

The Disappearance of the Ancient Landscape and the Climatic Anomaly of the Early Middle Ages

In the now substantial historical literature on the ‘transformation of the Roman world’ the subject of agriculture and the rural world in what had been the western Empire has been relatively neglected, despite the plethora of archaeological investigations that directly bear on the subject. In the series published under that commodious title, only one volume out of fourteen has been devoted to the rural economy, and that one under the curious questioning title The Making of Feudal Agricultures?¹ Almost all consideration of the Late Antique and Early Medieval economies of what was once the western Roman Empire appears still to be in thrall to the questions and hypotheses first put forward by Henri Pirenne over seventy years ago. Did cities remain vibrant and economically active places? Did international commerce survive? What were the rhythms of decline and revival of urban marketplaces and the trade that fed them?²

There is no need to insist on the fact that urban centers and an urban economy of whatever size and strength, not to mention armies, monasteries, and aristocratic courts, would not have existed without a rural world to feed them. And although there is no way to calculate accurate figures for late Antiquity and the early Middle Ages, the examples of both early modern European populations and modern third world populations suggest that an estimate of eight or nine agricultural workers for every individual not working in the fields would be a reasonable guess.³ The story of the rural world is therefore the story of the vast majority of the population, in addition to being the necessary prerequisite to all those studies of the urban world and the market economy which dominate the literature.

In all likelihood, the reasons for this neglect are many. Of the most important, surely the first is the belief that there is little or no new evidence to make such a history possible, since all the written sources – the few relevant texts in the Roman law codes, the early ‘barbarian’ codes, sermon literature, a few Italian papyri, and so forth – have long been worked over. Few conclusions drawn from them seem, however, to be above controversy.⁴ Second, the continuing assumption among many historians that the only changes that might have occurred would have been in the manner in which elites exploited the peasantry, from this to conclude that the only story worth telling, or the only story that could be told, was how the Roman great estate turned into the monastic and imperial great estates of the Carolingian world.⁵ Third, the belief that if there were any changes in the way that agriculturalists – whether called slaves, serfs, or simply peasants – worked the land, those changes would have been mainly the result of technical or material losses. At the head of the list of such changes would have been the now long-disproved notion that iron tools disappeared from peasant households (an idea popularized in particular by Georges Duby⁶).

All of these beliefs have commonly fed the conviction that there was very long-term continuity in the rural world between late Antiquity and the beginning of the great medieval expansion, usually dated around the year 1000. From this, some have surmised that somewhere under modern villages one would find the Roman villa that originally served as the pole of attraction for medieval peasant households, while others have surmised that the dispersed habitat of antiquity continued until, sometime in the tenth or eleventh century or later, castle lords forcibly resettled peasants into nucleated villages where they could more easily be controlled and exploited.⁷

Over the last twenty years or so, archaeological field surveys and rescue archeology have begun to suggest a very different narrative. This narrative has not been without its obscurities and points of contention, not surprising in the case of a young and rapidly developing field of study. The

results of these studies, nevertheless, have clarified the nature, rhythms, and chronology of changes in material culture and the agricultural economy over the half millennium from the third through the seventh century. They have thus brought into sharper focus the vexed issues of economic and demographic “decline” (whatever its ideological baggage, still a useful term, I believe, to cover material impoverishment and reduced population). They have also described the nature and chronology of the stages through which the ancient rural landscapes of both northern and Mediterranean Europe passed to become the very different landscapes of the Middle Ages.⁸ In particular, when looked at in detail, the research on the rural world points to an important distinction between the developments of the third and fourth centuries and what happened in the centuries that followed, a distinction that is obscured by the far more complex cultural, political, and physical transformations of the urban world. In this article I will briefly discuss the longer half-millennial narrative before turning to the period when the ancient countryside vanished in the West and the first elements of what would be the medieval countryside came into being: the period from the fifth to the seventh century. A critical factor in this later period, I will argue, was a climate anomaly, largely ignored by historians but well known to historical climatologists.

I: The evidence of field surveys.

The general shape of this new archeology-based narrative was first sketched by the South Etruria Survey conducted in the years following the Second World War by the British School at Rome. The results were summarized by Timothy Potter in 1979, and brought to the attention of historians a few years later by Richard Hodges and David Whitehouse.⁹ In his analysis of African Red Slip ware (ARS) and Forum ware from the Ager faliscus, Potter showed that where 82% of all the known Antique sites were occupied in the second century CE, only 58% were occupied in the third century and only 19% in the fifth and sixth. When Helen Patterson and her team recently re-examined the material from the survey, including so called ‘coarse ware’ as well as ARS, they found that Potter’s broad narrative was substantially confirmed: they identified 1300 sites from the period 100-250, fewer than 400 from the period 250-450, and a continued dramatic decline through the later fifth, the sixth and seventh centuries.¹⁰

Since the publication of the South Etruria survey, other surveys have confirmed equivalent declines in occupied sites between the second century and the end of the third, and the continued disappearance of sites from the fifth century onward in region after region, not only in Italy but throughout the western Empire. Many of these surveys have recently been summarized elsewhere; there is no need to do so again here.¹¹ I will merely mention three recently published examples that have particular value.

Marco Valenti’s fine-grained twenty-year study of 1979 square km. of the provinces of Siena and Grosseto (9% of Tuscany), which involved both field surveys and excavations, revealed a decline in the average density of occupation from one site every 1.27 square km. in the early third century to one every 4 square km. in the fifth century and one every 10 square km. in the sixth. By the fifth century a little more than a fifth of the early third-century sites were still occupied, and only about a third of these survived into the sixth. Patterson’s survey of the Tiber river basin showed a similar decline, with a first reversal of expansion in the third century, a little more than a third of the sites surviving into the fifth century, and only 1/18 of that number still occupied in the seventh.¹²

Though more exact dating of pottery, especially of coarse or ‘common’ ware, has refined the chronology of older surveys, making the decline look less catastrophic than it did to Hodges and Whitehouse in 1983, both the direction and the rhythm of site abandonment has been confirmed time and again in Italy, though with significant regional variation.¹³

Direction and rhythm have also been confirmed in southern Gaul, where the international program working under the name ‘Archaeomedes’ in their survey of eight separate regions of the lower Rhone valley discovered 865 Roman period sites. For these sites the group recorded not only the dates of occupation, size, and the nature of material found, but also data on the environment. The dates of first occupation from the Roman conquest to the fifth century CE are presented in Table 1. 780 of these sites gave no signs of occupation prior to the arrival of the Romans.

Table 1: date of foundation of Roman era sites in the mid- and lower-Rhône valley

B.C.E.	1 st century	2 nd century	3 rd century	4 th century	5 th century	total
252	462	36	21	58	26	865

Table 2 gives the number of individual sites occupied during the same centuries.

Table 2: number of Rhône valley sites occupied

B.C.E.	1 st century	2 nd century	3 rd century	4 th century	5 th century
252	541	565	313	224	188

That is, the number of sites occupied in the fifth century was only a third of the number of sites occupied in the second century, and nearly half of these could have been sites first occupied in the fourth or fifth century. The published data unfortunately do not give numbers for sixth-century occupation. For the period up to 500 CE, however, the Rhône valley percentages are of the same order as those of the South Etruria survey.¹⁴

A richer vision of developments in the lower Rhône valley, and one extending beyond 500, comes from an earlier survey that was part of the same program, a survey of the Lunellois plain between Nîmes and Montpellier, just west of the mouth of the Rhône¹⁵. Here, 150 ancient and medieval sites were intensively studied. The chronology of their occupation is represented in Figure 1.

Figure 1: Numbers of sites in the Lunellois, by date of foundation and longevity

Not surprisingly, the rate of survival in this small sample reflect those of the larger survey of which it was a part. Sixty-six of the sites were created *de novo* in the first century. Two-thirds of these did not survive into the third century, and three-quarters did not survive to the end of the third. The fourth and fifth centuries mark a period of renewal, though about half of these new sites do not survive into the sixth. In terms of numbers of creations and disappearances, there are two important ‘breaks’ in the pattern of settlement: one in the passage through the third century, the second in the sixth and seventh, by the end of which nearly all the ancient sites had been abandoned.

These three recent surveys are particularly important, first because of the size of the areas covered and the number of sites investigated, several thousand all told. They were conducted in areas where late-Antique and early-medieval fine and common wares have now been much more securely dated. They have involved excavation of selected sites as well as the gathering of surface pottery. And they have been exceptionally attentive to all the factors that might bias their results.

What might their findings mean?

The earliest impulse when the results of the South Etrurian survey were published was to conclude, to quote Tim Potter himself, that ‘everything points to a level of depopulation that is as marked in the towns as it is in the countryside.’¹⁶ Whitehouse and Hodges were equally forceful.¹⁷ But not everyone was convinced.

Some, in response, tried moving what appeared to be the absent country-dwellers to the cities or to the villas and farmsteads that remained. This solution proved implausible, for the supposed migrants would have had to be fed by someone in the very countryside that instead appeared to be emptying out; and though luxury expenditures are everywhere visible in the great villas of the fourth-century countryside, there has been no demonstration of their increased productivity, in fact – where attempts have been made to answer the productivity question – just the opposite.¹⁸ Furthermore, with rare exceptions, such as Trier, which as imperial capital enjoyed a vibrant fourth century (as did the countryside around it), most Western cities were being partially, or in some cases completely, abandoned.¹⁹ Others have suggested that the people who had lived in dispersed farmsteads (or their immediate descendants) moved to new proto-villages (thus a hamlet of three farmsteads could have the same population as three dispersed farmsteads, and in consequence, in the tabulation of sites, three old ones would disappear and a single new one be created without any necessary change in the total population represented).²⁰ Yet others propose that many of the smaller sites, especially those of the first and second centuries, were not living spaces at all, but modest structures to hold equipment or temporary quarters for agricultural laborers whose residences were elsewhere²¹

These objections to a simple demographic interpretation of the evidence seem to be driven more by a desire to avoid a ‘catastrophist’ vision of late Antiquity, than to open up the debate on the fate of the late-Antique rural world. They do, however, have the heuristic advantage of raising two fundamental questions about the survey data, which we may put simply as, ‘What lies behind those black lines in Figure 1?’ Specifically, what constitutes a ‘site’? And what do we understand by ‘continuous occupation’? It is only in recent years, as archeologists have begun at long last to pay attention to post-fifth-century levels of both rural and urban sites and, in the case of villas, to the working areas as well as the living areas where art objects of value were likely to be found, that the nature and importance of these questions has become clear.²² No single excavation can represent all the complexities that have recently been found, but the work on one villa may at least suggest what could be hiding behind one of those long lines, and why ‘site’ and ‘continuous occupation’ are problematic terms.

