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Periurban agriculture in Lombardy between urban sprawl, multifunctionality and new lifestyles: towards a territorial approach for rural development

The European approach to rural development policies is gradually shifting to spatial differentiation, blending the territorial dimension. A differentiation of the rural character based on specific attributes of the territory is required, including lifestyles, supply of services and amenities and competition in soil use. We present a classification of the municipalities in Lombardy (Italy) aimed at providing recommendations for the development of regional policies. Grounding on four different and independently developed thematic classification relating to the heterogeneity in urban-rural linkages, the social morphology, the economic geography and the geographical morphology we construct a unified classification of municipalities that considers the multidimensionality of the rural attribute.

Introduction

"Spatial differentiation" of rural development policies in Europe has become a prominent topic in the 80's, when the relevance of the territorial dimension in agriculture was acknowledged by the European Union together with the role of multifunctionality in the agricultural sector (EC, 1985; 1988). These new perspectives on agriculture and related policies have been eventually endorsed by the Mac Sharry reform (1992). For the first time the importance of promoting environmental and territory-specific characters associated to the development of agricultural activities was underlined (De Castro *et al.*, 2012). In the following two decades these issues have gained more and more relevance inside the political debate on the future of agricultural policies in the EU and, accordingly, have guided reforms. This is precisely the case of the reformed Common Agricultural Policy (CAP), whose aim is to promote measures that will result in a territorially and environmentally balanced agriculture (EC, 2010), alongside viability of food production and sustainability of natural resources management. Among others, main topics in the new CAP are the support of rural employment, the maintenance of the social fabric of rural areas, the promotion of diversification, capacity building, improvement of local conditions and links between rural and urban areas, etc. (EC, 2010).

In Italy, and in particular in Lombardy, the relevance of spatial characterization of agricultures has been following a similar time pattern. Pioneering scientific contributions to the topic have been in fact proposed during the 70's and the 80's.

These were primarily aimed at describing and understanding patters of urbanization and the emergence of a new rural identity, dependent not exclusively on agriculture (i.e. Saibene, 1974; Volgyes, 1980; Mainardi, 1982; Barberis, 1988; Hoggart, 1990). It is, however, only in the '90s that the first territorial classification system for Italy was developed, together with more detailed approaches aimed at the identification of so-called "territorial agricultural systems" (Cannata, 1989; Favia, 1992; Cannata, 1995; Anania and Tarsitano, 1995; Cannata and Forleo, 1998).

From this time on, many studies have focused on the characterization of peri-urban agriculture (i.e. Veenhuizen, 2006; Fleury and Donadieu, 1997; Adell, 1999; Camagni, 1999; FAO, 2007). Nonetheless none was able to provide clear classification schemes. Traditional classification schemes for rural areas are grounded on the use of several indicators, sometimes even in combination, and the spatial unit of analysis is frequently defined based on administrative borders, as in the specific case of the National Strategic Plan and Regional Strategic Plans (PSN and PSR, respectively) for the period 2007-2013 (Ministero dell'Agricoltura e dell'Ambiente, 2007; Bassi and Cristea, 2009, Regione Lombardia, 2011). However, the capacity of these classification schemes to adequately describe, in general, the territorial diversification of agriculture and, more in specific, socio-economic and environmental linkages between urban and rural areas, is debated. These schemes, in fact, might not provide a sufficiently solid basis to develop policies for a truly multifunctional agriculture (Boscacci, 1999).

