

Summary of the case study on valuation of the forest ecosystem services

Title of the valuation study: Estimation of forest values using choice modelling: An application to Spanish forests

Author(s): Raul Brey, Pere Riera, Joan Mogas

Affiliation: Pablo de Olavide University, Autonomous University of Barcelona, Rovira i Virgili University

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Objectives of the study

One of the most significant land-use changes over the last decades in Europe was afforestation of large areas of post-agricultural lands. European Union's financial support for these programs led to afforestation of some 1 Mio hectares in Spain until 1999 (EC Regulation 2080/92 and 1257/99). In 2007, Catalonia reviewed the implementation of a new afforestation program.

Social benefits of a possible afforestation program of 10% of the total area in Catalonia were estimated. Using a Choice Modelling (CM) approach, individual's ratings of attributes representing recreational and environmental functions of forests were analysed. The knowledge about the extent of the benefits that the "new forests" provide to Catalonian society is very limited. Their estimation should constitute a significant source of information for decision making processes, forest managers, forest policy design and the development of financial instruments.

Scope of the study

The ecosystem services valued in the study were provisioning services (mushrooms), regulating services (CO₂ sequestration, erosion prevention), and cultural services (recreation, picnic, car-driving in the forests). A regional geographical scope was covered.

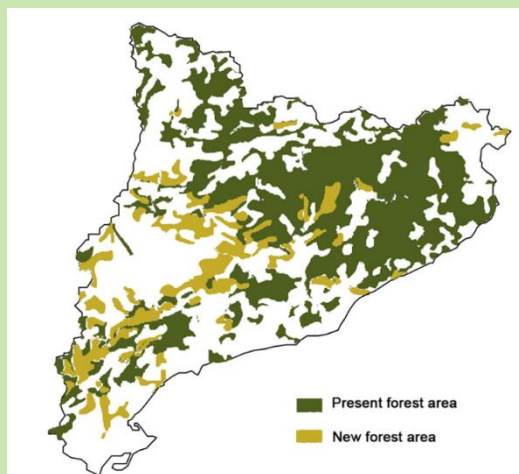


Fig. 1 – Forest areas in Catalonia before and proposed expansions.

Catalonia is located in the North-East of Spain, with an area of 32,100 km². The majority of the region is under Mediterranean climate with a forest cover of 1.3 million ha. Regarding forest ownership, slightly more than three-quarters of the Catalan forest area belong to private owners. Due to the low profitability of the timber industry, commercial forests represent only 2% of the agrarian production in Catalonia. Therefore, some of the Catalan forests provide mainly non-market goods (recreational opportunities, non-timber-products, carbon sequestration, erosion prevention and biodiversity preservation). An afforestation program could raise the forest cover from 40% to 50% of the total area (Fig. 1).

Valuation method(s) applied

In **choice modelling**, different sets of alternatives (choice sets) defined by attributes with different levels are presented to individuals, who express their preferences for the alternatives as "better than" or as "worse than" a business-as-usual (BAU).

The new forests were characterized by six attributes with varying levels. For the valuation survey, four focus

groups were conducted in a **pre-test** study with 100 residents. The attributes selected included recreational activities (picnicking, picking mushrooms, and driving motor vehicles on forest ways), environmental functions of forests (CO₂ sequestration and erosion prevention), and the program costs. The payment vehicle was a mandatory yearly contribution to a fund. By making one of the attributes a price or cost term, marginal utility estimates could be converted into willingness-to-pay (WTP) estimates for changes in attribute levels, and welfare estimates obtained for combinations of attribute changes. The elicitation format was consistent with the **Random Utility Maximization model**.

From the attributes and levels, 512 different alternatives were obtained. Thus, a main effect **fractional factorial design** reduced the number of alternatives to 16, which were grouped in 4 choice sets composed of 4 alternatives, including the option of the business-as-usual situation.

In a **Contingent Choice experiment** with 800 individuals, the respondents selected the most preferred alternative from several differing in terms of attributes and levels. Thus, the **econometric model** was formulated as a **random parameter logit model** for panel data. Hence, each respondent made a series of binary comparisons to the BAU option. In that way, the coefficients entering the utility function varied over individuals and were constant over the choice situation for each person.

The first model showed estimates obtained using a fixed parameter logit model and including exclusively the attributes and a BAU dummy as explanatory variables. In **the second model** socio-economic variables were included (Use/Nonuse; Smalltown/Largetown; Age). **The last model** allowed for some parameters of the second model to vary over respondents. The random coefficients were determined by combining two different approaches. One was based on estimating different models using the **Likelihood Ratio test**. The other procedure was based on **the Lagrange Multiplier test**. From the estimated random parameter logit model, the mean marginal WTP for the different forest attributes could be estimated.

Key results

- Strong perception of Mediterranean forests as public or collective goods led to high WTP in Catalonian public.
- Forests provided significant non-market values to the public, far beyond those held by forest landowners.
- Catalans would annually pay an average of 11.79 €/year for the forests to sequester 68,000 tons of CO₂, 0.12 €/year for delaying the loss of land productivity for ten years, and 6.33 €/year for the possibility to picnic in the new forests. Being allowed to pick mushrooms in the new forests is valued at 12.82 €/year by those respondents who live in rural areas.
- Local people would experience a loss in welfare equivalent to -9.67 € if four-wheel driving would be allowed in the new forests.