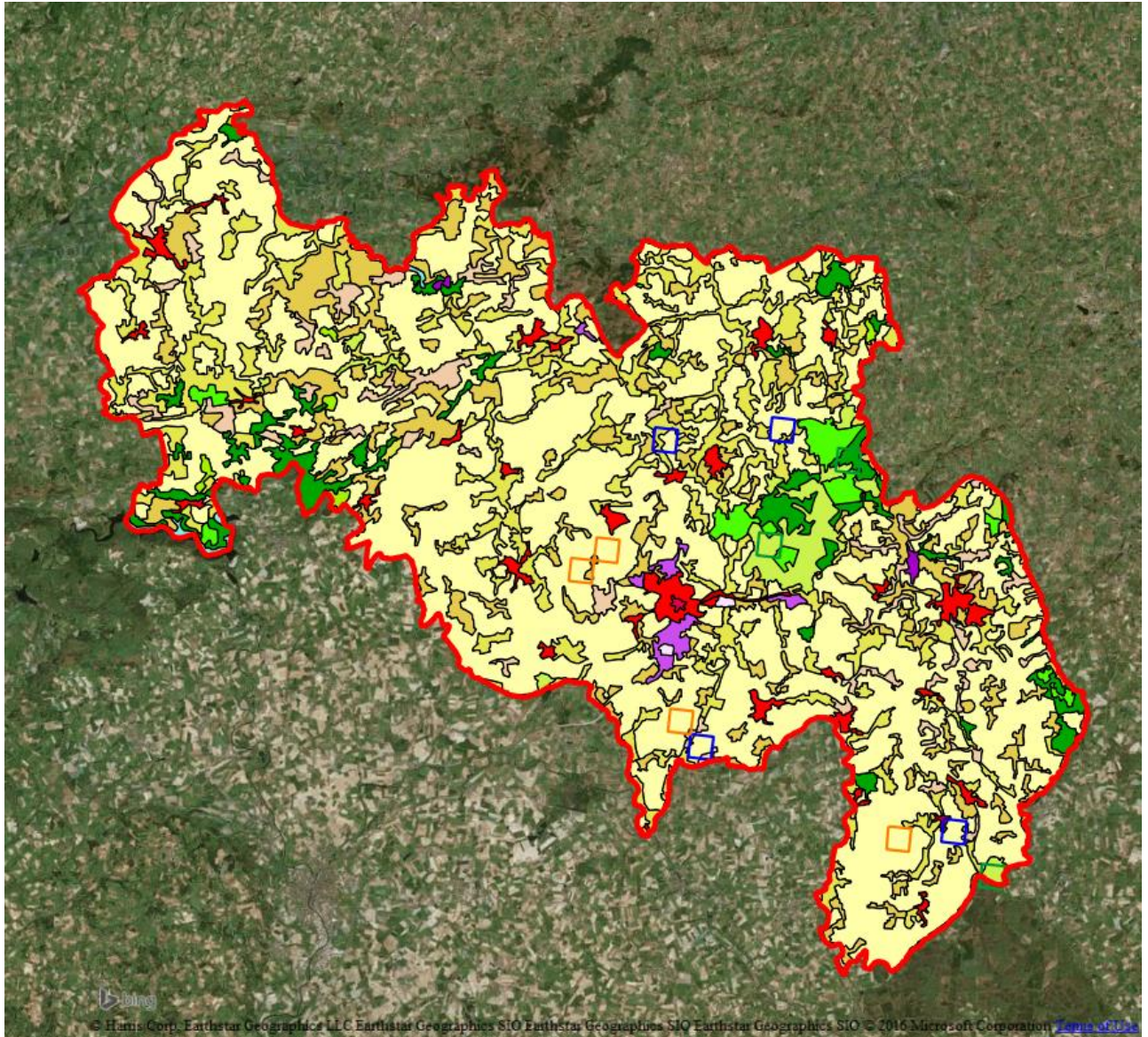
Figure 16. Map of land use based on CORINE database. Legend of colours can be consulted in Annex A (page 53). Original scale 1:400.000.

Table 11. Mean percentages of land uses in the different types of LTS compared to the whole social catchment.

Land uses	Socio-cultural catchment	Agriculture LTS	Agroforestry LTS	Forest LTS
Artificial	3.6%	0.0%	2.0%	0.0%
Agriculture	57.9%	94.5%	87.6%	2.1%
Agroforestry	15.1%	5.5%	7.2%	24.1%
Grasslands	15.3%	0.0%	0.0%	0.0%
Forestlands	7.8%	0.0%	0.0%	73.7%
Others	0.3%	0.0%	0.0%	0.0%

Figure 17. Example of Landscape Test Squares (LTS). Blue: agroforestry LTS; Orange: agriculture LTS; Green: forest LTS.

6.4   Agroforestry of high nature and cultural value in the Boreal region

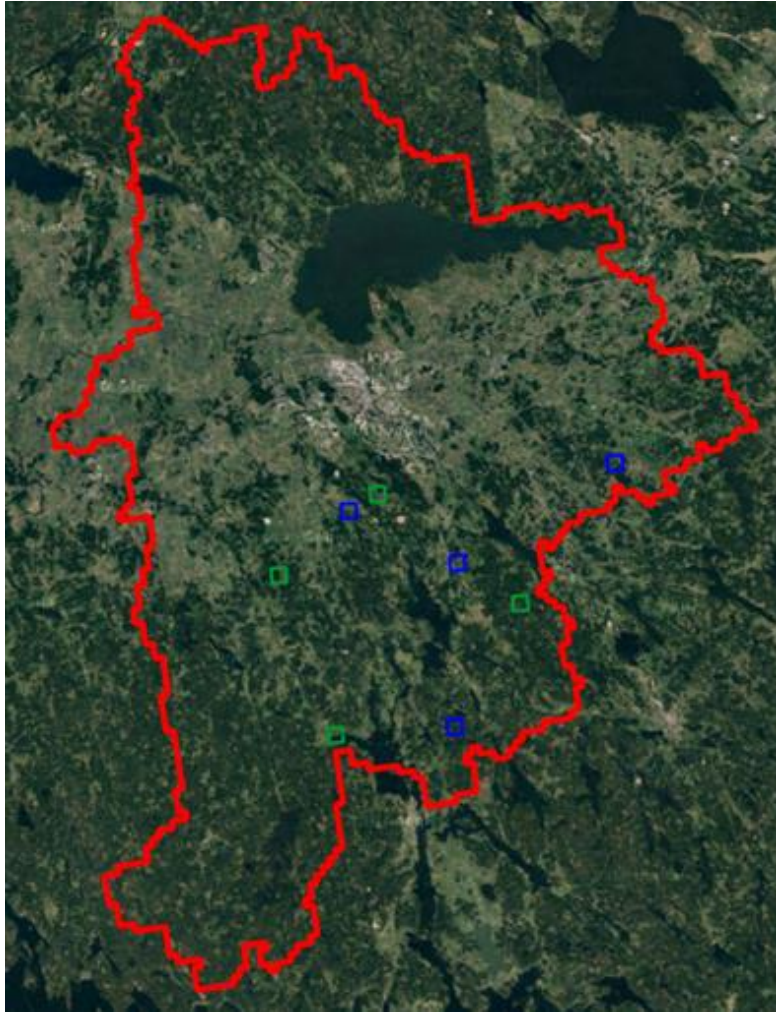Case Study: Fennoscandian oak wood-pastures in Sweden

Figure 18. Location of the 8 LTS (Landscape Test Squares) selected (1x1 km). In orange, LTS dominated by monocultures and in blue LTS dominated by agroforestry combinations. Original scale 1:500.000.

Table 12. Location and main physical characteristics of the LTS selected (A= LTS dominated by agriculture land uses; AF= LTS dominated by agroforestry land uses) compared to the whole socio-cultural catchment.

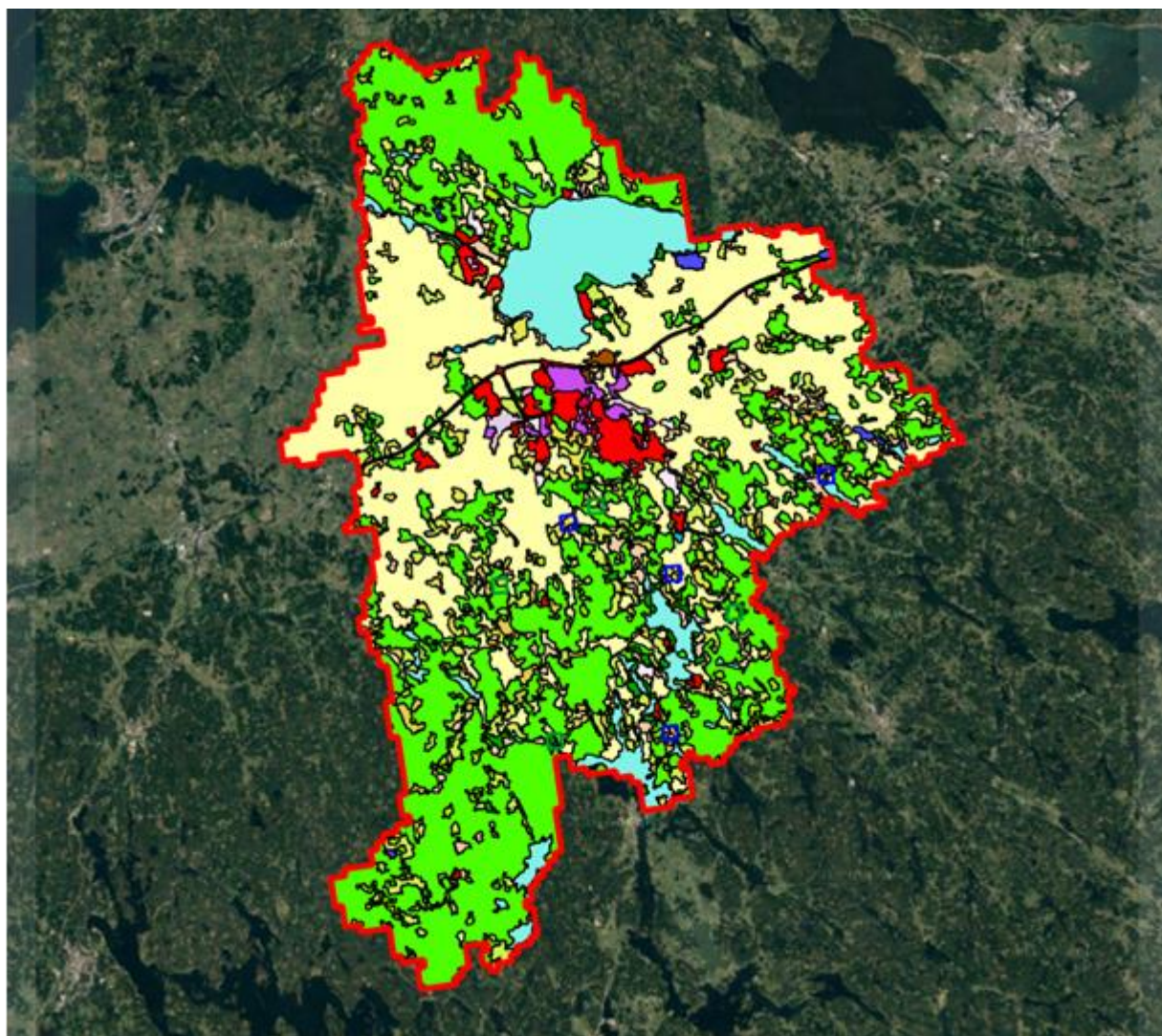| LTS	X	Y	Altitude (m)	Slope (%)	Aspect (°)	Natura 2000 (%)
AF_1	15.90288	58.35349	73	3.7	177	16.9
AF_2	15.59504	58.33733	107	1.8	169	0.0
AF_3	15.71386	58.30079	98	3.3	151	0.0
AF_4	15.69486	58.20209	122	3.6	168	0.0
F_1	15.62935	58.34614	102	2.9	145	0.0
F_2	15.50913	58.30177	117	3.3	165	0.0
F_3	15.78150	58.27345	110	3.5	184	0.0
F_4	15.55876	58.20276	121	4.5	139	0.8
Socio-cultural catchment			96 (27-240)	2.5 (0-37)	177 (0-360)	4.1

Figure 19. Map of land use based on CORINE database. Legend of colours can be consulted in Annex A (page 53). Original scale 1:500.000.