The characterization of geographical setting as well as of inter-linkages between different activities is perceived as a necessary first step in efficient planning of rural development policies. Concerning classification, several research institutes in Europe have developed classification methodologies that involve spatial analysis on a raster base, attempting to overcome limitations imposed by the use of administrative units (i.e. Vard *et al.*, 2005; Schwartz *et al.*, 2010; Dijkstra and Poelman, 2008; Jonard *et al.*, 2009, EUROSTAT, 2010). In recent years economic and spatial models have been developed that, in addition to numeric value at individual grid cells, account also for functional linkages and gradients between cities and countryside (i.e. Zhang *et al.*, 2004; Caruso *et al.*, 2007; Terzi and Kaya, 2008; Batty, 2008; Wilson, 2008; Crooks, 2010; Smith and Crooks, 2010; ESPON and University of Geneva, 2011; Kim and Batty, 2011). Furthermore, in order to gain a better understanding of the urban-rural complexity, it is important to be able to characterize territories by describing the specific characters of the agricultural compartment, but also their social and economic features, such as the geographical transition of one (or more) determinant, the evolution of life styles over time, changes in local demand/supply of services and, most importantly, "competition" in soil use.

In this paper we present the result of a research conducted during a two-year project, co- financed by Regione Lombardia. The research was aimed at characterizing peri-urban areas and at providing recommendation for the development of regional policies for peri-urban agriculture (Pareglio, 2013). The research was conducted by four teams, each belonging to a different discipline. Sociologists, economist, geographers ad planners have worked to provide different perceptions and viewpoint on the topic of peri-urban, eventually resulted in four differ-

ent classification schemes. Here we attempt to mix these different approaches into a unique classification capable of communicating the multidisciplinary aspects of our approach. In what follows we first describe the basic classifications schemes referring the interested reader to the full research report published by Fondazione Lombardia per l'Ambiente (FLA) for further details on the classification methods (Pareglio, 2013). In section three the methodology used to aggregate all classification schemes in a unique output is described. The resulting classification of the territory in the Lombardy region is presented in section 4, together with some statistics relevant for the discussion of agricultural policies. A discussion concludes the work.

Classification schemes

In this section we illustrate the four input layers that have been merged to produce the final territorial classification (Pareglio, 2013).

Urban and Rural Systems

This approached was developed by Fondazione Lombardia per l'Ambiente (FLA). Classification of territories is based upon Esploratory Spatial Data Analysis (Anselin, 1995), carried out using the ratio of urbanized to total area. Based on statistical significance of the Local Indicator of Spatial Association (LISA), 4 categories have been detected.

The cluster of municipalities reporting high values of urbanization density in the municipality and in neighbours is referred to as "areas in the Urban System". Patterns of territories with low urbanization density in the municipality and high urbanization density in neighbours are classified as "rural areas at the margins of the Urban System". By the opposite, territories with high urbanization density values in the municipality and low in neighbours are classified as "Urban Centres in rural areas". Accordingly, territories where the value of urbanization density is low both in the municipality and in neighbours are considered as "areas in the Rural System"

Functions and social morphology

This approach was developed by the Dipartimento di Sociologia e Ricerca Sociale (DSRS) – University of Milano Bicocca. After a preliminary exploratory factor analysis of 24 indicators of social morphology and the consequent estimation of 4 latent major domains (urbanity, sprawl, services, mobility), a cluster analysis has clearly identified groups of neighbours based on similar functions. The resulting classification consists of 4 classes:

1. Consolidated Urban Functions Areas, characterized by high availability (per capita) of public services, transports and production factors (agricultural and industrial)

2. Dynamic Urban Functions Areas, characterized by high birth rate, civic awareness, high endowment of production factors (basically agricultural);

3. Tourist Function Areas, characterized by high attractiveness, high €/ m2, presence of neighbours businesses and banks (per capita)
4. Naturalistic Function Areas : predominantly naturalistic, isolated, characterized by a strong presence of elderly population.

Territorial systems

This approached was developed by the Centro di Ricerche per l'Ambiente, l'Energia e lo Sviluppo sostenibile (CRASL) – Catholic University. The classification is based on a geographical classification, conducted on a raster grid with 100 x 100 m cells, of two main indicators: population density and land use. These two indicators were chosen based on a preliminary statistical analysis of a large set of indicators (socio-economic, demographic, life styles, land use and agricultural activities). Population density was extracted from the Population Census 2010 (Istituto Nazionale di Statistica, 2011), while land use was derived form the Land Use Database (DUSAF) 2007 (ERSAF, 2010). The resulting classification consist of 4 classes:

- Urban areas: characterized by high population density (> 1,000 people/km2) and land use classified as "urbanized";
- Periurban areas: characterized by medium population density (between 200 and 1,000 people/km2) and land use classified as "agricultural", or high population density and land use classified as "forest";
- Rural areas: characterized by low population density (< 200 people/km2) and land use classified as "agricultural", or medium population density and land use classified as "forest";
- Natural area: characterized by low population density and land use classified ad "forest".

