Journal Article

High-resolution environmental variability during decomposition in a UK humid temperate climate

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Abstract

Environmental conditions play a critical role in decomposition processes and the estimation of the post mortem interval. However, access to high-resolution environmental datasets within forensic taphonomy remains limited. This study presents hourly environmental measurements recorded during the decomposition of *Sus scrofa domesticus* in a UK humid temperate climate between May and August 2021.

Environmental variables were collected using a Steinberg Systems SBS-WS-100 weather station and include temperature, relative humidity, atmospheric pressure, wind speed, wind direction, dew point, wind chill, and rainfall. Data was recorded continuously at hourly intervals throughout the decomposition period to capture environmental variability influencing decomposition processes.

Environmental conditions varied throughout the study period, with fluctuations in temperature, relative humidity, and rainfall reflecting seasonal variation typical of the UK climate. These findings highlight the variability of environmental conditions during decomposition and reinforce the importance of high-resolution environmental monitoring in PMI estimation. The dataset has been made publicly available and supports further research in forensic taphonomy, including comparative studies and modelling approaches.

Keywords: Forensic Taphonomy; decomposition; environmental data; environmental monitoring; time-series data; temperature; humidity.

1. Introduction

Environmental conditions are a primary driver of decomposition processes and significantly influence the estimation of the post mortem interval (PMI) [1]. Factors such as temperature, humidity, and precipitation directly affect decomposition rates and patterns [2-4]. Despite their importance, access to high-resolution and standardised environmental datasets remains limited within forensic taphonomy [5].

Previous research has highlighted challenges associated with fragmented datasets, inconsistent methodologies, and limited opportunities for comparative analysis [6]. As a result, there is a need for datasets that capture environmental variability at a high temporal resolution to support more robust and reproducible research.

This study presents environmental data collected during the decomposition of *Sus scrofa domesticus* in a UK humid temperate climate. The aim was to systematically record environmental conditions at hourly intervals to better capture variability and support future research into decomposition processes and PMI estimation.

2. Materials and Methods

Environmental data was collected during the decomposition of *Sus scrofa domesticus* over a 12-week period between May and August 2021 in a UK humid temperate climate. The study site was located in [Redacted for Peer Review].

A Steinberg Systems SBS-WS-100 weather station was installed at the site to record environmental variables at hourly intervals. Measurements included temperature, relative humidity, atmospheric pressure, wind speed, wind direction, dew point, wind chill, and rainfall (See *Table 1* for technical specifications). The weather station was positioned to accurately capture environmental conditions influencing the decomposition process.

Table 1. Steinberg Systems SBS-WS-100 technical specifications, including range, resolution and accuracy.

	Technical Specifications
Temperature	Range: -40.0 °C To + 60 °C Accuracy: ± 1°C
Humidity	Range: 10-99 % Resolution: 1 % Accuracy: ± 5 %
Air pressure	Range: 700-1100
Wind speed	Accuracy: ± 10 % (Wind Speed > 5 m/s)
Rainfall	Resolution: 0.3 mm Accuracy: ± 10 %

Data was recorded continuously throughout the decomposition period and periodically downloaded for storage and processing. Raw data was exported in CSV format and subsequently cleaned in Microsoft Excel to ensure consistency in formatting, including the standardisation of timestamps and variable naming. Data cleaning involved the removal of redundant columns, including index and interval fields, and the standardisation of variable names to ensure consistency. Date and time fields were combined into a single timestamp column to facilitate time-series analysis. Formatting was standardised across the dataset, including the application of consistent units and the use of a uniform timestamp structure. Missing values were retained as blank entries, and no interpolation or modification of recorded values was performed.

3. Results and Observations

Environmental conditions varied throughout the study period, reflecting seasonal patterns characteristic of a UK humid temperate climate. As shown in Figure 1, temperature and relative humidity demonstrated temporal fluctuations across the decomposition period, with periods of increased temperature generally associated with reduced humidity. Temperature and humidity fluctuated across the decomposition period, with periods of increased temperature generally associated with reduced

humidity. Rainfall varied throughout the study, contributing to changes in environmental conditions at the site.

These variations demonstrate the dynamic nature of environmental conditions during decomposition and highlight the importance of continuous monitoring. The use of hourly data enables the identification of short-term fluctuations that may not be captured in lower-resolution datasets.

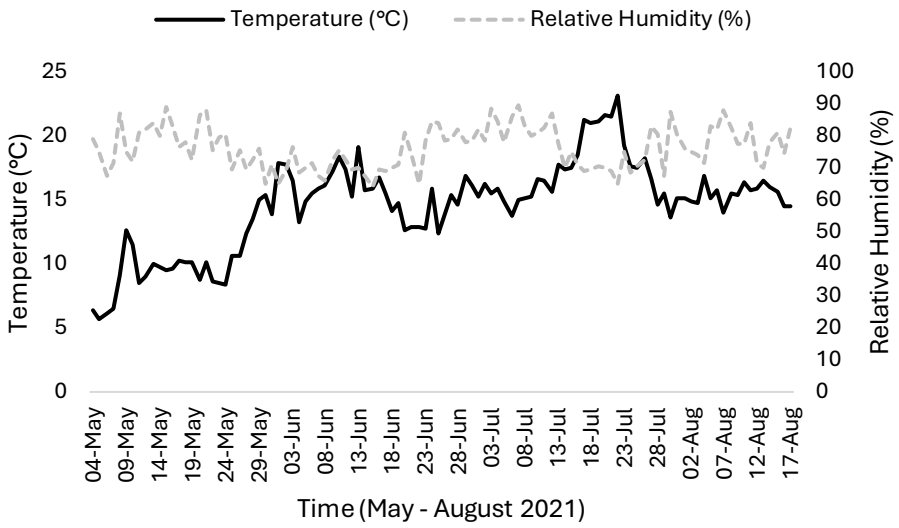

Figure 1. Daily average outdoor temperature (°C) and relative humidity (%) recorded during the decomposition period (May–August 2021), illustrating temporal variation in environmental conditions.

4. Discussion

The variability observed in environmental conditions reinforces the importance of high-resolution data collection in forensic taphonomy. Environmental factors are known to significantly influence decomposition processes and PMI estimation [1-4], yet the availability of detailed datasets remains limited [5].

By providing high-resolution environmental data recorded at hourly intervals, this study contributes to addressing this gap and supports the development of more robust and reproducible research. The dataset [7] enables comparative studies across geographical regions and can be used in statistical and modelling approaches to better understand decomposition processes.

5. Data Availability

The dataset [7] supporting this study is openly available via Zenodo: https://doi.org/10.5281/zenodo.19257604.

6. Limitations

This study represents environmental conditions recorded at a single geographical location within a UK humid temperate climate, which may limit generalisability to other regions [8]. The use of *Sus scrofa domesticus* as a human analogue may not fully replicate human decomposition processes [9]. Additionally, data was collected over a single seasonal period (May–August 2021) and does not capture seasonal variability beyond this timeframe.

Declaration of generative AI and AI-assisted technologies in the manuscript preparation process

During the preparation of this work the author used ChatGPT (OpenAI) in order to assist with language refinement, and improving clarity and organisation of the manuscript. After using this tool/service, the author reviewed and edited the content as needed and takes full responsibility for the content of the published article.

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