Table 13. Mean percentages of land uses in the different types of LTS compared to the whole social catchment.

Land uses	Socio-cultural catchment	Agriculture LTS	Agroforestry LTS	Forest LTS
Artificial	4.9%	n.a	0.0%	0.0%
Agriculture	35.3%	n.a	38.3%	9.4%
Agroforestry	4.2%	n.a	17.4%	5.7%
Grasslands	2.5%	n.a	20.8%	0.0%
Forestlands	44.2%	n.a	23.1%	84.9%
Others	8.9%	n.a	0.4%	0.0%

Figure 20. Example of Landscape Test Squares (LTS). Blue: agroforestry LTS; Orange: agriculture LTS.

6.5 Agroforestry Systems with High Value Trees in the Mediterranean Region

Case study: olive tree system in Greece

Figure 21. Location of the 8 LTS (Landscape Test Squares) selected (1x1 km). In orange, LTS dominated by monocultures and in blue LTS dominated by agroforestry combinations. Original scale 1:300.000.

Table 14. Location and main physical characteristics of the LTS selected (A= LTS dominated by agriculture land uses; AF= LTS dominated by agroforestry land uses) compared to the whole socio-cultural catchment.

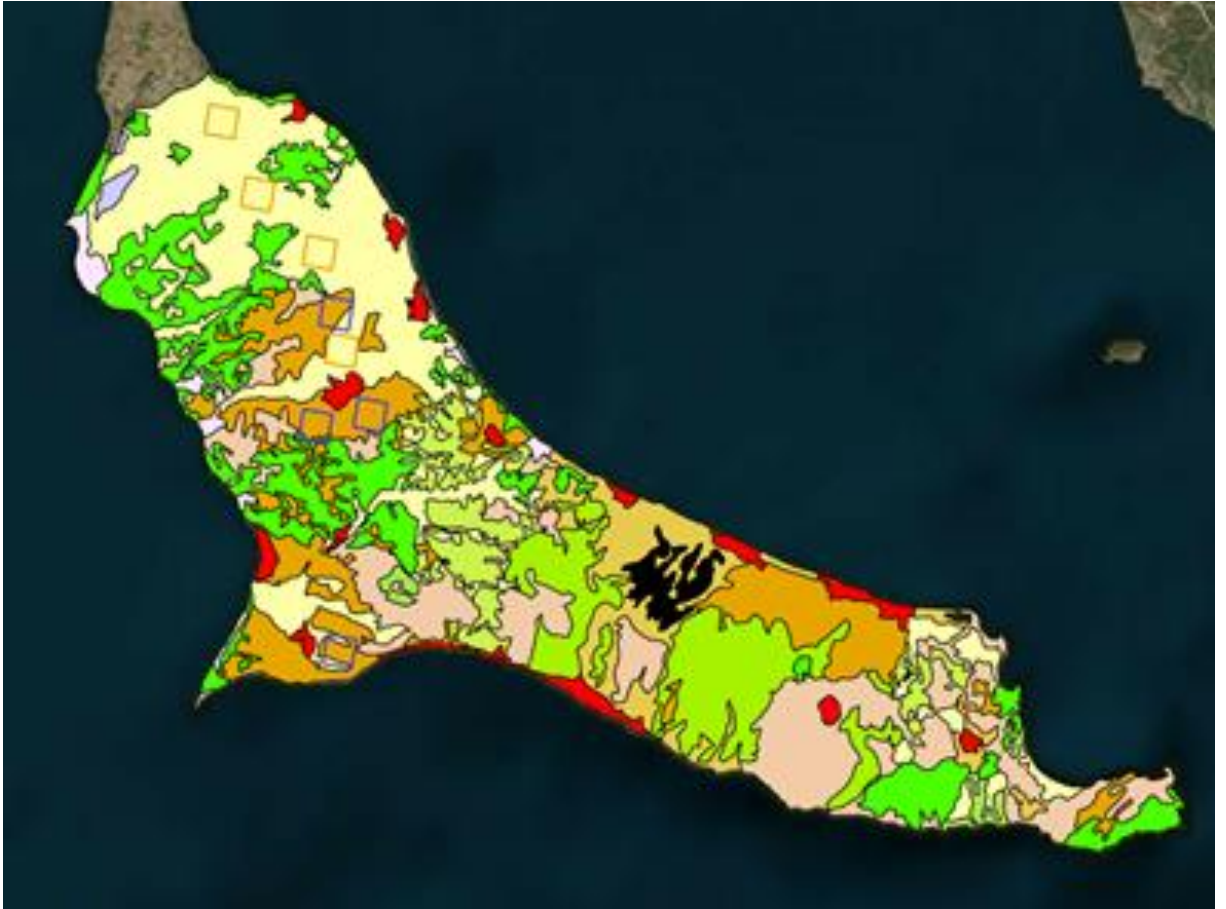| LTS	X	Y	Altitude (m)	Slope (%)	Aspect (°)	Natura 2000 (%)
A_1	23.36715	40.13086	32	2.4	218	0.0
A_2	23.38150	40.10876	52	2.7	214	0.0
A_3	23.40610	40.09092	74	2.2	146	0.0
A_4	23.41495	40.06113	39	2.2	140	0.0
AF_1	23.41269	40.07242	69	4.2	139	0.0
AF_2	23.40450	40.03804	90	5.7	197	0.0
AF_3	23.42624	40.04147	77	4.6	196	0.0
AF_4	23.41395	39.96936	75	5.1	196	0.0
Socio-cultural catchment			94 (0-338)	7.8 (0-50)	184 (0-360)	1.0

Figure 22. Map of land use based on CORINE database. Legend of colours can be consulted in Annex A (page 53). Original scale 1:300.000.

Table 15. Mean percentages of land uses in the different types of LTS compared to the whole social catchme*nt.*

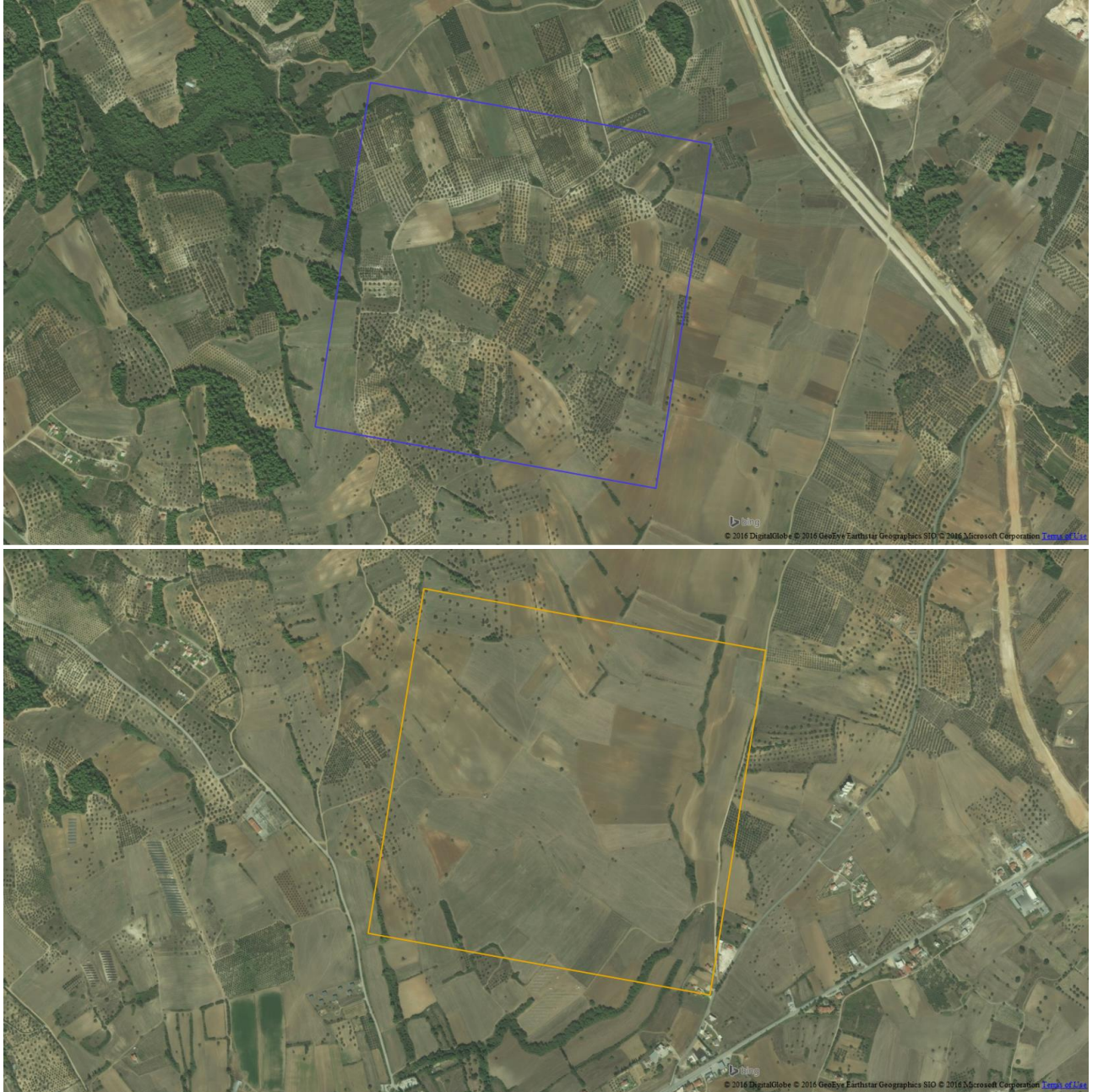| Land uses	Socio-cultural catchment	Agriculture LTS	Agroforestry LTS	Forest LTS
Artificial	4.5%	0.3%	0.0%	n.a.
Agriculture	39.7%	98.9%	88.6%	n.a.
Agroforestry	23.6%	0.0%	2.8%	n.a.
Grasslands	0.0%	0.0%	0.0%	n.a.
Forestlands	30.5%	0.8%	6.3%	n.a.
Others	1.7%	0.0%	2.4%	n.a.

