Socio-economic and Demographic Trends in EU Rural Areas: An Indicator-based Assessment with LUISA Territorial Modelling Platform

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Abstract: This work presents an application of the LUISA Territorial modelling platform under the last released Territorial Reference Scenario 2017. It provides a broad overview of the situation of EU regions from a socio-economic and demographic point of view with special focus on rural areas. In particular, five indicators were selected, developed and analysed to better understand current and future spatial patterns and trends with regard to the rural population, agricultural production systems, agricultural land abandonment, employment and GVA (Gross Value Added) in the primary sector. The relevant indicators were developed, implemented and mapped at different level of aggregation (European, national and regional/local) from 2015 to 2030. Differences and disparities between regions are, then, further analyzed, emphasizing the situation of predominantly rural regions.

1 INTRODUCTION

Rural areas are very diverse across Europe due to various geographic, socio-economic and environmental particularities. Natural and mountainous zones, rural landscapes, biodiversity richness, predominant agricultural or forest-related land uses, abundant natural resources, cultural traditions and important recreational functions, along with moderate economic and demographic development are among the principal characteristics associated with rural areas.

The economic development of rural regions relies primarily on local natural resources, environment quality, and quality of life. The economic growth in rural regions is mainly due to new activities from the secondary and tertiary sector such as tourism, food production, business services, transport and technology. Primary sector activities typically serve as a platform for other diversification activities and employment relies partially on the diversity of local activities. Moreover, declines in agricultural employment produce cascade processes affecting other branches of industry with immediate losses of jobs and economic decay. Agricultural intensification, often driven by market forces, leads to high productivity on more fertile areas with the consequent marginalisation or abandonment in less fertile ones. Land abandonment is furthermore directly linked to population dynamics, especially in mountainous or remote rural areas, where ageing and the lack of economic and social opportunities leads to their decline (Hart et al., 2013; Eurostat, 2013).

During the last decade, all the mentioned aspects related to Europe‘s rural areas have been at the core of the European Union (EU) policy debate due to the importance of rural regions and the different directions of development that they can take. For a meaningful debate, understanding of the future of EU past and future agricultural trends is necessary. The GIS-based LUISA modelling framework developed by the European Commission’s Joint Research Centre is specifically developed to inform such policy debates. In this context, this study will present results from LUISA, focusing on key rural and agricultural trends in an analysis of socio-economic and demographic characteristics in Europe’s rural regions.

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2 MODELLING AND ASSESSING EU RURAL AREAS IN LUISA

This section briefly introduces the main tool used for this analysis, namely the LUISA Territorial Modelling Platform. Furthermore, the selected indicators (rural population, employment and GVA in primary sector, agricultural land and agricultural land abandonment) are presented, highlighting the most important data sources and methods needed to performed the analysis.

2.1 LUISA Territorial Modelling Platform

The LUISA provides EU-wide scenarios of territorial development in order to understand the direct and indirect impacts of EU policies in an integrated, spatially explicit manner. The LUISA platform consists of several elements that: 1) provide multisectoral regional trends and derived demands for land functions; 2) allocate those demands as land uses, population counts and accessibility levels on a 100x100m spatial raster, typically until 2050; 3) compute a large amount of indicators based on the resulting LUISA projections; and 4) provide web platforms to share the computed results. For that purpose, LUISA coherently links specialised macroeconomic, demographic and geospatial models with thematic spatial databases. Under this modelling approach, LUISA aims to explain the causal link between economic decisions and resulting spatial patterns of human land-based activities. Further relevant for this paper are the sources of regional demographic and agricultural expectations. For this study, regional population projections were obtained from Eurostat (the EUROPOP13 scenario) and regional agricultural projections were derived from the CAPRI 2016 Baseline projections. The latter are allocated by LUISA in aggregate production systems, with imposed additional degrees of freedom to allow for the effects of land market competition with other land uses not modelled in CAPRI[1].

2.2 Developing Socio-economic and Demographic Rural Indicators: Data and Methods

2.2.1 EU Rural Population

The indicator presents the people living in rural areas as a percentage of total population and the changes in rural population between 2015 and 2030 at national and regional level (NUTS3[2]) for all EU Member States (MSs). The regional demographic projections are produced by Eurostat (EUROPOP2013) and, later on, implemented in the LUISA platform (Jacobs-Chrisioni et al., 2017). These projections are then dynamically allocated at a finer resolution in a 100m grid map for each time step throughout the simulation period (2015-2030). The identification of rural areas is based on the degree of urbanization (Dijkstra, L. and Poelman, H., 2014), according to which three main classes are distinguished: cities (densely populated areas), towns and suburbs (Intermediate density areas) and rural areas (thinly populated area).

