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Research Article

Ridge-and-Furrow Agriculture around Lake Mikri Prespa, Greece, in a European perspective

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Abstract

Ridge and furrow is an archaeological pattern of ridges and troughs used in Europe, frequently associated with communal open-field farming and strip cultivation. Strip farming spread throughout Europe in the Middle Ages but appears to have only slightly penetrated southern Europe. In Greece, no areas under a ridge-and-furrow system were previously known. Working on 1945 aerial photos of Prespa, Greece, a border area around two lakes whose water levels fluctuate seasonally, we noted the presence of strip fields around the lakeshore, and subsequently identified them in the field as a ridge-and-furrow system. Using GIS, we measured the dimensions of all individual fields and collected oral histories from elderly locals. The area under strip farming was over 900 ha. Strips were straight, ca 200 m long and 10m wide, with a mean area of 2,160 m^2. Wheat, rye, maize and beans were cultivated on the ridges, whilst grass in the furrows was mowed for hay. The construction and dimensions were almost identical to those seen in England. No information was found on either the origin of this system in Prespa, or connections with 'zadruga' or 'chiftlik' – other regional communal land management systems. A few adjacent areas with strip cultivations still in use were located in the two neighbouring countries sharing the lakes, and still fewer areas with ridge-and-furrow traces, particularly around lakes. By using ridge-and-furrow agriculture, local people had successfully coped with the perennial and seasonal inundation of their fields, a problem that remains unresolved and afflicts modern biodiversity conservation in the area.

Keywords

Aerial archaeology, air photos, farming practices, fossil landscape, strip cultivation, strip farming.

Introduction

The division of land into strips, typically 200m by 10m, but often longer, allocated amongst different owners and often re-allocated from time to time, is often thought of as the norm in medieval Europe and is referred to either as strip cultivation or strip farming.[1] It was frequently associated with communal open-field farming practices and with using ploughland as pasture in fallow years or after the harvest. Since field systems were related to settlement patterns, reorganisation of strips into large fields is thought to be related to the nucleation of villages.[2] There is no consensus on when it started[3]: either in the eighth century, perhaps as a way of making the best use of arable land where there was no rough-land into which to expand,[4] or in the tenth century,[5] or even much earlier, possibly in the Roman era.[6] Riddle claims that strip cultivation was modified in areas where land was reclaimed, or freshly occupied, especially with the eastward expansion of Germanic peoples into Slavic areas.[7] Strip cultivation spread throughout Europe in the Middle Ages but penetrated southern Europe haphazardly.[8] It penetrated as far south as Greece and was rigorously adopted in Sardinia, where it is still visible locally.[9] It had also even reached Crete, where some parts of the Messara Plain were covered with strips until at least 1944.[10] Fields were straight or curving and the strips not closely related to topography or to township boundaries.[11]

Ridge and furrow is an archaeological pattern of ridges and troughs used in Europe during the Middle

Ages, partly associated with the open field system and often with strip cultivation typically encountered on heavy, non-permeable soils.[12] The earliest examples date to the immediate post-Roman period and it was used until the 17th and 18th centuries.[13] Surviving ridge-and-furrow topography is found in Great Britain, Ireland and elsewhere in Europe (e.g. Switzerland and eastern France),[14] reaching as far as Australia.[15] In Germany, ridge-and-furrow fields probably already existed by the 9th century, certainly by the 10th, and their general spread was complete by the late Middle Ages.[16]

Ridge-and-furrow topography was the result of ploughing with non-reversible/single-sided ploughs on the same strip of land each year. It is visible on land that was ploughed in the past, but which has not been ploughed since then. The continuation of ploughing with different methods and tools removed ridge-and-furrow patterns, except from cases where the land reverted to grassland and the pattern has been preserved. The remains of ridge and furrow often mark the landscape with a characteristic strongly rippled, corrugated effect.[17] The exact purpose, date, distribution, and various identifiable peculiarities of ridge and furrow, are not so widely understood.[18] Ridges were not created accidentally, but in order to create a self-draining seedbed. The furrow improved drainage and also served as a demarcation of ownership between ridges.[19] Ridge and furrow was almost exclusively used in soils where the aquifer was close to surface, there was no good drainage or the fields frequently flooded.

