SOCIAL PREFERENCES FOR MANAGEMENT OF RURAL FORESTS IN THE IBERIAN ATLANTIC REGION [1]

Albino Prada, Manuel González, Mª Xosé Vázquez and Mario Soliño
Department of Applied Economics
Lagoas Marcosende s/n – University of Vigo
36200 Vigo
Pontevedra (Spain)
(aprada@uvigo.es)

10th EUROPEAN ASSOCIATION OF
AGRICULTURAL ECONOMISTS CONGRESS
"Exploring diversity in the European Agri-Food System"

Possible Sessions:
Agricultural and Rural Development Policies
Resource Economics
Analytical Methods

Zaragoza, August 28-31, 2002

ABSTRACT

This article presents results from an experiment into attribute perception and relevant levels for management of woodland and mountain areas typical of the Iberian Peninsula's Atlantic region. The aim, which the authors argue has been robustly reached, was to identify those aspects of forestry policy clearly perceived by citizens. This is useful for defining enlargement of areas protected under Natura 2000 Network. Results show clear preference for an increase in woodland to over half the current surface area, with replanting of traditional trees, in woodlands of low density and trees of different age and, preferably in irregular shaped plots.

Keywords: Landscape preference; Visual quality; Non-market goods; Preference models; Economic valuation; Landscape Management.

[1] Preliminary results from the first stage of the project "ECONOMIC ANALYSIS OF ENVIRONMENTAL VALUE OF GALICIAN RURAL AREAS NOT USED FOR AGRICULTURE", financed by Xunta de Galicia (project 99PXI30005A) and University of Vigo (project 64502E911).

1. Introduction

Agro-environmental measures accompanying CAP reform have been applied in various EU countries since 1996. This has allowed numerous advantages of a global approach to rural landscape system conservation to be identified, as recommended by the fifth conclusion of the measures assessment document (COMMISSION, 1998). Also, *the Dobris Assessment* (Stanners and Bourdeau, 1998) regarding Europe's environment devotes a chapter to landscapes[2], pointing out that "a pragmatic approach to future biological conservation should include the landscape as a whole within a rural framework for land use".

However, in the analysis of landscape elements and systems for EU rural spaces, we must distinguish between territories with large areas of forest and those with mainly farmland since "wooded areas are unequally spread within the EU. They take up more than 50% of Finland and almost all the territory of Sweden, as in the Pyrenees and some Mediterranean and Atlantic areas of Spain" (COMMISSION, 1999). Thus, it is justified that analysis in this study is focused on non-farming areas that will be the most relevant in the Iberian Peninsula's Atlantic regions (Chart 1). Our aim is to know social preferences for conservation and management of these areas.

Chart 1: Non agricultural surface area over total (%) (EU15 = 58)

Above average		**Below average**	
Galicia (Spain)	69	Ireland	37
Cantabria (Spain)	70	United Kingdom	30
North (Portugal)	67	Brittany (France)	33
Finland	94	Centre (Spain)	42
Sweden	93	Germany	51

Source: Drawn up by the authors from Eurostat (1999) NewCronos data.

In Galicia, the rural landscape depends decisively on the two million hectares of woodland, almost 70% of all land, which according to *Corine Land Cover* (CLC-GISCO) are included in group 3: wooded (deciduous, evergreen or mixed), open wooded or pasture land and non-productive land ... where it is important[3] "that timber forms an integral part of rural development and that, therefore, forestry measures must be included in the funding regime for such development".

In this context, we have decided to centre our empirical work, in the interest of territorial and ecosystem homogeneity, on Natura 2000 Network proposals[4] for predominantly forest land areas that, although less than half in number (only 24 from a total of 53 proposed areas), nevertheless come to 86% of the proposed 280,000 ha. in Galicia. This is not unusual, as we are dealing with an Atlantic region where woodland is predominant (Chart 1). In addition the *Estrategia Forestal Española* (Spanish Woodland Strategy) indicates[5], when referring to Natura 2000 Network, that "... a large part of the land earmarked for inclusion in

[2] Op. Cit. pp. 172-189 and 221.
[3] Quote from Reg. (CE) 1257/1999 (DOCE 26.6.1999).
[4] Directive 92/73/CEE, Real Decreto 1997/1995, Orden Autonómica 28.10.1999 (DOG 9.11.1999).
[5] MMA (1999), pp. 30 and 49.

Natura 2000 Network will be classified as uncultivated ... Natura 2000 Network not only includes Old Growth Forest and Ancient Forest, …"

The current situation of these forest or mountain areas[6] could be characterised by regressing autochthonous, deciduous woodland (common oak, *quercus robur*; sweet chestnut, *castanea sativa*; cork oak, *quercus suber*; Pyrenean oak, *quercus pyrenaica*; ash, *fraxinus excelsior*; sycamore maple, *acer pseudoplatanus*; willow, *salix sp.*; black alder, *alnus glutinosa*; European white birch, *betula pendula*; sweet cherry, *prunus avium*; English walnut, *juglans regia*) of hardly 300,000 ha.; abandoned scrub such as treeless uncultivated land of about 800,000 ha. and afforestation with planted production forests (320,000 ha. of eucalyptus, *e. globulus* and over 500,000 ha. of maritime pine**,** *p. pinaster*).

