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MEMENTO MORI: Carbon Emissions of Different Types of Human Burial & the Land Use Futures of Cemeteries in the United States

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**MEMENTO MORI: Carbon Emissions of
Different Types of Human Burial & the Land Use
Futures of Cemeteries in the United States**

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Master of Advanced Studies in Climate Science & Policy

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Finally, I would like to thank anyone who reads this paper for their time and attention. We are all mortals who will experience death (whether it be our own mortality or someone else’s) within our lives. Acknowledging and accepting such an experience as a part of life as

opposed to shying away from the anguish it can bring is the core of the human experience:
everything will always be changing; take nothing for granted, as it is all temporary.

Project Abstract

As the saying goes, there are two things certain in life: death and taxes. Taxes aside, death is something that every person with a body will at some point or another come into contact with and/or experience for themselves. The purpose of this study is to analyze the carbon footprints of different types of burial, including but not limited to, traditional burial, natural organic reduction, and alkaline hydrolysis. Gaining a better understanding of the carbonic impacts of our chosen methods of burial can enable individuals to make informed decisions as they plan their or one of their loved ones' burial. In tandem with methods of burial, it is also essential to examine the function of cemeteries within our society. This study analyzes historical uses of cemeteries and the laws that influenced their formations, as well as looking into evolving present-day uses of cemeteries. It includes an examination of the Green Burial Council's different Green Cemetery Certifications, and an assessment of how those cemeteries function within their communities. Finally, this study presents recommendations regarding the most environmentally-friendly methods of disposition and types of cemeteries to be buried within. This analysis and assessment will be used to inform those who are environmentally conscious to make the best decisions possible for them for their own burial arrangements. It will also ideally contribute to a broader conversation about scientific topics that may not necessarily be publicly discussed, due to personal discomforts or societal taboos.

Context, Motivations, & Research Questions

The Evolution of American Burial Practices

Historically, traditional below-ground burial has been the primary burial style of human remains within the United States (Slominski, 2023). A dead body is brought to a funeral home, where it is then embalmed, dressed, and put in a casket. Then, after a viewing for mourners, this casket is placed in the grave, within a vault at a plot on a cemetery. The vault is then sealed, the dirt replaced over the top, and the gravestone erected in a person's memory. It is important to note that the vault will not keep the necroleachate from leaching into the soil; rather, it exists to maintain the leveling of the ground within the cemetery. Without a vault, the ground would cave in as the body and casket decompose, filling the space left behind. While styles of burial have been relatively consistent over the course of history, the accoutrements that serve as a part of it, such as casket, headstone, and the accompanying service can vary greatly from person to person. More recently, this has led to attention being placed on the funerary industry for how expensive all of these products can be, and whether or not it is truly ethical to encourage families or individuals to spend incredible amounts of money on their loved ones.

The traditional style of embalming a body prior to burial was born of necessity but endured out of popularity. Embalming is a burial practice originating from ancient Egypt and was popularized in the United States during the Civil War when bodies of deceased soldiers were preserved and then transported back to their home states so their families could bury them (Britannica, 2023). Additionally, this practice was made more widely popular by Abraham Lincoln's assassination in 1865, as his body was embalmed and shipped on ice from Washington, D.C. to Springfield, Illinois (Britannica, 2023). As his body lay in state and Americans came to see him, the United States' oldest burial trend took root. The trend of embalming carried on for

some time, at the consumer's detriment. The funeral industry can be incredibly expensive, and having a traditional burial can cost families anywhere from \$2,000-\$10,000 for the cost of the casket alone (Federal Trade Commission, n.d.). After some time, families began to search for more cost-effective alternatives to dispose of their dead. Families without bodies to be embalmed or worked upon looked for a non-casket burial option. Enter: cremation. Cremation involves placing the body in a flammable box and sticking the whole bundle into what is effectively a giant oven. The result is a very fine grained ash that is typically pale-grey in color (Cremation Solutions, n.d.). Cremation didn't surpass traditional burial in popularity until the early 2000s, but accounted for 59% of all burials on American soil in 2022 (Slominski, 2023). While the convenience and simplicity of cremation was appealing to consumers, it does have a rather high environmental impact. Because of this evolving environmental awareness, burial trends are shifting once again. Now, many individuals are moving towards more sustainable burial practices that do not cause so much environmental damage.

Within the past decade, many different methods for environmentally-friendly forms of burial have been suggested. Some novel concepts, such as tree pods and mushroom suits, do not actually provide the environmental benefits they purport. Tree pods are a process in which a corpse is folded into a pod that is then planted under a sapling of their or their family's choosing (Harries, 2023). However, making the body properly fit into the pods toes the line of mutilating a corpse; most funeral service providers decline to work with them. The idea behind mushroom suits involved burying the dead in a suit made of mushrooms, spores, and other decomposers therefore ideally aiding in the decomposition of their remains (Lee, 2016). The scientific concepts behind the suits have not been fully tested and use only oyster and shiitake mushrooms

(Campbell, 2016). However, there are three main sustainable burial methods that *are* effective and have much lower carbon footprints than traditional methods or cremation.

As times and consumer preferences are changing, the death care industry must also adapt. Recently, technology such as alkaline hydrolysis, Natural Organic Reduction (NOR) and what is now referred to as green burial have emerged. The first is known as alkaline hydrolysis (AH), which has been legally characterized as a form of cremation and is colloquially known as water cremation. There are several manufacturers of these devices and they all operate in different ways. In broad terms, the process for AH is as follows: the body is laid on a metal tray that is inserted into a machine that effectively functions like a massive dishwasher. Within this machine, a mix of water and alkaline substances is forced at the body at an incredibly high velocity, melting the flesh and breaking it down to its most basic components: lipids, amino acids, and nucleotides (Slominski, 2023). The resulting bones are dried and mechanically pulverized. Sometimes, the liquid is dumped down the drain into the municipal water system (Slominski, 2023). While some members of the public may be uncomfortable with the idea of particles of human remains floating around in the municipal water system, it is important to acknowledge that this is not the case. The resulting liquid from AH is totally sterile and the soft tissues are broken down to the molecular level, so it is no longer even recognizable as human remains (Slominski, 2023). In some cases, the liquid remains are retained because it contains valuable plant nutrients. It can be returned to the family for ritual use or donated for agricultural purposes. In terms of environmental impact, the water usage is on par with the amount of water a person uses in a day. And, the energy requirements and air-borne emissions are far less compared to cremation (Slominski, 2023).