Figure 23. Example of Landscape Test Squares (LTS). Blue: agroforestry LTS; Orange: agriculture LTS.

6.6 Agroforestry systems with high value trees in the Continental region

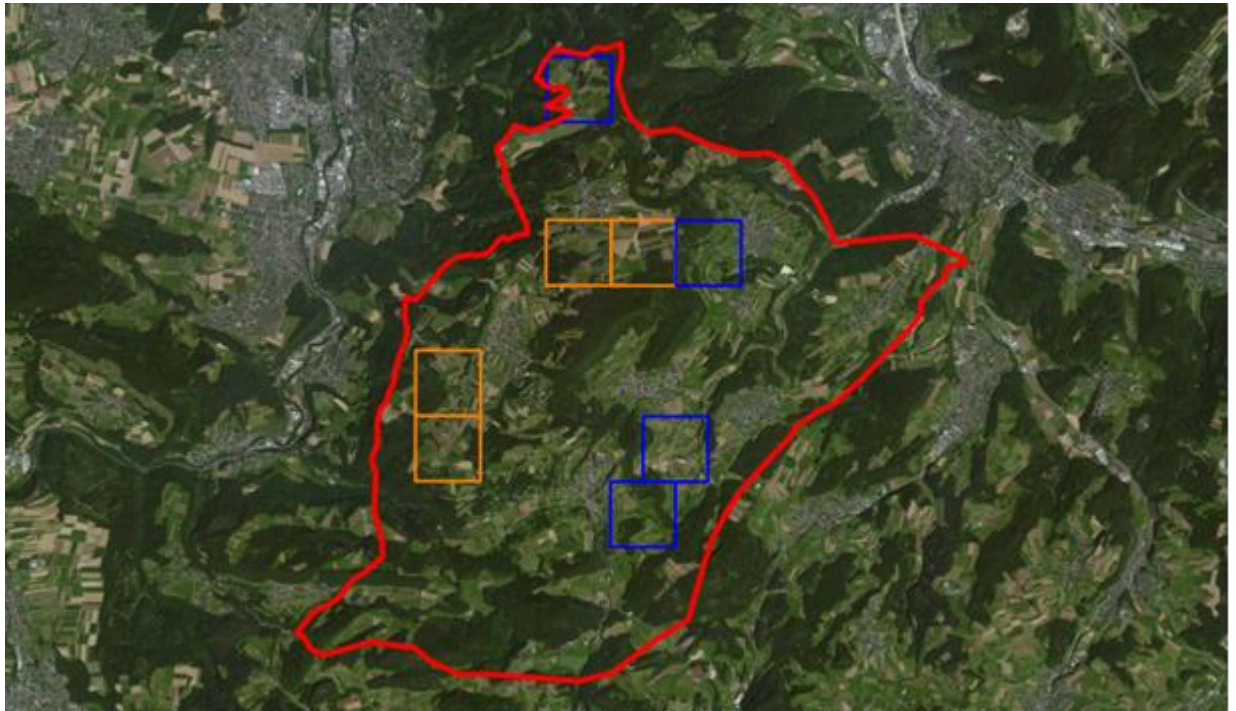Case study: fruit orchards in Switzerland

Figure 24. Location of the 8 LTS (Landscape Test Squares) selected (1x1 km). In orange, LTS dominated by monocultures and in blue LTS dominated by agroforestry combinations. Original scale 1:150.000.

Table 16. Location and main physical characteristics of the LTS selected (A= LTS dominated by agriculture land uses; AF= LTS dominated by agroforestry land uses) compared to the whole socio-cultural catchment.

| LTS	X	Y	Altitude (m)	Slope (%)	Aspect (°)	Natura 2000 (%)
A_1	7.63085	47.44113	634	5.9	205	No data
A_2	7.63089	47.45013	636	7.0	191	No data
A_3	7.65748	47.46807	699	4.7	236	No data
A_4	7.67074	47.46804	711	4.0	260	No data
AF_1	7.65757	47.49055	613	6.0	139	No data
AF_2	7.67058	47.43207	597	10.7	177	No data
AF_3	7.67725	47.44105	471	8.2	112	No data
AF_4	7.68401	47.46802	566	15.1	114	No data
Socio-cultural catchment			597 (333-899)	10.6 (0-44)	183 (0-360)	No data
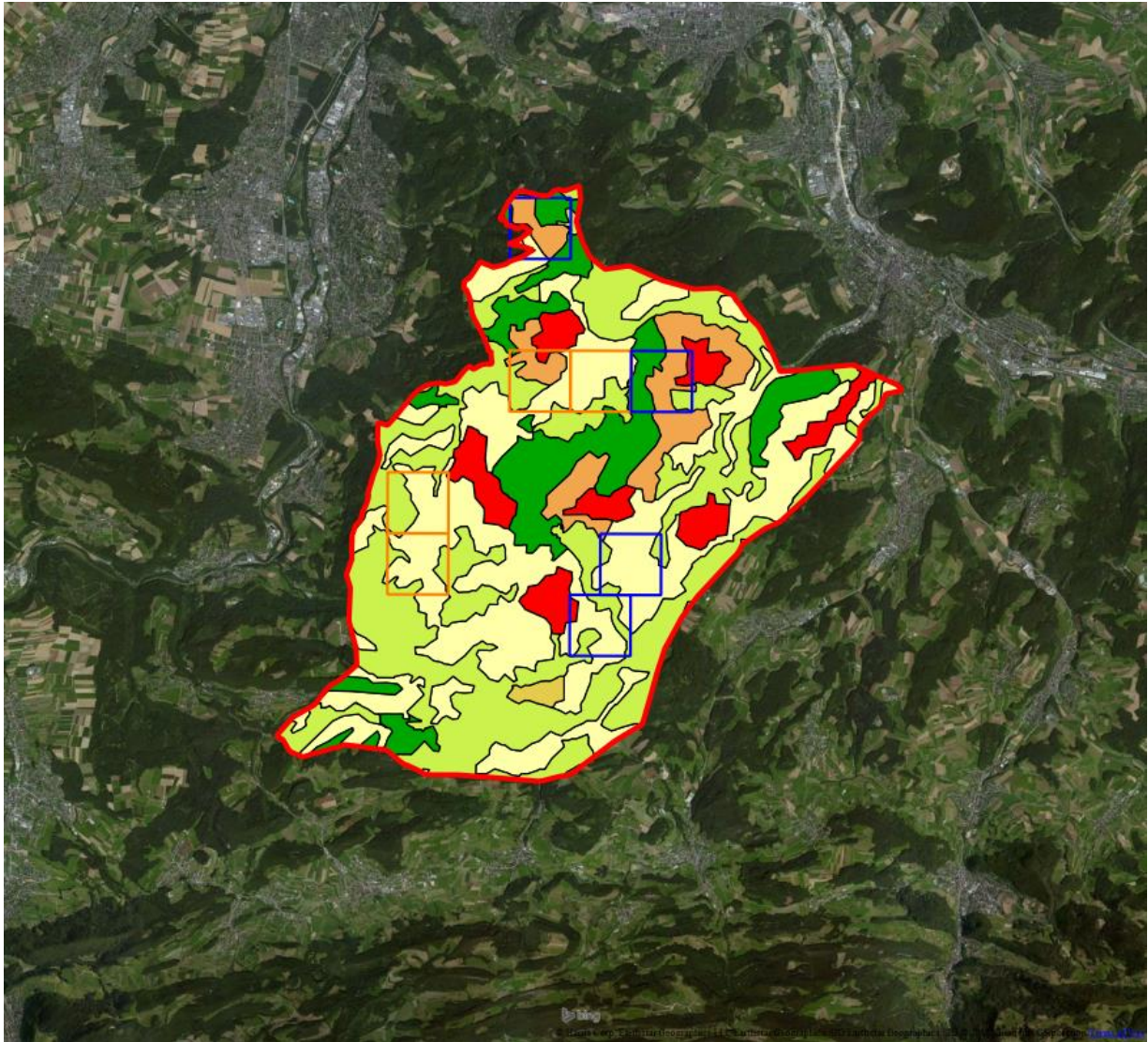
Figure 25. Map of land use based on CORINE database. Legend of colours can be consulted in Annex A (page 53). Original scale 1:150.000.

Table 17. Mean percentages of land uses in the different types of LTS compared to the whole social catchment.

Land uses	Socio-cultural catchment	Agriculture LTS	Agroforestry LTS	Forest LTS
Artificial	7.5%	1.1%	3.1%	n.a.
Agriculture	43.9%	67.9%	62.6%	n.a.
Agroforestry	0.6%	0.0%	0.0%	n.a.
Grasslands	0.0%	0.0%	0.0%	n.a.
Forestlands	47.9%	30.9%	34.3%	n.a.
Others	0.0%	0.0%	0.0%	n.a.

Figure 26. Example of Landscape Test Squares (LTS). Blue: agroforestry LTS; Orange: agriculture LTS.

6.7   Agroforestry systems with high value trees in the Atlantic region

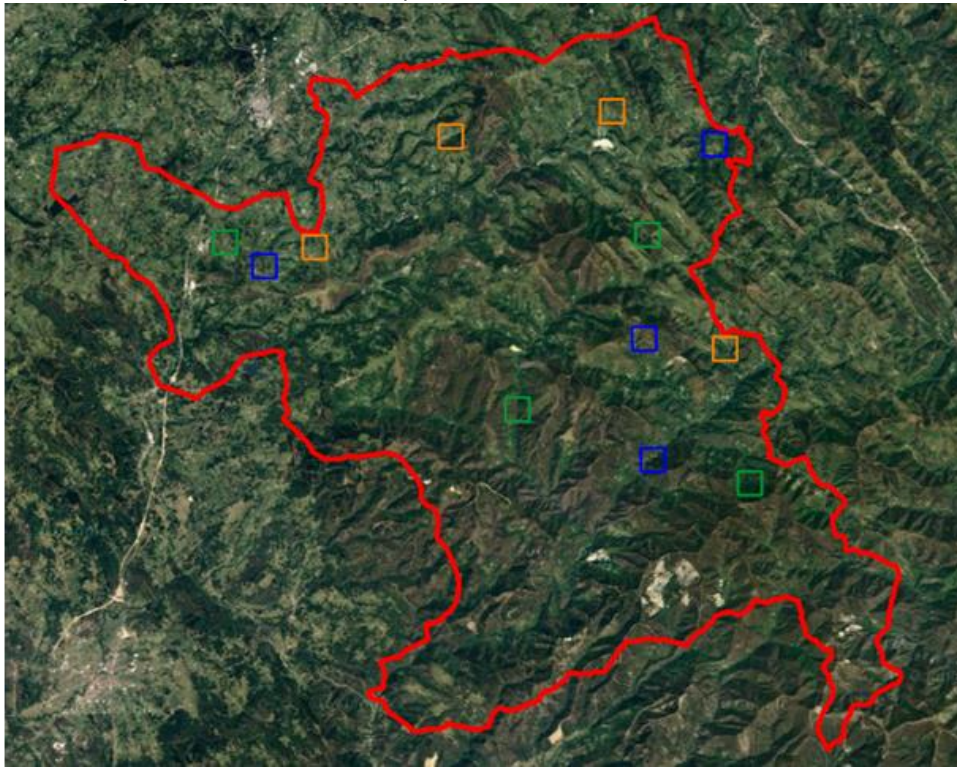Case Study: chesnut "soutos" in Spain

Figure 27.Location of the 8 LTS (Landscape Test Squares) selected (1 x 1 km). In orange, LTS dominated by monocultures and in blue LTS dominated by agroforestry combinations. Original scale 1:250.000.

