# MODEL FOR AGRICULTURAL PRODUCTION PLANNING

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## Abstract

In this paper is described one of our most successful projects, which was the establishment of a Model for Agricultural Production Planning in 21 rural areas (“comarcas”) of Galicia. The first part of our research consisted in obtaining field information about these areas. Fieldwork was carried out between 2002 and 2004, and consisted of 4.348 surveys made to farmers from these 21 “comarcas” of Galicia, more than 350 interviews to experts, and of course bibliographic, statistical and cartographic research. The second part consisted in the generation of a Model for Agricultural Production Planning (including agricultural and livestock farming, and forestry), which could be used for decision-making assessment in the application of policies, programs and plans at this “comarca” scale. It was created to be an instrument to plan agricultural uses of land, to rationalize and optimize the sustainable exploitation of rural soils, and to achieve higher levels of rural development The core of this model was the establishment of 44 indicators of sustainability (social, environmental and economical indicators), and the integration of them in a computer application.

***Keywords:*** *Agricultural Production Planning, indicators of sustainability, indicators of rural development.*

## 1. Introduction

By the end of 2001, the University of Santiago de Compostela, under a form of joint venture (Unión Temporal de Empresas or UTE) with EIDO GALICIA, S.L. Consultants, successfully tendered for a contract to provide technical assistance on the project ‘Development of Agricultural Production Planning Surveys in 22 comarcas of the Autonomous Community of Galicia, 2001-2002’, funded by the Galician Administration. (UTE EIDO-USC, 2004)

The aim of our Agricultural Production Planning Studies was to generate an objective Model of Agricultural Production Planning (comprising agriculture, farming and forestry) to support and dynamize production sectors, which could be used as a decision-making tool to implement policies, schemes and plans aimed at rural comarcas (Andersen et al, 2007)The model was used as an instrument to allocate agricultural land uses, to rationalize and optimize the sustainable use of rural land and to promote rural development (Álvarez et al., 2008; Riveiro et al., 2008).

The Objective Agricultural Planning Model for Galician Comarcas synthesizes the information pertaining to the distinctive features of the current situation and of the parameters that govern the evolution of the situation based on the analysis of a number of elements that characterize the agricultural subsystem of an area (natural environment, socioeconomic conditions, infrastructure and legal framework). By using this model, the potential situation of agricultural production in the area considered can be delineated. (De Wit & Van Keulen, 1988; Riveiro et al. 2005).

Agricultural Production Planning was considered as a process for the spatial organization of agricultural and forestry products that allocated specific land uses to priority land areas at the comarca level. The aim of such a spatial organization process was to achieve sustainable development by optimizing agricultural production systems according to structural and socioeconomic conditions and by considering environmental concerns (Riveiro et al., 2005).

The Comarcas included in the Agricultural Production Planning research were:

- Province of A Coruña: Arzúa, Bergantiños, Noia, Ordes, Terra de Melide and Ortegal.
- Province of Lugo: A Fonsagrada, Os Ancares, Terra Chá, A Ulloa, A Mariña Occidental and Terra de Lemos.
- Province of Pontevedra: O Baixo Miño, Tabeirós-Terra de Montes, Caldas, O Salnés and A Paradanta.
- Province of Ourense: Terra de Celanova, Terra de Trives, O Ribeiro, O Carballiño and A Limia

Figure 1: Location of the 22 comarcas studied in the Autonomous Community of Galicia, NW Spain.

## 2. Methods

### 2.1. Characterization of *Comarcas*

The characterization phase involved the systematic and comprehensive collection of data pertaining to aspects that could be used to describe the current situation of the structures and productive sectors that form the agricultural structure of the comarca

The collected data were structured into three levels:

1) 'Objective information', obtained by reviewing all the documentary sources available (literature, maps, statistics, internet information…).

2) 'Field information', obtained from a survey on the agricultural sector that was conducted through direct and personal interviews with experts who were well acquainted with the situation of the comarca (more than 350 experts over the 22 comarcas studied).