Territorial morphologies

This approached was developed by the Dipartimento di Architettura e Studi Urbani (DAStU)

– Politecnico di Milano.

This classification aims to identify and map the municipalities that have characters of continuity and/or discontinuity of urban areas, highlighting the system of conurbations.

The first step consisted in mapping the municipalities as continuous or discontinuous conurbations as they appear in the Land Use Database (DUSAF) 2007 e 2009 (ERSAF, 2010). Then a potential threshold of aggregation/conjunction of the urban areas equal to a distance of 500 meters was selected, simulating the natural conurbation effect created by the welding of the urbanized areas.

The resulting classification consists of two classes:

- Continuous conurbations: characterized by municipalities with bordering urban areas
- Discontinuous conurbations: characterized by municipalities with not bordering urban areas

Aggregation

For the purpose of creating a combined classification of territories in the Lombardy region we proceeded with the crossing and matching of different classification described above. The crossing of information yielded to 128 possible categories, each category being defined in the four-dimensional space limited by the original classifications. Each category hence represents a possible combination of the four basic classifications.

In 54 cases the category was not determined, meaning it was just an empty sets, provided that no municipality was observed to correspond to such combination of classifications. For instance, no municipalities are classified as "urban areas" based on the first classification "rural areas at the margins of urban system" based on the second classification, "tourist function areas" based on the third classification and "discontinuous conurbations" based on the fourth classification.

The remaining 74 classification have then been aggregated based on matching similarities between then. This has been done in a two step procedure. In the first step we selected combination of categories (primary classes) representing a sufficient number of observations (at least 1% approximately). Upon an overall number of observations as big as 1544, we selected combinations in which a number at least equal to 15 municipalities was counted. This was necessary to detect dominant characters of the different classifications of territories. After obtaining this first group of categories, all the remaining have been associated to these major ones, based on similarities among resulting combinations.

More in the detail, 27 primary classes have been originally detected. For a large number of these we have found that many (normally 3/4) characters were in fact common to more than one class. For instance we started by detecting the primary class of "Urban Areas" as the class for which every single classification was indicating the urban character of that territory. Then we aggregated to this primary class all other observations for which two and even more classifications were pointing to the urban character, but one not. This resulted in a set of territories in which the urban character is the predominant or at least the prevailing one. It is worth here distinguishing the notions of predominant and prevailing. The logic of "predominance" was used to define primary classes. The logic is objective, as any basic classification was pointing to similar characters of the territory. "Predominantly urban" accordingly means that all our basic classifications agree on characterizing this territory as urban. This holds also for other categories different than urban. By the contrary, the logic of prevalence was used to aggregate other classes to the primary ones. The problem with other classes is, in fact, that a distinct definition does not emerge from the crossing of classifications. However some characters emerge with

a certain degree of coherence between classifications, and it is possible to argue that such characters are prevailing. This usually happens when two or three classification agree on a definition while one points to different characters. The logic is consequently subjective and implies a certain degree of arbitrariness. For this reason, the result of our effort could be defined more as an effort of "interpretation" of the territory, which clearly goes beyond the purpose of simple classification.

Based on this type of logical efforts the 27 primary classes were reduced to a straightforward classification based on 8 final categories. Admittedly the final representation provided by this exercise appears quite an excessive simplification with respect to the initial set of information available. However this simplification was deemed necessary to come out with a meaningful and interpretable classification of the territory. As a drawback of the procedure, a mix of characters appears in each primary class. Therefore we had to rely on qualitative analysis, primarily based on the knowledge of the territory, to highlight the most relevant characters of each primary class.

