Suitability model for Land Consolidation projects:

a case study in Galicia, Spain

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Key words: land consolidation, rural planning, ex–post evaluation.

SUMMARY

Land consolidation actions in Galicia, northwest of Spain, started in 1952 and currently cover more than 1130 zones. This dynamism in the consolidation process is mainly due to the problem posed by land fragmentation and smallholdings. At present, land consolidation in Galicia affects 1/5 of its total area and more than 200,000 landowners. Land consolidation is the most widely used tool in rural development in the last fifty years.

As regards funding sources, 75% of the budget comes from the EU structural funds. Two considerations can be made based on this assertion; first, community budgets must be managed properly; second, this type of funds will gradually disappear from 2006. Therefore, an efficient use of these budgets requires knowing which are the priority zones for consolidation. The methodological formulation presented in this paper derives from this relevant justification.

This paper describes an efficient methodology based on GIS and multivariate statistics to know the suitable areas for land consolidation projects. In addition, this objective suitability model is tested in zones that are currently paralysed, the economic resources of which could have been redirected to other zones or activities by applying the guidelines of the model.

RESUMEN
Las actuaciones de concentración parcelaria en Galicia, Noroeste de España, dan comienzo en el año 1952 y en la actualidad superan ya las 1130 zonas, este dinamismo concentrador responde fundamentalmente a un problema de fragmentación de la propiedad y de minifundio. Tal es así que, hoy en día, la concentración parcelaria en Galicia afecta a 1/5 de su superficie y a mas de 200,000 propietarios, de tal magnitud en el medio rural gallego que ya constituye la herramienta de desarrollo rural mas aplicada en los últimos cincuenta años.

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Por lo que respecta a la fuente de financiación, el 75% del presupueto lo obtiene de fondos estructurales de la Unión Europea, de lo que se desprenden dos reflexiones, primeiro debemos administrar adecuadamente los presupuestos de la comunidad, segundo este tipo de fondos tienden a desaparecer a partir del año 2006. Por lo tanto, es preciso emplegar con mas eficiencia que nunca estos presupuestos, así debemos en primer lugar saber cuales son las zonas prioritarias a concentrar. Motivo de gran relevancia y que da lugar a la formulación metodológica que se presenta en esta contribución.

Así, este artículo describe una metodología eficiente basada en SIG y estadística multivariante para conocer las áreas aptas para acoger proyectos de concentración parcelaria. Además de testar este modelo objetivo de aptitud con las zonas que actualmente están paradas, que de haber seguido los dictámenes del modelo que se presenta hubiesen podido reconducir sus recursos económicos, bien a otras zonas, bien a otras actividades.

1. INTRODUCTION

We must define the characteristics of the 'Galician territorial model' before dealing with land consolidation implementation in the region.

The main characteristics of the Galician territorial model that are related to land consolidation are mentioned below:

As a general framework for the situation, the Sixth Periodic Report on the social and economic situation and development of the regions of the European Union includes Galicia in the group of the least developed regions within Objective 1 regions (European Commission, 1999).

Galicia has a population of about 2,725,000 people (Eurostat, 1997), with a population density of 93 hab/km^2, distributed among 3793 parishes (90% of which had a population less than 1000 people in 1999).

Population density in this region is not homogeneous. More than one third of the Galician area shows a population density per parish lower than 20 persons/km^2. Population desertification is concentrated in the eastern part of Galicia.

This trend can be summarized by mentioning that 64% of the population is concentrated in 10% of the territory. About 90% of the Galician territory lost population between 1960 and 1991, with different repercussions (INE, 1993, 2001, 2002).

This traditional decentralization results in a population density of 1.1 population entities/km^2 (half the density of the Spanish State). If we add a complicated topography and our situation of 'periphery of the periphery', the result is a considerable shortage of infrastructure and equipment.

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According to the Spanish Centre for Cadastral Management and Tax Cooperation (CCGCT, 1997), about 90% of the land in the autonomous community of Galicia can be considered as rural or rustic (defined as non-urban land), with different levels of 'rurality'.

The occupied population engaged in agricultural activities accounts for 29.1% (Eurostat, 1997). Only 10 out of 166 regions in the European Union reach 30% of agricultural population.

The area devoted to forestry accounts for 61.3% of the total area, and the area devoted to agriculture accounts for 29.1% of the total area in Galicia.