Not far to the west of the Lunellois is the villa of Pré-Bas just outside the village of Loupian, 4 km. from the port of Mèze.²³ There was a farm here in the Republican period, of which naught remains but some filled storage pits and ditches. The villa of the first century CE was devoted almost exclusively to producing and exporting wine, with substantial space given over to living quarters for the workforce and to the warehouse for the wine. In the late second and third century,

both areas were allowed to shrink. An entire section of the inhabited space fell to ruin. The remains imply a partial shift to cereal cultivation. Among other changes, the storage area for wine was transformed into an iron-working shop. One to two centuries later in second half of fourth century the building's owner built new wine presses and wine storage areas, but the volume of containers from that period suggest a production that was only a half to a third of the production of the villa's most profitable days in the first century. The remains of the fifth century suggest a production that is in turn five to six times smaller than that of the fourth. Nevertheless, it was in the fourth century that the villa was rebuilt on an elaborate and luxurious scale, with mosaic floors and painted walls. It is that fourth-century villa that one visits now. Not more than a century later the villa suffered what its excavator Christophe Pellecuer calls 'a brutal and permanent decline' (une brutale et durable récession de l'occupation). The occupants continued to repair worn mosaics with mortar, but wall paintings were allowed to fade and crumble, marble was removed from one wing, and mosaics eventually suffered when heavy objects (roof beams, perhaps) fell on them, after which they were covered over with a mixture of cement and tile fragments. Finally in the sixth century the great courtyard was colonized with buildings that made use of the remaining walls. They were perhaps timber framed structures. Some may have been 'sunken huts.' The inhabitants threw their kitchen garbage just outside these buildings, where it was eventually buried in the ruins. These scant remains (only 3% of the potsherds collected on the site post-date the year 450) are the last signs of occupation. At length a destruction layer covered the entire site. After a glorious fourth, an impoverished but hopeful *romanitas* persisted at Pré-Bas through part of the fifth century, as fourth-century residential rooms were converted to utilitarian usage. Those who lived here strove to maintain what they could of the old structure. Then the will, or the means, no longer survived, and finally the site was abandoned and buried. .

Meanwhile, sometime in the fifth century, about 800 meters away a Christian church went up, most likely at the behest of (and paid by) the owner of Pré-Bas, a church that also served as a cemetery for the villa, for the artisanal and fishing hamlet near the lagoon whose products served the villa, and for the small community that quickly gathered around the sacred space and remained there until at least the Carolingian period. The original church probably fell to ruins by the seventh or eighth century and was replaced by another, which itself was replaced in the late Middle Ages by the gothic structure that is now on the site.

Here, we see, is the problem with just counting sites. A villa such as this, with a substantial work force in the first century, an uncertain number in the second and third, and a renewed prosperity but still perhaps only half the first-century work force in the fourth is counted as one site. It is still one site in its impoverished sixth-century state. At the same time, small agglomerations (such as ancient Lunel), post-fifth-century rural churches, and small farms are also counted individually as 'sites.' Their presumed populations are very different. Furthermore, is Pré-Bas, with its associated late-Antique church and artisanal-fishing quarter one site, two, or three? Is the survival of the church after the villa and artisanal quarter disappear an example of continuity or of abandonment and new foundation? Indeed, given the changes through all the centuries of its occupation, should we pay more attention to the continued use of the site (or sites) or to the direction and speed of the transformations? However these questions are answered, it is obvious that a 'site' is not an entity with any fixed physical meaning, still less any demographic meaning, even if defined by the number of square meters where the shard fragments were found. Pellecuer could estimate the manpower

required for production at Pré-Bas, based on the containers used for stocking wine and grain, but it would be foolhardy to extrapolate from that to all the large villas in the Rhône valley survey or anywhere else. Thus, while it seems clear enough that behind the drop in ‘occupied sites’ lies a fall in population, we will probably never be able to measure that fall with any precision or even set it within a plausible range.²⁴

The scale of population decline, however, may very well be a secondary issue. What appears more important are the social and economic changes over the long term – implied by the scale and direction of physical changes at Pré-Bas and confirmed by similar changes at many other sites.

The fourth-century heyday of luxurious villas – a few newly founded at that time, most of them rebuilt, sometimes after a period of abandonment – has long been a fixture of Roman archaeology.²⁵ It is this feature of the late Roman countryside that has always seemed to be a strong counter-argument to notions of late-Antique ‘decline.’ More refined analysis of survey data coupled with the identification of post-fifth-century pottery sequences has gradually resolved this apparent contradiction. The Rhône valley project, for example, by carefully identifying sites by their size, demonstrated that the small and medium-sized farms were the most fragile; they were the ones most likely to disappear after the mid-second century. It was the larger villas that were most likely to survive or be reoccupied in the fourth century.²⁶ Surveys in Emilia, Tuscany, and Friuli have found the same phenomenon.²⁷ What we may be looking at in the late-second and third century is the collapse of a speculative commercialized agriculture, a collapse that smaller farms were unable to withstand. The nature of this economic crisis remains a problem for the specialists to solve.²⁸ It is clear from luxurious villas like Pré-Bas that the reforms of Diocletian and his successors succeeded in returning wealth to the countryside, at least in the hands of the well-connected, the rich, and the super-rich.²⁹

What happened from the fifth century on is another story. As recently as a decade ago, there was little but supposition and guesswork on which to base a narrative of rural change in these later centuries.³⁰ That has all changed as the careful identification of fifth- and post-fifth-century pottery in many regions has established that the villas still occupied in the fourth century were abandoned in the course of the fifth or early sixth centuries or were profoundly impoverished in ways that match the story of Pré-Bas.³¹

The crunch, or in less imagistic terms, the transition, is clearly visible in the Lunellois data (Figure 1). After the end of the first century ‘bubble’ took its toll of smaller villas and farmsteads, it was the turn of the larger and more prosperous. The handful that did not vanish by 400 would probably prove, if carefully excavated, to have gone through an impoverishment equivalent to the villa of Pré-Bas: parts falling to ruin, other parts rebuilt with spolia, wood, wattle and daub, colonnades divided into living spaces or artisan workshops, all summed up in Tamara Lewit’s colorful phrase, ‘burials in the bathhouse.’³² A second aspect of the Lunellois data must be noted as well: new foundations of the fourth and fifth centuries were relatively fragile, lasting only one or two centuries. And, of course, a number of those ‘sites’ may be churches or cemeteries, with or without known attendant habitations.

Wherever archeologists have recently looked, the situation is similar: a further, and radical, thinning out of fourth-century habitation sites during the fifth and sixth centuries and the impoverishment the few that remained. This has been confirmed in the region of Metz in north-east

Gaul, in the Eifel west of the Rhine, in the Paris basin, along the Danube frontier, in northern and southern Italy.³³ The ruin of baths, the subdividing of mosaic floors with light partitions made of wood and scavenged materials, the planting of ‘sunken huts’ in courtyards, and the disappearance of all signs of luxury in an accumulation of garbage and crumbling walls, may be a sign of ‘squatter’ occupation or not: archeology cannot tell us anything about the legal rights of the people who lived in these places, nor their connection to previous owners. They are all surely signs of impoverishment. The major exceptions to this story so far discovered (and their location is significant) were along the coasts of the Adriatic and the Gulf of Taranto.³⁴ I will return to these in a moment.

If we compare the data from northern Gaul to that of the Mediterranean we see the same pattern emerging. In 1992, P. Van Ossel summarized the results of a multiplicity of surveys in north-eastern Gaul.³⁵ They showed that around Trier, on the rich soil of the Rhineland west of Cologne, in the Pays de France between the Seine and the Oise, and doubtless other regions of the Picard plain and north of France, about three-quarters of the sites occupied in the third century were still occupied in the fourth. In contrast, around Nijmegen and on the sandy soils of the northern Rhine perhaps 80% of the inhabited sites were abandoned between the third and the fourth century. Then, even where antique occupation had held its place, as in the region of Hambach (east of Jülich), desertion followed in the fifth century.³⁶ During the course of the fifth century almost all of the last Roman-style villas and farmhouses disappeared in north-eastern Gaul. Van Ossel concluded that in a vast region stretching from Ardennes and central Belgium through northern France, it is difficult to find establishments even in the fourth century that presume a high economic productivity. This is true both of buildings in stone and buildings in wood. By the fifth century such impoverished sites had become the substantial majority. And this economic downturn was not compensated by increased activity in the larger villas. In the archaeological material, he says, one witnesses a leveling to the bottom.

The regional story is picked up by Édith Peytremann’s catalogue of 308 excavated sites in an area that covers the northern regions of modern France (thus not including the Belgian and Rhineland areas in Van Ossel’s summary, but encompassing regions west and south of the Paris basin).³⁷ Her tabulation of occupation dates can be represented graphically in a manner that allows a direct comparison with Figure 1.

Figure 2: Numbers of sites in northern Gaul by date of foundation and longevity.

Because a number of these sites were excavated before the pottery chronology of the fifth, sixth, and seventh centuries was clarified, the dating of a number of them can be fixed only within a range of several centuries. Those sites are indicated in gray. There is a further caution: most of these sites were discovered in rescue operations. It is therefore possible that site portions where occupation could have persisted lay beyond the areas available for excavation.³⁸ The graph nevertheless shows the relative fragility of new foundations through this transitional three-century period as does the data from the Lunellois. Of the nineteen sites in Peytremann’s survey that were already established in the fourth century (or newly created then), four lasted two centuries or less. One more was re-occupied after a possible hiatus of a century or more. Of the remaining fourteen, three had vanished before the end of the sixth century and three more by the end of the seventh. Four survived into the

tenth century and the remaining four into the eleventh, twelfth, and thirteenth. Twenty-four new sites were first established in the fifth century. Of these, eight were abandoned by the end of the sixth century. To these we can add another four sites less securely dated but occupied sometime during the fifth to sixth centuries. Fifty-nine new sites were first established in the sixth century, to which we can add another twenty-two of possible sixth-century foundation. Nearly half of these were likewise short-lived: only forty-five showed signs of occupation beyond the end of the seventh century, and most of these went on into the tenth century or beyond. For many of these new early-medieval creations of the fourth to sixth centuries, something created a bottle-neck. Only those that passed through this transition period survived to near or beyond the year 1000.

In Peytremann's data, as in that from the Lunellois, it is clear that we are not witnessing a desertion of the countryside. The rural world remained inhabited from the fifth century to the seventh (otherwise who would have been buried in all those cemeteries that for a long time were our only archeological evidence for the Merovingian period in northern Gaul?). It was, however (and with only localized exceptions), far more thinly populated than it had been at the end of the second century or even in the fourth. Most important of all, some distinguishing features of that antique countryside – and, as we will see, perhaps all – were vanishing. Whatever new structures were taking their place, they were very fragile, both in terms of their physical properties (light and perishable construction) and in terms of their continued use over time.

