Ritual Ecologies: Analyzing the Environmental Impact and Cultural Sustainability of Death Practices Across Civilizations through Selected Case Studies

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Abstract Death is universal but experienced and ritualized in different ways across cultures. In the era of accelerating climate change, we need to look again at our mortuary practices. It becomes imperative to ask, how sustainable are our death rituals? With a focus on Hindu cremation, Christian burials, and Indigenous rites this study explores the ecological impact of death rituals across cultures. Drawing from environmental data, literary narratives, and cross-cultural case studies, it examines how traditional rituals intersect with environmental concerns like carbon emissions, deforestation, land use, and water contamination. It introduces the concept of ritual ecology, which critiques and reimagines sacred practices through a sustainability lens. From wood-fired Hindu pyres to the chemically treated burials, the study traces the material consequences of mourning and memory. It highlights technology-based innovations such as electric crematoriums, aquamation, and biodegradable burial options. Reimagining and reframing death rituals for a sustainable future does not mean erasing traditions but having a meaningful dialogue between heritage and innovation. It calls for ecologically sustainable practices that align with the emotional and spiritual dimensions of death. The research hopes to contribute to a growing conversation about how we might mourn, remember, and honor the dead without endangering the planet.

1. Introduction

While life is often regarded as complex, the processes surrounding death, particularly in terms of ritual, logistics, and ecological impact present profound challenges that are seldom acknowledged. A living person has all the rights to make all types of decisions, but after death, others decide what will should be done with the body. The moment a person dies, family members start thinking about what to do with the body and they find predominantly two options: burial or cremation.

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However, none of these options are environmentally friendly, and burial is the worst of them. Traditional burial practices, especially in North America, consume vast ecological resources. For instance, annually they require an estimated 100,000 tons of steel, 1.5 million tons of concrete, 77,000 trees, and 4.3 million gallons of embalming fluid every year. Moreover, with the burial, approximately 4.3 million gallons of carcinogenic embalming fluid leak into the earth, which pollutes our water and soil. This does not mean that cremation, which is considered an eco-friendly option for decomposing the dead, is better. According to an estimate, a single cremation uses a huge amount of gas and electricity, which is equivalent to a 500-mile road trip. Together with that, it gives off around 250 pounds of carbon dioxide, which is harmful to the environment [1].

Death is something that happens naturally, and ideally the way we dispose and mourn should be natural and support nature. Our body is made up of five elements of nature, that is, water, earth, sky, fire, and air. After death we have to return it to nature. But in the process of giving back to nature, we add huge amounts of pollutants to it. We consider nature as our mother, creator, and preserver. But we, while performing the typical ceremony, which involves embalming and a casket burial in a traditional cemetery, leave behind a lasting burden on our ecosystem. Traditional burials not only damage the environment but are also expensive. Moreover, many a times we make choices to have more elaborate and expensive rituals than we want or need. The reason behind this is we do not realize that we have options. We have the option to make the burial and cremation practices simpler and more hands-on, and we have the option to go green.

No matter how much medical science and technology advances, all of us will die someday. In spite of this harsh reality, still we remain unprepared for death. No one ever plans for the death and how the ceremonies should be performed. A glance at history tells us that burial practices in the past differed from what we perform today. Now cemeteries are not peaceful green spaces despite facing changes in burial practices. Lawns are pesticide-treated. Headstones and caskets are made up of metals that go deep in the earth. The place has become extremely toxic due to chemicals and metals that are immensely harmful to nature and to human beings. That means we are not exactly getting mixed from ashes to ashes and dust to dust. Instead of that, we are adding more pollutants to our environment. The person has left the world but has made the surrounding environment unfavorable to live in. How morally correct is it that we are leaving this world and making it polluted for the coming generation?

The environmental footprint of cremation is influenced by multiple variables, including the type of fuel utilized, the deceased's body mass, the presence of chemicals or heavy metals in the body, and the composition of the casket and clothing. Cremation furnaces are required to operate at sustained temperatures of at least 850°C for durations ranging from 1.5 to 5 hours, depending on the body's size [2]. This process is energy-intensive, particularly due to the high moisture content of human remains, which increases the energy demand needed to maintain optimal combustion temperatures [3]. Typically, crematoria use natural gas, and in some cases liquefied petroleum gas (LPG), as their primary energy source. A study conducted in 2016 estimated that cremating a 60 kg body with natural gas generated around 388 kilograms of carbon dioxide, excluding emissions from additional materials like caskets and garments [3]. Meanwhile, a life cycle assessment by Keijzer (2017) reported an average CO_2 emission of 210 kg per cremation, highlighting variability based on factors such as fuel type and body characteristics.

