Ecological Modelling 222 (2011) 1303–1314

Contents lists available at ScienceDirect

Ecological Modelling

journal homepage: www.elsevier.com/locate/ecolmodel

Terraced fields and Mediterranean landscape structure: An analytical case study from Antikythera, Greece

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ARTICLE INFO

Article history:
Received 7 October 2010
Received in revised form
14 December 2010
Accepted 16 December 2010

Keywords:
Logistic regression
Monte Carlo simulation
Spatial autocorrelation
Demography
Erosion
USPED
RUSLE

ABSTRACT

Terraces are important capital investments in a range of agricultural landscapes worldwide, typically enduring well beyond any single farming cycle and over many human generations. This paper begins by emphasising that, while human population growth may often be loosely linked to terrace construction efforts, the association is by no means a straightforward one. We then argue that the choice of which parts of the landscape to terrace is driven by a range of cultural and environmental priorities that are most usefully explored by a combination of global, local and auto-correlative modelling, as well as via simulation-based methods. The results demonstrate that surficial geology, terrain slope, pre-existing terraces and pre-existing patterns of human habitation are all important structuring features. We also consider terraces as method for soil conservation, question the uncritical use of meso-scale erosion models and argue that patterns of catastrophic soil loss are often overstated in Mediterranean contexts. However, erosion modelling can, if deployed cautiously and comparatively, nonetheless be used to explore ways in which terraces do indeed manage localised soil movement in agriculturally favoured parts of the landscape, with our results suggesting that a substantial proportion of the erosion in this regions is indeed ameliorated by such measures.

1. Introduction

Terraces are highly flexible forms of agricultural construction used by farmers in tropical to semi-arid environments to convert hillslopes into stepped linear units of relatively flat ground that are suitable for cultivation. Although they share the common function of increasing available arable land, they vary considerably in shape, complexity and degree of labour investment, as well as in the environmental setting in which they are deployed. Their ubiquity, variability, and importance for agricultural productivity have motivated a range of studies designed to understand them better both as cultural and ecological features (e.g. Donkin, 1979; Evans, 1990; Lansing and Kremer, 1993; Dunning et al., 1994; Price and Nixon, 2005; Rodríguez, 2006, among many others). Terracing processes are often thought to involve increased exploitation of marginal landscapes by expanding local populations and/or by new colonists (e.g. Coote and Whitelam, 1987: 129; Donkin, 1979: 33, 133; Kunen, 2001), although it is far from clear whether this is the motivating factor in all situations in which terraces are found.

Terraced agricultural fields are a defining feature of Mediterranean landscapes and their antiquity and socioecology has been the subject of considerable interest (e.g. in the Aegean, Whitelaw and French, 1999; Frederick and Krahtopoulou, 2000; Grove and Rackham, 2001; Price and Nixon, 2005). However, the socioecological contexts under which such built features emerge and persist remains poorly understood, despite their obvious relevance to modern concerns about sustainable land use, erosion control, water management and food production. This paper seeks to address this problem by exploiting an exhaustive mapping of terraces across the Greek island of Antikythera. There are three objectives. First, we aim briefly to address the demographic context in which terraces emerge and demonstrate, at least for the more recent history of the island's occupation, that there is no immediate link between population growth and terrace expansion. Second, we develop a spatial model to explore the aggregate human preferences behind the landscapes chosen for terraced agriculture in order to formalise and develop further our understanding of their locational characteristics. Finally, we examine the role that terraces play in soil conservation via two kinds of meso-scale erosion model. In so doing, we also revisit some of the key methodological challenges associated with quantitative assessment of built structures at the landscape scale.

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doi:10.1016/j.ecolmodel.2010.12.016

2. Research context

In the Mediterranean, up until the recent and more haphazard use of bulldozers, terrace construction has typically involved the use of stacked and/or interlocked dry stone risers that act as the walls or retainers to support beds of level soil ('treads') of varying depth for a wide assortment of cereal crops, vegetables, vines and fruit trees. In addition, although explicit control of soil movement has not always been the primary concern of the farmers who construct dry-stone wall terraces, nevertheless such features do reduce the effects of hillslope erosion. For these reasons, terraces and other dry-stone wall features, such as enclosures and houses, are in fact an important form of niche construction (Odling-Smee et al., 2003) that provide significant adaptive benefits for the constructors as well as for later inhabitants. Such investment therefore has both anticipated and unanticipated uses beyond the current farming cycle and/or over many human generations, making them a well-regarded form of *landesque* capital (Blaikie and Brookfield, 1987: 9–10; Widgren, 2007).