2.2.2 Employment and Gross Value Added (GVA) in Primary Sector

Added Historical data of the EU Employment and GVA in primary sector are used to understand past economic trends up to the last observed year 2015. Thus, the two selected indicators measure:

- the share of employment in primary sector relative to total employment. Primary sector employment is defined as employment in the NACE A branch (Agriculture, Forestry and Fishing). The indicator shows historical trends at European, national and regional level (NUTS 3) derived from the Cambridge econometric database[3].
- the sectoral economic productivity in the primary sector in terms of GVA, relative to total regional GVA. Agricultural GVA is measured as NACE A productivity, and obtained from the Cambridge econometric database at regional level (NUTS 3).

2.2.3 Agricultural Land

This indicator provides the share of land occupied by agriculture and the percentage of changes between the years 2015 and 2030. In function of its final production, two categories are distinguished: 1) the

[1] CAPRI is a partial equilibrium model that simulates market dynamics of agricultural commodities for impact assessment of the Common Agricultural Policy (Britz and Witzke, 2012). The spatial patterns of agricultural activities are simulated by the mentioned agricultural production systems as a result of an aggregation process from the individual crops provided by CAPRI.

[2] Nomenclature of Territorial Units for Statistics at level 3.

[3] Cambridge Econometrics' European Regional Database (ERD), Revision: 25/07/2017

production of food and feed takes place on land allocated to the following modelled production systems: arable farming, pastoral systems, mix-crop systems, livestock production, permanent crops and rice production, and 2) the production of energy from agricultural land correspond to the modelled class of bioenergy crops (Perpiña et al., 2015). The indicator presents data for future projection from LUISA, at national and regional level (NUTS3) for all EU28 Member States.

2.2.4 Agricultural Land Abandonment

Agricultural land abandonment indicator represents the share of the agricultural abandoned land with regard to the total agricultural land area (ALA) for the period 2015-2030 at the national, regional and grid level for all 28 EU member states. LUISA models agricultural land abandonment explicitly using regional expectations of abandonment along with a dynamic composite map that assesses the local potential risk of farmland abandonment. Local risks are defined according to regional characteristics such as biophysical, agri-economic's, farm structure, remoteness and population density.

The dynamic composite indicator is built by the spatial aggregation of the set of factors shown in Table 1. Selected factors driving an agricultural land abandonment Table 1, as an adaptation of different methodologies from the scientific literature (Benayas et al., 2007; Pointereau et al., 2008; Eliasson, et al., 2010; Terres et al., 2014; Lasanta et al., 2016). These factors are selected to reflect a number of criteria that drives and influence an abandonment process from different points of view.

Each criterion corresponds to a spatial thematic layer or statistical information (at NUTS2/3 level) from different European data sources. The spatial aggregation is made by using a weighted linear addition (WLA) where biophysical factors are assigned the highest weights following the assumption that abandonment can be initially triggered by primary drivers related to remote and mountain regions, along with unfavourable soil and climate conditions for agriculture. Finally, the spatial combination of the three maps for each group allows to build the dynamic risk map of farmland abandonment for the whole Europe (Figure 6).

Table 1: Selected factors driving and agricultural land abandonment process.

Biophysical land suitability factors[4]	Economic and structural agricultural factors[5]	Population and regional context[6]
Length of growing period	Farmer qualification	Population density
Organic matter	Age of farmers	Remote areas
Soil texture	Farm size	
Root depth	Rent paid	
Soil ph	Rented UAA	
Salinity and sodicity	Farm income	
Precipitation	Farm investment	
Soil drainage	Farm scheme	
Slope		

3 RESULTS: FACTS AND TRENDS IN EU RURAL AREAS (2015 - 2030)

3.1 EU Rural Population Trends (2015 – 2030)

Rural areas cover 75% (3.3 million km2) of EU's total populated land area, but in 2015 hosted only 28% of the total population, as the great majority of Europeans live in towns, cities or suburbs. The implicit concentration of people is expected to continue. By 2030 the EU population, 510 million, is projected to grow by around 2%, while the EU's rural population roughly 0.6% between 2015 and 2030.

Important differences can, however, be found at national and regional level. Six countries (Germany, Spain, France, Italy, Poland and the United Kingdom) account for about 70% of the total EU population in 2015. Rural population accounts for about 40% or

[4] Soil, climate and terrain criteria are used for classifying land according to its suitability for generic agricultural activity. Delimitation of areas facing severe natural constraints (limiting conditions) follows the last EU Regulation No 1305/2013 (European Union, 2013). The spatial layers are mainly gathered from IIASA (International Institute for Applied Systems Analysis) and FAO (Food and Agricultural Organization of the United Nations), SINFO project (Soil Information System for the MARS Crop Yield Forecasting System), ESDB (European Soil Data base) and EFSA (European Food Safety Authority, Spatial Data).

[5] This information is mainly gathered from FADN (Farm Accountancy Data Network) and DG EUROSTAT -FSS (Farm Structure Survey) to reflect the stability, viability and performing for preventing farmland abandonment at regional level.