Slowly the time is changing. Today there are people who are putting a lot of effort into lessening the negative impact of humans and their activities on nature. They have started

adopting multiple ways. Many of them started using renewable energy sources, driving hybrid or electric vehicles, consuming plant-based food products, using cloth bags, and sustainable practices mainly in agriculture. We all consume natural products through our lifetime. But we have to consider not harming nature even after we die. For this, green burial is a way that can promote sustainable living and also death, which will have less impact on our environment. Green burials involve an eco-friendly way of preparing the body and eco-friendly burial practices, which make the body decompose naturally. There are special sites designed where they can perform green burials for their family members.

Death rituals are one of the oldest and most enduring among all cultural practices. It is one of the practices that is deeply embedded in religious, emotional, and symbolic worlds. In Hinduism, *Agni* (fire) is considered as a sacred medium that helps the soul in liberation. Also, it acts as an aid to facilitate the soul's journey towards rebirth and *moksha* (liberation). Cremation is not just an act related to the physical body but a spiritual transformation. Approximately 8.5 million deaths annually in India the cumulative environmental burden is immense. Together with that, the ashes are immersed in sacred rivers which adds up more pollutants to water which endangers aquatic ecosystems. On the other hand, Christian burial practices are based on theological beliefs of bodily resurrection, eternal rest and the sanctity of the grave. In Christian countries, burial was the only method of disposition since ages [4] until the late 1870s when Italy became the first Christian country to permit cremation [5]. It was majorly practiced because it does not require technological support and also allows the local community to handle the deceased body. The burial ritual often empathizes with physical preservation and long-term memorialization. But it brings with itself considerable ecological costs. Modern practice of embalming contains injection of formaldehyde-based fluids which slows decomposition. However, this practice of embalming adds toxic chemicals into the soil and groundwater. The process of embalming began during the American Civil War in 1860s, which was majorly developed for the preservation of soldier's bodies for months, for their family [6]. Initially arsenic was used for this but due to its hazardous effects, it was replaced by formaldehyde, which is in use at present for embalming. Formaldehyde is a carcinogen declared by International Agency of Research on Cancer (IARC) [7]. Today, in the United States alone, over 800,000 gallons of embalming fluid are buried annually, which contaminates ecosystems and pose long-term environmental hazards [8].

Now, in the Anthropocene era, there is a profound impact of humans on Earth's ecosystem, which has made it crucial to interrogate the impact of these spiritual practices on our surroundings. The present environmental crisis is begging us to reframe our cultural practices. This study focuses on traditional death rituals. It is true that the traditional way of performing the death rituals has a great cultural significance but it often carries heavy ecological costs. By looking at Hindu cremation, Christian burial and indigenous rites with a lens of sustainability, this study proposes a new paradigm, which is ritual ecology. This study encourages environmentally conscious ways of mourning and memorializing the dead.

The concept of green burial is not new, it began in 1990s, when Carlisle Cemetery was opened in 1993 in UK and Ramsey Creek Preserve in 1998 in South Carolina. The main focus was to conserve the land and restore our eco-system [9]. Green burials practices can also be traced in religions like Judaism and Islam, which avoided cremation and embalming process with a motive to maintain the integrity of the dead [10]. This historical context builds the foundation for the contemporary movement of green burial.

In a study conducted by Van der Burgh et al. (2017), concluded that burials and cremations have four time more harsh impact on environment compared to green burials. Also, they found that these are a major reason of water depletion at various places. It also makes marine life toxic and unfit for survival [11]. It has also been found that scarcity of land is another major issue in death industry. It is not a problem which US is facing because of abundance, but there are other countries across the globe who are not finding rooms for dead bodies. In Australia, government has implemented a 50-year licensing period in which the place where someone is buried can be re-used after the end of 50-year period [12]. In Columbia, the graves of low-income group are allowed to be re-used after 4 years or less by other families [13]. The population will keep on growing and it would require more space for future interment, and land is a finite resource.