In a second stage, we analysed the variability among the identified systems regarding land use and agricultural activities. In particular, we included variables derived from the following two data sources:

a. Land Use Database for the years 1999 and 2007: we estimated the absolute and proportional increase in urbanization and loss of agricultural soil;
b. Agricultural Census 2010: Average farm Utilized Agricultural Area (UAA), education and age of farm manager, hours worked (per ha of UAA), livestock units, number of organic farms, presence of holiday farms, proportion of main land use typology, etc.

The list of indicators is presented in the Results section.

Results

The main result of the above methodology is a classification of the Lombardy region in 8 territorial systems, summarized below. The description follows the 4 input approaches, thus the first item will refer to the classification by FLA, and represent the geographical location and relation with surrounding areas; the second item represents urbanization, as summarized by population density and land use; the third item provides information on functions (services, touristic, etc); and the fourth item is related to the morphology and location of the urban area within the administrative unit.

- Urban areas: these areas are within urban systems, urbanized, with functions related to availability of infrastructure and services, "continuous conurbations";
- Periurban Areas (first belt): these areas are within urban systems, partially urbanized, with mixed functions (mostly urban, but also natural and touristic), mostly "continuous conurbations";
- Periurban Areas (second belt): these area are not within urban systems, even though in close proximity, with little urbanization, with mixed functions, "continuous conurbations";

- Agricultural Areas - with Urban Functions: these area are located mostly in rural and agricultural contexts, but are characterized by typically urban functions, can be "continuous" or "discontinuous conurbations";
- Rural/Agricultural Areas: these are also located in the most rural areas of Lombardy, present typical agricultural characteristics, have functions related mostly to the natural environment, can be continuous" or "discontinuous conurbations";
- Natural Areas - with Urban Functions: mostly rural areas, with characteristics of the natural environments, but which present typically urban functions, are "discontinuous conurbations";
- Natural Areas - with Touristic Functions: mostly rural areas, with characteristics of the natural environments, but which present touristic functions, can be "continuous" or "discontinuous conurbations";
- Natural Areas: these area rural areas, characterized by low urbanization, with prevailing naturalistic functions, can be "continuous" or "discontinuous conurbations".

In a second phase, we further aggregated the previous classes into 4 main "macro-systems", as to provide an even more immediate view of the periurban areas, obtaining the following:

- Urban areas;
- Periurban areas;
- Agricultural areas;
- Natural areas.

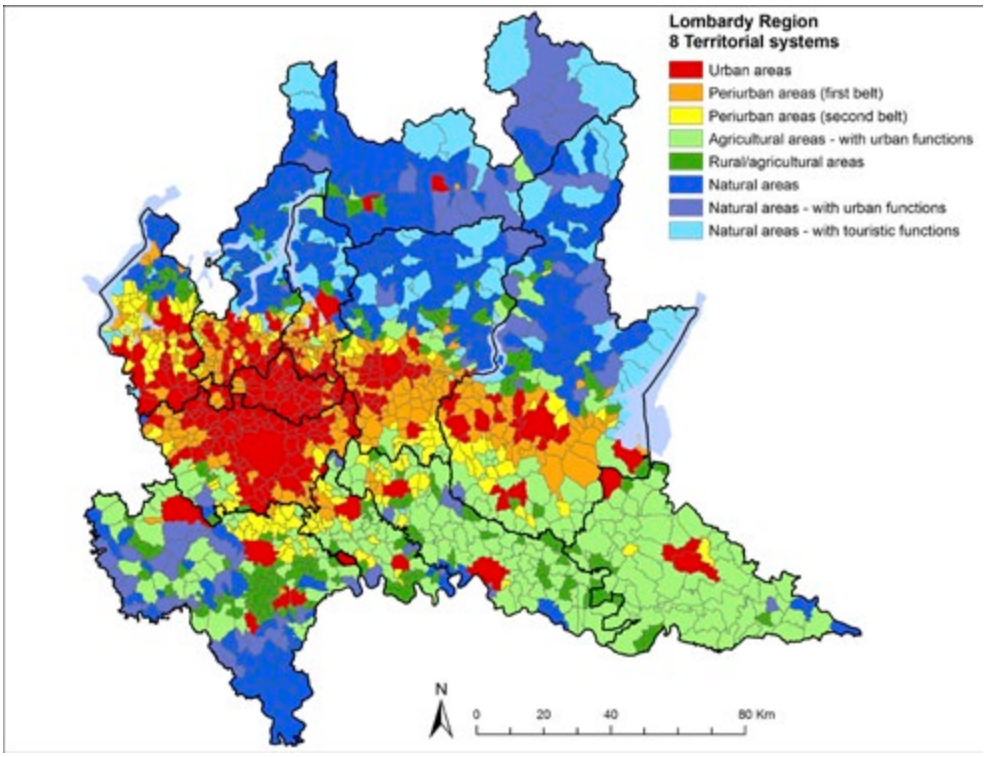
The following maps show the classification of the 1544 municipality in Lombardy according to the 8 and 4 territorial systems, while the table illustrates the variability in agricultural characteristics for the 4 territorial systems.