In this context of profound changes, it follows that evaluation should be made of the social preferences associated with the effects of intensive timber farming with forest plantations, with former agricultural land left as scrubland and with regression – also through neglect in management – of Atlantic deciduous woodland. It would appear that intensification and abandonment affects over 50% of rural landscape nowadays and has a negative impact compared to the alternative of Atlantic natural woodland[7]. This negative impact is associated to the fact that; in plantation forests (STANNERS and BOURDEAU, 1998: 467) there are clumps of evergreens with well-defined limits, which simplify shape, colour and texture in the landscape; the intensification associated with monocultural exotic species means loss of biodiversity; and handling, site preparation, new diseases propagation, and so on, associated with these crops generate environmental impacts. To these arguments must be added numerous forest fires, loss of biodiversity, etc., clear examples of opportunity cost (negative externalities) inasmuch as woodland plays a vital role in the conservation of the natural environment, that is, water, soil and air (COMMISSION, 1999b).

Our aim is to know the preferences of individuals for management aspects for the different mountain landscapes included in the RN2000 proposal and thus determine which landscape attributes are the most socially significant (and to what degree). This is usually quantified in the literature by means of an *Aesthetic Valuation Index* (TINDALL, 2001) (TEMPESTA, 1993 and 1998) (FALINI and CIARDINI, 1985) or *Average Preference Index* (HERZOG, 1984) or *Scenic Beauty Estimation* (HULL, 1984) for the attributes in question and for other potentially explicative variables and their corresponding levels. These are all measurement methods for scenic quality based on psychophysical methods[8] used repeatedly since the 1970s.

In the next section we describe the approach used for the elicitation of preferences. Then results from a *Perception Test* for characteristics of these areas are presented and discussed. Finally, we summarize the main conclusions and point out directions of future research, related to cost-benefit analysis.

[6] About 2,100,00 ha altogether.
[7] Atlantic oak woodland (Santos, 1999).
[8] The seminal work (THURSTONE, 1927) is transferred to landscape issues (SHAFER, 1969).

2. Material and methods

In order to estimate the benefits or impacts associated with woodland management in Atlantic mountain areas, it does not seem appropriate to restrict ourselves to the valuation of direct recreational use by visitors to affected areas. It is, therefore, necessary to estimate values for both active use and for conservation: values that citizens in general (visitors, local residents and the rest) state concerning possible increases in size and number of protected areas.

It becomes necessary to forsake, simultaneously, both valuation related merely to recreation and that limited to a single space, by widening the exercise in two directions: to non-recreational services (landscape, biodiversity, etc.), and to as yet unprotected spaces (Natura 2000 Network rural-agrarian environment) where active recreational use is scattered and agreement with farmers for adequate management is voluntary. Both are issues of interest, not only for applying economic-environmental analysis to so far untouched territory, but also for defining efficient instruments for economic policy (CAP and Agenda 2000).

Total value[9] associated with the proposed changes could be estimated and expressed in monetary units by means of direct methods based on surveys (ADAMOWICZ et al., 1999) (GONZALEZ and PRADA, 1997). These methods generally begin by creating a hypothetical market presented through a questionnaire. In the usual format - dichotomous contingent valuation - a change is described and a price is proposed. Individuals may accept these or not, and reveal a preference above or below the offered price if they accept. There are alternative direct methods such as choice experiments, which take into account the multidimensional nature of the good or proposed changes. In this latter format, the individual is offered different intervention alternatives, described according to characteristics or attributes and their levels, and each combination of attributes and levels is associated with a price. The individual, when interviewed, must choose one from a set of proposed alternatives. Seen in this way the traditional dichotomous format would be a simple choice experiment with two attributes: the proposed change and the price.

The initial inventory of attributes and levels chosen to illustrate the specific context whose context is to be valuated is shown in Chart 2 (KAPLAN and KAPLAN, 1989) (HANLEY, 1993) and comes from a review of previous studies[10], from which those characteristics most suitable for mountain areas of Atlantic region have been selected: tree covered area, deciduous share[11], plantation area[12], mass density, mean height, height diversity, outline shape, etc.

---

[9] Economic value of natural heritage (MMA, 1998).

[10] For forest landscape attributes (HANLEY, 1991, 1992, 1998), (BENSON 1992), (GARROD, 1992) can be reviewed, among others.

[11] Definition (MMA-DGCONA, 1999:18 and 47): “Forests formed by tree species of natural or artificial origin whose characteristics (structure, species composition, biological diversity) approach complex ecosystems. If there are forms of use, they make the protecting and regulating function (water, soil, biodiversity, landscape) compatible with timber production.”.

[12] Definition (MMA-DGCONA, 1999:18): "Artificially originated tree mass whose raw material productive end conditions its simplified structure and composition, as well as scarce biological diversity. The basic objective of maximum productivity and profitability involves application of intensive forest management far removed from natural ecosystem dynamics." Cites as typical species: eucalyptus, pinaster, radiata, pseudotsuga, ... calling them "forest plantations" (p.26) and informs that they take up 12% of Spanish woodland (over 70% in Galicia).