[6] The risk of abandonment increases in mountain areas with extreme remoteness, physical disadvantage and very low population density (MacDonald et al., 2000). In this study population density below 50 inhabitants/km2 is considered low populated areas and remote areas are identify as those that are further than 60 minutes away from towns.

more in a number of countries such as Austria, Croatia, Ireland, Romania, Poland, Slovenia, Slovakia, Finland, Czech Republic and France. In contrast, rural population is particularly low (below 15%) in Malta, the Netherlands and the United Kingdom. As presented in Figure 1, the EU Member States will undergo significant, but not equal changes both in general and by population categories up to 2030. The largest growth in rural population is projected for the United Kingdom, Spain, Denmark and Sweden. Conversely, the Baltic region (Lithuania and Latvia) as well as in Bulgaria will see the deepest drop (more than 7%) in their rural population between 2015 and 2030.

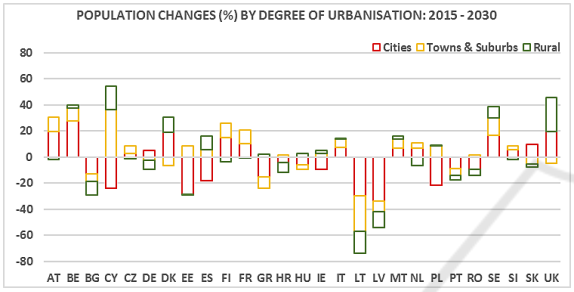

Figure 1: Percentage of changes in population in cities, towns and suburbs and rural areas at MS level between 2015 and 2030.

The average rural population at NUTS3 level is approximately 100.000 inhabitants, with the majority of rural regions in having a population of less than 300,000 inhabitants (Figure 2). The share of regional rural population is substantially higher in Eastern Europe regions compared to Western Europe. By 2030 important changes (>10%) in rural population across NUTS 3 regions are expected such as in: Southern and North-eastern parts of Spain; South-eastern part of Sweden, Finland, Belgium and United Kingdom; Northern part of Italy and Poland; and around most capital cities (Bucharest, Budapest, Dublin, Madrid, Prague, Rome, etc.), as well as in Cyprus. Conversely, deep (>10%) cuts in rural population are expected in: Northern Portugal, Eastern parts of Germany and Hungary, and large areas in Sweden, Croatia, Greece and Romania, as well as in the already identified Lithuania, Latvia and Bulgaria.

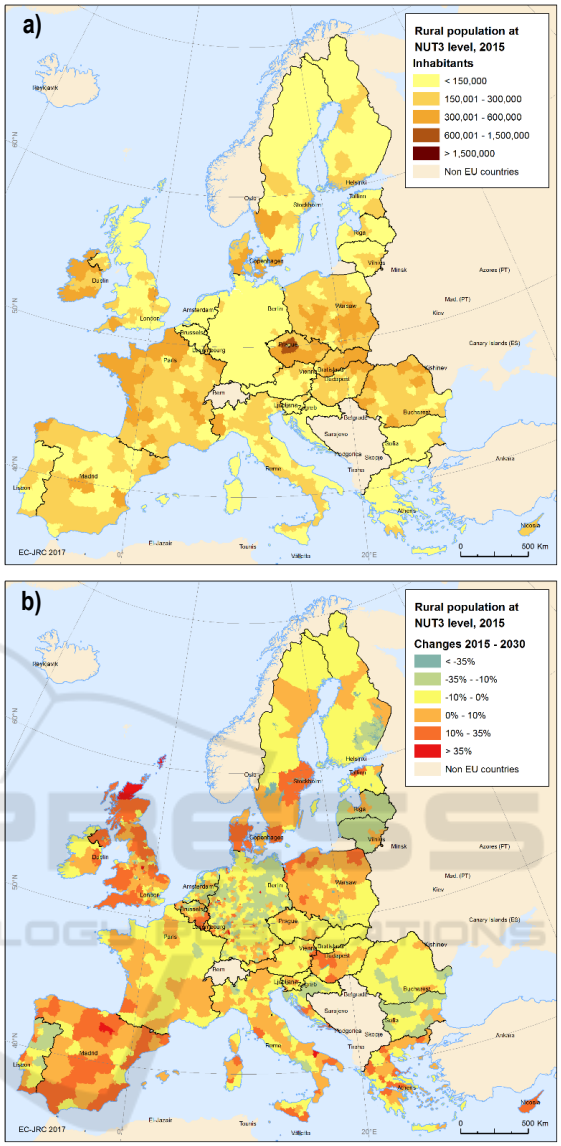

Figure 2: a) Population living in rural areas in 2015, b) Change of rural population between 2015 and 2030.