Discussion and Conclusion

This work describes a methodology to create a classification of territories in the Lombardy region by merging different disciplinary approaches. Notwithstanding some simplifications and assumptions, this process produces a meaningful and interpretable classification of the territory, useful for decision making processes.

The analysis of agricultural features in the different systems does not show striking differences. By the opposite a general trend of transition emerges, whose main feature is the simultaneous occurrence of social, productive and morphological characteristics as well as the availability of services, some typical of urban areas (high density, good infrastructure and services), some of rural areas (increasing immigration, high agricultural areas, lower number of services) and some others of more natural/touristic areas (isolation, elderly population). The differences between regional systems, or urban areas, are more evident than those within their agricultures. Furthermore, the level of multifunctionality in agriculture, at least in periurban context, does not appear as relevant as expected.

Figure 1. Classification of Lombardy municipalities according to the 8 territorial systems.



The analysis of agriculture in peri-urban areas however allows for a better definition of rural development policies. The maps of periurban areas need to be interpreted according to a multi-disciplinary approach, investigating the differences at different scales, rather than delineating the exact boundaries. For this purpose, it is important to make available adequate methodologies, tools and indicators, that also need to be shared among the relevant policy- makers. An a priori selection of the analysis framework (i.e. based on geographical proximity, urbanisation rate, life styles, presence of valuable elements, etc) is clearly not the best approach, as it reflects subjective perceptions and cannot allow for a unique and sharable characterization of area. Furthermore, territorial policies should not be focused on one or few sectors, whether it is rural development or regional planning, nor should they be limited to a single scale: integration of levels and themes is fundamental.

Among the most urgent policies for peri-urban agriculture are those that should aim at reduction of soil loss, revitalisation of agricultural production (though structural and commercial approaches), protection of the environment and biodiversity, and increase of qualitative and quantitative offer of services, both to people and to businesses.

Figure 2. Classification of the Lombardy Region according to the 4 aggregated territorial systems.