Table 18. Location and main physical characteristics of the LTS selected (A= LTS dominated by agriculture land uses; AF= LTS dominated by agroforestry land uses) compared to the whole socio-cultural catchment.

| LTS	X	Y	Altitude (m)	Slope (%)	Aspect (°)	Natura 2000 (%)
A_1	-7.37273	42.69341	674	11.0	188	0.0
A_2	-7.31693	42.74583	665	7.6	174	0.0
A_3	-7.23920	42.76903	811	8.2	188	0.0
A_4	-7.15700	42.69141	1211	14.9	208	100.0
AF_1	-7.39580	42.68211	614	10.9	212	0.0
AF_2	-7.18095	42.64439	1123	22.7	133	100.0
AF_3	-7.19842	42.68818	1135	19.7	111	100.0
AF_4	-7.18435	42.76566	949	15.0	224	0.0
F_1	-7.41799	42.68733	616	8.7	139	0.0
F_2	-7.25396	42.65135	743	24.1	186	100.0
F_3	-7.20811	42.72667	1073	26.1	200	100.0
F_4	-7.13007	42.64414	706	23.0	238	100.0
Socio-cultural catchment			849 (342-1623)	16.5 (0-54)	193 (0-360)	55.8
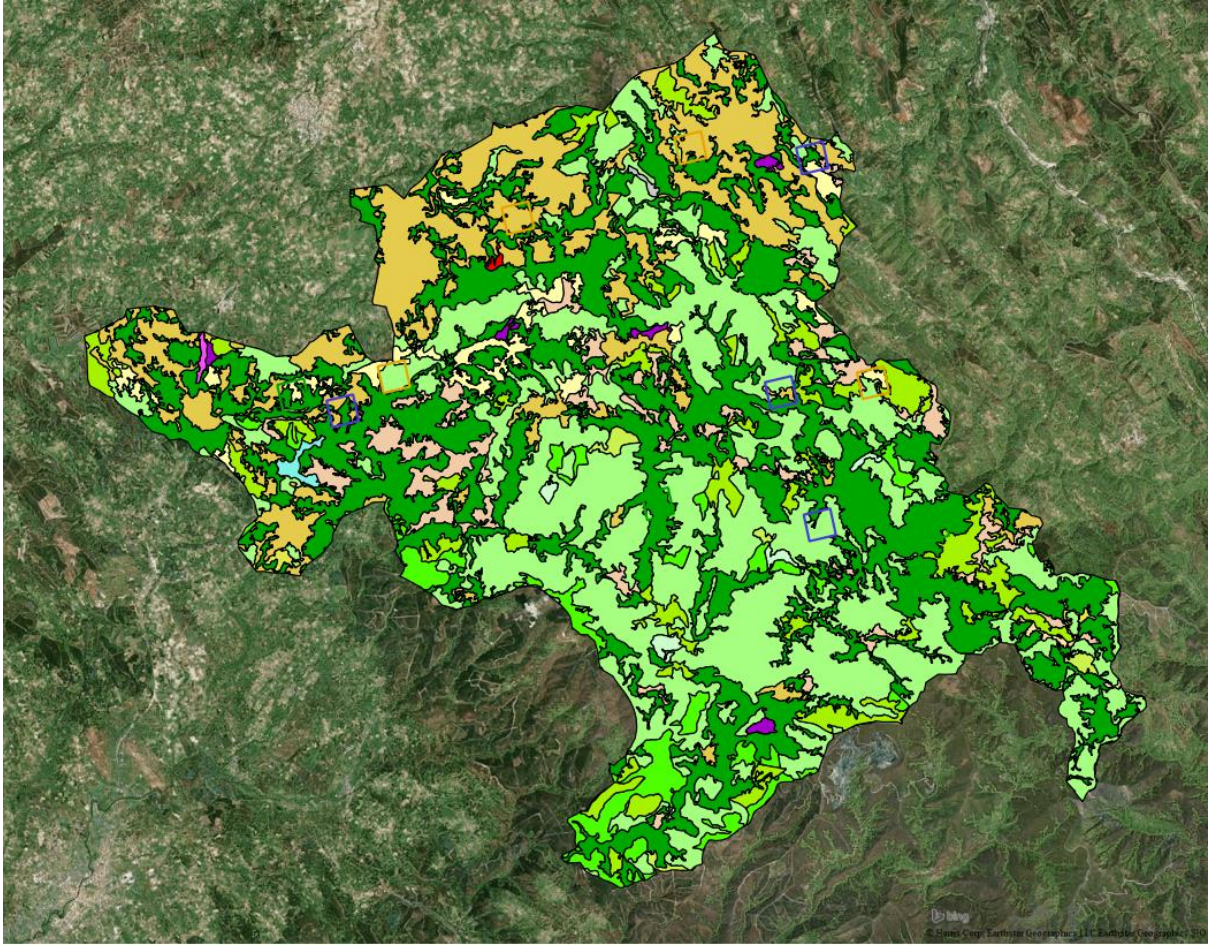
Figure 28. Map of land use based on CORINE database. Legend of colours can be consulted in Annex A (page 53). Original scale 1:250.000.

Table 19. Mean percentages of land uses in the different types of LTS compared to the whole social catchment.

Land uses	Socio-cultural catchment	Agriculture LTS	Agroforestry LTS	Forest LTS
Artificial	0.5%	0.0%	0.0%	0.0%
Agriculture	2.7%	11.2%	5.0%	9.0%
Agroforestry	10.6%	43.9%	28.5%	2.9%
Grasslands	0.3%	0.0%	0.0%	0.0%
Forestlands	85.2%	44.9%	66.5%	88.1%
Others	0.7%	0.0%	0.0%	0.0%

Figure 29. Example of Landscape Test Squares (LTS). Blue: agroforestry LTS; Orange: agriculture LTS; Green: forest LTS.

6.8 Agroforestry systems with arable lands in the Mediterranean region

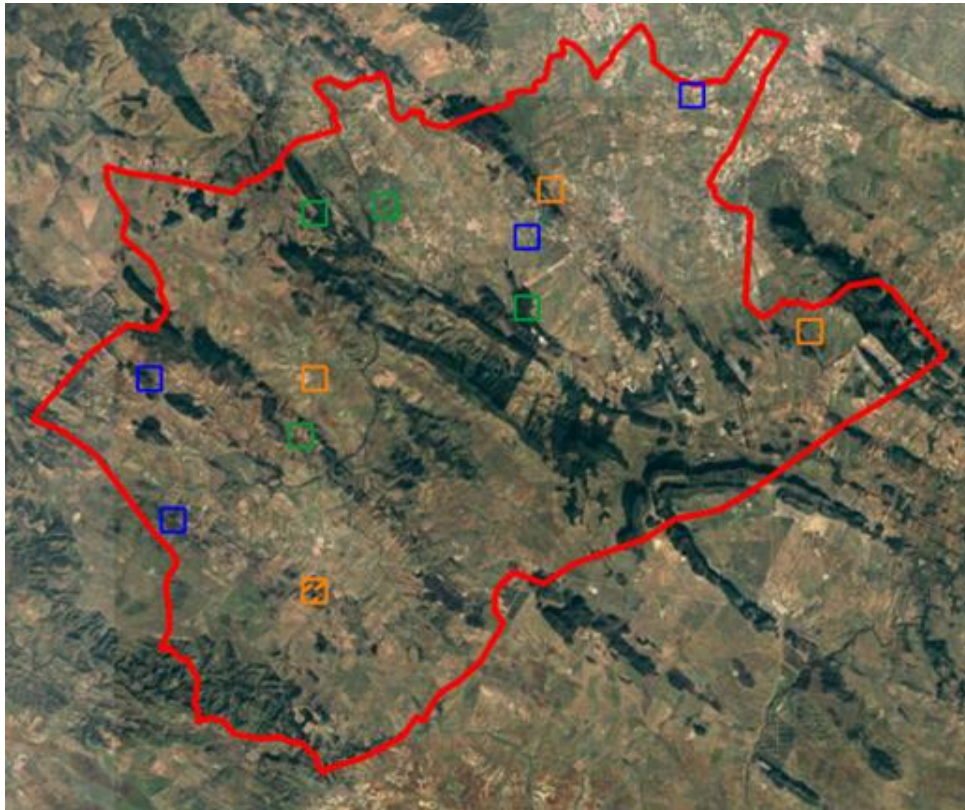Case study: Intercrop oaks in Spain

Figure 30. Location of the 8 LTS (Landscape Test Squares) selected (1x1 km). In orange, LTS dominated by monocultures and in blue LTS dominated by agroforestry combinations. Original scale 1.300.000

Table 20. Location and main physical characteristics of the LTS selected (A= LTS dominated by agriculture land uses; AF= LTS dominated by agroforestry land uses) compared to the whole socio-cultural catchment.

