Johannes Preiser-Kapeller, Ekaterini Mitsiou

The Little Ice Age and Byzantium within the Eastern Mediterranean, ca. 1200–1350: An Essay on Old Debates and New Scenarios

Abstract: This paper discusses written historical documentation and paleo-environmental evidence in order to explore connections between climatic and socio-economic change. It focuses thereby on the Byzantine Empire and the eastern Mediterranean more generally in the period between the collapse and "restoration" of Byzantine rule in Constantinople (1204–1261) and the beginning of Ottoman expansion in the Balkans in 1352, which roughly coincided with the outbreak of the first wave of the "Black Death" in 1347. The paper entails juxtaposing various older scenarios of "fatal" social and political developments in Byzantine history with new studies based on proxy data from regions across the Balkans and Asia Minor and comparing these events with developments in other polities of the region during the transformation from the "Medieval Climate Anomaly" to the "Little Ice Age."

Keywords: Byzantine Empire, Mediterranean Studies, Climate History, Little Ice Age, Medieval Balkans, Ottoman History, Environmental History, Plague

1 Introduction – Old Debates

Contemporary scholarship still often considers late Byzantium a "pseudo-empire" that was more or less "programmed" for destruction after the Fourth Crusade's conquest of Constantinople in 1204 (or even earlier) and interprets the development of the subsequent 250 years from the perspective of their endpoint, the Ottoman conquest of 1453.[1] In this narrative, the demise of Byzantium is hardly a unique case of "decline" and collapse but rather part of the general "crisis of the late Middle Ages" and the

1 Peter Schreiner, Schein und Sein. Überlegungen zu den Ursachen des Untergangs des byzantinischen Reiches, in: Historische Zeitschrift 266 (1998), pp. 625–647. For a more detailed discussion of the historiography and the period in general, see also: Johannes Preiser-Kapeller, Complex historical dynamics of crisis: the case of Byzantium, in: Sigrid Jalkotzy-Deger/ Arnold Suppan (eds.), Krise und Transformation, Vienna 2012, pp. 69–127.

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calamities and widespread socio-economic and political instability that swept across Afro-Eurasia during this time.[2]

This common scenario has, however, undergone significant revision over the course of the last century. Historians began by re-assessing the late medieval period from the perspective of cultural history,[3] and the emerging disciplines of economic and social history went on to establish an empirical foundation for the concept of a late medieval crisis in various countries of Western Europe.[4] This model was closely connected to the hypothesis that the Black Death had counteracted growing demographic pressure and resulted in better living conditions for the smaller population which remained. According to this theory, this long-term beneficial development had permitted the "Rise of the West" in the early modern age as Europe outpaced other regions of the globe. The well-documented English case seemed especially to support such a "Malthusian" model; John Hatcher and Mark Bailey concluded: "The case for a demographic downturn along Malthusian lines around c. 1300 has been argued so many times that is has become something of an orthodoxy."[5] Angeliki Laiou has likewise proposed a growth period in Byzantium starting in the tenth century which was followed by a "Malthusian impasse" in the late thirteenth and early fourteenth centuries. Laiou analyzed tax registers *(praktika)* for a number of Macedonian villages that were in the possession of monasteries of Mount Athos, and her study, published in

2 Ulf Dirlmeier/ Gerhard Fouquet/ Bernd Fuhrmann: Europa im Spätmittelalter 1215–1378 (Oldenbourg Grundriss der Geschichte 8), 2nd ed., Munich 2009, pp. 3–8, 41–52, 183–193. Victor Lieberman, Strange Parallels. Southeast Asia in Global Context, c. 800–1830. Vol. 2: Mainland Mirrors: Europe, Japan, China, South Asia, and the Islands, Cambridge 2009, pp. 77–84; Wolfgang Behringer, Kulturgeschichte des Klimas. Von der Eiszeit bis zur globalen Erwärmung, Munich 2007, pp. 119–162; John Watts, The Making of Polities. Europe, 1300–1500 (Cambridge Medieval Textbooks), Cambridge 2009, pp. 13–19. Behringer also examines this "grand narrative" of the late medieval period from a critical perspective.

3 See for instance Johan Huizinga's classic "The Autumn of the Middle Ages," first published in 1919. See also, František Graus, Pest, Geißler, Judenmorde. Das 14. Jahrhundert als Krisenzeit, 2nd ed., Göttingen 1988.

4 Michael M. Postan, Revisions in Economic History, in: Economic History Review 9 (1938/1939), pp. 160–167; Wilhelm Abel, Agrarkrisen und Agrarkonjunktur in Mitteleuropa vom 13. bis zum 19. Jh., Berlin 1935; Marc Bloch, Les caractères originaux de l´histoire rurale française, Paris 1931. Cf. also now John Drendel (ed.), Crisis in the Later Middle Ages. Beyond the Postan-Duby Paradigm (The Medieval Countryside 13), Turnhout 2015.

5 John Hatcher/ Mark Bailey, Modelling the Middle Ages. The History and Theory of England's Economic Development, Oxford 2001, pp. 30–52. Cf. also Bruce M. S. Campbell, English Seignorial Agriculture 1250–1450 (Cambridge Studies in Historical Geography 31), Cambridge 2000, pp. 1–25; Dirlmeier/ Fouquet/ Fuhrmann (note 2), pp. 16–21, 158–168; Watts (note 2), pp. 13–19; Daniel R. Curtis, Coping with Crisis. The resilience and vulnerability of pre-industrial settlements, Farnham, Burlington 2014, pp. 2–4.

2007, found that the rural population was declining in the first half of the fourteenth century, even before the plague struck, and that the economic situation of peasant households was deteriorating, as well (see also Table 2).[6]

However, Laiou herself had been more cautious regarding a possible "Malthusian" mechanism in an earlier survey of the late Byzantine agricultural economy in 2002, in which she highlighted the relevance of social and economic factors – e.g., the relationship between landowners and peasants – that had affected the material situation of the majority of the population beyond demographic pressures per se.[7] The generally accepted explanation of the calamities which befell the Byzantine Empire in its last centuries – or even beginning in the eleventh century – focuses on the growth of the economic and political power of the "aristocratic" great families at the expense of the free peasantry, which in this interpretation had provided the financial and military backbone of the empire since the seventh century and which the emperors had tried in the tenth century to protect with legislative measures to no avail. Georg Ostrogorsky (1902–1976) wrote accordingly about the "feudalization" of Byzantium,[8] and Peter Schreiner asserted in 1998 that this "gain of private interests at the expense of the state" was "the seed of decay" which finally led to the collapse of Byzantium.[9] Recent research, however, has qualified these views with regard to the impact of large-scale ownership on economic expansion from the tenth to thirteenth century, which was especially strong in the European provinces of Byzantium. In her 2002 study, Laiou states: "The large estate, once thought to signal and promote the collapse of Byzantium and its agrarian base, is now seen as a factor in economic

6 Angeliki Laiou/ Cécile Morrisson, The Byzantine Economy (Cambridge Medieval Textbooks), Cambridge 2007, pp. 169–170; Angeliki Laiou, The Palaiologoi and the World around them (1261–1400), in: Jonathan Shepard (ed.), The Cambridge History of the Byzantine Empire, c. 500–1492, Cambridge 2008, pp. 803–833, here pp. 817–818. For the data from the tax registers cf. also Angeliki E. Laiou, Peasant Society in the Late Byzantine Empire. A Social and Demographical Study, Princeton/ N.J. 1977; Jacques Lefort, Population et peuplement en Macédoine orientale, IXe-XVe siecle, in: Catherine Abadie-Reynal et al. (eds.), Hommes et Richesses dans l'Empire Byzantin, vol. 2, Paris 1991, pp. 63–89. For further literature on the discussion of Malthus and Byzantium see Preiser-Kapeller (note 1), pp. 78–81.

7 Angeliki Laiou, The Agrarian Economy, Thirteenth-Fifteenth Centuries, in: Angeliki Laiou (ed.): The Economic History of Byzantium. From the Seventh through the Fifteenth Century, Washington / D. C. 2002, pp. 311–375, here pp. 316–317. For a new evaluation of the evidence, see also Kostis Smyrlis, Byzantium, in: Harilaos Kitsikopoulos (ed.), Agrarian Change and Crisis in Europe, 1200–1500, New York 2012, pp. 128–164.

8 Georg Ostrogorsky, Geschichte des byzantinischen Staates, Munich 1963 (English version Oxford 1968, there pp. 316–375); Georg Ostrogorsky, Pour l'histoire de la féodalité byzantine (Corpus Bruxellense Historiae Byzantinae, Subsidia I), Brussels 1954. On this debate see also Preiser-Kapeller (note 1), esp. pp. 72–77 and 91–93. A systematic and detailed survey of relevant documents is now provided by Mark C. Bartusis, Land and Privilege in Byzantium. The Institution of Pronoia, Cambridge 2012; cf. also the review of this monograph by Ekaterini Mitsiou, in: Medioevo Greco 14 (2014), pp. 37–43.

9 Schreiner (note 1), pp. 625–647.

expansion."[10] Alan Harvey in 2006 considered the advance of the great aristocratic estates essential for economic and demographic growth in the tenth and eleventh centuries, suggesting that the emperors' legislative efforts to limit this expansion were "misconceived" and impeded the "very process that was enriching Byzantine society as a whole." It was only these larger-scale economic entities, according to Harvey, that could afford the necessary investment for an intensification of land use.[11] In 2008, however, Mark Whittow disagreed: "We should perhaps be thinking of a world where landowning aristocrats hijacked the fruits of pioneering peasant enterprise. [...] Did the great estates necessarily promote local and regional economic enterprise, or did they dampen such activity in favor of self-sufficiency and the provision of goods in kind to feed their dependents in the capital? [...] An economy, in other words, shifting, like that of later medieval eastern Europe, to become one of great estates producing for a profitable export market, but in so doing fundamentally damaging its social base."[12]

Whittow draws up a scenario discussed at length in the 1970s and 1980s in the so-called "Brenner Debate," sparked by Robert Brenner's (Marxist) criticism of the "Neo-Malthusian Orthodoxy" (as Guy Bois has called it) represented in the work of Michael M. Postan and others. Brenner challenged this demographic determinism and emphasized the (in turn, for him universal) role of "social-property relationships and balances of class forces" in the socio-economic trajectories in different European polities at the dawn of the early modern period.[13] Although historians never generally accepted Brenner's mono-causal interpretation, the important influence of socio-economic factors and the institutional framework – such as the relationship between an aristocratic elite and the majority of the population – on demographic trends seems evident.[14] In 2005, Stuart J. Borsch extended this discussion to Mamluk Egypt, which he contrasted with late medieval England. While both polities suffered a comparable loss of population in the mid-fourteenth century due to the plague, the material conditions of the population in England improved after this period of general contraction, and population numbers and agrarian productivity began to increase in the fifteenth century. Not so in Egypt, where population, agrarian output,

10 Laiou (note 7), p. 1150.

11 Alan Harvey, The Byzantine Economy in an International Context, in: Historisch Tijdschrift Groniek 39/171 (2006), pp. 163–174, here p. 170. See also his monograph: Alan Harvey, Economic Expansion in the Byzantine Empire, 900–1200, Cambridge 1989.

12 Mark Whittow, The Middle Byzantine Economy (600–1204), in: Jonathan Shepard (ed.), The Cambridge History of the Byzantine Empire, c. 500–1492, Cambridge 2008, pp. 465–492, esp. pp. 487–491.

13 Cf. Robert Brenner, Agrarian Class Structure and Economic Development in Pre-Industrial Europe, in: Trevor Henry Aston/ C. H. E. Philpin (eds.), The Brenner Debate. Agrarian Class Structure and Economic Development in Pre-Industrial Europe, Cambridge 1985, pp. 10–63, esp. p. 23; Guy Bois, Against the Neo-Malthusian Orthodoxy, in: ibid., pp. 107–118, and the other papers reprinted in this volume. Cf. also Hatcher/ Bailey (note 5), pp. 52–65.

