UNSUSTAINABLE DEVELOPMENT; THE ORIGIN OF RUINED LANDSCAPES IN THE ROMAN EMPIRE

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We are to day interested in growth, in increased productivity. In the case of agriculture this means making it possible for the same piece of ground to feed more people or at least to make it possible for the same number of people to have a higher standard of living. In a word, to enable two blades of grass to grow where one grew before. How well did the Roman Empire do when judged by this criterion?

Wherever the Romans established their rule they created, or stimulated, profound agricultural change, a kind of agricultural revolution¹, which is described for convenience, though with much simplification, as the introduction of the villa system.² Its effect surely was the creation of a greatly increased agricultural surplus. And it was this, which in turn nourished Roman colonies, provincial urbanisation, Roman armies and above all the population of Rome itself, which by the time of Augustus had grown to something like a million inhabitants. The question is whether the Roman 'agricultural revolution' resulted in a permanent increase in the agricultural productivity of the areas involved. The conclusion of this paper is that it did not. The 'growth' initiated or stimulated by Roman rule was real and substantial. It was sustainable too, in that the systems created under Roman rule were stable for many years. But it appears that Roman agricultural growth almost invariably was succeeded by periods of decline, which often left the land less productive than it had been at the starting point of the development. Moreover the same cycle of growth and reversal seems to have been largely independent of physical and climatic conditions. At any rate it can be observed in regions that were totally dissimilar in terms of geology or climate.

¹ K.Greene, *The archaeology of the Roman Economy* (London 1986), 98-123; G.Barker and J.Lloyd, *Roman Landscapes: Archaeological Survey in the Mediterranean Region*, Archaeological Monographs of the British School at Rome 2 (London 1991); P.Leveau, P.Silières, J.-P.Vallat, *Campagnes de la Méditerranée romaine-occident* (Paris 1993).

² The description 'villa' covers a wide range of buildings from a solidly built farm-house of a holding large enough to produce cash crops, to a palace like structure with attached farm buildings, the centre of an estate. In the early colonial settlements in Italy the farm type were in the great majority, see F.Cambi, 'Demography and Romanisation in Central Italy', in J.Bintliff and K.Sbonias, eds., *Reconstructing Past Population Trends in Mediterranean Europe*. The Archaeology of Mediterranean Landscapes 1 (Oxford 1999), 115-127, esp.124-126.

Reversal when it came was gradual and spread over centuries. In Europe decline began in different regions at different times, but generally still within the period of the Early Empire. In Africa the development started later, and the ultimate collapse was later too. In the Near East dramatic expansion was a feature of the Late Empire, and the reversal came correspondingly later, but it came there too. My procedure will be to start with a discussion of three areas of Italy, and then go on successively to Baetica in Spain, to Northern Gaul and the Rhineland, to Africa and finally the desert fringe of what to day are Syria and Jordan.

The transformation of the area around the colony of Cosa began in the third century B.C., with the foundation of the colony. Subsequently there was a steady increase in the number and density of solidly built farm buildings of every kind. Wine and olive oil were produced for the market on a large scale. The development reached a climax in the first century A.D.³ Then a steady and continuous reduction in the number of sites set in. The people making the survey found c. 245 sites in occupation at the end of the first century A.D., 115 at the end of the third, 84 by the end the fourth, 53 by the end of the fifth. One cause of this development was the amalgamation of properties into ever larger units. But an effect almost certainly was the emptying out of large areas of the countryside, as also of the city of Cosa itself, the market centre of the region. Thus town and country declined together.⁴

Significantly the breakdown of the system of rural settlement did not happen, or did not happen as radically, in the territory of Saturnia, away from the coast. There agricultural specialisation had not developed to the same extent, and smaller villas continued to produce a wider range of crops,

³ F.Cambi, E.Fentress, 'Villas to castles: first millennium A.D. demography in the Albegna Valley', in K.Randsborg, ed., *The Birth of Europe: Archaeology and Social Development in the first Millennium* (Rome 1989), 74-85; E.Fentress, 'Creation, transformation and failure', *Journal of Roman Archaeology*, Suppl. 38 (Ann Arbor 2000), 9-24.

