**Introduction**

No-one doubts that climate, environment and societal development are linked in complex ways. The problem is in the actual mechanics linking the two, and in trying to determine the causal associations, or in assigning these causal factors some order of priority. Key questions include, for example, at what scale are the climatic and environmental events observed, and how does this relate to the societal changes in question? What factors are linked in causally complex ways. The problem is in the actual mechanics linking the two, and in trying to determine the causal associations, or in assigning these causal factors some order of priority.

One good reason for a historical perspective is to determine how different categories of socio-political system respond to different levels of stress — in the hope that knowledge can contribute to contemporary policy and future planning, for example. How and why are some societal systems more resilient or flexible than others? Understanding such complex causal associations in the past will help us generate effective responses to environmental — societal stress today and in the future.

Historians understand causal relationships from the point of view of multiple interconnected social, economic, and political factors. Climate scientists think in terms of environmental impacts on agriculture, warfare, demographics, and longer-term stability. Scholars of past climates have a range of tools at their disposal; proxy data deriving from natural archives such as tree rings, fossil pollen, marine and lake sediments, corals, speleothems, as well as documentary evidence.

Recent work comparing dendro-data from the Altai region in Mongolia and from the Austrian Alps, combined with the data extracted from other proxy sources, especially the boreal palaeoecology, reveals a period of substantial cooling that set in across Eurasia in the period ca. 536-660 CE, a period that the authors dub the late Antique Little Ice Age (LALIA, Fig. 1).

**Problem and context**

Between the early 630s and 740s the Eastern Roman (Byzantine) empire lost some 75% of its territory (Fig. 2) and an equivalent amount in annual revenue to the Arab-Islamic conquests or, in the Balkans, to various ‘barbarian’ groups. How did it survive such a catastrophic loss, and how was it able to recover stability and go onto the offensive in the later 9th and 10th centuries? There are many factors, as noted already, but environmental aspects have hitherto been largely disregarded.

A focus on Anatolia offers some important clues.

**Fig. 2a. The empire ca. 590 CE**

**Fig. 2b. The empire ca. 717 CE**

Anatolia’s arable and pastoral land was, with some regional variations, put to relatively intensive use during the 6th and 7th centuries. Both the palynological (Fig. 3) and the archaeological evidence indicate that much of the region was densely inhabited and characterized by mixed farming. Much of Anatolia experienced a rather wetter climate than beforehand during the 8th and up to the later 7th century, stretching in some areas into the early 8th century (Fig. 4). This is a pattern that is supported by textual evidence, with a comparatively unusual severity of freeze and snow, but with relatively few events associated with floods or drought, and similar climate issues.

But the evidence for agriculture, for what was being produced from the land, does not parallel these climatic changes. Pollen data show that beginning in the middle of the sixth century the intensive and relatively homogeneous exploitation of land in Anatolia receded. There took place a simplification of the agrarian regime. At different rates according to area, the established pattern is gradually replaced, either by natural vegetation or by a more limited range of crops, with a particular emphasis on cereals and livestock at the expense of viticulture and olive culture (Fig. 5).

**Fig. 3. Sites with pollen data for the first millennium CE in central and western Anatolia (Haldon et al. 2014)**

**Fig. 5. Summary of agricultural production in Anatolia according to pollen data ca 300-900 CE (Haldon et al. 2014)**

On the other hand, this simplification does seem to intensify during the Arab-Islamic invasions and raids into Anatolia, which had significant consequences for urban life and the demography of the region. How did the 8th century state react? One factor that played a role is that of the grain supply of the empire. Fig. 6. The loss of Egypt in 618 to the Persians, and then for good to the Arabs from 641, was a serious blow, because Egypt had been the breadbasket of the empire. New sources of grain for the Byzantine army had to be found, while the presence of armies in Anatolia from the 640s and 650s onward also meant that the provinces had to supply substantial numbers of additional products, both human and animal. There is good written evidence that the empire was able to reorientate its management of both the Constantinopolitan supply as well as the number of grain production for some of its provincial armies, the environmental data for the production of cereals seems to support this hypothesis.

**Fig. 4. Historically documented climate-related events, climatic moisture conditions in central and western Anatolia and proxy records of temperature from Central Europe. Shaded bars mark notable periods of dry climate** (Haldon et al. 2014)

The climate of survival? Environment, climate and society in Byzantine Anatolia, ca. 600-1050

Part of Princeton’s Climate Change & History Research Initiative

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**Fig. 6. Grain sources of the E Roman empire 6th-7th c CE**

**Conclusions**

The simplification of agrarian output across Anatolia, and more especially the greater emphasis on cereal production and livestock, would in fact have been very opportune for the east Roman state under the sort of intense pressure that it experienced at this time, since the difficult situation constituted serious pressure on the fisc to generate the supplies needed by its armies — livestock and grain, precisely the products that the pollen record suggests came to dominate. We can thus suggest that it was this report from the regions, through its fiscal system, that contributed to this shift in the pattern of agrarian output. Evidence for a change in technical language in the tax system and in the administration of the empire suggests such a conclusion.

The conditions of climatic instability that provided the background and context for the gradual transformation of the Roman empire in the course of the third-fifth centuries were precisely the conditions that, along with a range of other political, social and economic factors, permitted the survival of the eastern Roman state in the seventh century.

Following this period Anatolia enters a much simplified agro-pastoral regime and a reduced level of activity. The wholesale retreat and the reduction in farming is accompanied by a reduced rural population in areas. The political and economic effects of these changes were also to erode the economic and military advantages of the Empire through its fiscal system, that contributed to this shift in the pattern of agrarian output. Evidence for a change in technical language in the tax system and in the military administration of the empire suggests such a conclusion.

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In the 906s, Anatolian landlords began to invest in expanding their estates, coinciding with the height of imperial political and military power and expansion and widespread growth of the agrarian economy in the Byzantine world, which is also evident in Egypt. This suggests that this improvement in the economic, political, and military fortunes of the Empire and the rise of a powerful magnate elite was aided by an amelioration in the climate regime.

**References**

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