

NATIONAL HELLENIC RESEARCH FOUNDATION
INSTITUTE OF HISTORICAL RESEARCH
SECTION OF BYZANTINE RESEARCH

AUREUS

VOLUME DEDICATED
TO PROFESSOR
EVANGELOS K. CHRYSOS

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ATHENS 2014

ΕΘΝΙΚΟ ΙΔΡΥΜΑ ΕΡΕΥΝΩΝ
ΙΝΣΤΙΤΟΥΤΟ ΙΣΤΟΡΙΚΩΝ ΕΡΕΥΝΩΝ
ΤΟΜΕΑΣ ΒΥΖΑΝΤΙΝΩΝ ΕΡΕΥΝΩΝ

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ΕΠΙΣΤΗΜΟΝΙΚΟΙ ΕΠΙΜΕΛΗΤΕΣ
Ταξιάρχης Γ. Κόλιας – †Κωνσταντίνος Γ. Πιτσάκης

ΕΠΙΜΕΛΕΙΑ ΥΛΗΣ
Κατερίνα Συνέλλη

ΑΘΗΝΑ 2014

*Η έκδοση πραγματοποιήθηκε
με την οικονομική ενίσχυση
του Κοινοφελούς Ιδρύματος
Αλέξανδρος Σ. Ωνάσης*

*The publication was funded
by the Alexander S. Onassis
Public Benefit Foundation*

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Εθνικό Ίδρυμα Ερευνών
Βασιλέως Κωνσταντίνου 48, 116 35 Αθήνα
Τηλεομ.: 210 7273629
Ηλεκτρονική Διεύθυνση: bookstore@eie.gr

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Διαμόρφωση - εκτύπωση - βιβλιοδεσία:
Γ. ΑΡΓΥΡΟΠΟΥΛΟΣ ΕΠΕ

ISBN 978-960-9538-26-8

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IOANNIS TELELIS

*Environmental History and Byzantine Studies:
A Survey of Topics and Results**

“Humans have histories because they change Nature”

Maurice Godelier, 1990

The way the natural environment has been managed and perceived in the past has recently become a major field of historical study. The theoretical and philosophical repercussions of the environmental movements in the 1960s-70s upon the evolution of modern historiography in one hand, and the present-day global environmental problems on the other, have introduced new topics and opened new perspectives in historical research. Nowadays, the rapidly increasing interest in the global environment is developing along with the belief that we have entered an era of environmental crisis. This fact stimulates a wide array of academics, scholars and policy makers to focus on present-day ecological concerns, to deepen their understanding of how the natural environment has affected humans and how humans have influenced the natural environment, and to reassess current problems and solutions. It has become commonplace for scientists to admit that the comprehension of an ecological system relies strongly on learning about its past environmental framework, and that this knowledge can offer a landscape record for those who attempt to explain modern ecological crisis¹. Consequently, the upgrade of the role of nature from a “familiar” and “self-evident” –though unknown– backdrop of human activity to a multi-parametric agent in human history and the interconnection between human activity and non-human nature was an inevitable progress in historical research. There is no doubt that the emergence of Environmental History, i.e. the scientific discipline that analyzes the interaction between human societies and physical environment over time, certifies the diffusion of the ecological thinking in historical research².

* I dedicate this article to Professor Evangelos Chrysos, the teacher who inspired my first steps in scientific research and encouraged me to pursue my early studies on the exciting field of historical climatology of the Byzantine world.

1. D. WORSTER, *The Vulnerable Earth: Toward a Planetary History*, in: *The Ends of the Earth: Perspectives on Modern Environmental History*, ed. D. WORSTER, Cambridge 1988, 320.

2. Environmental History (in Europe also commonly called “ecological history”) began with the American forest conservation movement of the 1950s and developed rapidly as a sub-discipline

Environmental History has opened new perspectives in historical research³. Nowadays, historians are more enthusiastic than ever to incorporate environmental issues into their work⁴. One of the historical fieldworks in which Environmental History is expanding most rapidly is that of Middle Ages. Medieval Europe, as a preindustrial society, had based its political and economic organization on the exploitation of the natural environment through agriculture, technological innovations, settlement patterns, and exchange networks in a depth of time and in a variety of landscapes. The earliest initiatives for the introduction of the environmental parameter in the historical setting of pre-modern Europe belong definitely to historians of the Annales School (e.g. Henri Pirre, Fernand Braudel, Emmanuel Le Roy Ladurie), who demonstrated how important the workings of the natural world are in human history. Ever since, several studies of Medieval History have succeeded to incorporate the environmental context within the analysis of the social, economic and political structures of Medieval Europe, and to integrate the topics of Environmental History into the questions of the history of the Middle Ages. Medievalists increasingly take advantage of new methods, questions, and intellectual frameworks posed by environmental historians for their own research field, and produce interesting results. Several studies on Medieval History have succeeded to incorporate the environmental context within the analysis of the social, economic, and political structures of Medieval Europe, and to integrate the topics of Environmental History into the questions of Medieval History⁵.

of environmental science in the 1980s. A detailed overview of this scientific field can be found in: J.D. HUGHES, *What is Environmental History?*, Cambridge 2006, especially 1-17. For a review of the European scholarship on the recently shaped discipline of Environmental History, see V. WINIWARTER ET AL., Environmental History in Europe from 1994 to 2004: Enthusiasm and Consolidation, *Environment and History* 10 (2004) 501-530. For an updated review of the field with a discussion of its perspectives, see P. VAN DAM – S.W. VERSTEGEN, Environmental History: Object of Study and Methodology, in: *Principles of Environmental Sciences*, ed. J. BOERSEMA – L. REIJNDERS, Dordrecht-Boston 2009, 25-31; V. SEIRENIDOU, Οι ιστορικοί στη φύση: μία εισαγωγή στην περιβαλλοντική ιστορία, *Τα Ιστορικά* 51 (2009) 275-297.

3. There are several Environmental History bibliographic databases, which are freely available over the Internet; for a collection of thematic bibliographies the reader can access the *H-Environment* web site, the online initiative of the American Society for Environmental History and the European Society for Environmental History: <http://www.h-net.org/~environ/resources.html> (last accessed June 2013).

4. In July 2010 hundreds of historians gathered for the annual conference of the Institute of Historical Research, London, to find out more about the past, the present, and the future of environmental history, and how this new discipline might inform global green awareness today. For a brief report of this meeting, see M. TAYLOR, The nature of historical research, *History Today* 60, 7 (2010) 6-7.

5. For a discussion of the most representative topics that environmental historians explore and a survey of the integration of these topics into the research interests of historians of the Middle Ages, see E. ARNOLD, An Introduction to Medieval Environmental History, *History Compass* 6, 3

Environmental historians focus their efforts on three different levels of work: First, they study the “nature itself”, including the physical changes of local ecosystems and global environment, the behavior of biological species including those cultivated and domesticated, as well as humans from a biological point of view. Second, they explore the “socio-economic interaction” between humans and nature, including human impact upon nature and human response to environmental changes. Third, they analyze the “mental interaction”, the cultural representations of natural reality, i.e. myths, ideology, and ways of thinking about nature⁶. Climate and ecological history, history of water, forests and agriculture, landscape studies, religious and cultural history are a few representative areas that environmental historians –and recently researchers of the Middle Ages– systematically explore. This multi-directional grid of themes requires data, methodologies and insights from a wide range of environmental and social sciences. That is why Medieval Environmental History is primarily characterized by an interdisciplinary orientation and focuses on the attempt to combine medieval historical evidence with data derived from other disciplines. On the other hand, the evolution of the technological means has provided the environmental scientists with an ever-growing wealth of local regional and inter-regional proxy data sets. This wealth seeks for validity and reliability in the medieval historical evidence, namely the information that Medievalists obtain from the study of all types of primary historical evidence⁷.

The study of the interaction between natural environment and human societies is the subject of Environmental History. However, what is the relation of Environmental History to Byzantine studies? Is there any integration of Environmental History into the study of Byzantium? Have Byzantinists managed to open up to the field of Environmental History so far, as Medievalists have successfully managed to do? As will be hopefully shown below, the general answer to this question is “yes”. Without a doubt, Byzantinists nowadays have become more and more familiar with terminology and topics related to this relatively new discipline more than ever. The earliest inquiries towards environmental topics of the Byzantine world can be found around three decades ago, when scholars and researchers active in the field of historical geography of Byzantium expanded their interest to framing questions and themes that both environmental historians and Medievalists wrestle with since the 1970s. A major example of this innovation is the book of Johannes Koder *Der Lebensraum der Byzantiner*, 1984, a fundamental handbook for the research of

(2008) 898-916. Cf. also J. ABERTH, *An Environmental History of the Middle Ages: The Crucible of Nature*, Routledge: London-New York 2013.

6. D. WORSTER, Doing Environmental History, in: *The Ends of the Earth*, 289-307.

7. For examples of studies combining medieval written evidence with proxy physical data, see ARNOLD, *An Introduction to Medieval Environmental History*.

historical geography of the Byzantine world⁸. With Koder's study, as well as with the edition of the volumes in the series *Tabula Imperii Byzantini*, the environmental variable and its role in the shaping of human activity during the Byzantine era were placed in a new perspective⁹.