3.2 Employment in Primary Sector, 2015

By 2015, the share of primary sector in the EU overall employment was 4.4% (more than 9.5 million people). Agriculture accounted for 93% of that employment[7]. The employment in primary sector is substantially higher in the newer EU-13 than in the elder EU-15 (12% versus 3%, respectively). Romania and Bulgaria had by far the highest shares (27% and 19%, respectively) followed by Greece and Poland

[7] Shares derived from DataM bioeconomy data https://datam.jrc.ec.europa.eu/datam/mashup/BIOECONOMICS/index.html

with around 12% each, and Portugal with 10%. On the other side, Belgium, Germany, Malta and the United Kingdom contribute with less than 2% share, as well as Luxembourg with the absolute low EU-wide of less than 1%.

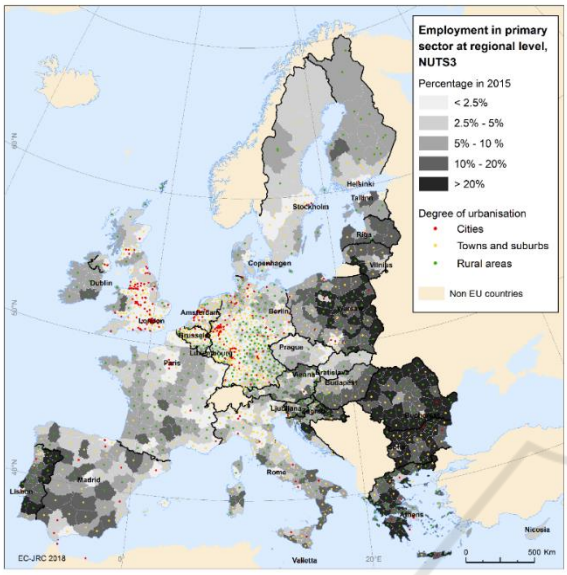

Figure 3: Share of employment in primary sector per degree of urbanization at NUTS 3 level in 2015.

By regional typologies, rural areas provided the largest number of employees accounting for about 4.8 million (11.5% share in primary sector employment). With almost 4% share, towns & suburbs ranked second and close to the EU average, while cities had the lowest share of primary sector employment (less than 1%). Eastern European regions in Lithuania, Poland, Romania, Bulgaria, Greece, and Croatia as well as in Portugal were the ones where the employment share of primary sector exceeded 20% (Figure 3). Town & suburban regions with such a high share were mainly found in South-eastern Europe (Romania, Bulgaria and Greece). On the contrary, most NUTS 3 containing capital cities or other large cities, as well as vast areas in Western and Central Europe (in Germany, Southern United Kingdom, Benelux, Northern France and French Riviera, Northern Italy, Czech Republic, etc.) presented very low shares of primary sector employment (less than 2.5%). In all those regions, employment in secondary and tertiary sectors were the dominant.

3.3 Gross Value Added in Primary Sector, 2015

In 2015, primary sector accounted for just 1.7% of total GVA in the EU. Similarly to the primary sector employment, the weight of rural economy differed considerably between the newer EU-13 and the elder EU-15. The share of primary sector's GVA in EU-13 was roughly two times higher than in EU-15 (8.1% versus 4.1%, respectively means that the productivity of labour force in EU-13 was much lower than the one in EU-15. In the same way as employment, Romania was the EU leader in primary sector GVA with 5.7% followed by Greece (4.8%), (4.6%) and Bulgaria (4%). At the bottom of the GVA ranking there was no significant difference with the employment one. Germany, the United Kingdom and Belgium occupied the lowest placing with less than 1%, going down to the record low of 0.25% in Luxembourg.

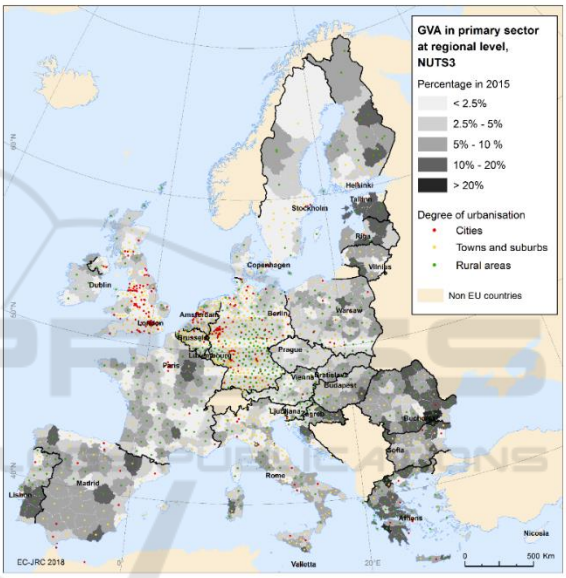

Figure 4: Share of GVA in primary sector per degree of urbanization at NUTS 3 level in 2015.

