

IMPACT OF HUMAN BIOMASS REDUCTION THROUGH COMPOSTING ON PMI ESTIMATE RELIABILITY

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Introduction

As ecologically sustainable mortuary practices become more popular, Forensic Anthropologists may be presented with new questions regarding the resulting remains or scenes of decomposition. One such practice, the conversion of human remains to soil via composting, is currently under development by a group in Seattle, Washington, USA called ReCompose (1). This research was a part of their pilot study conducted at a body farm, the Forensic Osteology Research Station (FOReSt), on the campus of Western Carolina University.



Figure 1: Cadaver donation atop mulch heap.

Method

On January 16, 2016, a 2 x 6.5 x 1.5ft pile of cedar and oak mulch was piled onto the ground surface and lined with a mixture of co-nitrogenating compounds such as alfalfa pellets and hay. A human cadaver was placed onto the pile with another layer of the co-nitrogenating compounds and 1.5ft of mulch placed atop him. Water was added to the pile (15 gallons). Moisture levels were monitored and additional water was added manually (10 gallons at a time) once per week if rainfall was not adequate. Temperatures were recorded through the use of HOBO 8K Pendant® Temperature data loggers and compost thermometers.

Results

The temperatures recorded in proximity to the body core were exceedingly higher than the ambient temperatures for a majority of the study, only starting to equilibrate as soft tissue decay had ceased and the warmer weather of Spring arrived. On January 27th 2016, the maximum temperature achieved within the pile was recorded at 160°F (71°C), while the average ambient temperature was only 36°F (2°C).

- All soft tissue had been removed from the skeleton by observation on March 26th
- Human Remains Detection Canines showed no interest in the pile, failing to notify their handlers via trained final response during exercises.
- ABFA certified forensic anthropologists and experienced researchers also noticed no odors coming from the pile, and noted a lack of insect activity.

By applying Megyesi's (2) formula for Accumulated Degree Days (ADD), a comparison of decomposition rate and post-mortem interval from within the compost pile to that of the ambient environment can be made. ADD can be calculated using the formula $ADD = 10^{(.002 \cdot TBS \cdot TBS + 1.81)} \pm 388.61$



Figure 2: Compost temperature on January 27.

Using a total body score (TBS) of 32 – the score for dry, slightly greasy skeletonized remains – the minimum ADD necessary for this degree of skeletonization is between 6922.47 and 7599.69. Using the temperature data from the compost pile, the PMI would fall between January 25th 2016 and January 29th 2016. Using ambient temperature, the range would be from October 12th 2015 to October 26th 2015.