Aldcroft mentions that strip farming (but no direct mention of ridge and furrow is made) had been quite common, especially in the Balkan countries, in the interwar period of 1914–1939.[20] In Greece, this system is not directly referred to in the literature. However, it is well known that in the early 20th century in northern Greece large parts of the cultivated plains, under the "chiftlik" land tenure system, were sparsely inhabited, suffered from floods and were managed with an open field system, but according to our knowledge no direct mention of ridge and furrow is available. Chiftliks were large private estates that had appeared in place of lands owned by state feudal lords within the Ottoman Empire during its economic stagnation phase between the late 17th to 19th centuries.[21] The natural fertility of the soils was limited by the lack of proper drainage or reclamation works. The numerous marshy areas were more suitable to livestock rearing than cereal cultivation.[22]

This was exactly the situation around Lake Mikri Prespa, Greece (Fig. 1), an area that has been continuously inhabited since the Neolithic.[23] There are only a few studies describing the farming systems before the 1960s. In one of them, Kavounis wrote that the locals "… do plough in parallel, artificial ridges",[24] while a little later Polyzopoulos wrote that "…the farmland is used rather inefficiently because the peasants shape the ground into saddle-like ridges to assist drainage during winter…".[25] In the mid-1960s, major reclamation works were launched in the farmed lowlands around the lake, including major ground levelling, stream canalisation and embanking, together with the large-scale re-allocation of fields and the construction of a ca 1,100 ha drainage and open-furrow irrigation system, using water pumped from the lake and the largest of the area's streams. However, a narrow zone between the re-allocated fields and the lakeshore, frequently flooded by the annually rising levels of the lake, remained out of the irrigation scheme, intended for use as rough permanent pasture for communal sheep and cattle grazing. Researchers working on the area's habitats and ethnography in the 1980s and 1990s, who used aerial photos from the 1940s and 1960s, failed to recognise and interpret the "mysterious" land forms in this pasture zone of undulating surfaces in many places.[26]

In 2015 we started working on aerial photos from 1945 for a reedbed management study. We quickly noticed that a large part of the low-lying areas around the lake showed a characteristic pattern of narrow light and dark strips lying next and parallel to each other, mainly perpendicular to the shoreline of the lake. Soon the connection was made to the corrugated ground we had been observing in the pastures around the lakeshore for years, and which had remained un-interpreted (Figs 2, 3). Following discussions with local elderly people, we realised that before the construction of the modern irrigation system, local farmers had been using a ridge-and-furrow system of cultivation. The case of Prespa is even more interesting, because there are very few similar systems in SE Europe, although similar systems of cultivation around lakes, called "raised fields", have been described for pre-Columbian South America[27] and Western Africa.[28] Raised fields have been defined as "any prepared land involving the transfer and elevation of soil above the natural surface of the earth in order to improve cultivating conditions".[29]

In this paper we describe for the first time the basic features of this cultivation system around Lake Mikri Prespa, which had ceased to be used after the mid-1960s. We have mapped its geographic distribution, collected information about the use and construction of these land forms, measured the dimension of the fields and related this method with old and contemporary ecological problems and water management issues that are crucial for the sustainable management of the area.

