TERRACE CONDITION AND AGRICULTURAL CHANGE IN THE ISLANDS OF THE MEDITERRANEAN REGION

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ABSTRACT: The farming of thin soil in hilly, semi-arid regions of the Mediterranean basin, has bequeathed a reworked landscape dominated by terraces. These structures have represented elements of stability in an otherwise fragile environment for over a thousand years. In many areas, agricultural activity is now declining rapidly as local and regional economies are restructured and social expectations transformed. Abandonment of terraced terrain threatens to aggravate already serious soil erosion problems, degrade a central aesthetic component of the Mediterranean landscape, and obscure valuable geographic evidence regarding patterns of land tenure. As part of the broader task of assessing the extent and pace of local change, this paper proposes a method of measuring terrace decay in order to establish an index of local agricultural decline. Such measurements are an essential first step in damage mitigation.

INTRODUCTION

Examples of terracing as a means to optimize marginal agricultural conditions on sloping terrain may be found in many countries around the world, from the Pacific Islands to Southeast Asia, through Central and South America, to the islands of the Mediterranean region. Over time, and with much labor and ingenuity, intensive terracing forms a reworked landscape that melds agricultural form with function. In contrast to the common characterization of humans as despoilers of landscape (Goudie 1986), terracing provides a measure of geomorphological stability in a remarkably harmonious and enduring contract between soil, slope, and farmer.

The function of terraces as effective conservers of soil and moisture have met an ancient necessity along the shores of Mediterranean and its connected seas, and particularly in the islands of the region (see Appendix). Terrace cultivation was introduced into the Balearic Islands by the Muslims and, similarly, into the Maltese archipelago between the eighth and eleventh centuries. In some areas, intensive terracing is the most dominant physical feature in the landscape. In all cases, terracing can serve as a stabilizing element in an area highly susceptible to soil loss.

The Herculean effort of leveling terraces and constructing retaining walls, together with the tasks of constant maintenance, could only be justified, according to Houston (1971, p. 123) by locally high population densities. Cases of abandonment or disrepair of the terraces, it is claimed, can be attributed to subsequent depopulation or lessening of required density thresholds. It is argued here that the currently very high vulnerability to terrace decay reflects broad and powerful structural changes that are not only demographic, but also technological, social and economic. These changes have been in train since at least the 1940s (Diakosavvas 1993) and continue to profoundly effect the status of agriculture throughout the Mediterranean region.

Statistically expressed agricultural trends for specific nations are highly aggregated and can easily mask important changes occurring on the landscape at the local level. There is a compelling need not only to focus on areas particularly sensitive to change, but also to find an appropriate index of change that is itself sensitive to what is happening on the ground in a particular Mediterranean locality. The most appropriate index in terraced terrain is the condition of the landscape's most important element: the terrace walls. After discussing the context of the problem, and relating it to conditions in three islands, this paper lays out a basic and inexpensive method for assessing wall condition over time. Although measurement of terrace condition does nothing to address the root causes of declining agricultural status, field measurement is essential for informed decision making about remedial action.

FACTORS IN TERRACE DECAY

A fundamental component of change in agricultural status is the relative unattractiveness of agriculture as a means of livelihood as local and regional economic transformations occur and, with them, social aspirations. There is a clear trend among countries monitored by the Organization for Economic Development and Cooperation (OECD), showing agricultural employment responding inversely to overall national development. In 1965, 1 in 4 of people in the more industrialized nations of OECD worked in agriculture, in 1993 the figure was 1 in 7 (Diakosavvas 1993). As yet unknown, in terms of full effect on the Mediterranean agrarian landscape, are European Community (EC) and OECD policies and recommendations to have agricultural practices be removed from government protection and become more responsive to "market signals" (Viatte 1992; Alexandratos 1990). To the extent that such policies would involve agricultural retreat from marginal lands, the long-term consequences for the islands of the Mediterranean region are severe, since most of the land is marginal.

For dryland farmers, exposed to the seasonal vagaries of the hydrologic year, the disincentives to working the land can be felt particularly keenly. In those areas that are truly under the influence of a Mediterranean climate, with a summer drought often exceeding four months in duration, most farming is still of the dryland variety. Although both Greece and Spain registered an increase in irrigated land area between 1950 and 1985 of 51 per cent and 35 per cent respectively, 69 per cent of Greece's arable land was unirrigated in 1991, while in Spain it was 83 per cent. In Malta, the percentage of irrigated arable land has held constant at approximately eight per cent (FAO 1993; Baric and Gasparovic 1992).

