Feeding Anglo-Saxon England: a bioarchaeological dataset for the study of early medieval agriculture (Data paper)

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1. Dataset location

The main data archive has been deposited with the Archaeology Data Service. https://doi.org/10.5284/1057492

The photographic archive has been deposited with the University of Oxford's Sustainable Digital Scholarship service. https://portal.sds.ox.ac.uk/feedsax

2. Dataset content

documents, images and queries produced by the 'Feeding Anglo-Saxon England' (FeedSax) project between 2017 and 2022 at the Universities of Oxford and Leicester. The data and interpretations concern bioarchaeological evidence from excavated Anglo-Saxon and medieval settlements across England, including both animal and plant remains. In addition to this principal data archive, the FeedSax Photographic Archive (deposited with the University of Oxford's Sustainable Digital Scholarship service) consists of 6,599 microscope photographs of charred cereal grains selected for destructive biochemical analysis by the FeedSax project, or for geometric morphometric analysis by Tina Roushannafas in collaboration with FeedSax (Figure 1).

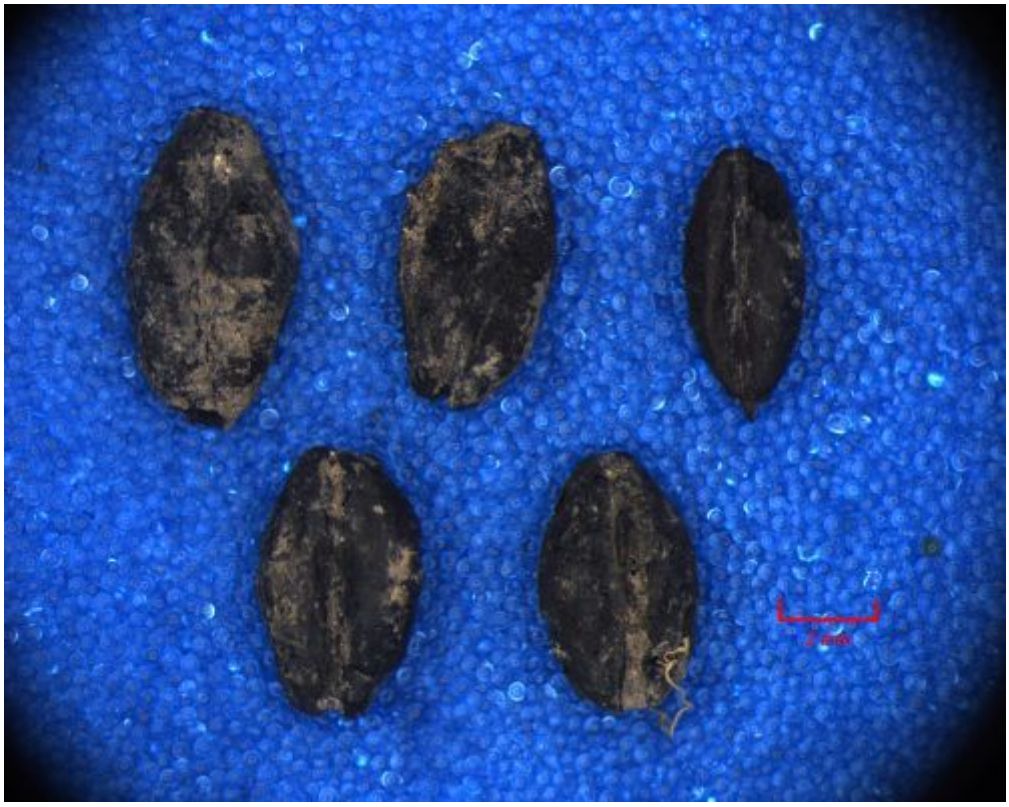

Figure 1: Charred cereal grains (*Hordeum* L.), in ventral view, from archaeological excavations at Lyminge, Kent (Image credit: Feeding Anglo-Saxon England project)

