A99 Disturbed Soil: Unexplored Variables and the Postmortem Interval (PMI) in Southwest Florida

Matthew D. Rolland, BS, 5795 SW 7th Court, Cape Coral, FL 33914; Shawn R. Dahl, BS, Florida Gulf Coast University, 10501 Florida Gulf Coast University Boulevard, S, Fort Myers, FL 33965; and Heather A. Walsh-Haney, PhD, Florida Gulf Coast University, Dept of Justice Studies, 10501 FGCU Boulevard, AB3, Fort Myers, FL 33965-6565*

After attending this presentation, attendees will understand how subsurface variables, such as soil moisture, temperature, and pH value, are influenced by the act of disturbing soil in the absence of human decomposition in Southwest Florida. The environment of Fort Myers, FL, will be delineated in an effort to determine how the simple act of agitating soil influences these ecological variables upon which well-established PMI estimation methods rely.

This presentation will impact the forensic science community by increasing the accuracy of PMI estimations.

Time-Since-Death (TSD) and Time-Since-Burial (TSB) estimation methods have grown from research conducted within the University of Tennessee–Knoxville's Forensic Anthropology Center. As a result of decades of research at this facility, Dr. Arpad Vass helped to establish two standardized equations to estimate the PMI associated with human body decomposition.[1] Of specific interest to this study was Dr. Vass' equation to estimate TSD. Key variables used in this equation are soil moisture and soil temperature. Similarly, other prominent PMI estimation methods, such as Megyesi's Accumulated Degree Days (ADD) system, also rely upon variables, such as average daily temperature and atmospheric humidity.[2] It is well established in the literature that these variables are proximal influences upon decomposition rates as: (1) warm temperatures increase in the rate of decomposition (per Van't Hoff's Law); and, (2) an increase in soil moisture slows body decay rate; however, this current study proposes that while the relationship of these variables to decomposition rates is well described, previous research has neglected to consider how the act of disturbing soil strata layers when a clandestine grave is dug without the addition of a body may influence these variables.[1]

Twice a year, as part of Florida Gulf Coast University's (FGCU's) forensic anthropology graduate and undergraduate course, five mock clandestine burials containing plastic skeletal specimens are uncovered from a pine flatwood ecosystem. The specimens are buried at a depth of 40 to 60 centimeters within an area of approximately 250 square meters.

From June 19 through July 1, 2016, a Science, Technology, Engineering, and Math (STEM) Student Research Opportunity (SRO) was conducted in conjunction with the Whitaker Center for STEM Education. This training included instruction in forensic anthropological field methods which allowed the SRO students to assist the FGCU Human Identification and Trauma Analysis (HITA) graduate students and faculty in large-scale data collection. Soil temperature, moisture, and pH readings were taken at surface level (0-3cm), the level of the skeletal specimen, and the grave bottom using Vernier probes. These same readings were also taken from the control test pits.

The statistical analysis revealed no significant differences in soil temperature (R = -0.053, t = 1.98, p = 0.08), skeleton level (R = 0.30, t = -0.039, p = 0.7), grave bottom (R = -0.36, t = -2.87, p = 0.34), or moisture (R = 0.22, t = 0.42, p = 0.68; pH (R = -0.53, t = 1.98, p = 0.08) between the undisturbed soil of the test pit and the previously disturbed soil of the mock graves. These findings therefore indicate that the agitation of soil does not significantly influence the soil temperature, moisture, or pH of a clandestine grave as compared to a control test pit. Caution

must be used in the application of these findings because exogenous variables, such as insect activity and local floral species, may have an unaccounted-for impact upon these soil readings.

Accurate estimation of the PMI and TSB is imperative in forensic anthropology casework. A truly universal PMI formula would be an invaluable tool for forensic anthropologists. For this to be a future possibility, a complete understanding of the variables that influence decomposition rate is paramount; additionally, the calibration of environmental impact on those variables by using a control test pit in each experiment should be implemented as a standard.

Reference(s):

1. Vass A.A. The elusive universal post-mortem interval formula. *Forensic Sci Int.* 2011: 209(1-3): 34–40.
2. Megyesi M.S., Nawrocki S.P., Haskell N.H. Using accumulated degree-days to estimate the postmortem interval from decomposed human remains. *J Forensic Sci.* 2005: 50(3): 619–626.

Anthropology, PMI, Burials