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Drone aerial imagery for the simulation of a neonate burial based on the geoforensic search strategy (GSS)

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Abstract
A woman reporting the homicide and burial of an infant in 2004 prompted the creation of an experimental simulated neonate grave shortly before the real search commenced. The real case, documented here, did not use aerial imagery, but used ground-penetrating radar (calibrated to the test site described here) to identify two locations that were probed for gas release and the deployment of victim recovery dogs. We suggest technological advances in remotely sensed aerial imagery that have developed since 2004 will demonstrate their use in focusing such searches by informing a Geoforensic Search Strategy (GSS) and suggesting locations accessible by a perpetrator to identify a burial location using the still-existent analogue site. To test this, in the spring of 2020 a DJI Mavic Pro drone was flown over the control site containing the simulated 2004 burial. Aerial image processing included the creation of orthomosaics, Normalised Difference Vegetation Index (NDVI), Visual Atmospheric Resistance Index (VARI), and photogrammetry. Conventional ground-based geophysical surveys using ground-penetrating radar, guided by this new type of information integrated into the GSS, confirmed that anomalies seen in drone data were the 16-year-old burial. We test this strategy using both the original simulated burial in Northern Ireland and further evaluate it in two recent simulated graves in the United States in more complex scenarios, but with successful results.

KEYWORDS
drones, forensic search, geoforensic search strategy, geophysics, neonate burial, Normalised Difference Vegetation Index, remote sensing, unmanned aerial vehicles, Visual Atmospheric Resistance Index

1 | INTRODUCTION

1.1 | Geoforensic search strategy (GSS)

The Geoforensic Search Strategy (GSS) combines the experiences of geologists and police/law enforcement officers in a new and innovative approach that details best practice forensic search protocols and procedures and fundamental geological field techniques [1]. This blended approach enables an appropriate selection of search assets to be identified. The GSS provides a pragmatic, proportionate, and cost-effective methodology for the Highest Level of Assurance (HLA) for the presence or absence of a target suspected by the law enforcement officer to have been buried as part of a criminal or terrorist act. The GSS was developed over 25 years ago during the search for missing (presumed buried) child victims of homicide on Saddleworth Moor in the Pennine Hills, located in northern England [1–5]. The GSS is an evaluation of diggability and an assessment of the likelihood of detecting a buried target. The GSS is based on the
production of a separate Conceptual Geologic Model (CGM), whose purpose is to provide a preliminary geological assessment of the subsurface around the target, which informs which resources are needed to execute the search [5]. The GSS incorporates conventional techniques such as geological mapping and associated geomorphological observations, analysis of traditional aerial photography, and the use of engineering geophysics (e.g., ground-penetrating radar, and electromagnetic, magnetic, conductivity, and electrical resistivity surveys). Subsequently, the GSS has developed and evolved to combine this geological approach with other search and law enforcement techniques and now comprises a rigorous yet adaptable workflow, outlined below in Figure 1.

We highlight aspects of the GSS relevant to the experimental part of this work, as the historic case this is based on occurred prior to the development of the GSS. Furthermore, we evaluate what developments in aerial imagery may bring to this tried and tested, if always evolving, search model. The GSS was not developed as a prescriptive strategy to be followed for each and every search. Instead, the GSS provides a framework to work within, which can be adapted to suit the individual circumstances that are unique to each crime and search area, and enables measurable and proportionate resources to become applied to each task in a timely and cost-effective manner. The GSS has 30 stages divided into three distinct phases known as “Pre-search,” “Search,” and “Post-search.” The work in this paper aligns predominantly with the “pre-search” phase of the GSS framework. The stages included in this work are listed below, and their integration into the full GSS is shown in Figure 1.

Elements of the GSS this work intersects:

- Desk Study
- Aerial Imagery (Remote Sensing)
- Reconnaissance
- Search Boundary
- Feature Focused Survey
- Detectability
- Diggability
- Red-Amber-Green (RAG) Map
- Conceptual Geological Model (CGM)
- Selection of Search Assets
- Geophysics

### 1.2 | Aerial Imagery

Data from satellites and aircraft have long been used in the search for mass burials [6]. However, the issue of low image resolution at the scale of an individual adult burial, let alone that of a child or neonate (as in this study) remains a problem, especially with the passage of time due to body decomposition, land-use changes, and vegetation growth. For some time, satellites, helicopters, and fixed-wing aircrafts have been capable of performing regional assessments of the ground using remote sensing data, which has been complemented by high-resolution ground-based tools such as geophysical surveys, but an intermediate solution has been lacking, which can now be filled by drone technology.