| LTS	X	Y	Altitude (m)	Slope (%)	Aspect (°)	Natura 2000 (%)
A_1	-5.824	38.565	458	4.2	144	0.0
A_2	-5.728	38.654	482	2.6	198	0.0
A_3	-5.592	38.621	511	2.7	254	0.0
A_4	-5.805	38.485	505	2.5	148	0.0
AF_1	-5.902	38.552	524	3.5	191	0.0
AF_2	-5.878	38.5	542	5.4	117	0.0
AF_3	-5.735	38.635	483	2.0	175	0.0
AF_4	-5.669	38.701	426	1.1	251	0.0
F_1	-5.839	38.627	533	10.7	142	0.0
F_2	-5.730	38.609	564	10.1	187	0.0
F_3	-5.806	38.635	413	6.5	151	20.2
F_4	-5.826	38.543	473	7.1	145	10.9
Socio-cultural catchment			519 (354-840)	4.3 (0-31)	170 (0-360)	8.6
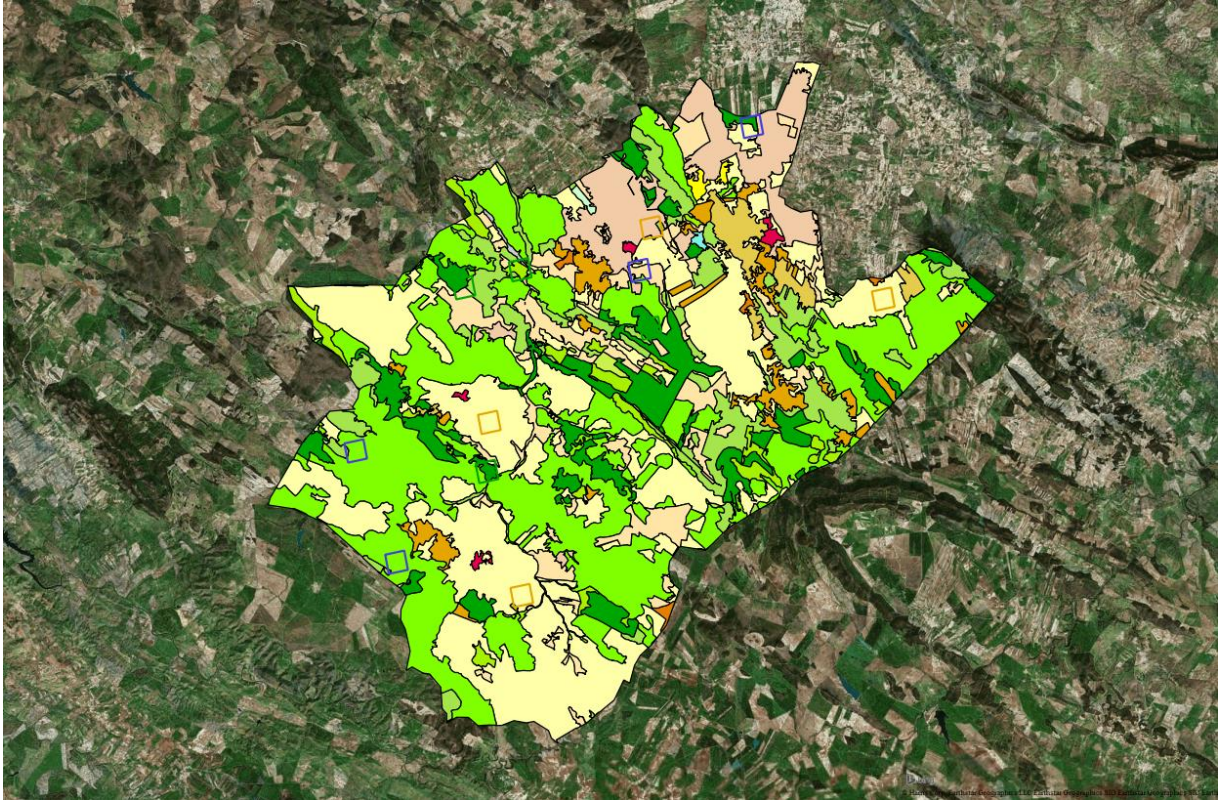
Figure 31. Map of land use based on CORINE database. Legend of colours can be consulted in Annex A (page 53). Original scale 1:300.000.

Table 21. Mean percentages of land uses in the different types of LTS compared to the whole social catchment.

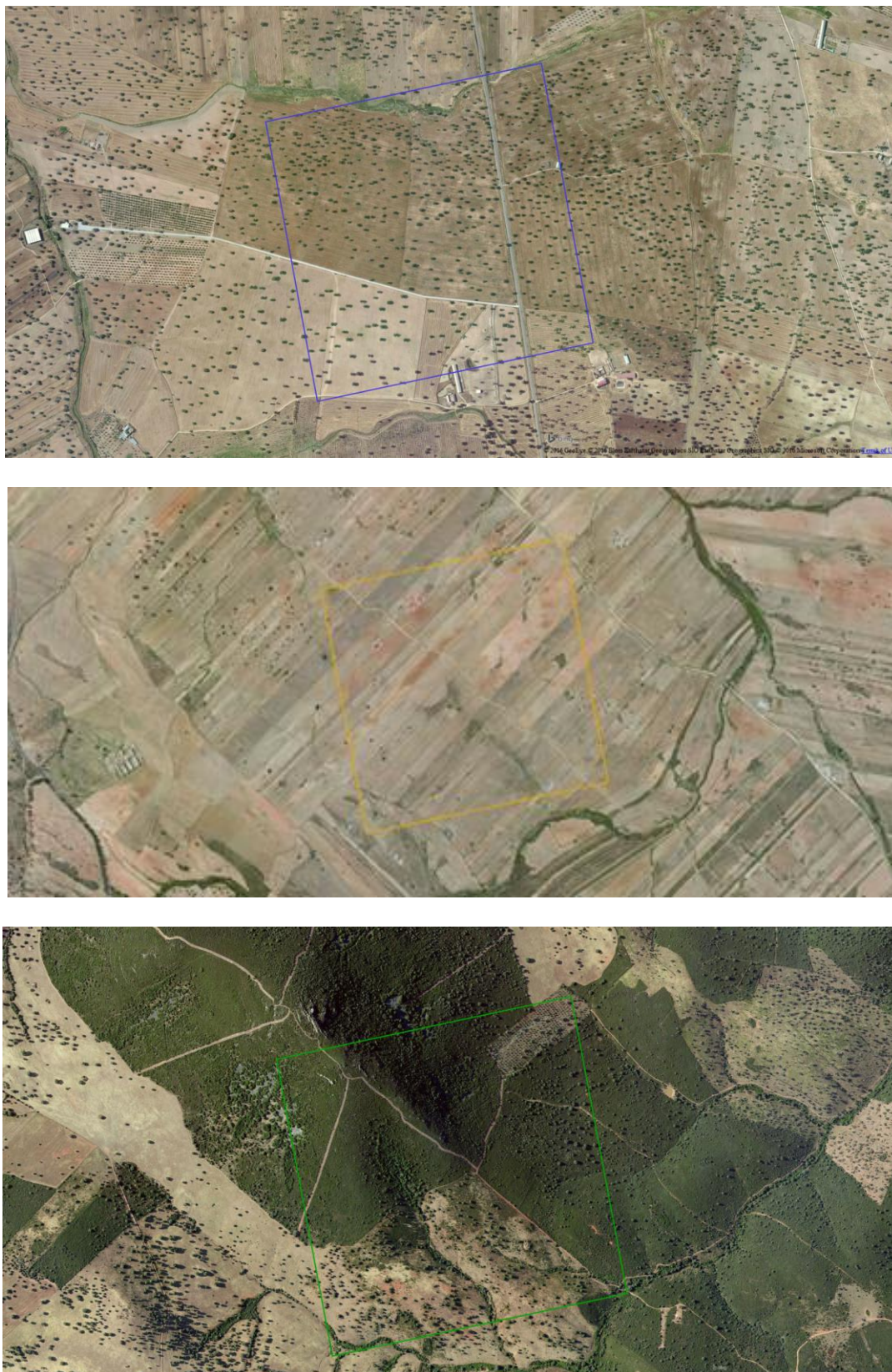| Land uses	Socio-cultural Catch-ment	Agriculture LTS	Agroforestry LTS	Forest LTS
Artificial	0.3%	0.0%	0.0%	0.0%
Agriculture	33.0%	76.0%	15.6%	2.5%
Agroforestry	39.7%	21.3%	59.9%	13.5%
Grasslands	7.3%	0.4%	14.2%	11.2%
Forestlands	19.5%	2.4%	10.4%	71.4%
Others	0.3%	0.0%	0.0%	1.3%

Figure 32. Example of Landscape Test Squares (LTS). Blue: agroforestry LTS; Orange: agriculture LTS; Green: forest LTS.

6.9 Agroforestry systems with arable lands in the Continental region

Case Study: Intensive arable system with trees/ woodlands in Germany
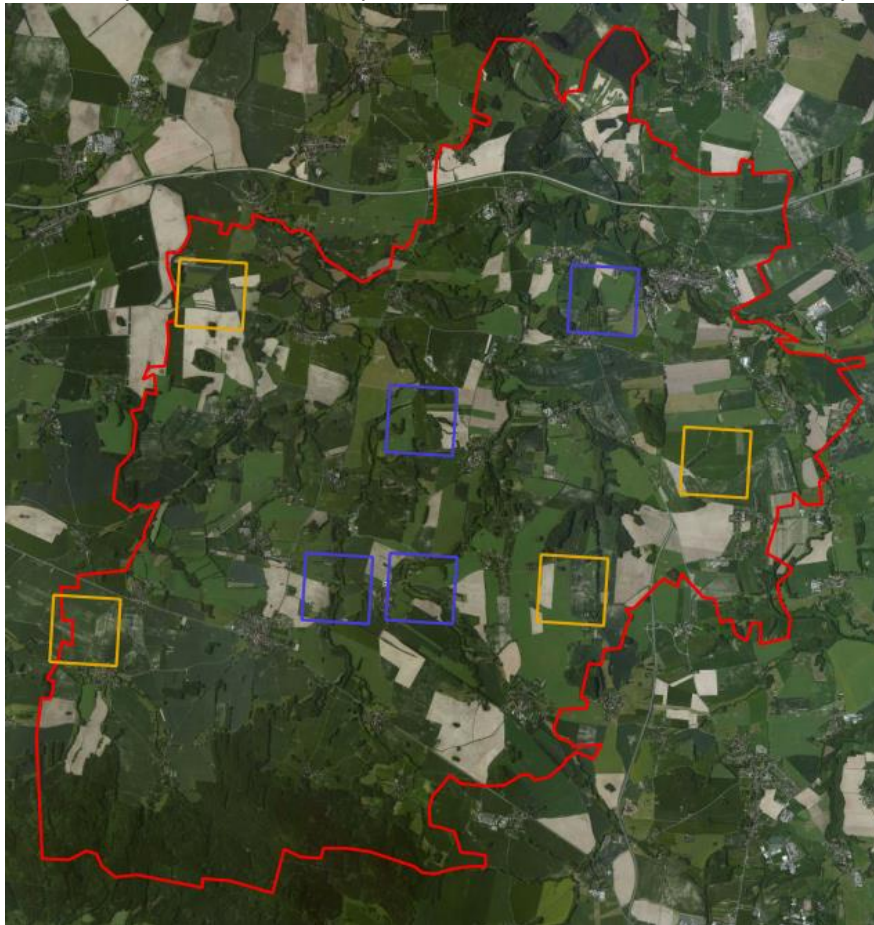

Figure 33. Location of the 8 LTS (Landscape Test Squares) selected (1x1 km). In orange, LTS dominated by monocultures and in blue LTS dominated by agroforestry combinations. Original scale 1:150.000.

Table 22. Location and main physical characteristics of the LTS selected (A= LTS dominated by agriculture land uses; AF= LTS dominated by agroforestry land uses) compared to the whole socio-cultural catchment.