Holdings with an acreage lower than 20 ha amount 134,000, and the holdings with an area between 20-50 ha (Eurostat, 1997) amount approximately 5000. The professional qualification observed in most of these holdings is low.

Due to the aim of consolidation (consolidation is understood as the union of things or plots that are scattered, or rather, of the property rights that fall on them), getting to know property structure is essential. Information sources are scarce and not very reliable, and must be updated. The situation is particularly serious in Galicia, where property is highly fragmented and most of the land is private. Nevertheless, cadastral updates (promoted and cofinanced by European institutions) gradually improve the levels of information about the territory. In the case of Galicia, the mapping scales required render the complicated process of land inventory more difficult.

As regards land structure and property structure in the territorial model of the autonomous community of Galicia, we must consider the following data, obtained from rural cadastre (Crecente, R. et al. 1998, 2002):

a. Plot density or number of plots per hectare:
The Galician land structure is characterized by the occurrence of many smallholdings that form a complex landscape in the shape of a mosaic. This landscape is the result of a historical process that includes social, economic and cultural factors. As compared to the rest of the autonomous communities in Spain, Galicia stands out with a value of 4.7 plots per hectare.

b. Plots per owner:
Property structure shows a strong correlation with the situation described in the previous section. When plots are small, farmers need more plots to meet production and consume demands.

At the national level, we observe three different situations. The north-western area shows the highest number of plots per owner, which ranges 6 to 8. Galicia falls within this area, but slightly far from the values of its neighbouring communities.

c. Area per owner:
This index summarizes variables a. and b. because it combines the size of the plots and the number of plots per owner. In addition, it provides information about land yield, land uses, and mean size of the holding. The situations represented by this index are more varied due to the different combinations of the mentioned variables.

The low values observed in Galicia, 1.7 ha per owner, contrast considerably with the values for the rest of the communities. These values suggest that—in addition to land fragmentation—there is a high level of land dispersion, which involves a large number of agricultural owners who may own a holding or not. Moreover, the size of the holding is not appropriate for a rational and economically feasible exploitation.

Production structure:
The location of the population occupied in the primary sector is an indicator of the weight that this economic activity has on local economy. The distribution of this population enables us to know its relation to property structure and plot structure.

There are large homogeneous areas with a high percentage of population occupied in the agricultural sector, more than 80% (INE, 1991). These areas are mainly located in the east, west and south of the province of Lugo, and in the south of the province of Ourense. We must take into consideration that the population settled in these areas and the economic weight of these spaces is very low (see Figure 1).
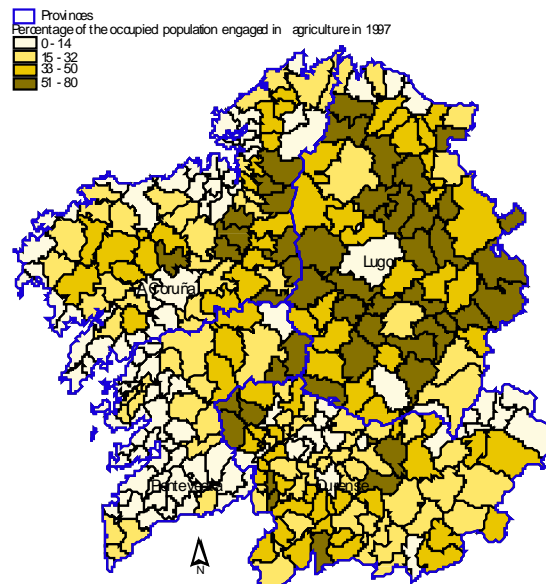

Figure 1. Percentage of occupied population engaged in agriculture

In order to know the distribution and the location of the areas with more demographic and economic weight, we established the mentioned value at 60% of the occupied population. Most of the population in almost the whole province of Lugo, except for some municipality in the north and in the south, is occupied in agriculture. The same situation occurs in the west and centre of the province of Ourense, which is less consolidated, and in the east of the province of A Coruña.
Considering that the utilised agricultural area per municipal area shows the level of land used for agriculture and farming, we can state that not many zones exceed 50% of the area. The

provinces of A Coruña and Lugo show the highest percentages of UAA (Utilised Agricultural Area).

The distribution of forestry uses is complementary to the distribution of agricultural and farming uses. We must underline that there are zones with a large forest cover that have gradually increased in the last few years, particularly in coastal areas.