Chart 2: Attributes and levels chosen

Attributes	**Levels**
Wooded cover	(0: scarce; 1: medium; 2: total)
Deciduous	(1: yes ; 0: no)
Plantation	(1: yes ; 0: no)
Undefined vegetation	(if 2 and 3 zeros, value 1;value 0: if 2 or 3 take value 1)
Neglected open woodland	(1: yes; 0: no)
Active scrub land management	(1:yes; 0:no)
Undefined management	(if 5 and 6 are zero, value 1; 0: if 5 or 6 take value 1)
Paths	(1: yes; 0: no)
Firebreaks	(1: yes; 0: no)
Marked edges	(1: yes; 0: no) (regulars / irregulars)
Heights	(0: homogeneous; 1: non contemporary)
Age	(0: latizal; 1: medium; 2: woods)
Density	(0: low; 1: high)
Morphology	(0: neutral: 1: slopes)
Perspective	(0: mid; 1: birdseye)
Photo quality	(0: low; 1: normal)
Luminosity	(1: normal-high; 0: low)

The attributes and levels were selected from among the potentially most relevant in the preferences of the individuals. However, others were excluded (presence of water, seasonal colouring, and, above all, manmade constructions) that, because of their well-known incidence in works on landscape preferences (WHERRETT, 2000 and 2001) (KAPLAN, 1998) (HULL, 1989), would blur (as they did when introduced into WHERRET, 2000) the central role that the vegetation cover must play in our analysis. This selection makes it possible to specify and detail which factors turn woods and wooded areas into more appreciated and valued landscapes (TEMPESTA, 1998).

A personal survey was then designed in which individuals had to choose and rank, according to their preferences, various alternative landscapes shown in 46 photos including all the attributes and their levels. In the literature reviewed (KAPLAN and KAPLAN, 1989) (TEMPESTA, 1993) (FALINI and CIARDINI, 1985), about 50 is considered to be a manageable number of photos for interviewees, 200 a sufficient number of questionnaires and values from 0 to 5 an adequate preference scale for each picture.

Thus, our study typifies 46 photographs (two for each attribute and level)[13] which were given in a shuffled deck that had to be first sorted by interviewees into five groups, not necessarily equal in number, from greatest to least preferred (DEARDEN, 1984). This procedure is preferable to comparing pairs of photos (HULL, 1984) (TAHVANAINEN et al., 2001), which is more tiring for the interviewee and more costly. Furthermore, using colour photos has been the norm for decades (HULL, 1984) and is as efficient – and much cheaper – that obtaining preferences *in situ*, above all if there are a great number of landscape types (STAMPS, 1990). It is also always preferable to verbal description (TAHVANAINEN, 2001). In a second stage of the questionnaire, interviewees were asked to order photos sequentially with different levels for each attribute. In neither case was additional non-visual information provided.

[13] Distributed randomly in pairs and matching numbers (Appendix B and C). This was an attempt to avoid that results were affected by visual aspects of the specific picture chosen. Attributes of both water and seasonal colour variation were excluded from all photos.

Through careful selection of the presented photographs and later ordering, the relative importance of the different attributes and their relevant levels was estimated. The basic valuation or *Landscape Preference Index* (LPI) is obtained from the ordering (mono-criterion) of the 46 photos according to the levels and attributes we aim to valuate. The LPI is calculated for the odd and even images as an average of 200 observations; assigning a photo 5 points if it is in the first pile, 4 if in the 2nd, 3 if in the 3rd, 2 if in the 4th and 1 if in the 5th (TEMPESTA, 1998). The procedure followed is completed by two supplementary controls. The first consists of ordering (also mono-criterion) within each attribute. The second consists of modelling[14] of the estimated LPI.

Here we will focus on the results from the survey of preferences derived from 200 questionnaires[15] answered by representative samples in the metropolitan areas of three major Galician cities, Santiago de Compostela, Pontevedra and Lugo. Each sub-sample was designed proportionally to the population of the city of residence, grouped in urban, suburban and rural areas, and households were randomly selected according to the *Random Route* method with quotas by age and sex. In each stratum, selection of the area where surveys were obtained was random, with two persons per stratum as a minimum.

Personal interviews were undertaken by professional interviewers between 15th and 23rd February 2001. These interviews took place in the interviewees' homes. The final sample, representative of the population, was made up of 105 women and 95 men, with adequate distribution for age bands. Education level is distributed evenly among higher, secondary and primary education. The main occupation is full-time employee (30%) followed by student (21%) or house-keeper (14%).

Finally, a series of questions were asked in the questionnaire that attempted to discover opinions about the various management options for the spaces and their environmental problems and also to know the interviewee's socio-economic characteristics. Among results regarding non-visual aspects - which are secondary here - we noted that the most serious environmental problems considered for mountain areas are[16]: forest fires, loss of natural flora and fauna, location of industry and uncontrolled dumping, drying up natural springs and indiscriminate afforestation with short-term planted production species. Of lesser relative importance[17] are intensity of tourism and recreational use, and pests and diseases affecting woodlands.

3. Results and Discussion

The aim of this work is to know the preferences of the population for different characteristics of mountain forest landscapes. In this sense the LPI calculated with the 46 photos shows clear results (Appendix B).

At the positive extreme there is a clear preference for proposal 15 with LPI close to 4 and for proposals 41, 42, 43 and 45 with LPI over 4. Images that, in all cases, assign the highest aesthetic valuation - over any other landscape presented - to the option for replanted

[14] WHERRET, 2000 and 2001; TEMPESTA, 1998.
[15] In Scotland (WHERRET, 2001), 180 questionnaires were used for a total of 90 landscape photos.; (TAHVANAINEN, 2001) uses 114; (TEMPESTA, 1998) uses 203.
[16] Over 60% give a rating above 7 on a 0-10 scale.
[17] Less than 40 % ibidem.

traditional woods (oaks, chestnuts, other deciduous), markedly higher than conifer replanting but, above all, higher than eucalyptus plantations, which register a much lower LPI (2.8- 2.9 points assigned to images 13 or 14). This result fits in with the findings of other studies on European Atlantic regions -(SANTOS, 1999)[18] for the North of Portugal region, (GOURLAY and SLEE, 1998) for Scotland or (O'LEARLY et al. 2000) for Ireland - which obtain similar preferences for deciduous woodlands.

