Life After Death: What Human Burial Options Will Look Like in a Sustainable Future

Embalming, cremation and casket-making are far from eco-friendly. Some researchers want to return human bodies to the earth naturally.

By Joan Meiners August 6, 2020 12:00 PM

What might sustainable cemeteries of the future look like? Seattle-based Recompose says human compost, trees and mod architecture. (Credit: Olson Kundig)

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Imagine a world where, when a person died, they took all their riches with them like the pharaohs of Egypt. If you consider biological material to be of value, this is not so far removed from modern reality, except that instead of gold and silver treasures being buried with us, it's our nutrients.

These riches we hoard in our graves are the mineral building blocks necessary for those still alive — the carbon in our skin, the iron in our blood and the calcium in our bones. These nutrients exist as finite, limited resources in the world. But conventional practices of embalming and cremation prevent their recycling, hindering our ability to give back that which we have attained from other living things.

The average human weighs 136 pounds at the time of their death. After subtracting water weight, that means we depart this world holding on to about 54 pounds of mass we borrowed from the plants and animals we ate while we were alive. In the current mainstream American system of embalming a body with chemicals, then entombing or cremating remains, very little of our bodily nutrients — carbon, calcium, nitrogen, phosphorus and more — are returned to our ecosystems in a usable way. Scientists say this may be contributing to nutrient-poor soils, as well as air pollution when chemical additives are burned during cremation. Instead of nourishing our environment after death the way it nourished us during life, for the last 150 years, the legacy we leave behind is largely toxic sludge.

THE INEVITABLE GREAT BEYOND

For as long as humans have been alive, they have been dying. And for every different burial practice, there is another culture that deems it barbaric. But the practicalities of nature are what have shaped traditional human funeral practices over time and across the world. For instance, in 19th-century India, honored dead in the Parsi community were routinely placed atop a tower for a waiting throng of vultures. There are still towers of silence in Mumbai today, but not enough vultures to dispose of the bodies.

In Tibet, such sky burials still take place, but require someone to dismember the body before it is left for wild dogs or vultures. Sky burials occur at high altitudes where wood is scarce, the soil is too rocky to dig and a colder climate slows natural decay.

Himalayan tribes who live near water but lack large vulture populations instead view water burials as a sacred practice — they even avoid eating fish out of respect for their role in recycling human flesh.

Some Amazonian societies consume their own dead in a funerary cannibalism practice believed to help release their loved ones' souls to the afterlife.

Natural mummification is easily achieved in hot deserts, as well as in some northern European bogs where naturally occurring acids in the soil dry and preserve bodies.

In Alaska, Athabascan tribes build rock mounds and colorful "spirit houses" over their dead, who are laid directly on the frozen tundra where they may never thaw.

—J.M.

(Credit: Dewi Putra/Shutterstock)