⁴ S. L. Dyson, 'Settlements patterns in the Ager Cosanus: The Wesleyan University Survey 1974-76', *Journal of Field Archaeology* 5 (1978), 251-68; Idem, 'Settlement reconstruction in the *ager cosanus* and the Albegna valley', in G. Barker and R. Hodges, eds., *Archaeology and Italian society: prehistoric, Roman and medieval studies* I. BAR International Series 102. Papers in Italian Archaeology 2 (Oxford 1981), 269-274; E. Fentress, 'Cosa in the empire, the unmaking of a Roman town', *Journal of Roman Archaeology* 7 (1994), 208-22. On the revival of Cosa as a Byzantine fortress, with a *mansio*, a church, a cemetery, and a few huts, see M. G. Celuzza and E. Fentress, 'La Toscana centro-meridionale: i casi di Cosa-Ansedonia e Roselle', in R.Francovich and G.Noyé, *La storia dell' alto medioevo italiano (vi-secolo) alla luce dell' archeologia* (Florence 1994), 601-13.

with the result that the region was less vulnerable than the area nearer the coast.⁵

Surveys in Southern Etruria show that the development was quite parallel to that in the northern survey area, although the proximity of Rome must have made a considerable difference to the economy. Here decline, that is reduction in the number of settlements registering in field surveys, began in the third Century A.D. By 500 between 50% and 80% of the sites had been deserted. As around Cosa, we can observe concentration of ownership into fewer hands, but there also is evidence that land was abandoned. Strangely enough this seems to have happened especially in the neighbourhood of roads. One might perhaps compare the abandonment of settlements on the Fosse Way in Britain. From the eighth century there is evidence of the establishment of hill settlements. In other words, a new pattern of settlement was replacing the Roman one, giving great importance to situations of natural strength.⁶

Campania was and is exceptionally fertile because of its volcanic soil. The area in the north of Campania examined by Arthur experienced dramatic development from the third century B.C. The establishment of Latin colonies was followed by the building of solid stone farms, which you can call villas, but included villas of every kind. Eventually Roman senators assembled estates and built great country-houses. The produce, that is corn, oil and especially wine, was sold in Rome and all over the West. Site density reached a maximum in the last century of the Republic and the first of the Empire. A sharp decline began before the end of the second century. Around the end of the 5th century occupation becomes almost imperceptible to field surveys. Roads, harbours and aqueducts had fallen into ruin. Great areas of marshy swamp had developed around the coast. But in the valley of the upper Liris, away from the coast where Roman rule had also resulted in the building of villas, but smaller villas which did not eliminate farms of more modest size, a system of mixed farming did not go into early decline, but survived from the republic into the sixth century.⁷

With Baetica we enter an area where dramatic development began two hundred or more years later than in the regions of Italy discussed so far. It began in the first century A.D. and was targeted at the production of olive

⁵ I. Attolini, *et al.*, 'Political geography and productive geography between the valleys of the Albegna and the Fiora', in Barker and Lloyd 1991, op.cit. (n.1), 142-152.

⁶ T.W. Potter, *The Changing Landscape of Southern Etruria* (New York 1979), 92-167.