Eucalyptus plantations share this situation of low appeal with open, scrub or uncultivated land, which is, as a group, the least valued option aesthetically. They reach minimum LPI of 2 points (for image 20), 2.3 (for 23) and 2.4 (for 22). Also with average scores below 3 are photos 7 to 10 where scrubland is the dominant - though not exclusive - plant cover.

The correlation observed between the LPIs calculated for odd and even photos is medium-high (reaching $r = 0.512$), which would be a first proof of internal consistency for the test undertaken, as the 46 photos were presented jointly and indistinctly to the interviewees. Disaggregated analysis of the odd and even photos leaves little room for doubt about the priority that citizens appear give to repopulation of traditional woodland over a large part of land currently open or covered by thicket and included in spaces from the Natura 2000 Network proposal.

Interviewees were asked, in the second stage of the interview, to give a new ordering for their preferences for the same photos but this time only for those representative of each attribute and, again, without any supplementary information on the attribute to which they were related (Appendix C). The responses to this question can be considered as a control instrument for the previous overall ordering, but it was also useful as complementary information inasmuch as it allows preferences to be profiled given that the individual faces a more limited group of options[19].

This second question was included, in the main, to verify whether results were coherent or not with data already obtained, firstly, ordering in group ii confirms supremacy of traditional woodland over pine or eucalyptus plantations (LPI of 3.9 against 2.6-2.9 and 2.2-2.4 respectively) and, secondly, ordering in group i also confirms supremacy of mountain landscape with over 50% tree cover over those where scrub predominates (between 2.7 and 3.2 in some cases and between 1.7 and 3 in the others). A high correlation is observed between the results for attribute preferences and the total ($\rho = 0.670$ for even photos and $\rho = 0.668$ for odd ones) (Appendix B and C), which reinforces the thesis that the same image was valuated coherently both times it was submitted to the interviewee.

This second question not only confirms the initial results but also allows their further profiling. In conifer plantations (31 to 38 in v.i.) less dense forests[20] are preferred (3.6-3.9 against 2.7-2.8). This is also the case for traditional woods (39 to 46 in v.ii.) with, for example, 4 against 2.6 when, in both cases, they are of similar age. Another feature profiled, as yet unmentioned but already appreciable in the overall preferences (proposal 27-28 against 29-30), is the clear preference for irregular visual aspects (paths, edges, limits, firebreaks, etc.) as opposed to linear or regular ones (LPI of 3.3-3.7 against 1.8-3.1).

[18] Both in a perception test with 35 photos for 32 Park visitors and in a later contingent ranking.
[19] Ten photos as a maximum now in the first attribute on woodland cover.
[20] A quantative reference would be: <500 feet/ha for deciduous and >2,500 feet/ha in plantations.

All these results obtained so far indicate that if agro-environmental measures seek to promote "Low Intensity Agricultural Systems" (WHITBY, 1996)[21], then in our case it would seem advisable to complement these with "Low Intensity Forest Systems" which, above all with regard to forestry plantations, contribute to the higher valuation – in the terms defined here - of rural landscape.

Finally, we present the estimation of a model that makes it possible to relate the LPI for landscapes contemplated in the photographs (Appendix B) with the their attributes (Chart 2), that will constitute our set of regressors or explicative variables. For this estimation we have used a classic linear model (ordinary square minimums method) with a backwards regressor selection analysis. Both the methodology used and the significance of obtained results are similar to those of other recent works (WHERRET, 2000 and 2001; TEMPESTA, 1998). Thus, those attributes that can be used to predict LPI are isolated in the seven explicative variables (Chart 3) that do so at 60%.

Chart 3. List of explicative variables

Variable	**Description**
CUBARB	Dummy Variable for Wooded Cover (0= scarce; 1= medium; 2= total)
PLANT	Dummy Variable for Plantation (0= no; 1= yes)
GESTMB	Dummy Variable for Active Scrub Land Management (0= no; 1= yes)
CORTAF	Dummy Variable for Firebreaks (0= no; 1= yes)
EDAD	Dummy Variable for Age (0= latizal; 1= medium; 2= woods)
DENSID	Dummy Variable for Density (0= low; 1=high)
PERSP	Dummy Variable for Perspective (0= mid; 1= birdseye)

The result of regression analysis is as follows:

$$
\begin{aligned}
LPI = \; & \underset{(0,001)}{0,395\,\mathrm{CUBARB}^{*}} - \underset{(0,004)}{0,491\,\mathrm{PLANT}^{*}} \\
& + \underset{(0,071)}{0,312\,\mathrm{GESTMB}^{**}} - \underset{(0,073)}{0,545\,\mathrm{CORTAF}^{**}} \\
& + \underset{(0,027)}{0,232\,\mathrm{EDAD}^{**}} - \underset{(0,067)}{0,267\,\mathrm{DENSID}^{**}} \\
& - \underset{(0,008)}{0,378\,\mathrm{PERSP}^{*}} + \underset{(0,000)}{2,778}
\end{aligned}
$$

Sample size= 46 R^2= 0,60 p-values in brackets
* Significant to 99% ** Significant to 95%

We observe that the signs for the regressors are what were expected and mentioned earlier. Thus, the existence of wooded cover positively affects LPI as does scrubland management and the age of the tree mass. On the contrary, we find factors that negatively influence valuation such as plantations, firebreaks, density and the perspective of the photograph.

