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# The UNESCO Libyan Valleys Survey: environmental change and human settlement in Tripolitania

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## Introduction

The project which is the subject of this paper began in 1979 with a direct brief from UNESCO to investigate the nature of ancient farming in the Tripolitanian pre-desert of Northwestern Libya (Fig. 1), to give an archaeological perspective to modern plans for agricultural development in the same region. Fieldwork took place in 1979, 1980, 1981, 1984, and 1989. The project has been directed by Prof. G.D.B. Jones of the University of Manchester and myself. The British contribution to the project has developed under the aegis of the Society for Libyan Studies, whose journal *Libyan Studies* has published detailed progress reports about the project every year since 1979.

The study area, the Tripolitanian pre-desert, is the region which lies between the coastal zone and the true desert. It consists of an undulating rock plateau some 100 kilometers long from north to south, principally of limestone but in places mantled with basalt, dissected by the two main wadi systems of the Sofeggin and Zemzem. The major wadis may be several kilometers wide, but the tributaries are often narrow trenches, a few hundred meters across. Both are floored with a mosaic of flood loams, gravels, and sand dunes. To the north of the pre-desert, in the Gebel hills and the coastal plain, annual rainfall is higher than 200 mm, the minimum for dry farming without irrigation, making these zones the preferred areas for human settlement in antiquity as today. In the pre-desert, however, rainfall decreases very rapidly moving southwards, to only 25 mm or less on the southern boundary with the rock desert and sand seas of the Sahara. The regime consists of sporadic and often highly localized cloud-bursts on a few days a year, which cause torrential floodwaters to fill the depressions on the plateau or flow down the wadis, reworking the alluvial sediments and replenishing their nutrient levels.

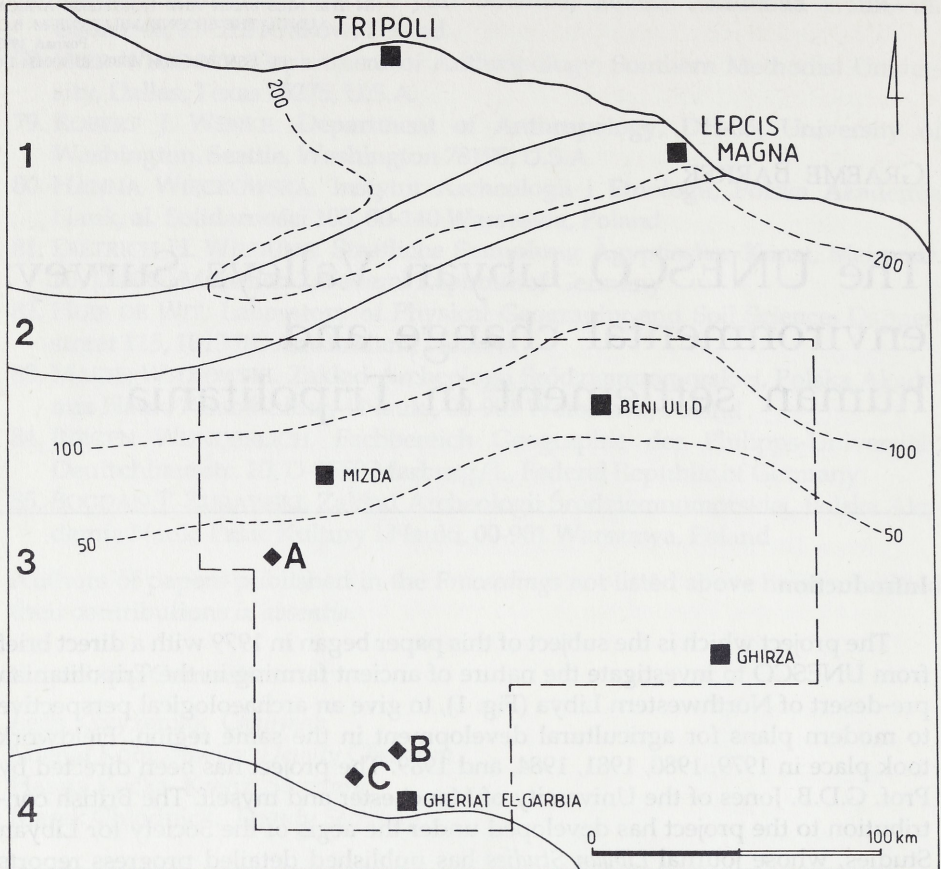


Fig. 1. The study area of the UNESCO Libyan Valleys Survey: the Tripolitanian pre-desert, between the settlements of Beni Ulid and Gheriat el-Garbia (after Barker 1986: Fig. 1);