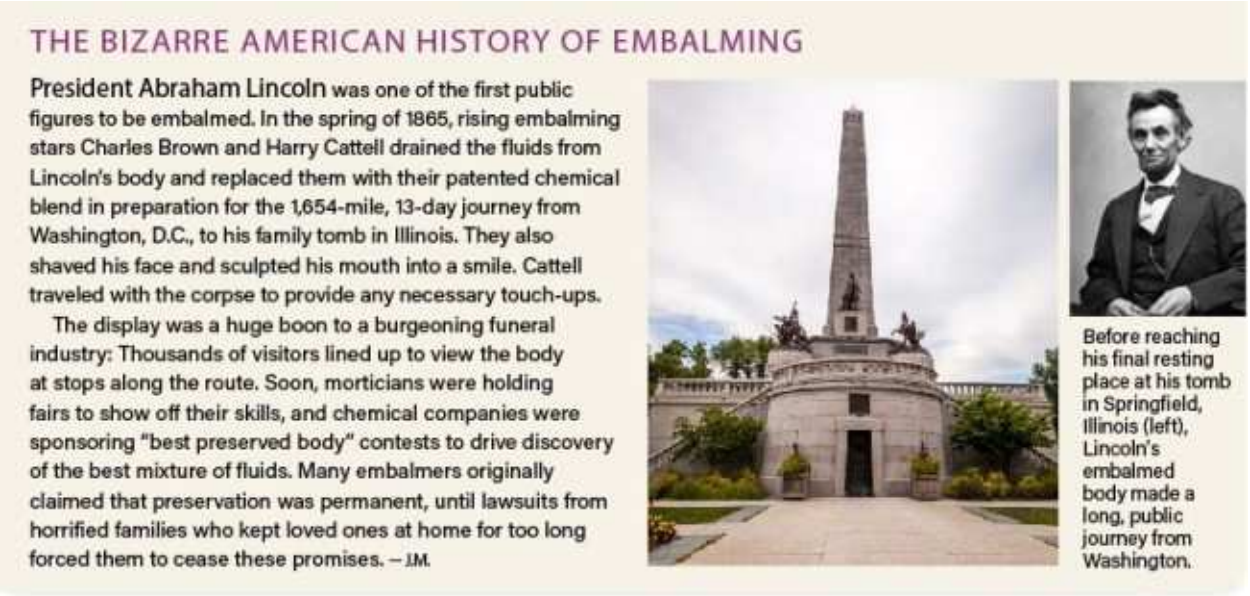
How that 54 pounds of our organic matter and minerals might be more effectively returned to the living planet is the business of the rising “ecodeath” movement. On the front lines of this mission are a couple of architects, a passionate young gravedigger and a scientist working hard to compost a cow. These ecodeath warriors are making it possible for people to choose not what type of hardwood they want for their casket, but what kind of tree they want their body to nourish.

Our Chemical Romance

Americans first lost touch with more ecosystem-inspired processes of death care during the Civil War. With thousands of soldiers dying on battlefields far from home, the custom of keeping bodies on ice until funeral arrangements could be made was suddenly inadequate. Railway conductors were struggling — olfactorily — to get the men to family burial plots in an acceptable state. Physicians began offering embalming services to families who could pay, and some started specializing in the service and charging for it. The profession of commercial undertaking was born.

Embalming fluid is primarily formaldehyde mixed with methanol. These chemicals preserve tissue by linking molecules across cell membranes so they can’t properly break down, says Kartik Chandran, an environmental engineer at Columbia University. Small formaldehyde molecules easily permeate cell membranes where they join larger molecules like fats and proteins together, temporarily stabilizing them against decay.

The embalming process is a bit like taking your car in for a final oil change. Natural fluids are flushed out of the circulatory system and replaced with a fresh blend of lubricants. What sounds like a squeaky-clean way to spare someone the indignity of decay is a grisly scene behind the mortuary curtain. After the embalmer slices open a vein in the neck, the body is inverted to allow the blood to drain, often directly into the sewer through a grate in the floor. A pinkish blend of embalming fluid is then pumped in through an artery, which restores color and plump to sunken, pallid skin. Orifices are stitched closed to prevent seepage, and the body is encased in tight clothing to catch any leaks — all for a few hours of open-casket viewing at a wake. Once the body is out of sight underground, embalmed tissues eventually melt into a toxic putrefaction.



THE BIZARRE AMERICAN HISTORY OF EMBALMING

President Abraham Lincoln was one of the first public figures to be embalmed. In the spring of 1865, rising embalming stars Charles Brown and Harry Cattell drained the fluids from Lincoln's body and replaced them with their patented chemical blend in preparation for the 1,654-mile, 13-day journey from Washington, D.C., to his family tomb in Illinois. They also shaved his face and sculpted his mouth into a smile. Cattell traveled with the corpse to provide any necessary touch-ups.

The display was a huge boon to a burgeoning funeral industry: Thousands of visitors lined up to view the body at stops along the route. Soon, morticians were holding fairs to show off their skills, and chemical companies were sponsoring "best preserved body" contests to drive discovery of the best mixture of fluids. Many embalmers originally claimed that preservation was permanent, until lawsuits from horrified families who kept loved ones at home for too long forced them to cease these promises. – J.M.