Secondly, Natural Organic Reduction (NOR), also called terramation, is essentially the composting of human remains. Upon death, the body is transported to an NOR facility where it is placed in a pod that is full of alfalfa, wood chips, and straw. The pod is occasionally spun which assists in the decomposition process (Slominski, 2023). This process was pioneered in Seattle, Washington, which was the first state to legalize this process. There are now 8 other states where the process is legal, including Colorado, Oregon, Vermont, California, New York, Nevada, Arizona, and Maryland. There is also legislation to legalize NOR pending in multiple other states. This type of bodily disposal results in approximately one cubic yard of compost that the surviving family can spread at a location of their choice. Some facilities also partner with outside organizations where the compost can be donated (Recompose, n.d.). This practice works incredibly well for cities with limited amounts of physical space to store their dead and to designate as cemeteries.

Finally, the sustainable burial practice that has existed longer than both embalming and cremation is green burial. Green burial simply takes the body, wraps it in either a shroud or dresses it with clothes that are easily biodegradable, and then places the body in a grave with or without a casket. If the deceased chooses to be buried with a casket, it is done with a naturally-made, untreated material, such as pine or whicker (Green Burial Council, n.d.). This practice has the least impact on the environment, and is also seen throughout multiple cultural traditions across the world. As methods of burial change, the ways in which our cemeteries operate must also adapt to accommodate consumer preferences.

Cemetery Usage Within the United States

Cemeteries provide a unique challenge when planning the development of communities. Generally, cemeteries are subject to local community zoning and planning regulations. The land for cemeteries is typically acquired via eminent domain; urban planners do not recommend prohibiting cemeteries within city limits (Lehrer, 1974). Preemptively placing cemeteries outside city limits to encourage internal urban growth can impede future community development (Lehrer, 1974). Instead, cemeteries should usually be established in residentially-coded zones (Lehrer, 1974). That being said, the official zoning usage of cemeteries is historically murky. Some cemeteries operated by religious institutions were once considered “religious use,” but some courts decided cemeteries cannot be zoned as such (Lehrer, 1974). For the most part, cemeteries do not have their own land use classification and are instead designated as a semi-public space, or, outdoor space that is privately owned but open for access to all.

The difficulty with establishing specific locations for cemeteries is that the land needed for them is held in perpetuity. Hypothetically, designating land for use in perpetuity could result in the world’s lands steadily filling up with cemeteries to accommodate the dead. Locating the optimal space to establish a cemetery is an essential element of city planning, as legal obstacles make removal or relocation incredibly difficult or virtually impossible. The problems involving cemeteries can generally be divided into two main categories: those involving already existing cemeteries and those involving proposed cemeteries. Existing cemeteries can pose problems for communities when they fall into disrepair or prevent further community improvements (American Society of Planning Officials, 1950). While it is relatively straightforward for communities to repair and maintain an existing cemetery, it is much more difficult to remove or relocate one. The greatest risks cemeteries can pose to their communities are physical health

hazards. For burials involving embalmed remains, the decomposition process can develop a necroleachate that matures from the human remains and embalming fluids (Franco et al, 2022). This necro-slurry can find its way into community water tables and the surrounding soil because its high density makes it travel much quicker than water (Franco et al, 2022). This potential leakage can expose communities to heavy metals like lead, copper, zinc, and nickel that can cause damage to the neurological and gastrointestinal systems and encourage the development of cancer (Franco et al, 2022). For cemeteries located in smaller communities, the proximity of a funeral home to residential areas can also cause negative health impacts, as it releases copious amounts of carbon dioxide and particulate matter when conducting cremations. In particular, residing near a funeral home can subject residents to increased air levels of CO₂, NO_x, SO₂, as well as mercury from dental features such as fillings or caps (Franco et al, 2022).

While cemeteries are necessary parts of communities, their physical location is paramount for their long-term sustainability. Municipal areas may seek to establish cemeteries outside of their city limits, but this is short-sighted. As previously mentioned, cemeteries can pose unique developmental problems for growing communities (Capels & Senville 2006). In order to adequately incorporate the cemetery into the city, it is critical to consider the direction of future development within the community. For example, multiple city plans within the state of California, such as Claremont, Culver City, and Paradise mention cemeteries, however mostly as an aside. There is little to no discussion of the longer-term plans for their cemeteries, other than how they plan to maintain them. Of the three plans that were examined for this project, only Culver City's general plan from 2000 included an extended discussion of cemeteries, which focused on the expansion of the Hillside Cemetery within city limits. The city itself does recognize cemeteries as a specific land-use designation, in order to aid in their longer-term

planning (City of Culver City, 2000). That being said, that unfortunately is the extent of the discussion that takes place within the city plan. In general within the state of California, no city plans discuss how they plan to use the cemetery as time marches forward, the discussion of cemetery planning generally refers to site maintenance. Additionally, forecasting capacity for cemeteries can be incredibly difficult. In particular, as advancements in medical science and technology have been made, the lifespans of the average individual have gotten longer, therefore reducing cremation rates and other statistics that are considered when determining cemetery size (Capels & Senville 2006).

To help a community develop to its fullest and healthiest extent, it is important to prioritize the values of sustainable development when situating cemeteries in a city's general plan. As defined by the well-known document *Our Common Future* (1987) from the Brundtland Commission, "sustainable development is a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development; and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations" (page 43). In short, the common definition for sustainable development involves what are known as "the three E's: environment, economy, and equity" (Godschalk, 2004). How can cemeteries fit into such a broad definition? They can be used by land use planners as a tool to bring green space into urban areas, as well as provide boundaries for the growth and development of suburban and rural communities.

As it has been noted with the rapid urban development in the U.S., third spaces, or places where members of a community can gather and recreate for free, are shrinking rapidly (Shukla et al, 2024). On top of this, with the broadening of urban sprawl, it is becoming incredibly difficult for cities to adequately maintain or introduce more green spaces in their community, unless it is

made a priority by planners. Cemeteries, while having a unique purpose in our communities as a place where members of the community can visit their loved ones, they also possess the to be used as a place of relaxed recreation in urban areas, as green spaces are harder and harder to find.

Motivations Behind this Project

The main motivation for this study is the present lack of United States focused research on the topic. As can be seen from the background section of this paper, sources cited range from 1950 to 2024. A quick Google search can offer an interested party a swath of information, but it can be difficult to find sufficient information about the American markets, as it is an under-researched area. As Europe and European countries are much smaller than the United States, those countries have already been dealing with many of the cemetery problems acknowledged in this study, such as overpopulation, improper care, or improper burial. Fortunately, there is quite a bit of research available for those who may be interested in being buried overseas, however, as this study is United States focused, effort was made to keep the sources America-specific, proving to be a challenge. In reference to the American funerary industry, it is generally accepted that it is predatory and not particularly eco-friendly, but there is a lack of readily-available scientific research that is aimed at educating the general public about their burial and service options (Slominski, 2023). People deserve a dignified burial and death experience, as much as possible, and it is important that individuals educate themselves about the options that are available in order to make the best decisions for themselves.