The mentioned characteristics of the Galician territorial model, represented at municipal level and integrated into a database of 315 records—as many as municipalities—enable us to analyze the territory by location in spite of heterogeneity. Heterogeneity in Galicia is not a concept that can be applied exclusively to plants or animals but also to the socioeconomic field. The diversity of local resources and economic activities leads us to conclude that different initial situations or different diagnoses require different treatments or prophylaxes. This means that land consolidation is not and must not be the only tool to solve the problems of the rural space (van Huylenbroeck, G. et al. 1996). However, land consolidation is currently the tool most widely used for rural development. It must therefore be studied so that the appropriate knowledge of the past (evaluation) allows consolidation to be managed in an efficient and sustainable manner in the future (planning).

Land consolidation (Miranda, D. 2002):
The following table shows the results obtained for consolidation projects until 2001.

STAGE	No OF ZONES	AREA (ha)
Paralysed	108	50,203
In process	240	600,205
Terminated	781	359,546

Table 1. Number of land consolidation zones according to their development stage.

Table 2 shows how the average values per zone obtained for the technical parameters of consolidation vary before and after consolidation.

Land Consolidation Parameters	Before LC	After LC
Plots/owner	11.26	1.96
Mean area/plot (ha)	0.16	0.76
Nº of plots/ha	11.0	2.13
Nº plots/LC zone	4435	736

Table 2. Evolution of technical parameters of consolidation per consolidation zone.

The results presented suggest the impact that land consolidation has in Galicia. This impact—together with the interpretation of a territorial model in which most of the surface area is rural and with a fragmented property structure—justifies the need of evaluation and planning studies that are objective and technical, and that guarantee sustainable rural development in this periphery region.

2. OBJECTIVES

2.1 Obtaining a suitability model for LC in Galicia

The solution proposed must be applicable to other territories and must apply the results of LC evaluation in order to obtain a suitability model that— taking into consideration the Galician territorial model—enables us to plan actions in accordance with previous experiences.

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The description of the evaluation phase exceeds the objectives of our contribution to this Symposium. However, due to its relevance in the development of the model presented, we must remember that we conducted a multicriteria evaluation (social, economic and environmental) based on the questions-criteria and indicators established in the MEANS programme of the European Commission (1999a). This evaluation meets certain requirements and standards established by the EU and included in the guide 'Evaluating socio-economic programs' (Miranda, D. 2002).

2.2 Prioritizing suitable zones for LC

To achieve such an ambitious objective as the first one, which attempts to use technical and objective criteria to select new consolidation zones, a further phase is required. We must consider that the resources available for land consolidation become increasingly scarce, and are insufficient to meet the requirements of all the zones that can be consolidated. This situation leads us to the second objective of this model: prioritizing the suitable zones based on a detailed knowledge of the territorial model, on the results of the ex-post evaluation of the almost 1000 terminated LC projects, and on the zones currently in process where investments have already been undertaken.

3. MATERIALS AND METHODS

3.1 Selection of zones for consolidation

To achieve this aim, in search of a suitability model for land consolidation projects, we follow a process of exclusion based on the following premises:

Reasons for exclusion:

- 'Non-rural municipalities'.

Because the model used is a tool for rural development, we do not consider non-rural municipalities, which are the municipalities with a population density of more than 100 p/km^2 (Miranda, D. 2002).

- Natural spaces proposed by Natura 2000 Network.

Sites of Community Interest (SCIs), which cover 369,057 ha, 340,759 of which are land surface (12% of the total area of Galicia). SCIs were georeferenced and excluded as potential zones to develop land consolidation projects.

- Parishes with more than 45% of the area devoted to communal forests.

Based on the information about the area devoted to communal forests in each parish, the parishes with more than 45% of the area devoted to this use were excluded.

- Areas devoted to great infrastructures, masses of water, rocky areas or other areas that are unproductive form the perspective of agriculture, farming, or forestry.

The mentioned areas are obtained from the data contained in the III Forest Map of Spain (MFE III) (Ministerio de Medio Ambiente, 2001).

- Forests covered by native forest species, clearly for protection purposes according to the MFE III (Ministerio de Medio Ambiente, 2001).

- Area of public ownership or useful for the community (Ibid).

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◼ Demographically depressed zones, with sharp decreases in population density—much higher than the average in Galicia—and population densities lower than the average in Galicia. Mountain areas with steep mean slopes that limit agricultural production and correspond to the 82 municipalities included in class 3 and class 4 of Table 3.