For this reason of scale, drones (also known as unmanned aerial vehicles or “UAV’s”) have found increasing use in supporting ground searches, some of which are summarized, below. An overview of a range of applications can be found in Murray et al. [7], Horsman [8], and Mishra [9] provide preliminary introductions to the technology of the time, largely based on crime scene recording as opposed to search—the topic of this work. Mendis et al. [10] and Urbanová, et al. [11] do much the same as the above authors, with a critique of more up-to-date technology used in surface crime scene documentation. Evers & Masters [12] used a modified Go-Pro camera mounted on a Dia Jiang Innovations (DJI) Phantom 1 drone to visually assess ground disturbances and more specifically process their data for near-infrared (NIR) monitoring of vegetation. Their study site comprised a natural burial ground, also known as green burials, as these contain no coffins, embalming fluids, or headstones, and thus replicate features of a homicide burial. This natural site near the border of Oxfordshire and Wiltshire (England, UK) was active from 2000 to 2017 and the authors undertook their survey in 2017 with successful results, except where vegetation differences were not sufficient to be distinguished in the NIR imagery. Critically for this study of an historic burial, Evers & Masters (p. 416) [12] state: “The time in which the graves were created were found to have considerable influence on the results given that the NIR aerial images exclusively revealed recent graves where vegetation regeneration had not fully concealed disturbed soil locations.” They conclude that NIR is useful and that further work using NDVI, as trialed here, would add to their work. Parrott et al. [13] used very similar equipment as Evers & Masters, with a GoPro camera mounted on a DJI Flame Wheel drone. Their site and imagery comprised a 1 x 1 m purpose-dug simulated shallow grave (from their Figure 2, approximately 10–20 cm deep) to create a ground disturbance in clay-rich soil outside of Chester, Cheshire. Parrott et al. [13] used image processing to despeckle and enhance visible light photographs as opposed to NIR, but Parrott et al. [13] do not definitively state how long after their ground disturbance was made that they obtained drone imagery, but do state that at the time of the overflights, the vegetation had

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**Highlights**

- We revisit a simulated grave based on a neonate homicide case from 2004 with modern drone technology and GPR.
- Orthomosaics, vegetation indices, and digital elevation models derived from drone data can focus a search by informing the early stages of the GSS.
- The use of vegetative indices such as NDVI and VARI derived from drone imagery can suggest grave locations for both 16-year-old and recent graves.
partly recovered. Critically for this work, the Evers & Masters [12] and Parrott et al. [13] work were primarily focused on the efficacy of the drone-based survey method, as opposed to our approach which is to integrate primary and processed aerial imagery with an understanding of the overall solid/drift geology and topography (part of the GSS), with attendant controls on vegetational variations and digital elevation modeling using photogrammetry.

In a 2020 study by Butters et al., an infrared sensor was mounted to a DJI drone and flown over a simulated burial using two large cuts of pork. The infrared sensor imaged a thermal anomaly as decomposition from insect activity progressed [14]. Remote sensing such as this and drone-mounted LiDAR [15] are relatively new to crime scene detection and are not within the scope of this study.

From the summary above we can conclude that a significant surveying method may complement the Geoforesnic Search Strategy by integrating drone data such as orthophotography/orthomosaics, digital elevation modeling, and vegetation indices (such as NDVI) in order to focus a search.

2 | THE CASE

2.1 | Background

In March 2004 a Caucasian female informed police in England that she wished to report a murder (more correctly, a homicide). As a teenager some 20 years earlier, in a rural area of NW Ireland, she said she became pregnant during an affair with a foreign national of different race, which at the time would have carried deep social stigma. Upon home delivery of the infant, the woman (then teenager) believed her mother drowned the baby, and went alone with the corpse in an old cloth handbag with wooden looped handles (no metal parts) to bury the body. Such traumatic events would remain memorable and the witness recalled her mother's boots and shovel had abundant fragments of what she described as “bog rushes” on them (possibly Juncus sp.), upon return to their house. The witness did not know the location of the burial. As her mother had exited their house via the backdoor, which led to a sloping field with a waterlogged, marshy ground (bog) at its far extreme, the burial was likely somewhere in this general location. Upon interview, the English police and their psychologists thought the witness testimony to be credible and contacted the local police in Ireland. The daughter's motive was to provide the child with a proper burial, and although she risked being charged, she had waited until her mother died so she could not be prosecuted for her crime. A team of search personnel were assembled, including two Police Search Advisers (PoLSA's), a Major Crime Forensic Adviser, a police archeologist (now known as Disaster Victim Identification [DVI]), two dog handlers and their specialist cadaver-detection canines, plus a geophysicist (author AR). In 2004, there was no formal, agreed, and published Geoforesnic Search Strategy, although many of the individual techniques were known to the search team.