14 Cf. also Curtis (note 5), pp. 4–7; Verena Winiwarter/ Martin Knoll, Umweltgeschichte. Eine Einführung, Cologne, Weimar, Vienna 2007, pp. 73–78.

and living conditions declined further in the wake of the Black Death. Borsch identifies the main cause for this divergence in the fact that English landholders failed in their efforts to collectively confront a scarce rural labor market and "to intensify the mechanisms of coercive surplus-extraction," and therefore had to accept lower rents for their land, higher wages for labor, etc. As a result, "economic opportunities for those below the top of the social pyramid expanded." The Mamluks, on the other hand, were able to "collectively force" a consistently high level of surplus-extraction onto the reduced agrarian population after the Black Death, but this led over time to further deterioration in material conditions and a decline in agrarian yields, which ultimately resulted in long-term demographic depression.[15]

If we accept Whittow's argument, Byzantium's "wrong turn" in its socio-economic development came already in the eleventh or twelfth century, when it began marching "backwards" – i.e., away from the path towards modern economic growth later followed by England and other western European societies.[16] Yet, more recent detailed studies on various regions and settlements within Europe have shattered various assumptions on which both models (the "Malthusian" and the "Brenner") relied: one found neither a ubiquitous "Malthusian impasse" nor a universal "golden age of low and middle incomes" after the Black Death.[17] John Hatcher and Mark Bailey conclude: "The foundations on which each grand model is built, and the methods by which it proceeds, are essentially far too crude. At best they might be applicable to very simple systems, but modern research has confirmed that the medieval economy was relatively complex and that it operated within a sophisticated environment." In the face of the high diversity of crisis- (and non-crisis-) phenomena within the politically cracked landscape of fourteenth-century Western Europe, some scholars (such as Peter Schuster) even totally negate the existence of a late medieval crisis and consider it a "fantasy of the twentieth century."[18]

As a result of these debates within the scholarship, there is no monolithic established view on the events of the fourteenth century remaining, which makes the contribution of new data and perspectives from environmental studies that much more valuable in its potential to help mend this fragmentation. As Bruce Campbell high-

15 Stuart James Borsch, The Black Death in Egypt and England. A Comparative Study, Austin 2005, pp. 24–66 and pp. 113–117. Borsch's analysis borrows heavily from the model Guy Bois has developed for Normandy, see Guy Bois, Crise du féodalisme, Paris 1976, and Michael North, Europa expandiert 1250–1500 (Handbuch der Geschichte Europas 4), Stuttgart 2007, pp. 365–366 (for a useful summary of Bois' model).

16 Daniel Chirot (ed.), The Origins of Backwardness in Eastern Europe. Economic and Politics from the Middle Ages until the Early Twentieth Century, Berkeley, Los Angeles, Oxford 1989.

17 For an overview, see Peter Schuster, Die Krise des Spätmittelalters. Zur Evidenz eines sozial- und wirtschaftsgeschichtlichen Paradigmas in der Geschichtsschreibung des 20. Jahrhunderts, in: Historische Zeitschrift 269 (1999), pp. 19–55, and Drendel (note 4).

18 Hatcher/ Bailey (note 5), p. 209; Schuster (note 17). Cf. Dirlmeier/ Fouquet/ Fuhrmann (note 2), for an overview on these debates.

lighted in his recent magisterial study on the "Great Transition,"[19] empirical evidence suggests that the entire "old world" from eastern Asia to the Viking colonies on Greenland was affected by dramatic changes on a global scale when the so-called "Medieval Climate Anomaly" of circa 850–1300 came to an end with an accumulation of extreme weather events and the Black Death, which spread via the commercial routes that had been established during the preceding *Pax Mongolica* from central Asia into the Mediterranean and the rest of Europe as well as into China.[20] The epidemic's local and regional impacts and consequences depended on the circumstances of these individual societies and their vulnerability, and the outcomes included varying degrees of societal collapse but also the emergence of powerful new polities. By providing a global framework for this period, the discipline of environmental studies allows scholars to analyze similar crisis phenomena and how these influenced the development of societies with different (or similar) traditions, religions, institutions, geographies, or ecologies. Byzantium is just one potentially illuminating example for such a study.[21]

2 New Data and New Scenarios

Paleoclimatic research incorporates both the methods and scholarship of traditional history and evidence gathered in the natural sciences; the Swiss pioneer of climate history Christian Pfister distinguished the "archives of society" – i.e., primarily written sources – and the "archives of nature" – i.e., the evidence of past climatic conditions found in tree rings, lake sediments, or dripstones (speleothems).[22] These "proxies" allow for paleoclimatic reconstructions of varying durations and chronologies stretching over millennia to individual years (or even shorter intervals) and spatial resolutions from the global down to the local level. An extremely important

19 Bruce M. S. Campbell, The Great Transition. Climate, Disease and Society in the Late-Medieval Worlds, Cambridge 2016.

20 Emmanuel Le Roy Ladurie spoke in 1973 already of L'Unification Microbienne du Monde (XIV-XVII Siècles), in: Schweizerische Zeitschrift für Geschichte 23 (1973), pp. 627–696. Cf. also Janet L. Abu-Lughod, Before European Hegemony. The World System A.D. 1250–1350, New York, Oxford 1989.

21 See also Jared Diamond/ James A. Robinson, Natural Experiments of History, Cambridge / Mass., London 2011.

22 Christian Pfister, Klimageschichte der Schweiz 1525–1860. Das Klima der Schweiz von 1525–1860 und seine Bedeutung in der Geschichte von Bevölkerung und Landwirtschaft, 2 vol., Bern, Stuttgart 1985; Franz Mauelshagen, Klimageschichte der Neuzeit (Geschichte Kompakt), Darmstadt 2010; Jürg Luterbacher et al., A Review of 2000 Years of Paleoclimatic Evidence in the Mediterranean, in: P. Lionello (ed.), The Climate of the Mediterranean region: from the past to the future, Amsterdam 2012, pp. 87–185 (with sections on various natural scientific data). For further bibliography cf. also Johannes Preiser-Kapeller, A Collapse of the Eastern Mediterranean? New results and theories on the interplay between climate and societies in Byzantium and the Near East, ca. 1000–1200 AD, in: Jahrbuch der Österreichischen Byzantinistik 65 (2015), pp. 195–242.

collection in this "natural archive" is lake sedimentation, which can be resolved in annual layers. Lake sediments, for example, often include pollen from plants from areas even further afield. Palynologists are then able to identify these different species and their relative share of the vegetation of the surrounding area and subsequently to reconstruct climatic changes and human interventions (via "anthropogenic indicators") in the landscape.[23] In addition to pollen, the composition of sediments can offer other important information on past climatic conditions via, for instance, oxygen isotope analysis.[24] The "social archives" encompass mainly written sources, which sometimes include direct meteorological observations of anomalies such as extreme winters or flood events, but also indirect data about the beginning of plant flowering, for instance, which allow for conclusions on weather conditions.[25]

By drawing on both the archive of nature and of society, historical climate research is increasingly able, both globally and regionally, to reconstruct climate history and assess its impacts on human societies over centuries and millennia. For Byzantine studies, groundbreaking in this regard is the work of Ioannis G. Telelis, who not only provided the first systematic survey of meteorological information on Greek and other written sources for the medieval eastern Mediterranean in two massive volumes published in 2004, but has also outlined a methodological basis for combining the archives of society and of nature (see also Table 1) in several articles.[26] Since then, an

23 On methods, potentials, and problems, especially for the interpretation and dating of pollen sequences from sites in Byzantine Anatolia and the Near East, see Adam Izdebski, A Rural Economy in Transition. Asia Minor from Late Antiquity into the Early Middle Ages (Journal of Juristic Papyrology, Supplement vol. 18), Warsaw 2013, pp. 109–132. See also Warren J. Eastwood, Palaeoecology and eastern Mediterranean Landscapes: Theoretical and practical approaches, in: John F. Haldon (ed.), General Issues in the Study of Medieval Logistics: Sources, Problems and Methodologies, Leiden 2006, pp. 119–158.

24 C. Neil Roberts/ Giovanni Zanchetta/ Matthew D. Jones, Oxygen isotopes as tracers of Mediterranean climate variability: an introduction, in: Global and Planetary Change 71 (2010), pp. 135–140. For a practical example, see Jonathan R. Dean et al., Palaeo-seasonality of the last two millennia reconstructed from the oxygen isotope composition of carbonates and diatom silica from Nar Gölü, central Turkey, in: Quaternary Science Reviews 66 (2013), pp. 35–44. For the pitfalls connected with a neglect of the uncertainties regarding the temporal resolution and spans of dating of such sediments and data for their historical interpretation, cf. John F. Haldon et al., The Climate and Environment of Byzantine Anatolia: Integrating Science, History, and Archaeology, in: Journal of Interdisciplinary History 45/2 (2014), pp. 113–161, esp. pp. 120–121.

25 On the use of historical documents for climate reconstructions, see Raymond S. Bradley, Paleoclimatology. Reconstructing Climates of the Quaternary, Amsterdam, Waltham, San Diego 2014, pp. 517–551. Cf. Preiser-Kapeller (note 22) for further bibliography.

26 Ioannis G. Telelis Μετεωρολογικά φαινόμενα και κλίμα στο Βυζάντιο. 2 vols., Athens 2004. Cf. also Ioannis G. Telelis, Climatic Fluctuations in the Eastern Mediterranean and the Middle East AD 300–1500 from Byzantine Documentary and Proxy Physical Paleoclimatic Evidence – a Comparison, in: Jahrbuch der Österreichischen Byzantinistik 58 (2008), pp. 167–207; Idem, Medieval Warm Periods and the Beginning of the Little Ice Age in the Eastern Mediterranean: An Approach of Physical and Anthropogenic Evidence, in: Klaus Belke/ Friedrich Hild/ Johannes Koder/ Peter Soustal (eds.),

increasing number of studies have contributed a variety of proxy data from "archives of nature" for the ancient and medieval Mediterranean. One focal point of these efforts has become the "Climate Change and History Research Initiative," founded, among others, by the Byzantinist John F. Haldon at Princeton. Publications emerging from this group include a special issue of Quaternary Science Reviews in 2016 and a special issue of Human Ecology in 2018.[27] The 2016 issue also contained an insightful programmatic paper by Adam Izdebski et al. on the dialogue between historians and paleoclimatologists.[28] Izdebski has also pioneered the large-scale introduction of palynological data into the study of the Byzantine economy, both in a monograph on Asia Minor[29] and in a major paper co-authored with Grzegorz Koloch and Tymon Słoczyński, which re-evaluated and also re-dated pollen data from dozens of sites in Asia Minor and the Balkans and created synthetic trajectories of the trends of cultivation of various crops such as wheat, grapes, or olives for seven larger regions: central Greece, the highland hinterlands of Macedonia, the mountains of western Bulgaria, eastern Bulgaria, eastern Bithynia, inland Pontus, and southwestern Anatolia (with a focus on Pisidia) (see Figure 1 and Figure 8–10). Most recently, Adam Izdebski in summer 2018 has established an independent research group at the Max Planck Institute for the Science of Human History in Jena, entitled "Byzantine Resilience: Environmental History of the Eastern Romans (ByzRes)"; it focuses on those regions in Greece and in Western Turkey which are also of special interest for the period discussed in the present paper and therefore will constitute a decisive step forward for answering questions which have to remain open for now due to the lack of data (see

Byzanz als Raum. Zu Methoden und Inhalten der historischen Geographie des östlichen Mittelmeerraumes, Vienna 2000, pp. 223–243.