Study area

Lake Mikri Prespa is situated at ca 850 m a.s.l, is eutrophic and ca 47.4 km^2 in area, with a mean depth of 4.1 m and a maximum depth of 8.4 m; for the most part it is located within Greece, though a small section belongs to Albania (Fig. 1). Lake Megali Prespa is mesotrophic, varying between 245–270 km^2 in area depending on water levels, and has a maximum depth of ca 55 m and a mean depth of 14–18 m.[30] It is shared by Albania, North Macedonia and Greece. Lake Mikri Prespa was once a branch of the larger and deeper Lake Megali Prespa, separated from it – possibly in the Holocene – by an alluvial strip of land. The two lakes should be considered as a functio-

Figure 1. The location of Lake Mikri Prespa and Lake Megali Prespa in Greece and the Balkans.

nal unit, because they are connected hydrologically. Four national parks are wholly or partly situated within the catchment of the two lakes, and both have been designated as wetlands of international importance under the Ramsar Convention, particularly for their populations of breeding rare waterbirds.[31] In 2011, the population of the Municipality of Prespa, to which this paper refers, was 1,560 people, distributed in 20 settlements.[32]

In historic times no less than 15 villages were built around Lake Mikri Prespa and the surrounding mountain slopes.[33] A large part of the farmland of these villages was situated close to the eastern and northern shoreline of the lake, on very mildly sloping land with mainly alluvial soils. In the late 19th and most of the 20th century, the main crops had been cereals, pulses, fruit trees and a few vegetables. A notable proportion of the farmland around the lake was poorly drained, and large areas were flooded by the streams discharging into the lake from the surrounding mountain slopes (Fig. 4). In addition, since the lake is rather shallow, the high inflows in spring raised the water level (by ca 1 m), resulting in the flooding of a strip of land of varied width around the lakeshores, which thus became uncultivable, mainly in the eastern and northern parts.

In the local slav-macedonian language a ridge was called a "slóghi", while a furrow was called a "lázo(u)rka". So, the ridge-and-furrow system, if translated into the local language, could be called a "sloghi-y-lazourka" system.

Methods

We used black-and-white panchromatic air-photographs taken in May 1945 by the Royal Air Force (RAF). Their scale is 1: 42,000, and their resolution is rather low (Fig. 2). Fifty nine of them were needed to cover our research area. They were purchased from the Hellenic Military Geographical Service.

The software ArcMap 10.2.2 was used to manage the raster images, using a raster catalogue. The areas of the ridge-and-furrow fields were digitised. A polygon shapefile was created containing groups of strips with similar geometrical characteristics. For each polygon we calculated the area, and from this the total area of

Figure 2. The strip fields as they appear in the alluvial piece of land that separates the two lakes, Mikri Prespa and Megali Prespa, in aerial photos from May 1945.

Figure 3. Remnants of ridge-and-furrow topography as seen from the ground in the area shown in Figure 2.

Figure 4. Ridge-and-furrow topography as shown on Google Earth satellite photos of the northern lakeshore of Lake Mikri Prespa, Greece (40°48.96'N; 21°05.55'E). These are areas which have remained unploughed for more than fifty years and are now used as grazing pastures or covered by marsh vegetation.

ridge-and-furrow fields. Furthermore, for each group of strips the mean length, mean width, direction and angle were calculated, through the ArcMap Linear Directional Mean algorithm.

We also collected information on the ridge-and-furrow cultivation system of Prespa in situ. For this purpose we interviewed two elderly people in the villages of Laimos and Plati, and also circulated a questionnaire in the villages, asking for any kind of information that could help us increase our knowledge of this practice. An agronomist from a nearby region in neighbouring North Macedonia scanned the national literature of the country, in an attempt to locate relevant information, and also interviewed local agronomists and university researchers working in the fields of agronomy and plant production.

Results

Distribution and dimensions of the ridge-and -furrow fields

The majority of the areas cultivated under the ridge-and-furrow system were located in the northern, north-eastern and central-eastern parts of Lake Mikri Prespa (Fig. 5), with two very small areas on the western shore, close to the villages of Pyli (40°46.44'N, 21°02.84'E) and Angathoto (40°42.73'N, 21°02.79'E abandoned after the Greek Civil War, 1946–1949). As in the past, these are the areas of the shoreline where the water of the lakes meets the land with the shallowest incline.