2.2 | 2004 search

A basic desk study of the search location in 2004 showed on published geological maps to be underlain by Carboniferous Bundoran Sandstone Formation with glacial till above and peat concentrations in inter-drumlin hollows (bogs). The precise location is not provided out of respect for family members, some of whom still live in the area. No satellite or aerial imagery was used at this time. At the search site, a reconnaissance search was carried out (Figure 2), concentrating on the low-elevation boggy ground. This comprised repeated 2D GPR profiling, marking of anomalies, deployment of approximately 20, 20 mm-diameter soil probes to 0.5-1.0 m depth, depending on soil strength and any refusals. The detector dogs were deployed separately and indicated at two locations. Archeological excavation revealed one had domestic waste, the other contained the well-preserved body of the child, wrapped in cloth and in the handbag, as described by the witness. Following a post-mortem, the remains were returned to the mother via a funeral service and
interred. No charges were brought forward by either police force to the authorities.

3 | THE CONTROL SITE STUDY

3.1 | Control site summary

The simulated burial within the control site was created in 2004 after the homicide was reported but before the official search had begun. It is located on the author’s own property (AR) in Northern Ireland, shown in Figure 3, and thus no external permissions were required. A full description of the site is provided below. In summary, the location was analogous to the child burial site, comprising gently undulating fields with bog-filled soil at its edges, overgrown with the common Irish Rush, *Juncus* (probably *Juncus effusus*). However, the underlying geology of both the original 2004 search and the 2020 control sites are different, the former being Carboniferous Sandstone and the latter Palaeozoic greywackes. This could cause a potential problem, but as both are covered by peat (described below), the efficacy of the test should be unaffected as it was suspected the 2004 child grave would be shallow given the witness testimony.

To test the resolution and depth limitations of the GPR in a 2004 experiment, a simulated, rectangular grave, 1 m deep, 0.75 m wide, and 1.7 m long was cut into the peat until the underlying glacial till was reached. A cloth handbag containing some woolen clothes was placed in the ground and covered. It was noted at the time that having dug and buried the bag, workers’ boots had peaty soil and cut *Juncus* fragments adhering. This kind of control burial is common practice in geophysics and especially forensic geophysics [16]. The handbag was left buried for future experimental studies (e.g., this work). To test the efficacy of the ground-penetrating radar (GPR) system at the simulated burial, a 1998 generation Mala RADAN system, fitted with unshielded 200 and 400 MHz antennas was used in 2004, and the 200 MHz GPR profile, gathered one month later at the crime scene, successfully imaged the target. A major issue with this kind of controlled test is the limited time available between control testing and that of the actual search, where even one month is rarely possible. Some burial homicide searches begin within hours or days of their initiation, or can be initiated months or years afterward.

GPR was re-run on the Control Site in 2020 using a modern-generation Mala Geoscience 100 MHz Rough Terrain Antenna for depth profiling of the peat, and a 450 MHz shielded antenna for target characterisation during the 2020 simulated aerial survey (see below, “Focussing the Survey”).

3.2 | Desk study

In the Geo forensic Search Strategy (GSS) [3,4], Stage 4 recommends a desk study to be completed, including the collation of pre-existing data, information, and intelligence, which is considered good practice [17]. Typically, this includes a review of topographic, land-use, soils, and geological maps, local history records, and anecdotal accounts. This should be followed by a reconnaissance walk-over survey to observe the general ground conditions including the geology, geomorphology, and vegetation changes, and perform an evaluation of the diggability of the ground if a burial is being considered. The geomorphology will be addressed later, as will the case intelligence.

According to the 1:50,000 scale (solid) geological map, published by the Geological Survey of Northern Ireland [18], the Control Site search area is underlain by vertically bedded, metamorphosed Palaeozoic sandstones and shales (collectively: greywackes) of the Lower Palaeozoic Longford-Down Terrane [19]. These greywackes are cut by NE-SW trending faults and intruded by NW-SE trending Palaeogene basaltic-dolerite-microgabbro dykes (Figure 3C).