Class	Temperature (ºC)	Radiation (cal/cm²/day)	Rainfall (mm)	Slope (%)	Elevation (m)	POP_DENS91 (p/km²)
1	11.27	305.38	1379.49	6.58	100.00	31.480
2	11.65	314.50	1570.00	7.75	60.10	55.930
3	8.69	393.44	1425.31	13.44	740.50	11.691
4	11.47	374.85	1276.41	8.20	270.62	35.878
Galicia	11.16	339.69	1366.93	7.91	210.76	34.050

Table 3. Classification of rural municipalities based on cluster analysis according to physiographic and demographic parameters

3.2 Prioritization of zones for consolidation

◼ Percentage of area that can be consolidated

Taking into consideration the reductions applied, the area of the parish that can be consolidated is sometimes smaller than its total area. Different classes of parishes can be established according to the percentage of area that can be consolidated. Different values are assigned to each class, as shown in the following table.

Percentage of area for consolidation per parish	Class
0 - 25%	1
25 - 50%	2
50 - 75%	3
75 – 90%	4
90 – 100%	5

Table 4. Classification of parishes in terms of the percentage of area for consolidation

◼ Zones with a physiography favourable to land consolidation

According to the results of the cluster analysis conducted, priority municipalities would be class 1 municipalities, followed by class 2 municipalities (see Table 3)

◼ Zones with a favourable climate (in terms of temperature and rainfall)

As regards climate characteristics, and based on cluster analysis, class 2 municipalities were selected first because they show a moderate climate, which is more favourable to agriculture and farming. These municipalities were followed by class 1 municipalities.

◼ Zones with a favourable socioeconomic activity.

These zones were obtained from a cluster analysis conducted by using socioeconomic variables, as shown in class 2 and class 3 municipalities represented in the following table.

Socioeconomic cluster of rural municipalities									
GROUP	Mean values								
	Ind_act	Ind_ind	Ind_tour	Banks	Ind_com	Cad_Val_ha	Evol_dai_c	C_dairy89_p	Machines	Telephones
0	6.08	71.57	1.87	4.08	6.26	51.80	207.98	51.79		1293.71
1	35.00	421.00	18.00	15.00	43.00	70.00	-3047.00	85.80	5389.01	7348.00
2	5.59	77.18	1.81	3.63	7.09	71.22	777.72	70.20	1334.32	1260.05
3	11.71	113.09	3.23	6.03	10.74	64.22	327.11	66.16	1395.23	1961.11
4	3.05	42.52	1.03	3.04	3.02	39.40	-5.15	39.10	908.96	867.27
r	0.26	0.38	-0.26	-0.20	ns	-0.50	-0.19	-0.50	-0.30	0.32
R²	6.91	14.51	6.86	4.20	ns	25.59	3.96	25.40	9.00	10.69

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Table 5. Characterization of the classes of rural municipalities obtained from a cluster analysis of the variables shown in the table. Ind_act, index of economic activity; Ind_ind, index of industry; Ind_tour, index of tourism; Banks, number of banks; Ind_com, index of commerce; Cad_Val_ha, cadastral value; Evol_dai_c, evolution of dairy cows; C_dairy89_p, percentage of dairy cows in 1989; Machines, number of agricultural machinery; Telephones, number of telephones (La Caixa, 2001). Coefficients 'r' and 'R²' correspond to the coefficients of correlation (per one) and to the level of adjustment (%) of the groups with the variables.

◪ Appropriate technical parameters of land consolidation. This parameter is valid only for parishes with terminated LC zones, which correspond to classes 2 and 5 of the following cluster analysis.

Homogeneous area	Mean values of LC technical parameters			
	% AREA LC	PLOTS before LC (No)	PLOTS after LC (No)	OWNERS (No)
1	37.01	31,978	5.202	2818
2	62.00	57,004	6.906	5044
3	23.01	14,436	254	1309
4	2.01	2,294	479	244
5	47.01	141,990	25.044	12,486

Table 6. Mean values of LC technical parameters for the homogeneous areas defined by cluster analysis

◪ The degree of land use fragmentation in terms of the potential use of land for agriculture or forestry. If the suitable area for consolidation of a parish is distributed in the shape of a mosaic and, therefore, shows a high degree of fragmentation, it will be punished in the prioritization process, as shown by scores in Table 7.