The geographical context –as it is defined by land relief, climate conditions, water resources, vegetation and animals– and the implication of the geographical factors in land-use, settlement, transport, and exploitation of natural resources, have been emphasized by several studies that explore the historical geography and economy of the Byzantine world¹⁰. Furthermore, recent technological innovations and interdisciplinarity has made new data and questions to emerge in such a degree that we are able today to speak about an “Environmental History of Byzantium”. The evolution of the archaeological science to a multidisciplinary field over the past half century has produced major advances in the study of the relationship between changes in the natural environment and changes in human society. For instance, the reconstruction of vegetation and man-induced landscape change is primarily based upon palaeoecological data and methods, such as stratigraphy and pollen analysis, whereas the history of human occupation relies heavily upon landscape archaeology, as well as upon historical accounts for later periods¹¹. Environmental History,

8. J. KODER, *Der Lebensraum der Byzantiner: historisch-geographischer Abriss ihres mittelalterlichen Staates im östlichen Mittelmeerraum. Nachdruck mit bibliographischen Nachträgen* [Byzantinische Geschichtsschreiber; Ergänzungsband 1], Graz 1984. Koder's work includes chapters devoted to climate and climate change (40-44), changes in the natural environment since Late Antiquity (45-54), and the exploitation of the natural environment in the Middle Ages (55-61). This important book was revised and bibliographically updated in its Greek edition: J. KODER, *To Βυζάντιο ως χώρος. Εισαγωγή στην Ιστορική Γεωγραφία της Ανατολικής Μεσογείου στη Βυζαντινή Εποχή*, translated by D. STATHAKOPOULOS, Thessaloniki 2005.

9. Each one of the 10 published volumes of *Tabula Imperii Byzantini* begins with a detailed introductory discussion of the physical geography, demography, and land use of the area under research.

10. The symposium “Byzanz als Raum”, Vienna 1997, organized in the framework of the project *Tabula Imperii Byzantini*, is a paradigm for this new enriched spectrum of interests related to Environmental History, that researchers engaged with the historical geography of the Byzantine Empire have adopted. Cf. *Byzanz als Raum: zu Methoden und Inhalten der historischen Geographie des östlichen Mittelmeerraumes* [Veröffentlichungen der Kommission für die Tabula Imperii Byzantini 7], ed. K. BELKE ET AL., Wien 2000. Several works integrate the geographical context within the development of the Byzantine economy; see for example: M. KAPLAN, *Les hommes et la terre à Byzance du VIe au XIe siècles*, Paris 1992, 5-24 & 455-464; B. GEYER, Physical Factors in the Evolution of the Landscape and Land Use, in: *The Economic History of Byzantium from the Seventh through the Fifteenth Century*, v. 1, ed. A. LAIOU, Washington, D.C. 2002, 31-45; A. LAIOU – C. MORRISON, *The Byzantine economy*, Cambridge-New York 2007, 8-16; A. KÜLZER, Möglichkeiten zur Rekonstruktion historischer Landschaften: Die Historische Geographie, in: *Fragmente. Der Umgang mit lückenhafter Quellenüberlieferung in der Mittelalterforschung* [Denkschriften der phil.-hist. Klasse 415], ed. CH. GASTGEBER ET AL., Wien 2010, 173-184.

11. For a discussion of problems and limitations associated with each one of these different

which explores changes on past landscapes, climate, flora and fauna, diet, nutrition, health and the pathology of people, as well as human response to those changes, is primarily based upon an increasing volume of palaeoenvironmental data and methods obtained from various disciplines (such as: palaeo-climatology, -seismology -zoology, -botany, -pathology etc.). Recently, researchers of Byzantium who are interested to draw patterns of interaction between natural environment and society during the Byzantine period are disposed to combine data obtained from these disciplines in the historical context of the Byzantine world more and more¹². Nevertheless, synthetic scholarly works dedicated to the analysis of environmental topics and the reconstruction of interactions between the Byzantine society and environmental variables and change are still relatively few, and research in this particular field is not yet as systematic as for the Environmental History of the European Middle Ages¹³. It is not a coincidence that the term “environmental history” is absolutely absent from *The Oxford Handbook of Byzantine Studies*, published in 2008, even though there are articles in the handbook devoted to particular topics relevant to what we call for the needs of this article “Environmental History of Byzantium”¹⁴.

Therefore, the primary goal of this article is heuristic: It does not presume to sketch an Environmental History of the Byzantine Empire; however, it calls for some tentative observations in a thematic survey concerning the coupling of Environmental History with Byzantine studies. Moreover, it offers an introductory bibliographic tool

data sources with a focus on the eastern Mediterranean, see W. EASTWOOD, Palaeoecology and eastern Mediterranean landscapes: Theoretical and practical approaches, in: *General issues in the study of medieval logistics: sources, problems and methodologies*, ed. J. HALDON, Leiden 2005, 119-158.

12. Some recent examples: J. HALDON, ‘Cappadocia will be given over to ruin and become a desert’. Environmental evidence for historically-attested events in the 7th and 10th centuries, in: *Byzantina Mediterranea: Festschrift für Johannes Koder zum 65. Geburtstag*, ed. K. BELKE ET AL., Wien [a.o.] 2007, 215-230; J. PREISER-KAPPELLER, (Not so) Distant Mirrors: a complex macro-comparison of polities and political, economic and religious systems in the crisis of the 14th century, Working Paper delivered in: “The Age of the Anjou” in Târgoviște [Romania], 21.10.2011 [<http://www.academia.edu/512025/>] (last accessed June 2013)]; A. IZDEBSKI, *A Rural Economy in Transition. Asia Minor from Late Antiquity into the Early Middle Ages* [The Journal of Juristic Papyrology Suppl. xviii], Warsaw 2013.

13. In a recent book on the environmental history of the Mediterranean J.D. Hughes has included a chapter devoted to the Mediterranean environment during the Middle Ages. Nevertheless, the focus of this chapter is mainly upon western medieval regions; see J.D. HUGHES, *The Mediterranean. An environmental history*, Santa Barbara-Denver-Oxford 2005, especially 59-86. For an ecological looking at the Graeco-Roman society, see J.D. HUGHES, *Pan’s Travail: Environmental Problems of the Ancient Greeks and Romans*, Baltimore 1994.

14. Chapters of *The Oxford Handbook of Byzantine Studies*, eds. E. JEFFREYS – J. HALDON – R. CORMACK, Oxford 2008, relevant to topics related to the “Environmental History of Byzantium” are: P.I. KUNIHOLM, Chapter I.2.17 Dendrochronology (182-192), and D. STATHAKOPOULOS, Chapter II.5 Population, Demography, and Disease (309-316).

and a review of the status of the research in this particular cross-disciplinary field, which could be helpful for anyone wishing to become acquainted with the research of the environmental topics that have intrigued Byzantinists and environmental scientists so far. Works quoted in the following paragraphs represent findings from various scientific disciplines and are tentative for an assessment of data and questions that have emerged from the node points between palaeoenvironmental research and Byzantine studies. Even though the geographical spectrum of some observations refers to either entire regions or individual locales, the task of a more detailed analysis of the ecosystems of the Byzantine world within a regional or local scale context is beyond the scope of this article, but undoubtedly a desirable subject for further research.

The general themes and the specific topics that Environmental History deals with should be specified, so that the reader gets an idea of the various subjects in which Environmental History and Byzantine studies intersect¹⁵. For this purpose, I cite a list of topics emerging from the study of human-nature interaction based on structures established by the discipline of Environmental History¹⁶, and I divide them into three basic categories, depending on the ways in which natural environment and human activities interact:

1. Topics related to the study of environmental processes and changes produced by natural mechanisms capable to influence human activity:
 - Climate history.
 - History of natural events and environmental disasters (e.g. cosmic events, volcanic eruptions, earthquakes, tsunamis).
 - History of epidemics / pandemics.
2. Topics related to the environmental impact of socioeconomic activity. This is a large and complex category including various environmental parameters embracing the multiple impact of human activity upon natural processes. We can distinguish several topics in this category:

15. I consider as geographical area of the Byzantine Empire the Balkan peninsula, Asia Minor, Armenia and Georgia, northern Mesopotamia, Syria, Palestine, North Africa, Italy, the islands of the Ionian and Aegean sea, and Cyprus, i.e. the landscapes of the Eastern Mediterranean and the Middle East during the period 330-1453 A.D. For the geographical and chronological setting of the Byzantine world, see KODER, *Der Lebensraum der Byzantiner*, 13 & 20-39. For an environmental definition of the Mediterranean areas, see J. WAINWRIGHT – J. THORNES, *Environmental Issues in the Mediterranean: Processes and perspectives from the past and present*, London-New York 2004, 4-10.

16. I based this structure on HUGHES, *What is Environmental History?*, 3-8 and A. GOUDIE, *The human impact on the natural environment: past, present, and future*, Malden, MA ©2006.

- Human impact on atmosphere and climate (world climates; urban climates; urban air pollution).
 - Human impact on the waters (deliberate modification of rivers; urbanization and its effects on river flow; vegetation modification and its effect on river flow; human impact on lake levels; changes in groundwater conditions; water pollution; deforestation and its effects on water quality; marine pollution).
 - Human agency in geomorphology (landforms produced by excavation; landforms produced by construction and dumping; accelerated sedimentation; ground subsidence; deliberate modification of water channels; reactivation and stabilization of sand dunes; accelerated erosion).
 - Human impact on the soil (human agency and increased salinity; irrigation salinity; coastal zone salinity; interbasin water transfers; soil structure alteration; soil drainage; soil fertilization; fires and soil quality; soil erosion associated with deforestation and agriculture; soil erosion produced by fire; soil erosion associated with construction and urbanization; attempts at soil conservation; use of mineral resources).
 - Human impact on vegetation (use of fire, effects of fire on vegetation; role of grazing; deforestation, the maquis of the Mediterranean lands, forest decline).
 - Human influence on animals (domestication of animals; dispersal and invasion of animals; human influence on the expansion of animal populations; habitat change and animal decline; animal extinctions).
3. Topics related to thinking about nature and the environment, i.e. the study of cultural, religious, and social attitudes conditioning human response to natural environment and natural phenomena.

In the following section, I present an interdisciplinary bibliographic snapshot related to the above-mentioned three basic categories and I sum up some of the results emerging from the bibliographic survey in order to illustrate the coupling of Environmental History with Byzantine studies.