The drift (superficial) geological maps show the site to be underlain by glacial till (diamicton), overlain by discontinuous alluvium, peat, and artificial (made) ground (Figure 3B). Soils are recorded as podsols, with cambisols also present in the area (Figure 3A). The geomorphology of the area was observed as part of the reconnaissance walkover survey. This comprises low rounded hills (drumlins)
FIGURE 3 Geological maps of the Control Site Survey Area, arranged in stratigraphic order (oldest/deepest at bottom). (A) Soil map of survey area [27] (B) Drift (superficial) Geology map of survey area [28]. (C) Solid Geology of survey area [28]
from large (50–100 m in height above Ordnance Datum [OD]) to small (1–10 m in height above surrounding fields) with inter-drumlin peat-filled depressions, often with ponds, minor rivers, streams, and human-dug drainage ditches (Figure 4A). Land-use is predominantly arable grass-grazing and hay cultivation with villages and separated farm dwellings. The Control Site Survey Area has been used for cattle-grazing since the initial burial in 2004, with saplings planted in some parts during early 2020. The area of the burial location itself has not been used for tree-planting, although willow saplings were present approximately 4 m away. The burial site has not been disturbed as the ground is owned by one of the authors (AR). The limits of the Control Site Survey Area were marked on subsequent (2008-onwards) satellite imagery from the GeoEye Satellite (50 cm/pixel) (Figure 4B), delimited by inaccessible land (ditches, hedges) from a simulated “Suspect’s House,” and by views from neighboring houses to the south and north (Figure 4C,D). This allowed a focus for the survey (“Focussed Survey Area” in Figure 5) to the north-west of the simulated “Suspect’s House,” where the walk-over survey, designed to replicate an intelligence-led search, showed three areas of Juncus vegetation, similar to that of the search area of the 2004 cold case, that also limited the area to be imaged.

4 | AERIAL IMAGERY

4.1 | Method

A Mavic Pro drone, fitted with a 4.55 mm gimbal-mounted camera, recording at 12.35 megapixels was used by pre-planning a flight grid in DroneDeploy®, an internet-based platform also available as

**Figure 4** Control Site Survey Area, delimited by inaccessibility to the northwest, north, and northeast by 4 meter-deep ditches and hedges, to the east by neighbor presence and hedges/forest, and to the south and north by hedges and viewability from dwellings. (A) Map of the Control Site Survey Area, showing limits of the search area in red dashed line, and areas of inaccessibility [29]. (B) Geoeye satellite imagery (2008) [30] with resolution at 50 cm/pixel (compared to 1.4 cm/pixel obtained in Figure 9). (C) Orthomosaic of drone imagery from 2020 obtained at 150 m altitude flyovers of the Control Site Survey Area (resolution at 4.9 cm/pixel) and the three locations of Juncus growth, with a Focussed Survey Area for Figure 5 delineated in red. (D) Digital elevation model of Survey Area modeled using DroneDeploy software, with interpreted (manually) diggable/viewable locations in a RAG map style, red being elevated, visible, and not diggable, yellow being elevated, partially visible, and partially diggable, blue being low-lying and diggable.
an app which facilitates data capture and analysis used in this work via automated flight plans. The land is privately owned and all Civil Aviation Authority guidelines were adhered to. In addition, the survey was undertaken during the Covid-19 Pandemic, when no domestic aircraft were permitted to fly in the area. A grid was flown autonomously at 60 m spacing over the Control Site Survey Area (Figure 4C) that contained all three peat-filled and *Juncus*-vegetated locations. The whole of the Control Site Survey Area and the Focussed Survey Area (Figure 5) were imaged after a two-month period of dry weather (March–May, 2020) whereby drought-stressed grassland may appear on aerial images. In addition, there were also some small areas of mature trees, sapling-planted areas, and peat bogs. DroneDeploy software was used to create topographic (Figure 4D) and vegetation index maps (Figure 5C). The Digital Elevation Model (DEM) from DroneDeploy© in Figure 4D utilized photogrammetry, whereby the flight program captures high-resolution (12.35 mega-pixels in this case) images and overlaps them at a default of 70% on the side and 75% in the front. Combining images of the same point on the ground from different angles and overlaps enables the software to derive a z elevation value, which in our case was accurate to +/-0.4 m.

There are a range of vegetation indices available, but two of the most common are shown here. Visual Atmospheric Resistance Index (VARI) originally came from satellite monitoring of vegetation and provides an index minimally sensitive to atmospheric effects and is applicable in a wide variety of vegetated environments. While VARI did not show any anomaly at the burial site (Figure 6D), it did prove useful in ongoing studies (Figure 11).