The total area under the ridge-and-furrow system in 1945, when the aerial photos were taken, was at least 905 ha, but it may have been more extensive in years of lower water levels.

The total surface of permanently waterlogged areas within the above field system could not be estimated accurately in the examined photos, but it was certainly less than 5% of the total. These areas were left uncultivated, because they contained so much water that it was impossible to farm the land, even with this land management system. Thus, the net area under cultivation with strip farming was certainly over 860 ha.

The strips were mostly straight (Fig. 6A, B) as in other areas in Europe.[34] The average length of the strips was 207 m ± 151 m (n = 162, median 160 m, range 50–770 m), with 68% between 50–220 m. The length varied according to the local micro-relief. The mean width of the strips was estimated to 10m ± 3.8 m, (n = 162, median 10 m, range 5–20), with 60% being between 9 and 20 m in width. Respectively, the average area of each strip was 2,163 m^2 ± 1,970 m^2, median 1,575 m^2, n = 160, range 312–9,630 m^2, with 78% of the fields between 300 and 3,000 m^2, while only 11.6 % of the fields had an area of over 4,000m^2.

Practices and crops according to local information and knowledge

A ridge, would be created by ploughing in a clockwise spiral, "filling" (i.e. throwing the soil) constantly to the

Figure 5. The Greek part of Lake Mikri Prespa as it appears in the aerial photos of 1945. The areas under the ridge-and-furrow cultivation system are demarcated with the red lines.

right with a one-sided plough, starting from the middle of the strip. According to the information provided by the interviewees, in the 20th century they were mainly ploughed using oxen, horses and water buffalo. Only four crops were cultivated on the ridges: wheat, rye, maize and beans. The vast majority were planted with wheat. Beans were grown only on the wettest of the ridges, or in the wettest parts, side by side with maize sown on the highest and driest parts. Beans were grown without supporting canes; they were creeping or semi-shrubby varieties.

Grass growing in the furrows was mowed for hay with scythes just prior to, or during, the harvest of the main crop. The furrows also served as a demarcation of ownership between ridges. More often the half-width of a furrow, was around two scythe-cuts. The ridges would be created exclusively in heavy, waterlogged soils down to-

Figure 6. A. The Koula area photographed from a vantage point by K. Hatzopoulos in 1965. The ridge-and-furrow field strips can clearly be seen as still in operation; B: The area shown in the circle is the same as that which appears in Figure 6A under the ridge-and-furrow system. Aerial photograph of 1945.

wards the lakeshore, in order to overcome the problem of flooding or poor drainage, and to secure more cultivable land. So, neighbouring strips would tend to be parallel to each other, and when strips at a different angle would appear this was due to adaptation to the local micro-relief, i.e. small-scale scattered mounds and depressions.

After the maize harvest in August, free grazing of stubble fields by livestock was allowed for all herds and not just the animals of the landowners. Only enclosed vegetable gardens would keep out grazing herds. It was clearly stated that, as for other areas in Europe,[35] the ridges, which were the units of ploughing, should not be confused with the strips, which were the units of tenure. There could be three or more ridges within the width of a strip holding.

Discussion

Comparison of strip dimensions in Prespa to those in other parts of Europe

The construction method of the ridge-and-furrow fields, as described by local interviewees, was identical to those described in many sources for the ridge-and-furrow system.[36] The dimensions of strips under strip cultivation – not necessarily ridge and furrow – mentioned in the literature were: (strip width (in m)-strip length (in m)-strip area (in m^2): 10-200-2,000,[37] NA-NA-1,570,[38] 8-200-1,000/4,000,[39] but there are also other references for England of widths ranging from 3 to 20 m. Most medieval ridge and furrow had a standard width of ca 10 m and the majority of strips had a standard length of ca 200 m, which is the distance a pair of oxen could plough without resting (called a "furlong").[40] Thus, the dimensions of the ridges around Lake Mikri Prespa are practically identical to those mentioned for other places in Europe. Very few strips in Prespa were found to be over 700–800 m when measured. Examples of very long strips of up to 1,000 m long are known from soil marks on aerial photographs, and from 18th century maps from England, Germany and Austria.[41] The Concise Oxford Dictionary of Archaeology states that "The width of the ridges preferred seems to vary between regions, while dates for ridge and furrow range from the immediate post-Roman period through to the 17th century AD".[42]