The most striking change is that all the settlements in Peytremann's catalogue, even those dating from the fourth century, were built in a manner that resembled the iron-age settlements beyond the Roman limes. Even when those of the fourth and fifth century (and even some of the sixth) occupied the sites of earlier Roman farmhouses, they were not built in the Roman manner. They were timber-framed one room or two-aisled structures, and sometimes nothing more than a 'sunken hut' (a form that is found over almost all the surveyed area by the sixth century), occasionally associated with other structures that archaeologists have interpreted as granaries or workshops. From the point of view of Imperial Rome these settlements were something radically new in the landscape. From the point of view of iron-age Europe beyond the Roman frontier they are a sign that northern Gaul had rejoined their world. And not just northern Gaul, for the same type of structures were being built in rural Italy, and by the sixth century in urban Italy as well.³⁹

Peytremann points out, furthermore, that the passage from the seventh to the eighth century was also the period when a major change occurred in the plan of these settlements. At its beginning a majority of the newly created rural habitations were still dispersed farmsteads following the antique pattern; at its end almost all new sites were groups of farmsteads that shared production and storage areas, truly proto-villages. In the sixth century, rural settlements still followed the alignments and the field boundaries that survived from the ancient world; by the eighth, peasants were creating new and different field plans. And it is in the eighth century that one begins to find churches and chapels in the midst of farmyards and the living sharing their space with the dead.⁴⁰ Again, this transformation is sooner or later common to all the European lands that had once been part of the Roman Empire.⁴¹ After a long decline in inhabited sites since the second or third century, with a revival in some regions in the fourth, the passage through the fifth and early sixth century is the beginning of a major transition. The last surviving major physical structures of the antique rural world are in ruins or disappear by the end of the sixth century. After a difficult passage through the seventh century a very different organization of the rural world begins to appear in the eighth.

II. The evidence of field structures.

Up to now we have been looking at buildings in the landscape, dwellings and farmhouses. The rural landscape, however, is far more than farm buildings. There is also the constructed terrain, consisting of roads, field boundaries (fenced and/or ditched), terraces or other structures to hold soil in place, ditches to drain and ditches to irrigate. The very existence of arable, in fact, implies constant upkeep, implies structures, in the sense of human actions to arrest natural processes. Signs that such upkeep has been abandoned implies, at the very least, a change in land use, for without means to drain off excess rainfall or to irrigate when and where necessary, crops will fail; where fields have not been cleared and plowed there will be no domesticated plants and natural succession takes over, as any backyard gardener knows – grass and weeds, then shrubs and trees. This succession also leaves its marks over time and can be read – as superimposed field patterns, as crop marks, damp marks, or frost marks in aerial photographs, in soil stratigraphy, in fossil pollen samples.

Where these changes can be dated, they give us direct evidence for human impact on the rural environment and tell us what happened in the increasingly impoverished and thinly populated west of the fifth, sixth, and seventh centuries. And what they reveal is a decrease in arable, a reversion of plowed lands to pasture for cows, sheep and goats, or, often enough, to forest for pigs, as mixed agriculture turned increasingly to stock raising. Here again, the evidence points to fewer mouths to be fed, fewer stomachs to be filled, and both as cause and as consequence, fewer hands working the soil. As we explore this narrative of fields, we will once again move from a broadly structured story line, made evident now by radical changes in field plans, to the type of data that could in time spell out more precisely the rhythms and chronology of change, region by region.

Some of the most striking examples of the disappearance of Roman field systems and the physical structures that implanted them in the landscape are in the same general area where the Archeomedes survey was made and in neighboring areas west along the Mediterranean coast. Roman centuriation practices had long been known from the texts of Roman surveyors, and recognized in aerial photographs taken during the Second World War. But it was in Orange in the lower Rhone valley that André Paganiol discovered the first physical documentary record.⁴² Since then, historical geographers have discovered in the landscape the phantom traces of a number of Roman centuriations belonging to the ancient cities of Orange, Nimes, Béziers, and Narbonne, and the search for others, not only in Mediterranean regions but in the north as well, has become a minor industry. It is important to emphasize the adjective ‘phantom’ in the previous sentence, for in contrast to some regions of Italy (in the Po valley, for example) to spot what may remain of the alignments of those ancient landscapes has sometimes demanded sophisticated computer analysis of aerial photographs.⁴³

Figure 3: Béziers (Hérault, FR).

The Mediterranean landscape in Figure 3, a mosaic of photographs taken in 1968 by the Institut Géographique National, shows the beginning and the end of this narrative of transformation and, by implication, sets many of the questions that need to be answered.⁴⁴ The area covered is the countryside south-east of Béziers in southern France, between the city, just off the top of the

photograph and the Mediterranean, just off the bottom. The field patterns (primarily vineyards when the photographs were made) are dominated by the roads radiating out from three villages, Vendres on its lagoon (just off the bottom left), Sauvian, and Serignan, both on the Orb river. (The radiating fields of Sauvian are partially, and those of Serignan are principally on the other side of the river from the villages because they were laid out before the river changed its course in the mid-thirteenth century.) There are, however, a few field roads that appear to belong to another non-radiating structure. They are orthogonal and run north-south. The longest, to the left of the picture, turns off the Vendres-Sauvian road and runs straight to the river flood-plain just south of Béziers. At the time the photo was made it was still a dirt field-road; when the autoroute was built two decades later this field road was paved to link the highway to the beaches. This road and some much shorter parallel roads and field boundaries are all that remain here of the ancient centuriated landscape, intensively studied by Monique Clavel.⁴⁵ Yellow arrows point to traces of this centuriation. Orange and green arrows point to medieval radiating field roads from Sauvian and Serignan, cut by the Orb river when it changed its course.

[Figure 4](#) (just to the north of Figure 3), where in 1968 the first major urban expansion was taking place, one can see significantly more of the ancient centuriated alignment in an area called St-Jean-d'Aureilhan. Here a field road runs due east from the city, and then for no apparent reason turns resolutely 90° to the south, in the same orientation as the orthogonal north-south field roads south of the city and the river. Immediately to the south of the main road are several shorter roads at precisely the distance (20 *actus*) of the standard Roman centuriation. Some of these roads are now city streets, others have disappeared as the area has been completely urbanized. But rescue archeology in different sectors, including the vicinity of the medieval chapel that gave the area its name, found that one field road was superimposed on a Roman era ditch. Excavations nearby found other ancient ditches aligned with this centuriation (which Monique Clavel labeled 'Béziers A. '), while yet others (probably later) were oriented in a different direction, suggesting two different phases of antique occupation. These excavations confirmed that the visible alignments indicated in Figure 3 do indeed follow that of the first Roman centuriation. The fill in the earlier ditches could not be dated; that of the later ditches contained pottery from the fourth to the early sixth century. At the same time, the excavators showed that on this site there was a break in occupation during the seventh to ninth centuries. Three hundred meters to the north, however, there was an ample spread of pottery from the fifth-sixth centuries to the ninth-tenth, associated with storage pits, post holes, and ditches.⁴⁶

Documentation of this area in the cartulary of Béziers cathedral begins in the tenth century.⁴⁷ By then the present-day villages – as well as one that vanished before the mid-twelfth century – already existed. The documentation is sufficiently dense to allow the identification of field roads mentioned in tenth-century charters with those visible in the twentieth-century photographs. By the tenth century, and probably at least several generations earlier, the basic structure of the medieval-modern landscape had been created, with its central villages and their radiating field roads. With the exception of the few remaining traces just described, the structures of the ancient landscape had vanished.⁴⁸ How had this happened? And when?

The most likely sequence is the following. The physical structures – roads and ditches – that fixed Roman field boundaries in the landscape and provided the drainage so essential to agriculture in a Mediterranean climate were no longer maintained. They were allowed to fill up with alluvial

soil, especially those ditches that did not run with the slope of the land. This would explain why some north-south ditches and associated roads would survive or occasionally be cleared, for that is the direction of natural drainage, while east-west ditches and roads, without practical purposes were abandoned to natural processes. This could only mean that fields were no longer cultivated but were allowed to return to grass and probably here and there to scrub and wood. Roman boundaries, no longer meaningful, vanished from the land (though perhaps not always from memory). Place-names, however, survived here and there. An early eleventh-century charter mentions a substantial tract of land called Licinianum (Licinius's place?) east of the flood plain of the Orb, between the villages of Cers and Villeneuve. Its eleventh-century boundaries, however had nothing to do with ancient centuriation. They were determined by field roads that radiated from the nearby village, by the river, and by a wandering 'carraria que discurrit per loca multa' which can still be identified in the photos of the 1968 aerial survey.⁴⁹ When medieval peasants plowed this land once again, it would have been easy for them to spot where ancient drainage ditches once had been. They would stay waterlogged for a longer time after heavy rains, and in time perhaps be overgrown with shrubs and trees. Yet it would have been easier to re-dig the old ditches than to dig new ones where none had been before. In this way ancient alignments could reappear here and there after centuries of abandonment, but now in the context of very different field structures with very different field shapes and property boundaries.

This narrative is not entirely imaginative. Exactly such a sequence of events has been uncovered on the plain of Orange in the middle Rhône valley and dated with relative precision. In the commune of Lapalud, a few kilometers north of the city, archeologists working in advance of the construction of the TGV were able to test the identification of the hypothesized 'centuriation B' of Orange and not only confirm its existence and orientation but also identify two other ancient cadasters.⁵⁰ A complex sequence overlay the earliest Antique cadastration. The two 'centuries' uncovered (whose exact numbering could be extrapolated from the recovered fragment of the Roman cadastral map discovered by Paganiol) were originally co-planted in grain and vines, but by the last quarter of the first century CE had been converted to pasture. Already in the early second century this was a less humanized landscape and was showing signs of heavy erosion. The ditches that defined the centuriation, write the excavators, appear to have silted up 'almost instantaneously.' In the third century, with a rising water table, the drainage system was completely abandoned, and 15 to 20 cm. of soil slowly accumulated. Then, in the fourth century, cereal pollen, missing since the late first century, reappear in the samples. Drainage ditches were re-cut. Arboreal pollen, however, is now over 30% of the total, and towards the end of the fourth or in the early fifth century, alluvial soil once again filled these abandoned ditches. The ditches were invaded with hydrophilic plants and pioneering species, and over the ensuing centuries the soil level rose another 20 to 40 cm. Eventually, perhaps as late as the twelfth or thirteenth century, new ditches were cut where those of Antiquity had been.⁵¹ A similar sequence was discovered not far away at Pierrelatte, 'les Malalognes', where the entire sequence of early ditches was covered in the seventeenth and eighteenth century by alluvial soil carried by a local stream, yet a modern hedge was planted barely two meters from the Antique ditch.⁵² In this manner the Antique alignment was repeatedly recreated through abandonments and reoccupations, over two millennia, while agriculturalists were succeeded by pastoralists, the land abandoned, and reoccupied over several cycles. The story is enough to make one wonder whether the apparent maintenance of centuriated fields in the Po valley, for example,

is an illusion that masks another case of recreation or even repeated recreations, rather than continuity of arable use.⁵³

Ideally, one would like to have such careful stratigraphy of field structures from the Béziers plain, indeed, from all over Europe. In its absence one can only hypothesize, as I have done, that the superposition of medieval field patterns over radically different Antique patterns hides the same story. It is a story of decay and abandonment of the physical infrastructure of production that follows the same complex curve as the site data summarized in the first section of this article. Field ditches were abandoned and grain fields and vineyards were converted to pasture as the first-century ‘bubble’ was reaching its climax. Erosion followed, and a slow reforestation. Then renewed investment of labor in arable agriculture in the fourth century, only to be followed by abandonment, alluviation, and a rise in the water table. Either money, or manpower, or the will was lacking to keep these fields in production.