Besides the restricted range of potential produce from drylands, other factors are serving as agents of decline, including the inability to use mechanized techniques on small enclosures, and the high proportion of fields worked under tenancy. The fragmentation and limited size of land holdings has been identified as a major contributor to the overall inertia of agriculture in the Mediterranean region (Grenon and Batisse 1989, p. 81).

AGRICULTURAL STATUS IN ISLANDS OF THE MEDITERRNEAN REGION

In many island locations, the factors of finite land area, sloping terrain, marginal soil, fragmented land holdings, and desire for productivity on the part of farmers, have combined to create extensive terracing. Such landscapes are particularly sensitive to changes in agrarian status. In addition, many islands in the Mediterranean region have been subject to rapid socioeconomic and demographic re-adjustments over the past 30 years due to the effects of mass tourism and development pressures. In sum, the insular environment can represent, in microcosm, the full consequences of agrarian change. Reports from the field indicate a high vulnerability to terrace decay.

Observations in Lesvos, a Greek island in the northeastern Aegean Sea, reveal a progressive loss of topsoil following the abandonment of olive groves and discontinued wall maintenance (Anthopoulou 1993). The aging agricultural workforce, the exodus of rural populations, the control of land by non-cultivators, and the relatively high costs of traditional production have resulted in the abandonment of approximately 10 per cent of groves. Examination of aggregated national data reveals a more mixed signal, however. Although the overall Greek agricultural labor force dropped significantly after 1970 and was declining by 1-2 per cent annually through the 1980s (Schwenk 1986), the area of arable land or land under permanent crops increased slightly from 3,826,000 ha in 1976 to 3,912,000 ha in 1991 (FAO 1993).

In Malta, in the central Mediterranean, the median age of farmers is also rising steadily, and working on the land remains an unattractive prospect in this island nation which is now largely urbanized and increasingly dependent on tertiary activity, especially tourism. Few Maltese farmers own their land. Since, under Maltese agricultural tenancy laws, the tenant farmer is responsible for wall upkeep, unleased land is prone to wall decay barring the unlikely eventuality that the landowner undertakes maintenance. There is now evidence of widespread terrace decay throughout the southern and western regions of Malta Island. Nationally, the percentage of the population employed or seeking employment in agriculture has declined from six per cent in 1975 to 3.6 per cent in 1992 (FAO 1993), while the area of land that is arable or under permanent crops has declined over this period from 12,858 ha to approximately 10,700 (Meli 1992). Promising innovations in drip irrigation, increasing crop-raising under glass, and near self-sufficiency in some vegetable yields, masks the broader malaise of dry farming, and the complete abandonment of dryfarmed fields has been predicted in some quarters (Camilleri 1992).

In Mallorca, the largest of Spain's Balearic Islands and located in the western Mediterranean Sea, traditional agriculture was almost wholly displaced by tourism between 1960 and 1980. In 1960, 34 per cent of Mallorca's working population was employed in agriculture but, by 1973, the figure was 13 per cent (Morey 1985). Such was the relative attractiveness of service industries that Mallorca registered a net in-migration of workers over this period to service the tourism industry. The best maintained terraced land in Mallorca is that supporting still-valuable fruit trees such as carob. Citrus groves are no longer particularly profitable. Terraced land that is not under permanent crops is vulnerable to degradation. Unlike the neighboring island of Minorca, the economic viability of Mallorcan agricultural land is diminished because holdings are small and distributed among many owners. For Spain overall, although considered one of the more agrarian countries of the EC, the percentage population employed or seeking employment in agriculture has declined from 21.5 per cent in 1975 to 9.8 per cent in 1992, and the area of arable land or permanent cropland has declined from 20,659,000 ha in 1976 to 20,089,000 in 1991 (FAO 1993; Alexandratos 1990).