27 Haldon et al. (note 24). Alexandra Gogou / Adam Izdebski / Karin Holmgren (eds.), Special Issue: Mediterranean Holocene Climate, Environment and Human Societies, in: Quaternary Science Reviews 136 (2016), pp. 1–252, there especially the papers: Elena Xoplaki et al., The Medieval Climate Anomaly and Byzantium: A review of the evidence on climatic fluctuations, economic performance and societal change, in: Quaternary Science Reviews 136 (2016), pp. 229–252; Erika Weiberg et al., The socio-environmental history of the Peloponnese during the Holocene: Towards an integrated understanding of the past, in: Quaternary Science Reviews 136 (2016), pp. 40–65. John F. Haldon et al. (eds.), Special Issue: Society and environment in the East Mediterranean ca 300–1800 CE. Resilience, adaptation, transformation, in: Human Ecology 46/3 (2018), pp. 273–398. For the "Climate Change and History Research Initiative" see: http://climatechangeandhistory.princeton.edu/ and also the bibliography via https://climatechangeandhistory.princeton.edu/bibliographies (last time accessed 07/01/2019). One of the authors of the present paper (Johannes Preiser-Kapeller) is also a member of this initiative and has contributed to the special issue of Human Ecology.

28 Adam Izdebski et al., Realising consilience: How better communication between archaeologists, historians and natural scientists can transform the study of past climate change in the Mediterranean, in: Quaternary Science Reviews 136 (2016), pp. 5–22.

29 Izdebski (note 23).

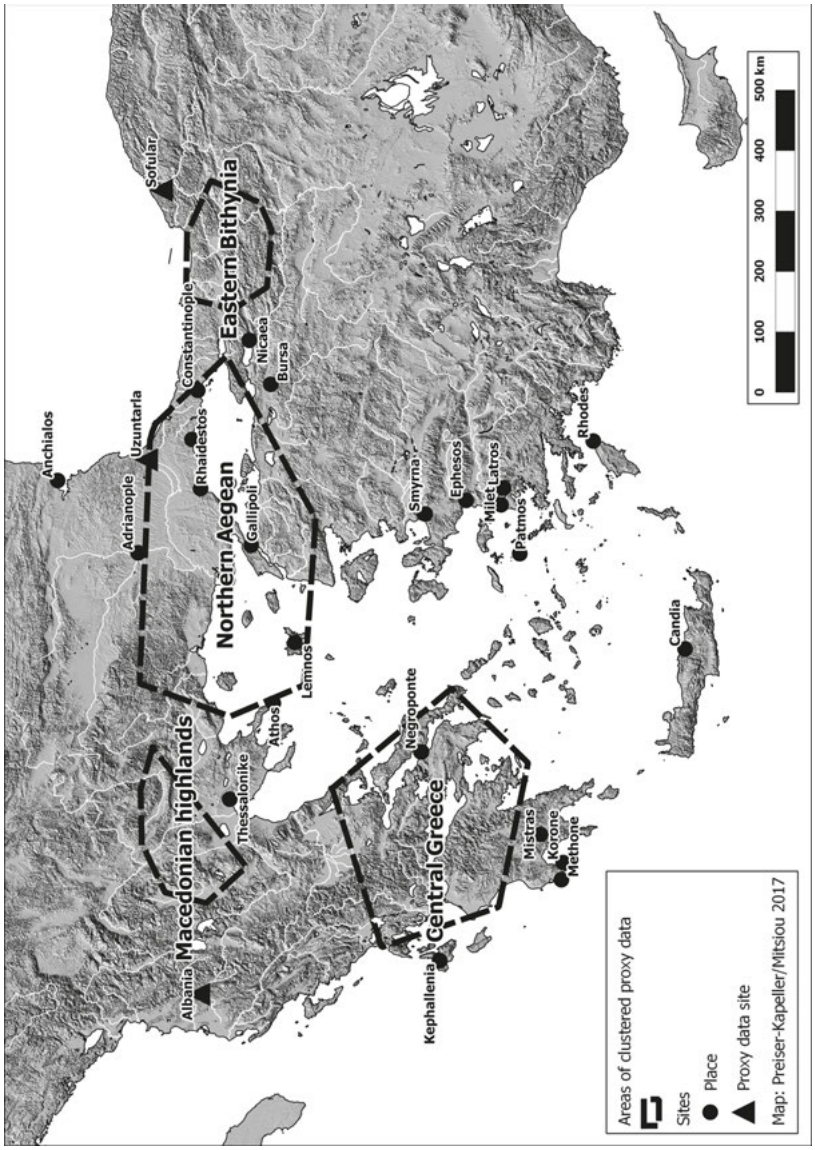

Figure 1: – Map of selected historical places and proxy data sites as well as of areas of clustered proxy data mentioned in the paper (image: Preiser-Kapeller/ Mitsiou 2017; see also Koplaki et al. [note 27], Figure 1, for a similar map of places of origin of proxy data).

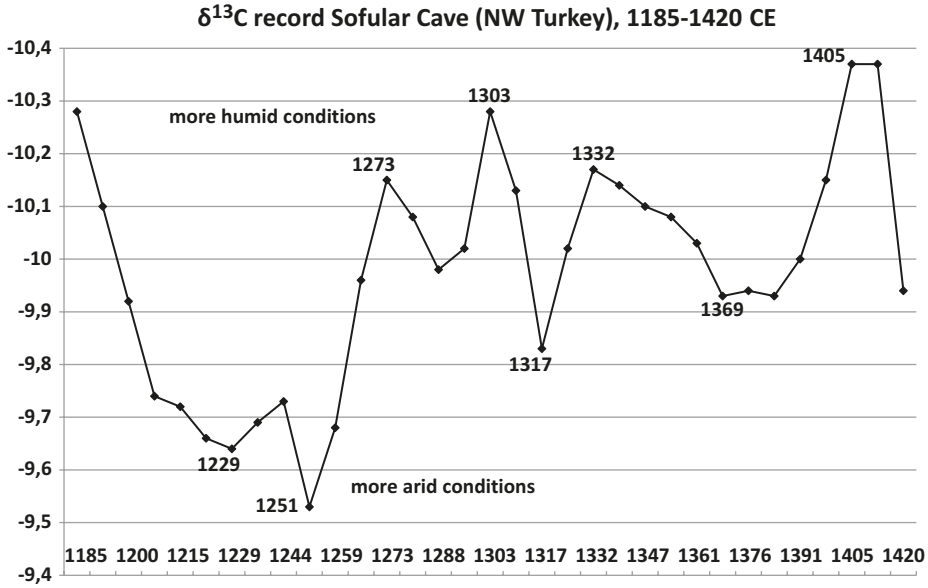

Figure 2: – $\delta^{13}C$ record from speleothems in the Sofular Cave (NW Turkey), 1185–1420 (data: Fleitmann et. al. [note 32]; image: Preiser-Kapeller/ Mitsiou 2017).

also below).[30] Of course, scholars working outside the Princeton research initiative have also published various relevant studies: most interestingly, Edward R. Cook et al. present spatial reconstructions of summer wetness and dryness across Europe and the Mediterranean for the last two thousand years in the "Old World Drought Atlas" (OWDA) based on tree ring data; for the period under consideration, the OWDA includes the eastern Mediterranean, as well.[31]

All this new data allows us to re-evaluate the possible impact of the transition from the Medieval Climate Anomaly to the Little Ice Age on the late Byzantine Empire; as illuminating examples, we have visualized four groups of proxies (see Figure 1): the pollen data provided by Izdebski/ Koloch/ Słoczyński (see Figure 8–10), the carbon isotope record from speleothems in the Sofular Cave (northwest Turkey) (see Figure 2–3) as well as tree ring data for Albania (see Figure 4–5) and the northern Aegean (see Figure 6–7) (in addition to other proxy data discussed throughout the

30 Adam Izdebski/ Grzegorz Koloch/ Tymon Słoczyński, Exploring Byzantine and Ottoman economic history with the use of palynological data: a quantitative approach, in: Jahrbuch der Österreichischen Byzantinistik 65 (2015), pp. 67–110. For the new project of Adam Izdebski in Jena see: https://www.shh.mpg.de/1056512/byzres (last time accessed 07/01/2019).

31 Edward R. Cook et al., Old World megadroughts and pluvials during the Common Era, in: Science Advance, November 2015 (DOI: 10.1126/sciadv.1500561).

paper).[32] Climate proxies and pollen data cannot answer some questions discussed within this context, such as the actual impact of the rise of great estates, but they can provide a general environmental framework within which Byzantium and other polities operated in the thirteenth and fourteenth centuries, and they provide additional data on the increase or decrease of agricultural activity in various regions which can be compared with historical records. The following sections of this paper try to do just that. Although the findings are at times exploratory and additional data and research are clearly necessary, these preliminary findings highlight the potential of combining these archives of society and of nature for a further re-evaluation of the development of Byzantium in the thirteenth and fourteenth centuries.

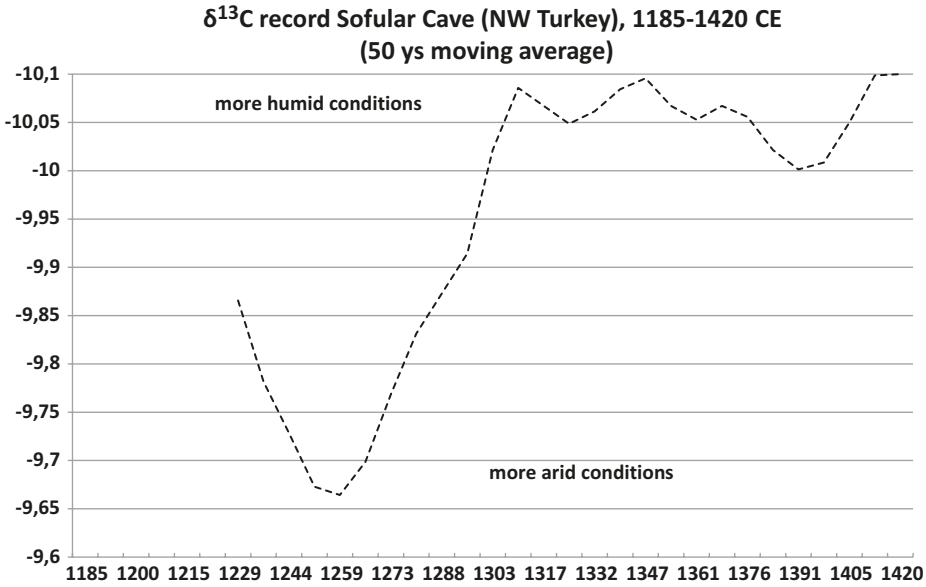

Figure 3: – $\delta^{13}C$ record from speleothems in the Sofular Cave (NW Turkey), 1185–1420, 50 years moving average (data: Fleitmann et. al. [note 32]; image: Preiser-Kapeller/ Mitsiou 2017).

32 For the Sofular-data: Dominik Fleitmann et al., Sofular Cave, Turkey 50KYr Stalagmite Stable Isotope Data. IGBP PAGES/World Data Center for Paleoclimatology Data Contribution Series # 2009–132 (ftp://ftp.ncdc.noaa.gov/pub/data/paleo/speleothem/asia/turkey/sofular2009.txt, last time accessed 20/09/2017), and Ozan M. Göktürk, Climate in the Eastern Mediterranean through the Holocene inferred from Turkish Stalagmites, Ph.D.-Thesis, University of Bern 2011. For the tree ring data from Albania: PAGES 2k Network consortium, Database S1 - 11 April 2013 version: http://www.pages-igbp.org/workinggroups/2k-network (last time accessed 21/04/2015). For the precipitation reconstruction based on tree rings from the northern Aegean, see Carol B. Griggs et al., A regional high-frequency reconstruction of May–June precipitation in the north Aegean from oak tree rings, A.D. 1089–1989, in: International Journal of Climatology 27 (2007), pp. 1075–1089. Cf. also Preiser-Kapeller (note 22), for the earlier period between the eleventh and thirteenth century.