VARI uses the equation:

\[
\text{VARI} = \frac{\rho_{555} - \rho_{645}}{\rho_{555} + \rho_{645} - \rho_{469}}
\]

Where \(\rho\) represents the reflectance for the wavelength given in nanometers. VARI uses the visual band of light (400–700 nm wavelength) for analysis and can be done with a consumer-grade camera. Values range from −1 to +1, lower values indicating distressed vegetation, higher values indicating healthy vegetation [20].

Normalised Difference Vegetation Index (NDVI) determines the difference in the reflectance of visible red and near-infrared light (NIR) and is more useful for comparing green biomass with dry biomass [21]. The
Mavic camera has a consumer-grade filter above its sensor, which cuts off most of the light below UV and above IR wavelengths, but it does let in enough near-infrared (NIR) light to create a meaningful NDVI analysis, and recent studies have shown genetic algorithms using standard RGB cameras can produce similar results to NDVI taken with a modified or multispectral/hyperspectral camera [21]. NDVI uses the following equation:

\[
\text{NDVI} = \frac{(\text{NIR} - \text{Red})}{(\text{NIR} + \text{Red})}
\]

5 | FOCUSING THE SEARCH

5.1 | Focused survey

The orthomosaic imagery and possible burial locations were integrated with the topographic map, wherein it was noted that Location 1 is elevated (Figure 4C,D) and thus both visible from houses to the north and less likely to represent diggable ground. Location 2 is
likewise elevated, but has tree-growth and thus may or may not have been visible. Location 3 was likely an area both diggable and discrete. This was supported by further analysis of the aerial images to the north of the “Suspect’s House” (Figure 4C) when the three possible locations were assessed by a second site visit and use of a steel probe to determine soil thickness, verified by 2D GPR transects (see below and Figure 7).

Although the location of the simulated and experimental burial site was known to the authors, the interpretation of the aerial imagery was performed, without location bias (author AR did not mark the 2004 burial site) as would be done in an actual law enforcement-led search, using the Geo Forensic Search Strategy (GSS). The search area limit of the focused search was delineated in Figure 4C and shown in the high-resolution aerial image in Figure 5A. Further analysis of the topography produced a digital elevation map (Figure 5B), red representing high ground and comprising thin (5 cm–0.5 m deep) soils, with 1–10 m diameter and 50 cm–2 m high rounded outcrops of greywacke, gradating to blue representing low ground, which comprised soft peat and diggable with ease. This is confirmed by the NDVI image (Figure 5C), where stressed vegetation is observed on elevated ground and healthy plant growth (especially bogs) north-west of Location 3, dug allotments adjacent to the “Suspect’s House,” and hedgerows and mature forested areas. Figure 5D shows a 3D model of the Control Site which combines the aerial photography of the Mavic Pro with the elevation model in Drone Deploy and shows the “Suspect’s House” in relation to the 3 potential locations and topographical features.
5.2 | The burial at location 3

Negating two locations with *Juncus* vegetation on the basis of visibility from neighboring dwellings or lack of thick, soft, easily diggable soil, our trial focused on Location 3 (see Figure 6A), which contained the simulated burial from 2004. The increased resolution of the topography around this area of bog and *Juncus* vegetation also produces an elevation map that focuses the search to the north of the red-yellow elevated ground in the low-lying green and blue areas (Figure 6B). NDVI of the location overlain on topography (Figure 6C) shows a discrete area with similar response to normal bog and *Juncus* vegetation, but distinctly separate from the main bog area. VARI overlain on topography (Figure 6D) did not show this anomaly.

When the original, high-resolution orthomosaic of this area is examined (Figure 7A), during the period of dry weather, when the imagery was obtained, this anomaly can be discerned some 16 years after the burial took place. In less-dry conditions, this may not be visible, as is often the case in archeological analysis of aerial photography during droughts [22]. A further test of NDVI and other indices when the soil has an elevated moisture content is recommended as future test work.