CONSEQUENCES OF TERRACE DECAY

Physical and Biological Loss

Reduced vegetation cover magnifies the effects of intense solar heating and of rainsplash. The abandonment, or prolonged leaving fallow of fields, is strongly associated with the physical stripping of soil, although the exact timing of soil removal is contingent on factors such as wind velocity and the periodicity and intensity of rainfall (Blaikie 1985, p. 10). The Mediterranean climate is characterized by a strongly pronounced seasonal drought over the summer months, relatively low annual rainfall, and high variability from one hydrologic year to the next. Erosive potential is high when periodic heavy winter rains fall over sloping terrain where the soils are thin and immature. Such conditions are common among the islands of the Mediterranean region (Batisse 1990). On terraced slopes, erosion is opportunistic in the sense that it will exploit gaps in the terrace walls.

Over the Mediterranean region as a whole, 31 per cent of land has erosion loss in excess of 15 t/ha per annum (Grenon and Batisse 1989, p. 217), which is very much faster than topsoil is formed in sub-humid areas of the basin. The preferential removal of organic material and fine sediment can rapidly impair the water holding capacity of the soil (Goudie 1986, p. 130) and unchecked surface stripping can, in extreme cases, reduce a field surface to bedrock especially in areas where the fields are composed of campi artificiale, or made ground. The products of accelerated erosion can cause sedimentation of reservoirs and behind structures such as check dams, shortening their useful life and increasing the need for periodic maintenance.

Aesthetic Loss

The visual impact of intricately terraced Mediterranean hillsides evokes a sense of good stewardship of land under marginal conditions (Kuhlken 1993). The network of tracks and paths linking field to local village provides an organic landscape texture that contrasts strongly with the ephemeral resortscapes that one often encounters along the shorelines of Mediterranean islands. Such local field patterns translate to form part of the tourist appeal of a particular island location which then, in turn, translates into a financial return. Although this translation cannot be precisely quantified, landscape degradation through terrace decay is likely to detract from tourist appeal and adversely affect an important economic sector.

Cultural loss

In cases of complete obliteration of terrace walls, valuable historical evidence concerning past patterns of land tenure may be lost. In many cases, field patterns are the only reference point since no written records are likely to exist. Also at risk are parts of the landscape record of communication networks in the form of paths and tracks linking field to village. The relative size and position of terraces constitutes a "memory" of land use decisions, possibly extending back a millennium. In the case of Mallorca, for example, the terraces in the vicinity BaÑalbufor are probably Moorish in origin. Terraces are reflective of a particular relationship between livelihood and landscape from a time when adaptation to locally harsh surroundings was essential (Nunn 1994, p. 322). Now that issues of livelihood are decided regionally and globally, a record of local adaptation to land and climate becomes a subject of increasing historical importance.

FIELD ASSESSMENT OF TERRACE DECAY

It is important to make field surveys and establish benchmark measurements of terrace conditions. Continuing measurements over time can provide an accurate indication of change. The following methodological scheme is suggested as a basic model, but both method and approach should be adapted to fit local conditions.

A Typology of Wall Breach

To be characterized as a breach, the missing wall section should extend to a point greater than half the height of the wall section in which it is located. An effective typology of wall breaches should have three components: (1) wall height; (2) breach width; and (3) overall slope of land surface. Taking the latter component first, surveys by Lang (1961) in Malta classified slopes on a 4-point scale, and this scale can be usefully replicated here. It consists of slopes < 5% (1:20); slopes 5%-15% (1:20-1:7); slopes 15%-40% (1:7-1:2.5); and slopes > 40%. For simplicity of tabulation and to aid overall evaluation of conditions, an alphabetical coding should be applied to each of the slope categories such that slopes < 5% are "D" types; slopes 5%-15% are "C" types; and slopes 15%-40% are "B" types; and the steepest slopes (> 40%) are designated as "A" types.

Turning to breach width, it is suggested that this be measured at the widest point of the breach, using a 3-point scale and alphabetical designation, where breaches < 1 meter are designated "C"; breaches 1-3 meters are designated "B"; and breaches > 3 meters are designated as "A" type breaches.

The final component of the typology is wall height. A 3-point scale may again be used, where walls > less than 1 meter are categorized as "C" types; walls 1-3 meters are categorized as "B" types; and walls > 3 meters are categorized as "A" types.

The objective of the field work, in addition to counting and classifying breaches, is to determine the numbers and types of wall breaches per unit measure of wall length; 100 m is suggested as a feasible unit.