⁷ P. Arthur, *The Romans in Northern Campania* (London 1991).

oil.⁸ Huge quantities were exported to Rome. J. Remesal Rodríguez has calculated that 5,600,000 kgs of oil were sent to Rome each year.⁹ The development of this export was surely one of the factors responsible for regression in Italy. But this boom too came to an end. Here the end came in the third century.¹⁰ The effect on the landscape does not appear to have been as devastating as in northern Etruria and northern Campania. There seems to have been a return to arable farming organised around very large villas.¹¹

But as in Italy there was a dramatic reduction in the number of occupied sites. By the seventh century 70% of the sites known from the second century appear to have been abandoned.¹²

The reduction of exports of oil from Spain is likely to have been caused by a dramatic expansion of the export of oil from North Africa, especially modern Tunisia. There arable cultivation had over centuries been spreading from the area around Carthage to the edge of the desert.¹³ But from the 2nd century A.D. there was a striking development of the growing of olive trees for the purpose of the export of olive oil which soon reached all shores of the Western Mediterranean. This export weathered the fall of the Western Empire to a surprising extent, and it continued on a significant scale perhaps to the end of the sixth century, or even later¹⁴. The physical remains of the

⁸ M. Ponsich, *L'implantation rurale antique sur le Bas-Guadalquivir*, 3 vols. (Paris 1974–1987) and vol. 4 (1991) reviewed by S. Keay in *Journal of Roman Studies* 83 (1993), 236. K.E.Carr, *Did Roman Government Matter? The Standard of Living in the Guadalquivir valley A.D. 300-700* (PhD University of Michigan 1992), has applied Heyes' pottery dates to Ponsich's finds, and so been able to estimate the number of settlements at different dates.

⁹ J.Remesal Rodríguez, 'Baetican oil and the Roman economy', *Journal of Roman Archaeology*, Suppl.29 (1998), 183-99; Idem, 'Politik und Landwirtschaft', in: P.Herz and G.Waldherr, eds., *Landwirtschaft im Imperium Romanum*. Pharos, Studien zur griechisch-römischen Antike 14 (St. Katharinen 2001), 235-255.

¹⁰ L.H.Curchin, *Roman Spain: Conquest and Assimilation* (London 1991), 131, fig.71.

¹¹ P. Silières, 'La péninsule ibérique', in: P.Leveau and J.P. Vallat, eds., *Campagnes de la Méditerranée romaine* (Paris 1993), 201-49; A. Padilla Monge, *La provincia romana de la Bética* (Écija 1989).

¹² K.E.Carr 1992, op.cit. (n.8), 198-200.

¹³ P.Trousset, 'Limes et frontière climatique', in: Idem, *Histoire et archéologie de l'Afrique du Nord* (Paris 1986), 55-84; P. Leveau, 'L'Afrique du Nord' in: Leveau, et al. 1993, op.cit. (n.1), 155-200; J.-L. Ballais, 'Land degradation in the Eastern Maghreb', in G.Barker and D.Gilbertson, eds., *The Archaeology of the Drylands*, (London/New York 2000), 125-136, relevant 130. J.M.Lassere, *Ubique populus, peuplement et mouvements de population dans l'Afrique romaine 146 av. J.-C. – 225ap. J.-C.* (Paris 1977), on demographic expansion from 2nd century.

¹⁴ S.Gutiérrez Lloret, 'Eastern Spain', in: R.Hodges and W.Bowden, eds., *The Sixth Century: Production Distribution and Demand* (Leiden/Boston/ Cologne 1998), 161-183, esp. 164 f., 181-183; S.T.Loseby, 'Marseille and the Pirene thesis', *ibid.* 203-229, esp. 210-214; P.Reynolds, *Trade in the Western Mediterranean A.D. 400-700, the Ceramic Evidence*, BAR International Series 604 (Oxford 1995).

economic development in Africa have been traced. The story of regression is still very obscure.¹⁵ But the fact of eventual regression, indeed of dramatic regression, is evident, as photographs of Numidia to-day will confirm. When, and in what stages, regression happened is still obscure.

