Indigenous Resource Management and Environmental Degradation, Southern Greece

Eugenia A. Petropoulou[1]

School of Social Sciences, Department of Sociology, University of Crete, Gallos Campus, 74100 Rethimno, Crete, Greece

Abstract

Purpose – To examine the potential of indigenous agricultural knowledge for sustainable development. Drawing upon fieldwork on the natural resource management practices of diversified farming systems in a mountainous community in southern Greece, the paper explores the potential of the traditional system for a sustainable food security system.

Design/methodology/approach – The need to better integrate environmental and social research methods both quantitative and qualitative in order to explore the stock of indigenous knowledge and information about land degradation assessment and management held by small-scale farming communities in Greece.

Findings – Small-scale mountainous farmers possess a range of ideas and concepts from experience related to land degradation. At another level the findings of the study suggest that farmers place over-riding emphasis on the physical characteristics of their environment in judging the various stages of degradation. Until in a direct interview situation they were forced to confront the part played by human related factors.

Practical Implications – A major implication is that mountain farming communities need to be educated on the human aspects of degradation and in fact the interrelatedness of cultural activities and the physical world. Furthermore, sustainability in mountain communities depends on more than ecological factors; it requires sensitivity to socio-economic parameters such as labour demands and food security policies.

Originality/value – The current paper presents useful information on indigenous resource management practices and environmental degradation in mountain communities in Greece. The approach, fieldwork data and interpretation of data can be of value to social researchers in Greece and southern Europe who study issues of sustainability in mountain farming communities.

Keywords Southern Greece, Indigenous resource management, Environmental/land degradation, Sustainable food security system

Paper type Case study

Introduction

In most southern European countries a respective amount of food and cash crops are still produced by small-scale mountainous farmers using traditional farming methods. Significant yield increases have been achieved in these farming areas due to modern farming techniques. But this marriage between traditional and modern farming methods has its drawbacks stemming from inappropriate EU and state policies, low population densities, market forces and biophysical-agroclimatic factors. Inevitably this has brought into sharper focus issues of food security and self-sufficiency in those nations still dependent on mountainous small-scale traditional farming systems (Black, 1992).

Specifically, the mountainous areas of Greece, comprising nearly three-quarters (65%) of the national territory (Nakos, 1983), have attracted the attention of many academic, EU, state, policymakers and planners over the past 20 years, primarily to evaluate environmental conditions and population loss stemming from rapid agricultural transformation and modernisation policies (Maravegias, 1989). Most studies explored the extent and causes of population loss and sustainable management of mountainous resources (Damianakos *et al*., 1990).

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Little attention has been paid to the status and management of agricultural lands, which account for a substantial proportion of the total land area. Numerous studies have been undertaken on agricultural land over the past two decades, but most of them have been confined to the analysis of crop production and cropping patterns (Louloudis, *et al*., 1989). The few in-depth studies on land management focused on farmers' local livelihood strategies (Petropoulou, 2004; Louloudis *et al*., 2004). No studies have examined the environmental implications of the on-going land use and management practices in the pursuit of formulating a sustainable mountain development and food security strategy. Its relevance is explained by three major factors.

1. Being mostly steep slopes, agricultural lands are vulnerable to accelerating soil erosion, causing land productivity to fall (Conacher and Sala, 1995).
2. Agricultural lands in the mountains in Greece are characterized by low population density due to socio-economic and political factors. Hence, land abandonment as a result of outmigration and off-farm employment in the Greek mountains leads to less productive and susceptible to environmental degradation lands (Millington, 1991).
3. Although agriculture is considered as the economic mainstay of the majority of households in Greek mountains, primarily it operates to meet subsistence needs. Recent EU structural policies directed to the so-called Less Favourable Areas (LFAs) - namely, mountainous, semi-mountainous and disadvantaged areas of the member-states – aimed mainly at raising farm productivity and thus farm incomes, and/or non-farming employment opportunities (Spilanis *et al*., 2004).