In predominantly rural regions, the primary sector's GVA contributed well above the EU average (1.7%), accounting for roughly 4.5% whereas in towns & suburbs was considerably lower (only 2%). The activities of primary sector were mainly concentrated in rural regions of Austria, Croatia, Estonia, Finland, France, Ireland, Poland, Portugal, Romania and Slovenia. In Belgium, Czech Republic, Germany, Denmark, Hungary, Italy and Sweden the GVA of primary sector came simultaneously from towns & suburbs and rural regions. The highest EU values (above 25%) were identified in Romania (Brăila and Ialomița) and Bulgaria (Silistra) and, modestly, most of the regions of the Eastern and Southern Europe (Hungary, Romania, Bulgaria, Croatia and Greece) reached more than 15% share. Conversely, many regions in Italy, France, Belgium, the Netherlands,

Germany and Poland scarcely contributes (below 2.5%) to the GVA in primary sector. However, even in those countries was possible to identify NUTS 3 with higher importance of this sector (5% - 10 %), particularly in traditional rural zones. The regional heterogeneity is highlighted by the large differences amongst rural-urban typologies, for instance in Spain or Bulgaria.

3.4 Agricultural Land (2015 – 2030)

The total agricultural land area (ALA) reached 185 million ha (42.6% of the all EU land area) in 2015 and it is expected to decrease 1.1% between 2015 and 2030. By aggregated production systems, arable farming systems8 cover the largest proportion of EU agriculture systems with 103.4 million ha (56% over the total ALA) in 2030, despite an important reduction of more than 4%. The second largest contributor to agriculture systems are livestock grazing systems [9] which account for 47 million ha (25% over the total ALA) in 2030, also being expected to undergo a drop of 2.6%. Mixed crop-livestock systems [10] are the agriculture system projected to experience the largest increase (almost 11%), with a total land surface of 25 million ha representing 13.5% of the total ALA in 2030. Besides of mixed-crop, permanent crops systems [11] are also expected to increase by approximately 3.5%, with a total cultivated are of 10.2 million ha (5.5% over the total ALA). Regarding different types of permanent crop systems, olive trees will represent practically double of the combined land surface of fruit trees and vineyards, being the production system expected to grow the most (13.3%). Bioenergy crops are likely to occupy a small area of 0.21 million ha, i.e. only to 0.12% of the total ALA in 2030. Though abandoned agricultural land is not considered here as productive land, it must be highlighted that more than 5 million ha will be abandoned in EU in 2030.

The analysis of the ALA at MS level indicates that seven countries (France, Spain, Germany, Poland, Italy, Romania and United Kingdom) contribute the most to the EU total ALA in 2030, accounting for about 70% (128.6 million ha). Slight increases (<5%) are projected for France, Spain, Cyprus, Portugal, Greece, Malta, Croatia, and Latvia. In relative terms (agricultural land as share of total area), Denmark, Hungary and Ireland are the clear EU leaders, with more than 60% of their surface being occupied by agricultural land both in 2015 and 2030. Conversely, Sweden, Finland, Slovenia, Austria and Estonia are the group of countries with the least land devoted to food, feed and energy production in the EU.

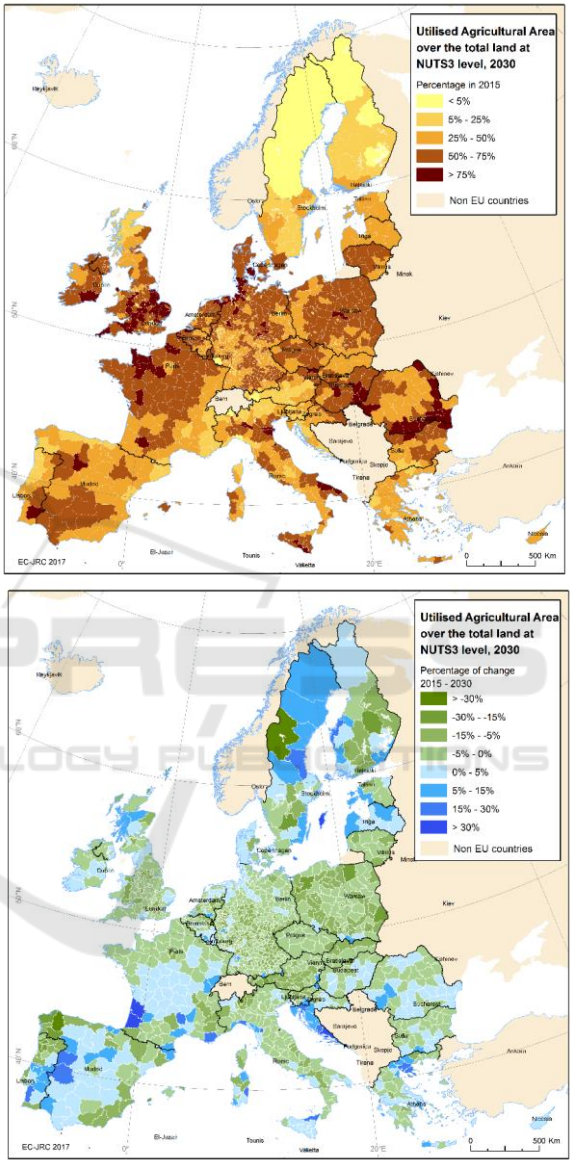

Figure 5: Share (top) and percentage of changes (botton) in agricultural land for the production of food, feed and energy land over the total land at NUTS3 level, 2015 -2030.