3) 'Individual information', obtained from a field survey among 4384 farm owners of all the parishes and productive sectors in the different comarcas. The farmers survey was a valuable source of information because it checked a variety of aspects related to the attitude and competence of producers, which is particularly relevant in the assessment of the response of affected farmers to the implementation of specific measures and actions.

### 2.2. Zoning of *Comarcas*

Although the contract was regional in scope, the research team searched for homogeneous units within the regions or comarcas in order to increase the definition of the Objective Agricultural Planning Model and to correct the internal heterogeneity of comarcas. The defined homogeneous units were composed of groups of parishes with similar characteristics. The research scope changed then from a municipal to a parish range; that meant an additional effort to obtain the pertinent information.

Based on parish units, the regional territory was subdivided into a number of units with a given level of homogeneity that could be useful in crop planning. To delineate such units, the environmental, structural and socioeconomic characteristics of the different parishes were analyzed. The 88 units resulting from the subdivision of comarcas were termed Ecological and Economic Units (EEUs) and became the basic units of analysis and production of results.

The method used to perform such a subdivision was based on multivariate cluster analysis. Cluster analysis is aimed at solving problems in the classification of variables into homogeneous groups. Consequently, cluster analysis defined parish groups (EEUs) or clusters, so that the variance between variables of the same group was minimized and the variance between variables of different groups or EEUs was maximized.

### 2.3. Data management

After the main characteristics of the initial situation were known and every comarca was divided into homogeneous units, the following step was to compare the suitability of every crop or land use for a given Ecological and Economic Unit (EEU). To that end, the so-called Suitability Matrix was constructed to contrast the information obtained from the characterization of comarcas for every EEU and every crop and land use considered.

### 2.4. Estimator design

To construct the matrix, a set of 'Sustainability Indicators' or 'Estimators' was defined. Sustainability indicators provide information about the social, environmental or economic constraints that determine the feasibility of farms for a given agricultural or forest land use in every EEU. These estimators used information from the 1999 Agricultural Census, and also from the conducted interviews and surveys.

By constructing estimators (one for each answer -or group of answers- to the survey, one for each specific aspect -or group of data- from the Census), the total score obtained (number of positive responses or specific value), which was interpreted in absolute terms, was transformed into a relative value that was used to compare different EEUs and Comarcas. By using relative values, the deviations of the analyzed values (e.g. responses to survey questions or census data) from the mean of the entire set of comarcas can be known.

The general construction of the estimators is described below. There are three types of estimators, classified according to the operational procedure used: simple, complex and composite estimators. The method developed to obtain a Simple Estimator can be best described by way of an example. Let us consider the percentage of positive responses to a question in the field survey, named question K. The construction of the corresponding simple estimator, $E_K$, consists of the following steps:

1. Estimation of the percentage of positive responses to question K (or aspect K) in Unit X, denoted by $P_{K,X}$.
2. Estimation of the percentage of positive responses to question K (or mean value of aspect K) for the whole set of comarcas, denoted by $P_{K,T}$. This value, which coincided with the mean value of positive responses, was assigned a Simple Estimator $E_K$ value of 0.5.
3. Search for the Unit with the lowest value of positive responses to question K (or minimum value of that aspect) from among the whole set of comarcas. Such a value was denoted as $MIN_K$, and was assigned a Simple Estimator $E_K$ value of 0.
4. Search for the Unit with the highest value of positive responses to question K (or maximum value of that aspect) from among the whole set of comarcas. Such a value was denoted as $MAX_K$, and was assigned a Simple Estimator $E_K$ value of 1.
5. The value of the Simple Estimator $E_K$ for Unit X was obtained by interpolation: if the value of $P_{K,X}$ was lower than the mean for the Comarcas, the $E_K$ value for Unit X was obtained by interpolation between $MIN_K$ and $P_{K,T}$. If the value of $P_{K,X}$ was higher than the mean, the $E_K$ value for Unit X was obtained by interpolation between $P_{K,T}$ and $MAX_K$. Figure 2 shows the construction method.

