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SCIENCE DIRECT
Agriculture, Ecosystems and Environment 115 (2006) 88–96
Agriculture Ecosystems & Environment
www.elsevier.com/locate/agee

Land terracing for new vineyard plantations in the north-eastern Spanish Mediterranean region: Landscape effects of the EU Council Regulation policy for vineyards' restructuring

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Received 28 July 2005; received in revised form 24 November 2005; accepted 29 November 2005
Available online 17 February 2006

Abstract

The landscape of Mediterranean mountain areas in north-eastern Spain, in particular lands traditionally devoted to vineyard cropping, is rapidly changing. This is due to new terrace construction, being built without any environmental impact considerations utilizing heavy machinery. The European Union regulation policy for vineyards' restructuring, which subsidize up to 50% of the land terracing costs, encourages this activity. A clear example of this situation occurs in the Priorat region (Catalonia, NE Spain), where vineyards were first cultivated in the XII century on hillslopes with terracing systems utilizing small stone walls. However, since the 1980s–1990s, the viticulture boom is based on a new terracing system, relying on mechanization and resulting in high negative environmental and landscape impacts. This paper tackles several aspects that this modern land terracing/vineyard system has initiated in the Priorat: (a) the land use changes and rates of changes during the last two decades, in order to determine the magnitude of the environmental and landscape dynamics problem, (b) the assessment of the terrain morphology changes due to land terracing (volumes of soil displaced, slope morphology and slope degree changes) and (c) an analysis of the cost of the restructuring operations, mainly land terracing, subsidized by the EU policy for vineyards' restructuring. In this respect, the effects of this policy are discussed. The results show that modern land terracing methods produce huge material displacements (about 9460 $\pm$ 900 Mg ha^{-1}). These figures approximate the range of catastrophic natural mass movements and confirm land terracing as an antrophic geomorphic processes which is rapidly reshaping the terrain morphology. Land terracing costs, which represent 34% of the total costs for a new terraced vineyard, is the operation which receives the maximum EU subsidy. This has encouraged vine growers in the Priorat region to create new plantations, increasing significantly the transformation rate from 7.5 ha year^{-1} between 1986 and 1998 to 36.1 ha year^{-1} in the 1998–2003 period.

Keywords: Land terracing; Land use change; Vineyards' restructuring; Landscape effects; EU policy

1. Introduction

One of the most distinctive components of the landscape of Mediterranean mountain environments is agricultural terraces (Douglas et al., 1994, 1996; Gallart et al., 1994; Dunjó et al., 2003). They are mostly cropped in almond, hazelnut and olive trees as well as vineyards. Most of the historical terraces are of bench type with stone walls. They needed a large amount of labour since they were built and maintained by hand. Their main function is soil conservation, accomplished by reducing slope on the cultivated land and allowing run-off from the upper side of the terrace to spread out and infiltrate on the bench portion. While conserving soil and water and facilitating a more intensive cropping in steep lands (Landi, 1989), land terracing has introduced specific human induced geomorphic processes, that often are the most effective soil erosion and landscape changing processes acting at the field and hill-slope scales (Borselli et al., 2006).

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0167-8809/$ – see front matter
doi:10.1016/j.agee.2005.11.030

Although, during the last 50 years, land levelling and terracing have gained an important role in European agriculture, whenever and wherever the profit (market trends and subsidies) was threatened by local morphology (Zalidis et al., 2002; Borselli et al., 2006), problems or impacts associated with their implementation have not been widely studied. One of the best examples of extensive land levelling, promoted by agricultural policies, is Norway (Lundekvam et al., 2003). It was extensively introduced during the 1970s when subsidies encouraged the alteration of ravine landscapes into arable land. In other countries such as Hungary, Italy, Portugal or Spain, land levelling and terracing operations have concentrated on mechanized vineyard cultivation (Borselli et al., 2006). In Italy, particularly in Tuscany, vineyard plantations increased by 90,000 ha from 1968 to1975. Here soil movement due to land levelling was estimated at 300 Mg ha^{-1} $year^{-1}$ (Borselli et al., 2002).