Before reaching his final resting place at his tomb in Springfield, Illinois (left), Lincoln's embalmed body made a long, public journey from Washington.

(Credit: Everett Historical/Shutterstock, JL Jahn/Shutterstock)

Cremation, the other common postmortem option, also doesn't leave much behind in the way of nutrients that can nourish new plant life. It's more likely, Chandran says, that cremation converts body carbons to the greenhouse gas CO_2, leaving behind ash with minimal amounts of nitrogen and phosphorus, the nutrients that plants need.

"In cremation, a huge amount of natural gas is consumed to combust the body, and then the body itself becomes emissions," says Troy Hottle, a sustainability researcher and life cycle analyst at the private firm Franklin Associates. In other words, cremation requires burning the dead tissue of ancient plants — a common source of fossil fuels — in order to burn the dead tissue of modern humans.

Often, bodies are embalmed and then cremated, resulting in gallons of formaldehyde being burned off into the air, along with mercury and other heavy metals from the body. The fuel required for cremation also has impacts. In India, for example, demand for exotic hardwoods for funeral pyres — over 1,000 pounds of timber each — is driving deforestation in parts of the Himalayas. All year long, black clouds of smoke can be seen rising from the ceremonial funeral fires on the banks of the Ganges River.

Death Stoichiometry

If you place a dead cow out in the sun on a bed of woodchips, it will take about a year in a moist environment for the flesh to decompose back into the soil. Lynne Carpenter-Boggs, a soil scientist at Washington State University, knows this because she's done it. Her research may help new efforts to compost human bodies, too, turning them into usable, life-giving soil.

"Soil makes life on Earth possible. It's underappreciated," says Carpenter-Boggs.

The bulk of an animal's body is made of carbon, hydrogen and oxygen. But it's also full of other life-sustaining nutrients — nitrogen, phosphorus, potassium, sulfur and calcium — that form the basis for new plants and animals. Our agricultural system of mass production has depleted our soil of these nutrients, particularly nitrogen, she says.

"Farmers are increasingly dependent on feeding nutrients back into the soil," says Carpenter-Boggs. But while ammonium fertilizer does support crop growth, we tend to overcompensate. The excess runs off into waterways, fueling rapid algae growth that uses up all the oxygen, killing aquatic life and resulting in massive dead zones in the Gulf of Mexico, the Amazon and the Columbia River.

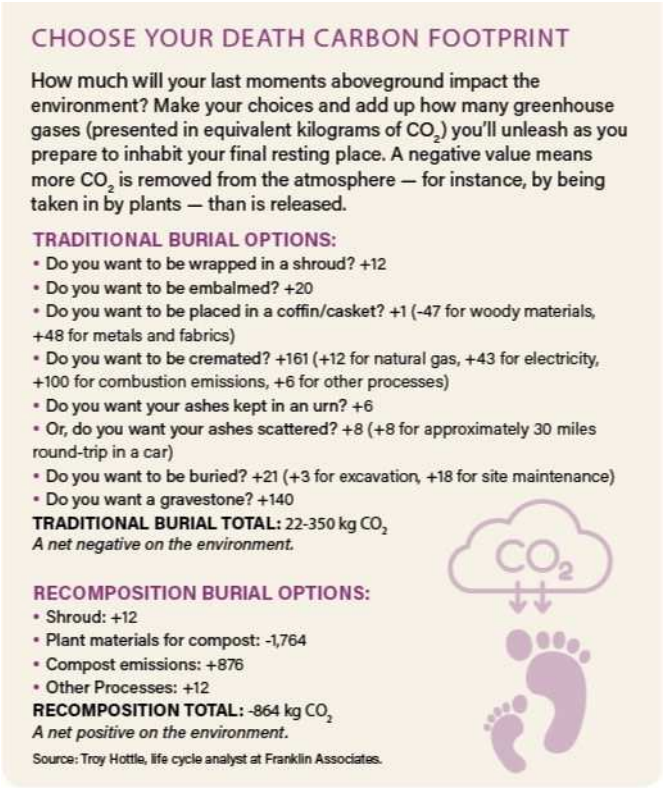
So, how do dead cows factor into this chemical equation? By becoming slow, perfect compost with an ideal mix of elements for plant growth. Animal material that decomposes slowly, like that used in Carpenter-Boggs' cow-composting system, releases nutrients into the soil at a rate plants can absorb as they grow. Humans, theoretically, can become perfect compost, too, Carpenter-Boggs says: "Returning our bodies to the soil in a way that can be used is helping."

