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# Drought, Conflict and the Use of Historical Data and Methodologies in Interdisciplinary Palaeoclimatic Research

**Helen Foxhall Forbes[1,2] · Mateusz Fafinski[3] · Guy Halsall[4] · James M. Harland[5] · Dan Lawrence[4] · Kelly Clarke-Neish[6] · Lin Foxhall[7] · Michele Abballe[1] · Massimiliano Borroni[8] · Ismini Lypiridou[9] · Vicky Manolopoulou[1] · Anastasia Nikulina[10] · Jakub Sypiański[1] · Dominik Fleitmann[9]**

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**Abstract**
A major challenge in the interdisciplinary study of past climates is ensuring that evidence and data relating to different disciplines are analysed effectively using appropriate methodologies. In 'Droughts and conflict during the late Roman period', Clim. Chang 178, 2025, Norman et al. argue that historical sources support their conclusions that drought contributed causally to the 'barbarian conspiracy' of 367CE and to other late Roman conflicts. Although historians have developed rigorous methodologies for effective analysis and interpretation of surviving texts, the authors outline no methodologies for dealing with the textual evidence. Further, there are issues with the historical 'conflict' and numismatic datasets and with their interpretation. We focus on four major evidential points: 1) the 'barbarian conspiracy', 2) the agricultural economy; 3) the 'conflict' dataset and 4) the coin dataset. Historical evidence relating to drought and famine in the late Roman Empire does exist: future interdisciplinary research may indeed offer interesting observations on the relationships between drought and conflict, but the textual evidence discussed by Norman et al. does not, and cannot, support the authors' assertions. Effective interdisciplinary research must allow all disciplines to engage on their own terms and with their own accepted standards of rigour.

**Keywords** Roman Empire · Climate change · Drought · Conflict · Interdisciplinary · Resilience · Barbarian conspiracy

A major challenge in the interdisciplinary study of past climates is ensuring that evidence and data relating to different disciplines are analysed effectively using appropriate methodologies. In 'Droughts and conflicts during the late Roman period' Norman et al. (2025) argue that historical sources support their conclusions that drought contributed causally to the 'barbarian conspiracy' of 367CE and to other late Roman conflicts. However, they have

Extended author information available on the last page of the article

not analysed the historical data effectively or used historical methodologies to examine the textual evidence, which does not in fact support their claims.

All historical evidence is fragmentary and imperfect. Historians have therefore developed rigorous methodologies for effective analysis and interpretation of surviving texts. In 'Data and methods' (2025:4–6) the authors give a partial and misleading description of some of the relevant textual evidence but describe no historical methodology; their discussion of coin hoards (2025:S1) likewise outlines no effective methodology. Further, there are issues with the historical 'conflict' and numismatic datasets and with their interpretation. The article has numerous problems, including factual errors; a full discussion is beyond the scope of this commentary. We focus on four major evidential points: 1) the 'barbarian conspiracy', 2) the agricultural economy; 3) the 'conflict' dataset and 4) the coin dataset.

## 1 The 'barbarian conspiracy'

The authors argue that dry summers from 364CE to 366CE resulted in poor harvests, causing famine and the 'barbarian conspiracy', and rely on historical evidence to support their argument. The article analyses no historical evidence directly, either in the original languages or in translation, but mostly relies on selected extracts from a discussion published over three decades ago (Frend 1992). Their claim that the 'barbarian conspiracy' was 'cataclysmic' (2025:14) and a 'pivotal event' (2025:Abstract) is not supported either by historical evidence or by scholarly consensus, and virtually everything they say about the historical evidence is incorrect. Consequently their reconstruction of the event and its causes is not credible.

Since the 'barbarian conspiracy' was described by only one writer, Ammianus Marcellinus (d. c.400CE), it is impossible to verify his account independently. His narrative cannot be taken at face value but must be analysed critically. A standard qualitative historical methodology (Morley 1999) involves detailed critical examination of the original text (i.e. not in translation), paying close attention to issues such as the language used; the author's purposes; where, when and in what context s/he was writing; the manuscript(s) in which the text was copied. Subsequently the textual information is interpreted and contextualised through intertextual analysis and, where relevant, with reference to other types of evidence such as material or visual culture. It is impossible to undertake a full analysis of the textual evidence here, but a brief discussion demonstrates the study's major flaws.