In a similar vein, there is also a noticeable lack of discussion on the topic socially, as there are many Western taboos in reference to the experience of death, as individuals are forced

to confront their own mortality. Pre-planning death care has become more and more popular, as options for burial styles and flexibility of services is expanding, individuals are becoming more willing to investigate the options most available to them. It is important for individuals to engage in pre-planning of their own funerary services because it enables consumers to have the most appropriate service for them. Experiencing the COVID-19 pandemic and the large death toll within the United States beginning in 2020 and the difficulties that came with handling those deaths further brought the question of what we do with our bodies into the public's mind.

Research Questions

1. What are the carbon impacts of different methods of burial of human remains?
2. How can cemeteries be used in a more sustainable way within their communities? Are there opportunities in which we can approach their land use differently?
3. How do humanity's rising concerns about climate change impact the death care industry and encourage a changing of practices?

Study Methodology

This project takes a two pronged approach, in order to adequately address the broad grounds of both burial methods as well as the land use of cemeteries. The first direction this project addresses is the various carbon emissions of different methods of human burial. With assistance from Dr. Dan Ziskin of The Natural Funeral, we have developed a study for publishing that examines the different carbon emission rates from different methods of burial. The main types of burial that the study focuses on are conventional casket burial, flame cremation, and then the three greener technologies that are gaining popularity—alkaline hydrolysis, Natural Organic Reduction (NOR), and green burial. The study breaks down each form of burial into its most basic components, the steps that must be taken in order to perform a successful form of whichever method the decedent or family chooses.

The second direction that this project takes is a focus on the land use futures of cemeteries in communities. Site tours were taken at Hillcrest Cemetery on Bainbridge Island (April 2nd, 2024), Cedar Lawns in Redmond (April 3rd, 2024), and the City of Sumner's cemetery (April 4th, 2024) were the sites visited in Washington; Graceland National Cemetery and Arboretum was visited in the state of Illinois (May 9th, 2024), and Oak Hill Cemetery in Montgomery County, Indiana (May 13th, 2024). Additionally, at each of these sites, interviews were conducted with cemetery staff. The primary filter for selection of sites to visit is that most of the sites visited, other than Graceland Cemetery, possess hybrid cemetery certification from the Green Burial Council (GBC). Oak Hill Cemetery in Crawfordsville possesses a natural certification. The reason Graceland National Cemetery was included in this project, despite not possessing a GBC certification, is because it is both a registered arboretum and federal historical

site, in addition to being a cemetery. The use of a cemetery as a registered arboretum is unusual and of interest in terms of the scope of this study.

The hybrid cemetery certification is the most basic GBC cemetery certification that is offered, there are also Natural Burial Grounds and Conservation Burial Grounds certifications. At its core, the Hybrid Cemetery certification acknowledges that the cemetery in question is legally allowed to perform green burials on-site and they adopt language similar to that of the GBC's when discussing green burial. More on these certifications in the figure below (Green Burial Council, n.d.).

**Green Burial Council
Cemetery Certification Standards**
Revised and adopted January 5, 2020

	Standard	Hybrid Cemetery	Natural Burial Grounds	Conservation Burial Grounds
1.	Accurately represent earned level of GBC certification in marketing materials, websites, and conversations with the public, clients, and the media.	✓	✓	✓
2.	Provide clients and families with the opportunity to participate in the burial and ritual process, in keeping with state law and with these standards.	✓	✓	✓
3.	Accept for burial only decedents that have not been embalmed or those embalmed only with GBC-approved, nontoxic chemicals.	✓	✓	✓
4.	Prohibit the use of a vault (partial, inverted, or otherwise), a vault lid, concrete box, slab or partitioned liner in the burial plot.	✓	✓	✓
5.	All burial containers, shrouds, and other associated products made only of natural, biodegradable materials.	✓	✓	✓
6.	Develop a <i>Maintenance and Operations Manual</i> to be utilized by all staff members, contractors, and volunteers to implement site goals, policies, and best practices.	✓	✓	✓
7.	Establish an endowment fund to ensure the long-term maintenance of the site by setting aside at least 10% of all burial plot sales.	✓	✓	✓
8.	Conduct an <i>Ecological Impact Assessment</i> , starting with a property baseline document that includes existing ecological conditions and sensitive area analysis. Update periodically to assess future property/habitat conditions and plant inventory.	✓	✓	✓
9.	Restrict access and burial operations within sensitive areas as identified in the <i>Ecological Impact Assessment</i> .	✓	✓	✓
10.	Use operational and burial practices that have no long-term degradation of soil health, plant diversity, water quality, and ecological habitat.	✓	✓	✓
11.	Limit the type and size of memorial markers so that they do not impair the ecological conditions and aesthetic of the natural cemetery landscape.	✓	✓	✓
12.	Site conditions as identified in the <i>Ecological Impact Assessment</i> and sensitive areas analysis, will restrict burial density on the property; therefore, Natural and Conservation burial grounds will have limits to allowable burial density. For Natural Burial, the cemetery's average density shall not exceed 500 burials/acre. For Conservation Burial, average density shall not exceed 300 burials/acre. Burial density of sensitive areas may be transferred to less restricted areas on the property to maximum densities of Natural Burial - 600/acre, Conservation Burial - 400/acre.	✓	✓	✓
13.	Establish and apply strategies that conserve, preserve, enhance, or restore the historic native or natural habitat and flora of the region.	✓	✓	✓
14.	Conserve or restore a minimum of 20 acres, or 5 acres if contiguous to other protected land.*	✓	✓	✓
15.	Operate in conjunction with a government agency or a nonprofit conservation organization that has legally binding responsibility for perpetual monitoring and enforcement of the easement.	✓	✓	✓
16.	Guarantee preservation of the burial ground by deed restriction, conservation easement or other legally binding and irrevocable agreement that runs with the land and is enforceable in perpetuity.	✓	✓	✓

*All existing certified burial grounds not meeting these changed standards shall be grandfathered and allowed to maintain their current GBC classification.