The location of the three groups of rock carvings

A: Maia Dib; B: Udei el-Ghel/Gaf al-Hetshia; C: al-Tobga

Topography and modern vegetation

1: coastal plain – mixed steppe; 2: Gebel escarpment – steppe; 3: pre-desert plateau – rare vegetation except on wadi floors; 4: Hamada al-Hamra desert – vegetation almost absent.

Dash lines show rainfall isohyets in mm.

Patterns of land use are undergoing major changes today in the social, economic and technological transformations of modern Libya, but the traditional way of life that was evolved by the Bedouin to cope with this hostile environment was characterized above all by low density populations, seasonal mobility, and a reliance on pastoralism. Cereal crops were sown in the floodloams of the pre-desert wadis after the autumn rains, and the Bedouin then moved south with their sheep, goats, and camels to the desert margins for the winter, coming north again with their animals in the spring for the harvest. The summer months were spent on the dry pastures of the pre-desert, the only water available (apart

from isolated deep wells) being rainwater collected the previous winter in rock-cut cisterns. Settlements consisted either of tents or drystone walled shelters roofed with timber or tenting, and stock were normally penned in brushwood or thorn enclosures.

The kind of ephemeral archaeology created by this way of life contrasts vividly with much of the archaeology of ancient settlement. The German explorer Heinrich Barth first reported the very large numbers of ancient ruins, particularly the "castles" (in Arabic *qsur*) or fortified farms that are found mainly along the edges of the narrower wadis, noting also that these monuments were frequently associated with systems of low drystone walls running both along and across the wadis (Barth 1857). The *qsur* implied a density and permanence of settlement in antiquity very different from the traditional Bedouin system of settlement, and the wall systems likewise implied an agricultural system with much greater organizational and technological inputs than Bedouin farming. The first systematic archaeological studies of the *qsur* indicated a late Roman date, the consensus being that they represented a frontier defence system of soldier-farmers (*limitanei*) to protect the Romano-Libyan coastal cities and their rich agricultural hinterlands from the desert nomads (Brogan 1964; Brogan and Smith 1957; Goodchild 1950).

Hence the Libyan Valleys Survey was initiated by UNESCO as the first modern study of the archaeology of pre-desert settlement. The fact that we needed to understand not only how the Romano-Libyan agricultural system functioned but also why it began and why it collapsed has meant that from the outset the project adopted a multi-period approach, as it seemed very unlikely that Romano-Libyan farming could be understood in isolation from earlier and later systems of settlement and land use in the pre-desert. Given the agricultural dimension, too, the project has been characterized throughout by multidisciplinary investigations linking archaeology with the natural sciences, particularly botany, zoology, and geomorphology.

The first phase of the project consisted of primary mapping, with vehicle-based survey teams visiting all the major wadis and recording the range of archaeological monuments visible along the wadi edges (Barker and Jones 1981; 1982; Jones and Barker 1980). We then selected a representative series of wadis in the north, centre and south of the survey area for more detailed study on foot, mapping the full range of the surface archaeology from major upstanding monuments to lithic scatters, and mapping in detail the systems of wadi walls (Barker 1985; Gilbertson *et al.* 1984). The third phase of the project has consisted of the detailed investigation, including by excavation, of individual Romano-Libyan farms and their agricultural systems (Barker and Jones 1984; Barker *et al.* 1991; Hunt *et al.* 1986).

### Prehistoric settlement

The preliminary analysis of the surface lithic material (Hivernel 1985) has identified a succession of homogeneous assemblages of Middle Palaeolithic, Epipalaeolithic, and Neolithic styles, with only one assemblage being classified

as Upper Palaeolithic in its typology. Whilst it is possible that some of the Aterian material classified as Middle Palaeolithic is in fact late glacial in date, the paucity of evidence for Upper Palaeolithic occupation in the pre-desert is perhaps not surprising given the climatic evidence across North Africa for the intense aridity of the late glacial environment *ca.* 20,000 - 10,000 b.p.