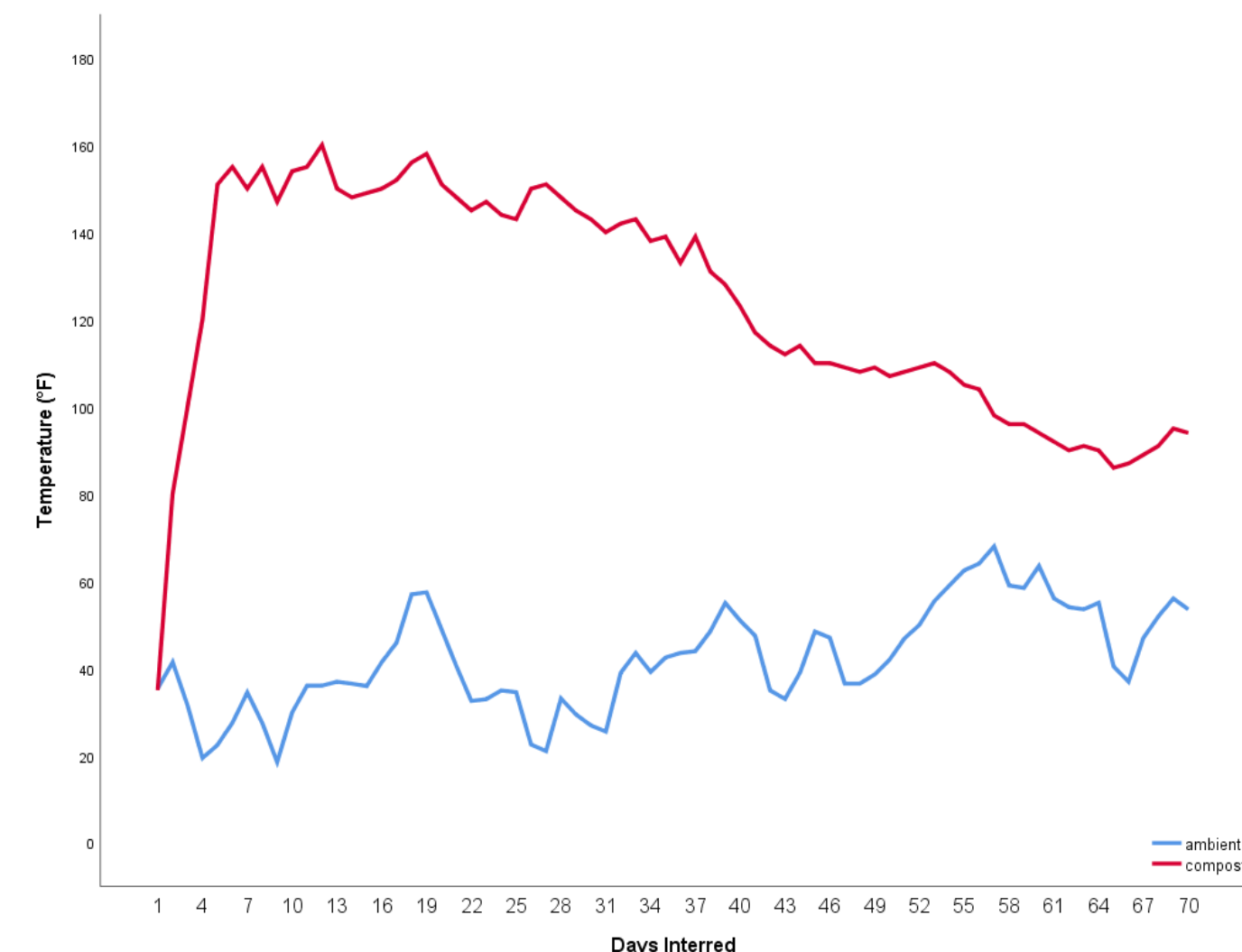


Figure 3: Temperature over time.

Conclusions

The estimation of PMI is reliant on an analyst's ability to interpret the taphonomic influences acting upon the body and use that information to adjust their estimate. Here, there are no outward signs of alteration, and, instead, there is a reduction in the available information.

- Given a known date of deposition, the amount of thermal energy needed to reach skeletonization would have been met between March 8th and 16th 2016.
- The lethal temperature threshold for many of the common insects associated with decomposition and decay is 125.6°F, or 52°C (3), which was far exceeded at the body core, making the mulch pile uninhabitable by prominent insects such as *calliphoridae* and *sarcophagidae*.

As legislation has recently been passed in the state of Washington (4), allowing this process as a legal mortuary option, further research must be undertaken to better understand taphonomic and forensic significance.

References

- 1 <https://www.recompose.life/>
- 2 Megyesi, M. S., Nawrocki, S. P., & Haskell, N. H. (2005). Using Accumulated Degree-Days to Estimate the Postmortem Interval from Decomposed Human Remains. *Journal of Forensic Sciences*, 50(3), 1–9. <https://doi.org/10.1520/jfs2004017>
- 3 Greenberg, B., & Kunich, J. C. (2002). *Entomology and the law: Flies as forensic indicators*. Cambridge: Cambridge University Press.
- 4 Human Remains—Alkaline Hydrolysis and Natural Organic Reduction, SB 5001, 66th Leg. (2019)



Figure 4: Example of composting set-up.