In the plains of northern Gaul and Britain the evidence of a sharp break between Antiquity and the Middle Ages is no less clear. Aerial photographs showing Iron Age and Roman period enclosures, farmsteads, and villages as well as ‘Celtic fields’ eventually overlain by the long strips of medieval open fields have often been published, especially from sites in the English midlands. The same phenomena are visible all across the northern plains of Europe and have been confirmed by excavation.⁵⁴ Figure 5 is an example from Brittany. It shows proto-historic enclosures and traces of antique field systems revealed by aerial photographs, here overlain on an early nineteenth-century cadastral map whose boundaries are directly inherited from the strips of medieval open fields.⁵⁵

Figure 5: St-Brieuc-de-Mauron (Morbihan, Brittany)

What we are seeing both north and south is thus a sharp reversal of a development that began with the spread of arable agriculture in the late Bronze Age. In the passage from one set of structures to others that are very different, the rural economy of mixed arable and stock raising abandoned much of the arable (that, among other purposes, fed the ancient cities and the imperial armies) and moved sharply in the direction of a silvo-pastoral economy.

For the regrowth of forests there is plentiful evidence from all over western Europe. From the English midlands to Picardy to the Po valley evidence has long since emerged for extensive Roman farming in land where forests were being cleared in the twelfth century.⁵⁶ Two striking examples come from the Rhineland where two supposedly ‘primeval’ forests turned out to be regrowth of the early Middle Ages. In the Eifel, east of Jülich, the clearing of the forest of Hambach for coal mining revealed that it had been cleared and densely occupied in the Roman period and abandoned by the sixth century, for the few Merovingian sites in the region were all outside the limits of the forest except for two glass-making establishments. The Kottenforst not far to the south was likewise densely occupied in the Roman period and abandoned by the sixth century. Unfortunately only 19 of the well over 200 Roman sites in and around the forest of Hambach were excavated, and there is no published data on the pottery collected during the rescue operations in either of the two forests.⁵⁷ A similar phenomenon with similar dating has been documented, mainly by studies of pollen, from the Rhineland all the way east to modern Poland.⁵⁸ But it was not limited to areas that ancient and modern myth-making has long associated with primeval impenetrable forests. It was equally true of central Gaul, where a study of eighty-eight lake and bog sites indicates

reforestation beginning in the fourth century and lasting until the middle of the ninth.⁵⁹ So, too, for areas along the Mediterranean coast and the Cantabrian mountains of north-west Spain.⁶⁰ As might be expected, the dates for these developments vary from place to place, since so much depended on local factors. But the tendency can be found everywhere. To be sure, reforestation did not mean an absence of human activity. Quite the contrary, there are many signs of forest use, for charcoal, for pottery-, glass-, and iron-making, for construction, and, perhaps most importantly, for feeding pigs. Yet the decline in human impact is evident.⁶¹

Even the pastures, apparently, were not maintained, or at least not sufficiently to support the more robust cattle and sheep that iron-age and Roman pastoralists had bred. The study of animal bones in fifth-century and later archeological sites reveals a steady decline in the stature of sheep, cows, oxen, and pigs (though not of horses).⁶² The most likely explanation is that larger and more robust animals were no longer selected to be fattened for market; meanwhile, in pasture no longer regularly hayed but invaded by woody plants, the lower metabolic needs of smaller animals would have given them a competitive advantage.⁶³ In all this we are seeing exactly what we might expect from the site-occupation data: a thin and widely-dispersed rural population that lived in what was, by comparison with the fourth century, a profoundly impoverished manner.

This correspondence with site-occupation data is suggestive, as is the chronological correspondence of the two carefully excavated sites in the lower Rhône valley. Are there any other independent data that might eventually give us more precise dates for this transformation and enrich our understanding of the changes occurring in the environment? The answer is yes, in studies of fossilized pollen, such as those just mentioned, which allow paleobotanists to investigate the environment surrounding the sites from which the samples have been taken.

Figure 6: Pollen diagram from Glatinié

Figure 6 comes from the site of Glatinié, near the city of Laval, west of Paris.⁶⁴ Pollen diagrams are made by extracting a soil core from a bog or other anaerobic environments, cutting it into thin slices, then identifying and counting the fossilized pollen in each slice. The diagram is made by representing the percentage of each species at each level from the present (top) to the most ancient (bottom). Absolute dates are derived by carbon dating when suitable material is present in the core. In this diagram the different species have been gathered into general categories to indicate not only the extent but also the nature of human impact on the area vegetation. Because not all plants produce air-borne pollen, and those that do so produce it in different quantities, the percentages represented do not exactly represent the percentage of each species in the local landscape. They do, however, signal the appearance, growth, decline, and disappearance of the pollen-spreading species. Because bogs have their own specialized species, it is necessary to filter those out of the totals before calculating percentages in order to represent the wider environment around the bog. The diagram reproduced in Figure 6 presents the filtered data to the left of the central axis and the unfiltered to the right.

I have reproduced here only the section of the diagram pertinent to the present argument, between two calibrated C -14 dates: CE 73 ± 91 at the bottom and CE 989 ± 35 at the top.⁶⁵ An intermediate date of 857 ± 87 is also marked. The diagram is arranged to read groups of plants outward from the central axis: closest to the axis are cereals and other cultivated plants, then weeds

of grain fields, followed by weeds of disturbed land (roadsides, around houses and farmyards, on abandoned sites), grasses, and forest cover. As we should now expect, the agricultural impact on this environment was at its height in the first century CE, with mixed cereal, orchard and garden crops and extensive pasture land. It was a very open landscape (indicated by the percentage of ruderal species). From then on, the species indicating human presence declines rapidly. Since there is no proof that soil was accumulating in the bog at a steady rate it is impossible to date even approximately when forest took over much of the landscape, only that it did at some moment between about 400 and about 700. This was followed by a brief revival of agriculture (peaking around 700-750?) with a notable extension of pasturage, followed by a less significant retreat (note the continuation of cereals and accompanying weeds) before the rapid and more securely dated deforestation and extension of pasture and plowed land in the late ninth to tenth centuries. Here again, the uncertain dating of the earlier changes may not be all that important, since we might expect that local ecological conditions as well as human decisions would have a large part in both the chronology and the extent of pasture and forest expansion and therefore result in significant regional differences.

III. The role of climate.

What caused the transformation in productive practices, the decline in cereal cultivation, and the end of the Ancient rural landscape?

Without a doubt, constructing a fully satisfactory answer to this question would require a complex flowchart with numerous feedback loops, for given the centuries over which this transformation took place and the economic and ecological complexities of any agricultural economy, especially one as highly commercialized as was that of Rome during the early centuries of the Empire, we are doubtless looking at many causes that were also consequences, tendencies that were self-reinforcing. Any satisfying answer, furthermore, would have to take into account the simultaneous changes north and south. It would also have to take into account changes both within what had once been the limits of the western Empire as well as beyond the camps and fortifications that marked the limes, beyond even the reaches of Mediterranean commerce. For, as we have just seen, pollen diagrams from as far east as Poland show the same rise and fall of cultivated species occurring at around the same time as the same movements occurred in the west.

The most frequent answer to be found in the literature, whether archeological or historical, is local political and military events. It is the invasion of the Saxons (Britain), the invasion of the Franks (Gaul), the Gothic-Byzantine wars or the invasion of the Lombards (Italy). Yet, curiously, where careful excavation of late-Roman sites has been undertaken, signs of violent destruction range from exceedingly rare to non-existent. And often enough, neither the signs nor the direction of transformation change across such 'important' events.⁶⁶ If warfare disrupted commerce, as it most likely did, why did the economy not quickly recover, and the population with it, after marauding armies had passed or had settled down? Furthermore, the supposed influx of new immigrants is hard to locate, now that grave goods are no longer taken to be 'ethnic' identifiers, and the population loss suffered by Europe beyond the limes is not reflected in population gain where they settled. Local political conditions – the retreat of Roman armies from Britain, for example, or the 'barbarians' crossing the Rhine, the Danube, or the Alps, whatever the antiquity of this explanation – cannot

possibly be sufficient.

Other explanations, less localized this time, are the Justinianic plagues and their sequels, and the so-called ‘536 event.’ Both undoubtedly had severe and long-lasting consequences, the plague especially. But they hit a West that was already well on the road to impoverishment and depopulation. And they did not long interrupt the sixth-century economic prosperity of the East, which, far more densely populated than the West, surely suffered more.⁶⁷ The cloud of volcanic dust that covered the earth in 536, a ‘year without a summer,’ was recorded in texts from Ireland to China. Major famines followed in Europe, perhaps continuing as late as 541.⁶⁸ While the short-term consequences of this ‘dry fog’ were surely important, it seems unlikely that the long-term changes in the European landscape we have seen can be attributed to this one event. Indeed, there were even stronger volcanic events noted world-wide that occurred at the beginning of what would be two periods of agricultural expansion, the eighth century and the eleventh.⁶⁹ Once again, a particular event or sequence of events, no matter how dramatic and devastating in the short term, seems inadequate to the explanatory demands. Something in the West prevented the region from recovering for centuries.

Was it the break in the commercial links that bound rural producers to cities and long-distance trade?⁷⁰ This explanation cannot be dismissed out of hand, even though, as we have just seen, the decline in cereal cultivation (and apparently in population as well) affected lands far to the east of the Roman limes, far beyond the reach of Mediterranean commerce. Nevertheless, there were a few areas of the old western empire that, however impoverished, continued to survive long after others went into decline, and those were the cities of the Adriatic coast, Emilia-Romagna, and the Gulf of Taranto, as well as Rome and – to a lesser extent – Marseille, reconnected to Byzantine trade routes by Justinian’s reconquest.⁷¹ Any explanation of the general pattern will also have to explain these exceptions. The possible mechanisms connecting long-distance trade to rural production have yet to be explored. I will offer a few hypotheses later. For the moment, it is sufficient to note that, whatever those connections, the decline of commerce is not sufficient to explain what is happening in the countryside. Again, the geographical range of the phenomena remains to be explained.