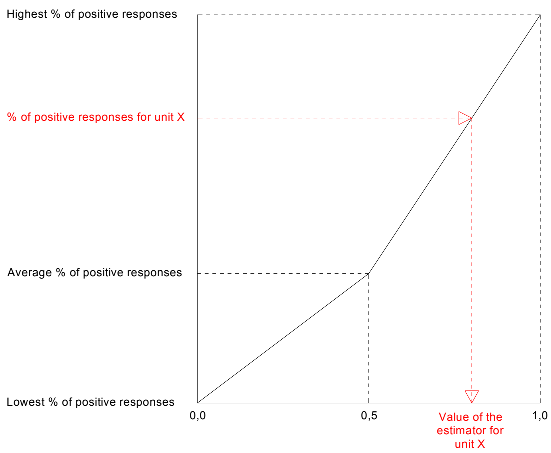


Figure 2: Conversion of total scores into homogeneous units.

Simple estimators were built such that low values of the estimator (minimum = 0) represented frequencies of positive responses below the mean for the comarcas, and high values of the estimator (maximum = 1) represented frequencies of positive responses above the mean. The mean value for the comarcas was set at 0.5.

Such a method was valid when assessing responses to simple questions. However, the response could sometimes take more than two values (positive/negative) or values lying in different ranges. In such cases, another type of estimator had to be defined: Complex estimators.

The methods used to construct Simple or Complex estimators can be used to construct virtually any numerical value based on field survey values (% positive or negative responses to over 60 questions) or census values (% area allocated to a specific land use, as compared to the average for Galicia). The problem comes down to simplifying the information available, which is too rich and sometimes redundant, and to applying it to a suitability matrix.

For simplification purposes, Composite estimators were constructed. Composite estimators were used to group (as a mean or weighted mean) the responses to two or several related questions, such that the value of each estimator provided considerably more information than the mere survey results or census data.

### 2.5. Suitability Matrix

The Suitability Matrix included two sets of elements, grouped into 'Rows', in which up to 50 different crops or livestock productions were represented, and 'Columns', in which up to 44 sustainability indicators were identified and tabulated.

A suitability matrix was constructed for each EEU, such that a total of 88 suitability matrices were obtained. Each matrix contained data pertaining to the estimators for the relevant area and assessed such information for every product.

The suitability of the crop or land use *'n'* was equivalent to the following value:

$$PS_n = \sum_{i=1}^{44} WF_i x TE_{i,n} \qquad (1)$$

Where:

$PS_n$: Total value of the suitability of crop or livestock product *'n'* for an EEU, between a minimum value of 0 and a maximum value of 1000. The matrix construction method allows for the comparison of the $PS_n$ value obtained with the values obtained for other EEUs, such that the suitability of the different *comarcas* for producing a crop or land use can be compared.

$WF_i$: Weighting factor for Constraint i. Weighting factors are used to adjust the relative weights of the different constraints or limiting factors. Weighting factors are constant for all the EEU and crops, but can be modified by the user.

$TE_{i,n}$ : Transformed Estimator of Weighting Factor i for crop or land use *n*. The transformed estimator stands for the value of the sustainability indicator defined to characterize constraint/limiting factor i, weighted for each specific crop or land use. The weighting factors defined above are unique because each estimator is weighted for each crop.

By calculating Suitability PSn, a numerical value between 0 and 1000 is obtained that includes the weighted sum of the different estimators by crop and EEU, and represents the potential carrying capacity for a crop or land use in an EEU.

This value presents two remarkable characteristics:

- It represents a relative comparison value among the 50 crops/land uses considered. This allows to set a hierarchy for these productions in the EEU, and so to establish the most suitable crops/land uses for that EEU, which will undergo the following analysis.

- Suitability Values are obtained through a homogeneous method for all the EEUs, so it is possible to recognize for which Units a crop/land use is more suitable, thus the suitability values for a crop or land use can be organized by EEU into a hierarchy.

Each factor was assessed by using the sustainability criteria defined in the above section, and could be transformed into numerical values that varied for every EEU and crop or land use.