Figure 1: The various qualifications for certification

Results

Burial Methods

As calculated with Dr. Dan Ziskin and Tomás Escorza, the total carbon emissions of Traditional Burial, Flame Cremation, Alkaline Hydrolysis, Natural Organic Reduction, and Green Burial are as follows:

Traditional Burial Carbon Emissions	
Involved Process	Emissions in CO ₂ e (kg)
Materials (Casket, Marker, Vault)	224.5
Procedure (Digging Grave, Placing Marker, Closing Grave)	20.1432
Maintenance	12.21606486
Sequestration (Burial of Casket and body)	-118.464239
Total Emissions	138.395

Note: Does not factor in embalming

Flame Cremation Carbon Emissions	
Involved Process	Emissions in CO ₂ e (kg)
Materials (Shroud, Cremation Container, Methane, Urn/Container)	146.073
Process (Body Emissions & Cremulation)	80.85
Total Emissions	226.92

Alkaline Hydrolysis Carbon Emission - Specifically FC500	
Involved Process	Emissions in CO ₂ e (kg)
Physical Procedure (Heating Water, Hydrolysis Process)	9.51
Materials (Alkaline Solution, Urn/Containers)	128.1462
Aftercare (Cremulation, Dehydrator, Driving)	13.99
Sequestration	-86.4282
Total Emissions	65.13

Natural Organic Reduction Carbon Emissions	
Involved Process	Emissions in CO ₂ e (kg)
Procedure (Set Bedding, Aeration, Turning, Cremulation, Dehydrator)	39.61
Materials (Wood Chips, Straw)	27.552
Aftercare (Loading into Truck, Drive to Destination)	18.54
Sequestration (Wood Chips, Straw, Body)	-554.288
Total Emissions	-468.59

Note: As the NOR process is relatively new, there are many different iterations of it that have varying levels of emissions. Additionally, the amount of electricity needed to keep the facility powered is not factored into this calculation.

Green Burial Carbon Emissions	
Involved Process	Emissions in CO ₂ e (kg)
Burial Procedure (Digging Grave, Placement of Marker, Closing Hole)	12.7512
Materials (Shroud, Eco-Casket, Marker)	20.804
Aftercare (Site Maintenance)	0
Sequestration	-97.278
Total Emissions	-63.7228

Note: These calculations assume the grave is closed with a backhoe, but some sites toured indicated they only use a backhoe to open the grave and still fill by hand.

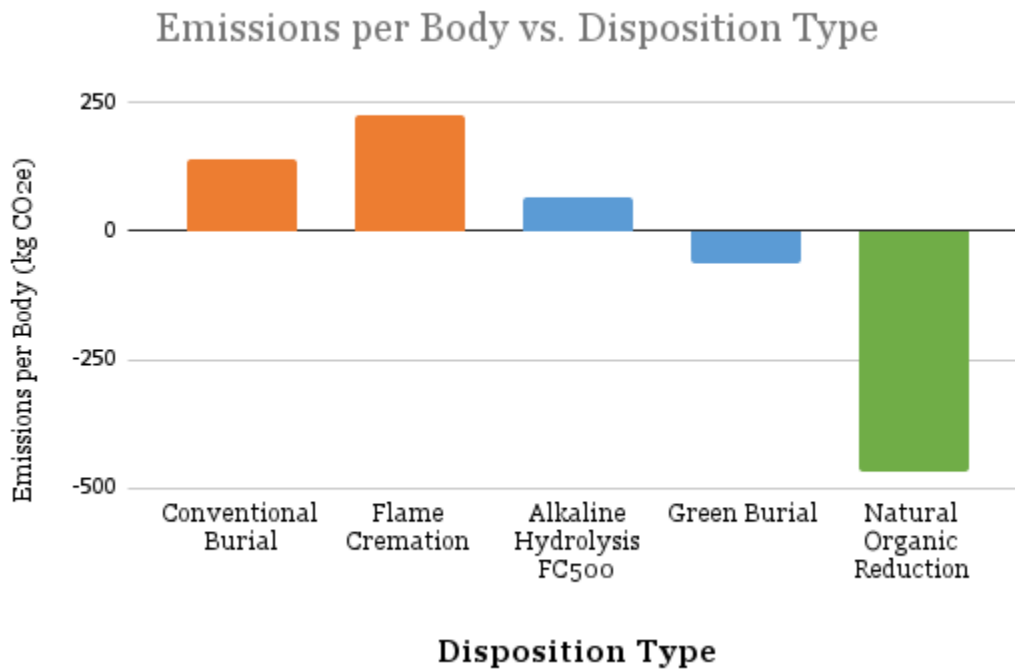


Figure 2: Graph displaying results of analysis

Data Analysis

As indicated by the presented data, the two methods of burial that provide maximum carbon sequestration are green burial and NOR, in that order. It is important to note beyond the note under the table that NOR is one of the newest sustainable burial technologies and the practice is therefore evolving and changing regularly. Different organizations perform slightly different processes and therefore this data can only be taken as guidelines or recommendations as opposed to fact set in stone.

As anticipated, flame cremation and traditional casket burial, respectively, are the two most carbon emitting methods. These calculations also do not factor in the further damage that can be caused to the environment through embalming (not within the scope of the study), or the damage that spreading cremated remains can do, which is highly location dependent. Oftentimes, individuals release cremains into bodies of water, which is a violation of the Clean Water Act, which requires cremains be released at least three nautical miles from shore (The Code of Federal Regulations, n.d.). Beyond just bodies of water, cremains are often dispersed on lands in ways that do not follow regulation and these infractions are rarely enforced.

Site Visits

As mentioned above, cemeteries were toured within the states of Washington, Illinois, and Indiana. In the state of Washington, Hillcrest Cemetery, Cedar Lawn Cemetery, and the City of Sumner Cemetery. In Illinois, Graceland Cemetery and Arboretum was toured, and then in Indiana, Oak Hill Cemetery was toured. These sites were chosen primarily due to their Green Burial Council (GBC) certifications, with all of the sites in Washington having a Hybrid

Certification, the site in Indiana having a Natural Certification. Graceland Cemetery and Arboretum was allowed as a part of this study due to the fact that it is a certified arboretum. At all of these site visits, interviews with staff members were also conducted. The topics that were included in the interviews ranged from basic functions of cemeteries, zoning and permitting regulations, future predictions for their cemeteries, and assessment of the attitudes of their communities.