The application of the model to codification of the 46 photos (Appendix A) gives us similar estimated LPIs for each photograph pair (we must recall that they were selected at the

[21] e.g. mountain livestock farming, pastures in woodland thickets, multi-activity smallholdings, traditional market gardens (op.cit. p. 33-37).

beginning of the experiment to represent *a priori* a same attribute and level[22]). Furthermore, LPI estimation corresponds with the real data, predicting differences in the same way and in a similar quantity to what is observed. At the same time, the estimation seems to correct certain anomalies observed between the valuation the individuals had made for photos that, in principle, should have had a similar, if not the same, LPI. We are referring to cases such as the 7-8 or 27-28 photo pairs (see Appendix B) with results that are very distant between the matching and non-matching pair. In these cases, the model estimates similar values in the first pair and identical values in the second.

4. Conclusions

We have proved the usefulness of identifying, through the use of in-depth personal interviews, preferences for forest or mountain landscapes that are typical in an Atlantic region of the Iberian Peninsula. This utility resulted from detecting relevant attributes and levels for citizens (and society as a whole) in particularly difficult terrain (Commission, 2000) since "... the definition of operative indicators continues to be a serious challenge in ... landscapes, habitats, biodiversity and landscape diversity"; an issue dealt with at Community level by the ELISA-DG VI Programme (*Environmental Indicators for Sustainable Agriculture*).

Some elements have been detailed to define reliable indicators related to woodland and the environment, which are obtainable without great difficulty and that, for certain EU regions such as Galicia and the North of Portugal, affect most of the rural area. Results have been obtained by means of perception questionnaires with 46 photos structured around six major attributes (with their corresponding levels). From their analysis, and in this order, the following conclusions have been obtained:

- Preference for afforestation or recuperation of traditional woodland as opposed to eucalyptus or pine plantations[23]. This result would fit in with Directive 4.2.b for sustainable woodland management in Europe when it states that "in first or second repopulating native species are preferred"[24].
- Priority to reduce mountain areas with no tree cover on over half surface area. This implies compliance with Directive 3.1.b. according to which "economic yield must take into account economic, ecological and social factors".
- The population prefers landscapes without straight or regular limits, edges, firebreaks or access paths. This result would be coherent with "management operations having to take into account all socio-economic functions, especially those that are recreational and aesthetic values" (Directive 6.2.c).
- Less dense and variably aged adult forests are also preferred, though with lesser intensity, as is non-neglect of scrubland. These results are coherent with "promoting diversity in horizontal and vertical structures, such as trees at various ages, diversity of species and mixed clumps. Practices attempt to maintain or restore landscape diversity" (Directive 4.2.c.).

[22] We should recall that the sample is made up of 23 photo pairs. One thought could be that the analysis undertaken is using repeated data, however, this is not true since, as can be seen in the codification matrix (Appendix A), each photo pair with identical attribute and principal level is not so for the other attributes and levels used in regression analysis.

[23] As in HANLEY (1993) or GOURLAY (1998).

[24] We cite Pan-European General Directives for Application at Operative Scale of Sustainable Management (Geneva, April/1998) from Appendix 2 of Resolution L2 at the 5th Meeting of Experts for Ministerial Process on Woodland Protection in Europe).

Furthermore, this information is important in order to draw up credible and relevant, hypothetical scenarios of the type needed to apply direct Environmental Economics valuation methods and thus make it possible to estimate conservation value (for different land cover and management types) for these spaces in RN2000; this is a necessary economic valuation in that, if costs are imposed upon farmers, "... it is logical that it should be society that pays for this service" (COMMISSION, 2000). Therefore, we would be giving solid basis for the economic analysis of policy measures related to forestry and environment[25], needed to conserve and improve landscape and natural heritage within the new Rural Development Policy that seems to direct the course of the old CAP. Measures and policies that, in some Atlantic regions, must necessarily be applied in forest and mountain areas.

5. References

ADAMOWICZ, W.; BOXALL, P.; LOUVIERE, J.; SWAIT, J.; WILLIAMS, M. (1999). *Stated-Preference Methods for Valuing Environmental Amenities*. In: Valuing Environmental Preferences, BATEMAN, I. & WILLIS, K. (Edit.), Oxford University Press.

BENSON, J.F. y WILLIS, K.G. (1992). "Valuing informal recreation on the Forestry Commission Estate" Bulletin 104, Forestry Commission, Edinburgh.

BIANCO, J.L. (1998). "La forêt: une chance pour la France", La Documentation Francaise, París.

BONNIEUX, F. and LE GOFFE, P. (1997). "Valuing the Benefits of Landscape Restoration", Journal of. Envir. Management 50: 321-333.

COMISION EUROPEA (1998). "Evaluación del Programa Agro-Ambiental", Doc. de Trabajo (VI/7655/98), DG VI, Bruselas.

COMISION EUROPEA (1999). "Agriculture, Environnment, Developpement rural: faits et chiffres - Les défis de l'agriculture", Bruselas.