With the climatic amelioration of the Early Holocene, regular utilization of the pre-desert plateau resumed by people with Epipalaeolithic and Neolithic technologies. Further evidence for human occupation at this time consists of a series of rock art sites in the survey area (Barker 1986: Fig. 1). These consist of carvings of the well known bovids at Maia Dib, including one with a disc between the horns (Graziosi 1934; 1941); bovids, equids and ostriches at el-Chel (Graziosi 1937; 1941); and a bovid, antelope- or gazelle-like animals, a giraffe, and human figures at el-Togba. The close association of the cattle and game motifs at these sites suggests an occupation of the pre-desert by people combining pastoralism with hunting, by analogy with southern Libya perhaps somewhere within the range 6,000 - 3,000 b.c. (*Arte Prehistorica del Sahara* 1986; Barich 1987).

The locations of the Tripolitanian carvings correlate broadly with the locations of the most abundant evidence for surface lithic assemblages of Epipalaeolithic and Neolithic type, on the southwestern margins of the pre-desert plateau at its border with the Hamada al-Hamra rock desert. In this area the landscape is dominated by undulating terrain interspersed with isolated oases and springs, very different from the dominant landscape of the rock plateau and dry wadi channels. The region has also been the natural corridor north for pastoralists wintering on the desert margins. The area of the pictographs is likely to have been a critical part of the subsistence territories of both hunter-gatherers and pastoralists, the carved boulders perhaps serving as territorial markers for particular social groups. Given that hunter-gatherers and pastoralists tend to define their seasonal territories very elaborately, with access to some resources shared but to others being strictly controlled, the location of the Tripolitanian pictographs near springs and oases must be significant, particularly given the evidence for increasing desiccation during the period represented by the carvings and Neolithic industries.

No prehistoric pottery has been recovered by the project. The principal evidence for pre-desert settlement in the late prehistoric and protohistoric periods consists of a series of rock carvings at el-Togba: small stick figures, mostly four-legged animals, but also humans, palm trees, and a possible wheeled vehicle. As elsewhere in the Libyan Sahara, such late rock carvings showing evidence on the one hand for the existence of desert conditions similar to today and on the other for contact with the protohistoric and historic cultures of Egypt are likely to date to the later second and first millennia b.c.

In addition, the prolific evidence for settlement in the Romano-Libyan period incorporates further indications of small-scale utilization of the pre-desert in the immediately Pre-Classical period. It quickly became apparent from the detailed surveys of wadi settlement that the archaeology of the Romano-

Libyan period embraced a wide variety of monuments. Apart from the fortified farms or *qsur*, major monuments included enclosed hilltop settlements, open (undefended) courtyard farms, mausolea, small enclosures with one- and two-roomed buildings, single huts, groups of what seem to be tent footings like those of the modern abandoned Bedouin camps, and small burial cairns. Dating monuments by surface artifacts is of course problematical, and the deflated surface of the pre-desert plateau is a palimpsest of the archaeology of very different periods of antiquity. However, there are repeated correlations of sites which are identical to the smallest categories of domestic and funerary sites containing Romano-Libyan pottery but which are associated instead with lithics of Neolithic/Post-Neolithic type. These correlations suggest the very strong possibility that a Bedouin-style pastoralist population was living in the pre-desert in the centuries immediately preceding the Romano-Libyan transformation, perhaps using a simplified version of the wadi-wall technology described in the following section.

### Romano-Libyan farming

The transformation began in the first century AD, with the superimposition on the indigenous settlement system of farms comparable in design and architecture to the villa farms of the Gebel hills that provided the principal agricultural wealth for coastal cities such as Lepcis Magna (Mattingly 1985; 1988).

We conducted excavations in the middens associated with the pre-desert farms to recover faunal and botanical residues as direct information on their agricultural systems. The study of the botanical remains (van der Veen 1985) has shown that the new farms grew barley as the principal crop as well as various wheats, together with lentils and pulses, vegetables such as water melons, and tree crops: olive, grape, fig, date, and almond. Many farms had pressing equipment for oil or wine, smaller versions of the presses well known on the Gebel farms (Oates 1953). In one we excavated on a farm in Wadi el-Amud (Barker and Jones 1984), in the southern part of the pre-desert, the main oil tank had a capacity of 3000 litres and two ancillary vats had a combined capacity of 1200 litres. There seems little doubt that these pre-desert forms were substantial enterprises capable of producing oil and wine in surplus for the coastal markets (Mattingly 1986).