In a mountainous environment lands are susceptible to accelerating soil erosion and thus, land degradation (Blaikie, 1988). Therefore, understanding the stock of indigenous knowledge possessed by farmers for land resource evaluation and the management of their peculiar environments may be crucial in the development of renewable resource management strategies that will provide a long-term base for sustainable agricultural production (Biot *et al.*, 1995) Accordingly, this paper examines the role of land use and land management practices in soil conservation with reference to a small mountainous community in southern Greece. The specific focus is on landholding structures, crop diversification, cropping intensity, agroforestry, crop management practices and indigenous resource-conserving practices. Moreover, the study aims to describe traditional methods of recognizing and managing the various stages of land degradation. It employs techniques of qualitative investigation to determine what knowledge is possessed by mountainous small-scale Greek farmers. Besides contributing to studies on the mountains, this study will contribute towards the formulation of an environmentally and economically sound land management and food security strategy consistent with indigenous values (*cf.* Conway and Barbier, 1990).

Research design

Information on local land use and management practices was collected through a questionnaire survey of 26 households from a total of 98, in a resource-poor mountainous community of southern Greece, Alagonia.

The lack of lists identifying individual households prevented the adoption of simple random sampling to determine which households were to be surveyed. Agroecological transects or the so-called random walk method was adopted into different parts of the village (Beebe, 1992). The survey was contacted from the fourth week of May until the fourth week of July, 1999. The survey included information on landhoding structures, cropping systems, agroforestry, land management and environmental-conserving practices. Field observations were also carried out and informal interviews held with farmers to evaluate the resource management systems. In addition, each farmer, with the researcher, were directly involved in various fields and site inspections to evaluate the evidence of various stages of land degradation known to the farmers.

The utilization of inexpensive and rapid qualitative field techniques facilitated the appreciation of the indigenous traditional knowledge and information which is necessary to the formulation of the "bottom-up" renewable resource management policies (Barker, 1977).

Finally, supplementary information was collected by unstructured interviews and personal discussions with key informants (e.g. secretary and president of the village) and extension workers on

the transformation of farming systems and on land degradation matters. All information was analysed using SPSS.

Description of the study area

Alagonia is located at the foothills of mountain Taygetos within the province of Kalamata, prefecture of Messinia, southern Greece, department of Peloponesos (see Figure 1). The mountain of Taygetos, catches the rains blown on from the Messinian gulf all winter and is very wet from around the end of November to the beginning of May. Alagonia retains much of this rainfall which bubbles out of hundreds of natural springs during the dry part of the year. It extends some 22,100 stremmata (10 stremmata = 1 ha), about the point 37˚ 07′ North; 22˚16′ East and its agricultural lands both arable and pastureland account for nearly 58% of the total land area (Agricultural-Livestock Census, 1991). At its highest point the land of the village rises to over 850m. a.m.s.l., falling around 700m. Mean annual temperatures range from 14˚C to 16˚C.

According to Nakos (1983), the soils of the study area are usually shallow (depth ranging from 5 to 30cm) with slopes ranging from 18-25% in ridges and from 14-21% for terraced cultivated sites within the village. The vegetation of the terraced site - now greatly reduced in extent and composition - ranges from coniferous trees, scrubs, plane trees, orchards, cherry-trees, chestnut-trees, fruit trees, olive-trees, pasturelands and agriculture. Soils here range from deep dolomitic limestones to loamy/skeletal texture of the main arable area.

These lands are suitable for both arable and non-arable agriculture. The regular hoeing and ploughing involved in arable agriculture results in frequent disturbance of the soil structure. Non-arable agriculture, however, does not cause such frequent disturbance in soil structure, as lands are not regularly tilled. Despite requiring regular hoeing and ploughing, arable agriculture does not aggravate high rates of soil erosion, since lands are nearly leveled.

Agricultural lands on ridges and slopes of the greater Alagonia area between 1300 and 1750m range from limestones to loamy/skeletal texture on the sides of the steeply sloping mountain peaks. As a consequence of their soil characteristics and because these steep slopes are vulnerable to accelerating soil erosion, they are most suitable for agricultural systems which do not require regular hoeing and ploughing, i.e. forestry, livestock raising. The vegetation of the terraced area, now greatly reduced in extent and composition, ranges from fir forests, scrubs, pine trees, plane trees, perennial springs, fruit trees, olive-trees, pasturelands and agriculture.