COMISION EUROPEA (1999b) 22 final. "Pistes pour une agriculture durable", Bruselas.

COMISION EUROPEA (2000) 20 final. "Indicadores para la integración de las consideraciones medioambientales en la PAC", Bruselas.

DEARDEN, P. (1984). "Factors Influencing Landscape Preferences: An Empirical Investigation", Landscape Planning, 11 pp. 293-306.

FALINI, P. y CIARDINI, F. (1985). "La qualita visiva del paesaggio: metodi e tecniche di valutazione", Agricoltura Ambiente 25: 23-35.

GARROD, G. and WILLIS, K. (1992). "Valuing Goods` Characteristics", Journal of Env. Management 34: 59-76.

GONZALEZ, M. y PRADA, A. (1997). *Rentabilidad financiera y social de los bosques: de la madera al medio ambiente*. En: Manual de gestión del medio ambiente, Manuel A. Soler (coord.), Ariel, Barcelona.

[25] Textually named thus by Estrategia Forestal Española (MMA-DGCONA 1999:33 t.III) in appendix VII concerning Red Natura 2000. *Sustainable forestry* considering number 39 of Reg. (CE) 1257/1999 on Rural Development).

GONZALEZ, M. (1999). "Medio ambiente, políticas sectoriales e instrumentos financieros en la UE" Ciudad y Territorio, vol. XXXI, nº 121: 501-519.

GOURLAY, D. and SLEE, B. (1998). "Public Preferences for Landscape Features", Journal of Rural Studies vol 14.2: 249-263.

HANLEY, N. and CRAIG, S. (1991). "Wilderness development decisions", Ecological Economics 4: 145-164.

HANLEY, N. and RUFFELL, R.J. (1992). "The contingent valuation of forest characteristics: two experiments", Journal of Agricultural Economics vol 44: 218-229.

HANLEY, N. (1993). "The Contingent Valuation of Forest Characteristics: Two Experiments", Journal of Agricultural Economics, pp. 218-229.

HANLEY, N.; KIRKPATRICK, H.; SIMPSON, I. and OGLETHORPE, D. (1998). "Principles for the Provision of Public Goods from Agriculture", Land Economics, 74(1): 102-113.

HERZOG, T.R. (1984). "A Cognitive Analysis of Preference for Field and Forest Environments", Landscape Research, 9: 10-16.

HULL, R.B.; BUHYOFF, G.J. and DANIEL, T.C. (1984). "Measurement of Scenic Beauty: The Law of Comparative Judgment and Scenic Beauty Estimation Procedures", Forest Science, 30(4): 1084-1096.

HULL, R.B. and REVELL, G.R. (1989). "Issues in Sampling Landscapes for Visual Quality Assessments", Landscape and Urban Planning, 17: 323-330.

INSTITUTO NACIONAL DE ESTADISTICA (INE) (1996). Padrón Municipal de Habitantes, Madrid.

INSTITUTO GALEGO DE ESTATISTICA (IGE) (2000). Enquisa de condición de vida das familias. Avance de resultados, Santiago de Compostela.

KAPLAN, R. and KAPLAN, S. (1989). *The Experience of Nature*, Cambridge University Press, Cambridge, 338 pp.

KAPLAN, R.; KAPLAN, S. and RYAN, R. (1998). *With People in Mind. Desing and management of Everyday Nature,* Island Press, Washington, D.C.

MAJID, I.; SINDEN, J.A. and RANDALL, A. (1983). "Benefit Evaluation of Increments to Existing Systems of Public Facilities", Land Economics, vol.59-4, pp. 377-392.

MINISTERIO DEL MEDIO AMBIENTE (MMA) (1998). "Estrategia española para la conservación y el uso sostenible de la diversidad biológica", Madrid.

MMA - Dirección General de Conservación de la Naturaleza (DGCONA) (1999). *Estrategia Forestal Española*, Madrid.

OECD (1999). *Environmental Indicators for Agriculture. Issues and Desing*, Paris.

O`LEARY, T.; McCORMACK, A. and CLINCH, J. (2000). "Afforestation in Ireland, regional differences in attitude", Land Use Policy 17: 39-48.

PRADA, A. and VARELA, M. (1996). *Renewable Resources and Public Intervention: Woodlans and Fisheries in Spain.* In: Environmental Economics in the European Union, Carlos S. Juan & Alicia Montalvo (Eds.), Mundi Prensa y Carlos III Univ. Madrid.

PRADA, A. (2000). "Forest areas in the EU regions:CAP and environment", MEDIT, Journal of Economics, Agriculture and Environnement 2/2000 pp. 52-61, Bologna.

PRADA, A. (Director) (2001). *Valoración Económica del Patrimonio Natural*, Fundación Pedro Barrié-Banco Pastor, A Coruña.

SANTOS, J.M. (1999). *The Economic Valuation of Landscape Change*, Edward Elgar, Cheltenham, UK.

SANTOS, J.M. (2001). *Nature and Landscape Conservation Benefits.* In: Environmental Economics and Society, PRADA, A. & VAZQUEZ, M.X. (Editores) Consello da Cultura Galega, Santiago de Compostela.

SHAFER, E.L.; HAMILTON, J.F. and SCHMIDT, E.A. (1969). "Natural Landscape Preferences", Journal of Leisure Research, 1: 1-19.

STAMPS, A.E. (1990). "Use of Photographs to Simulate Environments: a Meta-Analysis", Perceptual and Motor Skills, 71: 907-913.