We now move away from the Mediterranean to northern Gaul, that is the region of the Somme and the Rhineland. Climate and economic links are entirely different. But once more the years of the Early Empire saw dramatic development. The region around the Somme in the North East of France was covered with a dense network of villas.¹⁶ Abandonment of sites began even before the third century. It was not rapid, but there is little evidence for the occupation of any of the sites after the early fifth century.¹⁷ Written sources show that the area was not depopulated. So the totally negative impression left by field surveys is misleading. But the particular kind of development stimulated by the *pax Romana* evidently did not last.¹⁸ It depended on a particular social situation. Further north in the Rhineland the trend was identical, though its rapidity in different areas depended on factors like location and geology.¹⁹ What this shows is that the basic pattern was not a consequence of specifically Mediterranean conditions, but that it was somehow rooted in the working of Roman society.

The latest case of dramatic agricultural development under Roman rule was the great extension of settlement in to the steppe bordering the desert on the eastern frontier in what now is Syria and Jordan. This process began in the fourth century A.D., and continued to the middle of the sixth century. It began in northern Syria and gradually moved south. The development of the eastern frontier is unusual in that its historian need not depend on field

¹⁵ G. Vitelli, *Islamic Carthage: The Archaeological and Ceramic Evidence* (Tunis 1981); Y. Thébert and J.-L. Biget, 'L'Afrique après la disparition de la cité classique', in: *L'Afrique dans l'occident romain 1er siècle avant J.C. – 4e siècle après J.C.* Collection de l'École Française de Rome 134 (Rome 1990), 575–602.

¹⁶ R. Agache, *La Somme pré-romaine et romaine* (Amiens 1978); Idem, 'La campagne à l'époque romaine dans les grandes plaines du nord de la France d'après les photographies aériennes', in: W. Haase and H. Temporini, *Aufstieg und Niedergang der Römischen Welt* II.4 (Berlin 1975), 658–713; K. Greene, *The Archaeology of the Roman Economy* (London 1986), 116–120.

¹⁷ P. v. Ossel, *Établissements ruraux de l'antiquité tardive dans le nord de la Gaule* (Paris 1992). See also the discussion in E. Wightman, *Gallia Belgica* (London 1985), 243–266.

¹⁸ Was the Romanization of land-holding in Northern Gaul a result of the need to supply corn to the legions on the Rhine, and can the decline of the villa system be linked to the development of corn farming in the Rhineland, together with a reduction of the military importance of the Rhine relative to the Danube frontier?

¹⁹ C. Bridger, 'Die römische Besiedlung der klempenerer Lehmplatte', *Bonner Jahrbuch* 194 (1994), 1–94, esp. graph on p. 86; M. Gechter and J. Kunow, 'Zur ländlichen Besiedlung des Rheinlandes in römischer Zeit', *Bonner Jahrbuch* 186 (1986), 377–86, esp. graph p. 391, based on surface finds.

surveys, but can study relatively well-preserved remains of houses and churches. Furthermore many of the buildings bear an inscription giving the date of their construction. So Tate was able to state quite conclusively that growth stopped around 450 and went into reverse around 600²⁰. In Jordan growth began later and continued until later. There reversal came after 750. As in Africa, the present state of the landscape, or rather the state not many decades ago,²¹ suggests that eventually the greater part of the area reverted to the conditions of steppe.

So much for the overall picture. An important book has recently been published on the development of Mediterranean landscape, *The Corrupting Sea* by Horden and Purcell.²² In a very general but fundamental way their conclusions are quite similar to those reached in this paper. They stress the importance of geography and climate which remained generally constant,²³ and has tended to reverse the effect of energetic human efforts to change the environment. Change in the countryside is cyclical rather than linear, a phase of what they call 'intensification' is eventually followed by a phase of 'abatement'.²⁴ This is I think a fair description of many of the developments I have discussed.

The emphasis on the importance of physical conditions, and of the instability of the physical environments in the Mediterranean, is certainly illuminating, and indeed salutary. 'Intensification' followed by 'abatement' can be observed all over the Empire in the East as well as in the West, but 'intensification' clearly did more lasting damage in Mediterranean conditions than in Gaul, and even around the Mediterranean the long-term effects of Roman intensification differed from region to region. Horden and Purcell are surely also right to warn against attempts to explain rural change by changes in the natural environment alone. Change has always been produced by a combination of natural and human factors.