There remains the climate, which, of course, is European-wide despite the obvious differences between the Atlantic and continental regimes of the north and the Mediterranean regime of the south. What follows is a brief review of some of the climatological evidence for the first millennium CE and some hypotheses to serve as a future research agenda.

Climate change, or more precisely a two- or three-century climate anomaly has occasionally been evoked by scholars studying the last centuries of Roman Britain and early Anglo-Saxon agriculture.⁷² It has also been evoked by some scholars working on Mediterranean agriculture (though just as forcefully denied by others).⁷³ Recent research by climatologists has allowed more precise dating of this anomaly as well as clarifying its nature.⁷⁴

Since the Bronze Age, cereals have been a large and fundamental part of the western diet. Two aspects of climate have a determining effect on their production: precipitation and temperature. All plants are genetically programmed to produce seed within a relatively narrow range of both water availability and of optimal degree days during the growing season. Too much or too little rainfall or bad timing of that rainfall during the growing season will lead to seed rotting or failing to sprout or, later on, to plants rotting or drying. If frost comes too late in the spring or too early in the fall or the growing season is too cold, the plant will not have time to ripen its seeds. Grains are

particularly sensitive to wet, cold winters.⁷⁵ There are, of course, no direct instrument records of either precipitation or temperatures before the nineteenth century to tell us when such events happened, so climatologists have been forced to turn to proxy records of a physical nature whose traces are left in the soil, in arctic and alpine glaciers, and many other physical records. Such data are significantly less precise than instrument records, but with the development of increasingly sophisticated dating techniques they are starting to become useful for historical analysis.

Indirect evidence for an extended period of heavy rainfall has long appeared in the archeological record of Mediterranean Europe, from the ‘newer fill’ of Claudio Vita-Finzi to recent analyses of accumulated sediments in Mediterranean river beds.⁷⁶ The research of J.-F. Berger and his colleagues along the TGV right-of-way in the Rhone valley has given dates from the late fourth to the seventh century for an extended period of torrential rains, erosion, and a rise in the water table, with fields becoming water-logged.⁷⁷ Dating of such soil strata, however, is always problematic. First, because the accumulation of water-borne soil depends on the plants and man-made structures (such as drainage ditches, dams, terracing) upstream. Soil without plant cover is eroded rapidly by excess rainfall. As grasses, shrubs and trees take hold, erosion will lessen, even in times of torrential rains. On the other hand, the abandonment of ditches and terrace walls may lead to increased erosion. Therefore, the accumulation of soil downstream is usually not only an indirect but also an incomplete proxy record of when and where the rain was falling. Furthermore, with the exception of rare finds, such as that of the buried ships in Pisa’s ancient harbor, the accumulation cannot be dated directly by the man-made material it may contain, since that material has been washed there from somewhere else; it can only be dated by what is in the strata sealed beneath the alluvion and the more recent material in the stratum that seals the alluvion in turn. The error bar therefore may be very wide.⁷⁸

Recently, however, a group of climatologists have found proxy data with remarkable time resolution for rainfall along the upper Rhône, in the north-western Alps. Before 1870, when attempts began to bring the river under control through the construction of dikes, and eventually of dams, the Rhône at flood stage poured its waters into Lake le Bourget, a little to the south and west of Annecy. The flood waters carried silicate sediment which settled to the bottom of the lake. By measuring the relative amount of these sediments in 5 mm. slices cut from a nine-meter core extracted from the lake bottom, F. Arnaud and his colleagues were able to reconstruct periods of flooding over the last 7200 years, with a resolution of 8 years.⁷⁹ The portion of their graph relevant to this paper – the two millennia of the Common Era – is reproduced in Figure 7. The dating is in calibrated calendar years.

Figure 7: Flooding of the Rhône river.

Increased silicate sedimentation in the lake could come either from land clearing or from increased precipitation. Part of the sediment documented here may thus be due to the clearing of the countryside between Lake Geneva and le Bourget during the Roman centuries. This may account at least in part for the two small spikes on the graph dated to the first and third centuries, though these also correspond to flooding of rivers in the Appenines (perhaps, to be sure, caused by the same process of land clearing). The large spike that begins between 450 and 500 CE, however, can only be due to a major long-term increase in precipitation, since it corresponds to a period of large-scale abandonment of agriculture in the region and an increase in forest cover.⁸⁰

It should not be imagined that this increase in precipitation concerned only the north-west Alps. There is evidence from elsewhere, notably the Italian peninsula, that increased rainfall was widespread. The spikes in the first and third centuries CE correspond, as I have said, to an increase in the recorded flood events of the Tiber river. So does the spike from the fifth to eighth. There were also intense alluvial phases of rivers in the northern Appenines in the sixth and seventh centuries.⁸¹ There is equivalent evidence of colder and wetter weather in the same period in Denmark and Germany, associated with a decline in agriculture.⁸² The reason for this change in precipitation would have been a long-term shift in the North Atlantic Oscillation (NAO), the relative strengths of the winter-time high pressure system near the Azores and the low pressure system near Iceland. When both pressure systems are weak (a ‘negative’ NAO in the jargon of climatologists), the jet stream shifts south, bringing wet winters to southern Europe and cold winds out of the Arctic across northern Europe. There is a strong correlation between this record of high flood water on the Rhône and some reconstructions of the NAO since 1500, so we may hypothesize that the same was likewise true for the early medieval change in the frequency of flood events.⁸³

Was there also a cooling of the climate? The evidence is reasonably good, to begin with because the increase in rainfall itself implies lower temperatures. The most direct sign of a cooling climate, however, is the advance of Alpine glaciers, as represented in Figure 8. In the sixth and seventh century the Aletsch advanced almost as far as it did during the coldest cycles of the Little Ice Age (the higher on the chart, the further down the valley the glacier extended); the Gorner advanced only a little less.

Figure 8: Aletsch and Gorner glaciers

The lower Grendelwald glacier shows a similar chronology.⁸⁴ Studies of the advance and retreat of the Rhône glacier and others in the Alps in modern times have shown that the daily mean temperature for July and August accounts for 58% of their variance, while precipitation between October and June account for 21%.⁸⁵ That is, advancing glaciers are, as one might suspect, largely the consequence of wetter winters and colder summers, but especially the latter. How much colder did summers get? One German study has estimated a decline of 1 degree Celsius in average summer temperature.⁸⁶ That may not appear to be very much, but it has been estimated that if the average fell that much during the early stages of the Little Ice Age, the frequency of crop failure in northern England would have increased from one year in twenty to one in three.⁸⁷ More relevant, perhaps, is the clear coincidence of the weather anomaly of 1816-17, caused by the eruption of Tomboro in 1815, with the great European subsistence crisis in those same years.⁸⁸

One of the consequences of a wetter and colder climate are immediately visible, however, in at least one aspect of the archeological record – the abandonment of settlement and agriculture in river valleys that had become waterlogged and a move to hill slopes or hill tops. The phenomenon has often been noted both in Italy and in Mediterranean Gaul.⁸⁹ Water-logging was also most likely the reason for the abandonment of heavy clay soils, as it was for the spread of rye, a grain somewhat more adaptable to colder and wetter soil.⁹⁰

The comparison to the first wave of the Little Ice Age (c. 1300 - c. 1460) implied by the graphs of glacier extension suggests some reflections more directly relevant to the subject of this article. As serious as plagues and famines were in the fourteenth and early fifteenth centuries, and as serious the

resulting demographic decline, the basic structure of the medieval rural world survived. Some villages were abandoned, but most were not, and at least some of those abandoned were re-occupied once the population began to recover. Field systems remained, even if some fields reverted to fallow and to 'waste.' In Britain it was the enclosure movement of the early-modern period that transformed the open fields (and fossilized many of them under grass), not the troubles of the fourteenth and fifteenth centuries. In some areas on the Continent, as we have seen, tenth-, eleventh-, and twelfth-century fields could still be photographed from the air in the mid-twentieth century. In contrast, the climatic down-turn that began around 500 CE wiped the slate clean and what began to emerge two hundred years later was completely new.

Why was this so? I would suggest that the answer is connected indirectly to the longer survival of a few exceptional Antique landscapes and economies along the Adriatic and Tyrrhenian coasts, the exceptions to the general picture of impoverishment and depopulation elsewhere. We saw earlier that one of the consequences of the bursting of the early imperial 'bubble' in commercial agriculture was apparently a disinvestment in rural infrastructure, revealed archaeologically in the filling of drainage ditches with alluvial soil. In some areas field structures may have been recreated, at least in part, during the fourth-century revival, but they too were allowed to fill and be covered over. Was the same true for other necessary infrastructures of the agricultural economy? If so, a worsening of the climate, especially increased precipitation, would have been fatal, washing away the soil on slopes until grass and woodland began to fix it in place, water-logging low lying plains and bottom lands (naturally among the richest soils). Near to cities where the economy, whether through commercial exchange or through the transfer of wealth from Constantinople to clients in the western outposts,⁹¹ there would have been incentive to continue or to begin again to invest in rural production, not least because the presence of Byzantine troops and administrators in the cities provided a ready market. Here a tenuous *romanitas* maintained itself. It is thus not surprising that among the best survivals of centuriated landscapes are those around Modena and Cesena, where, as we saw, survival or reoccupation of older rural sites in the fifth and sixth century was exceptionally high.

In most of the West that was not the case. Here political and military shocks, then the coming of plague, only exaggerated the effects of failed crops and famine in a world where even in the best of times fertility barely held its own against mortality.⁹² The archaeology of the rural world reveals an infrastructure in decay or in ruins, drainage and irrigation ditches clogged, terrace walls collapsing, roads no longer maintained. This development in the countryside occurs at the same time that portions of many urban centers begin to decay and are eventually abandoned. We are surely looking at a circle, or in systems language, a 'feed-back loop.' Urban centers were fed by commercial grain, meat, and wine production in their countryside, or, in the case of the greatest urban centers, from around the Mediterranean. Fewer urban mouths meant a smaller market, less investment, and, for independent peasants, reason enough to shift towards subsistence agriculture, away from labor-intensive grain production towards a pastoral economy requiring fewer hands. And even the producers of meat eventually stopped selective breeding and the production of good forage.

Without stimulus from outside, the commercial agricultural economy would have spiraled downward. This is exactly what we see in the gradual disappearance of the physical remains of that economy – the commercial pottery – from the archeological record. With a sparser population, infectious disease may not have spread as rapidly, but commercial circuits would no longer have functioned to supply those areas where crops had failed. It was in these circumstances that colder and

wetter weather would have had major consequences, ‘marginalizing’ soils that had once been prime producers of grain, inducing agriculturalists to move to locations more suited to the new productive mix of animals, products of woodland and marsh, and enough grain for their own consumption. That this happened at different rates in different regions should not be surprising, for the commercial circuits did not subside everywhere at the same time or at the same rate. But eventually it happened even in Byzantine Italy. The ancient landscapes vanished and, in time, the new landscape, the medieval landscape emerged.