Green burial, which is a natural way or returning the dead back to nature, "designed to allow the body to naturally return to the earth at the fastest rate possible" [14]. The major contribution of this study lies in conceptualizing the idea of "ritual ecology" as a lens to critically evaluate the sustainability of global death practices. This blends textual analysis with certain case studies to assess the environmental impact of Hindu, Christian, and Indigenous death rituals. This study also evaluates eco-innovations like aquamation and human composting.
Structure of the paper: Section 2 identifies research gaps and outlines the methodology, Section 3 discusses traditional death rituals and their ecological impacts, Section 4 presents sustainable innovations, and Section 6 concludes with reflections on cultural continuity and ecological ethics.

2. Research Gap and Research Focus

While there are significant amount of literature exists on individual death practices and ecological concerns, limited interdisciplinary work bridges death studies and environmental humanities. Moreover, few studies holistically assess ritual transitions across multiple cultures through sustainability lenses. This study delves into the implications of how death rituals and its process impact our environment. It will focus majorly on Hindu cremation, Christian burials, and Indigenous rites. This study is shaped within the emerging discourse of "ritual ecology," which looks critically on the intersection of sacred death practices and planetary sustainability. The study will focus on the consequences and impact of these death rituals on our Mother Earth and also evaluate sustainable alternatives, environmental data, cultural texts, and technological innovations.

3. Research Objective

The primary objective of this research is to explore the impact of traditional death rituals on our environment across selected cultural frameworks. This study also examines the importance and significance of death rituals in different cultures. It also talks about the emerging sustainable death technologies and other alternatives. Moreover, it contributes to the evolving field of ecological death studies.

4. Methodology

This study is based on an interdisciplinary qualitative methodology, which draws insights from environmental humanities, death studies, religious studies and cultural anthropology. The primary concept of this study is a combination of textual analysis with empirical case

study evaluation. In addition, case studies from Indigenous cultures, Western burial customs, and India provide practical insights into the environmental effects of conventional mortuary systems. A critical review of secondary data also helped in understanding how the death practices affect the environment. The secondary data supports environmental dimensions of the study.

In addition, technological innovations such as aquamation, electric cremation, and human composting are analyzed through scholarly articles, policy documents, and environmental assessments. This blended approach enables a holistic understanding of how ritual, culture, and sustainability intersect in the context of death.

5. The environmental cost of death: A Global Overview

Approximately 60 million people dies each year and each of these deaths involve a set of cultural and religious practices. This also includes several logistical practices which have a long-lasting impact on our environment. If we talk about traditional Hindu cremation practices, which takes place on open-air pyres which consumes approximately 400-500 kg of wood per body. This much of not only causes deforestation but also releases 500-600 kg of Carbon dioxide into the air [15]. Also because of cremation in India more than 500 million trees are consumed annually, contributing to loss of habitat loss and ecological imbalance [16]. On the other hand, cemeteries require large tracts of land, often in increasingly crowded urban places, which reduces green area for the living population and also affects sustainable development [17]. Embalming fluids used in Christian burials often contain formaldehyde, methanol, and phenol. These chemicals get mixed with the soil and the groundwater. The deceased also deserved to be honored in ways that do not endanger the planet.

5.1 Innovations in sustainable death practices

Looking into the significant environmental issues due to the traditional death rituals, science and technology have worked on innovations in sustainable mortuary practices. These alternatives fulfill our ecological responsibility together with spiritual and emotional needs. This also helps in building a more balanced relationship between mourning and Mother Earth. These innovative practices help in protecting nature together with maintaining the culture and people's beliefs.

5.2 Alkaline Hydrolysis (Aquamation)

One of the innovations is alkaline hydrolysis, which is also known as aquamation, resomation, or water cremation. It is an eco-conscious alternative to flame-based cremation. In this process a combination of water, heat, and potassium hydroxide is used to accelerate the natural process of decomposition of the body. This process uses 90% less energy compared to the traditional cremation, and it also does not emit any harmful gases such as carbon dioxide, mercury or particulates. After the process, there is a sterile, liquid byproduct, which is given back to the environment. Also, the bone remains of the deceased are processed into ashes for memorialization. In 2021, Nobel Peace Prize laureate Archbishop Desmond Tutu chose aquamation for his final rites, which sparked global interest in this method. This decision of his was deeply symbolic which aligned with his lifelong advocacy for environmental and social justice. The process of aquamation required less energy than traditional cremation and released no harmful emissions [18]. This step taken by Desmond Tutu illustrates how spiritual dignity can align with ecological ethics. This has also inspired churches and other policymakers to reassess conventional funeral practices. However, aquamation remains a subject of regulatory scrutiny. While legal in over 20 U.S. states and parts of Canada, Australia, and South Africa, it faces religious opposition and regulatory

delays in other regions. Nevertheless, its adoption is expanding as public awareness and legislative momentum grow.

