Journal of Forest Economics 16 (2010) 83–100

Contents lists available at ScienceDirect

Journal of Forest Economics

journal homepage: www.elsevier.de/jfe

Landowner net benefit from Stone pine (*Pinus pinea* L.) afforestation of dry-land cereal fields in Valladolid, Spain ☆

Paola Ovando [a,*], Pablo Campos [a,*], Rafael Calama [b], Gregorio Montero [b]

[a] *Institute for Public Goods and Policies (IPP), Spanish National Research Council (CSIC), C/Albasanz, 26-28. 28037 Madrid, Spain*
[b] *Centre of Forestry Research (CIFOR), Spanish National Agriculture and Food Research Institute (INIA), Spain*

ARTICLE INFO

Article history:
Received 27 May 2008
Accepted 21 July 2009

JEL classification:
Q23
Q54
Q58

Keywords:
Cost–benefit analysis
Silviculture models
Carbon sequestration
Government subsidies

ABSTRACT

This analysis measures the net benefit that a landowner could obtain from changing current dry-land cereal fields into Stone pine plantations in Portillo and Viana (Valladolid, Spain). We apply cost–benefit analysis techniques to estimate the present value of Stone pine afforestation net benefit by considering an infinite series of forestry rotations. We simulate three Stone pine silviculture models at each of the two sites. In addition, we estimate landowner extended net benefits from Stone pine afforestation when we consider a hypothetical payment for the carbon sequestration service. Results show that, when government subsidies are included, Stone pine afforestation only offers positive landowner net benefit in Portillo when both medium and high-stocking silviculture models are applied. Taking into account carbon prices up to €45 tC^{-1} (€12.3 tCO_2^{-1}), Stone pine afforestation gives landowner positive extended net benefits for the three silviculture models simulated at the Portillo and Viana sites.

☆ P. Ovando and P. Campos wrote the original text and revisions, and were responsible of collecting the economic information on revenues and cost and applying the cost benefit analysis techniques used. R. Calama and G. Montero developed the PINEA 2 model application for simulating the three different operative silviculture models for Stone pine stand in two representative sites of Valladolid province, and attended to the technical forestry revision required by two anonymous reviewers.

* Corresponding authors. Tel.: +34 91 602 2790/2535; fax: +34 91 602 2971.
E-mail addresses: paola.ovando@cchs.csic.es (P. Ovando), pablo.campos@cchs.csic.es (P. Campos).

1104-6899/$ - see front matter © 2009 Elsevier GmbH. All rights reserved.
doi:10.1016/j.jfe.2009.07.001

Introduction

Spanish national and regional governments have subsidized large afforestation programmes following the implementation of the 1992 and 1999 European Union (EU) Common Agricultural Policy (CAP) reforms. EU grants for afforestation on crop and pasture lands was noteworthy in Spain, which was partly favoured by the higher Community part-financing as an Objective 1 region. Indeed, Spain accounts for 45% of the areas afforested under Regulation 2080/1992 within the EU-15 (IDF, 2001). Evergreen oak species were the preferred choice in Spain (covering 50% of the planted area), while pure and mixed plantations of Stone pine (*Pinus pinea* L.) make up 6% (23,500 ha) of the Spanish afforested area in the period 1993–1999 (MAPA, 2002). More than 50% of these Spanish Stone pine plantations were established in Castilla-León, where this species is widely used for afforestation in semiarid climate zones (Junta de Castilla y León, 2002). Thus, the number of Stone pines has notably increased in Valladolid over the past decade[1] (STMA, 2008).

The Stone pine is one of the most widely spread conifers in the Iberian Peninsula and it grows in almost all of the countries of the Mediterranean basin. In Spain, the Stone pine covers a surface area of over 400,000 ha, which represents around 50% of its world distribution range (Montero and Cañellas, 2000). Stone pines cover, as the dominant species, 48,000 ha in Valladolid province (Castilla-León, Spain), which represent 39% of its total forested area (STMA, 2008). In Valladolid, 43% of the area in which Stone pines grow is classified as *montes de utilidad pública* (MUPs) – woodlands regulated by a special Spanish forestry law – which are owned and managed by different public entities, with the remaining 57% being privately owned (DGCN, 1996). The private forests are frequently divided up into extremely small plots, which in Valladolid results in 96% of private forests belonging to estates of less than 10 ha (STMA, 2008).

Private and public benefits from Spanish Stone pine afforestation have scarcely been analysed (e.g. Campos, 1998; Mutke et al., 2000), in part due to the previous data shortcomings on this species' timber growth functions, and pine cone yields. However, the Stone pine does not seem to be an exception, since the published references of cost–benefit analyses dealing with the benefits of afforestation programmes in Western Mediterranean countries are quite scarce (e.g. Díaz-Balteiro and Romero, 1995; Mutke et al., 2000; Campos et al., 2003; Tassone et al., 2004; Ovando et al., 2009). Recent advances made regarding the modelling of Stone pine management in Valladolid province enable us to undertake a cost–benefit analysis of Stone pine afforestation. We simulate the application of three silviculture models considering complete Stone pine productive cycles (Calama et al., 2007). These models are differentiated by average stand density and main production aim (cone or timber) at two representative Stone pine sites in Valladolid province (Spain), namely *Portillo* and *Viana*. Both sites differ in their higher natural productivity, with pine cones predominating in Portillo and timber in Viana. The reduced size of a relevant share of private forests in Valladolid province, as mentioned above, hinders and increases the cost of the application of those forestry techniques typically employed for favouring timber and pine cone growth, as they are the three silvicultural models simulated in this study. Therefore, our results refer to the extended net benefits that industrial private or public landowners would attain from Stone pine afforestation and management.

Stone pines traditionally supplied joint products such as resin, bark (for tannins), pine cones, timber and firewood; and, to a lesser extent, hunting and grazing practiced by the local population and landowners (Campos, 1998; Mutke et al., 2000; Montero et al., 2004; Calama et al., 2008). Resin and bark are no longer harvested, while the demand for timber, firewood and grazing is in decline (Mutke et al., 2000; STMA, 2008). More recently, government policy has aimed to encourage the production of higher quality cones, which is being upheld to adapt to the supply needs of Spanish industry, now the world's largest processor with a share of close to 45% of total world pine nut production (Barranco and Ortuño, 2004). All these goods and services (except resin and bark) are

[1] In the 10-year period between the Second and Third Spanish National Forestry Inventories, stocks of *Pinus pinea* (the number of standing trees belonging to diametrical classes equal to or greater than 10 cm) increased by 37% (STMA, 2008).