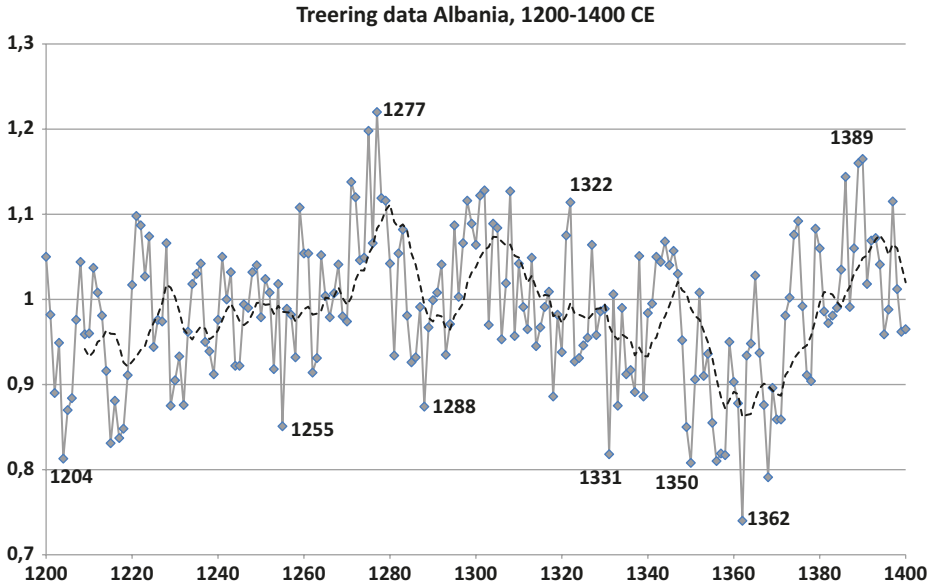

Figure 4: – Tree ring data for Albania, 1200–1400, with ten years moving average (data: PAGES 2k Network consortium, Database S1 – 11 April 2013 version: http://www.pages-igbp.org/workinggroups/2k-network [21.04.2015]; image: Preiser-Kapeller/ Mitsiou 2017).

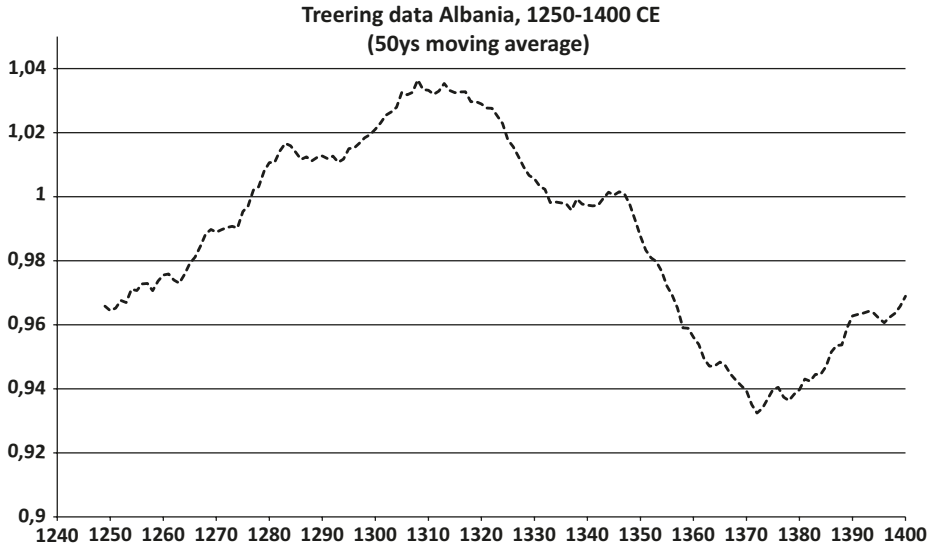

Figure 5: – Tree ring data for Albania, 1250–1400, 50 years moving average (data: PAGES 2k Network consortium, Database S1 – 11 April 2013 version: http://www.pages-igbp.org/workinggroups/2k-network [21.04.2015]; image: Preiser-Kapeller/ Mitsiou 2017).

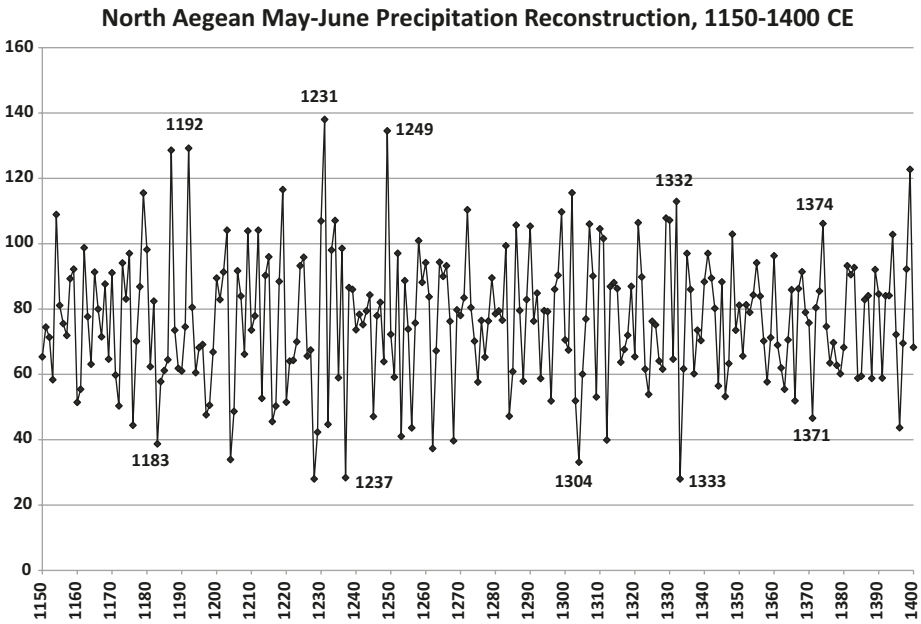

Figure 6: – Tree ring-based reconstruction of May–June precipitation in the northern Aegean, 1150–1400 (data: Griggs et al. [note 33]; image: Preiser-Kapeller/ Mitsiou 2017).

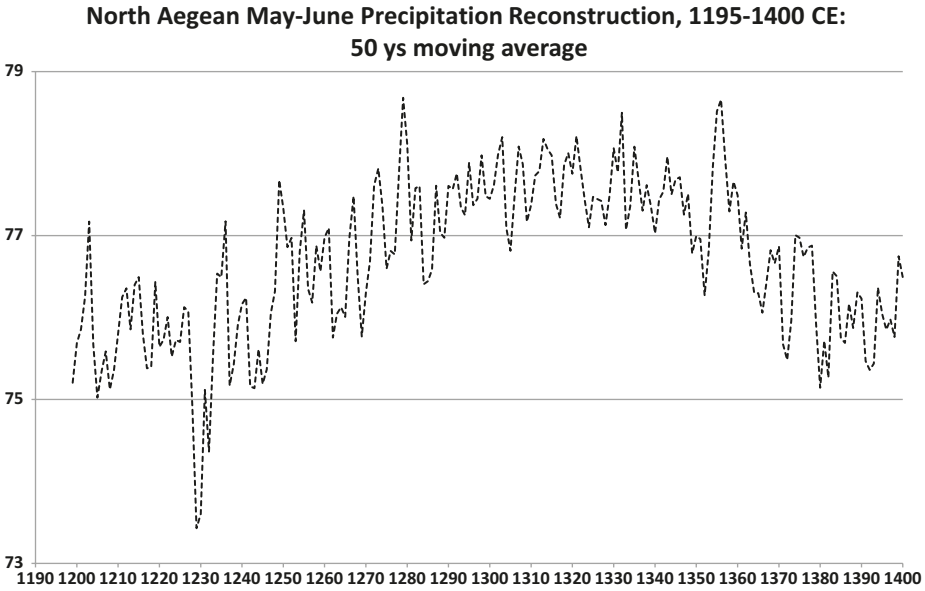

Figure 7: – Tree ring-based reconstruction of May–June precipitation in the northern Aegean, 1195–1400, 50 years moving average (data: Griggs et al. [note 33]; image: Preiser-Kapeller/ Mitsiou 2017).

3 Between Two Conquests: A Drought and a Bitterly Cold Spell, 1180–1261

The reign of Emperor Manuel I Komnenos (1143–1180) marked an apex of Byzantine influence in the Mediterranean, yet within the quarter century after his death, the empire collapsed. Various members of the imperial Komnenian family and the related clan of the Angeloi took their turns on the imperial throne, even as their power dwindled away, first in exterior provinces such as Bulgaria and Cyprus (since 1185) and finally even in core regions like the Peloponnese or western Asia Minor, where local potentates seized control. During this period, the Byzantine emperors alienated the increasingly threatening Western powers, then tried to appease them, and finally invited them to intervene in the struggles for the imperial throne, which led to the Fourth Crusade and the Crusaders' and Venetians' conquest of Constantinople in April 1204.[33] From a climate historical point of view, the Komnenian Empire of the twelfth century partly benefited from the generally favorable conditions that can be observed in other parts of the eastern Mediterranean as well as in western Europe during this period.[34] While these beneficial climatic conditions persisted (despite several severe famines) in western Europe until the thirteenth century, however, the eastern Mediterranean experienced less favorable parameters and drier conditions beginning in the middle of the twelfth century.[35] For northwestern Anatolia, proxy data (speleothems) documents a turn towards more arid conditions from the 1180s onward (see Figure 2–3). In a tree ring-based precipitation reconstruction for southwestern Anatolia for the years 1097 to 2000, Ramzi Touchan and his colleagues identified the seventy years from 1195 to 1264 as the driest period in their entire record (while the years 1098 to 1167 marked one of the wettest ones). Lake sediments from that region display an equal pattern, as do speleothems from Thrace (Uzuntarla Cave, Turkey), sediments of the Tecer Lake from Cappadocia, and pollen data from the area of Antioch, with a shift towards drier conditions beginning in the late twelfth century. This drought contributed to a severe famine in Syria between 1178 and 1181 and a prolonged drought in the Near East from 1224 to 1227.[36] In general, the years of the Angeloi

33 Charles M. Brand, Byzantium confronts the West 1180–1204, Cambridge / Mass. 1968; Michael Angold, The Fourth Crusade. Event and Context, Edinburgh 2003; Schreiner (note 1), pp. 628–630.
34 A discussion of the data supporting this scenario can be found in Preiser-Kapeller (note 22), pp. 210–216. See also Xoplaki et al. (note 27), for similar findings (up until the mid-12th century).
35 Preiser-Kapeller (note 22), pp. 214–215 (with further references).
36 Göktürk (note 32), pp. 13–39; for north-western Anatolia, see also Griggs et al. (note 32). For south-western Anatolia see Ramzi Touchan et al., May–June precipitation reconstruction of southwestern Anatolia, Turkey during the last 900 years from tree rings, in: Quaternary Research 68 (2007), pp. 196–202; Ingo Heinrich/ Ramzi Touchan et al., Winter-to-spring temperature dynamics in Turkey derived from tree rings since AD 1125, in: Climate Dynamics 41 (2013), pp. 1685–1701. For the Uzuntarla Cave in Thrace: Luterbacher et al. (note 22), pp. 104–106; Göktürk (note 32), pp. 67–80. For

(1185–1204) started to become drier and, especially in the Balkans, also colder.[37] The problems Emperor Isaak II Angelos, for instance, faced on his campaigns against insurgents in Bulgaria in the winter of 1187/88 coincide with a generally colder trend in the second half of the 1180s.[38] One may therefore ask how less beneficial or even adverse climatic parameters might have aggravated already crisis-prone conditions within a fragmenting Byzantine polity between 1180 and 1204; for a definite answer, however, more data is required.[39]

Yet after the "cosmic cataclysm" of 1204, the relative increase in power of the provinces (also due to regional economic growth) allowed for the constitution of several "Byzantine" states in exile, in northeastern Asia Minor ("Empire of Trebizond"), in northwestern Greece ("Despotate of Epirus") and most successfully, in northwestern Asia Minor ("Empire of Nicaea") by members of the landed elite (see Figure 1). In the agriculturally rich region of western Asia Minor, Theodore I Laskaris (1204–1221) and John III Dukas Vatatzes (1221–1254) were able to establish a more robust imperial government which relied on the incorporation of other elite clans, who, like the church, received tax immunities and land grants. Yet power was, for the time being, centralized around the emperor and his household.[40]

Scholarship on this age has painted a picture of "efflorescence" of the rural economy in the Empire of Nicaea based on contemporary Byzantine historiography, which describes the imperial regime as actively supporting agricultural expan-

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Lake Tecer: Catherine Kuzucuoglu et al., Mid- to late-Holocene climate change in central Turkey: The Tecer Lake record, in: The Holocene 21/1 (2011), pp 173–188. For Antioch and Syria: David Kaniewski et al., The Medieval Climate Anomaly and the Little Ice Age in Coastal Syria inferred from Pollen-derived Palaeoclimatic Patterns, in: Global and Planetary Change 78 (2011), pp. 178–187. On the droughts of 1178–1181 and 1224–1227 and on the Near East in general, see Sara K. Raphael, Climate and Political Climate. Environmental Disasters in the Medieval Levant (Brill's Series in the History of the Environment 3), Leiden 2013, pp. 76–87 and 87–90.