Sheep and goats in roughly equal proportions dominate the faunal samples from the farms (Clark 1986). Mortality data indicate the importance of meat production and a husbandry regime in general very similar to the traditional Bedouin system, augmented at the southern farms such as el-Amud by gazelle hunting.

In this marginal environment, the new agricultural system was maintained by sophisticated methods of floodwater farming designed to concentrate runoff from a large catchment into the restricted cultivated land of the wadi floor

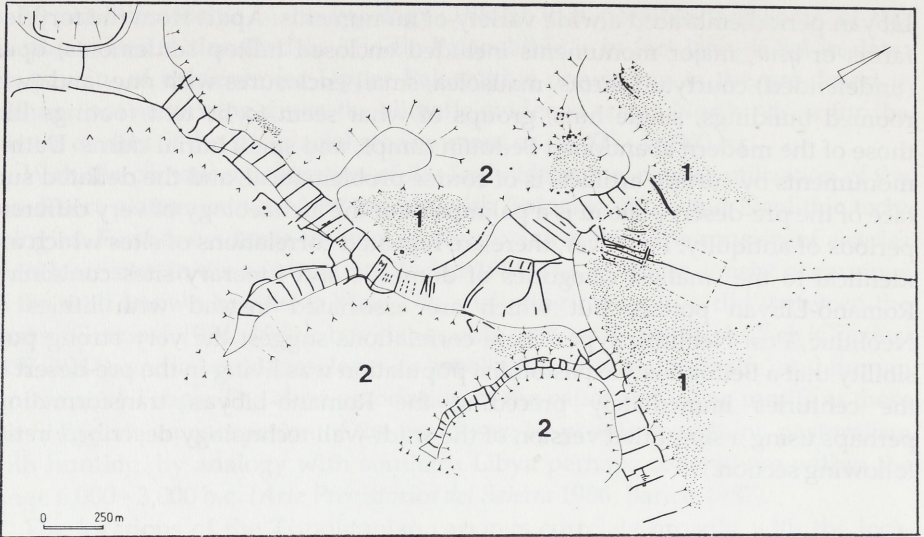


Fig. 2. Field systems in the upper Wadi Gobbeen (after Gilbertson *et al.* 1984: Fig. 3);  
1: basalt; 2: limestone.

(Barker 1985: Fig. 2). Most walls were built for controlling and trapping water, with their construction showing detailed local knowledge of runoff characteristics (Gilbertson *et al.* 1984). Others separate arable and pastoral land, others were field boundaries or larger territorial boundaries. Conduit walls fed water into cisterns, or controlled the flow of floodwater into the fields. One of the most impressive systems was mapped around the Wadi el-Amud farm (Fig. 3): floodwaters entered the fields through a series of sluices and excess water could be directed out into the main wadi over stone slipways. In the section of the Wadi Mansur in the northern part of the study area which is illustrated as Fig. 4, our investigations indicated that the area was divided into three farms or "estates", each with 35 - 50 hectares of arable land on the wadi floor (Hunt *et al.* 1986). One also had a subsidiary field system in the tributary wadi on the southern side, which appears to have been divided into a separate area for stock, a nursery area for olive trees, and cereal fields in between.

Inscriptions found at these sites indicate that the farmers were romanized Libyans rather than colonists, a hypothesis supported by the Libyan nature of cult architecture (Mattingly 1986; 1987). The pre-desert phenomenon appears to have been an example of the kind of frontier process found elsewhere on the fringes of the Roman world, whereby Roman pacification positively encouraged rural elites to opt into the Roman market for the accumulation of wealth.