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It is traditional to end an article of this sort by saying that only further research will confirm or disprove this hypothetical narrative. In this case, however, the data may already exist or soon come out of the ground in the programs of rescue archeology associated with the construction of rapid train lines and superhighways. It is to be hoped that the problems raised in this article will help shape the research agenda of those programs. What is needed above all is the rapid dissemination of the data in a form that historians can use. Needed as well is the rapid dissemination of data from the study of fossil pollen, again in a form accessible to non-specialists and, where available, with a temporal resolution useful for historians whose interest is in changes over decades, or from century to century, and not periods of five-hundred or a thousand years. Much of this data probably already exists in desk drawers, file cabinets, and digital data sets. May we hope to see it emerge to the light of day? So too with the data series produced by climatologists, especially those who claim increasingly refined temporal resolutions. It is to be hoped that they too will make their data accessible with the claimed temporal resolution made visible. For further progress in refining and correcting the story of this important and still obscure period of European history will demand the communication and cooperation of specialists in all these fields. Historians with their traditional tools can no longer go it alone.⁹³

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Notes

1. The making of feudal agricultures? ed. M. Barceló and F. Sigaut. (Leiden / Boston, 2004). The article in this volume by A. Durand and P. Leveau. 'Farming in Mediterranean France and Rural Settlement in the Late Roman and Early Medieval Periods' is one of the most important attempts in recent years to fill the gap. Because there is a vast bibliography on nearly every subject touched on in this article, I will restrict my references to only a few items, whose own notes and bibliographies will lead the interested reader on to a larger range of literature. For a more extensive bibliography, regularly updated, see this article on my web site: <http://www.amherst.edu/~flcheyette/Publications/Transformation%20rural%20world.pdf>

2. A recent exception is C. Wickham, Framing the Early Middle Ages : Europe and the Mediterranean 400-800 (Oxford, 2005), which considers many of the issues in the first part of this article. Some of the data that I present here was published too recently to have been available to him.

3. In 1821, in the midst of industrialization, some English counties still counted over 60% of the population engaged in agriculture, while in Finland in 1805 it was still 82% of the male labor force. E.A. Wrigley, Poverty, Progress, and Population (Cambridge, 2004), pp.118, 297. The first US census (1790) classified 95% of the population as 'rural': Historical Statistics of the United States (Washington, 1975), series A 67-72.

4. Discussion of the literary evidence in T. Lewit, Agricultural production in the Roman economy, A.D. 200-400, BAR international series 568, (Oxford, 1991), ch. 8, and in P. Van Ossel and P. Ouzoulias, 'Rural settlement economy in Northern Gaul in the Late Empire: an overview', Journal of Roman Archaeology 13 (2000), pp. 133-160. See also P. Ouzoulias, 'La déprise agricole du Bas-Empire: un mythe historiographique?' in P. Ouzoulias, and P. Van Ossel (eds.), Les campagnes de l'Ile de France de Constantin à Clovis: Colloque de Paris 1996, Document de travail 3 (Ile-de-France, 1997) pp.10-20 ; P. Van Ossel, Etablissements ruraux de l'Antiquité tardive dans le Nord de la Gaule, Gallia supplément 51 (Paris, 1992).

5. See the pertinent critical comments of Wickham, Framing, pp. 259-65, and for a recent example of this historiographical tradition, P. Sarris. 'The Origins of the Manorial Economy: New Insights from Late Antiquity,' English Historical Review 119 (2004), pp. 279-311.

6. Notably G. Duby, Rural Economy and Country Life (Columbia SC, 1968), pp. 20-22 and The Early Growth of the European Economy (Ithaca, 1974), pp.13-17, repeated almost verbatim by R. Fossier, La terre et les hommes en Picardie (Paris, 1968) 1:236, both based essentially on the inventory of Annapes. The theory was already severely criticized by R. Delatouche, 'Regards sur l'agriculture aux temps carolingiens', Journal des Savants (1977), pp. 73-100 at 78-9. Archaeologists have since found that the country smithy (evident in the slag from his furnace) was far from unknown in the early Middle Ages: iron production is present at eighteen of the fifth- to eighth-century rural sites inventoried by E. Peytremann, Archéologie de l'habitat rural

dans le nord de la France, 2 vols, Mémoires publiés par l'Association française d'Archéologie mérovingienne 13 (St-Germain-en-Laye, 2003). For the presence in the early Middle Ages of iron-tipped plows capable of turning the soil see now J. Henning, 'Germanisch-romanische Agrarkontinuität und -discontinuität im nordalpinen Kontinentaleuropa', in D. Hägermann et al. (eds.), Acculturation: Probleme einer germanisch-romanischen Kultursynthese in Spätantike und frühem Mittelalter (Berlin, 2004), pp. 396-435.

7. The classic statement of the first idea is M. Bloch, French Rural History, an essay on its basic characteristics, trans. J. Sondheimer, (Berkeley/Los Angeles, 1966), p. 1. The classic statement of incastellamento is P. Toubert, Les structures du Latium médiéval, 2 vols. (Rome, 1973), I, 330-54, generalized as 'encellulement' by R. Fossier, Enfance de l'Europe, 2 vols. (Paris, 1982), I, 288-317, and since turned into a commonplace in French and Italian historiography. Without denying the importance of 10th-11th century developments, both the archaeological and documentary evidence point to proto-villages as geographical and social entities and perhaps as nascent field systems at a significantly earlier date: see Wickham's nuanced discussion, Framing, pp. 516-17 and for Mediterranean Gaul, A. Durand, Les paysages médiévaux du Languedoc (Xe-XIIIe siècles) (Toulouse, 1998), pp.77-95. For Italy, see for example R. Francovich, 'L'incastellamento e prima dell'incastellamento nell'Italia centrale', in E. Boldrini and R. Francovich (eds.), Acculturazione e mutamenti: prospettive nell'archeologia medievale del mediterraneo (Florence, 1995), 397-406; É. Hubert, L'incastellamento en Italie centrale (Rome, 2002); R. Frankovich and R. Hodges, Villa to Village (London, 2003), ch. 3; and for the area studied by Toubert, H. Patterson, H. DiGiuseppi et al., 'Three South Etrurian 'crises': first results', Papers of the British School at Rome 72 (2004), pp. 1-36

8. I set out this last problem in F. Cheyette, 'The Origins of European Villages and the First European Expansion', Journal of Economic History 37 (1977), pp. 182-206, and for the Mediterranean landscape in C. Amado and F. Cheyette, 'Organisation d'un terroir et d'un habitat concentré: un exemple méridional', in A. Bazzana, P. Guichard, and J.M. Poisson (eds.) Habitats fortifiés et organisation de l'espace en Méditerranée médiévale (Lyon, 1983) pp.35-44.

9. T.W. Potter, The Changing Landscape of South Etruria (New York, 1979), ch. 6. R. Hodges & D. Whitehouse, Mohammed, Charlemagne & the origins of Europe : archaeology and the Pirene thesis (Ithaca, 1983), pp. 33-48.

10. H. Patterson et al., 'Three South Etrurian ', p.18. At the time this publication was prepared, Patterson states, the survey data had not been completely analyzed.

11. See especially N. Christie From Constantine to Charlemagne : an Archaeology of Italy, AD 300-800 (Aldershot/Burlington, 2006), ch. 5; Wickham, Framing, pp. 465-518; B. Ward-Perkins, The Fall of Rome and the End of Civilization (Oxford, 2005), especially pp.138-146. They reach very different conclusions about the meaning of the data. Major critiques of survey data at P. v. Dommelen, 'Una riconsiderazione di ricognizioni estensive: il caso dello Scarlino-survey', in M. Bernardi (ed.), Archeologia del paesaggio (Florence, 1992), pp. 859-76; P. vanOssel and P. Ouzoulias, 'Rural settlement economy'; E. Louis, 'A de-Romanised Landscape

in Northern Gaul: the Scarpe valley from the 4th to the 9th century AD', in W. Bowden et al. (eds.), Recent research on the late antique countryside (Leiden, 2004), pp. 479-504.

12. H. Patterson et al., 'Three South Etrurian ', and M. Valenti, (2005), 'La formazione dell'insediamento altomedievale in Toscana. Dallo spessore dei numeri alla costruzione di modelli,' in G. P. Brogiolo, et al. (eds.). Dopo la fine delle ville: le Campagne dal VI al IX secolo, Documenti di Archeologia 40 (Mantua 2005), pp. 193-219. Similar densities in the area of Claterna in Emilia: M. Librenti, 'Ricognizione di superficie e insediamento medievale nella pianura emillano romagnola: alcune considerazioni', in Secondo Congresso Nazionale di Archeologia Medievale (Florence 2000), pp. 170-74.

13. On the 'catastrophic' interpretation see the cautious remarks by Patterson, et al., 'South Etrurian Crisis', pp. 22-3. In general Christie, Constantine to Charlemagne, 412-27. For differing rates of survival between areas as close as Parma and Cesena see now S. Gelichi et al., 'La transizione dell' antichità al medioevo nel territorio dell'antica Regio VIII', in G. P. Brogiolo, et al (eds.) Dopo la fine delle ville, pp 53-80, on which more below.

14. S. van der Leeuw et al. (eds.), Archéologie et systèmes socio-environnementaux: études multiscalaires sur la vallée du Rhône dans le programme ARCHAEOMEDES, Collection de Recherches Archéologiques. Monographies 27 (Paris, 2003), annexe 2. The original data is presented in fifty-year periods. I have simplified by giving in table 2 the higher of the two figures for each century.

15. Archaeomedes, Des oppida aux métropoles (Paris , 1998), ch. 5 and annex 1.

16. Potter, Changing Landscape, p. 145.

17. 'Depopulation ... is not impossible; the ruined towns and wasted countryside suggest that it happened in the Mediterranean at the end of the Roman period – and the burden of proof rests with those who maintain that it didn't.' Hodges and Whitehouse, Mohammed, Charlemagne, p. 53.

18. See the discussion of the villa of Pré-Bas, below. Older excavations of rural sites, unfortunately, largely ignored their production areas, since these were unlikely to produce museum-quality artefacts.