The annual average precipitation is between 986 to 1,150mm. Most rainfall is concentrated between the months of March and October and frosts may be expected from December to March (Weather Forecast Centre, Kalamata's Airport). Steep slope gradients combined with a relatively heavy rainfall have made these lands vulnerable to accelerating soil erosion. It is thus important to examine the on-going agricultural and land management systems with regard to their role in soil conservation and management.

Landholding structures

Agricultural lands in the study area constitute 16.7% of cultivated area and fall into two main categories, rain-fed lands (10.8%) and irrigated lands (5.9%). Pasturelands constitute 41.2% while forests constitute 42.1% of the total land use area (Fieldwork data, 1999).

The limited amount of land suitable for agriculture, combined with a rising rural population prior to 1950s (about 1,000 inhabitants) increased the demand for land and gave rise to a mountainous agricultural economy characterized by small landholdings. Migration patterns and depopulation rates in the early sixties and seventies (drop of population to 541 inhabitants) accelerated land abandonment since the already small landholdings were not easily sold or rented out (Baxevanis, 1972).

Anthropologists on the other hand argued that landholdings in Greece are becoming smaller and economically marginal as a result of the division of property between heirs (Herzfeld, 1980). In reality there is little conclusive evidence to demonstrate such a trend. The task of providing such evidence is made more difficult by the fact that historical data on changes in farm structures are scarce in Greece,

particularly at the local level where they are either under-estimated or over-estimated depending on whether farmers want to minimize land taxes or obtain subsidies (Sakiotis, 1994).

Thus, historically as well as present, mountain farmers have been working on small landholdings, which are getting steadily smaller in size due to an ageing agricultural workforce, increasing outmigration rates and EU *hill farmers' compensatory allowance schemes* (under these agricultural modernization schemes farmers over 55 years of age have to rent or sell part or all of their land to younger farmers in order to get an early retirement pension) (Gidarakou *et al*., 2002).

The study area is not an exception. According to fieldwork data (1995) Alagonia was divided into large (>71 stremmata), medium (51-70 stremmata), medium/small (21-50 stremmata) and small (<20 stremmata) landholdings where one ha equals with 10 stremmata. None of farmers' landholdings exceeded 7.5 ha or 75 stremmata. Notably more than three-quarters of the households surveyed had landholdings smaller than 50 stremmata or 5 ha accounting for 73.1% of the total landholdings, leading thus to agricultural intensification.

Crop diversification and mixed cropping

As noted earlier, the land use potential differs throughout the study area owing to variations in soil type, elevation and slope gradient. Despite this, there was no significant variation in cropping pattern. Owing to the small size of landholdings and scarce non-farming employment opportunities, virtually all farm households had utilized their lands for potato (84.6% of total cropped area), vegetables (73.1% of total cropped area) and cereal crop (61.5% of total cropped area) production to safeguard their food supply. Agroforestry products such as cherry-trees, chestnut-trees, walnut-trees, apple-trees and olive trees accounted for 34.8%, 19.2%, 3.8%, 11.5% and 30.8% respectively of the total cropped land.

Confronted with the problems of increasing food security demand and marginal landholdings, farmers of the study area have adopted a practice of mixed cropping or growing two-three field crops simultaneously in one plot, as a strategy of securing more produce by tapping limited resources, both human and environmental. The maize-bean-squash complex was the predominant type of mixed crop combination in almost all landholdings according to informal interviews and fieldwork walks (*cf.* Altieri and Anderson, 1986).

Crop diversification and mixed cropping are both environmental and economically sound practices. When two or more crops are grown in sequence in the same field, each crop uses the fertility of the soil in its own particular way. Different plants grow to different depths and require different nutrients. When many plants are associated in the same field, more waste and organic matter are available. The economic benefits of mixed cropping could be three to four times higher than that of monocropping on a per hectare basis (Gliessman, 1990).