5.3 Human Composting (Natural Organic Reduction)

Another innovation is recomposition, or human composting, is another groundbreaking method that transforms human remains into nutrient-rich soil. It has become legalized in several U.S. states. This process has been admired due to its potential to reduce carbon emissions, and also it conserves land. In this method the body is placed in a vessel where natural materials like wood chips, straw, alfalfa, which helps the body to decompose into nutrient-rich soil within a week. The compost which gets ready can be used for tree plantation and also for restoring the land. This is a way which can turn death into an act of ecological renewal. Human composting offers multiple benefits: it avoids embalming chemicals, preserves land, prevents emissions, and restores ecosystems. Importantly, it offers a compelling narrative for individuals and families seeking a "return to Earth" ethos, making it especially appealing within environmentalist and spiritual communities.

Recomposition became the world's first licensed human composting facility in Seattle, Washington. It was founded by Katrina Spade, who is the founder and CEO of *Recompose,* which is a public benefit corporation, which brought a transformation to the funeral industry. Katrina, who is a designer and also the inventor of a system that transforms the dead into soil. The company Recompose, became the world's first company which offers this service in 2020. Now it has been legalized in Oregon, Colorado, Vermont, California and New York [19].

Since 2021, *Recompose* has given an option to those people who are concerned for our environment and the ecology, as this turns human remains into soil in a controlled indoor process. With this process, about one cubic yard of composted soil can be made which is open for the deceased family to take home or donate to ecological restoration projects. *Recompose* also emphasizes grief care and ceremony, which integrates ecological responsibility with emotional healing [20]. The website of *Recompose* says that it is a public benefit corporation which is powered by people who believe in changing the current death care industry. They do this work with energy, tenacity, and joy.

In September, 2021, at the age of 71, Wayne Thomas Dodge, who was a semi-retired physician and a passionate gardener from Seattle, passed away from complications from a fall. Before his death, he made a clear preference for human composting over traditional burial or cremation, which aligned with his environmental values and love for gardening. His family also honored his wish by contacting *Recompose.* In the process Dodge's body was kept for transformation for approximately 30 days. The soil was then distributed among the family and friends who used it to nourish plants and trees, including his cherished Japanese maples.

Dodge's case exemplifies how human composting can serve as a meaningful and environmentally conscious alternative to conventional end-of-life practices, resonating with individuals seeking to minimize their ecological footprint even in death.

5.4 Green Burial and Biodegradable Innovations

Since 1990s the practice of Green Burial has grown significantly in the United States. The Green Burial Council (GBC) which was established in 2005, has worked in spreading awareness among the public regarding death care through various certification programs. The

GBC possess 100 certified sites in US, out of which 57 are hybrid grounds which are typically conventional cemeteries set aside for green burials [21]. These burial grounds emphasize on saving any degradation to ecology and also to prevent long-term harm to soil and plants.

Green burial emphasizes the minimal intervention of the natural decomposition process. Bodies are buried in biodegradable caskets or shrouds, without embalming fluids, vaults, or metal hardware. These burials take place in designated conservation cemeteries or natural burial grounds, which are managed to protect biodiversity and native landscapes.

This practice aligns closely with ecological principles and is historically rooted in Jewish, Islamic, and Indigenous traditions that favor simplicity and direct return to the earth. It also addresses the issue of land scarcity, especially in urban areas, by enabling grave reuse and multi-purpose conservation land use, as implemented in countries like Colombia and Australia.

Recent innovations also include, Mushroom burial suits that use fungi to aid decomposition and neutralize toxins. Another is Biodegradable urns with seeds that grow into trees. Also, there is Sea burial pods that encapsulate ashes in marine-safe materials to foster coral reef restoration.

6. Conclusion

As we are facing an accelerating climate emergency, our concept of death and dying must also change. Death rituals, though it is deeply symbolic and culturally rooted, carries with itself significant ecological costs that cannot be ignored. Traditional rituals need not to be abandoned or ignored, but they can be thoughtfully adapted with innovations of green burials. These alternatives are not only technologically convenient but also, they are cultural responses to the urgent ethical call of our time. In doing this, mourning becomes not just a private act of remembrance but a public gesture of ecological solidarity. This study advocates for a future where the end of life is also a new beginning for the generation yet to come.

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