1. Research on topics related to the study of environmental processes and changes produced by natural mechanisms, capable to influence human activity during the Byzantine period, has largely attracted the interest of natural scientists, archaeologists and historians, and has led to interesting interdisciplinary results so far.

Climate history. Once climate history has been considered as the first historical field to have attempted the crossing of the disciplinary boundary between human-

ities and natural sciences¹⁷, the study of climate history of Byzantium has made a considerable progress so far. In early 1990s the idea of reconstructing the climate history of Byzantium was highlighted as a research *desideratum* among Byzantinists. It was the time when the interdisciplinary research on medieval climate patterns based on proxy palaeoclimate information had developed high standard methodological tools that enabled the reconstruction of the European climate history during the Middle Ages.¹⁸ Fruit of this trend was the expansion of our knowledge on the well-known climate trends of the Medieval period for central and western Europe (such as the “Roman Climate Optimum”, the increasingly questioned “Medieval Warm Period”, and the “Little Ice Age”) to the areas of the eastern Mediterranean and the Middle East¹⁹. On the other hand, the publication of studies, which attempt either to analyze specific meteorological events (storms, cold, droughts, floods etc.)²⁰ or to reconstruct the climatic fluctuations of the Mediterranean world in the Byzantine period²¹, gave rise to a recent fruitful integration of palaeoclimatic

17. VAN DAM – VERSTEGEN, *Environmental History: Object of Study and Methodology*, 29.

18. For an appraisal of the historical climatology in Europe with a summary of the developments in this field up to the early 2000s cf. R. BRÁZDIL, *Historical Climatology in Europe – The state of the art*, *Climatic Change* 70, 3 (2005) 363-430.

19. B. CROKE, *Climatology and Byzantine Studies (summary)*, *Byzantine Studies in Australia, Newsletter* 24 (1990) 7; J. KODER, „Zeitenwenden“. Zur Periodisierungsfrage aus byzantinischer Sicht, *BZ* 84/85 (1991/1992) 409-422; *ODB*, v. 1, s.v. *Climatology* (R. GOTTFRIED), 450-457; I. TELELIS, The great climatic risks of the past: The drought described by Byzantine sources (4th-6th cent. A.D.), in: *Proceedings of SEP Pollution Meeting in Padova, Italy, 29. 3.-2. 4. 1992*, Padova 1992, 289-301.

20. See I. TELELIS – E. CHRYSOS, The Byzantine sources as documentary evidence for the reconstruction of historical climate, in: *European climate reconstructed from documentary data: methods and results*, ed. B. FRENZEL – C. PFISTER – B. GLÄSER [Paläoklimaforschung 7 / European Palaeoclimate and Man 2], Stuttgart-Jena-New York 1992, 17-31; P. FARQUHARSON, Byzantium, planet earth and the solar system, in: *The Sixth Century – End or Beginning?*, ed. P. ALLEN – E. JEFFREYS [Byzantina Australiensia 10], Brisbane 1996, 263-269; J. KODER, Climatic Change in the Fifth and Sixth Centuries?, in: *The Sixth Century – End or Beginning?*, 270-285; D. STATHAKOPOULOS, Reconstructing the climate of the Byzantine world: State of the problem and case studies, in: *People and Nature in Historical Perspective*, ed. J. LASZLOVSKY – P. SZABÓ, Budapest 2003, 241-250.

21. Here I confine myself to a brief reference to the climate history of Byzantium. The reader can look for detailed discussions on the historical climatology of the Byzantine period and the use of Byzantine documentary evidence in the reconstruction of climatic shifts in: I. TELELIS, Medieval Warm Period and the beginning of the Little Ice Age in Eastern Mediterranean. An approach of physical and anthropogenic evidence, in: *Byzanz als Raum*, 223-243; I. TELELIS, *Μετεωρολογικά φαινόμενα και κλίμα στὸ Βυζάντιο* [Ποινήματα 5], 2 vols., Athens 2004; I. TELELIS, Climatic Fluctuations in the Eastern Mediterranean and the Middle East AD 300-1500 from Byzantine Documentary and Proxy Physical Paleoclimatic Evidence – A Comparison, *JÖB* 58 (2008) 167-207; P. SQUATRITI, The Floods of 589 and Climate Change at the Beginning of the Middle Ages: An Italian Microhistory, *Speculum* 85 (2010) 799-826. For an updated review of the climate history of the Mediterranean on the basis of various types of proxy evidence, see J. LUTERBACHER ET AL., A

data with historical and archaeological evidence aiming at: i. the improvement of the climate chronologies through the reconciliation of the available palaeoclimatic proxy data-sets, ii. the reinterpretation of topics which offer higher potentials for correlating well established palaeoclimatic data with human-societal response²².

Natural events with regard to environmental disasters. Natural hazards that occurred in the Byzantine Empire, have been a topic of historical study since the 19th c.²³. Nevertheless, only recently, phenomena such as cosmic events, volcanic eruptions, earthquakes, tsunamis etc. have become topics of interdisciplinary research²⁴. The focus of studies dealing with natural phenomena of this type has been multidirectional. We can identify studies attempting to combine evidence from all available types of data (e.g. direct and proxy physical data with evidence of literary type) in order to reconstruct either their environmental consequences or their social-cultural implications²⁵.

Cosmic events. The A.D. 540s “worst environmental downturn in the last two millennia” can be included into this quite broad topic²⁶. The interdisciplinary bibliography about the cause and consequences of the A.D. 536-37 dust veil event has been accumulated since the 1980s, when ice-core chronologies and dendrochron-

Review of 2000 Years of Paleoclimatic Evidence in the Mediterranean, in: *The Climate of the Mediterranean Region*, ed. P. LIONELLO, Oxford 2012, 87-185, as well as M. McCORMICK ET AL., Climate Change during and after the Roman Empire: Reconstructing the Past from Scientific and Historical Evidence, *Journal of Interdisciplinary History* 43, 2 (2012) 169-220.

22. See for instance the titles of the papers delivered at: “*The Avkat Archaeological Project: Workshop II. Climate, Environment and History in Anatolia CA 200-1000 CE*”, held in May 24-25, 2013 at Princeton University, <http://www.princeton.edu/avkat/news/AAPworkshopprogram.pdf> (last accessed June 2013).

23. The early catalogue by E. DE MURALT, *Essai de chronographie byzantine pour servir à l'examen des annales du Bas-Empire et particulièrement des chronographes slaves*, 2 vols., Petersburg-Leipzig 1855, 1871 and the more recent study by V. GRUMEL, *La Chronologie* [Traité d'Études Byzantines I], Paris 1958, have been the most used bibliographic tools for the chronology of earthquakes, floods and other environmental hazards of the Byzantine empire based on literary accounts.

24. The need of a systematic database of records relating to comets, meteorites, auroras, volcanic eruptions, dust storms, and weather patterns during the Byzantine period has been highlighted by P. FARQUHARSON, *Byzantium, planet earth and the solar system*.

25. In the following paragraphs, I discuss topics and results concerning these phenomena and I cite selective bibliography that focuses on their environmental consequences and/or social-cultural implications.

26. As indicated by M. Baillie, “the initial effects were in 536 and these were followed by a second pulse somewhere in the window 538-543; thus it became sensible to refer to the ‘540 event’ as something spanning 536-545”; see M. BAILLIE, Tree-Rings Indicate Global Environmental Downturns that could have been Caused by Comet Debris, in: *Comet/Asteroid Impacts and Human Society. An Interdisciplinary Approach*, ed. P. BOBROWSKY – H. RICKMAN, Berlin-Heidelberg 2007, 105-122, especially 105, and M. BAILLIE, The case for significant numbers of extraterrestrial impacts through the late Holocene, *Journal of Quaternary Science*, 22 (2007) 101-109.

logical series from Europe began to indicate the effects of a wide-range tropospheric dry fog accumulation, which resulted the diminution of sunlight and significant hemispheric impact on the ecosystems²⁷. Reduced plant growth implying reduced cereal production, crop failures and widespread famines, pestilential outbreaks, as well as climatic short-term cooling episodes were some effects recorded not only in the Byzantine historical record, but also in documents of other cultures²⁸.

Volcanic eruptions. Volcanic activity has either wide range environmental impacts or local scale effects on the ecosystems and societies. The major event of A.D. 536-37 –in case we accept its attribution to a volcanic eruption– is a paradigm of past volcanic burst with wide-range environmental consequences. Another less known volcanic eruption with wide range environmental impact and a strong symbolic effect upon the Byzantines was that of Kuwae volcano in Vanuatu, South Pacific Ocean, around the 1450s. Ice core records suggest a large volcanic eruption of that volcano, which emitted significant amounts of sulfate aerosols into both hemispheres. Scientists attribute the strange atmospheric optical effects noted during the siege and fall of Constantinople in April and May 1453 to that eruption²⁹. Apart from these two major volcanic eruptions, several others of lesser intensity and magnitude –but capable to produce stratospheric dry fogs– took place during the Byzantine period³⁰. On the oth-

27. The A.D. 536-37 dust veil event has been attributed either to a volcanic eruption or to a comet/meteoritic impact. The source volcano is unknown. Although, Rabaul Papua New Guinea, Krakatau Indonesia, and El Chichón Mexico have been proposed; see R. STOTHERS, Cloudy and clear stratospheres before A.D. 1000 inferred from written sources, *Journal of Geophysical Research* 107(D23) 4718 (2002) AAC-17 1-10, especially 4. For the comet/meteoritic impact hypothesis, see BAILLIE, Tree-Rings Indicate Global Environmental Downturns, 105-122.