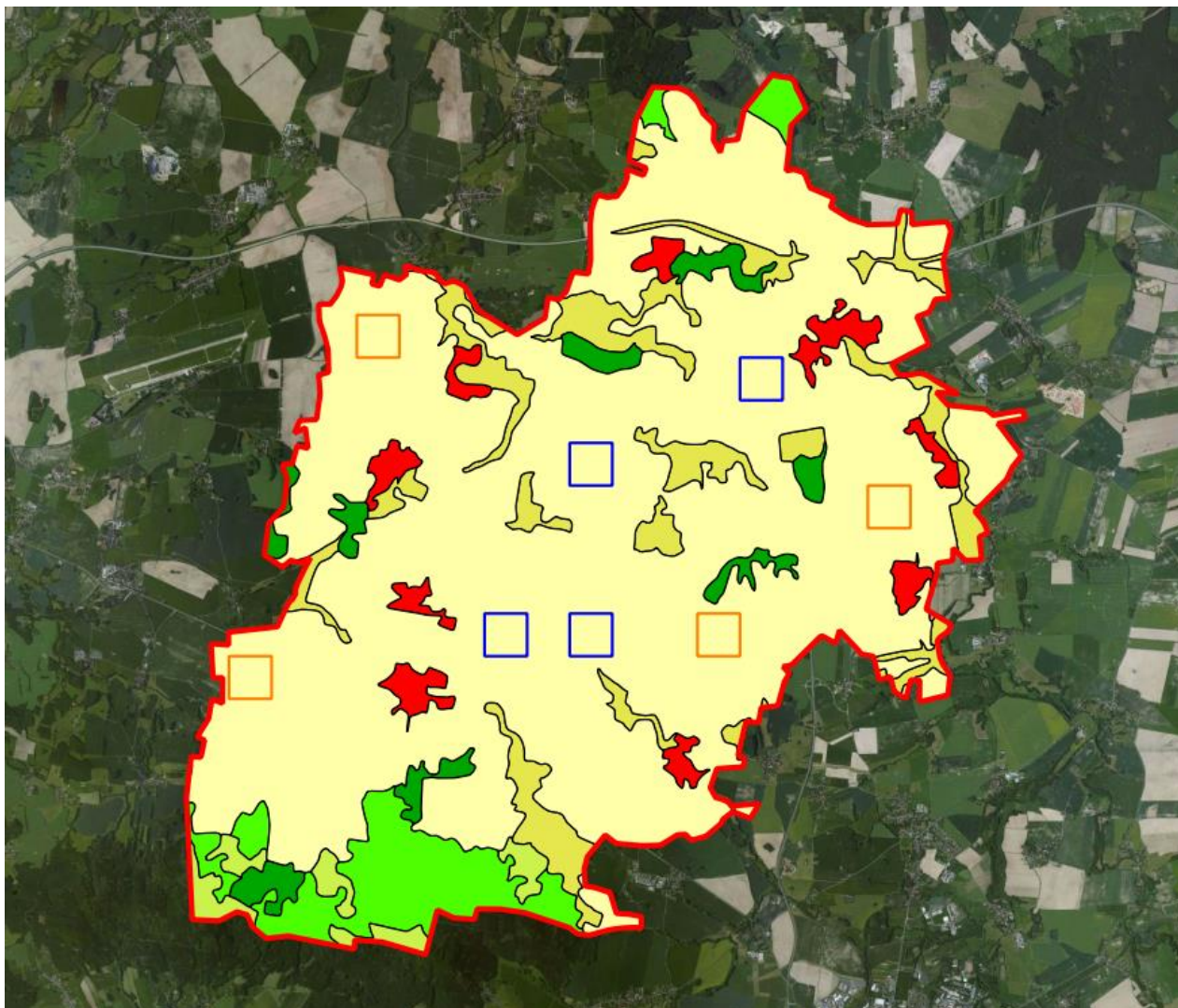| LTS	X	Y	Altitude (m)	Slope (%)	Aspect (°)	Natura 2000 (%)
A_1	14.56257	51.19605	251	2.7	182	81.5
A_2	14.67036	51.17353	262	2.2	249	0.0
A_3	14.63443	51.15663	208	1.7	88	100.0
A_4	14.53562	51.15099	159	1.1	168	13.8
AF_1	14.64341	51.19042	241	2.1	162	11.6
AF_2	14.60748	51.17916	230	1.9	196	73.2
AF_3	14.58951	51.15663	179	2.7	210	100.0
AF_4	14.60748	51.15663	184	1.6	213	0.0
Socio-cultural catchment			231 (151-561)	3.0 (0-21)	176 (0-360)	41.0

Figure 34. Map of land use based on CORINE database. Legend of colours can be consulted in Annex A (page 53). Original scale 1:150.000.

Table 23. Mean percentages of land uses in the different types of LTS compared to the whole social catchm*ent.*

Land uses	Socio-cultural catchment	Agriculture LTS	Agroforestry LTS	Forest LTS
Artificial	3.3%	0.0%	0.0%	n.a.
Agriculture	76.3%	100.0%	99.6%	n.a.
Agroforestry	0.0%	0.0%	0.0%	n.a.
Grasslands	9.1%	0.0%	0.4%	n.a.
Forestlands	11.2%	0.0%	0.0%	n.a.
Others	0.0%	0.0%	0.0%	n.a.

Figure 35. Example of Landscape Test Squares (LTS). Blue: agroforestry LTS; Orange: agriculture LTS.

6.10 Agroforestry systems with arable lands in the Atlantic region

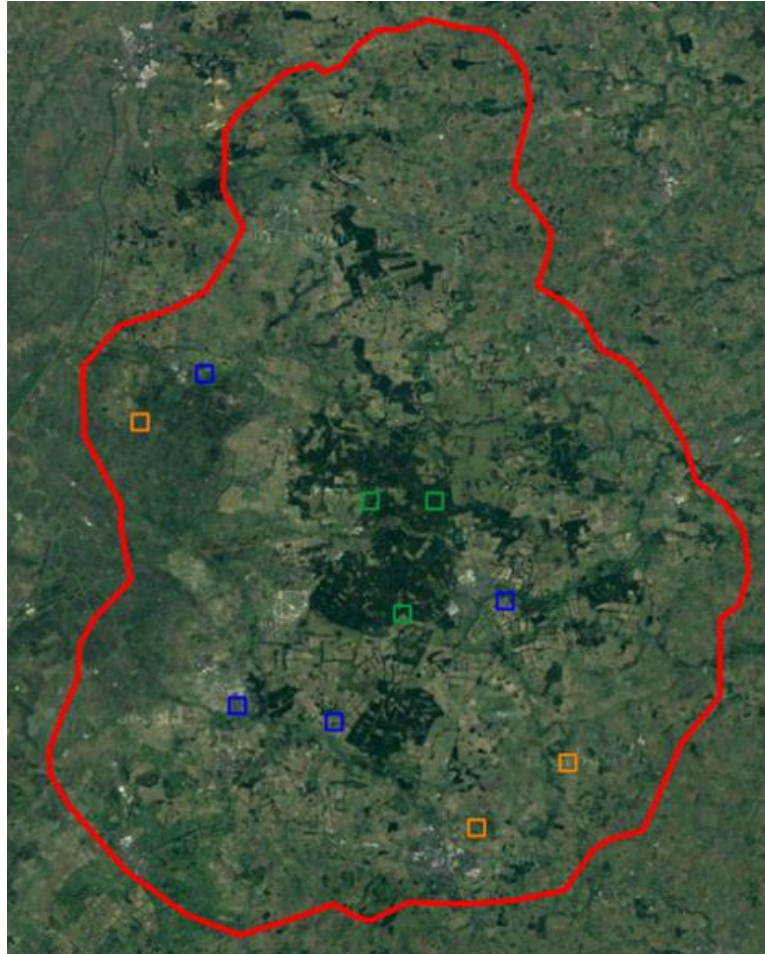Case study: silvoarable landscapes in UK

Figure 36. Location of the 8 LTS (Landscape Test Squares) selected (1x1 km). In orange, LTS dominated by monocultures and in blue LTS dominated by agroforestry combinations. Original scale 1:400.000

Table 24. Location and main physical characteristics of the LTS selected (A= LTS dominated by agriculture land uses; AF= LTS dominated by agroforestry land uses) compared to the whole socio-cultural catchment.

LTS	X	Y	Altitude (m)	Slope (%)	Aspect (°)	Natura 2000 (%)
A_1	0.86343	52.34333	44	0.9	167	0.0
A_2	0.78834	52.30103	56	0.9	182	0.0
A_3	0.43638	52.50085	-2	0.5	169	0.0
AF_1	0.78811	52.42819	32	1.8	228	0.0
AF_2	0.64748	52.34940	53	1.6	177	100.0
AF_3	0.55818	52.35134	31	2.1	155	96.0
AF_4	0.48906	52.53225	1	0.6	171	0.0
F_1	0.71259	52.47854	39	1.1	178	100.0
F_2	0.65414	52.4739	51	2.8	146	100.0
F_3	0.69657	52.4139	27	2.1	218	99.5

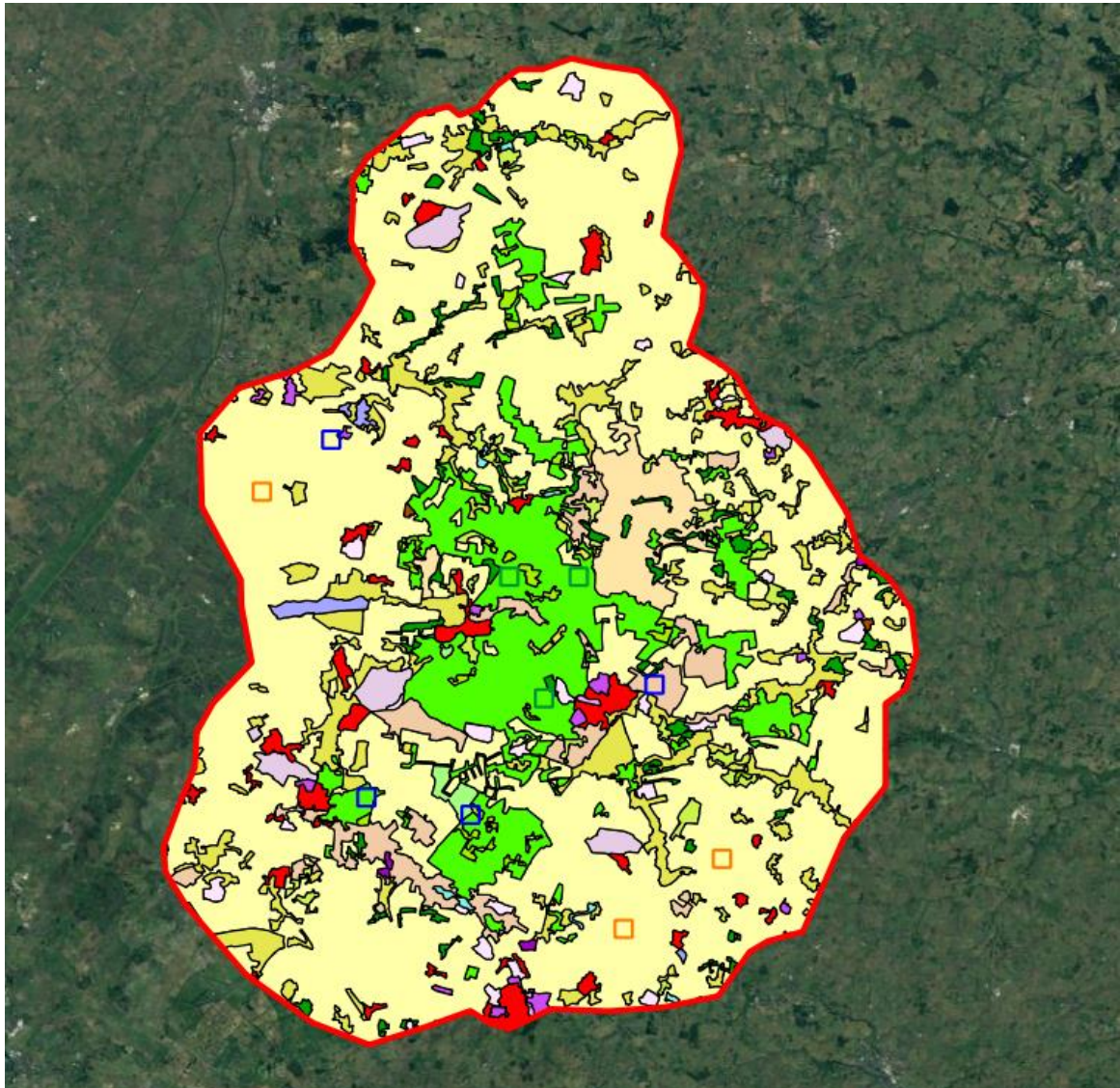| Socio-cultural catchment | 32 (0-110) | 1.4 (0-30) | 181 (0-360) | 29.0 |

Figure 37. Map of land use based on CORINE database. Legend of colours can be consulted in Annex A (page 53). Original scale 1:400.000.