In the second and third centuries A.D., these elites steadily abandoned their open farms in favor of massively fortified farms, the *qsur*. The botanical and faunal residues, pressing equipment and wall systems indicate the continuance of the earlier system of agricultural production without significant change, but

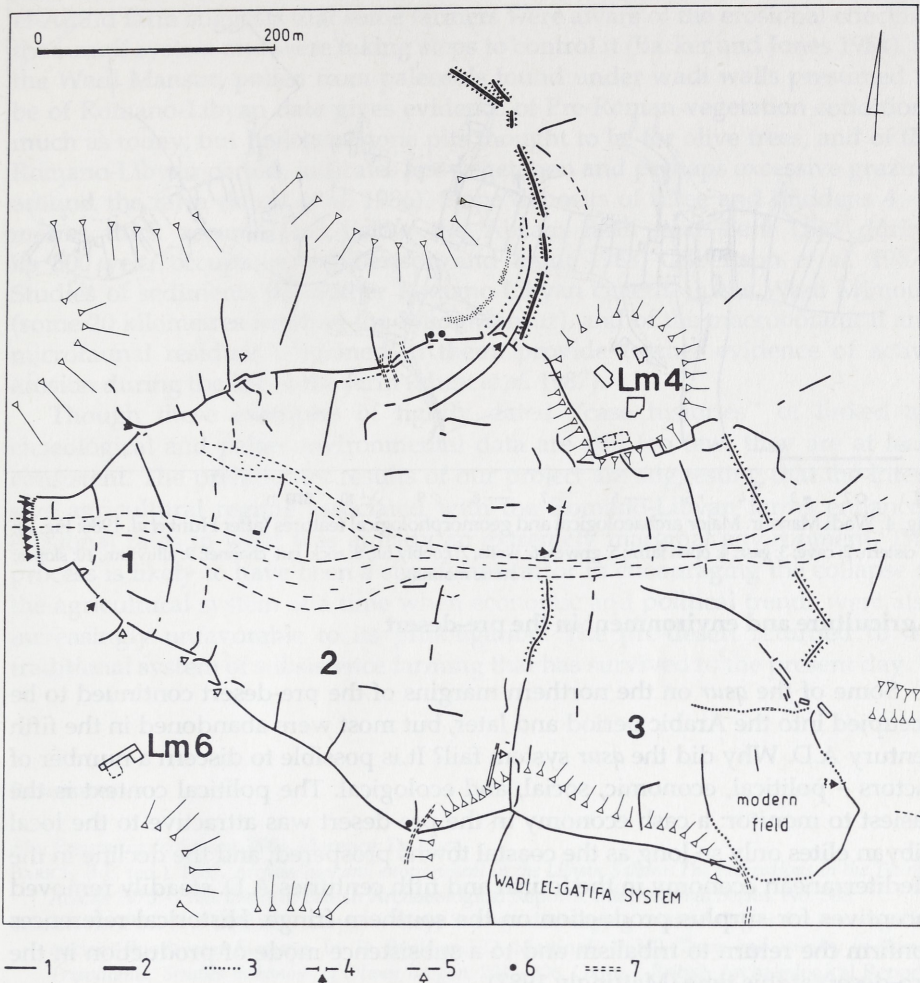
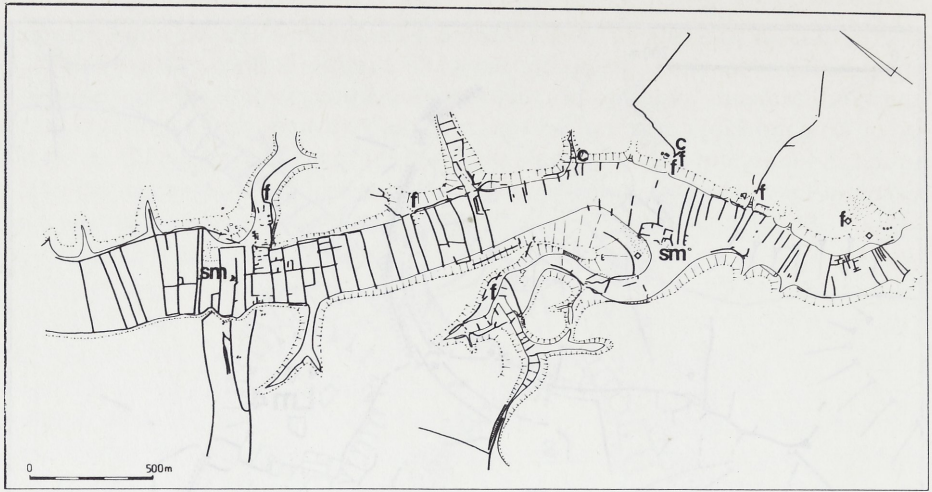


Fig. 3. Wadi el-Amud. The water control system of the Lm4 farm (after Barker and Jones 1984: Fig. 17);

Zones: 1: West zone; 2: Central zone; 3: East zone.