28. The environmental and social effects of this event have formed the subject of several books and research papers. For a comprehensive presentation of the historical record, the implications of the event and the extensive bibliography about it, see A. ARJAVA, The Mystery Cloud of 536 CE in the Mediterranean Sources, *DOP* 59 (2005) 73-94; B. GRÄSLUND – N. PRICE, Twilight of the gods? The “dust veil event” of AD 536 in critical perspective, *Antiquity* 86, 332 (2012) 428-443.

29. The dates obtained from ice cores, tree rings, and historic records from civilizations in Europe and China indicate deposition of volcanic emissions during the period 1453-1457, suggesting that the Kuwae eruption took place in either late 1452 or early 1453; see K. PANG, Climatic impact of the mid-fifteenth century Kuwae caldera formation as reconstructed from historical and proxy data, *EOS. Transactions of the American Geophysical Union* 74 (1993) 106; J. WITTER – S. SELF, The Kuwae (Vanuatu) eruption of AD 1452: potential magnitude and volatile release, *Bulletin of Volcanology* 69 (2007) 301-318.

30. Historical reports of dimming of the sun, red twilight glows, reddish solar haloes, and dark total eclipses of the Moon indicating a high atmospheric turbidity and, thus, stratospheric dry fogs due to volcanic emissions have been collected and analyzed by STOTHERS, Cloudy and clear stratospheres before A.D. 1000, 1-10. There are local scale stratigraphical studies that provide valuable data for the reconstruction of past volcanic eruptions and the volcanic tephra carry; e.g. the discovery of a tephra horizon discovered at Butrint, Epirus, indicating a considerable eruption of the Lipari islands volcano, Sicily, during the 6th c. with dispersal of ejectiles over a distance of

er hand, a recent survey on climatic forcing produced by volcanic aerosol emissions –with reference also to Byzantium– has helped us to evaluate how written evidence and proxy physical data can complement each other in the reconstruction of past environmental changes caused by volcanism during the Middle Ages and estimate the impact of nature on medieval cultural and religious identities³¹.

Earthquakes. Seismic events that occurred during the Byzantine period form a special category of natural hazards studied thoroughly by scientists from various disciplines. Today we have at our disposal a complete chronology of the earthquakes that afflicted areas of the Byzantine world thanks to the fruitful exploitation of the available documentary evidence in combination with data derived from archaeology and geomorphology³². Regional and local scale studies verify the onset of specific seismic sequences during the Byzantine period, which hit the eastern Mediterranean region and jolted vast areas with destructive effects. For instance, an exceptional burst of tectonism that occurred on a regional scale in post-Roman times –the “Early Byzantine Tectonic Paroxysm” (4th-6th c.)– resulted in severe damage in terms of ruin, human deaths, injuries and deterioration of health conditions³³,

600 km; see D. BESCOBY ET AL., Saints and Sinners: a tephrochronology for Late Antique landscape change in Epirus from the eruptive history of Lipari, Aeolian Islands, *Journal of Archaeological Science* 35, 9 (2008) 2574-2579. The A.D. 472 eruption of Somma-Vesuvius in Campania, Italy, had destructive environmental consequences; see G. MASTROLORENZO, The 472 AD Pollena eruption of Somma-Vesuvius (Italy) and its environmental impact at the end of the Roman Empire, *Journal of Volcanology and Geothermal Research* 113 (2002) 19-36.

31. M. MCCORMICK ET AL., Volcanoes and the Climate Forcing of Carolingian Europe, A.D. 750-950, *Speculum* 82 (2007) 865-95.

32. Cf. the earthquake catalogues of: E. GUIDOBONI – A. COMASTRI – G. TRAINA, *Catalogue of ancient earthquakes in the Mediterranean area up to the 10th century*, Rome 1994; E. GUIDOBONI – A. COMASTRI, *Catalogue of earthquakes and tsunamis in the Mediterranean area from the 11th to the 15th century*, Rome 2005. On the discipline of historical seismology, see E. GUIDOBONI, Historical Seismology: the Long Memory of the Inhabited World, *International Geophysics* 81, 1 (2002) 775-790.

33. There are local-scale studies that shed light on the environmental history of certain regions in relation to the environmental consequences of the earthquake-hazard. For instance, in some oases of the Dead Sea region precisely dated pollen diagrams of agricultural indicators (especially *Olea* and cereals) verify that, after the harsh earthquake of A.D. 363, agriculture was disturbed in a large part of the rift valley where earthquake damage affected irrigation and access to the fields. It took 4-5 years to resume agriculture to previous conditions; see S. LEROY ET AL., Impact of earthquakes on agriculture during the Roman-Byzantine period from pollen records of the Dead Sea laminated sediment, *Quaternary Research* 73 (2010) 191-200. On the impact of results induced by earthquakes to health condition of populations and the environmental implications of health and disease in Byzantine Crete, see CH. BOURBOU, The interaction between a population and its environment. Probable case of subadult scurvy from proto-Byzantine Greece, *ERES Arqueologia/Bioantropologia* 11 (2003) 105-114 and CH. BOURBOU, *Health and disease in Byzantine Crete (7th-12th centuries AD)* [Medicine in the Medieval Mediterranean], Ashgate 2010.

as well as environmental change, such as sea-level change from western Greece to the Levant coasts with remarkable vertical tectonic displacements³⁴. The same sequence of earthquakes has been also proposed to be responsible for a major ecological change that took place in SW Anatolia during the same period³⁵. Similarly, in the 12th c. two significant destructive seismic sequences, about 20 years apart, hit a huge area in the eastern Mediterranean region with devastating effects³⁶.

Cultural implications of- and attitudes towards the earthquake hazard is a well-documented subject among Byzantinists³⁷. The Byzantines perceived earthquake as natural disaster and they were describing it in the literary sources either as punishment for contemporary people and omen of the Day of Judgment³⁸, or as a natural phenomenon with a certain impact on human communities without further moral dimensions³⁹. Moreover, earthquake had a quite different meaning and function in a historical work than in a narrative of a Christian chronicler, because the

34. For the episodes of the “Early Byzantine Tectonic Paroxysm”, see P. PIRAZZOLI – J. LABOREL – S. STIROS, Earthquake clustering in the eastern Mediterranean during historical times, *Journal of Geophysical Research* 101(B3) (1996) 6083-97; R. DARAWCHEH ET AL., The 9 July 551 A.D. Beirut earthquake, eastern Mediterranean region, *Journal of Earthquake Engineering* 4 (2000) 403-414; CH. MORHANGE, Late Holocene relative sea-level changes in Lebanon, Eastern Mediterranean, *Marine Geology* 230 (2006) 99-14; S. STIROS, The 8.5± magnitude, AD 365 earthquake in Crete: Coastal uplift, topography changes, archaeological and historical signature, *Quaternary International* 216 (2010) 54-63.

35. It is the end of the so-called “Beyschir Occupation Phase” (AD 200-800), an ecological phase detected in palynological diagrams of SW Turkey that was marked by rich arboriculture when the environment was favorable to the cultivation of olive trees, vines, and cereals, as well as to pastoralism (see also below p. 755). Cf. S. LEROY, Are an early Byzantine seismic event (recorded in Manyas–Ulubat lake sediment, N–W Turkey) and the end of the Beyschir occupation Phase linked?, in: *Conference abstracts for “Rapid and Catastrophic environmental changes in the Holocene and human response”, first joint meeting of IGCP 490 and ICS Environmental catastrophes in Mauritania, the desert and the coast, Jan 4-18, Atar Mauritania 2004*, <http://atlas-conferences.com/cgi-bin/abstract/camu-34> (last accessed June 2013).

36. E. GUIDOBONI – F. BERNARDINI – A. COMASTRI, The 1138-1139 and 1156-1159 destructive seismic crises in Syria, south-eastern Turkey and northern Lebanon, *Journal of Seismology* 8 (2004) 105-127. For the earthquakes of the late Byzantine period and their socio-cultural implications, see FL. EUANGELATOU-NOTARA, *Σεισμοί στο Βυζάντιο από τον 13ο μέχρι και τον 15ο αιώνα. Ιστορική εξέταση* [Παρουσία 24], Athens 1993.

37. I only cite here the comprehensive paper of G. DAGRON, Quand la terre tremble..., *TM* 8 (1981) 87-103 and the recent work of M.H. CONGOURDEAU, Les Byzantins face aux catastrophes naturelles sous les Paléologues, *REB* 67 (2009) 151-163, mostly devoted to earthquakes. See also the paragraphs on cultural, religious, and social attitudes toward nature, below p. 758.

38. For these perceptions, see B. CROKE, Two Early Byzantine Earthquakes and their liturgical commemoration, *Byz* 51 (1981) 122-147 and F. VERCLEYEN, Tremblements de terre à Constantinople: l’impact sur la population, *Byz* 58 (1988) 155-173.

39. See D. BRODKA, Die geschichtsmächtigen Faktoren in den Historiae des Agathias von Myrina, *JÖB* 52 (2002) 161-176.

interpretative frameworks of the two types of texts differed fundamentally⁴⁰.

Tsunamis. Tidal waves caused by the displacement of a large volume of water during an earthquake, though of frequent occurrence in oceans, have occurred also in the Mediterranean basin. Exceptional seismic events gave rise to large tsunamis with significant geomorphological consequences in the Eastern Mediterranean coastline. Several tsunamis inflicted Constantinople and Nicomedia as consequence of large-scale earthquakes during the Byzantine period⁴¹.