²⁰ G.Tate, *Les campagnes de la Syrie du Nord, IVe au VIIe siècle* 1 (Paris 1992); G.R.D.King and A. Cameron, eds., *The Byzantine and Early Islamic Near East 2: Land Use and Settlement Patterns* (Princeton 1994).

²¹ This impression is based on field surveys. For references see my *The Decline and fall of the Roman City* (Oxford 2001), 72 n.72.

²² P.Horden and N.Purcell, *The Corrupting Sea. A Study in Mediterranean History* 1 (Oxford 2000).

²³ Horden and Purcell 2000, op.cit. (n. 22), 340: "The major environmental conditions of the Mediterranean have not in aggregate changed to a historically significant extent over the last four millennia".

²⁴ Horden and Purcell 2000, op.cit. (n. 22), 264: Local intensification involves its reverse, the abandonment of an initiative when it is complete or when circumstances change

But when it comes to the history of intensification and abatement in particular regions whether Northern Etruria, or Campania or Baetica, or Arabia, or wherever, the book is not very helpful. The emphasis of the book is on historical geography rather than social history. Its very considerable interest lies in discussion of topics like deforestation,²⁵ alluviation,²⁶ the relationship of pastoral and arable farming, the usefulness of scrub-land. Northern and Southern Etruria, Campagna, Baetica, Northern Syria, all provide illustrations of the factors that make for change in landscape, but the history of none of these landscapes is treated systematically. So the value of the book to the historian is to pose new questions, rather than help answer old ones, to stimulate new projects of research rather than to answer questions posed by papers such as the present one. But it must be remembered that this is only the first volume.

There is another problem. Certain ideas, almost dogmas, are repeated throughout,²⁷ which to me at least appear to be distinctly unhelpful when it comes to explaining the cyclical developments with which I am concerned in this paper. For instance Horden and Purcell do not believe that population growth was a dynamic factor for change: 'We see no exogenous variable promoting really sustained population growth'.²⁸ They consider that 'demographic determinism has little place in Mediterranean history as we see it'.²⁹ They insist that land-hunger as opposed to land-greed is not normally a very helpful category. The need to raise production to feed a growing population is considered unimportant in discussions of agrarian productivity. Failure and inadequacy are caused by war and social injustice. They quote approvingly: 'Starvation is blue-blooded'.³⁰

I think that this principle makes it distinctly more difficult to understand the development of landscapes in the Roman Empire. For it seems it is very difficult to explain the rural transformation of parts of Italy as a consequence of Roman expansion without positing the existence of population wanting

²⁵ Horden and Purcell 2000, op.cit. (n. 22), 337-8, 604-5. Early deforestation with subsequent liability to erosion in Apulia: C.Delano Smith, 'Where was the wilderness in Roman Times?' in G.Shipley and J.Salmon, eds., *Human Landscapes in Classical Antiquity* (London /New York 1996), 154-179, esp.154 f.

²⁶ Horden and Purcell 2000, op.cit. (n.22), 312-328; 602 f.: the arrival of 'the Younger Fill' was not a single event.

²⁷ I think it is not unfair to say that the authors are strongly influenced by the ideology of the contemporary ecological movement.

²⁸ Horden and Purcell 2000, op.cit. (n. 22), 267.

²⁹ Horden and Purcell 2000, op.cit. (n. 22), 268.

³⁰ Horden and Purcell 2000, op.cit. (n. 22), 267.

land. The character of the civil wars that ended the republic also suggests the pressure of population demanding land.³¹ Again the extraordinary expansion of village settlement in the Late Antique Near East is very difficult to explain without the assumption of a growing population.