Area that can be consolidated	No of tiles	Score in terms of fragmentation
> 70%	> 6	1
> 50%	>10	1.5
> 50%	> 6	2
> 30%	>10	2.5
> 15%	>10	3

Table 7. Punishment of priority level in terms of fragmentation

◪ After having obtained the priority level for each parish that can be consolidated, a new determining variable is added: the percentage of land consolidation area that is in process (see Table 8). The total score for each parish is grouped into 5 classes so that 5 priority levels are obtained: Very high, High, Medium, Low, and Very Low.

Percentage of area in process	Number of order in terms of % of LC area in process
1-15	1
15-30	2
30-50	3
50-70	4
70-100	5

Table 8. Priority in terms of the percentage of area in process of consolidation

4. Results and discussion

a) Zones that must not be encouraged or zones with a very low priority to receive land consolidation zones (68% of the total area):

◪ 135 'coastal non-rural' municipalities that account for an area of 851,193.04 ha, 28.79% of the total surface area in Galicia (see Figure 2)
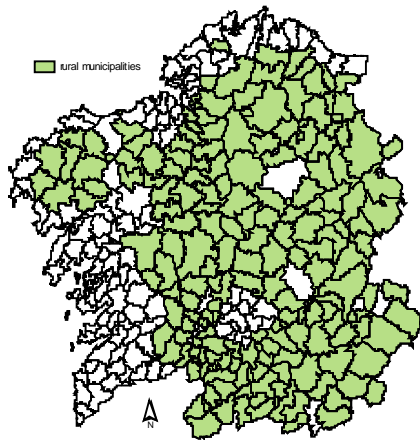
Figure 2. Distribution of rural municipalities in Galicia according to the methodology used by Miranda, D. (2002)
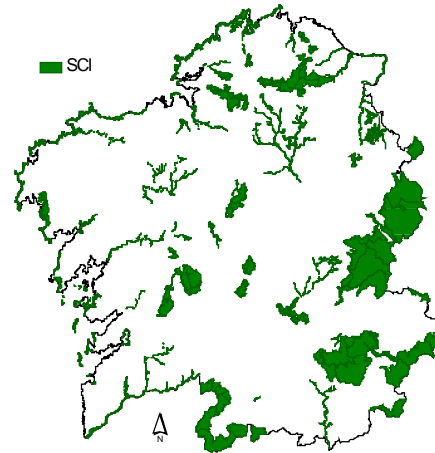
Figure 3. Sites of Community Interest (SCIs) according to Natura 2000 Network

▪ 57 natural spaces proposed by Natura 2000 Network, which cover an area of 340,759.27 ha and account for 12.00% of Galician total area (see Figure 3).

▪ 560 parishes with more than 45% of their surface area covered by communal forests, which represent 609,227.08 ha, 20,6% of the area.

▪ Areas devoted to great infrastructures, masses of water, rocky areas, and other zones that are unproductive from the perspective of agriculture, farming, or forestry. These areas cover 87,673.98 ha and account for 3% of the Galician geography.

▪ Forests covered by native forest species, clearly for protection purposes according to the MFE III, account for 8.44% of the total area, 249,452.83 ha.

▪ The area of public ownership covers 575,091.43 ha, which accounts for 19.45% of the total.

▪ 80 municipalities that cannot respond to land consolidation projects due to their social and physiographic characteristics. These municipalities, which correspond to class 3 and class 4 municipalities of the cluster represented in Figure 1, cover 842,054.8 ha and account for 28.56% of the Galician area.

As regards the total area selected, we must take into consideration that the areas described above may overlap, most frequently to the southeast, where communal forests are usually planted with native hardwoods. These areas are located in municipalities that are unfavourable from the social and environmental perspective. Figure 4 shows the total area excluded.
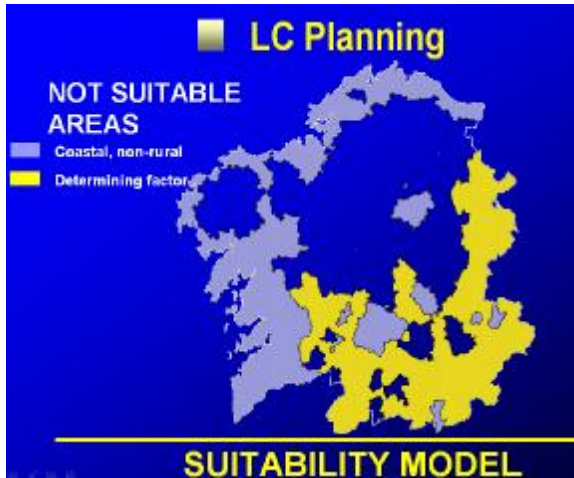
Figure 4. Area excluded for the development of land consolidation projects
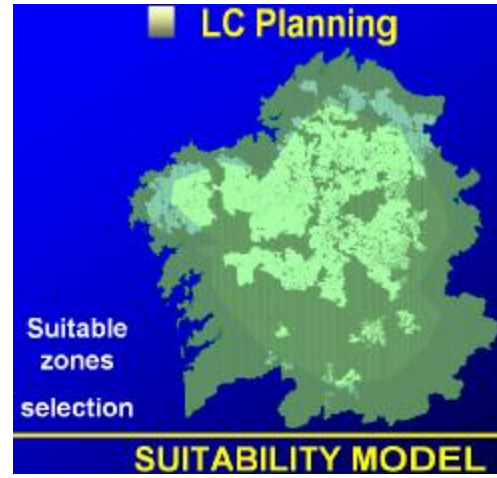