Planet of the Dead

Urban sustainability designer Katrina Spade heard about Carpenter-Boggs' work and took the idea one step further: If you can compost a cow, why not a human?

In Seattle, Spade's company, Recompose, is tackling the challenge of how to bury humans in a sensitive and environmentally friendly way. Spade is making waves by building human composting pods in a crowded city where grave plots sell for thousands of dollars. Already creating nutrient-rich soil from human bodies, Spade is turning Carpenter-Boggs' theory about human compost into a material reality.

"I was in grad school for architecture, so I was thinking about humans and culture and space, and how all these things fit together," Spade says. "And I would say I just felt, the word is probably disappointed, about the current offerings of the funeral industry. All the options were really toxic," she says, referring to the chemicals and air emissions that result from many modern burial practices.



(Credit: Elizabeth M. Weber/Discover)

"I wanted to bring nature to the city in some way."

Spade's design features human-sized honeycomb-shaped vessels, stacked three high in a tranquil, indoor, gardenlike space open for family visitation. Using a balance of woodchips, alfalfa, straw and airflow to create the optimal environment for microbial decomposition activity, she's already producing usable, biohazard-free compost. As of early May, the process is legal in Washington state. She's now fine-tuning the method down to 30 days to dirt.

Hottle, the life cycle analyst, calculated that Spade's method would reduce carbon emissions compared with conventional burial or cremation by over 2,200 pounds per body by removing the need for a casket, land or fuel. Families would also save thousands of dollars compared with conventional burial and, if they wanted, could take home about a cubic yard of their loved one as life-giving soil, instead of ashes devoid of the most important plant nutrients.

On the opposite side of the country, another architect has developed a different solution to the same problem. In 2013, Columbia University architect Karla Rothstein assembled a team of scientists who call themselves DeathLAB to figure out how to make urban death more sustainable and beautiful. She and Columbia environmental engineer Chandran have been exploring whether it's possible to create light from energy released by the chemical reactions that happen when bodies decompose.

As a body decomposes, chemical reactions happen that give off energy at the molecular level. But what if we could harness that energy and turn it into light? Researchers at Columbia University's DeathLAB think it's possible — and that the light could make for a new kind of cemetery, like these artist's renderings of what they call a "Constellation Park." (Credit: Keizo Kioku)

"Instead of just a chemical or physical breakdown of human remains, we want to turn that organic carbon into some form of energy," says Chandran, explaining that it's possible to capture the energy resulting from decomposition and use it to power LED lightbulbs. "It's not too far-fetched."

In 2018, Rothstein debuted an exhibition of her concept, which she calls a "Constellation Park," at the 21st Century Museum of Contemporary Art in Kanazawa, Japan. Monitors featured interviews with urban designers, scholars and funeral directors, while a collection of models of elegant, reusable 3D vessels hung from the ceiling. Waxing and waning with a soft, white light, each vessel represents a soul moving on.

"The idea that, upon death, you could do something meaningful and impactful and not damaging to the Earth is really appealing to some people," says Rothstein.

Spade, too, is excited to move forward with her vision, and plans to open a facility in early 2021. She already has a list of volunteer participants.