The possible origins of ridge and furrow in Prespa

We could not obtain any information about the possible origins of the ridge-and-furrow system in Prespa. We do know that they stopped being used in the mid-1960s, when the modern irrigation scheme and large-scale land levelling and reclamation works began, which changed the face of the landscape around the lake. Ridge and furrow has been described as early medieval reclamation works,[43] but in relation to the possible origins of strip cultivation in this part of the world, Riddle claims that "... more a development of the tenth century, strip cultivation was modified in areas where land was reclaimed, or freshly occupied especially with the eastward expansion of Germanic peoples into Slavic areas.[44] The strips were systematically laid out, with long strips behind farm premises and at right angles to the road or stream". Langewitz et al. though, propose an earlier dating and advise against a close association between ethnicity and cultivation techniques in a linear way.[45]

There are two periods that could possibly be connected to the origin of ridge and furrow in Prespa. The first is during the 11th century, when the Normans and Crusaders were present in the adjacent plain of Korce (in present-day Albania) and in Prespa (1072–73 and 1082–1085, 1096–1097 AD). Hammond wrote that "The plain of Korce was of cardinal importance for the Normans in 1082–1083 and for the Crusaders in 1096–1097.[46] Their general strategy was to live off southern Albania, where the valley of Argyrokastro was particularly fertile". Could it be that during their stay in this area they transferred the ridge-and-furrow cultivation method to the local population? Though much less likely, the other period where we might postulate the transfer of this technique could have taken place was during the second decade of the 20th century, when the French troops (the Armée d'Orient) were in the area during World War I. It is known that they stayed in this particular frontier area for over four years, and that they had been very active in constructing valuable infrastructure, such as railways and bridges, to mention the most important. A third and equally plausible explanation may be related to a local origin of the system, as an adaptation to the soil and moisture conditions of the area. The case of terracing is very similar, as it seems to have developed independently in many localities in the region.

The ploughing method for the creation of the ridges was described to us by local elderly people in exactly the same way as it is described in Williams and Lewis.[47] Furthermore, in England, Hall claims that ridges were usually cultivated with similar crops as in Prespa,[48] but on a three-year crop rotation, carrying wheat and barley in the first year, beans and peas the next, and left fallow in the third year, but not with such waterlogging conditions as in Prespa.

The simultaneous occurrence of both types of fields

A fact which should not be overlooked is that at least between 1945 and 1965, as can easily be seen in the aerial photographs and from in situ observation, the ridge-and-furrow system, or strip fields, co-existed with the conventional system of orthogonal, rectilinear, flat-ploughed fields, which was the only field pattern used in the higher elevations, where there were no problems of drainage. This co-existence is observed in many other areas in Europe with strip fields.[49] In Prespa, either the strip cultivation system was ubiquitous in older times and survived, but the dry fields in higher areas were transformed to the conventional land parcels of today, or, which is more likely, peasants started using this particular system sometime in the past in order to ex-

ploit poorly drained lands, or lands close to the lakeshore that were periodically flooded.

Possible relation of the ridge and furrow to communal land management systems such as "zadruga" and "chiftlik".