It will be immediately apparent from the above typology that the most critical breaches earn an overall designation, or rank, of "AAA." The height differential between terraces in these cases represents a substantial store of potential energy and poses a risk of downslope movement of material, and possible gullying. Based on field studies in Malta, Lang (1961) concluded that the consequences of breached wall were the most serious on slopes greater than 1 in 7 in association with thin calcareous soil. In such locations, the breaking down of a wall can result in cascading damage affecting an entire flight of terraces. As measurements are gathered over time, any proportional increase in AAA breaches should be considered particularly serious. Although most breaches will not represent as severe a risk, widening and eventual coalescence of smaller breaches is likely to occur over time.

Survey Method

Given the many hundreds of km of terrace walls that may be found within any particular island location, it is impractical to survey extensive areas. Therefore, carefully selected sections of rural land should be selected for study. A 50m x 50m grid, with an average inclusion of four to five fields, was used successfully to document land use in Malta in the 1950s (Bowen-Jones, Dewdney and Fisher 1961). However, a base map scale of approximately 1:10,000 would be required to effectively register grids that small, and such maps may be hard to obtain. It is, however, unlikely that wall density elswhere will approach that of Malta, and a larger grid size can be used, allowing use of a base map with a larger scale. It is not necessary for the base map to show field boundaries, but it must indicate topography and, ideally, some fixed features that will aid the drawing in of wall boundaries.

Numerous texts explain the basic methods of surveying and laying out of grids. The same areas will be measured repeatedly over years, and the first measurements will serve as a datum against which future changes can be gauged. Therefore, great care should be taken in choosing appropriate grids, in superimposing terrace boundaries on the base map, and in marking the position of each breach.

Survey Means

There is great value to be gained from rapid, direct, uncomplicated and cheap field measurements. The use of local, unskilled or semi-skilled, technical assistants further enhances this value since the observations will take on local meaning and be more locally persuasive regarding the dimensions of the problem than work done at a distant research base (Stocking 1987). Although technically feasible to detect and measure wall breaches from an aerial platform (helicopter or light aircraft) the cost would be prohibitive in many cases. On the other hand, the use of volunteers to compile highly accurate land use surveys is also technically feasible as amply demonstrated by Stamp's work in Britain (Stamp 1948). An additional value to using local assistants in the case of mapping in the Mediterranean region is the boost it provides to local environmental awareness.

The Mediterranean ethic of environmental disregard has drawn much criticism, but there are growing signs among the young of a changing attitude. The survey work outlined above could well be undertaken by high school or first-year college students under the supervision of a project director, the latter being responsible for compilation of the data, instruction in basic surveying, and negotiating access to fields.

SUMMARY AND CONCLUSION

Walled terraces perform two principal roles: to enable the more effective cultivation of marginal land, and to demarcate land holdings. Therefore, degradation of walls is an effective indicator of declining importance of these functions at the local level. The terraced fields constitute a major stabilizing element within an otherwise fragile environment with high erosive potential. Terrace degradation represents not only a physical loss, but also an aesthetic and cultural loss.

Abandonment of agricultural land in the Mediterranean region is increasing, particularly in the islands (Baric and Gasparovic 1992) as a result of complex cultural and economic changes. Continuation and acceleration of these changes creates latent abandonment (Anthopoulou 1993) which will eventually becoming locally detectable through wall decay. Highly aggregated statistical data for specific nations can easily mask the local rapid pace of change.

There is a compelling need to focus on areas particularly sensitive to change, such as the Mediterranean islands, using an index of change that is sensitive to what is happening on the ground in particular localities. Just as the effects of agriculture can be measured through local examination, so can agricultural decline if an appropriate indicator (in this case, terrace decay) are selected.

Changes in agricultural status stem from structural roots. Because local measurements examine symptoms but do not address root causes of change is no reason to eschew accurate measurement, particularly of change over time. Such measurements can spur local action that is literally "stop-gap" to stabilize the most severe degradation, while regionally and nationally, field measurement can alert decision makers to the extent of the terrace decay, and to the local effects of macroscale transformations on local agriculture. Ideally, such alerts should result in regional initiatives to keep terraced fields maintained and in production. Even if some remedial action is taken to combat decay, continued field measurement over time remains essential to monitor conditions.

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