*Washington
Hillcrest Cemetery*



Figure 3: The entrance to the site

Hillcrest Cemetery	
Type of GBC Certification	Hybrid
Ownership	Privately Held
Zoning/Permit	R4; Single-Family Residential with Conditional Use Permit
Capacity	Possibly Approaching Capacity
Site Maintenance	Mow Once a Year, No Pesticides/Fertilizers

Hillcrest Memorial Cemetery is a privately owned and managed cemetery located on Bainbridge Island, Washington, which is 10 miles across Elliot Bay from Seattle. It is a residentially-zoned space, specifically R4 (the land is zoned specifically for the construction of single family homes) with a conditional use permit establishing it as a cemetery from 1958. This means that the site is exclusively allowed to be a cemetery; there are no other developments allowed on the land, such as a crematorium. The cemetery is Green Burial Council Hybrid certified, although the cemetery owner acknowledged that they primarily do green burials over traditional casket burials. When they began to offer more methods of burial beyond the traditional casket and cremation, they have managed to boost their business. Washington is a progressive state in terms of burial practices, notably being the first to legalize NOR, however they feel that the state is not thinking practically long term about cemeteries. The city of Seattle even has a moratorium forbidding the establishment of any cemeteries within city limits, or the expansion of existing ones, which is concerning, given that the current population of the city sits at 737,015 (City of Seattle, n.d.; Walters, 2018).

Hillcrest’s locality, Bainbridge Island, population of 24,825, does fortunately have eight cemeteries, so they are not incredibly concerned about running out of space quite yet (United

States Census Bureau, n.d.). Fortunately, Bainbridge Island has not forbidden further establishment of cemeteries if needed and it also happens to possess a rather robust climate action plan. That being said, the plan does not acknowledge or involve cemeteries in any capacity, nor does the city discuss cemeteries much at all. With the island's aging population with many opportunities for different methods of burial, it will become a more desperate discussion in the future if plans are not made soon.

Hillcrest Cemetery, specifically, is unique in the sense that it mixes different types of burials together, as opposed to having a set green burial section that is removed from other styles of burial. A traditional casket burial with a vault may be placed right next to someone buried in nothing but a cotton shroud. Originally, the green burial plots were all dug and filled by hand, but with the amount of burials that they have had recently, they purchased a backhoe to make the process easier on the employees and more efficient. The burial sites are still filled by hand, to this day. The cemetery itself is also intentionally designed as a memorial park, with the expectation that flat grave markers will be used at the gravesites; this both makes maintenance of the site easier as well as giving the cemetery more of a park-like appearance. The maintenance of the cemetery is incredibly minimal—they use no pesticides, no fertilizers, and in fact engage in no active land management, save mowing the grass every so often. In terms of grave decorations, the park allows native plants to be planted at grave sites and otherwise restricts other forms of decoration. There are some exceptions to this, for example there are a few people who passed tragically early who's families maintain the decorations of the graves on a regular basis. The fact that the sites are so well cared for is what encouraged them to make such an exception.

Given that this cemetery is located on an island, there is a discussion to be had regarding what would occur when capacity is reached. Both funeral directors acknowledged that they are

far from reaching capacity, especially because the cost of land in Bainbridge Island is so prohibitive to expand. Apparently at one point one of the individuals who lives near the cemetery in fact actually tried to purchase it, with the hopes of developing it, but did not realize that in order to do so every body must first be disinterred, and that requires consent of every living relative the deceased has. They have found that, on occasion, there are individuals who will buy a space with them but then actually forget they own it, so that plot of land actually sits unused; one can't simply bury a different person at that site. In capacity concerns, however, the director acknowledged that the development of a columbarium, or essentially a mausoleum for cremated remains. The idea is that these could be established under or above ground, in an effort to create space to store remains while ensuring that surviving loved ones have a location to visit in remembrance. Additionally, if the cemetery fills, there is an established endowment fund designed to continue to pay for the maintenance of the site that is paid for at the time of purchase of a space on the site.

In terms of land use, the directors feel that cemeteries are an underutilized space of our communities. In their practice, they have regularly observed that many individuals have not considered how they want their body to be disposed of. Likely, this can be attributed to the general Western taboo and aversion (as mentioned previously) towards discussions of death and burial. They note that as attitudes are changing and moving towards more sustainable preferences, there are opportunities to use cemeteries as spaces for the community to recreate and relax, making cemeteries function closer to that of a park as opposed to having its own entirely separate usage. This would allow cemeteries to become a much more accessible third space in their communities, or a space in which locals can spend time out of their own property without having to spend money.

Additionally, they also have observed that as cremation has become the majority of burials in the United States, many cultural burial traditions have been lost. Some cultures, such as Hinduism, do prefer cremations to traditional burial. However, as it has become the more cost-effective method of burial, people have been putting their traditions aside in order to meet a funerary budget. The directors also note that in terms of cost, a green burial is typically surprisingly cheap in comparison to a casket burial or cremation, especially with the use of a

backhoe to help them dig the grave itself. They have found that people often think that green burials are more expensive than they are in reality.



Figure 4: One of well-maintained gravesites given decoration exceptions.

Cedar Lawns Cemetery



Figure 5: The entrance to the green burial section

Cedar Lawns Cemetery	
Type of GBC Certification	Hybrid
Ownership	Corporate
Zoning/Permit	Nonresidential Zone with a Limited Use Permit
Capacity	Not Approaching Capacity - Centuries Left
Site Maintenance	Pesticides/Fertilizers used to Maintain Path

Cedar Lawns Cemetery located in Redmond, Washington is primarily a memorial park style cemetery with sections for larger, above-ground gravestones. This site also features a small section for green burial that the General Manager acknowledges is relatively full, but not yet at capacity. They intentionally do not mix types of burials and are very intentional about sectioning



off each method in its own area. In the present, the most common type of burial they do is the burial of cremains. It was very apparent that this cemetery was corporately owned; those interviewed acknowledged that only about five minutes of preparation was completed despite being sent a question list in advance. The tone of the tour was very business-forward, brief, and it was difficult to obtain information regarding permitting uses. In terms of the cemetery itself, the green burial section is less frequently

maintained than the rest of the cemetery, in an effort to reduce the carbon footprint of the area.

That being said, the green burial site is probably an eighth of the land that the cemetery actually occupies, so the total environmental impact of the cemetery is unclear. Additionally, the path through the green burial section is maintained using pesticides. The director also acknowledged that their cemetery wouldn't exist at its current location if they were trying to establish it in the

present, as the cemetery is located within an aquifer recharge zone, however the cemetery was incorporated and permitted for before the aquifer recharge zone. Figure 6 (Above): A gravesite in the green burial section of the cemetery.