19. See in general J. H. W. G. Liebeschuetz, Decline and Fall of the Roman City, (Oxford, 2001) pp. 64-97, supplemented now by G.P. Brogiolo and S. Gelichi, La città nell'alto medioevo italiano (Rome, 1998), and by S.T. Loseby, 'Decline and Change in the Cities of Late Antique Gaul', in J-U. Krause and C. Witschel (eds.), Die Stadt in der Spätantike : Niedergang oder Wandel? (Stuttgart, 2006), pp. 67-104. Italian exceptions are surveyed by F. Marazzi, 'Cadavera urbium, nuove capitali e Roma aeterna,' in *ibid.*, pp. 33-66. A striking example of the synchronicity in the depopulation of a major urban center and the depopulation and

reorganization of its rural environs is presented by V. Bel et al., 'Réflexions sur une ville et sa proche campagne dans l'Antiquité: le cas de Nîmes (Gard)', in A. Bouet and F. Verdin (eds.), Territoires et paysages: mélanges Philippe Leveau (Bordeaux, 2005), pp. 19-44.

20. A hypothesis recently proposed by E. Louis, 'A de-Romanised Landscape'.

21. Proposed by F. Favory, J.-L. Fiches and C. Raynaud in 'La dynamique spatio-temporelle de l'habitat rural gallo-romain', in van der Leeuw et al. (eds.), Archéologie et systèmes socio-environnementaux, especially pp. 309-11.

22. On the difficulties of using published reports to say anything about post-fifth-century villas as recently as a decade ago see C. Balmelle, Les demeures aristocratiques d'Aquitaine (Bordeaux, 2001), pp. 118-22. Not much had changed since my lament in 'Origins of European Villages.'

23. What follows comes from C. Pellecuer, 'La villa des Prés-Bas (Loupian, Hérault) dans son environnement: contribution à l'étude des villae et de l'économie domaniale en Narbonnaise', Thesis, University of Aix-Marseille I, (2000). It is to be hoped that this important thesis will soon be published.

24. For a much richer examination of the problems involved in deriving demographic data from archeological surveys see F. Trément, 'Études micro-regionales et paléodémographie', in F. Gateau et al., L'Etang-de-Berre, Carte archéologique de la Gaule 13/1 (Paris, 1996), pp. 98-113. My thanks to Paul Van Ossel for clarifying these issues in conversation.

25. T. Lewit, Agricultural production. J. Banaji, Agrarian Change in Late Antiquity: Gold, Labour, and Aristocratic Dominance. (Oxford, 2001), esp. p. 16. C. Balmelle, Les demeures aristocratiques. Recent discoveries of second- to third-century abandonment and fourth-century reoccupation: L. Schneider, (2005). 'Dynamiques spatiales et transformations de l'habitat en languedoc méditerranéen durant le haut Moyen Age (VIe- IXe s.)', in Brogiolo et al (eds.) Dopo la fine delle ville, pp. 287-312.

26. Favory et al., 'Dynamique spatio-temporelle', pp. 297-99, 307-10. Archaeomedes, Des oppida, pp. 110-14.

27. Gelichi, 'La transizione dell' antichità al medioevo'. Librenti, 'Ricognizione di superficie e insediamento'. Valenti, 'Formazione dell'insediamento altomedievale'. C. Magrini, 'Il territorio di Aquileia tra tardoantico e altomedioevo', Archeologia Medievale 24 (1997), pp. 155-71.

28. As suggested by F. Favory et al., 'Dynamique spatio-temporelle', pp. 307-10. A start in considering the general problem, though only regionally, is J.-L. Fiches (ed.), Le IIIe siècle en Gaule Narbonnaise (Sophia Antipolis, 1995).

29. Banaji, Agrarian Change, pp. 83-120.

30. Lewit, Agricultural production, ch. 5.
31. For example, M. Py (ed.), Dicocer : dictionnaire des céramiques antiques en Méditerranée nord-occidentale : VIIème s. av. n. è - VIIIème s. de n. è., Provence, Languedoc, Ampurdan (Lattes, 1993)
32. T. Lewit, 'Bones in the Bathhouse: re-evaluating the notion of "squatter occupation" in fifth to seventh century villas', G. P. Brogiolo et al. (eds.) Dopo la fine delle ville, pp. 251-62.
33. T. Lewit, ' "Vanishing villas": what happened to élite rural habitation in the West in the 5th-6th c.?', Journal of Roman Archaeology 16 (2003), pp. 260-74, whose argument that this was only a 'cultural change' and not a sign of impoverishment and depopulation, I find implausible. Metz: G. Halsall, 'The Merovingian Period in North-East Gaul: Transition or Change?' in J. Bintliff and H. Hamerow (eds.), Europe between late antiquity and the Middle Ages (Oxford, 1995), pp. 38-52. Eifel: K. H. Lenz, 'Late Roman rural settlement in the southern part of the province of Germania Secunda in comparison with other regions of the Roman Rhineland', in P. Ouzoulias, P. Van Ossel et al. (eds.), Les Campagnes de la Gaule à la fin de l'Antiquité (Antibes, 2001), 113-46. Paris basin: P. Van Ossel, 'Structure, évolution et statut des habitats ruraux au Bas-Empire en Ile-de-France,' in Ouzoulias and Van Ossel (eds.), Campagnes de l'Ile de France, pp. 94-118, and P. Van Ossel and P. Ouzoulias, 'La mutation des campagnes de la Gaule du Nord entre le milieu du 3e siècle et le milieu du 5e siècle. Où en est-on?' in M. Lodewijckx (ed.), Belgian archaeology in a European setting, 2 vols.(Louvain, 2001), II, 231-245. Danube: C. Siffre, 'Kontinuität und Bruch entlang der Donau (4-8 Jahrhundert)', in S. Biegert et al. (eds.), Kontinuitätsfragen Mittlere Kaiserzeit-Spätantike, Spätantike-Frühmittelalter (Oxford: 2006), pp. 71-75. Northern Italy: S. Gelichi et al., 'La transizione dell' antichità al medioevo nel territorio dell'antica Regio VIII', in Brogiolo et al. (eds.), Dopo la fine delle ville, pp. 53-80. Southern Italy: A. R. Staffa, 'Riassetto urbano, trasformazioni territoriali, forme di acculturazione nell'Abruzzo Bizantino (secc. VI-VII)', in Boldrini and Francovich (eds.) Acculturazione e mutamenti, pp. 315-360.
34. See the articles by S. Gelichi, G. Volpe, and P. Arthur in L'Archeologia dell'Adriatico dalla preistoria al medioevo (Florence, 2003). G. Volpe, 'Villaggi e insediamento sparso in Italia meridionale fra tardoantico e altomedioevo: alcune note', in G. P. Brogiolo et al. (eds.), Dopo la fine delle ville, pp. 221-49; S. Gelichi et al. 'La transizione dell' antichità al medioevo.'
35. Data in P. Van Ossel, Etablissements ruraux de l'Antiquité tardive. Comment in Van Ossel and Ouzoulias, 'Mutation des campagnes'.
36. Lenz, 'Late Roman rural settlement'.
37. É Peytremann, Archéologie de l'habitat rural.
38. My thanks to Isabelle Catteddu for clarifying all these issues and for identifying the problematic dates in Peytremann's catalogue. In the following discussion I have included only

those sites whose dating is relatively certain (i.e. indicated in black on the graph).

39. M. Valenti, 'Forme abitative e strutture materiali dell'insediamento in ambito rurale toscano tra Tardoantico ed Altomedioevo', in G.P. Brogiolo (ed.), Edilizia residenziale tra 5 e 8 secolo (Mantua, 1994), pp. 179-90. G.P. Brogiolo and S. Gelichi. La città nell' alto medioevo italiano: Archeologia e storia (Rome, 1998), chap. 4.
40. Peytremann, Archéologie de l'habitat rural, I, 335.
41. Here my interpretation differs from Wickham, Framing, pp. 476-81. His focus, however, is not on numbers and physical properties but rather on the villa as a cultural and economic phenomenon. Compare Peytremann's data to the schematic flow chart in Christie, Constantine to Charlemagne, p. 493. R. Francovich and R. Hodges, Villa to village. Gelichi, 'Transizione dell'antichità al medioevo'. S. Gutiérrez-Lloret, 'La experiencia arqueológica en el debat sobre las transformaciones del poblamiento altomedieval en el SE de al-Andalus: el caso de Alicante, Murcia y Albacete', in E Boldrini and R. Francovich (eds.), Acculturazione e mutamenti (Florence, 1995), pp. 165-189. L Schneider, 'Dynamiques spatiales'.
42. A. Piganiol, Les documents cadastraux de la colonie romaine d'Orange, Gallia suppl. 16 (Paris, 1962).
43. Centuriated landscapes: J. Bradford, Ancient landscapes; studies in field archaeology (London, 1957), and above all, Misurare la terra: centuriazione e coloni nel mondo romano. Catalogo del Mostra (Modena, 1983). Polemical critique of the Ancient cadaster scholarly 'industry' by one of its early promoters: G. Chouquer, L'étude des paysages: essais sur leurs formes et leur histoire (Paris, 2000).
44. For a detailed analysis of this landscape see C. Amado and F. Cheyette, 'Organisation d'un terroir'.
45. M. Clavel, Béziers et son territoire dans l'Antiquité (Paris, 1970)
46. O. Ginouvez, and H. Pomaredes, 'Premieres observation sur les sites antique et médiéval de Saint-Jean d'Aureilhan commune de Béziers', Archéologie en Languedoc 17 (1993), pp. 157-71. Supplemented by Ginouvez et al., 'Saint Jean d'Aureilhan, fouilles programmées 1994, Parcelles HX 241, 258', manuscript report, Direction Régional des Affaires Culturelles, Service Régional d'Archéologie [hereafter ms. DRAC SRA], Montpellier, (1994). Ginouvez et al., 'St Jean d'Aureilhan, Sauvetage Archeologique', ms. DRAC SRA, Montpellier, (1993). And P. Chevillot et al., 'Beziens ZAC de Montimaran', ms. DRAC SRA Montpellier (1998).
47. J. Rouquette (ed.), Cartulaire de Béziers : livre noir (Paris, 1918).
48. See C. Amado and F. Cheyette, 'Organisation d'un terroir'.
49. Cartulaire de Béziers, no. 57.

50. J.-F. Berger and C. Jung, 'Developing a methodological approach to the evolution of field systems in the middle-Rhône valley', in P. Leveau et al. (eds.), Environmental reconstruction in Mediterranean landscape archaeology, The archaeology of Mediterranean landscapes 2 (Oxford, 1999), pp. 155-67, and reports on geomorphology by Berger and Jung in P. Boissinot et al., 'Lapalud: Les Girardes. Archéologie et TGV: Lot 21. Rapport de Fouille', ms. DRAC SRA Aix-en-Provence, (1998) and M. Goy and I. Remy, 'Montboucher-sur-Jabron : Constantin. Archéologie et TGV : Lot 12., Rapport de Fouille', ms. DRAC SRA Lyon, (1996).

51. P. Boissinot et al., 'Lapalud: Les Girardes'.

52. J.-F. Berger et al., 'Données paléogéographiques et données archéologiques dans le cadre de l'opération de sauvetage archéologique du TGV-Méditerranée', in J. Burnouf et al. (eds.), La dynamique des paysages protohistoriques, antiques, médiévaux et modernes (Sophia Antipolis, 1997), pp. 155-84.