37 Cf. Preiser-Kapeller (note 22) for the data.

38 Niketas Choniates p. 398, lns. 30–42, ed. J. A. Van Dieten, Nicetae Choniatae Historia (Corpus Fontium Historiae Byzantinae 11/1–2), Berlin 1975; cf. Telelis (note 26), Nr. 591, and Preiser-Kapeller (note 22), p. 215 with fn. 83 (citing the passage from Niketas Choniates at length)

39 Judith Herrin, The Collapse of the Byzantine Empire in the Twelfth Century. A Study of a Medieval Economy, updated version in: Eadem, Margins and Metropolis: Authority across the Byzantine Empire, Princeton 2013, pp. 111–129; Paul Magdalino, The Empire of the Komnenoi (1118–1204), in: Jonathan Shepard (ed.), The Cambridge History of the Byzantine Empire, c. 500–1492, Cambridge 2008, pp. 646–657, 663 (for the citation). On this period see also now Alicia Simpson (ed.), Byzantium, 1180–1204: "The sad Quarter of a Century"?, Athens 2015. As an example of the postulation of a causal interplay between climatic conditions and political crisis in this period, see Xoplaki et al. (note 27).

40 Michael Angold, A Byzantine Government in Exile. Government and Society under the Laskarids of Nicaea (1204–1261), Oxford 1975; Ekaterini Mitsiou, Untersuchungen zu Wirtschaft und Ideologie im ‚Nizänischen' Reich, Dissertation, Univ. Vienna 2006. For the term "cosmic cataclysm" (κοσμικὸς κλύδων), cf. Jean Darrouzès, Les discours d'Euthyme Tornikès (1200–1205), in: Revue des études byzantines 26 (1968), pp. 49–121, here pp. 82, ln. 28–83, ln. 1 and George Akropolites: A. Heisenberg (ed.), Georgii Acropolitae opera, I, Leipzig 1903 (revised ed. P. Wirth, Leipzig 1978), §50, p. 94, ll. 9–10.

sion, and fostering an ideal of the empire's "autarky" regarding foreign commerce, especially trade with Italian merchants.[41] These Byzantine authors, however, are clearly biased in their contrast of the "glory" days of the Laskarids with the later Palaiologos dynasty; these sources should be used with caution. For some regions of western Asia Minor, however, documents from monastic archives (especially Lembos, Latros, and Patmos, but also Athos) provide evidence of how these institutions invested in the expansion and improvement of their properties by constructing watermills or planting vineyards, for example.[42] Landholders used grapevines as a "cash crop," as Angeliki Laiou and Cécile Morrisson have pointed out, because "the price of vineyards was 5.5 to 10 times higher than that of arable land, while their fiscal value was eight to twelve times higher than that of the best-quality arable land."[43] The quantifiable data that would allow a more conclusive picture, however, is lacking: from all the regions of the Empire of Nicaea, Izdebski et al. were only able to create a synthetic pollen diagram for eastern Bithynia (southwestern Anatolia at that time was already largely beyond the grasp of Byzantine power). As they state, "vine is the only anthropogenic indicator whose values rose" from 1200 onwards (until the mid-fourteenth century), while grain and olive pollen indices remain more or less stable (see Figure 8–10).[44] Izdebski presents similar results in a recent study on the hinterland of Miletus (based on pollen data from nearby Lake Bafa in the Latros region, see Figure 1).[45] While the data so far does not support a general upwards trend of agricultural output in Nicaean lands, it at least does not show any significant impacts of the dry spell that proxy data suggests continued in western Asia Minor from the late twelfth to the middle of the thirteenth century (see also above).[46] On the one hand, the wetter regions of western Asia Minor may have been less affected than more arid areas in the interior of Anatolia, where a famine in the Seljuk realms is documented for 1243 – a famine, however, which was certainly also connected to Mongol attacks. (During this famine, the Empire of Nicaea sold grain

41 Mitsiou (note 40); Laiou/ Morrisson (note 6), p. 224.

42 Peter Thonemann, The Maeander Valley. A Historical Geography from Antiquity to Byzantium, Cambridge 2011, pp. 178–186 and pp. 263–278; Mitsiou (note 40), pp. 74–77.

43 Laiou/ Morrisson (note 6), p. 176. Cf. also Mitsiou (note 40), p. 85; Smyrlis (note 7).

44 Izdebski/ Koloch/ Słoczyński (note 31). The pollen trajectories for eastern Bithynia display a long term upwards trends since ca. 900 CE for vineyards and also for olives (until the eleventh century), perhaps at the cost of grain production, which shows a downwards trend. This may suggest that larger-scale landowners, including regional monasteries, invested in more marketable products.

45 Adam Izdebski, Environmental history of the hinterland, contribution to: Philipp Niewöhner et al., The Byzantine settlement history of Miletus and its hinterland. Quantitative Aspects: Stratigraphy, Pottery, Anthropology, Coins, and Palynology, in: Archäologischer Anzeiger 2/2016 (published 2017), pp. 225–290, here pp. 270–280.

46 Also the "Old World Drought Atlas" reconstructs years of increased summer dryness for 1204, 1216, 1228, 1232, 1237, 1243, 1244, 1245, 1250, 1251, 1253, and 1255 in western Asia Minor during the Laskarid period, cf. Cook et al. (note 31).

to the Seljuks with high profits.[47]) On the other hand, renewed political stability and a supportive government probably increased the resilience of agriculture in the face of adverse climatic conditions. A contemporary source mentions that the agrarian policy of the Laskarids aimed to lay up supplies for "times of harvest failure and shortage," and, although it is perhaps too much to assume an awareness of or an active response to changing climatic parameters, this sensible strategy may have proved even more beneficial in the first half of the thirteenth century in the regions of the Nicaean Empire.[48]

Figure 8: – Synthetic trajectories of cerealia pollen in Central Greece, Eastern Bithynia and the Macedonian highlands, 900–1500 (for each trajectory 900 = 1; data: Izdebski/ Koloch/ Słoczyński [note 31]; image: Preiser-Kapeller/ Mitsiou 2017).

47 Nikephoros Gregoras, ed. Ludwig Schopen, Bonn 1827, I, pp. 6–9, 43; Telelis (note 26), nr. 604. Telelis in his catalogue provides the relevant extracts from all the textual sources he is using. Although we have consulted and re-examined all texts (and their dating) in their original editions, we provide only references to Telelis´ monograph in most cases for the sake of brevity and clarity. This allows also for a direct comparison with other recent studies following the same way of shorthand reference such as Haldon et al. (note 24) and Xoplaki et al. (note 27).

48 Cf. Theodori Scutariotae Additamenta ad Georgii Acropolitae Historiam, in: A. Heisenberg (ed.), Georgii Acropolitae opera, I, Leipzig 1903 (revised ed. P. Wirth, Leipzig 1978), pp. 285, 23–286, 2. Cf. also Mitsiou (note 40).

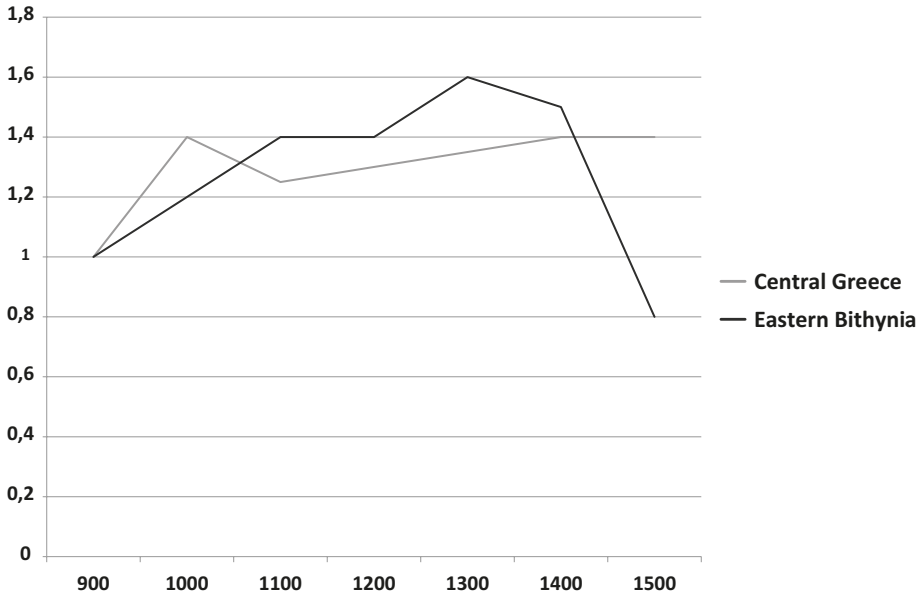

Figure 9: – Synthetic trajectories of vine pollen in Central Greece and Eastern Bithynia, 900–1500 (for each trajectory 900 = 1; data: Izdebski/ Koloch/ Słoczyński [note 31]; image: Preiser-Kapeller/ Mitsiou 2017).

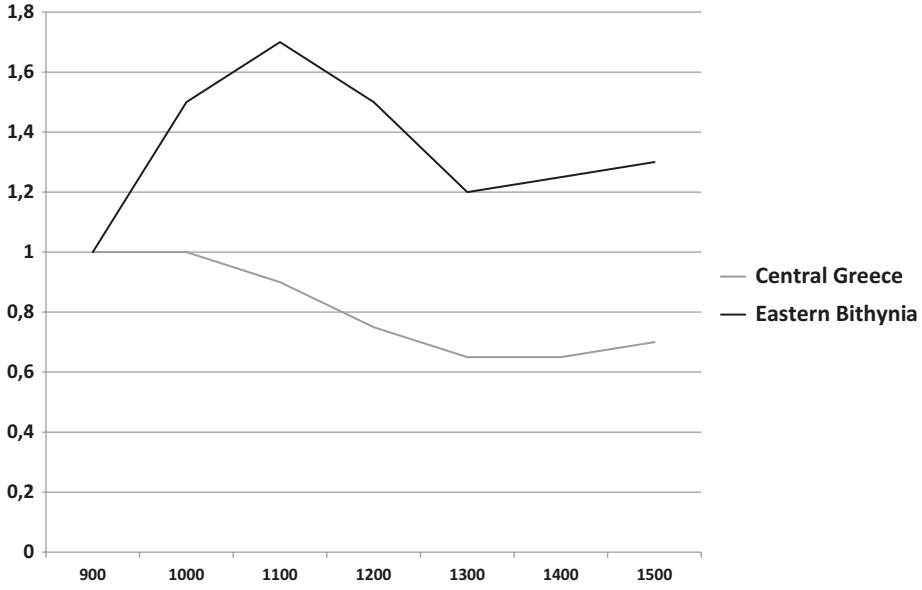

Figure 10: – Synthetic trajectories of olive pollen in Central Greece and Eastern Bithynia, 900–1500 (for each trajectory 900 = 1; data: Izdebski/ Koloch/ Słoczyński [note 31]; image: Preiser-Kapeller/ Mitsiou 2017).