To make therefore, the best use of limited land resources, farmers plant maize, beans, and pulses on bunds and terrace risers. Owing to the ever-increasing demand for food, farmers cannot cultivate single legume crops in farm plots (Mountjoy, 1988). Although there is the possibility of cultivating these crops in fields following the harvesting of potatoes, farmers have not taken any initiative towards it, owing to a- the tradition of releasing livestock into the fields, and b- farmers' lately economic interest on profitable garden crops.

Cropping intensity

Having assessed the intercropping pattern of the study area, it is sensible to examine the intensity of land utilization since intensification has been an uneven process that has resulted in social costs, particularly in the form of uneven distribution of assets and disparate environmental trade-offs (Gray, 2005).

The Alagonian potato production system is relatively old, first introduced in the area at the beginning of the 20th century and fully developed after the 1930s in the study area (Masourides, 1994). Overall, potatoes were more intensively cultivated than any other arable crop. The traditional indigenous rotation system of potatoes used to enhance soil fertility. Potatoes for example were planted near mountain ridges, from 1,250 to 1,300m, for the first year, during March or April and were harvested between September-October. In November the plots were cultivated with barley or oats and

sown in late June early July. Then the same plot was left either fallow or cultivated with legumes to enhance soil fertility, such as lupines, for a year before beginning again the rotation cycle with potatoes (State agronomist, 28.07.99). This can be described as a three year rotation system.

The post 1970 period, a period of rapid scale enlargement and intensification for rural Greece in general (Mouzelis, 1979) had a direct impact on farming practices with specific reference to the potato production system of the study area. In this context the potato rotation system on the ridges had slightly changed. Crop rotations of two years were then the norm meaning that potato plots were not left fallow or cultivated with lupines but instead land was chemically fumigated in order to receive the new cycle of potato crop.

Three to four times per year, the potato plots were disinfected from rotten potatoes. The intensification of potato planting reached a mean of one ton per every two stemmata (10 stremmata = 1ha) compared to that of one ton in every five stremmata (State agronomist, 20.07.99). The frequency of potato growing and the decrease of fallow years influenced the number of pests and diseases in different potato plantings.

After the country's accession to the EU accompanied by trade liberalization and the suppression of state monopolies, the Agricultural Ministry of Greece could not function any longer as the main regulator and distributor of potato-tuber production. Non-governmental or private institutions took over the distribution of potato-tubers by importing cheep seeds from abroad instead of producing them locally. This was due to the high cost of labour, lack of mechanization and land fragmentation in the mountainous areas of Greece. Farmers of the study area were placed in a position of marginality expressed with outmigration patterns, off-farm employment and land abandonment. The remaining population (410 inhabitants up to the late 1990s, Local Registry Book) in order to secure their food supply restricted the cultivation of potatoes within the village area (between 700-850m of altitude) and near household farm plots. The reason for cultivating plots relatively close to farmhouses was that the remaining farmers were old enough (63% over 55 years of age) and they lacked means of transportation.

Now most plots had been utilized for three crops per year when moisture and nutrient supplies were considered adequate. Potatoes were cultivated in March and harvested towards the end of September. Maize was sown in November and harvested in July. Beans were intercropped with maize, normally for four weeks before the harvest of the latter crop. Alternatively some plots after the harvest of potatoes were sown with wheat or oats. Following the potato harvest from the last week of September until the first week of November, most farm plots were left fallow. In the case of maize most plots were left fallow from the end of July till early November. Thus, the lands of close proximity to the farmers' households were being gradually utilized for both winter and summer crops to cope with the problem of food supply (Semi-structured interviews, 1999).

Agroforestry

Planting trees in association with field crops is a long established tradition in the mountains (Conway, 1985; Ite, 2005). Accordingly, farmers in the study area had grown assorted varieties of fruit fodder/fuelwood trees. The most common varieties of local fruits cherry, apple, pear, plum, fig, black cherry, and blackberry were the typical variety of fruits found in less than 800m altitude, close to farmhouses. Despite suitable soil, temperature and moisture in the ridges, all the farm households in Alagonia were engaged in fruit cultivation within the village area.