Ammianus' account of the 'barbarian conspiracy' relates that Count Theodosius (d.376CE) was sent to deal with events in Britain (*Res gestae*, XXVII.8). Count Theodosius was the father of Theodosius I (r.379CE-395CE), the reigning emperor when Ammianus was writing, which was twenty years after the 'conspiracy'. Ammianus was not present in Britain in 367CE and it is unclear where his information came from. His descriptions of Count Theodosius include many stock flattering phrases which occur in late Roman praise-poetry and it is highly likely that he exaggerated the seriousness of the events to emphasise the success of the reigning emperor's father; he certainly aimed to avoid offending Emperor Theodosius (Kelly 2013).

Understanding the nature of the 'conspiracy' is difficult partly because Ammianus - who wrote in Latin - uses words with multiple meanings. Ammianus described a 'barbarica conspiratio': 'conspiratio' could mean conspiracy, plotting, mutiny, or even a general agreement in feeling or opinion, while 'barbarica', an adjective modifying 'conspiratio', could

mean foreign, strange, outlandish or barbarous (Lewis and Short 1969). The combination could therefore be rendered in English in at least twenty different ways. Ammianus might have meant illegitimate political activity, or simultaneous raids by people from beyond the Roman frontiers, but he could also have meant 'barbaric plotting' in relation to social unrest and the notoriously fractious British army, or various other things. There are multiple plausible (if unprovable) explanations for what Ammianus meant, but a coordinated barbarian uprising of the sort that the authors suggest would be unique and is highly unlikely based on what is known of these groups (Halsall 2007). It is impossible to identify what exactly the 'barbarian conspiracy' involved, or even the nature of the 'conspiracy', because Ammianus' account is limited and probably exaggerated, and the origin of his information is unclear. It is difficult to see how exactly climatic fluctuations can convincingly be postulated to have caused an event which is so poorly understood that we do not even know what it was.

The authors claim that the components of their 'mechanistic model' are 'verified' by Ammianus' descriptions of famine and rebellion (2025:13), but Ammianus mentions neither famine nor rebellion. They state: 'Ammianus describes the population of Britain as in a state of extreme need, or the "utmost conditions of famine"' (2025:10). Ammianus reported that the 'barbarica conspiratio' disturbed Britain, bringing it to a state of 'ultimam … inopiam' (XXVII0.8.1). The authors have borrowed Frend's (1992) translation of 'ultimam … inopiam' as 'extreme need', which they assume means famine. The standard interpretive reference work (Boeft et al. 2009, not cited in the article) confirms that this phrase does not refer to famine. A better translation is 'utter helplessness': Ammianus flattered Emperor Theodosius by implying that his father successfully dealt with a supposedly significant problem. In addition, Ammianus clearly states that 'ultimam … inopiam' was the *consequence* of the 'barbarica conspiratio', not the cause (Boeft et al. 2009). The authors' claim that historical evidence supports their suggestion that famine caused the 'conspiracy' is unsound.

The authors assert that Ammianus states that the Saxons attacked southern Britain (2025:2) and that there was a rebellion of the 'Areani' - which they suggest was caused by a reduction of grain supply to Hadrian's Wall - which allowed the Picts to cross Hadrian's Wall (2025:10). Both assertions are incorrect. Ammianus states that the Saxons attacked Gaul, not Britain (XXVII.8.5); he describes that the Areani were removed from their posts by Count Theodosius but mentions no rebellion (XXVIII.3.8). This is not an issue of interpretation: the evidence simply does not say what the authors claim it does. (It is striking that the authors' assertion about the 'Areani', as well as other assertions which are supported neither by historical evidence nor by scholarship, does appear on the relevant English-language Wikipedia page discussing the 'barbarian conspiracy' (https://en.wikipedia.org/w/index.php?title=Great_Conspiracy&oldid=1237833990).) Since the authors' inaccurate assertions about Ammianus' account are central to their argument and to their model, this is a significant problem.

## 2 The agricultural economy

The authors' portrayal of the agricultural economy in late Roman Britain misrepresents current scholarly consensus, and they do not acknowledge that the fourth century is often considered to have seen an economic upswing and increased prosperity (Banaji 2015). What is known of the late Roman agricultural economy suggests attentive state management and intervention. Britain had the greatest concentration of grain-processing and storage infra-

structure in the northwestern provinces (Lodwick 2023). Farmsteads maximised output to satisfy state demand; the distribution of grain-processing and storage infrastructure indicates careful state involvement in the timing of surplus export (Allen and Lodwick 2017). A sophisticated and well-organised bureaucracy assessed land productivity and determined annual taxation levels based on multiple, variable factors (Chouquer 2014). Officials could, and repeatedly did, alter tax policy when farmers struggled to meet demand (Harland 2025). These mechanisms and infrastructure allowed the Roman state to address famines, including during instances of significant conflict; Roman provinces were generally far more resilient than the authors suggest.

