# D76 Assessing the Usefulness of Plant $\delta^{15}N$ as a New Forensic Tool to Identify Clandestine Graves

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After attending this presentation, attendees will understand a new, non-invasive forensic tool that may be useful in identifying clandestine graves.

This presentation will impact the forensic science community by demonstrating results from a pilot study indicating that new-growth grass samples collected above a burial and along a burial's edge have higher nitrogen isotope values than those collected off the grave.

Burials, including mass graves, are notoriously difficult to locate. As a result, forensic anthropologists and archaeologists often assist law enforcement teams searching for and recovering buried remains. Internationally, there is increasing interest in locating clandestine graves to aid in achieving accountability for mass atrocities and to further transitional justice processes. Homicide, genocide, and other crimes-against-humanity investigations are more challenging without a body, and victims' families often suffer emotionally because of the lack of a body.[1,2]

To potentially provide an additional tool to aid in the location of buried remains, an 18-month pilot study was conducted at the Forensic Anthropology Center at Texas State University, San Marcos, to test the hypothesis that plant $\delta^{15}N$ values could be used to identify clandestine graves.

The principle behind this study is based on the known differences in the ratio of the stable nitrogen isotopes in various biological organisms. Significant differences in $\delta^{15}N$ values exist between humans and naturally growing vegetation. Accordingly, a decomposing buried body will contribute nitrogen that is measurably $^{15}N$-enriched as compared to most soil systems. The assimilation of this human-derived nitrogen should result in much higher $\delta^{15}N$ values in plants growing above bodies as compared to those that do not have access to this source of nitrogen.

To empirically test the principle and examine the usefulness of plant $\delta^{15}N$ as a forensic tool, a single cadaver was placed in a shallow grave, and the vegetation growing both above and beyond the grave was collected weekly from a defined grid. The basic questions addressed in this test were: (1) Do plants growing above interred bodies have distinct $\delta^{15}N$ values as compared to the surrounding vegetation?; (2) If so, when does this signature appear and how long does it persist after burial?; and, (3) How localized is the signature? Does it provide for high-resolution identification of graves or is the signature dispersed?

Isotopic measurements were obtained for a subset of the plant samples collected at 4, 15, 22, 24, 39, 61, 63, 71, 73, 77, 81, and 94 weeks post-burial. From weeks 61 onward, plants above the grave had $\delta^{15}N$ that were >20 per mil higher than those growing as little as 2m beyond the grave. Although a shift in $\delta^{15}N$ was anticipated, the differences were larger than expected and it is likely that soil fractionation processes may be further enhancing the 15N-enrichment. While the experimental conditions were not ideal, the results still clearly indicate the effect buried bodies have on plant nitrogen isotopic values. More robust studies are now needed to explore the potential of the techniques as a useful forensic tool for locating clandestine graves.

**References:**

1. Boss P. Ambiguous loss: learning to live with unresolved grief. Cambridge, Mass: Harvard University Press, 1999.
2. Weinstein H. Where there is no body: trauma and bereavement in communities coping with the aftermath of mass violence. Paper presented at the ICRC Workshop on Support for Families of People Unaccounted For, Geneva, Switzerland, 10-11 June 2002.

**Clandestine Grave, Nitrogen Isotopes, Human Burials**

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