### 2.6. Calculation of Transformed Estimators

A key element must be considered in the calculation of transformed estimators: the sensitivity of every crop or livestock product to each of the issues included in the numerical values of the estimators. For example, one can obtain a numerical value for the average slope of a given geographical area, and this value will be included numerically in the Slope Estimator. However, the effect of slope on the suitability of a crop is dependent not only on the average slope value, but also on the suitability of the slope value obtained for crop productivity. Thus, slope values exceeding 10% may impede the introduction of a given crop in an area, while the same slope range may be suitable for other crops.

Accordingly, the value of each estimator must be adjusted to the sensitivity of each crop or livestock product. For that purpose, various transform functions were applied. These transform functions were different for each estimator and for each crop or livestock product considered within each estimator. By applying the specific transform function for a crop to an estimator, a new value was obtained: the Transformed Estimator.

| ESTIMATORS | VALUE |
|---|---|
| PHYSICAL ENVIRONMENT | 100 |
| Orientation | 20 |
| Suitability for agriculture | 40 |
| Landscape quality | 5 |
| Landscape fragility | 5 |
| Climate units | 30 |
| FARM STRUCTURE | 175 |
| Size | 70 |
| Structural Limitations | 35 |
| Adequacy for the main Types of Farming (TFs) | 70 |
| STRUCTURE OF THE PRODUCTION UNIT | 125 |
| Training level | 25 |
| Amount of labour | 25 |
| Hired labour | 15 |
| Difficulty in finding hired labour | 10 |
| Owner dynamism | 20 |
| Interest in Farm Management Associations | 5 |
| Interest in Agricultural Buying Groups | 5 |
| Interest in Service Provision Groups | 5 |
| Interest in Animal Health Groups – Integral Treatment Groups | 5 |
| Interest in Farm Machinery Cooperatives | 5 |
| Interest in Collective farming | 5 |

Table 1: List of Estimators (I).

| | |
|---|---|
| PRODUCTION SUPPORT | 150 |
| % Irrigated area to UAA | 3 |
| % Hydrological network to total area | 3 |
| Accessibility | 3 |
| Problems for input supply | 5 |
| % Cooperative members to population engaged in agriculture | 5 |
| % SAT to population engaged in agriculture | 3 |
| Availability of Processing Industries | 15 |
| % Area under LC projects to total area | 3 |
| Land Availability | 25 |
| Financial capacity /TGM | 35 |
| Financial capacity /FU income | 35 |
| Management innovation capacity | 15 |
| MARKETING | 225 |
| Availability of and level of satisfaction with marketing channel | 70 |
| Proximity to urban areas | 10 |
| Availability of PDO or PGI | 25 |
| Proximity to seasonal use areas | 15 |
| Internal market potential | 35 |
| Foreign market potential | 35 |
| Marketing innovation capacity | 15 |
| Commercial constraints | 20 |
| POTENTIAL OF THE LAND USE/CROP | 225 |
| Current weight of the crop | 80 |
| New crop / land use | 25 |
| Technical/Crop production problems | 30 |
| Potential of the crop | 60 |
| Production innovation capacity | 30 |

Table 1.List of Estimators (II)

Table 1: Shows the 44 estimators used in the model and the weights assigned to each estimator.

## 3. Results

To illustrate the potentials of the model, an example is provided below. The example discusses the results obtained for Baixo Miño, a comarca located in Southwest Galicia; more specifically, for its EEU-1.

The five EEUs obtained from the spatial zoning process were distributed as shown in Map 1.