Horden and Purcell again and again stress the great variety of Mediterranean ecologies: 'The distinctive texture of Mediterranean land is to be found the sub-dividedness...the continuousness of discontinuities.'³² This is an important observation, and the interrelation and mutual supplementation of micro-regions, for instance in circumstances of regional crop failure,³³ could be a profitable field of research. But change of the kind discussed in this paper affected very large areas at the same time. The growth in the number and size of villages in the eastern provinces from c. 400 to c. 550, and sometime well beyond that seems to have taken place all the way on the desert fringe from Egypt to Mesopotamia and also to have had parallels in Palestine, Cilicia and Lycia and elsewhere in Anatolia. This obviously is a phenomenon overriding the discontinuities of Mediterranean landscape.

As a model of change Horden and Purcell strongly insist on gradualism. They have no place for catastrophe. The book presents: 'An environmental history without catastrophe'. Rapid and radical transformation of whole regions, they argue, 'will be rare or non-existent. However terrible and sudden the accidents that may befall each locality, the complexity of the processes of interlocking diffuses the impact of the effect on the ensemble of thousand of definite places'.³⁴ It may indeed be rare that a natural catastrophe can be isolated as the only factor responsible for a significant change in the environment, but it surely has repeatedly been the case that a great disaster marks a historical turning point. So the coming of the bubonic plague in the mid sixth century marks a turning point in many spheres of life in the Roman East,³⁵ and the same was surely true of the Black Death in the fourteenth century in the West.³⁶ Moreover if terrible and sudden change is

³¹ See E.Lo Cascio in Bintliff and Sbonias 1999, op.cit. (n.2), 161-171

³² Horden and Purcell 2000, op.cit. (n. 22), 53.

³³ W.Jongman, 'Hunger and Power', in: A.C.V.M.Bongenaar, *Independency of Institutions and Private Entrepreneurs*, MOS Studies 2 (Istanbul 2000), 259-284, esp.276 f.

³⁴ See p.339, see also *ibid*: "Relative frequent repetition makes us want to associate ourselves with those who are reluctant to use the notion of catastrophe...We see the relationship between human communities and the environment as a relatively stable symbiosis."

³⁵ Liebeschuetz 2000, op.cit. (n. 21), 53; 391 f.; 409 f.

³⁶ J.Bolton, 'The world upside down' in M.Ormrod and P.Lindley, eds., *The Black Death in England* (Stamford 1996), 17-78.

taken to include political change, then the changes that took place in parts of Italy in the later republic and in Gaul under the early empire were surely both radical and rapid. The reversal of 'growth' in the east, from 'intensification' to 'abatement' does appear to me to have proceeded not imperceptibly, but by sharply distinguished stages, the earliest of which was signaled by the calamity of the first of a recurring series of visitations of plague, and in Northern Syria also by what turned out to be a series of devastating Persian invasions.³⁷ I would argue that the calamities of the 540s had a permanent negative effect not only along the desert fringe, but over the whole of the Late Roman East.³⁸ A second and intensified phase of abatement in Northern Syria followed the Persian invasion and occupation of Syria. Paradoxically the Arab conquest seems to have made little immediate difference, but the replacement of the Syrian Umayyad by the Abbasid dynasty seems to have led to striking acceleration of abatement in town and country in the whole area³⁹.

It would appear that the Roman empire did produce growth, the equivalent of getting two blades of grass to grow where only one had grown before. One factor that helped to make this possible, or at least should be investigated as a possible factor assisting growth, is technical innovation, or at any rate the introduction by the Romans of technical innovations to areas where they had not been previously applied.⁴⁰ Several other factors that produced agricultural development have been emerged in papers at this conference.⁴¹ However considerable uncertainty remains. For instance I know no obvious explanation for the great Late Antique boom in the East.⁴² But the successive phases of abatement are more difficult to explain than those of intensification. They clearly cannot be explained in terms of

³⁷ F.R.Trombley, 'War and society in rural Syria c.502-613A.D.', *Byzantine and Modern Greek Studies* 21 (1994), 154-129.