This cemetery is corporately owned and possesses a limited use permit as a cemetery in a nonresidential zone. As mentioned by the director, it is roughly \$10,000 a burial space within this cemetery; the corporation also doesn't allow buyback of spaces to take place, so if people no longer want the space they have to resell it of their own accord. They also acknowledged that some people are discouraged from buying spots at their cemetery due to its proximity to a relatively busy road. Unlike Hillcrest Cemetery, the director noted that most individuals do not forget that they own rights to spaces in this cemetery. They also mentioned, in agreement with Hillcrest's assessment, that green burial is often much cheaper than other burial styles, much to the consumer's surprise. Figure 7 (Below): The walkway through the green burial section.



City of Sumner Cemetery



Figure 8: The entrance to the green burial section

City of Sumner Cemetery	
Type of GBC Certification	Hybrid
Ownership	City/Municipality
Zoning/Permit	Low-Density Residential
Capacity	Not Approaching Capacity - Centuries Left
Site Maintenance	Mow Site Once a Year, Uses Pesticides

The City of Sumner cemetery, located in Sumner, Washington, was a well-maintained and developed space within the city. Due to the way the city's finances are organized, cemetery management actually falls under the responsibility of the city's parks system; which was apparent in the way this cemetery was maintained. Figure 9 (Below): The one buried grave at the green burial section.



The cemetery itself is primarily composed of standard burial practices (i.e., cremation and traditional casket burial); there is a newly established green burial section in the back corner of the space. Presently, there are 40 available plots, with four already sold and one burial performed on site. During the burial process, a backhoe is used to dig the grave initially, but it is

filled by hand in order to reduce the carbon footprint of the process. The cemetery also makes an effort to use pre-existing biomass accrued from other parts of the cemetery as the biomass added into the gravesite. The section is maintained as minimally as possible; it is mowed once a year and pesticides are not used in the space. The markers used on the grave sites in this section are restricted to locally sourced boulders, which then can be engraved.

When asked about their GBC certification, the cemetery managers noted they were planning on having a green burial section regardless of whether or not they actually successfully obtained certification. The interviewees acknowledged that it was fairly easy to obtain the Hybrid certification; there was paperwork that was filled out and certain language adopted to match that of the GBC, and that was essentially all. They have observed that the general trend of the funerary industry at this point is largely shifting towards greener burials; people are not as interested in the more “traditional” styles of burial, unless they have specific cultural preferences. At this point in time, they do not have sections specifically designated in their cemetery for different cultures, however, families are often buried near one another and have resulting spaces with high concentrations of specific types of people, for example there is a Catholic Swiss section.

In terms of capacity, the city is not concerned about running out of space any time soon. They are apparently decades and potentially a century or two from reaching full capacity. The zoning for this particular location is also low-density residential, similar to some of the other sites that were toured. This zoning allows for different types of specified use and they have a conditional use permit that allows for the land to be used as a cemetery. In addition to being a cemetery, some of the land that is less desirable as burial plots, due to its proximity to the road, is

used as a tree nursery for the city, enabling the city to purchase smaller trees at a lower price and then develop them into their desired size prior to planting.

Illinois

Graceland National Cemetery & Arboretum

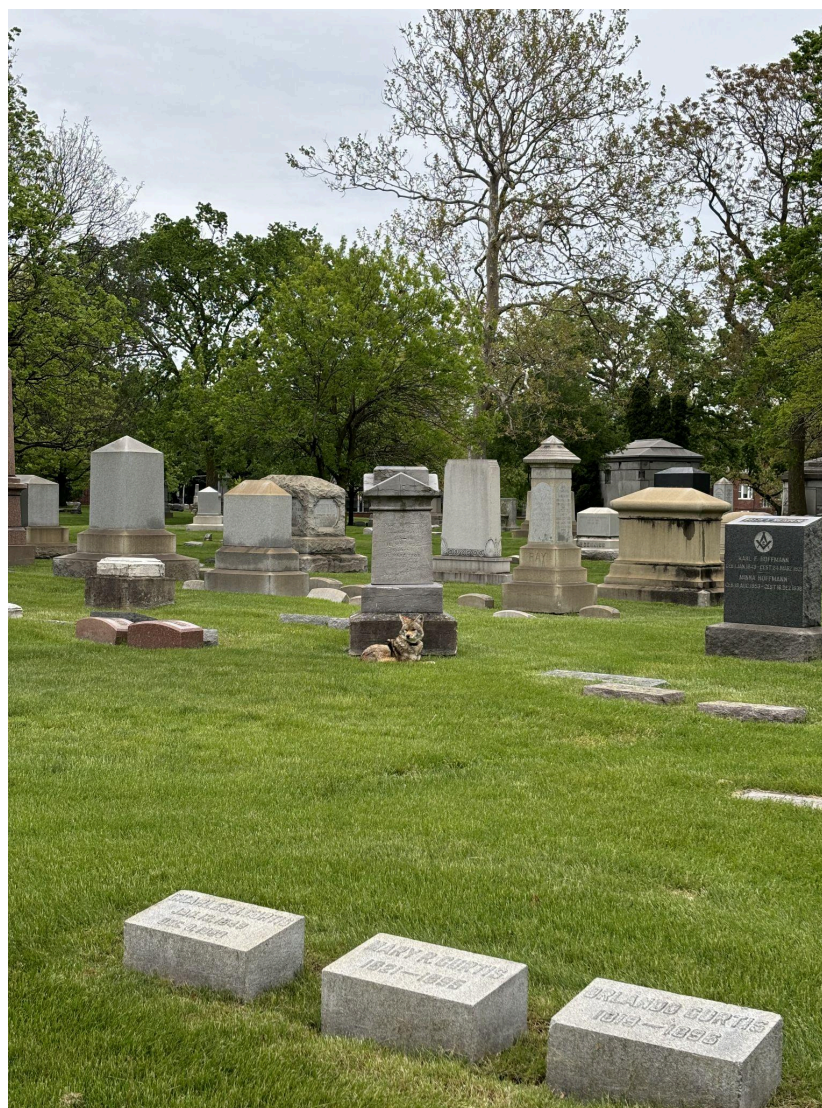


Figure 10: A member of the coyote pack that lives at Graceland

Graceland National Cemetery and Arboretum	
Type of GBC Certification	N/A; Level 2 Arboretum Certified
Ownership	Trust
Zoning/Permit	Cemetery
Capacity	Technically Full - Making Space
Site Maintenance	Pesticides/Fertilizers used to Maintain Path

Graceland National Cemetery and Arboretum is located right by Wrigley Field in Chicago, Illinois. Graceland has been privately owned since its establishment in 1860 (Graceland Cemetery, 2023). The cemetery is presently owned and managed by the Trustees of Graceland Cemetery Improvement Fund, a not-for-profit trust that uses the revenue from burials to maintain the grounds and the burial sites within the cemetery (Graceland Cemetery, 2023). The cemetery was added to the National Registry of Historic Places in 2001 and its official land use classification is funerary, with both cemetery and mortuary designations (National Archives Catalog, n.d.). The cemetery was intentionally designed in partnership with multiple landscape architects to evoke Victorian-era gardenscapes with native plants that encourage the landscaping to thrive (Graceland Cemetery, 2023). Presently, Graceland Cemetery is open to the public; the grounds are also a certified arboretum that draw many tourists and Chicagoans alike, not only as a burial site, but also as a space for contemplation and recreation. Graceland serves as a reminder that, with careful planning and execution, cemeteries can serve as a space to honor the dead while also providing larger greenspace benefits to the broader community.