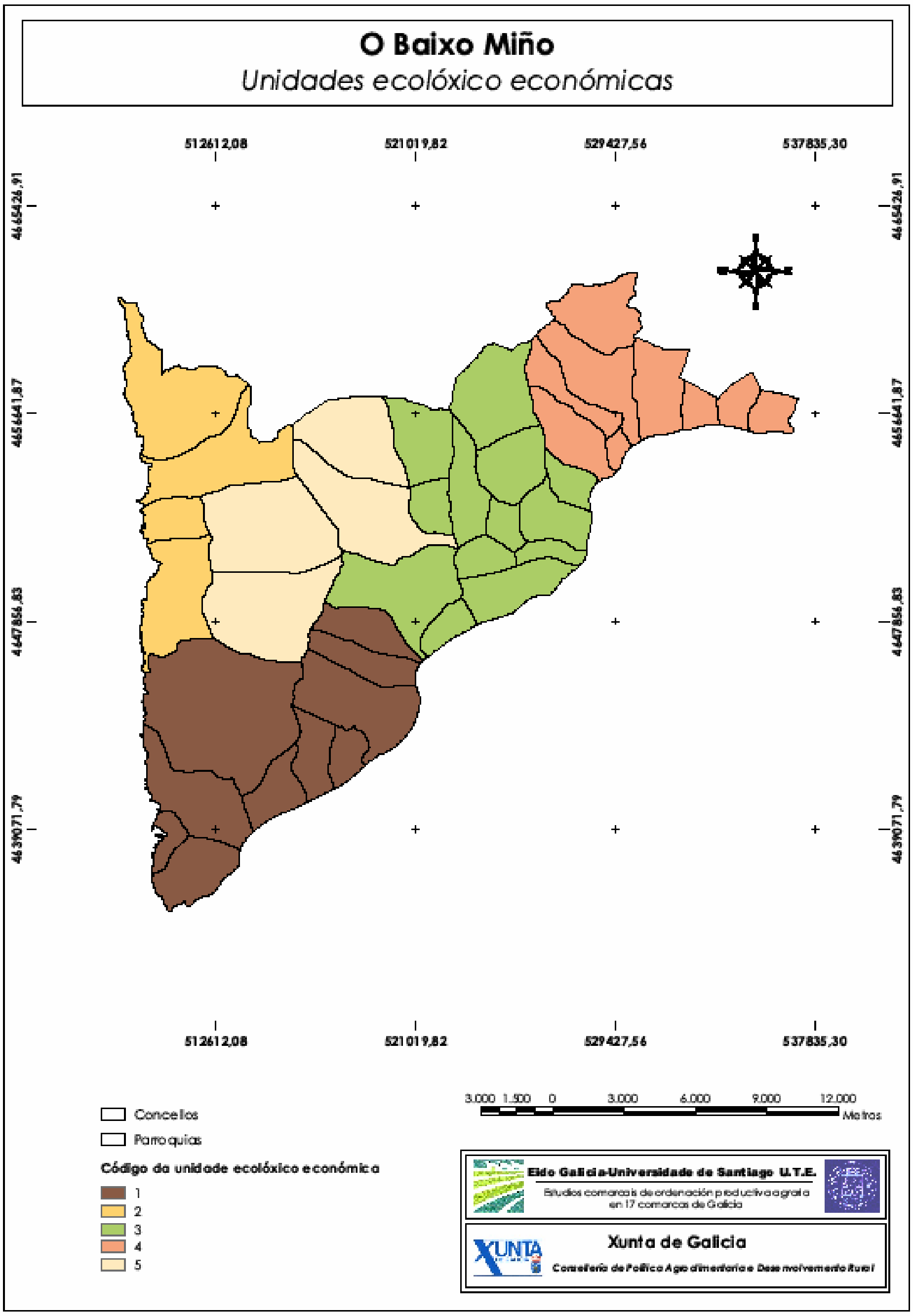


Figure 3: Division of Baixo Miño comarca into EEUs.

Table 2 includes the results of the suitability matrix for EEU-1, and table 3 the joint analysis of the matrix for EEU and crop (Mixed classification).