Table 25. Mean percentages of land uses in the different types of LTS compared to the whole social catchment.

Land uses	Socio-cultural catchment	Agriculture LTS	Agroforestry LTS	Forest LTS
Artificial	5.7%	0.0%	1.3%	0.0%
Agriculture	62.6%	100.0%	25.0%	0.0%
Agroforestry	3.6%	0.0%	24.4%	0.0%
Grasslands	11.9%	0.0%	0.0%	0.0%
Forestlands	15.8%	0.0%	49.3%	100.0%
Others	0.5%	0.0%	0.0%	0.0%

Figure 38. Example of Landscape Test Squares (LTS). Blue: agroforestry LTS; Orange: agriculture LTS; Green: forest LTS.

6.11 Agroforestry systems for livestock in the Mediterranean region

Case study: holm oak dehesa in Spain

Figure 39. Location of the 8 LTS (Landscape Test Squares) selected (1x1 km). In orange, LTS dominated by monocultures and in blue LTS dominated by agroforestry combinations. Original scale 1:400.000

Table 26. Location and main physical characteristics of the LTS selected (A= LTS dominated by agriculture land uses; AF= LTS dominated by agroforestry land uses) compared to the whole socio-cultural catchment.

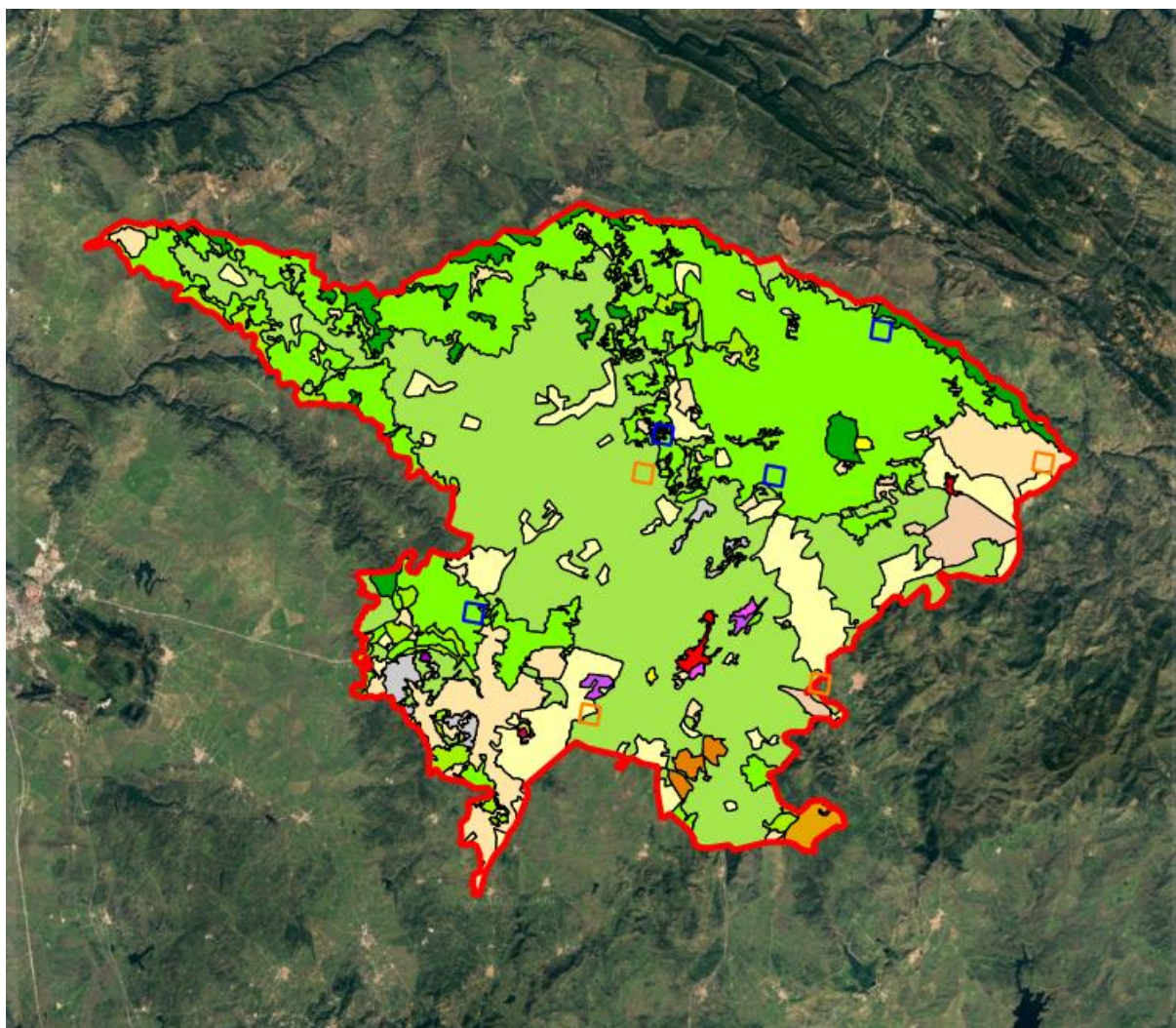| LTS	X	Y	Altitude (m)	Slope (%)	Aspect (°)	Natura 2000 (%)
A_1	-5.93761	39.42067	450	2.5	165	47.2
A_2	-5.93333	39.54134	415	2.7	164	0.0
A_3	-5.68742	39.58702	498	2.5	130	0.0
A_4	-5.79948	39.45884	510	1.5	222	0.0
AF_1	-5.92571	39.56191	445	2.0	234	0.0
AF_2	-6.02117	39.45720	398	2.7	249	0.0
AF_3	-5.80319	39.63387	463	2.6	168	0.0
AF_4	-5.85209	39.55350	446	1.8	185	0.0
Socio-cultural catchment			424 (209-781)	3.2 (0-41)	193 (0-360)	24.3

Figure 40. Map of land use based on CORINE database. Legend of colours can be consulted in Annex A (page 53). Original scale 1:400.000.

Table 27. Mean percentages of land uses in the different types of LTS compared to the whole social catchment.

Land uses	Socio-cultural Catch-ment	Agriculture LTS	Agroforestry LTS	Forest LTS
Artificial	1.2%	0.0%	0.0%	n.a.
Agriculture	18.4%	13.4%	1.3%	n.a.
Agroforestry	54.7%	6.2%	90.7%	n.a.
Grasslands	12.2%	24.6%	6.8%	n.a.
Forestlands	12.1%	55.7%	1.2%	n.a.
Others	1.5%	0.0%	0.0%	n.a.

Figure 41. Example of Landscape Test Squares (LTS). Blue: agroforestry LTS; Orange: agriculture LTS.

6.12 Agroforestry systems for livestock in the Continental region

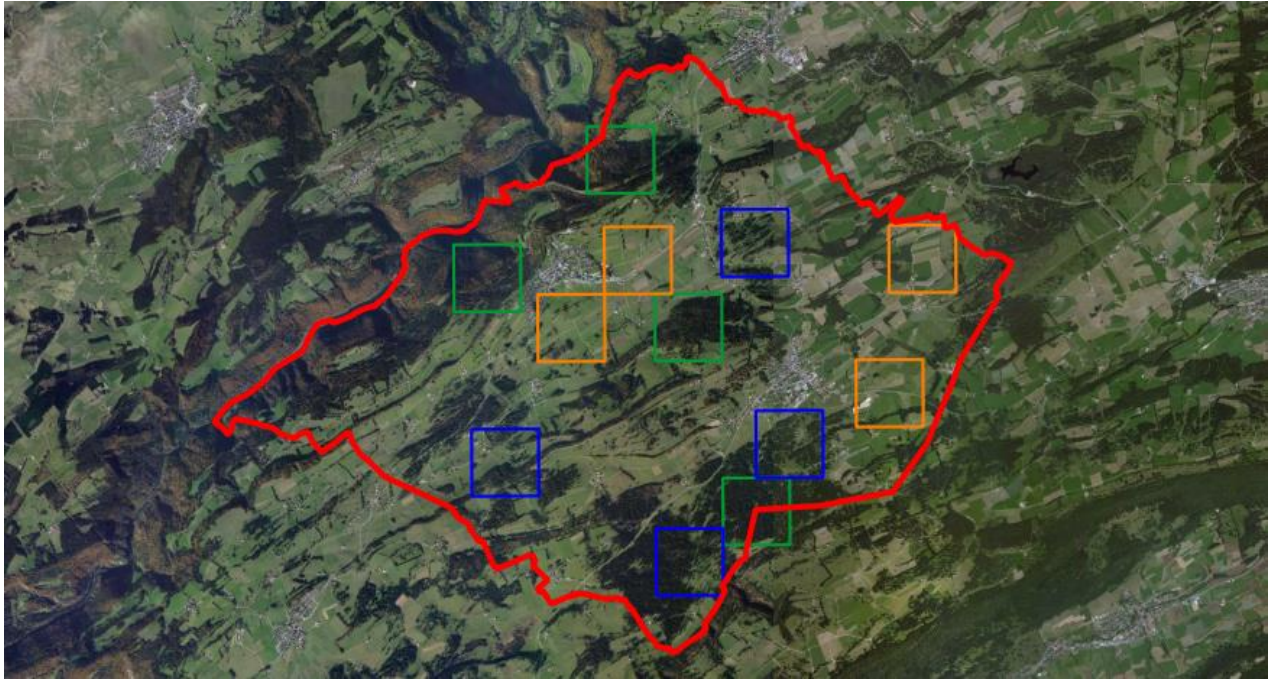Case study: wood pastures in Switzerland

Figure 42. Location of the 8 LTS (Landscape Test Squares) selected (1x1 km). In orange, LTS dominated by monocultures and in blue LTS dominated by agroforestry combinations. Original scale 1:150.000