Figure 5. Area suitable to develop land consolidation projects in Galicia

If the reductions applied due to stands of native hardwoods, infrastructure, water masses, and SCIs are added to Figure 4, we obtain a first estimation of the area suitable for consolidation, represented in Figure 5 and marked in light green.

   b)   Prioritization of parishes that must be consolidated

A classification of parishes is established in terms of their response to land consolidation works and according to their adaptation to the following aspects:

■ According to the percentage of area that can be consolidated

Score	Percentage of area that can be consolidated per parish	No of parishes	Area (ha)
1	0 - 25%	15	2320.03
2	25 - 50%	69	23,603.90
3	50 - 75%	228	123,294.38
4	75 – 90%	352	235,286.19
5	90 - 100%	883	580,361.38

Table 9. Classification of parishes in terms of the percentage of area that can be consolidated

■ Assessment of the zones for consolidation in terms of the socioeconomic and environmental characteristics of the municipalities to which they belong

Score	No of municipalities	Area (ha)
1	52	730,476.91
2	38	254,679.93
3	6	159,755.06

Table 10. Classification of municipalities in terms of the characteristics of the socioeconomic and environmental factors studied

■ Land consolidation technical parameters. Municipalities are classified according to LC technical parameters and are assigned the corresponding score.

Score	No of municipalities	Area (ha)
1	63	872,228.00
2	27	238,520.00
3	30	278,986.00
4	16	192,824.00
5	2	50,887.00

Table 11. Classification of municipalities according to LC technical parameters

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■ Joint action of socioeconomic, physiographic and land consolidation characteristics. We used the division of municipalities into zones according to LC technical parameters and to the rest of socioeconomic and environmental variables.

Score	No of municipalities	Area (ha)
1	46	498,488.20
2	20	342,287.80
3	20	265,788.10
4	1	28,054.66

Table 12. Number of municipalities in terms of the different priority classes

Once the mentioned information is superimposed, we obtain the scores for the different parishes in which LC projects can be developed. These scores enable us to establish priorities among them (see Table 13).

If we know the rural area that can undertake land redistribution processes and the different classes of parishes according to their capacity of response to the process in terms of the improvement of agricultural and social parameters, we can obtain the territorial demarcation, based on different priority levels. In addition, we can estimate the potential area affected.

PRIORITY	No PARISHES	AREA (ha)	PERCENTAGE
High	222	155,499.10	5.27
Medium	773	580,671.36	19.69
Low	552	411,879.33	13.97
No priority	2246	1,799,617.21	61.05

Table 13. Prioritization of parishes that can undertake LC processes without considering the degree of fragmentation

● DEGREE OF FRAGMENTATION

Fragmentation is an obstacle to achieve ideal efficiency levels in consolidated areas. However, this effect is mitigated by land use planning, which is implicit in LC. However, the following table shows a correction of the mentioned results after the decrease in priority according to the degree of fragmentation in the parish.

PRIORITY	No PARISHES	PARISH AREA	LC AREA	% NON LC AREA	No OF TILES MEAN VALUE
HIGH	221	153,371.2873	149,370.4906	2.59	4.04
MEDIUM	674	486,081.5801	443,417.8043	7.87	5.90
LOW	443	330,043.5725	266,448.8614	16.99	7.95
VERY LOW	156	135,535.0326	91,713.3356	32.57	15.23
NO PRIORITY (a)	54	43,565.6368	14,283.4292	66.04	13.07
NO PRIORITY (b)	2246	1,807,108.110	-	-	-

Table 14. Prioritization of parishes that can undertake LC projects considering the degree of fragmentation

The parishes included in the 'No Priority (a)' class are parishes that were previously included as capable of undertaking LC projects but that have been dismissed because they show a high degree of fragmentation of the land available for concentration.