Regarding the fodder/fuelwood trees, chestnut, walnut and olive were the predominant species grown in farmlands. Confronted with the problem of shrinking forest resources, lack of transportation facilities, these trees have been highly useful in fulfilling fodder/fuelwood and economic requirements of farmers. They were found to be nearby the village's settlement than in the ridges, owing to relatively distant location and strict municipal control of forest (Dewees, 1989).

Moreover, farmers of Alagonia had grown fruit and fodder trees mixed with maize and wheat crops primarily on terraced plots close to farmhouses. Specifically, fruits were found confined mainly to homeplots as these were well fenced to prevent cattle and human trespassing. As their landholdings were highly fragmented (an average farm household held seven plots), it was futile for farmers to plant fruit trees on scattered farm plots which could not be either fenced or watched regularly to prevent the theft of fruits.

The increasing number of trees estimated in Alagonia does not mean that local farmers plant trees in response to a generalized rational of conservation, still less to theories about the influence of trees on rainfall, but for reasons that are specific to the species in question. Trees are investments of capital and labour and have implications for the management of mountainous small scale-farming (Carter and Gimour, 1989). Trees, therefore, like cherries and chestnuts are of vital importance to the indigenous population. Oral interviews with farmers suggested that one of the main reasons, cherry and chestnut-trees are planted today, is due to the lack of young labour to convert and maintain the hilly land into terraces. This is attributed to changes in labour availability as already mentioned, combined with changes that occurred in the production system of potatoes, which had therefore shifted the calculus of land use. A point was reached where there was a corresponding shift in land use towards intensive tree crop cultivation.

The decision to plant trees also reflects a gender division of responsibility and rights of access to the farm. Men plant trees for their commercial value (e.g. olive-trees and lately chestnut-trees); fuel (e.g. olive-trees and walnuts) and for ornamental, or shade purposes (e.g. chestnut and walnut-trees) (Dewees, 1989; Carter and Gimour, 1989). Women favour fruit-trees of their need for household food supplies or amenity purposes.

Furthermore, fruit and nut-trees require little start-up capital or special education, according to (Ite, 2005). They compete minimally with the stable crops of Alagonia, potato and olive-tree (i.e. harvesting time of tree crops differ), representing an attainable form of intensification securing food for the remaining of the population and providing them with an extra income (informal interviews, June-July, 1999).

Resource-conserving practices of land management

This section will deal with resource-conserving practices used in the productive system of the study area, and also to the local knowledge which supports their use. Farmers typically posses a great deal of indigenous knowledge of their productive environments. Such knowledge relates to soil conservation elements such as contour tillage, fertilization, fallowing, surface mulching etc. (*cf*. Altieri and Anderson, 1986) The information presented below relies heavily on informal interviews and participant observation.

Soil conservation

Conservation can consist of appropriate agricultural practices (i.e. indigenous tillage) or the construction and maintenance of terraces, etc. to limit soil loss. Traditional operations such as contour tillage, terracing, mixed cropping, fallowing, fertilization, surface mulching will be reviewed in this section (*cf*. Warren *et al*., 1995).

Contour tillage. All farm plots in Alagonia are terraced while soil tillage is based upon local technical knowledge. Of the farmers interviewed 75%, cultivated on the contour. Of these, 96% stated that they did so in order to minimize run-off and hence erosion. In no cases were ridges used at right angles to the prevailing wind in order to control wind erosion, thus suggesting that farmers believe water erosion to present a greater problem. In all cases cultivation involved ploughing (i.e. ridging) and subsequently planting and cultivation on the contour rows.

In several cases farmers applied different methods within the same field, cultivating on the contour where the slope was gentle (within the village), and on the grade where the slope was steep (in the ridges). There were observed examples of cultivation on the contour where the slope was evidently too steep and thus storms and heavy rains had caused extensive overstopping and breaking of the contour rows and subsequently gullying and soil wash.