To complete this process of focusing the survey in order to (theoretically) advise whether Location 3 and its vegetation anomaly should be archeologically excavated, GPR was deployed (Figure 7). Reconnaissance 2D 100 MHz profiles using a Mala rough terrain antenna were gathered to assess peat bog thickness (Figure 7B).
as well as 2D and 3D 450 MHz high dynamic range antenna profiles (Figure 7C,D) over the NDVI and orthoimagery anomaly seen in Figure 6. After 16 years in the ground, the bag with contained cloth was clearly visible on the 450 MHz GPR data, both in 2D (Figure 7C) and in 3D (Figure 7D). This is consistent with the findings of Ruffell & Donnelly [23] when GPR was similarly deployed at a control site consisting of clothing buried in peat on moorland in northern England, which they successfully imaged on GPR several years later. Should no anomaly have been identified at Location 3, Locations 1 and 2 were also surveyed with the 450 MHz antenna, combined with probe thickness measurements. Location 1 (Figure 5C) is viewable and vegetated with Juncus, but proved to have thin (30 cm) soils on elevated topography (Figures 4D and 5B). The Juncus growth here was ascribed to localized waterlogging from a leaking cattle drinking trough from previous land use. Location 2 also held abundant Juncus vegetation and is in a low-lying, wet condition, but could be viewed from dwellings to the north, and because of rock outcrops at that location, probably had limited diggability. Should Location 3 not have proven successful in an actual operational search, Location 2 would have been further investigated.

6 | DISCUSSION

Our contribution to an actual search using aerial imagery is different from those who precede us [12,13] in that we placed the use of drone technology within the context of the Geoforensic Search Strategy to provide a basis for understanding ground conditions in and beyond the immediate area of interest (Control Site Survey Area). Subsequently, there was a more detailed focus on the survey locations (Focussed Survey Area and Location 3), using desk study combined with drone image analysis. Our burial is also considerably older (16 years) than that created by Parrott et al. [13]. A limitation of this experimental work is that the place of the burial was already known, as this was a simulation. However, the process was realistic and based on an actual case. The use of aerial imagery in this context, as opposed to assessing the response on specific sites is novel and

FIGURE 9 Orthomosaics of simulated graves in the United States. (A) Orthomosaic of simulated urban adult grave taken on 10 October 2020 when site was created. “Grave” is 2 m long (NW-SE), 0.5 m wide (SW-NE), and 25 cm tall. (B) Re-flown orthomosaic of same site taken on 6 November 2020. (C) Orthomosaic of simulated rural child grave taken on 3 October 2020 when site was created. “Grave” is 70 cm long (E-W), 40 cm wide (N-S), and 22 cm tall. (D) Re-flown orthomosaic of same site taken on 5 November 2020. Exact locations are anonymized.
now needs testing on a truly “blind” study, perhaps evaluating other vegetation index processing steps and using DEM’s from drones to complement geological and geomorphological mapping and the creation of RAG prioritisation maps [1]. What does stand out are the advances in resolution, which the drone imagery provides over satellite and aircraft imagery. The drone data is also more cost-effective and may be acquired and processed in adequate time (from less than an hour to 6 hours, depending on the size of the survey area). All three types of data (satellites, aircraft, and drones) are non-invasive and naturally have the advantage of not disturbing vegetation and soils, and therefore preserving any potential forensic evidence. Furthermore, the processing of the drone data and the verification it provides offer a perspective that walk-over ground observation cannot. The simulated burial site is located within a topographical area of low relief with abundant plants growing to approximately 1 m high, making assessment of small-scale (1-2 m) changes in topography and vegetation visually difficult (Figure 8). As such, repeated walk-over surveys of the ground and a vegetation survey would be necessary to assess the target location.

7 | FUTURE WORK

To further the work done here, two additional mock burials sites have been created in the United States. This work varies the size of the graves to represent a child and an adult burial site, and are located in a rural and urban setting, respectively. While these experiments do not have the advantage of a 16-year-old site, they do offer a look at fresh burials and will document how they evolve over time with the remote sensing techniques available, particularly with respect to drone-derived high-resolution (1.4 cm/pixel) orthomosaics (Figure 9), digital elevation models (Figure 10), and vegetative indices (Figure 11), which could factor significantly into the Pre-Search phase of the GSS.

Current work is limited to consumer-grade drone cameras that filter out the majority of light beyond the visual spectrum, but it is hoped a Near Infrared (NIR) or Red Edge (RE) drone camera will be available to facilitate robust NDVI analysis on the simulated graves as the vegetation changes through seasons and over subsequent years.
These simulated graves do not have significant topographic relief (less than 30 cm), and the algorithm Drone Deploy uses to calculate the DEM did not resolve any features at the grave site. Terrain modeling, which strips away the vegetation and only models the ground surface, may be able to resolve these small features, but this technology is not available to the authors at this time. Terrain or digital elevation modeling may be stretched to the limit of their capabilities when resolving a feature on the order of 20 or 30 cm, but when combined with vegetative indices, could verify the existence of a potential grave, even when ground searches and orthomosaics may fail.

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