● PRIORITIZATION OF PARISHES INCLUDING ZONES IN PROCESS

The eventual groups depend on the occurrence or not of LC zones in process in the parishes that were classified as capable of undertaking LC projects. Figure 6 shows the eventual groups:

PRIORITY	No PARISHES	PARISH AREA (ha)	LC AREA (ha)
VERY HIGH	107	83,437.31	77,200.65
HIGH	189	132,785.69	129,444.02

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PRIORITY	No PARISHES	PARISH AREA (ha)	LC AREA (ha)
MEDIUM	606	430,923.86	391,128.29
Subtotal	**902**	**647,146.86**	**597,772.96**
LOW	426	303,039.51	247,191.31
VERY LOW	153	133,651.06	90,337.18
Subtotal	579	133,651.06	90,337.18-
NO PRIORITY	2312	1,863,829.57	

Table 15. Prioritization of parishes that can undertake LC projects considering LC zones in process

As shown in Table 15, parishes with medium, high or very high consolidation priority (according to Proposal 2), cover 597 772.96 ha that can be consolidated (see Figure 6). If we compare this area with the consolidation zones terminated until November 2000, we can observe a large number of terminated LC zones that do not belong to the group of parishes with the highest priority. This finding becomes more marked in the surroundings of Ferrol and Santiago de Compostela. We must also remember that the suitability model presented is very flexible, but it is valid for the present moment. Therefore, some of the zones that were terminated 20-30 years ago could show favourable socioeconomic and environmental circumstances.
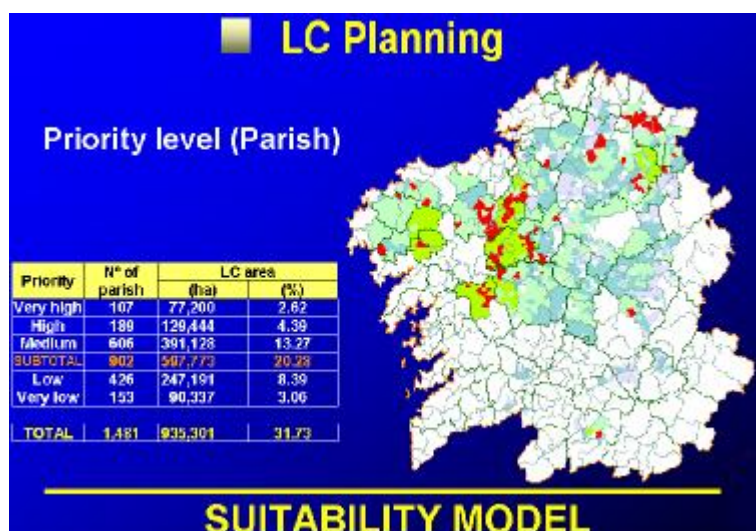

Figure 6. Parishes with medium-high consolidation priority

Conversely, if we compare the results for the parishes with the highest priority to the LC zones that are in process, we can redirect the actions in the zones in which the model suggests that consolidation priority is not adequate. In that case, we are dealing with a mid-term LC evaluation, in which the results of the evaluation feed planning and establish the possibility of redirecting this activity towards another activity that ensures a better future projection.

Finally, the performance of the suitability model established verifies once more the need and the relevance of conducting a previous, objective and scientific planning to avoid the high economic and opportunity cost of paralysed LC zones. Figure 7 shows that these zones are not included in the parishes defined by the model as priority parishes.
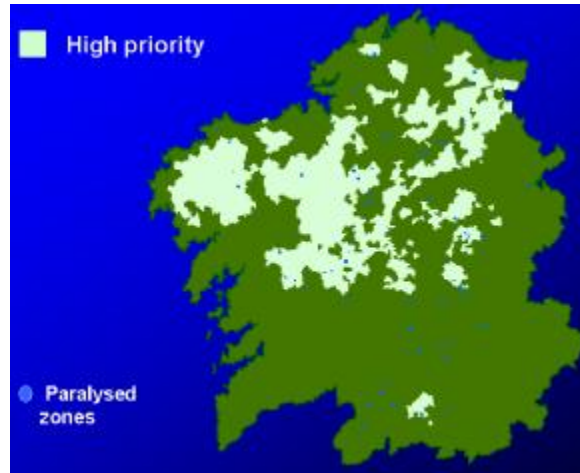
Figure 7. Comparison of high priority parishes and LC zones that are paralysed

5. Conclusions

A methodology capable of defining a suitability model for land consolidation is established and validated. Land consolidation is necessary in an eminently rural region. This model can be applied to an action that affects 1/5 of the territory and more than 200,000 owners but lacks adequate evaluation and planning.