Epidemics / pandemics. Plagues –epidemics or pandemics– are situations closely related to biological mechanisms. Their underlying causes originate both in nature and in human settlement. Because of the biological basis of these phenomena (appearance of pathogens with certain molecular structure hosted and carried by rodents) and because of the involvement of environmental conditions (e.g. climate and weather), which favor their incidence and spread, epidemics can be considered among the topics related to the study of environmental processes and changes produced by natural mechanisms, even though larger social conditions are drastically involved (e.g. models of human settlement, movement, communication, nutrition, food production etc.). In this framework, the environmental mechanisms of subsistence crises have been considered as parameters for the outbreak not only of the First Plague Pandemic (i.e. the Justinian's Plague of the 6th c.) and the recurrent epidemic waves after it, but also of the Second Plague Pandemic (i.e. the Black Death of the 14th c.)⁴². The fact that both occurrences of pandemic coincided with climatic shifts that are well documented by both literary and physical evidence (the climate

40. On the perception of the earthquakes and other natural disasters in the 6th c. authors, see M. MEIER, Natural Disasters in the Chronographia of John Malalas: Reflections on their Function – An Initial Sketch, in: *Coping with Natural Disasters in Pre-Industrial Societies*, ed. M. JUNEJA – F. MAUELSHAGEN, Los Angeles [a.o.] 2007 [= *The Medieval History Journal* 10, 1/2 (2007)] 237-266.

41. The tsunamigenic potential of the Sea of Marmara is studied by A. YALÇINER ET AL., Tsunamis in the Sea of Marmara: Historical Documents for the Past, Models for Future, *Marine Geology* 190, 1-2 (2002) 445-463. For the tsunami effect of A.D. 365 earthquake in Crete (see above, p. 748), cf. B. SHAW, *Active tectonics of the Hellenic subduction zone* [Springer Theses], Heidelberg etc. 2012, 7-28, chapter 2: The AD 365 Earthquake: Large Tsunamigenic Earthquakes in the Hellenic Trench. The earthquake that occurred on 8 August 1303 was one of the largest seismic events in the history of the Mediterranean area, as it gave rise to a large tsunami; see E. GUIDOBONI – A. COMASTRI, The large earthquake of 8 August 1303 in Crete: seismic scenario and tsunami in the Mediterranean area, *Journal of Seismology* 1 (1997) 55-72; A. SCHEFFERS ET AL., Late Holocene tsunami traces on the western and southern coastlines of the Peloponnesus (Greece), *Earth and Planetary Science Letters* 269 (2008) 271-279.

42. For a complete analysis of the mechanisms pertaining to food crises and pestilence in early Byzantium, see D. STATHAKOPOULOS, *Famine and Pestilence in the Late Roman and Early Byzantine Empire: A Systematic Survey of Subsistence Crises and Epidemics* [Birmingham Byzantine and Ottoman Monographs 9], Aldershot-Burlington 2004, especially 35-46, with references to natural and climatic causes.

anomaly of 536-537, the Medieval Warm Period and the beginning of the Little Ice Age) have given rise to several studies which attempt to integrate these events in the framework of the environmental history.

The “First Plague Pandemic”⁴³, has attracted the interdisciplinary scientific interest towards the direction of the environmental history, not only because of the seriousness of its consequences in terms of human loss, but also because of the recurrence of its epidemic phases in a broad geographical scale for many decades. From the vast literature about the Justinian’s Plague we can single out studies with palaeopathological orientation, which try to explain the ecology and the biological basis of the phenomenon⁴⁴. On the other hand, the key-question whether the climatic vicissitudes of the 6th-8th c. exacerbated famine and epidemic outbreaks of the First Plague Pandemic, and if so, which disruptions in the ecological equilibrium in local and regional scale produced such big consequences is still open⁴⁵.

As human population densities and trading activities recovered from the biological hazard of the First Plague Pandemic over the years, the ecological conditions were right for plague to appear again. The Second Plague Pandemic, known as the “Black Death,” erupted in Central Asia in the 1330s, moved through Crimea and the port of Constantinople to the ports all around the Mediterranean and penetrated Central and Western Europe with recurrent epidemic outbreaks over the next four centuries⁴⁶. The Black Death has been thoroughly investigated from an environmental perspective, especially in its European dimensions⁴⁷. Nevertheless, the lack of valid demographic data and the ambiguities of Byzantine documentary

43. For the use of this term, see L. LITTLE, *Life and Afterlife of the First Plague Pandemic*, in: *Plague and the End of Antiquity: The Pandemic of 541-750*, ed. L. LITTLE, Cambridge 2007, 3-32.

44. R. SALLARES, *Ecology, Evolution, and Epidemiology of Plague*, in: *Plague and the End of Antiquity*, ed. LITTLE, 231-289; M. McCORMICK, *Towards a Molecular History of the Justinianic Pandemic*, in: *Plague and the End of Antiquity*, ed. LITTLE, 290-312; M. McCORMICK, *Rats, Communication, and Plague: Toward an Ecological History*, *Journal of Interdisciplinary History* 34 (2003-4) 49-61. See also the recent epidemiological approach of K. ΤΣΙΑΜΕΣ, *Ιστορική και επιδημιολογική προσέγγιση της πανώλους κατά τους βυζαντινούς χρόνους (330-1453 μ.Χ.)*, unpublished Ph.D., University of Athens 2010.

45. See D. KEYS, *Catastrophe: An Investigation into the Origins of the Modern World*, New York 1999; I. ANTONIOU – A. SNAKOS, *The Sixth-Century plague, its repeated appearance until 746 AD and the explosion of the Rabaul Volcano*, *BZ* 98 (2005) 1-4; N. ROBERTS ET AL., *Climate change and the Justinianic Plague: an intercomparison of high-resolution lake sediment and documentary records*, poster presented in: *XVIII INQUA-Congress: Quaternary sciences – the view from the mountains*, 21-27 July 2011 Bern, Switzerland, <http://www.inqua2011.ch/?a=programme&subnavi=abstract&id=998&sessionId=71> (last accessed June 2013).

46. For a selection from the vast literature on the Black Death, see SALLARES, *Ecology, Evolution, and Epidemiology of Plague*, 232 n. 3.

47. See the relevant chapters in J. ABERTH, *An Environmental History of the Middle Ages: The Crucible of Nature*.

evidence raise questions about the actual transmission and mortality rates of this pandemic in the Byzantine Empire. A recent study has clarified the evolution and dynamic of the Black Death in the SE Mediterranean during the 14th-15th c.⁴⁸

2. Environmental impact of socio-economic activity. The study of socio-economic activities' environmental impact in preindustrial societies embraces a complex grid of topics related to anthropogenic alterations of the ecosystems as result of human labour and control. Human intervention in the natural environment is the outcome of settlement's expansion, of increased land cultivation, and associated activities: e.g. tree clearance to create arable land, settlement and urbanization, building or changing road networks, terraces, and dams, and exploitation of the natural resources. All these activities have direct or indirect impact to the agents of the natural environment: vegetation, animals, soil, water, atmosphere and climate. The Byzantine sources do provide information concerning human intervention in nature. Changes in the riverbeds aiming to diminish river flow, constructions for water treatment and drainage, urban reconstruction after earthquakes etc. are topics well documented and studied by historians and archaeologists⁴⁹. Nevertheless, what is the contribution of Byzantine studies to the exploration of those topics under the view of Environmental History, i.e. the specification of environmental changes caused by human activity either in local or in regional geographical scale? Are there any results from the environmental disciplines on which Byzantinists can rely, so that they expand their view to the field of Environmental History regarding this thematic category? The topics and results next presented encourage, in my opinion, a positive answer to these questions.

Pollution. Human impact on atmosphere, soil or water can be deduced from the effects of anthropogenic pollution⁵⁰. Although it may be generally anticipated that the contribution of the Byzantines to the pollution of the natural environment was hardly different from the generally low degree of pollution produced by any preindustrial society, there are case studies pointing to high degree of man-made pollution in certain locales. For example, people, plants and animals living in Wadi Fay-

48. C. TSIMAMES ET AL., Epidemic waves of the Black Death in the Byzantine Empire (1347-1453 AD), *Le Infezioni in Medicina* 19, 3 (2011) 194-201.

49. See for instance A. KARPOZELOS, Περὶ ἀποπάτων, βόθρων καὶ ὑπονόμων, in: *Πρακτικά τοῦ Α' Διεθνoῦς Συμποσίου: Ἡ καθημερινὴ ζωὴ στό Βυζάντιο. Τομέες καὶ συνέχειες στὴν ἑλληνιστικὴ καὶ ρωμαϊκὴ παράδοση (15-17 Σεπτεμβρίου 1988)*, Athens 1989, 335-352; A. AVRAMEA, Φυσικὸ περιβάλλον καὶ ἀνθρώπινη παρέμβαση. (Ἀντιλήψεις καὶ εἰκόνες ἀπὸ τὸ ἀστικό τοπίο), in: *Πρακτικά τοῦ Α' Διεθνoῦς Συμποσίου: Ἡ καθημερινὴ ζωὴ στό Βυζάντιο*, 687-694; A. SINAKOS, *Ἀνθρώπος καὶ περιβάλλον στὴν πρωτοβυζαντινὴ ἐποχὴ (4ος-6ος αἰ.)*, Thessaloniki 2003, 46-112.

50. For a brief discussion on pollution in Roman times, see WAINWRIGHT – THORNES, *Environmental Issues in the Mediterranean*, 291.

nan, Southern Jordan, during the Nabatean, Roman and Byzantine periods, were subjected to enhanced bioaccumulation of potentially harmful toxic heavy metals because of the extensive mining and smelting of copper and lead in the area⁵¹. Likewise, environmental pollution caused by heavy metals is also verified for the early Byzantine period in Carthage, Spain, resulting from mining and smelting⁵². Nevertheless, the case of Sagalassos, SW Turkey, is slightly different⁵³.