Terracing. Most farm plots in Alagonia have been terraced for more than 20 years. Reportedly, most plots were terraced many centuries ago. This is consistent with statements of the majority of respondents in Alagonia, that they didn't know how these terraces were constructed. Household labour is scarce meaning that a very small proportion of households have been involved in terrace construction or preservation. In order to preserve the already existent terraces 25% of farmers plant crops, grass or even small trees along contours or the back of a terrace. As the water flows across the surface it meets with rows of plants growing perpendicular to the flow, and slows the water down by

preventing soil erosion and improving infiltration. This is a low input alternative to the construction of physical structures that generally require large labour inputs, lacking in Alagonia.

Mixed cropping. Mixed cropping is widely practiced in the study area with 74% of farmers intercropping between two and three crops. The great majority of cases were a mix of maize, lima bean (*Phaseolus* spp) and squash (*curcubita pepo*).

Mixed cropping has the potential to reduce erosion by having a crop on the land for a longer period of the year. However, in this study area the crops cultivated have widely similar growing seasons and thus the potential for this benefit is reduced (see section 3.2). Nevertheless the inclusion of legumes in the system may improve its nitrogen available for cereal crops or maize.

The stated objectives of the farmers interviewed about mixed cropping did not include an awareness of its potential for improved soil conservation. In the majority of cases intercropping was undertaken as a strategy to hedge against risk.

Fallowing. Fallowing was used by a great extent in the study area. Less than 10% of farmers stated no practice of fallowing and if so it was only for a limited period. Fallowing ranged from 5-8 years. "Bareness" of land for such a long period could lead to soil erosion and as farmers stated outmigration was the major constraint for *abandoning* field plots.

Fertilisation. All farmers applied manure/compost to their field crops, yet the question arises if the supply was adequate from their subjective perspective. Despite this there is a decreasing ability to support cattle compared to the period before 1980 due to high levels of out migration and consequent changes in labour availability.

Instead inorganic fertilizers were used by all respondents of the village. When they were asked "if they used animal manure at all", 24 cases out of the 26 answered positively. When analysed 92.3% use animal manure along with inorganic fertilizers. Olive crops and homegarden vegetables received animal manure (69.3%) and only 3 cases less than 10% reported the application of organic fertilizers on potatoes along with organic fertilizers. The amount of manure applied was not specified. This is consistent with the assumption that nowadays mountainous farmers largely depend on chemical fertilizers.

Composting on the other hand conserves existing nutrients. Although it was not included in the form of a question in the survey questionnaire it was observed as a practice in few Alagonian farm plots. A handful of farmers mix household wastes, crop residues or twigs of trees before applying. This practice takes place in summer, few weeks before sowing in order to prevent quick digestion of organic matter as a result of high temperatures (Dougill *et al*., 2002). Composting demands high labour availability both in the building of heaps and in the spreading on fields. For this reason when practiced is limited to homegardens.

Surface mulching. Mulching could be a very effective practice for conserving soil nutrients or providing a protective cover at a time when crop cover is not present. For example, the vegetation cut down to make way for cropping could be used as mulch which not only adds nutrients and organic matter to the soil but also protects it from soil erosion. Thus, surface mulching or leaving crop stalks in the field is an important biological measure to protect soils from being directly exposed to agents of erosion and to improve soil structure and restore fertility (Dougill *et al.*,2002). Most of the respondents in Alagonia, regardless of their socio-economic status, reported that they didn't leave crop residues in their fields.

Wider use of this practice may well be restricted due to the relatively small amounts of residue available and the competing uses which exist. For example, the use of residues as animal fodder was witnessed in many farm plots. Furthermore, the density of mulch viewed in many fields was below the level required to be most effective as a protective cover.

Environmental degradation

Despite being comprised of high ridges (up to 1300m) and lower in altitude lands (700-800), with different types of biophysical conditions (see also section: Description of the study area), there was not significant variation in land use and management practices in the study area.

This section will help to identify the critical land characteristics used by local farmers to assess the level of land degradation and thus the need for management. The utilization of the local stock of knowledge can be viewed as an alternative approach to the control of land degradation. It can be

argued that such an alternative can form one of the bases for agricultural development and farmer-based research in the mountainous areas of Greece. Based on international bibliographical resources the local research findings show that Alagonia sees land degradation as composed of two distinct stages, each with recognizable signs on the landscape, namely: incipient and advanced stages of land degradation (Barker, D. 1977; Talawar and Rhodes, 1998; Pasquini and Alexander, 2005).