The authors suggest that in Britain in this period cereal crops, notably spelt wheat (*Triticum spelta*), were spring-sown, and argue that summer drought would consequently have been particularly problematic (2025:10). Weed flora can indicate season of sowing (Bogaard et al. 2001): the archaeobotanical evidence suggests that agrarian regimes varied regionally and that although spring-sowing did occur occasionally, autumn-sowing was more likely the norm (Lodwick 2017; van der Veen 2022; Lodwick 2023). The tree ring data discussed in the paper do not offer information about conditions from autumn through to spring, which predominantly determine the growing conditions of autumn-sown spelt. The conclusion that summer drought inevitably led to harvest failure or famine based on the particularities of the late Roman agricultural economy is not supported by the evidence currently available.

The authors state (2025:10–11) that historical sources suggest that Britain in the 350s and 360s saw 'drought-driven grain deficits' and a suffering population because grain was 'stripped' from Britain for the frontier. This is based on a misunderstanding of evidence cited from Frend (1992). They mention Zosimus' account of the construction of ships for transporting grain to the Rhine in 359CE, and a contemporary text, *De Rebus Bellicis*, which complains about 'the misery of the provincial population'. Zosimus wrote his account around a century and a half later; he was neither an eye-witness nor a contemporary. Contemporary sources indicate that this episode was not the normal state of affairs but rather a one-off instance in 358-359CE when Emperor Julian (r.361-363CE) broke a blockade imposed by barbarians on the lower Rhine (Harland 2025). *De Rebus Bellicis* is an idiosyncratic polemical discussion of 'affairs of war' probably written in the Eastern Empire (thousands of kilometres from Britain); the cited statement does not mention Britain specifically (Cameron 1985). This evidence does not suggest that famine or grain-shortages occurred in Britain in the 360s but even if famine (environmentally-caused or otherwise) had occurred the simplistic descent into chaos of the sort that the authors suggest is unlikely.

## 3 The 'conflict' dataset

The dataset of internal and external conflicts (Schwinden 2022) is incomplete, incompatible with the aims of the study, and contains some factual errors. The dataset, produced in German, identifies 'kriegerische Auseinandersetzungen' ('war-like conflicts', or 'armed conflicts') and distinguishes between internal and external foes. It was created for a publication accompanying a museum exhibition and was not intended to be exhaustive. Many incidents of conflict are missing and it is not an unbiased sample, partly because of the fragmentary nature of historical evidence but also because of the data collection methods (outlined in Schwinden 2022).

The authors neither define 'conflict' nor explain how the dataset's selection criteria relate to their understanding of the term. They refer frequently to conflict but also consistently describe all the dataset's events as 'battles', even though many events in the dataset are not battles (e.g. unrest in Antioch, 387CE; Rome, 419CE); some attested battles are, however, missing from the dataset (e.g. Thrace, 391CE; Kulikowski 2006). This matters because the dataset includes many different types of conflicts which would be expected to show different causal relationships to climatic fluctuations and food production. Urban unrest could be highly significant for analysing connections between climate and conflict since it was often caused by food shortages (Bjornlie 2023), but many known instances of urban unrest are missing, e.g. Thessaloniki, 390CE (Dolezal 2014), or Edessa, 449CE (Fafinski 2024). The authors therefore attempt to provide a mechanistic environmental cause for a phenomenon which is unclear and poorly-defined, based on a selective, biased and inaccurate dataset.

The authors state that their 'event-based aggregation analysis' identified 'spatially relevant climate records', resulting in a selected subset of events connected with an 'extreme' climate threshold (2025:6). They have not indicated which events were included and since they do not identify their criteria for 'spatially relevant' it is unclear what level of proximity was considered acceptable. Their environmental datasets (2025:Table 1) do not include local data for some conflicts, e.g. Hippo Regius (modern Annaba, Algeria), 431CE. Since environmental conditions are often extremely localised it is impossible to be certain without further information that the environmental samples used were genuinely relevant to the events considered, and therefore whether the correlation is coincidental rather than causal.

## 4 The coin dataset

The use of coin hoards as a proxy for unrest is problematic, and the discussion and interpretation of coin hoards (2025:S1) contain serious errors. Many coins are datable only to the reign (or part of a reign) of an emperor, and are therefore securely attributable to a range of years rather than a specific year (Lockyear 2012). The most recent coin in a hoard indicates the *earliest* year that a hoard could have been buried (*not* the last year, as stated in 2025:S1): the most recently-dated coin is the *date after which* (*terminus post quem*) the hoard must have been buried (Abdy 2009).