Human impact on the waters. The control of water resources –especially in the arid and semi-arid lands around the Mediterranean– has become a matter of critical importance for pre-modern societies and represents a crucial aspect of human manipulation of the natural world. Distribution, control, and ownership of water in the Byzantine period are well-documented topics in the Byzantine studies⁵⁴. The maintenance of a stable and consistent water supply of the Byzantine cities was a priority and the practices undertaken for this purpose have left considerable traces in the archaeological and literary record. Recent archaeological research has demonstrated the complex environmental parameters that the Byzantines considered in order

51. Skeletal remains of inhabitants in Byzantine Wadi Faynan contain concentrations of copper and lead comparable or even higher than those found in modern industrially contaminated populations; for a complete palaeoenvironmental study of all anthropogenic and natural processes and patterns of heavy metal pollution in this case study see J. GRATIAN ET AL., The local and global dimensions of metalliferous pollution derived from a reconstruction of an eight thousand year record of copper smelting and mining at a desert-mountain frontier in southern Jordan, *Journal of Archaeological Science* 34 (2007) 83-110; CH. HUNT – H. EL-RISHI, Human Paleocology in the Ancient Metal-Smelting and Farming Complex in the Wadi Faynan, SW Jordan, at the Desert Margin in the Middle East, in: *Landscapes and Societies: Selected Cases*, eds. I. MARTINI – W. CHESWORTH, [Springer] 2010, 121-134.

52. The observed increase of lead concentration, determined from bone remains for the Roman and early Byzantine periods, is attributed to the intensive exploitation of silver-bearing galenite mines in Carthage; see M. MARTINEZ-GARCIA ET AL., Heavy metals in human bones in different historical epochs, *Science of the Total Environment* 348 (2005) 51- 72.

53. Since the area immediately around the city of Sagalassos is known to have been polluted with copper, lead and zinc due to naturally enriched surface layers of metals and metallurgical artisanal activity, there is archaeozoological evidence indicating that goats consumed during periods of insecurity, such as the 5th-6th c. A.D., were coming from animal herds kept close to or inside the town, and that, hence, would have taken up more pollutants with the ingested food, as they were grazing in the polluted areas; see P. DEGRYSE ET AL., Statistical Treatment of Trace Element Data from Modern and Ancient Animal Bone: Evaluation of Roman and Byzantine Environmental Pollution, *Analytical Letters* 37, 13 (2004) 2819-2834.

54. For an introduction to the attitudes of the Byzantines towards water, see the papers in: *Περί υδάτων. Το νερό στο Βυζάντιο*, ed. N. ZAFEIROPOULOU, Athens 2000. For a discussion on the management and concept of water resource in the Roman period, see N. PURCELL, Rome and the management of water: environment, culture and power, in: *Human landscapes in classical antiquity: environment and culture*, ed. G. SHIPLEY – J. SALMON, London-New York 1996, 180-212.

to construct and maintain water supply systems of long-term use⁵⁵. Furthermore, the numerous legal testimonies reflecting the concern of the Byzantines for the protection of wells and rivers against pollution in the cities establish a detailed base of records referring to social attitudes toward- and perception of nature⁵⁶.

Human agency in geomorphology. Human role in creating landforms and modifying the operation of geomorphological processes, such as erosion and deposition, is a theme of great environmental importance. The wide range of direct and indirect human impact on both processes is considerable for the later phases of human history. While climate was the main driver of the geomorphic system during the early Holocene, from the Byzantine Period human impact became widespread and began to dictate sediment dynamics to a large extent⁵⁷. There are case studies showing human attempt to conserve soils and/or water through the construction of landforms during the Byzantine period. A good example of direct human impact on geomorphology is the case of water reserve and irrigation constructions in the Negev desert, Israel, where desert subsistence agriculture was developed through a network of terraced *wadis* and systems of runoff water harvesting constructions from slopes and *wadi* floods (5th-8th c. A.D.). Various studies have shown that the establishment of these runoff-harvesting constructions contributed to the interruption of the accepted natural erosion process –attributed to a long-term climatic trend leading toward desertification– and led to the redeposition of a thick fine alluvial loess layer⁵⁸. On the other hand, human agency on vegetation had a considerable

55. For Constantinople, see P. BONO – J. CROW – R. BAYLISS, The water supply of Constantinople: archaeology and hydrogeology of an Early Medieval city, *Environmental Geology* 40, 11-12 (2001) 1325-1333. For the city of Apamea, see B. HAUT – D. VIVIERS, Analysis of the water supply system of the city of Apamea, using Computational Fluid Dynamics. Hydraulic system in the north-eastern area of the city, in the Byzantine period, *Journal of Archaeological Science* 34, 3 (2007) 415-427. On the water supply systems in the Greco-Roman world, see M. NIKOLIC, *Cross-disciplinary investigation of ancient long-distance water pipelines*, Ph.D., University of Victoria 2008; J. WESSELS, Groundwater and Qanats in Syria: Leadership, Ownership, and Abandonment, in: *Water, Cultural Diversity, and Global Environmental Change. Emerging Trends, Sustainable Futures?*, ed. B.R. JOHNSTON ET AL., [Springer Netherlands] 2012, 149-162

56. S. TROIANOS, Ὑπὴρχε προστασία τοῦ περιβάλλοντος στό Βυζάντιο;, in: S. TROIANOS – K. PITSAKES, *Φυσικό καί δομημένο περιβάλλον στίς βυζαντινές νομικές πηγές*, Athens 1998, 11-61, especially 13-22.

57. B. DUSAR ET AL. Holocene environmental change and its impact on sediment dynamics in the Eastern Mediterranean, *Earth-Science Reviews* 108 (2011) 137-157; T. WILKINSON, Empire and Environment in the Northern Fertile Crescent, in: *Landscapes and Societies: Selected Cases*, eds. I. MARTINI – W. CHESWORTH, [Springer] 2010, 135-151.

58. For the case of Negev dry agriculture, see H. BRUINS, The impact of man and climate on the central Negev and northeastern Sinai deserts during the Late Holocene, in: *Man's Role in the Shaping of the Eastern Mediterranean Landscape*, ed. S. BOTTEMA – G. ENTJES-NIEBORG – W. VAN ZEIST, Rotterdam 1990, 87-99. The case of geomorphological human impact in Tell es-Safi/Gath, Israel, is

indirect impact on the acceleration of erosion and aggradation processes around the Mediterranean⁵⁹. Extensive investigations and discussions have explored the nature and causes of valleys' "younger fill" accumulation of the Mediterranean valleys throughout late Roman and medieval times. Originally tied to alternating periods of wet and dry weather, this process appears now far more complex than once imagined⁶⁰. Geological properties, agricultural practices and historical changes are believed to have played a major role in valley fill sedimentation for various sites of the Mediterranean basin during the last two millennia alongside the once dominant role of gradual climatic shifts⁶¹. Nevertheless, the only way to fully understand the complexity of this process is to gather and collate, area by area, further and more detailed evidence regarding settlement types, construction methods, the nature of stock and arable economies, and so on. As few studies focus on practices through which man altered vegetation, although these alterations may be geomorphologically important, much research remains to be carried out towards the creation of a properly coherent picture of human agency in geomorphology seen with an Environmental History focus.

Human impact on vegetation. Land morphology is a critical factor for the evolution of the Mediterranean vegetation. Changes in the vegetation cover of the Mediterranean landscapes over the Byzantine period were linked with historical

also characteristic. Sedimentological analysis of fill deposit accumulated during the Byzantine period (4th-7th c. A.D.) shows that its main cause seems to have been human-made earth movement and terrace building during this period, rather than passive erosion and accumulation as a result of general environmental pressure by human activity; see O. ACKERMANN ET AL., Landscape archaeology in a dry-stream valley near Tell es-Safi/Gath (Israel): Agricultural terraces and the origin of fill deposits, *Environmental Archaeology* 10, 2 (2005) 199-215. Additionally cf. Y. AVNI ET AL., Geomorphic changes leading to natural desertification versus anthropogenic land conservation in an arid environment, the Negev Highlands, Israel, *Geomorphology* 82 (2006) 177-200. For the case of Attiki, Greece, in the Byzantine period cf. K. KOULI, Vegetation development and human activities in Attiki (SE Greece) during the last 5,000 years, *Vegetation History and Archaeobotany* 21, 4-5 (2012) 249-266.

59. Alluvial history has been assumed as parameter of the Byzantine economy by M. HENDY, *Studies in the Byzantine Monetary Economy c.300-1450*, Cambridge 1985, 58-68.

60. The original climatic theory of Mediterranean erosion and deposition has been put forward in the pioneering work of C. VITA-FINZI, *The Mediterranean Valleys*, Cambridge 1969, and was supported by many archaeologists and geographers. For a synthesis of recent developments on the topic, see J. BINTLIFF, Time, Process and Catastrophism in the Study of Mediterranean Alluvial History: A Review, *World Archaeology* 33 (2002) 417-435; A. ROSEN, *Civilizing climate: Social responses to climate change in the ancient Near East*, New York 2007, esp. 150-171.

61. Many scientists opposed to Vita-Finzi's theory of climate-induced Mediterranean alluviation and suggested that aggradation correlated with peaks of human activity –especially during the Byzantine period– was responsible for silting; see for instance P. GOLDBERG – O. BAR-YOSEF, The effect of man on geomorphological processes based upon evidence from the Levant and adjacent areas, in: *Man's Role in the Shaping of the Eastern Mediterranean Landscape*, ed. S. BOTTEMA – G. ENTJES-NIEBORG – W. VAN ZEIST, 71-86.

changes in human settlement and land-use alongside with probable climatic shifts⁶². There are studies emphasizing the landscape degradation as grazing, land-clearance and deforestation accelerated soil-erosion process and desertification in regional scale⁶³. On the other hand, there are views emphasizing the long-term environmental stability of the Mediterranean landscapes arguing for a resilience of vegetation and soil at least for the preindustrial era: wood-consuming human activities –such as shipbuilding, metal-smelting, and charcoaling– did not drive deforestation, because timber would be automatically replenished⁶⁴. Archaeological and palynological research in Greece⁶⁵ and Anatolia has produced interesting results indicating periods of deforestation and woodland-clearance associated with agricultural growth, and phases of forest and scrubland growth associated with retreat of agriculture in the Byzantine era. The case of Anatolia is a well-defined regional phenomenon. In various sites of SW Turkey (e.g. Sagalassos, Gölhisar Gölü, Bafa Gölü) a period of increased anthropogenic activity from about 1250 B.C. through the 7th c. A.D. has been identified as corresponding to a major Late Holocene period of human impact on vegetation known as the “Beyşehir Occupation Phase”⁶⁶. Series of pollen sequences indicate a phase of human-induced landscape clearance and transformation of the area into an agrarian landscape characterized by cultivation of cereals and tree crops. Further proxy evidence combined with data from documentary sources indicates that the timing of those landscape changes in the area –including creation of arable land, transformation of vegetation cover and adoption of culti-

62. For a detailed discussion on the Mediterranean vegetation and its development throughout time, see WAINWRIGHT – THORNES, *Environmental Issues in the Mediterranean*, 120-153.