| UEE |
|---|
| BAIXO MIÑO-1 |

| Referencia Valor |
|---|
| 0,75 |

| FACTOR / CONDICIONANTE | VALOR |
|---|---|
| **MEDIO FÍSICO** | **100** |
| Orientacións | 20 |
| Aptitude para a actividade agrícola | 40 |
| Calidade da paisaxe | 5 |
| Fraxilidade da paisaxe | 5 |
| Unidades climáticas | 30 |
| **ESTRUCTURA DA EXPLOTACIÓN** | **175** |
| Tamaño | 70 |
| Limitante estructural | 35 |
| Axeitamento OTEs principais | 70 |
| **ESTRUCTURA DA UNIDADE PRODUCTIVA** | **125** |
| Nivel de formación | 25 |
| Cantidade de traballo | 25 |
| Utilización de M.O. asalariada | 15 |
| Dificultade para atopar M.O. asalariada | 10 |
| Dinamismo do titular | 20 |
| Interés AXEs | 5 |
| Interés asociacións compras | 5 |
| Interés asociacións prestacións servizos | 5 |
| Interés ADS - Atrias | 5 |
| Interés CUMAS | 5 |
| Interés asociacións explotacións en común | 5 |
| **MEDIOS DE APOIO Á PRODUCCIÓN** | **160** |
| % Sup. regadío s/SAU | 3 |
| % Rede hidrolóxica s/superficie total | 3 |
| Accesibilidade | 3 |
| Dificultade abastecemento inputs | 5 |
| % Asociados a cooperativas s/poboación agraria | 5 |
| % SAT s/poboación agraria | 3 |
| Existencia de industrias de transformación | 15 |
| % Superficie con CP en actuación s/superficie total | 3 |
| Dispoñibilidade de terras | 25 |
| Capacidade financieira s/MBE | 35 |
| Capacidade financieira s/ingresos UF | 35 |
| Capacidade de innovación na xestión | 15 |

| Referencia Cultivos |
|---|
| |
| |
| |

| Referencia Puntuación |
|---|
| 450 |

| FACTOR / CONDICIONANTE | VALOR |
|---|---|
| **COMERCIALIZACIÓN** | **226** |
| Existencia e nivel de satisfacción co canal comercial | 70 |
| Proximidade a núcleos urbáns | 10 |
| Existencia de D.O. ou P.G.C. | 25 |
| Proximidade a áreas consumo estacional | 15 |
| Potencialidade mercado interior | 35 |
| Potencialidade mercado exterior | 35 |
| Capacidade de innovación comercial | 15 |
| Limitacións comerciais | 20 |
| **POTENCIALIDADE DO APROVEITAMENTO** | **226** |
| Peso actual do cultivo | 80 |
| Novo cultivo / aproveitamento | 25 |
| Problemas técnico-agronómicos | 30 |
| Potencialidade do cultivo | 60 |
| Capacidade de innovación productiva | 30 |