[8] Arable farming is the result of adding arable land and rice production in the same group.

[9] Livestock grazing system is the result of adding pastures, agro-forestry and natural grassland in the same group.

[10] Mixed-crop system is the result of adding annual crops associated with permanent crops, complex cultivation patterns.

[11] Permanent crops system is the result of adding vineyards, Fruit and olive trees in the same group.

Within some countries (e.g. Italy, France, Spain or Portugal) is possible to find NUTS3 regions ranging from shares less than 5% to greater than 75%, while other MSs are more homogeneous (e.g. Finland, the Netherlands, Denmark, Slovakia, Estonia or Latvia).A number of regions located in the southern and eastern part of Romania, north of France and Germany, southern parts of Hungary, The United Kingdom, Italy and Portugal have the highest shares, above 75% of the total land. Future trends projects that only a small number of NUTS3 regions of a few countries will continue expanding their agricultural lands. This is the case of central France and Spain, western part of Croatia, Greece, Romania, Latvia, Denmark, north of Finland and Sweden. Conversely, more than 75% of all NUTS3 regions in Europe will undergo a contraction of land for the production of food, feed and energy between 2015 and 2030.

3.5 Agricultural Land Abandonment

3.5.1 European Risk Map of Agricultural Land Abandonment

In 2030, almost 183 million ha of agricultural land are projected to be under various potential risk of land abandonment. Particularly, almost 75% (roughly 138 million ha) of all EU agricultural land is expected to be subjected to very low and low risk of abandonment, while about 14% (27 million ha) will be under a moderate risk. More than 11% (21 million ha) will be, however, exposed to high and very high risk, primarily in Romania, Estonia, Latvia, Poland, Cyprus, Spain, Portugal and France (Figure 6).

Table 2: Classification of the abandonment risk in 2030.

EU -ALA	V.L.R.	L.R.	M.R.	H.R.	V.H.R.
Million ha	48	91	27	21	0.7
Percentage	25.7	48	14.2	11	0.4

Note: V.L.R. refers to Very Low Risk; L.R. refers to Low Risk; M.R. refers to Moderate Risk; H.R. refers to High Risk; V.H.R. refers to Very High Risk

The biophysical component is the leading one in large parts of Austria, Poland, Greece, Spain, Estonia and Latvia, northern parts of Sweden, Finland, Italy, Ireland and the United Kingdom, as well as in southern parts of France and Bulgaria due to mountain ranges (the Apennines, Pyrenees, Alps, Dolomites, Carpathians, etc.) which provide unfavourable terrain and climate conditions. Abandonment risk due to climate limitations is mostly found in the Mediterranean countries where soils suffer from drought (Greece, Italy, Spain), but also in the UK and Scandinavia (due to acidic and waterlogged soils). In the inner part of Spain, the middle and northern areas of Sweden, Finland and Ireland, the northern and eastern parts of Romania, and partially in Estonia, Latvia and Lithuania, Hungary and Cyprus, the elevated agricultural abandonment risk is mainly associated with remoteness and low population density. Economic and structural farm factors are likely to be the primary cause for the increased agricultural abandonment risk in many regions of Spain; the north of France, Greece and Italy; the central and northern parts of Sweden and Finland.

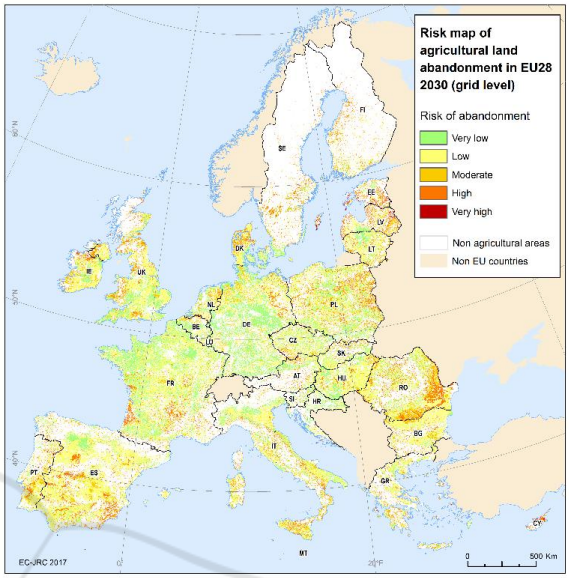

Figure 6. Map of the potential risk of agricultural land abandonment in 2030 at grid level (100-metres resolution) in the EU. The associated table reports the EU values per each risk category.