53. See for example, M. Cremaschi, 'Il territorio mantovano fra il Boreale e l'età romana: l'evoluzione ambientale', in Misurare la terra, III, 13 - 17, describing medieval field patterns overlying centuriation-oriented ditches filled with alluvial soil.

54. In northern Germany and Scandinavia the change has been dated to the seventh century, though there is some evidence from southern Scandinavia that in some locations it may have occurred as early as the third; in Anglo-Saxon England it has been dated to the eighth century: H. Hamerow, Early Medieval Settlements: the archaeology of rural communities in Northwest Europe 400-900 (Oxford, 2002), pp. 140-44, 152.

55. D. Marguerie et al., 'Bocages armoricains et sociétés, genèse, évolution et interactions', in T. Muxart et al. (eds.), Des milieux et des hommes: fragments d'histoires croisées (Paris, 2003), pp. 115-131.

56. A representative sample: C. Lewis, P. Mitchell-Fox and C. Dyer, Village, Hamlet and Field: Changing Medieval Settlements in Central England (London, 2001), pp. 76-81. The photographs of Estrées-s-Noye in R. Agache, Atlas d'archéologie aérienne de Picardie : le bassin de la Somme et ses abords à l'époque protohistorique et romaine, (Amiens, 1975), pp. 317, 385 where the relic of the medieval forest and even a charcoal burning pit impinge on a great Roman villa. G. Rippe, Padoue et son contado : Xe-XIIIe siècle (Rome, 2003) pp. 45-57, especially the case of the forest of Viminario, pp. 54-55.

57. W. Janssen, 'Römische und frühmittelalterliche Landerschliessung im Vergleich', in W. Janssen and D. Lohrmann (eds.), Villa-curtis-grangia: Landwirtschaft zwischen Loire und Rhein von der Römerzeit zum Hochmittelalter (Munich, 1983), pp. 81-122.

58. Lenz, 'Late-Roman rural settlement'. B. Zolitschka, and J.F.W. Negendank, 'A High Resolution Record of Holocene Palaeohydrological Changes from Lake Holzmaar, Germany', in S.P. Harrison et al. (eds.), Palaeohydrology as reflected in lake-level changes as climatic evidence for Holocene times Paleoclimate research 25 (Mainz, 1998), pp.37-52. 'Environmental

change and human impact in the middle Lahn valley (Hessen) during the middle and late Holocene’,

http://web.uni-frankfurt.de/fb11/ipg/spp/Postergallery/Poster_pdf/Poster_Urz_etal.pdf. C. Siffre, ‘Kontinuität und Bruch entlang der Donau (4-8 Jahrhundert)’, in S. Biegert et al. (eds.), Kontinuitätsfragen Mittlere Kaiserzeit-Spätantike, Spätantike-Frühmittelalter (Oxford, 2006), pp. 71-75. S.T. Anderson, ‘Local and regional vegetational development in eastern Denmark in the Holocene’, Denmarks Geologiske Undersogelse. Arbog (1976), pp. 5-27. K.E. Barber, F.M. Chambers and D. Maddy, ‘Late Holocene climatic history of northern Germany and Denmark: peat macrofossil investigations at Dosenmoor, Schleswig-Holstein, and Svanemose, Jutland’, Boreas 33 (2004), pp.132-44, at 142. See also the pollen diagram from Lake Woryty, Poland in B.E. Berglund (ed.), Handbook of Holocene Palaeoecology and Palaeohydrology (New York, 1986), figure 22.10.

59. J.-L. de Beaulieu, A. Pons, M. Reille. ‘Histoire de la flore et de la végétation du Massif Central depuis la fin de la dernière glaciation’, Cahiers de micropaléontologie n.s. 3 (1988), pp. 5-35.

60. C. Raynaud, Le Village gallo-romain et médiéval de Lunel-Viel (Hérault) (Paris, 1990), pp. 322-3, 327 So also in the Cantabrian mountains of north-west Spain: C, Muñoz Sobrino et al., ‘Palynological data on major Holocene climatic events in NW Iberia’, Boreas 34 (2005), pp.381-98.

61. L. Bourgeois, ‘Espaces boisées, pôles d'habitat, et occupations marginales de l'Antiquité au Haut Moyen Age’, in P. Ouzoulias and P. Van Ossel (eds.) Les Campagnes de l'Île de France, pp. 32-4.

62. S. Lepetz, et al., ‘Culture et élevage en France septentrionale de l'Age du Fer à l'an Mil’, in A. Belmont (ed.), Autour d'Olivier de Serres : pratiques agricoles et pensée agronomique, Bibliothèque d'Histoire Rurale 6 (Paris, 2002), p. 96. S. Deschler-Erb, et al., ‘La crise de l'empire romain au IIIe siècle après J.-C: les données archéozoologiques en Suisse du nord’, in H. Richard and A. Vignot (eds.), Equilibres et ruptures dans les écosystèmes depuis 20 000 ans en Europe de l'ouest Annales littéraires de Besançon 730 (Paris, 2002), pp. 281-90. F. Salvadori, ‘Resti osteologici animali: elementi di continuità e discontinuità tra tardoantico e altomedioevo’, in R. Francovich and M. Valenti (eds.), IV Congresso Nazionale di Archeologia Medievale (Florence, 2006), pp. 520-24.

63. See M.W. Demment, and P.J. Vansoest. ‘A Nutritional Explanation for Body-Size Patterns of Ruminant and Nonruminant Herbivores’, American Naturalist 125 (1985), pp. 641-672.

64. D Barbier, J Burnouf, and D Visset, ‘Les diagrammes sociétés/végétation’, Quaternaire 12 (2001), pp.103-9.

65. I have calibrated the raw BP dates given in Barbier et al. using CalPal (<http://www.calpal.de>).

66. For a new version of the old political explanation see Ward-Perkins, Fall of Rome, pp. 128-34. Yet the argument of P. Delogu, 'La fine del mondo antico e l'inizio del medioevo: nuovi dati per un vecchio problema', in R. Francovich and G. Noyé (eds.), La Storia dell'alto Medioevo italiano (VI-X secolo) alla luce dell'archeologia (Florence, 1994), pp.7-29 has only been confirmed by more recent research, and seems as valid for the north as for Italy.
67. Brief narrative in L.K. Little, 'Life and Afterlife of the First Plague Pandemic', in L.K. Little (ed.), Plague and the End of Antiquity: the Pandemic of 541-750 (Cambridge, 2007), ch. 1. Literary evidence assembled and translated in D.C. Stathakopoulos Famine and pestilence in the late Roman and early Byzantine empire (Aldershot, 2004). On prosperity of East see C. Foss, 'The near Eastern Countryside in Late Antiquity: A Review Article', in The Roman and Byzantine near East: Some Recent Archaeological Research, Journal of Roman Archaeology: Supplementary Series, 14: 1 (Ann Arbor MI, 1995), pp. 213-34; and Wickham, Framing, pp. 443-65; disputed by H. Kennedy, 'Justinianic Plague in Syria and the Archaeological Evidence', and P. Sarris, 'Bubonic Plague in Byzantium: the Evidence of Non-Literary Sources', both in Little (ed.), Plague, chs. 4 and 6.
68. See in general, J.D Gunn (ed.), The years without summer : tracing A.D. 536 and its aftermath (Oxford, 2000). Tree-ring evidence analyzed in M.G.L Baillie, 'Dendrochronology raises questions about the nature of the AD 536 dust veil event', The Holocene 4 (1994), pp.212-17. A skeptical assessment of volcanic effects (though not addressing the 536 event) is J. Grattan, 'Aspects of Armageddon : an exploration of the role of volcanic eruptions in human history and civilization', Quaternary International 151:1, (2006), 10-18.
69. See the 'volcanic explosivity index' in A. Robock and M. Free. 'The Volcanic Record in Ice Cores for the Past 2000 Years', in P. D. Jones et al. (eds.), Climatic Variations and Forcing Mechanisms of the last 2000 years (Heidelberg, 1996), pp. 533-46.
70. The explanation favored by B. Ward-Perkins, Fall of Rome, esp. pp. 132-7, and must be considered apart from his blaming it all on the 'barbarians.'
71. E. Zanini, 'Racontando la terra sigillata africana', Archeologia Medievale 23 (1996), pp. 677-88. G. Volpe, 'San Giusto e l'Apulia nel contesto dell'Adriatico tardoantico,' in L'archeologia dell'Adriatico, pp.507-36. A. Toniolo, 'Importazioni tra IV e VIII secolo d.c. nella laguna di Venezia', *ibid*, pp. 616-21. P. Arthur, 'I Balcani e il Salento nel medioevo, *ibid.*, pp. 654-65. Older survey by A.R. Staffa, 'Riasseto urbano, trasformazioni territoriali, forme di acculturazione nell'Abruzzo Bizantino (secc. VI-VII)', in Boldrini and Francovich (eds.) Acculturazione e mutamenti, pp. 315-360. Comparison of site survival around Modena and Cesena with that elsewhere in Gelichi, 'La transizione dell' antichità al medioevo'. L. Sagui, 'Indagini archeologiche a Roma: nuovi dati sul VII secolo', in P. Delogu (ed.), Roma medievale: aggiornamenti (Florence, 1998), pp. 63-78. Patterson, 'Three South-Etruria Crises'. F. Trément, Archéologie d'un paysage: les étangs de Saint-Blaise (Paris, 1999).

72. Notably by Jones, End of Roman Britain. See also E. Jones, 'Climate, Archaeology, History and the Arthurian Tradition: a multiple-source study of two Dark-Age puzzles', in J. Gunn (ed.), The Years without Summer: tracing AD 536 and its aftermath BAR International Series 872 (Oxford, 2000), pp. 25-34.

73. A. Durand, 'Les milieux naturels autour de l'An Mil: approches paléoenvironnementales méditerranéennes', in P. Bonnassie and P. Toubert (eds.), Hommes et sociétés dans l'Europe de l'An Mil (Toulouse, 2004), pp. 74-9. A. Durand and P. Leveau. 'Farming in Mediterranean France', in Barceló and Sigaut (eds.), The Making of Feudal Agricultures?, pp. 177-241. J.-F. Berger, 'Les étapes de la morphogenèse holocène dans le sud de la France', in van der Leeuw et al. (eds.), Archéologie et systèmes, pp. 144-7, with a curious contradictory assertion by Favory et al. in the same volume, 'Dynamique spatio-temporelle', p. 311. P. Leveau et al., 'La crise environnementale de la fin de l'Antiquité et du Haut Moyen Age: définition d'un modèle et retour aux milieux réels', in H. Richard and A. Vignot (eds.), Equilibres et ruptures, pp. 291-303, is a skeptical view.

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