The cemetery itself is full from the space that was originally allotted for gravesites. The Director of Graceland noted that they are doing what they can to free up more space for those who want to be buried here, but there is not much remaining. Presently, they are excavating some

of the less-used existing walkways to free up space. Additionally, they are reclaiming unused spaces from families who made plot purchases long ago, or repurchasing spaces that families no longer have a use for. Upon its initial establishment, the cemetery did host a crematorium on site and was in fact one of the first crematoriums within the Midwest. However, with the popularization of cremation and increased air quality regulations from the EPA, they opted to close the crematorium in order to have more usable space. They have roughly 100 burials a year, most of which are cremations. As previously mentioned, this cemetery does not expressly have a green burial certification or an affiliation with the GBC, but it has been included in this study due to its successful land use adaptation beyond purely a cemetery. Despite not expressly having a green burial section, the Director acknowledges that they attempt to be as green as possible in their burials. Given the fact that it is a Level 2 certified arboretum, they do require the usage of vaults with their burials, but individuals have the option of using a bottomless vault, therefore encouraging the decomposition of their remains, as the cemetery also has no specific casket requirements or regulations.

As far as the physical maintenance of the site, they do have an external crew come in for mowing, weeding, and general site maintenance. On the staff that Graceland personally maintains, there are three hired groundskeepers, who assist with burials as well as anything that the landscaping crew may need. They also frequently collaborate with the Morten Arboretum, located in Lisle, IL, which is also the arboretum that issued their certification. The Director indicated that the board is has no plans in allowing their arboretum certification to lapse, however they have no interest in working towards a Level 3 certification, as it requires the hosting of educational programs (which currently already happens to a minor degree), but also an arborist actively retained on staff, and even more trees properly tagged. In short, it is simply a lot



of effort and expense that Graceland does not quite have the budget for. The biggest expense in their budget by far is the maintenance of the site, by a significant amount. Given that this cemetery is presently managed by a dozen trustees and only a small number of burials, a majority of their income is from the 10% of each grave sale that is required to be contributed to the trust, and all of this is invested. It is important to note that it was acknowledged that Graceland is not particularly concerned with making incredible amounts of money, but

instead wants to focus on community involvement and education. Figure 11 (Above): The prairie walking area at the back of Graceland

Currently, in terms of future planning, the team actively works with landscape architects who specialize in historical restorations. Their master plan focuses especially on long term use of their space and how they can manage their space to be most beneficial to their surrounding community. Their National Landmark Certification stipulates that they must have a plan for preservation and future use of the space, therefore encouraging a large amount of this planning. According to the Director, they must maintain as much of the space in its original form as possible in order to maintain the certification.

In terms of land use of the space, the Director notes that most of the visitors that they have on a day-by-day basis actually do not have loved ones buried at Graceland. Even during the



period of my tour, I witnessed several runners, one person walking their dog, and multiple individuals taking walks through the property. Given that it is in the heart of Chicago, just a few blocks from Wrigley Field, it is no surprise that people would visit such a gorgeous and well-maintained space in order to feel closer with nature. It has become a location in which city dwellers can visit to get away from the hustle and bustle of the city itself. The Director notes that it can at time be difficult to balance the wants of the surrounding community with the wants of those who physically have family members buried at this

location—there is a noted generational gap where older individuals feel that the use of cemeteries as a green space is disrespectful to families or those physically buried within cemetery lines.

Figure 12 (Above): Graceland, also known as “The Cemetery of Architects,” features many mausoleums and walking paths.

Indiana
Oak Hill Cemetery



Figure 13: The Green Burial Section at Oak Hill Cemetery

Oak Hill Cemetery	
Type of GBC Certification	Natural
Ownership	Privately Held
Zoning/Permit	Agriculture with Conditional Use
Capacity	Not Approaching Capacity - Centuries Left
Site Maintenance	Mow Once a Year, No Pesticides/Fertilizers

Oak Hill Cemetery is a privately owned cemetery located in Montgomery County, Indiana, just outside of Crawfordsville. The site that was toured was the south cemetery, but Oak Hill also manages two other cemetery locations, both without green burial sites. Within this study, it is the only site with the Natural Certification from the Green Burial Council. That being said, this cemetery has been engaging in green burial practices for about 15 years, just without GBC certification until relatively recently.

The cemetery itself is largely full of traditional casket burials or burials of cremains, as it was founded originally in 1875. There are currently three sections within the green burial section of the cemetery, site A and B are both totally sold and site C is mostly sold. Of these three sites, only a handful of individuals have actually been buried. When the cemetery first started accepting green burials, there was a waitlist for individuals to purchase green burial plots as they were establishing the site. The president of the cemetery noted that a lot of the green burials they do are of individuals actually from other places in Indiana—people are drawn to their cemetery specifically because of their green burial services. Within the state of Indiana, Oak Hill is the only cemetery to have a Natural Certification from the GBC, and one of only three GBC certified cemeteries within the state.

For their green burial section, individuals are not allowed to select a specific plot; they are simply buried in the next available plot in the section. The cemetery allows marker stones and even allows decoration of those marker stones via painting or engraving, but no headstones are permitted. Additionally, there is a pillar erected at the base of each section detailing the names and location of those who are buried in each section. The gravesites themselves are untouched by grounds management, but there are 10-foot paths between each section in order to allow visitors to have a clear path to visit their loved ones. The president indicated that there is a

plan to turn the green burial section in to more of a prairie or park like space, there have been plans made with the Montgomery County Soil and Water Office to come and look over the site in an effort to try to determine the best kinds of native plants to grow within the sections. There has also been discussion of establishing beehives around the sites, in order to pollinate the plants themselves as well as the ample undeveloped prairie land that the cemetery also keeps just beyond the green burial sections.