Altogether, those findings mean that although the potential risk of agricultural land abandonment is relatively modest at EU level, it may be quite severe in some EU MSs and in particular (as shown in Figure 5) in some of their regions, e.g. Southern and Eastern Romania, Southern and central Spain, South-western France, etc. The risk is projected only for areas where the current land use is agriculture, i.e. arable farming (including rice), livestock grazing, mixed crop-livestock and permanent crops.

3.5.2 Agricultural Land Abandonment Projections (2015 – 2030)

In the period 2015-2030 the total agricultural land abandonment in EU-28 is projected to reach roughly 5.6 million ha (about 373 thousand ha per year on average), which will account for approximately 3% of the total agricultural land (183 million ha) in 2030. Arable land is by far the dominant type of agricultural land in the EU and consequently, it will also account for the largest share of abandonment. More than 70% of EU total abandonment in 2030 will be arable land (4 million ha), followed by pastoral land with more than 20% (1.2 million ha) and permanent crops with

approximately 7% (400 thousand ha). Almost a quarter (1.38 million ha) of all agricultural abandonment in the EU will most likely occur in mountainous areas where arable land would be again the most affected agriculture system (974 thousand ha, i.e. 70% of all mountainous abandonment) due to natural handicaps and difficult mechanization, among other limitations.

In absolute and relative terms, Spain and Poland are likely to face both the greatest agricultural land abandonment (about 1/3 of all EU). France, the United Kingdom, Germany and Italy complement the list in the group of the largest affected countries in the EU, altogether responsible for more than 70% of all ALA losses. However, Germany and especially France, are expected to rank below the EU average forecast of 3%. Conversely, due to their relatively smaller total agricultural land, the Netherlands, Portugal, Finland, Greece and especially Slovakia (4.6% loss) are expected to be above the 3% EU average.

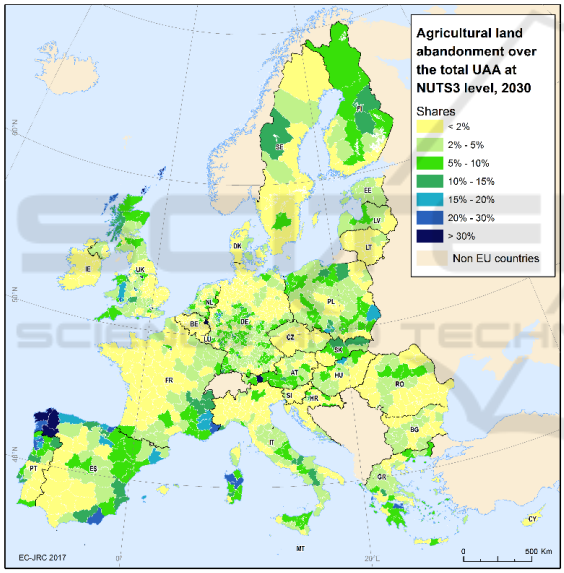

Figure 7: Share of the total agricultural land abandonment with regard to the total UAA at NUTS3 level in 2030.

Focusing on a regional perspective, figure 7 despicts the projected abandoned agricultural land as share of total ALA at NUTS 3. It confirms that Spain is expected to face the biggest challenges in the EU, especially in its North / Northwest, where the Lugo region will be affected the most, with almost 80 thousand ha of abandoned land. Other regions in Southern Europe, which are likely to face significant land abandonment, are located in Northern Portugal, Southeastern France, Sardinia in Italy, and Greece. In Central and Northern Europe, substantial agricultural land abandonment is projected for Northern Hungary, Southeastern Poland, where the largest absolute EU-wide loss of more than 85 thousand ha occurs in the Chelmsko-zamojski region, few more NUTS 3 in Western Germany, as well as in the central and far-North parts of the United Kingdom. It can be also highliheted some island regions in Western Austria and Southern Netherlands with more than 30% share of agricultural land abandonment, which trend is not likely to spread to the surrounding regions.

4 CONCLUSIONS

Over the last decades, considerable efforts have been made to better analyse the EU rural areas due to their socio-economic and environmental importance. This work attempts to contribute to the current and extend knowledge about EU rural regions by means of presenting a comprehensive analytical exercise on socio-economic and demographic future trends. For the purpose of this analysis, a set of indicators (rural population, employment and Gross Value Added in primary sector, agricultural land and agricultural land abandonment) are developed to further extend the understanding of the situation by 2015 up to 2030 in predominantly rural areas. The main tool that allow us to perform a comprehensive and integrated territorial assessment is the LUISA Modelling Platform (European Commissions – Joint Research Centre), and, in particular, its latest 2017 Territorial Reference Scenario.