Strip farming has been associated with communal open-field farming practices and communal land management systems.[50] Some authors mention it as typical of the open-field system, while others associate strip farming, or strip cultivation, in the Balkans with the "zadruga".[51] It is known that the "zadruga", a communal land use system that existed in quite a few Slavic countries and that in the south reached the region around Bitola,[52] also existed, albeit on a limited basis, in the Greek part of Prespa.[53] The land use practices of zadruga are similar to those of open field systems in the sense that they typically involve common sowing and rotational-grazing practices. At the beginning of the 20th century, there were 88 zadruga units in Prespa, but they were practically all dissolved before World War II.[54] Many peasants bought lands from the owner Ottoman beys in the first two decades of the 20th century. Different families owned scattered strips here and there, and only owned adjacent strips (up to 4 strips) in a few places. So, the strip farming plots that were observed in the 1945 photos, and which continued to be used as such until the mid-1960s, may have survived a previous era of collective farming schemes associated with the zadruga. However, we have not been able to locate any evidence or testimonies from local people about such direct or indirect connections. On the other hand, Todorova finds the theory that the zadruga is a phenomenon of the 19th and 20th centuries more reasonable than the assumption of its long term existence since the 13th and 14th centuries,[55] so, if the ridge-and-furrow system was indeed associated with the zadruga, then it might be much more recent than was supposed above.

We also could not find any evidence of the ridge-and-furrow system in Prespa connected to the "chiftlik" system (large land properties), although it is very well documented that most of the villages in Greek Prespa (Mikrolimni, Oxia, Karyes, Pyli, Agios Achillios, Agios Germanos, Antartiko, Psarades, Vrondero, Daseri, etc) belonged to chiftliks until the early20th century, when almost all land was transferred to small private properties.[56]

The geographical distribution of ridge and furrow in the region around Prespa

By checking Google Earth satellite photos, we have located a few other areas where the strip cultivation system is still used, and much fewer areas where we have identified traces of the ridge-and-furrow system, especially around lakes. The areas with strip cultivation are in the districts of Bitola and Prilep in North Macedonia (Fig. 7). Possible or certain ridge-and-furrow traces were located in the northern part of Lake Ohrid, north of Struga (North Macedonia, Fig. 1), in the northern part of Lake Megali Prespa between Resen and the Ezerani Nature Park (North Macedonia), as well as in Albania close to the villages of Tuminec, Dolna Gorica, Globoceni, Pustec and Zaroshka (Figs 7, 8). All these areas with clear occurrences of strip cultivation and traces of the ridge-and-furrow system are included in an area lying between latitudes 41°33'N (Gostirazhni, North Macedonia) and 40°40'N (Zagradec, Albania), and longitudes 20°43'E (Malik, Albania) and 21°33'E (Nebregovo, North Macedonia), i.e. in the upper basin of the Crna River and around the Prespa lakes and the drained Malik Lake/marshes, in an area encompassing parts of Albania, North Macedonia and Greece. We found no traces of either strip cultivation or the ridge-and-furrow system at other sites in Greece, or around the neighbouring lakes of Chimaditis, Zazari, Petron, Kastoria and Vegoritis. It is possible that ridge-and-furrow systems were present there too, but were later erased from the topography by reclamation interventions such as ground levelling and land re-allocations, although it is also possible that they were never there. There are also some possible traces of ridge and furrow further east of this area, in the north-western part of Lake Dojran, close to the village of Nov Dojran, North Macedonia (41°13.98'N, 22°42.70'E) (Fig. 7).

The ridge-and-furrow system around Lake Mikri Prespa was not only spread over all kinds of perennially waterlogged soils, but it also exclusively covered all gently sloping land on the lakeshore. Thus, it had been a very efficient way to cultivate the zone that was seasonally flooded with rising water levels in spring, thereby securing harvests regardless of the magnitude of the seasonal water level rise. In this particular aspect it bears a very strong resemblance to the raised field agriculture systems that had developed particularly around the lakes of South America since the Neolithic.[57] It is important to note that Kolata and Ortloff demonstrated that enhanced heat storage capacity was an essential design element of raised field agriculture in the Andean highlands plateau, and that this thermal effect served to mitigate the chronic hazard of frost damage to maturing crops in that environment.[58] As the fields around Lake Mikri Prespa also lie at a relatively high altitude (between 850–855 m a.s.l.), this thermal aspect of the ridge-and-furrow system should not be underestimated and should be appraised together with the other primary functions of raised fields, such as drainage, soil aeration and moisture retention.[59] However, neither of the two main local interviewees mentioned this aspect of the ridge-and-furrow system in Prespa, and it also did not appear in any piece of the collected information.