³⁸ For slow sustained decline of population following rapid growth to subsistence limit cf. M.Kiel, 'The Ottoman imperial registers' in J. Bintliff and K.Sbonias, eds., *Reconstructing Population Trends in Mediterranean Europe* (Oxford 1999), 196-218: disaster followed by rapid growth of population to limit of capacity, followed by long decline in central Greece A.D. 1460- 1660.

³⁹ Liebeschuetz 2000, op. cit. (n. 21), 72 f.; 314.

⁴⁰ Horden and Purcell 2000, op.cit. (n. 22), 232: "The study of inventions and innovations is conceptually subsequent to relations of control and subservience which have principally shaped decisions about production in the Mediterranean and elsewhere", may well be true in a very general sense, but this does not mean that the study of agricultural innovation and its propagation are irrelevant.

⁴¹ See in this volume De Blois, Pleket and Rich (p.IX-XX), Jongman (p. 28-47), De Ligt (p. 48-66), Erdkamp (p. 93-115) and Drinkwater (p. 128-140)

⁴² Horden and Purcell 2000, op.cit. (n.22), 274 f. The argument that it represents successful representation, not economic development, is not convincing.

physical causes alone, since they occurred in regions as diverse as the Rhineland and North Africa. It seems clear that agricultural decline particularly in areas specializing in the production of olive oil and wine was furthered by competition; in Italy by the competition of Baetica, in Baetica by that of North Africa. The competitive advantage of Africa was greatly assisted by the fact that very large numbers of shippers were subsidized to carry the *annona* from Africa to Italy to feed Rome.⁴³ No doubt transfer of armies, for instance from the Rhineland to the Balkans,⁴⁴ will have had a detrimental effect on farms that had developed to meet the legions' needs in their original location. It does however look as if there was also an inherent factor of self-destruction. By this I mean the process by which what was originally a system of small farms fell into ever fewer hands, with peasants often being replaced by slaves. The early stages of this development must have made the system more productive, but the eventual outcome at least in Etruria and Campania, and perhaps also in Tarraconensis,⁴⁵ was that arable farming or arboriculture were largely abandoned. Of course there were local factors too. I have argued that the Late Antique boom in the East was reversed by the combined effect of recurring plague and of war. It is likely that changes in the sea level contributed to the degradation of land in Northern Campania.⁴⁶ I would also suggest that we must not rule out the possibility that in lands on the margin of the desert very small changes in rainfall may have made all the difference whether land continued to be cultivated or not.

The title of this paper promises a discussion of ruined landscapes in the Roman Empire. It has I believe produced evidence for a cyclical development that eventually after centuries left some landscapes less productive than they had been before. But this does not necessarily mean that the eventual regression was the result of the landscape having been ruined by more intensive exploitation, much less that it was precisely the

⁴³ Chr. Wickham, 'Marx, Sherlock Holmes and Late Roman Commerce', in his *Land and power : studies in Italian and European social history, 400-1200* (London 1994), 77-118 = *Journal of Roman Studies* 78 (1988), 183-193.

⁴⁴ See John Drinkwater in this volume, pp. 128-140.

⁴⁵ Horden and Purcell 2000, op.cit. (n.22), 281; J. M. Recassens, *La ciudad de Tarragona II* (Barcelona, 1975), 69-85; S. Riera Mora and J. M. Palet Martínez, 'Landscape dynamics from Iberian-Roman (2nd-1st centuries B.C.) to early medieval times (12th century) in the Montjuïc-El Port sector (Plain of Barcelona)', *Archeologia Medievale* 21 (1994), 517-38. See also J.M. Palet Martínez, *Estudi territorial del Pla de Barcelona* (Barcelona 1997).