Nicaea also profited from favorable geopolitical factors: powers which might have competed with Nicaea either neutralized each other or were subjugated between 1241 and 1243 by the Mongols, who never reached Nicaean territory.[49] Nicaean forces were thus able to occupy Thrace and Macedonia in the decades after 1235 and to isolate Latin-controlled Constantinople. However, the awkward equilibrium between imperial power and aristocracy proved to be short-lived; the attempt of Emperor Theodore II Laskaris (1254–1258) to rely on *homines novi* from outside the elite for his regime ended with his premature death in 1258 and the minority of his son John IV.[50] The strongest elite faction took over power in the person of Michael VIII Palaiologos (1258–1282), who gradually pushed the young John IV Laskaris aside, distributed the positions of powers among his relatives and allies, and established a new imperial dynasty.

This transfer of power from the Laskarids to the Palaiologoi chronologically overlapped with the beginning of a watershed in the general climate history of late medieval Europe, the first phase of the transition from the warmer Medieval Climate Anomaly to the Little Ice Age. A massive volcanic eruption in 1257 or 1258 (now attributed to the Samalas volcano in Indonesia) created the "single largest sulphate spike of the entire Holocene" and was a major contributor to the climate change felt in Europe. Even before this eruption, however, cold, wet conditions had begun causing harvest failures and famine in large parts of Europe.[51] Byzantine sources also report severe cold and snowfall in Thrace and Macedonia in early and late 1256, while Bar Hebraeus mentions widespread famine in Syria, Mesopotamia, and Asia Minor in 1258.[52] As severe as these problems were, as Bruce Campbell has pointed out, they were only harbingers of the more dramatic changes to come.[53]

49 Schreiner (note 1), pp. 635–638; Preiser-Kapeller (note 1), p. 74.

50 Dimiter Angelov, Imperial Ideology and Political Thought in Byzantium, 1204–1330, Cambridge 2007, pp. 204–252.

51 Père Benito i Monclús, Famines sans frontiers en Occident avant la "conjuncture de 1300". À propos d´une enquête en cours, in: Monique Bourin/ François Menant/ John Drendel (eds.), Les disettes dans la conjoncture de 1300 en Méditerranée occidentale, Rome 2011, pp. 75–79; Richard C. Hoffmann, An Environmental History of Medieval Europe (Cambridge Medieval Textbooks), Cambridge 2014, pp. 318–320, 323; Campbell (note 19), pp. 3–10 (with the citation on the Salamas eruption); Franck Lavigne et al., Source of the great A. D. 1257 mystery eruption unveiled, Samalas volcano, Rinjani Volcanic Complex, Indonesia, in: Proceedings of the National Academy of Sciences 110/42 (2013), pp. 16742–16747.

52 Telelis (note 26), nr. 606–610 (with relevant extracts from the sources).

53 Campbell (note 19), pp. 55–56.

4 A New Dynasty and towards a New Climatic Regime, ca. 1258–1300

The successes of Michael VIII's early reign, especially the unexpected reconquest of Constantinople in 1261, seemed to legitimize the Palaiologos dynasty, but with the reestablishment of the empire and the patriarchate in Constantinople, "the new Byzantine Empire took over the burdens of the big old state from before 1204."[54] The reduced empire had to provide the means for an army and diplomacy of appropriate scale for the role of a great power, which Byzantium attempted to play for the last time. The provinces in Asia Minor, the former core of the Nicaean state, were especially "neglected, heavily taxed, and suffered from Turkish attacks."[55] In the following decades between 1280 and 1330, western Asia Minor was lost almost totally to various Turkish emirates, among them the Ottomans.[56] Only Thrace and Macedonia remained as the base of a Byzantine Empire which became "a small state with reduced finances and armed forces" in southeast Europe and part of a decentralized "international" system of competing polities of medium or minor scale.[57] This fragmented political environment was held together in part by the trading network established and dominated by the Italian cities of Venice and Genoa. This network integrated Constantinople, Thessaloniki and other cities in a "World System," connecting the Mediterranean region with Asia, especially during the period of the *Pax Mongolica* between 1250 and 1350.[58] Yet the privileges of the Italian merchants, which the Palaiologoi had to acknowledge after 1261, meant that the Byzantine state budget did not fully profit from the increased volume of trade.[59] The power of the lay elite and the church, both of which also enjoyed land grants and tax privileges, further limited the state's power and resources. As a result, the eighty years of the reign of the first three Palaiologoi

54 Laiou (note 6), p. 805; Angelov (note 50), pp. 78–115.

55 Laiou (note 6), p. 805.

56 Dimitri Korobeinikov, Byzantium and the Turks in the Thirteenth Century, Oxford 2014, pp. 217–281, with further literature.

57 Angeliki Laiou, Political-Historical Survey 1204–1453, in: Elizabeth Jeffreys/ John F. Haldon/ Robin Cormack (eds.), The Oxford Handbook of Byzantine Studies, Oxford 2008, pp. 280–294, here pp. 285–286. On the Crusader states in the former Byzantine sphere cf. Peter Lock, The Franks in the Aegean 1204–1500, London, New York 1995.

58 Cf. Abu-Lughod (note 20), esp. pp. 102–134; Preiser-Kapeller (note 1), pp. 75–76 (with further literature).

59 Laiou/ Morrisson (note 6), pp. 201–215 (see also below); Klaus-Peter Matschke, Commerce, Trade, Markets, and Money: Thirteenth-Fifteenth Century, in: Angeliki Laiou (ed.), The Economic History of Byzantium. From the Seventh through the Fifteenth Century, Washington / D. C. 2002, pp. 771–806.

(Michael VIII, his son Andronikos II, and Andronikos III, 1258–1341) are considered a heyday of the landed aristocracy.[60]

Recent scholarship has examined links between the collapse of Byzantine rule in western Asia Minor and climatic factors. Elena Xoplaki et al. state: "[...] model simulations show a significant reduction in winter temperatures around the middle of the thirteenth century related to the great Samalas volcanic eruption [...] and other tropical volcanic eruptions of that period. Severe winters can damage both vineyards and olive cultivation, since [...] both of these plants are sensitive to prolonged frost and very low temperatures during winter. [...] The economic impact of such severe winters would consequently reduce the tax resources available to the local Byzantine authorities, while the imperial government from Nicaea was too busy with the recovery of the control of Constantinople to deal with local problems in western Anatolia".[61] In fact, tree rings indicate "a higher frequency of cold or extremely cold months/seasons for AD 1251–1300" in western Asia Minor.[62] Byzantine sources report severe cold and storms in the years 1265, 1277, and 1297–1298. Also the years around 1300, which brought about the first decisive defeat of the Byzantine by the Ottomans in 1302, were characterized by a severe winter in 1298/1299 in Asia Minor and Syria, a drought in Asia Minor in 1302–1304, and a flooding of the Sangarios River in summer 1302.[63] Between 1303 and 1309, an influx of refugees from Asia Minor caused a famine in Constantinople, exacerbated by the fact that the Catalan Company (see below) devastated the countryside in the European provinces during this same period.[64] While the increase in observed frequency of weather extremes might be seen as having damaged cultivators in Asia Minor, the data on more enduring impacts on agriculture is inconclusive for this region. For the hinterland of Miletus, Adam Izdebski dates the "at least partial disappearance of olive cultivation" to approximately the thirteenth or fourteenth century. He also observes a "longer period of decline" of agriculture in the entire micro-region after the Turkish occupation in the fourteenth and fifteenth centuries. This he partly connects with the cooling trends of the incipient Little Ice Age in the region, but not necessarily with the last decades of the thirteenth century, which saw the collapse of Byzantine rule in the area (equally, we possess written evi-

60 Angeliki Laiou, The Byzantine Aristocracy in the Palaiologan period: a story of arrested Development, in: Viator 4 (1973), pp. 131–151; Klaus-Peter Matschke/ Franz Tinnefeld, Die Gesellschaft im späten Byzanz. Gruppen, Strukturen und Lebensformen, Cologne, Weimar, Vienna 2001, pp. 18–62.

61 Xoplaki et al. (note 27), p. 248. The reference to the "government from Nicaea" is somehow misplaced, since the imperial residence was once again located in Constantinople after 1261.

62 Xoplaki et al. (note 27), p. 236; Heinrich et al. (note 36), pp. 1685–1701.

63 Telelis (note 26), nr. 624–626. The drought of 1302 finds also parallels in central Asia (1300–1301) and in Syria and Egypt (1304); on the unusually cold temperatures in 1298–1299, see Raphael (note 36), p. 22, 103. As Martin Bauch informs us, there are also reports on parallel phenomena in northern and central Italy which he will analyze in a forthcoming publication.

64 Telelis (note 26), nr. 627 (with the relevant extracts from the sources).

dence from the fourteenth century which would qualify this scenario).[65] The pollen data from eastern Bithynia likewise displays a continuous downwards trend for olive cultivation, but as early as 1100, while the trajectory for grain is rather stable from the thirteenth to fifteenth century. Significant is the decline of vineyards from mid-fourteenth century onwards, but this could also be evidence of the cultural impact of Islamic rule (see Figure 8–10).[66] In short, though the temporal overlap between the first observable effects of the Little Ice Age and the rise of the Turkish emirates in western Asia Minor may suggest a causal relation between the one and the other, the evidence is inconclusive and the quantity and quality (especially dating) of the data is not sufficient to prove such a scenario for the time being.

At the same time, the demographic and economic growth period that had started in the European provinces of Byzantium in the tenth and eleventh centuries continued well until the first decades of the fourteenth century, as both written evidence (the lists of households in villages in Macedonia from the tax documents of the Athos monasteries, see Table 2) and proxy data (pollen trajectories for the Macedonian highlands, for instance, see Figure 8) illustrate. They also hint at a later trend reversal towards cooler conditions in comparison to Asia Minor (see below). This is not to say that they did not experience periods of dearth: a document from the Makrinitissa Monastery in Thessaly details sales of property between September 1271 and 1272 due to a "year-long general shortage of grain."[67] In this case (and maybe in others) the distress of smaller landowners worked to the advantage of larger estates and may thus have even contributed to the above-mentioned "heyday" of monastic and noble consolidation of land holdings.

Still, there are also reports of spectacular acts of imperial generosity based on what was left of the agrarian wealth of the empire in its European provinces: when Mamluk Egypt and Syria were affected by a severe drought and famine from 1295 to 1297, the "perfidious" Byzantine Emperor Andronikos II – as the Dominican Guillelmus Ade wrote – "the persecutor and ancient enemy of the Roman church, made one of the largest ships in the world and sent it loaded with grain to Alexandria. This

65 Izdebski (note 45). Venetian documents, however, illustrate a frequent export of grain from the Emirate of Menteşe established in that region throughout the fourteenth century, see Elizabeth A. Zachariadou, Trade and Crusade. Venetian Crete and the Emirates of Menteshe and Aydin (1300–1415), Venice 1983, pp. 163–165.

66 Izdebski/ Koloch/ Słoczyński (note 31). There is however ample evidence for wine consumption and the import of wine by the Turkish rulers of western Asia Minor: Zachariadou (note 65), pp. 171–172; Nicolas Trépanier, Foodways and daily life in Medieval Anatolia. A new social history, Austin 2014, pp. 101–103 and pp. 117–119.