Table 28. Location and main physical characteristics of the LTS selected (A= LTS dominated by agriculture land uses; AF= LTS dominated by agroforestry land uses) compared to the whole socio-cultural catchment.

| LTS	X	Y	Altitude (m)	Slope (%)	Aspect (°)	Natura 2000 (%)
A_1	7.02284	47.20893	997	3.3	194	No data
A_2	7.02930	47.22695	1023	3.8	180	No data
A_3	6.96006	47.21768	982	2.8	192	No data
A_4	6.97319	47.22673	981	5.0	159	No data
AF_1	6.94703	47.19964	1061	7.3	271	No data
AF_2	6.98344	47.18630	1058	2.8	210	No data
AF_3	7.00310	47.20211	1030	2.9	198	No data
AF_4	6.99628	47.22907	985	3.9	256	No data
F_1	6.98317	47.21778	1046	9.6	266	No data
F_2	6.99657	47.19309	1056	4.0	231	No data
F_3	6.96977	47.24021	987	14.1	270	No data
F_4	6.94350	47.22436	874	17.5	241	No data
Socio-cultural catchment			1002 (519-1180)	7.8 (0-52)	216 (0-360)	No data
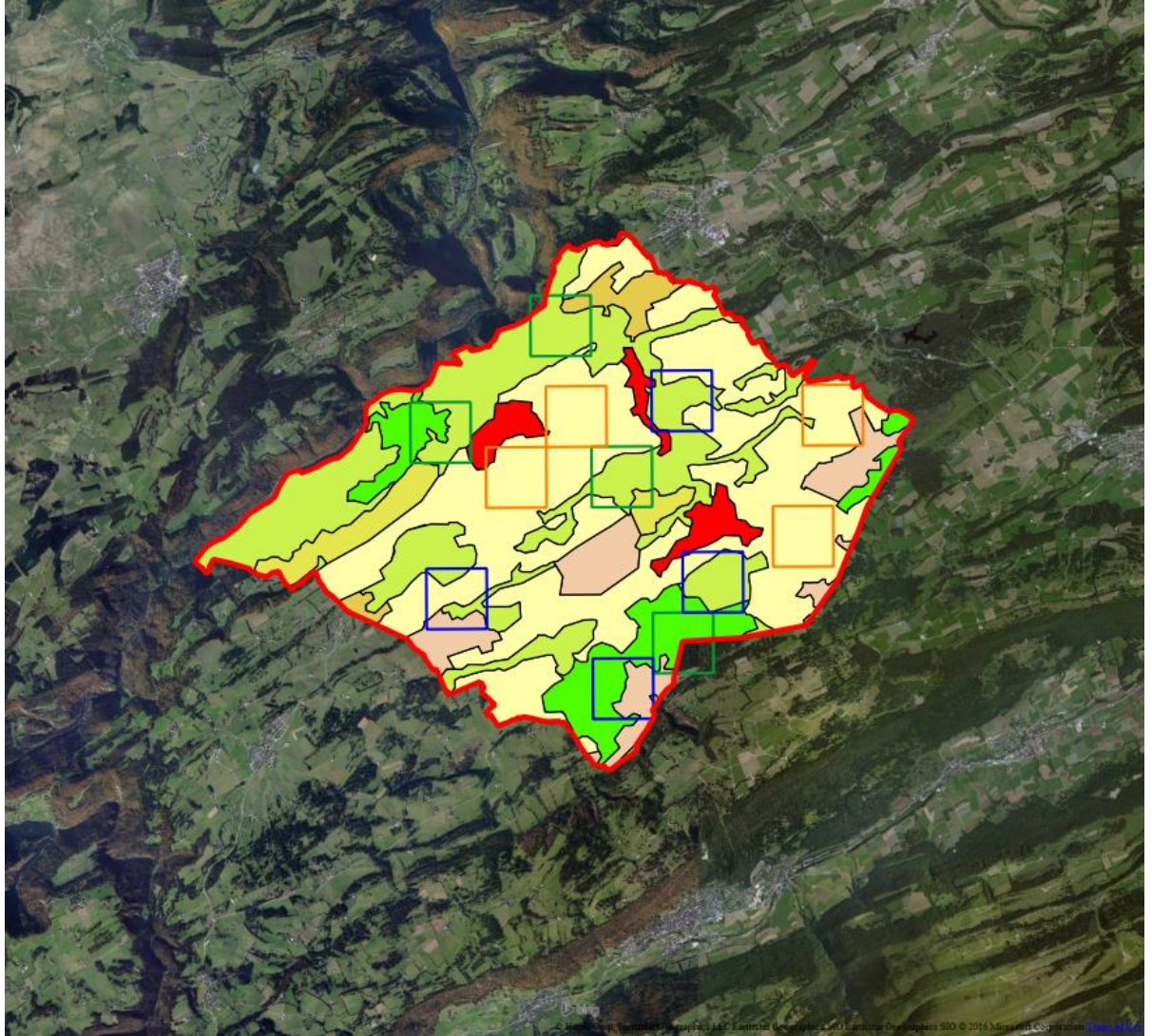
Figure 43. Map of land use based on CORINE database. Legend of colours can be consulted in Annex A (page 53). Original scale 1:150.000.

Table 29. Mean percentages of land uses in the different types of LTS compared to the whole social catchment.

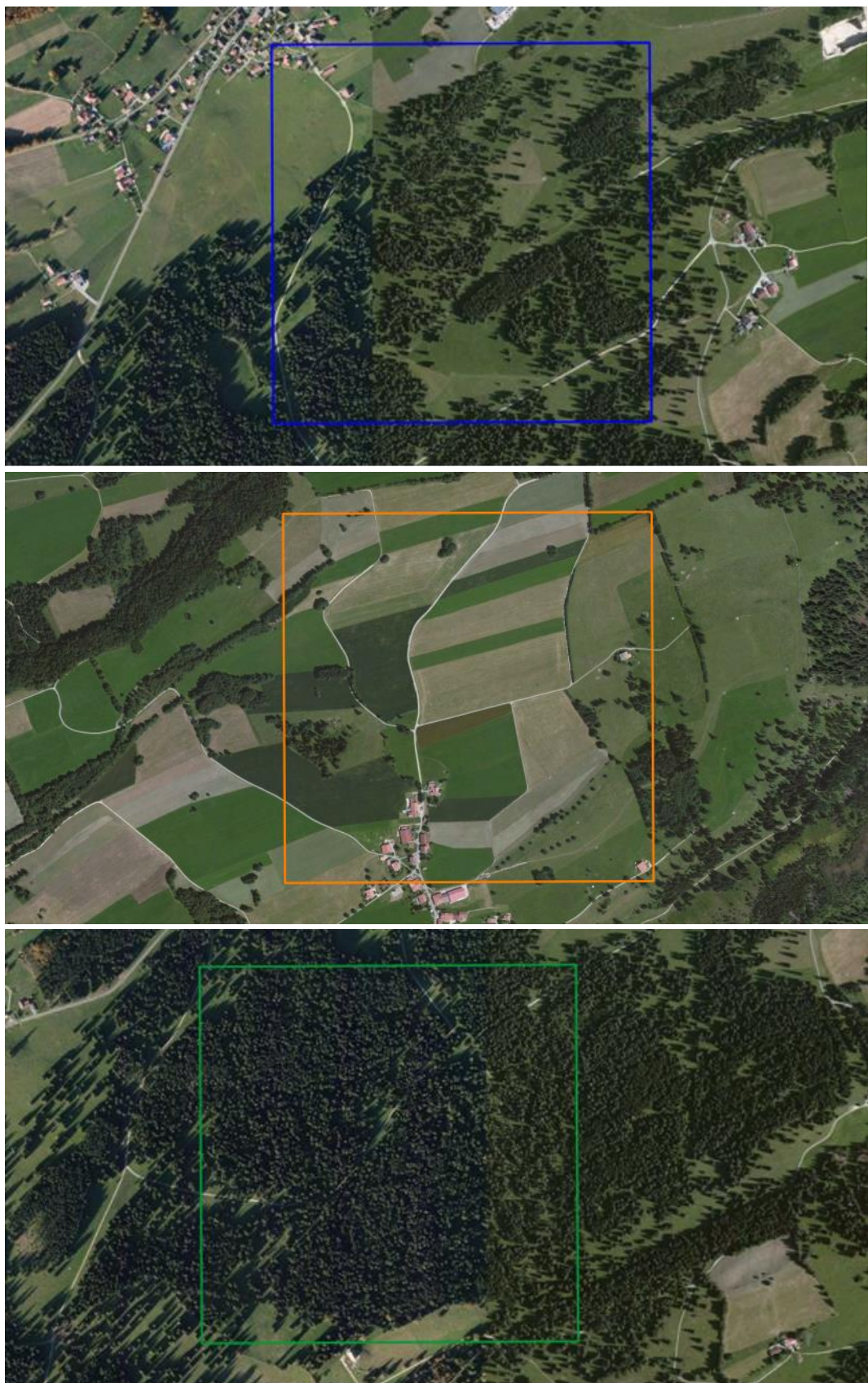| Land uses	Socio-cultural catchment	Agriculture LTS	Agroforestry LTS	Forest LTS
Artificial	3.7%	1.1%	0.7%	0.3%
Agriculture	44.6%	96.2%	23.6%	9.1%
Agroforestry	10.2%	2.1%	16.8%	4.7%
Grasslands	3.7%	0.0%	0.0%	2.4%
Forestlands	37.8%	0.5%	59.0%	83.6%
Others	0.0%	0.0%	0.0%	0.0%

Figure 44. Example of Landscape Test Squares (LTS). Blue: agroforestry LTS; Orange: agriculture LTS; Green: forest LTS.

7. Acknowledgements

Annex A. CORINE Land Cover codes

Colour	Code	Land Use Category	Land Use Type (Label 3)
	211		Non-irrigated arable land
	212		Permanently irrigated land
	213		Rice fields
	221	Agriculture	Vineyards
	222		Fruit trees and berry plantations
	223		Olive groves
	231		Pastures
	321		Natural grasslands
	241		Annual crops associated with permanent crops
	242		Complex cultivation patterns
	243	Agroforestry	Agriculture lands with significant areas of natural vegetation
	244		Agro-forestry areas
	311		Broad-leaved forest
	312	Forest	Coniferous forest
	313		Mixed forest
	322		Moors and heathland
	323	Shrublands	Sclerophyllous vegetation
	324		Transitional woodland-shrub
	331		Beaches, dunes, sands
	332		Bare rocks
	333	Bare soil	Sparsely vegetated areas
	334		Burnt areas
	335		Glaciers and perpetual snow
	111		Continuous urban fabric
	112		Discontinuous urban fabric
	121		Industrial or commercial units
	122		Road and rail networks and associated land
	123		Port areas
	124	Artificial	Airports
	131		Mineral extraction sites
	132		Dump sites
	133		Construction sites
	141		Green urban areas
	142		Sport and leisure facilities
	411		Inland marshes
	412		Peat bogs
	421		Salt marshes
	422		Salines
	423	Wetland areas and water bodies	Intertidal flats
	511		Water courses
	512		Water bodies
	521		Coastal lagoons
	522		Estuaries
	523		Sea and ocean