63. J. MCNEILL, *The Mountains of the Mediterranean world: An Environmental History*, New York 1992, especially 84-103; HUGHES, *The Mediterranean. An environmental history*, 59-86. As case study I cite here the increase of soil erosion and fluvial activity that occurred due to human interference at Vatos, Akarnania; see A. VÖTT ET AL., Late Quaternary evolution of Mediterranean poljes – the Vatos case study (Akarnania, NW Greece) based on geo-scientific core analyses and IRSL dating, *Zeitschrift für Geomorphologie N.F.* 53, 2 (2009) 145-169.

64. A. GROVE – O. RACKHAM, *The Nature of Mediterranean Europe: An Ecological History*, New Haven 2001, especially chapter 11. For an excellent analysis of environmental and historical evidence concerning the shifts of woodland and scrubland coverage in Byzantium, see A. DUNN, The exploitation and control of woodland and scrubland in the Byzantine world, *BMGS* 16 (1992) 235-298.

65. For results concerning sites in central and western Macedonia as well as Peloponnese, see DUNN, The exploitation and control of woodland, 243-247.

66. W. EASTWOOD – N. ROBERTS – H. LAMB, Palaeoecological and Archaeological Evidence for Human Occupance in Southwest Turkey: The Beyşehir Occupation Phase, *Anatolian Studies* 48 (1998) 69-86; M. KNIPPING ET AL., Human induced landscape changes around Bafa Gölü (western Turkey), *Vegetation History and Archaeobotany* 17, 6 (2008) 365-380; J. BAKKER ET AL., Man, vegetation and climate during the Holocene in the territory of Sagalassos, Western Taurus Mountains, SW Turkey, *Vegetation History and Archaeobotany* (2011), Doi: 10.1007/s00334-011-0312-4.

vars— during historical times has been determined primarily by human activity and historical conditions⁶⁷.

On the other hand, historic changes in the demographic, political and cultural affairs are considered as being correlated with human impact on vegetation and this impact has definitely left its ecological footprint in pollen spectra dating back to the Byzantine period. Palynological studies from various locales corroborate human impact on vegetation. According to pollen diagrams from various sites in Palestine, agriculture reached its climax during the early Byzantine period (4th-7th c.) and olive trees replaced the previously dominating cover of oak forests. From mid-7th c. the *Olea* pollen curve suggests a sudden collapse of olive cultivation together with low percentages of anthropogenic indicators, while oak trees and shrubs immediately expanded as a result of settlement abandonment and increasing nomadism following the Arab occupation after A.D. 638⁶⁸. In White Mountains, Crete, the corresponding change in the vegetation cover had a different timing due to different historical conditions. A phase of high arboreal pollen during the period 4th-9th c. dominated by evergreen oaks is succeeded by a major change in the vegetation from the 10th through the 12th c., when tree cover decreased sharply. Subsequent episodic variations along the vegetation continuum with a decline in tree pollen and an increase in maquis and shrub pollen are correlated with periods of population growth, and social prosperity, a time of human immigration to Crete, extension of settlements and cultivation on to higher-altitude areas, including the White Mountains⁶⁹. In addition to these examples, the case of Lago Alimini Piccolo, Salento

67. As far as it concerns the Byzantine period, pollen and charcoal data indicate three principal land-use phases in the area: (i) an early Byzantine agrarian landscape characterized by cereals and tree crops marking the later part of the “Beyşehir Occupation Phase”; (ii) a period of landscape abandonment and the establishment of secondary woodland coinciding with the Arab invasions of Anatolia (AD 670-950); (iii) the re-establishment of cereal-based agriculture and pastoralism from c. A.D. 950; see A. ENGLAND ET AL., Historical landscape change in Cappadocia (central Turkey): a palaeoecological investigation of annually laminated sediments from Nar lake, *The Holocene* 18, 8 (2008) 1229-1245. The rather sudden drop of agricultural indicators is synchronous with the conquest of the Arabs and fits well with historical evidence; see HALDON, ‘Cappadocia will be given over to ruin and become a desert’. Environmental evidence for historically-attested events in the 7th and 10th centuries. Nevertheless, the question whether changes in temperature and humidity may have played a decisive role in the end of the Beyşehir Occupation Phase is still open.

68. F. NEUMANN ET AL., Holocene vegetation and climate history of the northern Golan heights (Near East), *Vegetation History and Archaeobotany* 16 (2007) 329-346; F. NEUMANN ET AL., Palynology, sedimentology and palaeoecology of the late Holocene Dead Sea, *Quaternary Science Reviews* 26 (2007) 1476-1498; F. NEUMANN ET AL., Vegetation history and climate fluctuations on a transect along the Dead Sea west shore and their impact on past societies over the last 3500 years, *Journal of Arid Environments* 74 (2010) 756-764.

69. M. ATHERDEN – J. HALL, Human impact on vegetation in the White Mountains of Crete since AD 500, *The Holocene* 9, 2 (1999) 183-193.

peninsula in S Italy, should be mentioned as a typical case of natural arboreal cover decreased for the shake of the cultivation and exploitation of *Olea*, the emblematic tree of the Mediterranean vegetation⁷⁰.

Human impact on vegetation is not only observable in rural landscapes, but also in urban environments⁷¹. “Urban vegetation” (including all types of spontaneously occurring and intentionally cultivated vegetation in cities) is well recorded in Byzantine literature and art, because gardens, orchards and vineyards had a high practical and aesthetic value for the Byzantines. This type of vegetation was an essential element for the foundation of most Byzantine monasteries with substantial economic and symbolic-spiritual role. On the other hand, the Byzantine towns often contained fields, orchards and gardens used for the growing of food, most likely as a measure to safeguard supplies in times of siege, and benefiting from the manure of urban waste. Furthermore, urban open green spaces in the cityscape had an aesthetic role. The establishment of gardens presupposed forest or scrubland clearance, terracing, fencing, water channeling, and planting of trees and vegetables⁷².

Human influence on animals. From an Environmental History perspective, human impact on animals during the Byzantine period is a topic with a rather recent representation in literature. The archaeozoological state of knowledge concerning how animal husbandry, hunting, fowling, and fishery find expression in the faunal materials of the Byzantine period has been recently analyzed⁷³. Besides, the intervention of the Byzantines on the faunal environment and the impact of human activity on the wild and domestic animals has been discussed in a symposium⁷⁴. On the other hand, despite the crucial role animals have played in human survival, equally or sometimes more important seems to have been the role of animals in the Byzantine imagery. The concepts of animals and animals’ cultural representations

70. F. DI RITA, Holocene drought, deforestation and evergreen vegetation development in the central Mediterranean: a 5500 year record from Lago Alimini Piccolo, Apulia, southeast Italy, *The Holocene* 19, 2 (2009) 295-306.

71. H. SUKOPP, On the early history of urban ecology in Europe, *Preslia* 74 (2002) 373-393; S. BARTHEL ET AL., Urban gardens, agriculture, and water management: Sources of resilience for long-term food security in cities, *Ecological Economics* 86 (2013) 224-234.

72. The wealthy documentary evidence on this topic has been presented and analyzed in the papers published in the volume *Byzantine Garden Culture*, ed. A. LITTLEWOOD – H. MAGUIRE – J. WOLSCHKE-BULMAHN, Washington DC 2002.

73. H. KROLL, *Tiere im Byzantinischen Reich. Archäozoologische Forschungen im Überblick* [Monographien des Römisch-Germanischen Zentralmuseums 87], Mainz 2010.

74. Cf. T. KOLIAS, Man and Animals in the Byzantine World, in: *Animal Diversities*, ed. G. JARITZ – A. CHOYKE [Medium Aevum Quotidianum Sonderband XVI], Krems 2005, 165-166; *Ζώα και Περιβάλλον στο Βυζάντιο 7ος-12ος αι.*, ed. E. ANAGNOSTAKES – T.G. KOLIAS – E. PAPAPOPOULOU, Athens 2011.

have been studied systematically and the bibliography on animals' representation in Greek, Roman and Byzantine culture is extensive⁷⁵.