3. Background

Between the eighth and thirteenth centuries, the population of England grew to unprecedented levels. This could not have happened without a major expansion of arable farming. As well as feeding more people, the production of large cereal surpluses sustained the growth of towns and markets, and fuelled wealth inequality and the rise of lordship. Early medieval England thus witnessed a golden age of arable farming, in which the expansion of cultivation – 'cerealisation' – was the bedrock of demographic and economic growth. How, when and why this transformation occurred are some of the most enduring questions in British agricultural history, but more than a century of landscape-historical research has failed to produce a consensus. The FeedSax project addressed these longstanding conundrums by combining bioarchaeological data with evidence

including stable isotope analysis, functional weed ecology, animal palaeopathology and radiocarbon dating – to preserved grains, seeds, animal bones and pollen, in order to generate the first direct evidence for how crops were grown in this transformative period of history. This approach has resulted in a vast, multi-faceted dataset, combining both secondary data gleaned and transformed from published reports and 'grey' literature, and original data newly generated by the FeedSax team.

4. Scope

The geographical scope of the FeedSax archive is the entirety of England, although there are clear biases in the distribution of different strands of evidence (Hamerow 2022). The chronological scope, at its broadest, spans the fifth to fourteenth centuries, although in practice most evidence dates from the seventh to thirteenth centuries. In terms of source material and analytical approaches, the archives incorporate bioarchaeological data obtained from a variety of analyses of animal bones, pollen cores and charred plant remains, and the archive documents are divided into Sets A–E along these lines.

Set A concerns the dataset as a whole and is centred on 'Haystack', the SQL database which holds most of FeedSax's raw data. Document A02 contains a SQL script enabling users to reconstruct the entire database, aided by supporting documentation (A03–A04). To improve the accessibility of the data for users without recourse to SQL, each table is also included here as a separate CSV file (A05–A44). An interactive, simplified version of Haystack is also presented as part of the ADS archive; it can be queried via both form- and map-based interfaces, with data tables downloadable from individual site records.

Set B concerns archaeobotanical analyses, based mostly upon a transformed compilation of secondary data gleaned from published and unpublished reports, but also including original data for assemblages from Coton Park (Documents B01–B02), Houghton (B03–B04), and Lyminge (B05–B06). An assessment of how many archaeobotanists produced the data compiled in Haystack is given in document B45. Standardised archaeobotanical analyses (cf. McKerracher 2019) were applied to the national dataset, in order to produce a quantitative and descriptive characterisation of medieval English archaeobotany, presented here in a national data report with accompanying source tables and supporting metadata (B07–B08, B12). Presence analyses were used to obtain a broad picture of medieval English arable flora; example results are presented in documents B42—B43. SQL queries which can be run against Haystack to replicate many of the standardised analyses have been included in documents B18–41 and B44.

Figure 2: Botanical survey in the open fields at Laxton, Nottinghamshire (Image credit: Feeding Anglo-Saxon England project)

Functional weed ecology analyses were deployed to investigate husbandry practices; data and graphs are provided in documents B10–B11 and B46–B49. As part of this weed ecology work, FeedSax undertook botanical field surveys on modern farmland at Laxton and Highgrove, to explore the impact of soil disturbance on arable flora (Figure 2; Bogaard *et al.* 2022). The survey data and accompanying metadata are included here (B13–B17).

Set C contains analytical reports from the radiocarbon dating programme, with one report for each of the 26 sites for which FeedSax dated charred grain or animal bone samples (C1–C26). Each report lists, calibrates and interprets the radiocarbon dating results with reference to site-specific information. The radiocarbon table in Haystack (A02) also contains the results data, including dates obtained from pollen cores, which do not have separate reports in this archive. Finally, document C27 presents the FeedSax Universal Chronological Framework: a specially devised phasing structure for the fifth to fourteenth centuries, as outlined in the project monograph (Hamerow *et al.* forthcoming). These 'FeedSax phases' are referenced in Haystack's sitePhase table (documents A02 and A42).