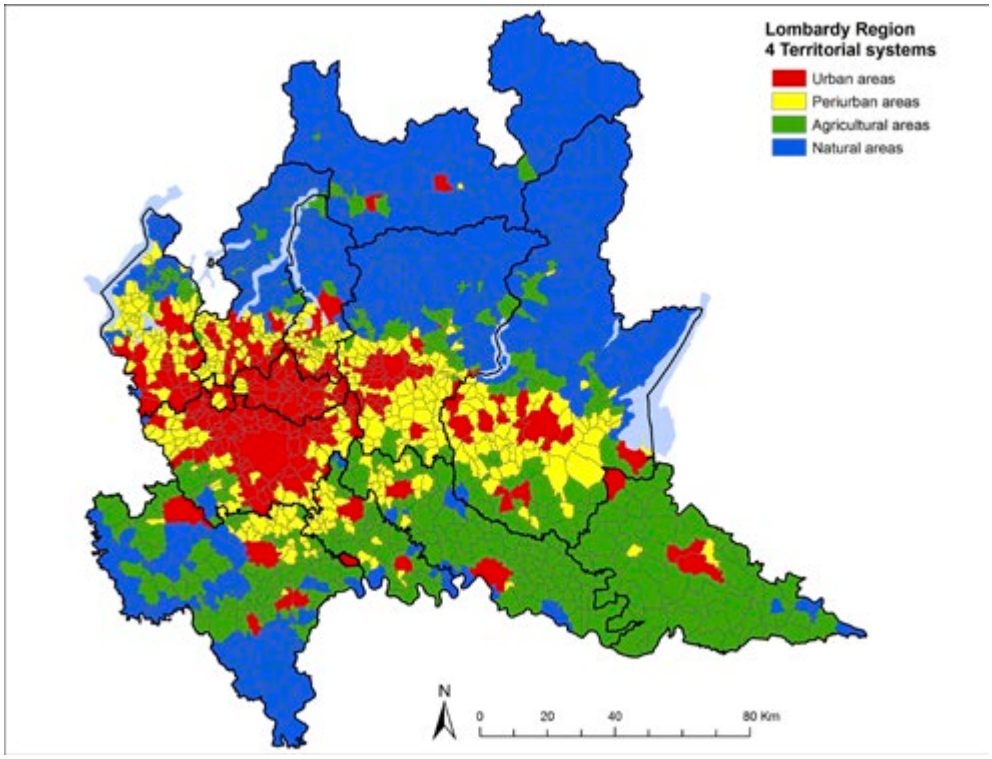


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Table 1. Agricultural characteristics in the 4 territorial systems of the Lombardy region.

	Urban areas	Periurban areas	Aricultural areas	Natural areas
Municipalities (number)	281	406	399	458
Proportion of municipalities (% of the regional total)	18.20	26.30	25.84	29.66
Area (% of the regional total area)	13.75	14.60	29.17	42.48
Population (% of the total regional population)	60.07	18.62	14.30	7.01
Annual rate of urbanisation (% of the total area, 1999-2007)	0.48	0.34	0.17	0.04
Annual rate of urbanisation (% of the urbanised area, 1999-2007)	1.24	1.76	1.81	1.15
Urbanised area (% of the total regional area)	47.97	25.03	11.08	4.70
Agricultural area (% of the total regional area)	36.82	49.27	69.59	23.77
Wooded area (% of the total regional area)	13.91	22.54	17.26	65.42
Average Utilised Agricultural Area (UAA)	13.72	17.05	27.58	21.72
Generational turnover index (Ratio between farm manager < 40 years old and farm manager > 65 years old)	0.61	0.76	0.71	0.95
Graduated farm managers (% with college degree)	7.92	7.02	8.46	6.00
Employment in the agricultural sector (% of employees)	2.15	3.31	14.12	20.93
Days worked (per ha of UAA)	62.70	51.31	26.41	55.11
Livestock Units (LSU) (per ha of UAA)	1.76	2.55	2.71	0.94
KW (per ha of UAA)	17.07	12.98	9.62	8.39
Organic farms (%)	17.49	7.78	5.17	7.73
Density of holiday farms (n/km2)	0.15	0.20	0.16	0.10
Density of raw milk distribution points (n/km2)	0.18	0.17	0.10	0.04
Farms with specialisation in crops (%)	38.87	40.41	52.45	24.63
Farms with specialisation in horticulture and fruits (%)	11.76	6.93	3.25	1.64
Farms with specialisation in permanent crops (%)	11.51	10.12	10.22	25.21
Farms with specialisation in ruminant livestock (%)	24.95	28.18	21.52	40.10
Farms with specialisation in poultry farming (%)	2.13	4.01	4.78	0.65
Farms with specialisation in mixed crops (%)	2.82	2.69	3.28	3.34
Farms with specialisation in mixed livestock (%)	0.90	1.01	0.61	0.62
Mixed farms (%)	6.42	6.26	3.39	3.26

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