3. The study of cultural, religious, and social attitudes conditioning human response to physical environment and natural phenomena is the third major category of themes representing central questions of Environmental History inquiry. The role of Christian ideology and its influence on the formation of the Christian theology with regard to the idea of man's ecological dominion is a well-studied topic both from philosophical and ecological points of view. The world-view and the associated concepts of nature of the Romans and, subsequently, of the Roman-Christian civilization was a synthesis of Greek (Platonic), Roman (Vergil, Seneca) and Patristic (old-jewish) ideas⁷⁶. 'Scientific' and religious models of explanation for the natural environment were developed in the Byzantine era by philosophers and theologians and have been satisfactorily discussed so far⁷⁷. Furthermore, concepts of nature in the Byzantine literary tradition and the visualization of nature in the

75. See T. FÖGEN, *Animals in Graeco-Roman Antiquity and Beyond. A Select Bibliography*, (updated until May 2006), accessible through the link: http://www.telemachos.hu-berlin.de/esterni/Tierbibliographie_Foegen.pdf (accessed in 10.1.2011; I thank Maria Leontsini NHRF/IBR for this link). On the transition from traditional Greek and Roman religion to Christianity in the Roman Empire and the effect of this change on the concept of animals, see I. GILHUS, *Animals, Gods and Humans: Changing Attitudes to Animals in Greek, Roman and Early Christian Ideas*, London-New York 2006. On the position of the animals in the Byzantine legislation and imagination S. TROIANOS, Τα ζώα στο βυζαντινό δίκαιο, κοσμικό και κανονικό, *Ἐκκλησιαστικός Φάρος* 75 (2004) 77-90, A. SINAKOS, Τα ζώα στα βυζαντινά ονειροκριτικά, *Βυζαντινά* 28 (2008) 115-135.

76. For a comprehensive discussion of the Biblical roots of human dominion over nature, see R. ATTFIELD, Christian Attitudes to Nature, *Journal of the History of Ideas* 44, 3 (1983), 369-386. On the early ecological influences of the Biblical teaching, see D. HILLEL, *The natural history of the Bible: an environmental exploration of the Hebrew scriptures*, New York 2006. For an updated brief presentation of discussions of western medieval Christian attitudes towards nature, see ARNOLD, *Medieval Environmental History*, 906-908.

77. 'Scientific' interpretation of nature and natural phenomena is reflected in the reception of the works of Plato and Aristotle on natural philosophy by the Byzantines. For the case of meteorological phenomena, see I. TELELIS, Οι λόγοι του 11ου αιώνα και ο Αριστοτελισμός: η περίπτωση των «Μετεωρολογικών», in: *Η Αυτοκρατορία σε Κρίση (;) Το Βυζάντιο τον 11ο Αιώνα (1025-1081)*, ed. E. CHRYSOS [Διεθνή Συμπόσια 11], Athens 2003, 425-442. Concepts of Greek Fathers about nature have been presented by D. WALLACE-HADRILL, *The Greek Patristic View of Nature*, Manchester 1968; cf. also EU. THEODORU, Ἡ οικολογική εὐαισθησία τῶν Καππαδοκῶν Πατέρων, *Θεολογία* 72 (2001) 7-29; SINAKOS, *Ἄνθρωπος και περιβάλλον στην πρωτοβυζαντινή εποχή*, 37-43. For an introduction to the Byzantine concept of nature, see N. KOUTRAKOU, Φύση και ἄνθρωπος στὸ Βυζάντιο. Ἀντιλήψεις καὶ ἰδεολογήματα, in: *Πρακτικά Διεπιστημονικῆς Ἐκδήλωσης, Ἄνθρωπος και Φύση – Man and Nature*, ed. L. ΜΠΑΡΤΖΕΛΙΟΤΗΣ [Διεπιστημονικὲς Ἐκδηλώσεις 2], Athens 1992, 130-141; P. SCHREINER, Die Byzantiner und ihre Sicht der Natur. Ein Überblick, in: *Natur im Mittelalter: Konzeptionen – Erfahrungen – Wirkungen; Akten des 9. Symposiums des Mediävistenverbandes, Marburg, 14.-17. März 2001*, ed. P. DILG, Berlin 2003, 136-150.

Byzantine art are subjects extensively studied⁷⁸. Apart from the Byzantine literature and art, concepts of nature and social attitudes towards natural environment can be identified in the ways in which the Byzantines responded to natural hazards and disasters⁷⁹. The Byzantine texts contain several narratives on events of this type and there have been attempts to interpret this evidence either from a palaeoenvironmental or from a cultural point of view⁸⁰.

As the Byzantines were neither environmentalists nor scientific resource managers, it would be anachronistic to speak of an “environmental provisionalism” or some type of “ecological thought” in any modern sense. Nevertheless, there are Byzantine texts that reveal the existence of a concern regarding environmental protection, which aimed to ensure the adequacy of the natural resources (protection of waters, forests, quality of life through the protection against urban pollution, health condition, and aesthetics in urban environment)⁸¹.

From the preceding bibliographic snapshot emerges the impression that “Byzantine Environmental History”⁸² is rather a trend diffused in an ever-growing number of studies oriented towards the reconstruction of the changes that the natural environ-

78. For interpretations of Christian exegetical literature on natural environment and its connection with representations of nature in art, see H. MAGUIRE, *Earth and Ocean. The Terrestrial World in Early Byzantine Art*, London 1987 and D. TRIANTAFYLLOPOULOS, ‘Ανθρώπος και περιβάλλον στη βυζαντινή τέχνη. Η εκκλησία ως εμπρακτική οικολογία, in: *Ὁρθοδοξία και Οἰκουμένη. Χριστήριος τόμος εἰς τὴν Α. Θ. Παναγιώτητα τὸν Οἰκουμενικὸν Πατριάρχην Βαρθολομαῖον Α΄*, Athens 2000, 641-668.

79. The relevant bibliography for medieval response to natural hazards has recently expanded. See for instance *Naturkatastrophen. Beiträge zu ihrer Deutung, Wahrnehmung und Darstellung in Text und Bild von der Antike bis ins 20. Jahrhundert*, ed. D. GROH – M. KEMPE – F. MAUELSHAGEN [Literatur und Anthropologie 13], Konstanz 2003; J. HELBLING, Coping with ‘Natural’ Disasters in Pre-industrial Societies: Some Comments, *The Medieval History Journal* 10, 1-2 (2007) 429-446; N. DROCOURT, Le millénaire byzantin: quelles sources pour quelles catastrophes?, in: *Histoire et Nature: Pour une histoire écologique des sociétés méditerranéennes (Antiquité et Moyen Âge)*, ed. F. CLÉMENT, Rennes 2011, 97-125; N. DROCOURT, Exploitation des sources et pistes de recherche historiographique: le domaine byzantin, in: IDEM, 185-216.

80. Palaeoenvironmental implications of natural hazards have been presented in the previous paragraphs of this article. For cultural aspects of such narratives, see D. STATHAKOPOULOS, Rain Miracles in Late Antiquity. An Essay in Typology, *JÖB* 52 (2002) 73-87; CONGOURDEAU, Les Byzantins face aux catastrophes naturelles sous les Paléologues. For descriptions of nature in the Byzantine epistolography, see T. KUSHCH, The natural world in late Byzantine epistolography, in: *Proceedings of the 21st International Congress of Byzantine Studies, London 21-26 August 2006*, ed. E. JEFFREYS – F. HAARER, London 2006, v.3, 103, abstract.

81. S. TROLANOS, Η προστασία τοῦ περιβάλλοντος στό Βυζάντιο, *Νόμος και Φύση* 2 (1995) 349-371; S. TROLANOS, Ὑπήρχε προστασία τοῦ περιβάλλοντος στό Βυζάντιο;

82. I put myself the quotation marks in order to match this scientific trend with that of “Medieval Environmental History”; cf. ARNOLD, *Medieval Environmental History*.

ments of the Mediterranean and the Middle East underwent during the Byzantine period, than a clearly discernible research fieldwork intersecting with Environmental History, like in the case of “Medieval Environmental History”. Though by no means unsystematic so far, the Environmental History of the Byzantine world is attracting the scientific interest both of Byzantinists and scholars of environmental disciplines, and has involved a variety of case-studies through the use of a wide spectrum of palaeoenvironmental evidence. Despite growing interdisciplinarity, one can observe the little connection achieved between documentary evidence and proxy physical datasets on one hand, and between attempts to combine environmental changes and discussions about the type of impact these changes had on Byzantine cultural and religious identities on the other. However, as hopefully shown above, there are topics and case-studies across the broad geographical and temporal range of the Byzantine history and across the different ecosystems that the Byzantines inhabited, which can support interesting comparisons⁸³.

The general impression emerging from the above survey is that conclusions obtained from the adoption of sophisticated methods applied by scholars from the environmental disciplines do find more and more place in the scholarship of Byzantine studies. From a bibliographic standpoint “the die has been cast” towards a fruitful exchange between Environmental History and Byzantine studies⁸⁴. I hope that the topics and results I highlighted in this article are convincing that today we dispose a solid bibliographic base to move on with the establishment of concepts, methods and sources of an Environmental History of Byzantium without quotation marks⁸⁵.

83. A recent interdisciplinary conference held in Landesmuseum Mainz, November 17th/18th 2011, on “*Man and his Enviroment in the Byzantine Empire*” reveals the trend among Byzantinists and other specialists to call attention to existing research gaps towards the combination of environmental reconstructions with human – environment interrelations during the Byzantine period; cf. <http://web.rgzm.de/1186.html?&L=1> (last accessed May 2012).

84. A forthcoming collective volume is anticipated to provide a systematic overview for the emerging field of environmental history of the medieval Eastern Mediterranean. *A Companion to the Environmental History of Byzantium*, ed. J. PREISER-KAPPELLER – A. IZDEBSKI – M. POPOVIC [Brill Companions to the Byzantine World], Brill 2016; cf. https://www.academia.edu/4098590/A_Companion_to_the_Environmental_History_of_Byzantium_together_with_Adam_Izdebski_and_Mihailo_Popovic_eds_ (last accessed June 2014).

85. This article was presented at “*The Avkat Archaeological Project: Workshop II. Climate, Environment and History in Anatolia CA 200-1000 CE*”, held in May 24-25 2013 at Princeton University; cf. <http://www.princeton.edu/avkat/news/AAPworkshopprogram.pdf> (last accessed June 2013). I wish to thank Prof. John Haldon for inviting me to offer it in the framework of this interdisciplinary Workshop.