In the re-allocation of lands that accompanied and followed the reclamation works for the construction of the irrigation scheme in Prespa in the 1960s, a considerable portion of these annually flooded fields close to the lakeshore were allocated to a number of farmers. However, in the modern agricultural era that ensued the ridge-and-furrow system was not resumed, and when intensive bean cultivation commenced the owners of these lands began pressing hard for keeping the water level of

Figure 7. Fossil agrarian landscapes with relict ridge-and-furrow earthworks around the Megali and Mikri Prespa lakes, located through examination of Google Earth satellite photos from the 2010s.

Figure 8. Ridge-and-furrow system topography at the Izvor locality close to Dolna Gorica village, Lake Megali Prespa.

the lake below a certain threshold, so that they would be able to cultivate their fields.[60] The lake level could be partly managed through a sluice that controlled the outflow water from Lake Mikri Prespa to Lake Megali Prespa. But keeping the water level low results in not enough wet meadows being flooded with shallow water, and consequently the feeding sites for the rare wading waterbirds in the lake are decreasing. The problem of reconciling local agriculture with waterbird conservation under the conditions set by the seasonally fluctuating waters of the lake is still the crucial management challenge in the area.[61] It seems that past management systems could be more effective than current ones in tackling conflicts between the local farming economy and the lake ecosystem.

Concluding remarks

Using methods of aerial archaeology and field observations, we identified large areas of ridge-and-furrow landscape, which appear as prominent undulations found under wet meadows, reedbeds or rough pasture, around Lake Mikri Prespa in Greece. It is an old type of agrarian landscape, like ancient wood-pastures, abandoned villages and farmsteads, man-made ditches, drystone walls and hedgerows, cultivation terraces and many others. We were unable to fully reconstruct its use in the past, and we are still far from thoroughly understanding the full spectrum of causes that led to its adoption and shaped its functionality. On the question of its origin, further research needs to be conducted in both Prespa and the adjacent areas, in order to date and collect information that can help us unfold its history. It can be considered as an archaeological site currently under grassland, a relic of a pre-18th century landscape, a traditional historic landscape according to Millman and Antrop and also an agricultural system of the past, which has continued to be productive until very recently.[62] In this sense it qualifies as a relict, or fossil, landscape according to the World Heritage Committee categorisation of cultural landscapes, in which "an evolutionary process came to an end at some time in the past, either abruptly or over a period, but their distinguishing features are still visible in material form".[63] Moreover, its systematic survey can help us understand how past communities adapted their land management systems to their environments.[64]

As with many other such historic and traditional landscapes, farming intensification and/or abandonment destroyed a large part of the ridge-and-furrow structures in Prespa in the mid-1960s during land levelling works for the building of the modern irrigation/drainage system. The remaining parts, basically those lying very close to the lakeshore, were retained because of use and ownership changes in the littoral zone of the lake, and were converted into pasture lands that were mowed and grazed by sheep and cattle, or gradually partly covered by expanding aquatic macrophytes.

To our knowledge this is the first mention of existence of ridge-and-furrow agriculture for Greece. Despite the fact that they lie in a national park and a protected natural area, they are threatened by future intensive trampling by grazing livestock and the possible improper use of heavy machinery, thus careful management decisions are vital for their conservation, since grazing must be maintained on these lands as a kind of management beneficial to biodiversity. This research also highlights a case where historic landscape land management systems and their landmarks may remain "hidden" while in plain sight and marks a need for wider in scope and historic reach studies for ridge and furrow and other systems in Greece and Europe. Such systems are historic markers and can also be future management examples.

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