One of the most interesting points that was made by the president during the interview is the evolution of the green burial industry over time. As mentioned, Oak Hill Cemetery has been

accepting green burial practices for about 15 years, but prior to his affiliation with Oak Hill, the president was working with another (now defunct) funeral home that was one of the first funeral



homes in the state of Indiana to encourage these kinds of practices. He noted that the green burial movement was originally largely focused on maintaining the land as it previously existed, so in the case of the Midwest this would largely mean keeping the land prairie-style and trying to as minimally impact the land as physically possible. However, as the industry has grown, evolved,

and adapted, he notes that the industry (and particularly the GBC) is much more open to a park-style atmosphere, while still considering ecological impacts of choices in greenery and management of gravesites; the industry has made a turn towards a larger variety of uses of the spaces that green burial cemeteries or cemetery sections can provide. Figure 14 (Above):
Sections A, B, & C of the Green Burial Section

Site Visit Analysis & Land Use Recommendations

On the whole, it is clear that the concept of greening death is becoming more and more popular across the country. As the general public becomes more environmentally-conscious, it will be essential for the death care industry to learn to adapt to consumer preferences, as they have previously, with the popularization of embalming and cremation.

As noted by many of those interviewed, access to education about the novel burial technologies is one of the key future elements in order to encourage the evolution of burial practices within the United States. Where burial preferences change, the way in which society at large engages with cemeteries will follow because cemeteries are forced to respond to consumer demand, if burial method is sufficiently important for consumers.

Obtaining a certification with the GBC, whether it be Hybrid, Natural, or Conservation, is a useful first step for cemeteries to begin engaging with green burial practices. Throughout the site tours, it is clear that cemeteries that offer sustainable burial services regularly engage with individuals who are interested in these methods, regardless of precise location. Obviously, in more progressive states, such as those where NOR is already legal or liberal populations are large, there tends to be more open-mindedness and opportunities for these different kinds of

burial. In more conservative areas, it could be useful to consider obtaining a GBC certification in order to encourage that vein of business within a cemetery.

By further educating the public of different burial opportunities, the ways that society approaches cemeteries is sure to follow. By normalizing conversations about death and dying, as well as shifting attitudes about death to be less negative, the public will be more likely to engage with cemeteries as a green space. In doing so, cemeteries could fill a growing void in our urban communities—a notable lack of green space or third spaces available for the public.

As it has been demonstrated by the interviews and tours, these sites are not exceptionally well-suited for these various certifications than others, they simply actively sought out becoming involved with the sustainable burial community, or to be used more as a park-style space. The more cemeteries that seek out such certifications, as it best suits their location, the more opportunities will exist for the public to become further aware and further educated of the green space in the cemeteries near them.

Similarly to individual preferences to burial, it is important to note that every cemetery has a very unique space and position within its community. This opportunity should not be squandered. As it is apparent that zoning codes do not need to be changed in order to encourage the development of existing cemeteries as a more central, communal green space, communities should consider the opportunity that is laying in wait in front of them.

Broader Implications & Further Research

Implications

The implications of this project is relevant to every individual, as every person engages with death at some point in time either within their life, or at the end of their own. Beyond the passing of loved ones, this project emphasizes the plethora of options that are now available for individuals during the burial and memorial process. For this reason, it is important that individuals engage in pre-planning their burial and memorial services. Not only does it take weight off of an individual's loved ones' shoulders, it enables individuals to better choose and budget for a burial and celebration of life that more adequately reflects their views. Without pre-planning, the immediate family is responsible for designing and planning the entire service and burial process without any approval from the deceased. Pre-planning also enables individuals to assert their individuality within their service itself.

Additionally, it is important to consider cemeteries as a possible host of third spaces in our communities, where individuals can connect with nature and spend time outside, even in densely populated urban areas. By encouraging and popularizing greener burial practices, cemeteries will be encouraged to change their approach to land management and hopefully become more sustainable and enjoyable for every member of the community, even if they do not have a loved one buried there. A changing of consumer burial preferences will encourage this shift, but it can also be encouraged by those in charge of managing cemeteries. By encouraging green burials to take place on their properties, it can also encourage a shift in the way cemetery space is used in our communities.

It is also important to acknowledge that, as this is a new and developing technology and policy space for communities, it is very important that individuals do research regarding the

funeral homes and cemeteries that they are working with, as there are already some isolated examples of individuals been taking advantage of the weak enforcement that is currently practiced. For example, within the past year, there was a couple arrested by the FBI within the state of Colorado for horribly mishandling 100+ bodies that were selected for a green burial (The Associate Press, 2024). Even within my own site visits, some sites toured acknowledged concern about cemeteries and funeral homes that could more poorly represent the industry, tarnishing the reputation of sustainable burial for the public.

Recommended Areas of Future Research

From this project, there are clearly many different routes that can be taken when continuing research. In particular, the psychological and sociological aspects of the death care industry should be further explored, as improving our understanding about how to have better conversations about death and burial processes will normalize the conversation. This will enable more information to be available to the public, as opposed to focusing solely on the grotesque or saddening nature of such discussions. Further, it is important to gain a better understanding of how regularly people within the United States are actually engaging in pre-planning of burials and memorial services. This would enable the funerary industry to have a better understanding of the ways in which actors enter their market. This would be both economically useful for the funerary industry as well as informative for the general public as it would again, encourage further conversation about pre-planning services. Finally, as the cemetery and burial laws vary greatly on a state by state basis, and even more so from locality to locality, it will be very important in the future to continue to assess and keep an eye on the evolution of burial practice preferences across the United States. What is an individual supposed to do if they want to be

buried at a particular location, but they are unable to be buried in the way in which they feel most comfortable? Standardizations within the industry or even just a broad assessment of variations could be useful for both the industry and consumers, as both parties could then identify gaps in their desires or markets and work to close them. In this same vein, ensuring that enforcement mechanisms at the local level are adequately being put in place is important to quash people who may take advantage of the new frontier this industry is on the horizon of. Ensuring that regulations are properly adhered to will be a community-based issue, or at the broadest, a state issue, and it is imperative that trust in this industry is maintained.

Additionally, the primary scope of this project focuses upon very specific scientific and policy aspects that impact human burial. It is important for research regarding other areas of society that impact burial as well, including but not limited to cultural traditions and the variety of beliefs surrounding death, anthropological research regarding how communities organize around their cemeteries, as well as sociological research on how discussions of death impact individuals or research regarding people's feelings towards death.

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