The results indicates that throughout the simulation period (2015 – 2030) the EU total population is projected to increase by 2%, while the rural population is expected to rise by just 0.6% (2.8 million). However, this modest increase will not be uniform across the EU, with the largest expansion generally located in Eastern Europe (Romania, Hungary, Slovakia, Czech Republic and Poland) than in Western side.

Approximately, a quarter of all EU agricultural land is expected to be subjected to moderate, high or very high risk of abandonment in 2030. Across Europe, it can be found NUTS3 regions almost completely cover by a moderate or high risk, especially in Mediterranean regions and mountain areas, where a combination of remoteness, low population density and unfavourable biophysical conditions are observed.

With this situation, LUISA projects to reach more than 3% (5.6 million ha) of the total agricultural land in the EU. This is, however, a noticeable trend, considering that the decrease of EU agricultural land is estimated to continue decreasing (about 1.1% compared to 2015). Per production systems, arable land is projected to account for the largest share of total abandoned land, followed by pastures and permanent

crops. This is in line with the prevailing breakdown of agricultural land, where arable land is the largest group, too, while the permanent crops are the smallest one.

Regarding the EU economic performance in primary sector, represented by the EU share of employment and GVA, both confirms the continue decline of this sector. Romania, Bulgaria followed by Greece and Poland have the highest shares of employment and GVA (adding also Estonia) in primary sector while the lowest rates are found in Luxembourg, Germany, The United Kingdom and Belgium. Rural areas provides the largest number of employees (about 4.8 million) and contributes the most of the EU' GVA in primary sector.

This assessment can, therefore, offer valuable qualitative and quantitative information, as well as provide useful insights about potential outcomes for rural areas across the EU. However, the work can even go beyond by addressing the topic from a broader point of view (such as the synergies between the rural-urban relationships or diversification of economic activities) as well as integrating new rural-related indicators (accessibility to transport and services, forest and natural areas, other economic sectors, etc.).

REFERENCES

Benayas J.M., Martins A, Nicolau JM, Schulz JJ., 2007 *Abandonment of agricultural land: an overview of drivers and consequences*. CAB Reviews: Perspectives in Agriculture, Veterinary Science, Nutrition and Natural Resources 2 (57).

Britz and Witzke, 2012. *CAPRI Manual. Version: 2012*.

Dijkstra, L. and Poelman, H., 2014. *A harmonised definition of cities and rural areas: the new degree of urbanisation*. European Commission. Regional Policy Working Papers.

Eliasson, A., et al., 2010. *Common criteria for the redefinition of intermediate less favoured areas in the European Union*. Environmental science and policy 13: 766-777.

European Union, 2013. *Regulation (EU) no 1305/2013 of the European Parliament and of the Council of 17 December 2013 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) and repelling Council Regulation (EC) No 1698/2005*.

European Union, 2014. *Rural development in the EU. Statistical and economic information. Report 2013.* Directorate-General for Agriculture and Rural development.

Eurostat -European Commission, 2017. *Statistics on rural areas in the EU. Statistics explained*. Data access: February 2017.

Jacobs-Crisioni, C., Diogo, V., Perpiña Castillo, C., Baranzelli, C., Batista e Silva, F., Rosina, K., Kavalov, B., Lavalle, C., 2017. *The LUISA Territorial Reference Scenario: A technical description*. Publications Office of the European Union, Luxembourg. doi:10.2760 /902121.

Hart, K., Allen, B., Lindner, M., Keenleyside, C., Burgess, P., Eggers, J., Buckwell, A., 2013. *Land as an Environmental Resource*. Report prepared for DG Environment, Contract No ENV.B.1/ETU/2011/0029, Institute for European Environmental Policy, London.

Lasanta, T., et al., 2016. *Space-time process and drivers of land abandonment in Europe*. Catena 149: 810–823.

MacDonald, D., et al., 2000. Agricultural abandonment in mountain areas of Europeç Environmental consequences end policy response. Journal of Environmental Management 59: 47-69.

Perpiña Castillo, C., Lavalle, C., Baranzelli, C., Mubareka, S., 2015. *Modelling the spatial allocation of second-generation feedstock (lignocellulosic crops) in Europe*. International Journal of Geographical Information Science, 29:10, 1807-1825, DOI: 10.1080/1365 8816.2015.1051486

Pointereau, P., et al., 2008. *Analysis of farmland abandonment and the extent and location of agricultural areas that are actually abandoned or are in risk to be abandoned*. Joint Research Centre, Institute for Environment and Sustainability.

Terres, J. M., et al., 2014. *Scientific contribution on combining biophysical criteria underpinning the delineation of agricultural areas affected by specific constraints*. Joint Research Centre, Institute for Environment and Sustainability. JRC92686.

Van der Zanden, E.H., et al., 2017. *Trade-offs of European agricultural abandonment*. Land Use policy 62: 290-301.