⁴⁶ A. Humbert, *Campagnes andalouses et colons castillans* (Madrid 1988): deforestation of slopes, and accumulation of sediments to form vast marshy areas in former lagoons is comparatively recent.

detrimental effect of the Roman period of intensification which inflicted permanent damage. It is however worth asking the question whether in some areas there was fundamental damage of the kind that could only be reversed by the application of modern resources and modern technology, if indeed it can be reversed at all. Horden and Purcell write: 'It is important to recognize that there were indeed more deltaic plains, fewer dense woodlands, more eroded badland etc in the nineteenth century than there had been in the Bronze Age. But those aggregate changes had come about in so piecemeal a way that it is not even possible to attribute them to periods, let alone to moments, and they were mostly susceptible to reversal.'⁴⁷ This is extremely pessimistic and would suggest that there is no point in a historian trying to establish the precise circumstances of the origin of the bad lands of the Roman Empire, or to answer the further question to what extent, if any, have these bad lands of imperial Rome remained bad land ever since. But that seems excessive pessimism. In some cases intensification involved serious destruction of the environment, sometimes more sometimes less irreversible.⁴⁸ But in many cases the return to a more 'primeval' form of exploitation of the landscape will have been an adaptation to changed social conditions linked to the disappearance of the Empire.⁴⁹ Some badlands that have sometimes been believed to have been degraded by Roman misuse of the landscape only become bad as a result of modern technology. The Romans must have cut many trees in connection with their building projects, for ship-building and for fuel, but they also were aware of the need to plant and conserve forests for coppicing.⁵⁰ It is well established that railways and other modern modes of transport have greatly accelerated deforestation

⁴⁷ Horden and Purcell 2000, op.cit. (n.22), 339.

⁴⁸ Agriculture caused degradation to some extent in the Maghreb (see J.- L. Ballais, 'Land degradation in the Eastern Maghreb', in G.Barker and D.Gilbertson, eds., *The archaeology of the Drylands* [London/New York 2000], 125- 136, relevant 130 f.), and very considerably as the result of a combination of arable-caused erosion and heavy metal mining in the Wadi Faynan (see G.Barker, 'Farmers, herders and miners in the Wadi Faynan, Southern Jordan', *ibid.* 63-85), but not in the Negev (see S.A. Rosen, 'The decline of desert agriculture: a view from the classical period Negev', *ibid.*, 45-62), or in Tripolitania (see D.Gilbertson, C.Hunt and G. Gillmore, 'Romano-Lybian floodwater farming', *ibid.* 137-159).

⁴⁹ R.-B. Hitchner, 'The Kasserine archaeological survey', *Antiquités africaines* 24 (1988), 7-41; 26 (1990), 231-260: expansion following Roman control involves the becoming sedentary of nomads. At the end of the fifth and early 6th century A.D. the decline of the Roman system stimulated a retreat from corn and arboriculture. The yielding of olive to palm represents a choice of inhabitants as production of agriculture became less attractive.

⁵⁰ Roman landowners planted trees for coppicing, feeding pigs, timber and amenity: R.Meiggs, *Trees and Timber in the Ancient Mediterranean World* (Oxford 1982), 261-278. In all classical literature Meiggs has only found one complaint at over-felling: Sidonius 5.441-4.

around the Mediterranean.⁵¹ There have been episodes of reforestation as well as of deforestation since Roman times.⁵² The fact is that for much of the Roman Empire the landscape history is still very obscure. We are still at an early stage in this investigation.

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⁵¹ Meiggs 1982, op.cit. (n. 50), 371-403. On Spain see Humbert 1988, op.cit. (n. 46): deforestation of slopes, and accumulation of sediments to form vast marshy areas in former lagunes is comparatively recent.

⁵² Cycles of deforestation and reforestation: P. Hemphill, 'Deforestation and reforestation in a central Italian hinterland; land usage during and after the Roman occupation' in R.F.J Jones, ed., *First Millennium Papers: Western Europe in the first Millennium AD*, BAR International Series 401 (Oxford 1988), 147-158. See also the titles in Chr. Wickham, *Land and power : studies in Italian and European social history, 400-1200* (London 1994), 184 n.61.