Our focus below is on the development of appropriate modelling methods to understand the environmental niches in which terraced agriculture is most common, and to consider what subsequent landscape impact terraces might have had, particularly with regard to erosion. We draw on recent landscape research on Antikythera—a small (20.8 km^2, maximum altitude 379 m) and relatively remote Greek island, lying midway between Kythera and western Crete in the southwest Aegean (Fig. 1a). Antikythera's terraced fields are not necessarily special or unusual by comparison to others in the Mediterranean, but as an analytical context, the island offers four important advantages. First, it is possible to acquire a close to complete feature-by-feature sample of the relict terraces across Antikythera during the last phase of the island's occupation. Second, we can also consider earlier possible terrace use in the context of a relatively comprehensive understanding of prior settlement patterns, due to the rare, if not unique, case of having conducted an intensive archaeological survey of the island's entire extent (for the method, see Bevan et al., 2008; Bevan and Conolly, 2009). Third, the island has experienced a dynamic history of human exploitation, cycling between phases of relatively substantial settlement for its size (in recent times, 10–45 people per km^2, with what appears often to be comparable levels in the past) and periods of near complete abandonment. This episodic settlement history is analytically more convenient that the complex and continuous conditions that typically prevail in other regions and offers a useful set of simplifying conditions under which to consider terrace construction and particular phases of the island's past.

Terraces are notoriously difficult to date, but slow progress has been made in assessing their antiquity in the Mediterranean and some systems of this kind clearly extend back to as early as the Bronze Age (e.g. Gibson, 2001; Krahtopoulou and Frederick, 2008). While some terrace systems were undoubtedly constructed in antiquity (see also Price and Nixon, 2005), there is little direct archaeological evidence to support (or refute) the relationship between historic population growth and terrace construction, largely because of the difficulty of directly dating terrace systems.

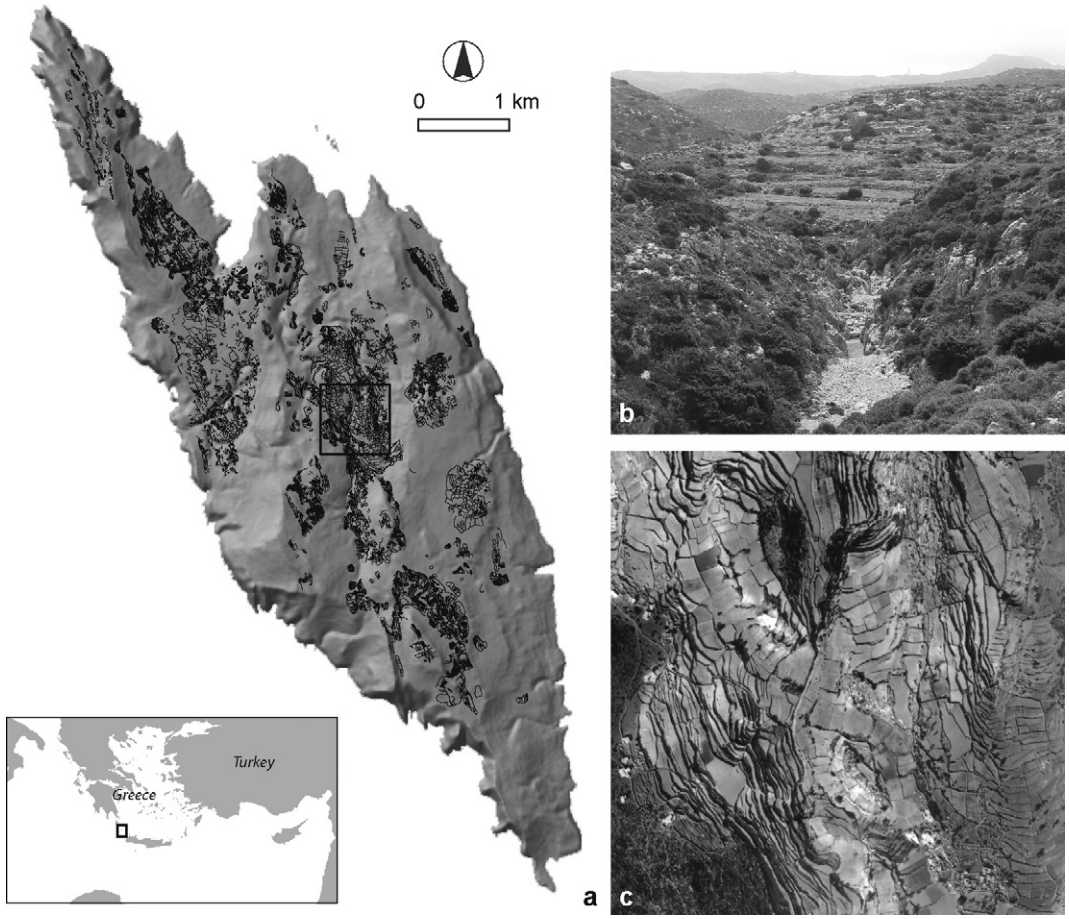

Fig. 1. (a) A map of Antikythera (as a hillshade surface) and its extant systems of agricultural fields, (b) a set of hillslope and cross-channel terraces on the north side of the island, (c) an aerial photograph of terrace systems in the centre of the island (see (a) inset box), taken in February 1944 just before the forced removal of the island's inhabitants to Crete (courtesy of the Aerial Reconnaissance Archive).