Legend: 1: ancient walls; 2: thick battered walls; 3: piled walls; 4: sluices and flow direction; 5: possible water inlets; 6: unclear features; 7: modern tracks.

in general the size of the agricultural holdings decreased as the number of *qsur* increased relative to the number of open farms before. It used to be thought that the *qsur* were occupied by *limitanei*, soldier-farmers, as a system of "defence in depth" separating the rich coastal lands from desert nomads, but it is now clear that the *qsur* were principally the response to local competition for land and prestige, and the resultant internal strains within the indigenous population. Relatively high populations (in the context of such a marginal environment) were competing for severely restricted arable land and runoff opportunities.



f 1 c 2 3 4 5 6 7 8 9 10 sm 11  
 Fig. 4. Wadi Mansur. Major archaeological and geomorphological features (after Hunt *et al.* 1986: Fig. 2);  
 1: cistern; 2: cave; 3: *gasr*; 4: open farm; 5: graves; 6: walls; 7: cobbly fill; 8: rock cut channel; 9: alluvium; 10: slopes;  
 11: stone mounds.

### Agriculture and environment in the pre-desert

Some of the *qsur* on the northern margins of the pre-desert continued to be occupied into the Arabic period and later, but most were abandoned in the fifth century A.D. Why did the *qsur* system fail? It is possible to discern a number of factors – political, economic, social, and ecological. The political context is the easiest to monitor: a cash economy in the pre-desert was attractive to the local Libyan elites only so long as the coastal towns prospered, and the decline in the Mediterranean economy in the fourth and fifth centuries A.D. steadily removed incentives for surplus production on the southern fringe. Historical references confirm the return to tribalism and to a subsistence mode of production in the pre-desert at this time (Mattingly 1987).

There is a large literature about the climatic context of Roman farming in North Africa, but remarkably little reliable or specific evidence and still less evidence that is tightly related to archaeological data for settlement and land use. The studies by the project's geomorphologists have found no clear evidence for any significant differences in climate between the Romano-Libyan period and the present, though the wetter periods of the earlier Holocene created paleosols on the plateau, the erosion of which might be associated with the Romano-Libyan farming (Barker and Jones 1982; Barker *et al.* 1983; Gilbertson *et al.* 1987; Hunt *et al.* 1986). There is clear evidence for the effect of Romano-Libyan farming on the landscape.

For example, sediments in a Romano-Libyan cistern in the Wadi Mansur demonstrate that plateau erosion was in progress during the life of the farm (Hunt *et al.* 1986). The partial blocking of the principal sluice system in the Wadi



el-Amud farm suggests that some farmers were aware of the erosional effects of the runoff system and were taking steps to control it (Barker and Jones 1984). In the Wadi Mansur, pollen from paleosols found under wadi walls presumed to be of Romano-Libyan date gives evidence of Pre-Roman vegetation conditions much as today, but pollen in stone pits thought to be for olive trees, and of the Romano-Libyan period, indicates less vegetation and perhaps excessive grazing around the farm (Hunt *et al.* 1986). Slope deposits of scree and middens 4 - 8 metres thick accumulated below the Abzam farm near Beni Ulid during its 500 year occupation (Gilbertson and Hunt 1988; Gilbertson *et al.* 1987). Studies of sediments in another Romano-Libyan cistern, in the Wadi Mimoun (some 20 kilometres south of the Wadi Mansur), and of the macrobotanical and microfaunal residues contained in them, provide further evidence of active erosion during the life of the farm (Hunt *et al.* 1987).

Though these examples of tightly dated "case histories" of linked archaeological and palaeoenvironmental data are still too few, they are at least consistent. The preliminary results of our project are suggesting that the intensive agricultural regime associated with the Romano-Libyan farms enhanced erosional rates in what was already an extremely marginal environment. This process is likely to have been a significant factor in encouraging the collapse of the agricultural system at a time when economic and political trends were also increasingly unfavorable to its prolongation. The pre-desert returned to the traditional system of subsistence farming that has survived to the present day.

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