The incipient stage of land degradation

Farmers in Alagonia seem to recognize early signs of land degradation by examining a number of indirect factors which affect the quality and physical appearance of their crops and fallow lands. This is not surprising because it is well known that in most traditional societies people have developed a remarkable stock of knowledge about their environment by using a range of indicators to make valid statements and prediction about the conditions of the physical world, e.g. weather and food forecasts. In this regard, Table I shows that most farmers recognize the following as the early signs of land degradation, namely: a- loss of soil fertility; b- extinction of plant varieties; c- increasing appearance of pests on farms; d- appearance of weeds on the farms and e- increased frequency of crop diseases.

Table I: Early signs of land degradation

Alagonia		
Early signs of degradation	Cases	%
Loss of soil fertility	18	69.2
Extinction of plant varieties	3	11.5
Appearance of pests on farms	23	88.6
Appearance of weeds on farms	14	53.8
Increased frequency of crop diseases	13	50.0

Source: Fieldwork data, 1999; Total number of farmers interviewed accounted for 26 cases

From the five indicators of land degradation identified by farmers, “increased frequency of crop diseases, appearance of weeds and pests” are those which directly destroy crop foliage and harvestable products or overrun farm lands, thus providing the farmer with glaring evidence of degradation. The one and final sign that of “loss of soil fertility” is that which provided the farmer with some indirect evidence of the declining nutrient status of the soil which in turn affected crop yield, thus marks the onset of land degradation.

It may be seen, therefore, that the early process of land degradation is well articulated in the minds of the farmers in Alagonia. Usually, after several years of observation, through close association with land during farming periods and activities, farmers acquire diverse information and knowledge on environmental characteristics. For example, the appearance of certain weeds on farmlands is also indicative of micro-climatological changes taking place within the mountainous environment of Alagonia. Typically, the floor of the forest is almost devoid of grasses and is characterised by a thick layer of organic matter. According to a group discussion, the paucity of plants in the herb layer in the forest was due largely to the grazing of flocks and to the burning and cropping farming practices. With the gradual afforestation measures taken by the Forestry Department and the local migration waves accompanied by a decreasing rate in the number of grazing flocks, the rapid growth of weeds belonging to the *filicales* family took place. It can be assumed that farmers were right in selecting the presence of weeds, which were alien to the forestry area, as a major indicator of degradation.

Advanced stage of land degradation

In contrast to early stages of land degradation, where farmers had to employ indirect indicators, advanced degradation was associated with more visible and direct signs, particularly those relating to soil appearance and vegetation cover, as well as crop yields.

Only two signs of advanced land degradation were reported by the majority of farmers. All of the cases interviewed (100%) commended on sandy or coarse top-soil texture, which is normally associated with areas of severe sheet erosion, as the most striking evidence of a degraded landscape.

Highly erosive landscapes were found in ridges due to over-cropped potato farmlands in the 1970s and the abandonment of those lands in the 1980s. Decrease in crop yield is the last and equally important sign of advanced degradation in Alagonia. 88.5% of farmers who identified this sign saw it as obvious evidence of declining soil fertility and consequently land degradation. Farmers of the study were conscious about the infertility of degraded soils.

A checklist validation of farmers' assessment

In order to assess with greater clarity and objectivity the elements which guided farmers' assessment of degradation in the area, a checklist was complied of potential major degradation indicators. The list was derived from various sources which included:

a- reconnaissance survey of farmers' viewpoint; (Barker 1977), b- interview with experts, extension workers etc., (Talawar and Rhodes, 1998; Pasquini and Alexander, 2005) c- existing literature on land degradation (Barker, 1977; Blakie, 1988; Biot *et al.*, Woods, 1984).

From such sources, five major groups of indicators were identified (Table II), with each group containing three to five indicators.

The checklist of indicators was presented to farmers to validate the importance attached to each during their individual assessments of land degradation.

Over 96% of farmers used land tenurial changes in their evaluation and accorded each of the tenurial indicators high to very high ratings (Table II). This is not unexpected since changes of tenure systems from ownership to rented land are often sited as the first sign of the onset of degradation (Boserup, 1965).