Crop and animal stable isotope data are spread across Set A and Set D. The 'raw' results – for both stable isotope analyses and, in some cases, FTIR analyses of contamination – are contained within Haystack (A02, A20–22, A24–27). Complementing these data, document D01 presents a discrete study investigating variability in stable isotope values from single grains of bread wheat, the results of which have informed FeedSax's wider methodology and interpretations (Stroud 2022; Hamerow *et al.* forthcoming).

Set E is devoted to pollen. The structure and schedule of the project meant that palynological data could not be incorporated directly into the Haystack database, but they are presented here – along

2022) – in document E01, accompanied by a map in document E02. The data include records from previously-analysed cores, plus new data from cores taken by the FeedSax project (Figure 3).

Figure 3: Taking peat/sediment samples using a Russian corer at Daisy Banks Fen, Oxfordshire

(Image credit: Feeding Anglo-Saxon England project)

There is no dedicated Set for zooarchaeological data, which are either contained within Haystack (A02, A05–A11, A16–A18) or presented in specific publications (Holmes *et al.* 2021a, 2021b, 2021c, 2021d).

5. Re-use potential

medieval England – in development-led excavation projects, for instance – can benefit from comparing their results to the data compiled in the FeedSax compendia, to explore and revise emerging regional and national trends in this period. The botanical survey data from Laxton and Highgrove will be valuable in future functional weed ecology work for many different places and periods. The crop and animal stable isotope results, and the report on inter-grain variability, will provide comparative material for new isotopic studies and syntheses – including for different places and periods – while the FeedSax radiocarbon dates will be valuable for anyone re-examining the evidence from the dated case study sites, or medieval English chronology more generally. Finally, the photographic archive constitutes a rare resource for future morphometric studies of charred cereal grains.

6. Relationship to other publications

The data contained within the main archive form the foundation for all of the project's publications, as listed in the References section, while the images in the photographic archive contributed to geometric morphometric analyses undertaken by Tina Roushannafas as part of her doctoral research (see Roushannafas and McKerracher in prep).

Acknowledgements

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The FeedSax database incorporates and builds upon, directly and indirectly, the work of hundreds of archaeologists: from excavators and palaeoenvironmental specialists who created much of the raw data we have transformed and analysed, to curators and custodians of archaeological archives, by whose kind permission we have accessed and analysed archival material such as charred grains, animal bones and pollen cores. Too numerous to mention here, these collaborators are individually acknowledged in reports within the FeedSax archive, and original sources are fully referenced in the Haystack database (A02): citations for excavation reports in the reference column of the site table (A41), and for specialist environmental reports in the event and worker tables (A14 and A44).

Referee statement by Tim Evans (University of York)

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The FeedSax project has successfully delivered a fantastic research dataset that combines legacy data with primary analysis. It presents a much-needed insight into the subject area, and demonstrates the power of combining traditional analyses with modern online delivery of data and publication. Archaeological projects focussed on collating and synthesizing large levels of data from excavated sites are now becoming more common (cf. Allen *et al.* 2018; Henry 2023), but are still a once-in-a-generation event. It is thus essential that the Open Access publication of data, as demonstrated here, is standard practice.

The Feedsax research dataset presents an accessible reference resource that will surely be of benefit to a wide range of archaeological researchers. The ability to take the whole dataset or generate CSV exports for specific queries facilitates broad and specific reuse potential. I'm particularly impressed by the level of planning, organization, and commitment required in order to get the research dataset published so soon after the project has ended. With the wave of publications being produced by the team, this only adds to the reuse value and presents an exemplar for projects of this type.

Although there is clear referencing between the two sets, the user may question the rationale behind splitting the archive between ADS and Oxford. However I am very positive about the approach taken here and interested to see the reuse case studies that should emerge. While the continued commitment to Open Access to data is vital, conversely, it is essential that the wider community promotes the reuse of these resources throughout Higher Education and the Commercial Sector. Ideally, the hard work and expertise demonstrated here should be the springboard for a multitude of projects and studies.

Archaeology.