STANNERS, D. y BOURDEAU, P. (Edit) (1998). *Medio ambiente en Europa - El Informe Dobris,* MMA, Madrid.

TAHVANAINEN, L.; TYRVÄINEN, L.; IHALAINEN, M. VUORELA, N. and KOLEHMAINEN, O. (2001). "Forest Management and Public Perceptions, Visual versus Verbal Information", Landscape and Urban Planning, 53: 53-70

TEMPESTA, T. (1993). "La Valutazione del Paesaggio Rurale Tramite Indice Estetico-Visivi e Monetari", Genio Rurale nº 2 pp. 44-54.

TEMPESTA, T. (1998). "The Economic Value of Rural Landscape: An Application to the Area between Isonzo and Taliamento Rivers (Friuli-Venezia Giulia)". In Bishop, R.C. and Romano, D. (1998). *Environmental Resource Valuation*. Kluwer Academic Publishers, USA.

THURSTONE, L.L. (1927). "A Law of Comparative judgment", Psychol. Rev. 34:273-286

TINDALL, D. (2001). *Why do You Think that Hillside is Ugly? A Sociological Perspective on Aesthetic Values and Public Attitudes About Forest*. In: Forest and Landscapes, SHEPPARD, S.R.J. y HARSHAW, H.W. (Edit.) CABI, UK.

WALSH, R.; LOOMIS, J. and GILLMAN, R. (1984). "Valuing Option, Existence, and Bequest Demands for Wilderness", Land Economics, vol. 60-1, pp. 14-29.

WHERRETT, J.R. (2000). "Creating Landscape Preference Models Using Internet Survey Techniques". Landscape Research, 25(1), pp. 79-96.

WHERRETT, J.R. (2001). *Predicting Preferences for Scenic Landscapes Using Computer Simulations.* In: Forest and Landscapes, SHEPPARD, S.R.J. y HARSHAW, H.W. (Edit.) CABI, UK.

WHITBY, M. (1996). The European Environment and CAP Reform, CAB International.

APPENDIX A: CODIFICATION MATRIX : 46 photos x 17 variables

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
2	0	0	1	0	0	1	0	0	0	0	2	1	1	1	1	0
2	0	0	1	0	0	1	0	0	0	0	1	1	1	1	1	1
1	0	0	1	1	0	0	0	0	0	1	2	1	1	1	1	1
1	0	0	1	0	0	1	0	0	1	1	0	1	1	1	0	0
1	0	0	1	1	0	0	0	0	0	1	2	1	1	1	0	1
1	0	1	0	1	0	0	0	0	1	1	1	0	1	1	0	0
1	0	0	1	0	0	1	0	0	0	1	0	0	1	1	1	1
0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	0	1
0	0	0	1	0	0	1	0	1	0	0	1	0	1	1	1	1
0	0	0	1	1	0	0	0	0	0	0	1	0	1	0	1	1
2	0	1	0	0	1	0	0	0	1	0	1	1	0	0	1	1
2	0	1	0	0	1	0	0	0	0	1	1	0	0	0	1	1
2	0	1	0	1	0	0	0	0	0	0	1	1	1	0	1	1
2	0	1	0	1	0	0	0	0	0	0	2	1	0	1	1	1
1	1	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0
2	1	0	0	1	0	0	0	0	0	0	2	1	1	1	1	1
2	1	0	0	1	0	0	0	0	0	0	2	1	1	1	1	1
2	1	0	0	1	0	0	0	0	0	1	2	1	1	0	1	0
0	0	0	1	0	0	1	0	0	0	0	1	0	1	1	1	0
0	0	0	1	0	0	1	1	0	0	0	0	0	1	0	1	1
0	0	0	1	1	0	0	0	0	0	1	1	1	0	0	1	1
0	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	0
1	0	0	1	1	0	0	0	0	0	1	1	1	0	0	1	0
0	0	0	1	1	0	0	0	0	0	0	1	1	0	0	0	0
1	1	0	0	0	0	1	0	0	1	0	1	1	1	1	1	0
1	1	0	0	0	1	0	0	0	1	0	1	0	1	1	1	1
1	0	0	1	0	1	0	1	1	1	0	1	1	1	1	1	1
1	0	0	1	0	1	0	1	1	1	0	1	1	1	1	1	1
1	0	1	0	0	1	0	1	0	1	0	1	1	1	0	1	1
0	0	0	1	0	0	1	1	0	0	0	1	0	1	0	1	1
1	0	1	0	0	0	1	1	0	0	0	1	0	1	1	1	1
2	0	1	0	1	0	0	0	0	0	1	1	1	0	0	1	0
2	0	1	0	0	1	0	0	0	0	0	2	0	0	0	1	0
2	0	1	0	0	1	0	0	0	0	0	2	0	0	0	1	1
1	0	1	0	0	0	1	0	0	0	1	1	0	1	0	0	0
1	0	0	1	1	0	0	0	0	0	1	0	0	1	0	1	0
2	0	1	0	1	0	0	0	0	0	0	1	1	0	0	1	1
2	0	1	0	0	1	0	1	0	0	1	0	1	1	1	0	1
2	1	0	0	1	0	0	0	0	0	0	2	1	0	0	1	0
2	1	0	0	0	0	1	0	0	0	0	2	1	0	1	1	1
1	1	0	0	0	1	0	0	0	1	1	0	0	0	0	1	1
1	1	0	0	0	1	0	0	0	0	0	2	0	1	0	1	1
2	1	0	0	0	1	0	0	0	1	0	2	0	0	0	1	0
1	1	0	0	0	0	1	0	0	0	1	2	0	0	1	1	1
2	1	0	0	1	0	0	0	0	0	1	1	1	0	0	1	0
2	1	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0