67 Alexandra Gogou et al., Climate variability and socio-environmental changes in the northern Aegean (NE Mediterranean) during the last 1500 years, in: Quaternary Science Reviews 136 (2016), pp. 209–228. For the Makrinitissa document, see Acta Monasterii Macrinitissae, ed. Franz Miklosich/ Joseph Müller, in: Acta et diplomata Graeca medii aevi. Sacra et profana, vol. 4, Vienna 1871, pp. 399–402, here p. 400. This event is not registered in the catalogue of Telelis (note 26).

ship carried fourteen thousand mule loads of grain in addition to arms and many other things. Thus the emperor, the perfidious friend and ally of the Saracens and enemy and torment of the Romans, relieved the neediness of the Babylonians."[68] Arabic sources described this crisis in detail,[69] as well, and Marino Sanudo Torsello interprets it as God's punishment for the Mamluk's conquest of the last Crusader base of Acre in 1291.[70] But according to the Chronicle of Amadi, Emperor Andronikos II was not the only Christian power to provide relief to Egypt; Sicily and Rhodes, then still also under Byzantine rule (but soon to be conquered by the Knights Hospitallers), also sent grain.[71] Soon, however, the demise of the Byzantine Empire would have limited the possibilities for such imperial largesse.

5 The Incipient Little Ice Age, the Black Death and the Fatal Crisis of Byzantium, ca. 1300–1360

Signs of the end of economic growth in the European provinces multiply in the first decades of the fourteenth century (see again, for instance, Table 2 and Figure 8), even before the Black Death devastated the region. Periods of violent conflict – e.g. during the raids of the Catalan Company (1302–1310), with which Emperor Andronikos II had hoped to stop the Turkish advance in Asia Minor – damaged the countryside in Thrace, Macedonia, Thessaly and central Greece (see also Table 2).[72] At the same time, noble clans and soldiers fleeing to Europe from the territories lost to the Turks inflated the rows of those competing for the distribution of this reduced surplus, increasing tensions which first erupted in the civil wars between Andronikos II and his grandson

68 Guillelmus Ade, Tractatus quomodo Sarraceni sunt expugnandi, ed. and transl. G. Constable, Washington / D. C. 2012, pp. 40–43. Western sources tended to view Andronikos II negatively due to his annulment of the Union of Churches, to which his father Michael VIII and Pope Gregory X had agreed in 1274. At the same time, since the reign of Michael VIII, Constantinople had established good diplomatic relations with the Mamluks, see Dimitri Korobeinikov, Diplomatic correspondence between Byzantium and the Mamlūk Sultanate in the fourteenth century, in: Al-Masāq. Journal of the Medieval Mediterranean 16 (2004), pp. 53–74.

69 Raphael (note 36), pp. 22–23, 90–94; Kristine Chalyan-Daffner, Natural Disasters in Mamlūk Egypt (1250–1517): Perceptions, Interpretations and Human Responses, Dissertation, University of Heidelberg 2013, pp. 566–578, both with a discussion of the Arabic sources.

70 Marino Sanudo Torsello, Liber Secretorum Fidelium Crucis, transl. Peter Lock, Farnham 2011, II, 13, pp. 370–371.

71 Chroniques d'Amadi et de Strambaldi, 1re partie: Chronique d'Amadi, ed. René de Mas-Latrie, Paris 1891, p. 233.

72 Laiou (note 6), pp. 808–810; Laiou (note 57), pp. 287–288; Lefort (note 6). See, however, the diverging trends in the numbers of households of selected villages in Table 2 for the first half of the fourteenth century, cf. also Smyrlis (note 7).

Andronikos III between 1321 and 1328.[73] The reign of the victorious Andronikos III (1328–1341) saw the loss of the remaining cities in Bithynia to the Ottomans, but also territorial expansion in Epirus and Thessaly, which incited hope for a restoration of Byzantine power, at least in Europe. The following period of civil wars between the pro-Palaiologos faction and the followers of John VI Kantakuzenos, formerly the most important confidant of Andronikos III, from 1341 to 1354, however, destroyed all these expectations. It coincided with the Black Death, which followed the trade routes from Crimea to the Mediterranean and hit Constantinople for the first time in 1347, returning in waves in the following decades.[74] Furthermore, inner-Byzantine struggles eased the establishment of a short-lived Serbian Empire under Stefan Dušan (who conquered Macedonia, Thessaly, and Epirus) – which began to disintegrate right away after his death in 1355[75] – and the beginning of Ottoman expansion in Europe after their conquest of the fortress of Tzympe in 1352 and the nearby strategically important city of Gallipoli in 1354 (see Figure 1).

As Raúl Estangüi Gómez's concluded in his recent magisterial study on the period, agriculture in the remaining Byzantine provinces in Europe in the first half of the fourteenth century faced an unfavorable context ("un context défavorable") which combined inclement climatic conditions ("inclémence climatique") and insecurity in the countryside.[76] Proxy data such as tree rings from Albania indicate a significant turn towards adverse, cooler conditions from around 1310 for the rest of the century (see Figure 4–5). The climatic extremes reported in Byzantine sources overlap significantly with those from other parts of Europe and the Mediterranean. The cold, wet years between 1315 and 1322, which brought about crop failures and the "Great Famine" in northern Europe, find their counterpart in severe cold temperatures and storms (in 1317 and in 1321 and 1322), but also droughts (in 1315 and 1317, according to the OWDA-reconstructions) in the Byzantine territories, as well as heavy snow and cloudbursts in Egypt and Syria (in 1315, 1316 – followed by a plague of locusts, and 1317–1318) and droughts (in 1318, 1319, and 1323) (see Table 1). In western and central Europe, as well as in the Byzantine Balkans, "weather inimical to humans and their possessions in fact continued past 1317 and far into the 1320s and 1330s," coinciding

73 Laiou (note 6), pp. 808–810; Laiou (note 57), pp. 287–288; Raúl Estangüi Gómez, Byzance face aux Ottomans. Exercise du pouvoir et contrôle du territoire sous les derniers Paléologues (milieu XIVe-milieu XVe siècle) (Byzantina Sorbonensia 28), Paris 2014, pp. 34–53.

74 Cf. Ole J. Benedictow, The Black Death 1346–1353. The Complete History, Woodbridge 2004, pp. 60–74; Michael W. Dols, The Second Plague Pandemic and Its Recurrences in the Middle East: 1347–1894, in: Journal of the Economic and Social History of the Orient 22/2 (1979), pp. 162–189.

75 Cf. John V. A. Fine, Jr., The Late Medieval Balkans. A Critical Survey from the Late Twelfth Century to the Ottoman Conquest, Ann Arbor 1994, pp. 345–366. In general on this period cf. Preiser-Kapeller (note 1), pp. 74–77, and Estangüi Gómez (note 73), both with further literature.

76 Estangüi Gómez (note 73), pp. 32–34, 102–114.

with the first civil war of the two Andronikoi in the 1320s.[77] Between 1315 and 1322, parts of central and northwestern Europe experienced another major calamity when a panzootic afflicted sheep and cattle. The extent of this infection is not clear; as Bruce Campbell states, "whether it penetrated south of the Alps and beyond the Pyrenees [or into the Balkans] is not known. Certainly, there are no obvious climatic or environmental reasons why Mediterranean Europe should have escaped the contagion."[78] In this case, further research is necessary for the Byzantine regions.

Richard Hoffmann warns, however, that any picture of these decades should not be painted in only the darkest colors: historians should "avoid an 'ecological fallacy,' namely the error of reasoning from a descriptive generalization to specific phenomena within the generalized class. Just because a period is labelled an 'ice age' does not mean that its every moment was chilly."[79] As a matter of fact, written evidence from this period indicates that agriculture within the former Byzantine imperial sphere could still act a surplus producer for foreign demands as it had in the century before: the Florentine merchant Francesco Balducci Pegolotti in his famous "Pratica della mercatura," written in the late 1330s, devotes a long chapter to the commerce of Constantinople and the adjacent Genoese colony of Pera (Galata) and reports that the city not only acted as a market for grain coming from harbors along the coast of the Black Sea (Kaffa, Anchialos, Maurokastron, Bitzina, Sozopolis), but also from the Thracian hinterland of Constantinople via the port of Rhaidestos (famous as a reloading point of grain since the eleventh century, see Figure 1).[80] Other sources from Florence also mention the region as a source of cereals in times of need; between 1336 and 1355, grain was imported four times from the Aegean, once from Kephallonia, once from Constantinople, once from Pera, and twice from "Turcia" (meaning the western Anatolian emirates).[81]

The fatal civil wars of the 1340s and 1350s already chronologically overlapped with another series of extreme events in the Byzantine territories and across Europe

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77 Hoffmann (note 51), pp. 324–327; Campbell (note 19), pp. 191–198; Telelis (note 26), nr. 631–634; Raphael (note 36), pp. 96–97, 175–176; Chalyan-Daffner (note 69), pp. 546–540; Cook et al. (note 31).

78 Campbell (note 19), pp. 209–227. There are, however, indications that the panzootic spread south of the Alps, cf. Martin Bauch, Jammer und Not. Karl IV. und die natürlichen Rahmenbedingungen des 14. Jahrhunderts, in: Český Časopis Historický 115/4 (2017), pp. 983–1016, here p. 988. We thank Martin Bauch for this reference.

79 Hoffmann (note 51), p. 320.

80 Francesco Pegolotti, La pratica della mercatura. Book of Descriptions of Countries and Measures of Merchandise (The Medieval Academy of America 24), ed. by Allan Evans, Cambridge / Mass. 1936, pp. 32–54, esp. p. 42.

81 Charles M. de la Roncière, Les famines à Florence de 1280 à 1350, in: Monique Bourin/ François Menant/ John Drendel (eds.), Les disettes dans la conjoncture de 1300 en Méditerranée occidentale, Rome 2011, pp. 225–246, here p. 238.

and the Mediterranean in general (see Table 1),[82] but the situation became even more devastating with the arrival of the plague. Bruce M.S. Campbell has summed up the interplay between climate extremes and the outbreak of the epidemic across Afro-Eurasia in a recent study.[83] Coming from the Crimea, the plague first arrived in Constantinople via sea in July 1347. As Nükhet Varlik has reconstructed recently, in the fall of that year, it spread across the Aegean to Thessaloniki, the islands of Lemnos, Euboia (Negroponte), and Crete, and to the harbors of Korone (Coron) and Methone (Modon) on the Peloponnese; by 1348, it had reached Rhodes and Cyprus as well as cities inland in Anatolia such as the Ottoman capital of Bursa and Sivas.[84] As in other regions of Europe and the Mediterranean, the short- and long-term impacts on demography and economy here were dramatic. For Macedonia, one of the remaining core regions of Byzantium and even then being gradually lost to Serbian expansion, a recent study drawing on the archives of society and of nature concluded, "the Black Death was a recurring problem [...] in the decades that followed after 1348 AD [...]. Within a relatively short time, the plague resulted in considerable population loss, which had damaging effects on the economic trends. The scale of cereal cultivation in the hills surrounding the Macedonian plain declines considerably within the next one to two centuries, which presumably had to do with the dropdown of the population levels [see also Figure 8] At the same time, the pine pollen increased its share in the pollen signal, which suggests the occurrence of secondary ecological succession onto lands previously used for agricultural activities [...]. The Byzantine archival data from the Athos monasteries also show considerable population losses [see also Table 2]."[85]

The co-occurrence of these phenomena with civil war from 1341 to 1354 was most unfortunate. One might ask whether there is a causational link between negative climatic trends and internal instability, whether declining revenues from landed property aggravated intra-elite tensions, for instance, or whether the displacement of the rural population into cities and other regions increased social unrest (as it did after the loss of Asia Minor). Raúl Estangüi Gómez ascertains a widespread abandonment of dwellings ("abandon des lieux d'habitation") in this period, but the share of climate-induced hardship vis-à-vis flight due to internal warfare and invasion is hard

82 Hoffmann (note 51), pp. 324–327; Campbell (note 19), pp. 191–198; Telelis (note 26), nr. 639–665; Raphael (note 36), pp. 103–104 (in 1344–1345, heavy snow even blocked roads in the Damascus region).