NOTA 1

NOTA 2

| VALOR XERAL DE COMPARACIÓN | 1000 |
|---|---|

| ORDE | CULTIVO | PUNTUACIÓN | VALOR |
|---|---|---|---|
| 1 | Horta baixo cuberta | 528,480846 | 1,00 |
| 2 | Horta aire libre 2 | 521,926548 | 0,98 |
| 3 | Horta aire libre 1 | 515,657853 | 0,96 |
| 4 | Flor cortada baixo cuberta | 508,890173 | 0,93 |
| 5 | Viña | 496,960839 | 0,88 |
| 6 | Mirabel | 483,146091 | 0,83 |
| 7 | Flor cortada Aire libre | 469,589170 | 0,78 |
| 8 | Plantas ornamentais | 468,301018 | 0,77 |
| 9 | Gandería intensiva vacún | 447,830803 | 0,69 |
| 10 | Kiwi | 441,490847 | 0,67 |
| 11 | Horta Ecolóxica | 438,802381 | 0,66 |
| 12 | Producción coscos | 434,938914 | 0,64 |
| 13 | Pataca | 422,830546 | 0,60 |
| 14 | Grelo | 414,736621 | 0,57 |
| 15 | Pequenos froitos | 406,134842 | 0,54 |
| 16 | Gandería intensiva avícola | 401,004624 | 0,52 |
| 17 | Gandería intensiva cunicultura | 397,551776 | 0,50 |
| 18 | Gandería intensiva porcino | 394,923001 | 0,49 |
| 19 | Eucalipto | 393,515468 | 0,49 |
| 20 | Cogumelos | 388,051102 | 0,47 |
| 21 | Pereira | 382,444640 | 0,45 |
| 22 | Faba | 377,728583 | 0,43 |
| 23 | Coníferas alta producción | 377,105890 | 0,43 |
| 24 | Gandería cinexética | 368,229429 | 0,39 |
| 25 | Mel | 367,734369 | 0,39 |
| 26 | Maceira | 363,973824 | 0,38 |
| 27 | Gandería semi-intensiva ovino / caprino | 363,902098 | 0,37 |
| 28 | Millo gran | 360,152361 | 0,36 |
| 29 | Gandería semi-intensiva vacún leite | 341,676138 | 0,29 |
| 30 | Centeo | 331,685100 | 0,26 |
| 31 | Trigo | 329,864442 | 0,25 |
| 32 | Gandería semi-intensiva vacún carne | 329,429554 | 0,24 |
| 33 | Gandería semi-intensiva vacún carne ecolóxica | 324,826609 | 0,23 |
| 34 | Gandería semi-intensiva avícola | 320,454715 | 0,21 |
| 35 | Gandería extensiva | 319,311127 | 0,21 |
| 36 | Castaña | 318,156346 | 0,20 |
| 37 | Cebada | 313,911226 | 0,18 |
| 38 | Pradeira corta duración | 311,252363 | 0,17 |
| 39 | Frondosas alta producción | 310,887457 | 0,17 |
| 40 | Raíces e tubérculos forraxeiros | 310,791894 | 0,17 |
| 41 | Avea | 308,655206 | 0,16 |
| 42 | Pradeira larga duración | 308,350246 | 0,16 |
| 43 | Noz | 308,016457 | 0,16 |
| 44 | Chícharo forraxeiro | 296,176302 | 0,12 |
| 45 | Gandería semi-intensiva porcino | 292,897369 | 0,11 |
| 46 | Gandería semi-intensiva vacún leite ecolóxica | 291,094083 | 0,10 |
| 47 | Alfalfa | 290,154862 | 0,09 |
| 48 | Millo forraxeiro | 285,481129 | 0,08 |
| 49 | Coníferas baixa producción | 277,991545 | 0,05 |
| 50 | Frondosas baixa producción | 265,219011 | 0,00 |

Table 2: Suitability matrix for EEU-1

| UEE |
|---|
| BAIXO MIÑO-1 |

| Referencia Cultivos |
|---|
| |
| |
| |

| Referencia Valor Total |
|---|
| 1,60 |

| ORDE | CULTIVO | VALOR TOTAL |
|---|---|---|
| 1 | Mirabel | 1,83 |
| 2 | Flor cortada baixo cuberta | 1,77 |
| 3 | Horta baixo cuberta | 1,76 |
| 4 | Plantas ornamentais | 1,68 |
| 5 | Horta aire libre 2 | 1,68 |
| 6 | Horta aire libre 1 | 1,62 |
| 7 | Viña | 1,59 |
| 8 | Flor cortada Aire libre | 1,50 |
| 9 | Kiwi | 1,44 |
| 10 | Horta Ecolóxica | 1,20 |
| 11 | Pereira | 0,98 |
| 12 | Pataca | 0,91 |
| 13 | Producción coscos | 0,90 |
| 14 | Gandería intensiva avícola | 0,89 |
| 15 | Gandería intensiva cunicultura | 0,89 |
| 16 | Pequenos froitos | 0,84 |
| 17 | Faba | 0,83 |
| 18 | Gandería intensiva porcino | 0,79 |
| 19 | Eucalipto | 0,78 |
| 20 | Grelo | 0,78 |
| 21 | Maceira | 0,77 |
| 22 | Millo gran | 0,72 |
| 23 | Coníferas alta producción | 0,72 |
| 24 | Gandería intensiva vacún | 0,70 |
| 25 | Gandería semi-intensiva ovino / caprino | 0,67 |
| 26 | Cogumelos | 0,65 |
| 27 | Mel | 0,60 |
| 28 | Gandería cinexética | 0,56 |
| 29 | Centeo | 0,45 |
| 30 | Trigo | 0,43 |
| 31 | Gandería semi-intensiva vacún leite | 0,40 |
| 32 | Pradeira corta duración | 0,38 |
| 33 | Avea | 0,38 |
| 34 | Frondosas alta producción | 0,38 |
| 35 | Castaña | 0,36 |
| 36 | Raíces e tubérculos forraxeiros | 0,36 |
| 37 | Cebada | 0,35 |
| 38 | Noz | 0,35 |
| 39 | Pradeira larga duración | 0,34 |
| 40 | Gandería semi-intensiva vacún carne ecolóxica | 0,33 |
| 41 | Gandería semi-intensiva avícola | 0,32 |
| 42 | Gandería extensiva | 0,32 |
| 43 | Coníferas baixa producción | 0,31 |
| 44 | Alfalfa | 0,29 |
| 45 | Chícharo forraxeiro | 0,26 |
| 46 | Gandería semi-intensiva vacún carne | 0,26 |
| 47 | Gandería semi-intensiva porcino | 0,25 |
| 48 | Frondosas baixa producción | 0,21 |
| 49 | Gandería semi-intensiva vacún leite ecolóxica | 0,18 |
| 50 | Millo forraxeiro | 0,15 |