In Spain, the admission to the European Union after 1986 has been one of the main driving forces for agriculture development. The acreage of rainfed tree crops such as almonds and olives has expanded rapidly in the south east (Faulkner et al., 2003; Van Wesemael et al., 2004). Vineyards have also increased areally, even into marginal areas, encouraged by policies that subsidize the conversion of old to new plantations to favour qualified productions. This expansion into marginal areas is stimulated by the EU Common Agricultural Policy which directly subsidizes modernisation of extensive plantations as well as supports rural development and the agro-industry (Beaufoy, 2003). In vineyard areas of NE Spain, such as the Penedès (Catalonia), this has led to increases in land levelling to reduce slope gradient and increase field size, removing old terraces and reshaping the land for the creation of modern mechanized plantations (Jiménez-Delgado et al., 2004). These authors reported that slope lowering by levelling without the implementation of broadbase terraces increased average annual soil loss by 26.5%.

Operations for land transformation as levelling or terracing are poorly regulated. Design and implementation usually rely on the field owner or on the person in charge of the machinery. No technical guidance is available (Borselli et al., 2006). In addition, land transformation operations are usually not or scarcely regulated by environmental impact laws. To a large extent, levelling or terracing escapes any environmental or legal controls.

A clear example of this situation is the Priorat region (Catalonia, NE Spain) (Fig. 1). This wine producing area traditionally had vineyards with terracing systems limited to small stone walls (Fig. 2). The maximum zenith of vineyards was in the late 18th and 19th centuries, when vineyards occupied 74% of the land (Morera, 1915). This traditional terracing system did not produce a significant topographic transformation of the landscape, since it did not build level or nearly level platforms, which would have required large cutting and filling. During the first half of the 20th century, a crisis in the agricultural sector resulted in the depopulation of rural area and concomitantly deintensification and abandonment of agricultural land (Douglas et al., 1994, 1996; Lasanta et al., 2001). This situation was only partially overcome in the Priorat in the 1990s, when a small group of producers introduced new vinification and marketing techniques, which pushed the wines towards the top of the international market.

The expansion of vineyards was stimulated by the EU Common Agricultural Policy through the restructuring and conversion plans (Commission Regulation EC No. 1227/2000 of 31 May 2000, which specifies detailed rules for the application of Council Regulation EC (1493/1999) as regards production potential). The main objective of these plans is to adapt production to market demand. The policy considers both compensation for the loss of earnings during

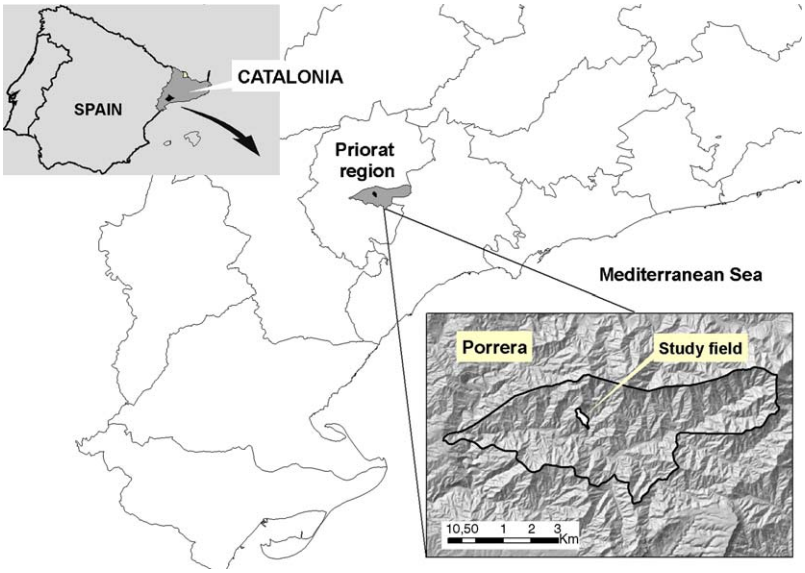

Fig. 1. Location of the study area.