83 Campbell (note 19), pp. 227–252. Already in 1337, a plague of rodents is reported in Egypt, cf. Raphael (note 36), p. 182.

84 Nükhet Varlik, Plague and Empire in the Early Modern Mediterranean World. The Ottoman Experience, 1347–1600, Cambridge 2015, pp. 99–107, with a map on p. 101; Campbell (note 19), pp. 302, 307.

85 Gogou et al. (note 69), p. 223; Izdebski/ Koloch/ Słoczyński (note 31). For a future, more nuanced and detailed study on the changes of this period in the areas of (Northern) Macedonia, cf. the results of the case study of Mihailo Popović within the project "Digitising Patterns of Power (DPP). Peripherical Mountains in the Medieval World": http://dpp.oeaw.ac.at/index.php?seite=CaseStudies&submenu=makedonien, as well as the new project of Adam Izdebski in Jena (note 30).

to estimate (see also Table 2).[86] At the same time, between 1341 and 1369 (the final Ottoman conquest of Adrianople/Edirne), Byzantium lost its remaining larger coherent territories (with exception of the "Despotate of Morea" on the Peloponnese) to states that expanded at the cost of Constantinople despite similar climatic and epidemiological challenges. At first this was Serbia and then especially the Ottomans. Climatic parameters are thus relevant but insufficient on their own to explain a polity's vicissitudes during the "Great Transformation" of the fourteenth century.[87]

6 Conclusion

Older concepts of climate determinism postulating strong linear lines of causation between climate and society and proposing "climate change as the ultimate cause of human crisis in preindustrial societies" persist in some scholarship.[88] Ecologists, however, have highlighted that the actual reaction of any ecosystem, including human societies, to environmental change depends not only on the strength and frequency of these disturbances, but also on the capability of a system to resist or to adapt to such changes.[89] For any society, one has to take into account not only the complex interplay between environmental conditions and human communities, but also the social complexity of political, economic, and cultural systems, which can process such "external" stimuli in different ways, maybe with fatal consequences, but also with adaptive measures.[90] Against this background, generalizations about

86 Estangüi Gómez (note 73), pp. 114–118. Cf. also Lefort (note 6), and Smyrlis (note 7), p. 145, who wrote: "The main tendencies are (...) clear: severe underpopulation, abandonment of previously exploited lands, and disruption of communications and commerce. Demographic decline is primarily the result of the plague that hit the Byzantine world in 1347 and kept returning every 10 years or so through the fifteenth century. The frequent warfare and raiding that depleted the population through death and enslavement contributed to the decline."

87 Cf. also Şevket Pamuk. The Black Death and the Origins of the "Great Divergence" across Europe, 1300–1600, in: European Review of Economic History 11 (2007), pp. 289–317.

88 Cf. David D. Zhang et al, Global climate change, war, and population decline in recent human history, in: Proceedings of the National Academy of Sciences 104/79 (2007), pp. 19214–19219 (also for the citation); Solomon M. Hsiang et al., Quantifying the Influence of Climate on Human Conflict, in: Science 341 (2013) doi: 10.1126/science.1235367. For a discussion of such approaches cf. Jan De Vries, Measuring the Impact of Climate on History: The Search for appropriate Methodologies, in: Journal of Interdisciplinary History 10 (1980), pp. 599–630; Curtis (note 5), pp. 7–10.

89 Michael Scheffer, Critical Transitions in Nature and Society, Princeton 2009. Cf. Preiser-Kapeller (note 22) for further bibliography.

90 Bruce M. S. Campbell, Nature as historical protagonist: environment and society in pre-industrial England, in: Economic History Review 63/2 (2010), pp. 281–314, especially on climatic factors of the fourteenth century crisis in Western Europe. Cf. Preiser-Kapeller (note 22) for further bibliography, as well as the special issue of Human Ecology ed. by Haldon et al. (note 27), for the concepts of "resilience" and "vulnerability" of past societies vis-à-vis environmental changes.

the impact of climatic conditions on historical trajectories become problematic. In her recent monograph on climate in the medieval Levant, Sarah Kate Raphael claimed that "each environmental disaster presents an almost independent case study. There is no clear pattern of behavior or policy that rulers followed."[91]

The Byzantine Empire ultimately also "adapted" to the "perfect storm"[92] of the mid-fourteenth century, although at a much reduced scale. It became a conglomerate of small territories around cities (Thessaloniki, Selymbria, the Byzantine enclave on the Peloponnese around Mistras, see Figure 1), from which various members of the Palaiologos dynasty, who continued to compete for power, ruled often more or less independently of the emperor in Constantinople. The civil wars between 1341 and 1354 reflected social tensions: the cause of John VI Kantakuzenos was generally "backed by the landed aristocracy," while the Palaiologos party was "backed by the merchants, the sailors, and the common people, especially in the cities."[93] While the aristocratic faction won the first phase of the war in 1347 (with Ottoman support), its outcome ended the heyday of landed aristocracy, since large territories including aristocratic property were lost to neighboring powers. Nevertheless, the dominance of noble families did not decrease in the small-scale, city-based Byzantium of the last century of its existence; aristocratic families (and the church) had been able to expand their property rights not only in the countryside, but also in the cities. In addition, various noble families established commercial ties with Italian merchants, became engaged in the trading business, and were thus able to maintain their aristocratic existence on this new material basis.[94]

On an individual or collective level, therefore, certain actors were able to adapt to changing circumstances to their own benefit, such as the village or the city, which surrendered to the Ottoman invaders under relatively favorable conditions, the aristocrat or abbot, who sought a compact with the Serbian or later Ottoman ruler, or the nobleman, who forged an alliance with Italian merchant forces. This, however, started a negative feedback mechanism at the level of the Byzantine polity since such strategies further eroded its ability to respond to the crisis in ways that would benefit of the empire at large. The fourteenth-century "Schumpeterian creative destruction,"[95] with

91 Raphael (note 36), pp. 55–94 and p. 189 (for the citation). Cf. also C. Ó Gráda, Famine. A short History. Princeton, Oxford 2009.

92 Cited from Campbell (note 19).

93 Laiou (note 57), pp. 289–290. Cf. Preiser-Kapeller (note 1), pp. 76–77, for further bibliography.

94 Laiou/ Morrisson (note 6), pp. 212–213; Matschke/ Tinnefeld (note 60), pp. 158–220. Cf. Preiser-Kapeller (note 1), pp. 76–77 and 99–101, for further bibliography.

95 Stephan R. A. Epstein, Freedom and Growth. The rise of states and markets in Europe, 1300–1750 (Routledge Explorations in Economic History 17), London, New York 2000, pp. 38–72, esp. p. 55. The concept of "creative destruction" was popularized by the famous Austrian economist Joseph Schumpeter (1883–1950). Smyrlis (note 7), p. 147, even assumes that: "at least in some respects, the peasants who did not fall victim to epidemic, war, and enslavement, must have found themselves in an improved position after the middle of the fourteenth century. Depopulation made manpower sought-after and land abundant. Peasants may have been able to negotiate better terms with their landlords."

Table 1: Extreme weather events registered in the catalogue of Telelis (note 26) for the period 1250–1360

Date	Months	Region(s)	Phenomena	Telelis (note 26), nrs.
1256	Jan.–Mar.	Thrace, Macedonia	Severe cold, snow	606, 607
1256	Nov.–Dec.	Thrace, Macedonia	Severe cold, snow	608, 609
1258		Asia Minor	Famine	610
1265	May	Constantinople	Severe storms, hail	611
1277/1288	Nov.–Jan.	Thrace	Severe cold	615
1297	Aug.	Constantinople	Severe storms	622
1298–1299	Dec.–Feb.	Constantinople	Severe winter	624
1301	March–May	Asia Minor	Drought	625
1302	July	Sangarios	Flooding	626
1303–1309		Constantinople	Famine	627
1317		Constantinople	Severe storms	630
1321	Dec.	Thrace	Severe cold	631
1322	Dec.	Constantinople	Severe cold	632
1325–1328	for 6 months	Constantinople	Severe winter, ice	633
1325–1328		Constantinople, Athos	Severe winter	634
1332	Feb.	Constantinople	Severe storms	636
1333	Nov.-Dec.	Thessaly	Severe winter, snow	637
1341	Nov.	Constantinople	Severe winter, snow	639
1341	Dec.	Thrace	Severe winter, snow	640
1341	Dec.	Thrace	Cloudburst, flooding	641
1341	Nov.–Dec.	Thrace	Cloudburst, snow	642
1341	Nov.–Dec.	Thrace	Ice, flooding	643
1342	March–May	Macedonia	Cloudburst, flooding	645
1342–1343	Nov.–Feb.	Thrace	Severe winter, snow	646
1343	May	Macedonia	Cloudburst, flooding	647
1343		Constantinople	Hail, crop damage	648
1344		Constantinople	Hail, crop damage	649
1346–1347	Nov.–April	Constantinople	Severe winter, snow	650

Table 1 (continued)

Date	Months	Region(s)	Phenomena	Telelis (note 26), nrs.
1346–1353		Athos	Severe winter, snow	651
1346–1371		Athos	Famine	652
1349	March	Constantinople	Thick fog	653
1349	March	Constantinople	Severe storms	654
1349	Nov.–Dec.	Macedonia	Cloudbursts	655
1350	Jan.	Macedonia	Severe cold, death of animals	656
1350	Sept.	Athos	Hail, storms, crop damage	657
1351	Sept.	Thrace	Severe storms	658
1352	Feb.	NW-Asia Minor	Severe cold	659
1352	Feb.	Sea of Marmara	Severe storms	660
1352	March–April	Constantinople	Severe cold	661
1352	May	Constantinople	Severe storms	662
1354	March	Thrace, Gallipolis	Cloudbursts, snow, cold	663
1358–1359	Dec.–Feb.	Western Asia Minor	Severe winter, snow	664

Table 2: Numbers of households for selected villages in Macedonia registered in tax lists of Athos monasteries, 1300–1409 (data: Laiou [note 7]; Lefort [note 6]).

Village	1300/1301	1320/1321	1340/1341	1409
Drymosyrta		56		35
Eleutheroi	38	26		
Gomatou (Iberon)	50	46	32	
Gomatou (Laura)	78	104		21
Hierissos (Iberon)	36	32	31	
Kato Bolbos	34	21	24	
Loroton		60		1
Melitziane	29	39	35	
Pinson		43		20
Stomion	6	17	19	

its unique combination of socio-political and environmental upheavals, left room for adaptation at the level of individual "social structures" at a rate that outran attempts to adapt at the level of the central power. Along similar lines, Nevra Necipoğlu has identified a "lack of unity and social cohesion" in the Byzantine society of this period, evident for instance during the Ottoman blockades of Thessaloniki before 1387 and of Constantinople between 1394 and 1402, when aristocratic entrepreneurs profited from the general paucity; this certainly weakened Byzantium's ability to find an answer to the internal crisis and the external threat of the Ottoman expansion.[96] It was in this context that the Byzantine Empire, however, was able to exist for another century until the Ottoman conquest of Constantinople in May 1453.

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Smyrlis thus follows a scenario developed for Western Europe by the proponents of the "Malthusian orthodoxy" (see above). In any case, due to the loss of territories, such a possible "heyday" of the agricultural workforce in Thrace or Macedonia would have taken place largely outside what was left of the Byzantine Empire.

96 Nevra Necipoğlu, Byzantium between the Ottomans and the Latins. Politics and Society in the Late Empire, Cambridge 2009, pp. 41–43, 117.