An appropriate planning of land uses, prior to the development of any plan for property redistribution, is required in rural Galicia and allows us to dismiss the zones that cannot be consolidated within the unit of work, which is the parish.

An analysis by province reveals that the characteristics of land plots in Lugo show the most favourable initial situation due to larger dimensions of plots, 0.30 ha/plot. These dimensions are twice the dimensions of the next province (A Coruña). Moreover, the province of Lugo shows a significantly higher mean area per owner, which implies the best results after redistribution in terms of mean area per plot and in terms of number of owners per unit area. In addition, the rest of the socioeconomic and environmental indicators, and the agricultural and forestry characteristics of the province—excluding mountain areas—suggest that a wide area of this province is suitable for developing land redistribution projects in an efficient manner.

A total of 32% of the Galician territory, which accounts for 44.82% of the area defined as rural, is established as suitable for developing land redistribution processes. By considering that some areas have no priority, particularly non-rural areas and areas with socioeconomic and environmental characteristics that make consolidation not advisable, we ensure a decision-making process that is coherent with land use. Moreover, we ensure an appropriate investment of the structural funds allocated to land consolidation with the aim of encouraging actions in agriculture and forestry.

The area that could be consolidated was classified by applying a model of multicriteria evaluation and characterization, based on the use of multivariate analysis, and by implementing a Geographic Information System. This division into zones represents the different levels of capacity of reception and response of Galician agriculture to land consolidation processes according to the strengths and weaknesses of each zone. Four classes of parishes can be defined according to their priority to receive consolidation projects. Considering socioeconomic and environmental parameters, and degree of fragmentation, high

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priority parishes account for 5.20%, and medium priority parishes account for 16.49%. From these data, we can conclude that more than 20% of the Galician rural area must be consolidated with high priority. However, if we must prioritize consolidation works in a near future, we must take into consideration the distribution of zones in process with respect to priority areas. Thus, 107 parishes with an area of 83,437.31 ha show the highest priority, followed by 189 parishes with high priority, which cover an area of 132,785.69 ha. These results make us think of the need of taking advantage of the possibility of encouraging agriculture and silviculture where possible and where a positive response is obtained.

▣ Our proposal for prioritizing the parishes that can be consolidated is objective information that could be used in the decision-making process by the administration responsible for rural planning. This proposal is even more useful for any institution responsible for rural development if we consider that it is based on a system of indicators that can be easily obtained and quickly updated. These indicators compose the model for the prioritization of consolidation zones. This model is characterized by a low cost and a high flexibility.

▣ The method established to select and prioritize zones for consolidation could imply a more efficient and effective use of the budgetary resources available for land consolidation projects. These resources will probably decrease after the European structural funds disappear by 2006. The prioritization of new zones for consolidation should follow this order: it should be prioritary to terminate the consolidation zones in high or medium priority areas, then the consolidation of parishes with no projects in process but with a high or medium priority should be undertaken. Then, the parishes included in the rest of the priorities can be consolidated if the budgetary resources allow for it.

▣ According to this prioritization, the classification of parishes was improved in terms of their priority to be consolidated. In this classification, we must highlight the incorporation of a new class of Very High priority parishes, which consists of 107 parishes; a High priority class, with 189 parishes; and a Medium priority class, which includes 606 parishes. The whole of the mentioned parishes cover a total area of 647,146.86 ha, 597,772.96 ha of which could develop land consolidation projects. This area, which is suitable for land consolidation and is a priority area, accounts for more than 92% of the selected parishes, which suggests the great compactness and representation that these zones could reach within each parish. The desired effects would therefore improve. Moreover, these results imply that there are rural areas that actually demand this activity and for which a good performance of the method can be predicted, based on the evaluation of previous experiences.

▣ In short, this study enables us to optimize land consolidation as a rural planning tool, basing the decisions on technical criteria that emanate from the knowledge of territory, from the needs of population, and from the results of its evaluation.

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