APPENDIX B
Perception Test Results
Landscape Preference Index (scale of 1 to 5)
Over the Total Number of Images

Photo nº	Attributes and levels	Preferences over Total	
		Odd	Even
	i. FRACTION OF WOOD COVER AND SCRUB		
1,2	Total tree cover of area. Undefined in panoramic view	**2.87**	**3.25**
3,4	Trees on 75% and the rest with scrub and thicket	**3.12**	**2.73**
5,6	Similar areas for both uses	**3.33**	**2.55**
7,8	25% woodland and the rest open countryside	**3.09**	**1.96**
9,10	Absence of woodland but with total scrub cover	**2.44**	**3.50**
	ii. TREE COVER TYPE		
11, 12	Conifer plantations	**3.10**	**3.09**
13, 14	Eucalyptus plantations	**2.80**	**2.95**
15,16	Traditional replanted woods (single-species)	**3.91**	**3.82**
17,18	Seminatural traditional woods (multi-species)	**3.00**	**3.32**
	iii. LOCATION AND MANAGEMENT OF SCRUB LAND		
19,20	Actively managed scrub land	**2.44**	**2.00**
21,22	Abandoned highland scrub land	**3.15**	**2.40**
23,24	Woody Abandoned scrub land	**2.32**	**2.43**
	iv. VISUAL MANAGEMENT ASPECTS		
25,26	As nº 5-6 with no tracks or firebreaks and with irregular edges	**2.69**	**2.78**
27,28	As nº 5-6 with regular paths, firebreaks and edges	**2.98**	**1.72**
29,30	As nº 5-6 with all elements, but irregular ones	**3.47**	**3.20**
	v. AGE, HEIGHT AND DENSITY		
	v.i. Conifers		
31,32	As photos nº 11-12 but of similar age and dense	**2.67**	**3.13**
33,34	As photos nº 11-12 but of similar age and not dense	**3.95**	**3.49**
35,36	As photos nº 11-12 not of similar age and not dense	**2.75**	**3.29**
37,38	As photos nº 11-12 not of similar age and dense	**3.15**	**3.12**
	v.ii. Traditional woodlands		
39,40	As photos nº 15-16 but of similar age and dense	**3.91**	**3.52**
41,42	As photos nº 15-16 but of similar age and not dense	**4.03**	**4.42**
43,44	As photos nº 15-16 not of similar age and not dense	**4.41**	**3.22**
45,46	As photos nº 15- not of similar age and dense	**4.09**	**3.36**

N=200, average LPI.

APPENDIX C
Perception Test Results
Landscape Preference Index (scale of 1 to 5)
Over Images of Each Attribute

Photo nº	Attributes and levels	Preferences over Attribute	
		Odd	Even
	i. FRACTION OF WOOD COVER AND SCRUB		
1,2	Total tree cover of area. Undefined in panoramic view	**2.84**	**3.17**
3,4	Trees on 75% and the rest with scrub and thicket	**3.18**	**2.66**
5,6	Similar areas for both uses	**3.15**	**2.69**
7,8	25% woodland and the rest open countryside	**3.01**	**1.69**
9,10	Absence of woodland but with total scrub cover	**2.12**	**3.04**
	ii. TREE COVER TYPE		
11, 12	Conifer plantations	**2.60**	**2.90**
13, 14	Eucalyptus plantations	**2.39**	**2.27**
15,16	Traditional replanted woods (single-species)	**3.89**	**3.90**
17,18	Seminatural traditional woods (multi-species)	**3.03**	**3.05**
	iii. LOCATION AND MANAGEMENT OF SCRUB LAND		
19,20	Actively managed scrub land	**2.98**	**2.63**
21,22	Abandoned highland scrub land	**3.81**	**3.00**
23,24	Woody Abandoned scrub land	**2.72**	**2.88**
	iv. VISUAL MANAGEMENT ASPECTS		
25,26	As nº 5-6 with no tracks or firebreaks and with irregular edges	**2.94**	**3.11**
27,28	As nº 5-6 with regular paths, firebreaks and edges	**3.14**	**1.78**
29,30	As nº 5-6 with all elements, but irregular ones	**3.72**	**3.32**
	v. AGE, HEIGHT AND DENSITY		
	v.i. Conifers		
31,32	As photos nº 11-12 but of similar age and dense	**2.69**	**2.79**
33,34	As photos nº 11-12 but of similar age and not dense	**3.92**	**3.64**
35,36	As photos nº 11-12 not of similar age and not dense	**2.63**	**3.08**
37,38	As photos nº 11-12 not of similar age and dense	**2.65**	**2.65**
	v.ii. Traditional woodlands		
39,40	As photos nº 15-16 but of similar age and dense	**2.84**	**2.63**
41,42	As photos nº 15-16 but of similar age and not dense	**2.91**	**4.05**
43,44	As photos nº 15-16 not of similar age and not dense	**4.20**	**2.01**
45,46	As photos nº 15- not of similar age and dense	**3.24**	**2.15**

N=200, average LPI.