The authors assume (2025:S1) that hoards were deposited 'just a few years' after the most recent coin, but their Fig. S1 indicates a 'possible response' to the 'barbarian conspiracy' lasting twenty years. Without corroborating evidence, it is usually impossible to ascertain when beyond the *terminus post quem* a hoard was deposited, but in some cases deposition clearly took place decades later (Guest 2015). The Hoxne Treasure, a mixed deposit of coins and metal artefacts, was plotted (2025:S1) to 407CE based on the most recent coins, issues of Constantine III dating to 407CE-408CE. However, detailed analysis of the objects and wear on the coins suggests that the hoard was deposited during the 420s to 450s (Guest 2005; Johns 2010). Beyond the authors' inaccurate dating of the hoard's deposition, it is clear that using coin-dates alone to link an individual hoard to specific moments of historical unrest is unreliable as a methodology.

Hoards were deposited for multiple reasons, including ritual or votive purposes, for storage (savings, loans, pay, dowries, etc) or as a response to real or perceived crisis (Guest 2015; Bland et al. 2020; Howgego and Wilson 2022). The apparent increased frequency

of hoarding in some periods may relate to the changing nature of Roman currency and its greater availability to more people (Walton and Moorhead 2016; Bland 2018). The assumption that there is a straightforward correlation between the frequency of hoard deposition and attested historical unrest is simplistic and outdated.

## 5 Conclusion

Norman et al. (2025) claim that their conclusions linking drought and conflict are supported by historical evidence; we have demonstrated that this is not the case. It is symptomatic that in Fig. 4 (2025:13), which illustrates the 'mechanistic model' which they claim is 'verified' by historical sources, the two textual quotations are incorrectly attributed and a third statement attributes to Ammianus information which does not exist in any historical text. The claim that historical evidence supports the components of the model is not credible.

Historical evidence relating to drought and famine in the late Roman Empire does exist: future interdisciplinary research may indeed offer interesting observations on the relationships between drought and conflict, but the textual evidence discussed here does not, and cannot, support the authors' assertions. Effective interdisciplinary research must allow all disciplines to engage on their own terms and with their own accepted standards of rigour.

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**Data availability** All data needed to evaluate the conclusions in the paper are present in the paper.

### Declaration

**Competing interest** The authors have no relevant financial or non-financial interests to disclose.



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## Authors and Affiliations

**Helen Foxhall Forbes[1,2] · Mateusz Fafinski[3] · Guy Halsall[4] · James M. Harland[5] · Dan Lawrence[4] · Kelly Clarke-Neish[6] · Lin Foxhall[7] · Michele Abballe[1] · Massimiliano Borroni[8] · Ismini Lypiridou[9] · Vicky Manolopoulou[1] · Anastasia Nikulina[10] · Jakub Sypiański[1] · Dominik Fleitmann[9]**

✉ Helen Foxhall Forbes
helen.foxhallforbes@durham.ac.uk

Mateusz Fafinski
mateusz.fafinksi@uni-erfurt.de

Guy Halsall
guy.halsall@durham.ac.uk

James M. Harland
dharland@uni-bonn.de

Dan Lawrence
dan.lawrence@durham.ac.uk

Kelly Clarke-Neish
KClarke-Neish@britishmuseum.org

Lin Foxhall
lfoxhall@liverpool.ac.uk

Michele Abballe
michele.abballe@unive.it

Massimiliano Borroni
massimiliano.borroni@unive.it

Ismini Lypiridou
ismini.lypiridou@unibas.ch

Vicky Manolopoulou
vasil.manolopoulou@unive.it

Anastasia Nikulina
a.nikulina@arch.leidenuniv.nl

Jakub Sypiański
jakub.sypianski@unive.it

Dominik Fleitmann
dominik.fleitmann@unibas.ch

1 Università Ca' Foscari (Dipartimento di Studi Umanistici), Venice, Italy

2 Department of History, Durham University, Durham, UK

3 Universität Erfurt (Max-Weber-Kolleg für kultur- und sozialwissenschaftliche Studien), Erfurt, Germany

4 Department of Archaeology, Durham University, Durham, UK

5 Rheinische Friedrich-Wilhelms-Universität Bonn (Institut für Geschichtswissenschaft - Abteilung Alte Geschichte), Bonn, Germany

6 Department of Money and Medals, British Museum, London, UK

7 Department of Archaeology, Classics and Egyptology, University of Liverpool, Liverpool, UK

8 Dipartimento di Studi sull'Asia e sull'Africa Mediterranea, Università Ca' Foscari, Venice, Italy

9 Departement Umweltwissenschaften, Universität Basel, Basel, Switzerland

10 Faculteit Archeologie, Universiteit Leiden, Leiden, Netherlands