Table II. Checklist validation of land degradation

Rating of indicators by farmers		
Indicators	Severity*	% using it
A. SOIL		
1. sandy soil	4	100.0
2. surface crust	1	14.8
3. soil texture change	4	87.0
B. EROSION		
1. sheet erosion	3	10.0
2. gully erosion	1	0.0
3. badland	1	0.0
C. VEGETATION		
1. forested	5	85.2
2. vegetation density	5	71.3
3. dominance of pests	4	87.0
4. drop in crop yield	4	88.5
D. FARMING PRACTICES		
1. monoculture	1	0.0
2. reduced fallow periods	1	0.0
3. change in cropping system	4	50.0
4. overgrazing	1	0.0
5. use of manure	2	55.5
E. LAND TENURE		

1. individual ownership	4	96.3
2. rented land	4	96.3
3. land fragmentation	5	100.0
4. conflict over land	5	100.0
* Meaning of severity rating scores (modal score): 1. absent or insignificant; 2. low; 3. moderate; 4. high; 5. very high.		

Source: Fieldwork, 1999.

Although indicators of land tenurial changes feature predominantly in the checklist assessment by the people, they were not associated, *per se*, with the early and advanced signs of degradation. It is possible that the farmers gave greater weight to physical characteristics and changes to their physical environment until in a direct interview situation they were forced to confront the part played by human related factors.

In addition to land tenurial changes there was one more important category of indicator – vegetation. In general, it may be observed that the checklist validation technique of land degradation indicators confirms in broad terms the extent to which small-scale traditional farmers in Alagonia have an accurate knowledge of their immediate environment and the various changes taking place in their physical world.

Conclusion

This paper has attempted to contribute to the evaluation of mountainous small-scale indigenous farming systems and management. It also attempted to explore the stock of indigenous knowledge and information about land degradation assessment and management in southern Greece. The information presented outlined farmers' landholding structures, indigenous agronomic knowledge regulating cultivation such as crop diversification, mixed cropping, cropping intensification and agroforestry to cope with issues of food shortage arising from their marginal lands. All farmers' plots were terraced although not preserved regularly due to labour shortages. Nevertheless out migration patterns, and an on growing elderly population led to increasing hoeing and ploughing rates of lands located in close proximity to household farms. Furthermore, the application of inadequate amounts of organic fertilizers, lack of mulching and fallowing of lands for too long a period without any vegetation cover can lead to the assumption that the terraced lands were undergoing unsustainable rates of degradation. Farmers' assessment of degradation in the study area was examined while a checklist was compiled of the potential major degradation indicators. In particular, the visible attributes of soils and physical landscapes, as well as noticeable changes in the composition and appearance of flora and fauna, were drawn upon to describe the character and process of land degradation in the area.

At another level, one of the findings of the land degradation assessment was that farmers placed over-riding emphasis on the physical characteristics of their environment in judging the various stages of degradation. The contributory roles of people and cultural land practices were largely ignored until they were prompted through the checklist validation procedure. The major implication is that farming mountainous communities need to be educated on the human aspects of degradation and in fact the interrelatedness of cultural activities and the physical world.

Furthermore, while this discussion has drawn attention to the potential for food security and self-sufficiency in the so called LFAs still dependent on small-scale ecological production systems, sustainability depends on more than ecological concerns (Spilanis *et al*., 2004). It also depends on government pricing policies, market forces (see sections on crop diversification and cropping intensity) and on the maintenance of young labour force if indigenous systems of land conservation are to be improved (Tanner, 2003).

Finally, mountainous farmers recognize the essential role of government in ameliorating land degradation problems in the study area, despite the fact that their views were hardly ever incorporated into past policies. The continued faith in government derives from the weak socio-economic strength and financial resources of community members in tackling basic land degradation problems facing

them. Future policies, therefore, must reciprocate by integrating community views on land management as discussed in this paper and finance land conservation efforts at the community level (Tanner, 2003). Meanwhile, much empirical work remains to be done on mountainous small-scale indigenous farming systems.

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