Table 3: Mixed matrix for EEU-1 /crops.

As shown in Table 2, the most suitable crops are horticultural crops, followed by a group of crops composed of cut flowers, vineyard, mirabelle plum (native variety of plum, *Prunus domestica L. var. syriaca*) and ornamental plants. The analysis of the overall assessment of the results sorted by order (relative classification within an EEU, obtained from the suitability matrix) and magnitude (overall classification of a crop or land use for all the comarcas considered as a whole) and summarized in Table 3, coincides with the situation shown in the previous table, only with some differences in the relative position of crops, which do not affect the election of the suitabilities assessed. Mirabelle plum ranks first because of the current weight of the crop, which is limited to the Baixo Miño comarca.

The main factors that maximize the suitability of these crops and uses are:

- **Horticultural crops:** The EEU presents good weather conditions for this product. Availability of established commercial channels and a processing industry in the region. High membership of farmers to associations or groups. The comarca is near seasonal consumption areas. Availability of hired labour. High potential for these crops.
- **Cut flowers under cover**: Proximity to large seasonal consumption areas. Availability of hired labour. High current weight of the crop.
- **Vineyard**: Good suitability of the EEU for this product. Good integration of the crop in the agricultural landscape of the EEU. Good marketing conditions, favoured by the existence of a good commercial channel, the strong presence of processing industries in the region, and the availability of hired labour. PDO Certificate.
- **Mirabel**: Good marketing conditions, favoured by the existence of a good commercial channel, and presence of processing industries in the region. Proximity to large seasonal consumption areas, and high potentiality of internal markets. Availability of hired labour. Production of the crop is almost exclusive of the region. High potentiality of the crop.
- **Ornamental plants**: Good integration of the crop in the EEU, as the climate is very suitable for this product. Good marketing conditions, favoured by the existence of a good commercial channel and a high potentiality of the foreign markets. Availability of hired labour. High current weight and potentiality of the crop.

## 4. Conclusions

Our first consideration for the drawing of conclusions is based on the premise that no model, regardless of its quality, can replace the work of a technician; we expect it to be an efficient help.

The model presented in this paper has proved useful in agricultural production planning and has enabled the Galician Administration, *Xunta de Galicia*, to define operational measures and action policies based on the results of the model.

Moreover, comparative assessment methods, which are typical of project engineering, have a high potential for prioritizing objectives and for using all the information available.

This model can be further developed by introducing more (comprising more aspects) and better (more detailed) information. The expansion of the model to the whole Autonomous Community of Galicia would produce more efficient assessments. Furthermore, in the decision process new indicators can be introduced, or existing ones improved.

Obviously the model must be more deeply tested, and is widely open to new improvements, particularly in aspects as the weighting coefficients for the indicators or the automatic use of transformed indicators to obtain an immediate assessment system. The limitations of the model derive from two main aspects: 1) the need to analyze the weighting of the indicators, i.e. the relative weight of each indicator in the final result and 2) the use of transformations that represent the suitability of environmental factors for the characteristics of each crop or land use.

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