STEPS OF DECOMPOSITION

1. When a person dies, their body is full of elements, like carbon (C), nitrogen (N), calcium (Ca) and phosphorus (P).
2. As the corpse decomposes, insects, bacteria and fungi consume the tissue, releasing these elements into the soil.
3. Plants take up these nutrients from the soil, and use them to grow.
4. Insects that feed on the body become food for other organisms, like birds.

(Credit: Jay Smith)

Hot Spots and Hot Moments

In more spacious rural areas, posthumous volunteers are sometimes just placed out in a field, for science. If you hang around the research body farm in Knoxville, Tennessee, long enough, researcher Jennifer DeBruyn says you can smell the difference between a human and an animal decomposing. To the insects and mammals that find these bodies within hours of death by following the scent, however, it's all a feast.

DeBruyn is an environmental microbiologist at the University of Tennessee studying how animal, including human, remains become part of the environment — a field sometimes referred to as taphonomy. Specifically, she researches the bacterial processes involved in natural decomposition that can be summed up as the necrobiome: the microbiome of a dead person. Or, as she puts it, "microbial life after death."

In a 2016 talk at a meeting of the American Society for Microbiology, DeBruyn described the process of decomposition after the death of a beaver. What happens to the carbon and other nutrients the animal has accumulated in its tissue during its life? First it goes to the scavengers: vultures, raccoons and carrion beetles, like the endangered American burying beetle. Blow flies, those metallic-green nuisances, use the beaver's tissue as fuel for their own reproduction, laying eggs that grow into maggots that might become a meal for moths, wasps or birds. Sometimes, bacteria and fungi bloom on the tissue surface and are consumed by tiny soil organisms called nematodes. This is the cycle of death to life.

SOLVING BURIAL CHALLENGES IN THE SWAMP

Back before ecodeath movements or Civil War entrepreneurs, the city of New Orleans had already solved the mortal burial problems of land area, nutrients and smell. In the 1800s, New Orleans endured several disastrous plagues. Yellow fever killed an estimated 41,000 people, about a quarter of the city's midcentury population. Water-borne epidemics of cholera and malaria also rippled through the port city. This left New Orleans with a pressing need to develop a solution to the growing body count.

With the city famously built around sea level, New Orleans had no way to bury bodies 6 feet under. When they tried, storms would erode away the earth above and send caskets bobbing to the surface. They tried drilling holes in coffins to let air escape and prevent them from floating, but residents still lived in fear of seeing their deceased loved ones floating down the street.

With very little land suited for burial, they designed Spanish-inspired "Cities of the Dead," where above-ground tombs were erected in rows, like skyscrapers along the downtown streets of a metropolis. Once sealed inside these stone or wrought-iron crypts under the sweltering Southern sun, bodies slow-roasted to a natural dust over the course of between six months and two years, after which the ashes could be swept into a bag for the family, and the tombs could be reused. –J.M.

(Credit: Joan Meiners)

“So, this one animal contributes to this whole food web of organisms, this whole little pop-up pocket of diversity in an ecosystem,” explains DeBruyn. “It’s a realm of diversity we just don’t often think about, and one of the reasons is that it’s very rapid and very ephemeral. All these nutrients are fairly rapidly cycled back into the environment. In biogeochemistry, we refer to this as a hot spot.”

Hot spots like the one left by the dead beaver increase local biodiversity and ecosystem health. The greater the diversity of organisms in one place, brought together by these carcass bounties, the less likely you are to lose some key environmental function. And the analogous hot moments in time — such as when a whale carcass sinks to the bottom of the ocean and revives an entire dormant community of sea creatures for another generation — are vital to the periodic abundance of many strange and wonderful creatures.

“The one truism of all life is that everything has to die,” says DeBruyn. “If there weren’t organisms specialized in cleaning that up, we would just be buried in dead things.”

So, What Do You Want to Be When You Die?

On a crisp, sunny spring day in 2019, the Society of the Pick & Spade assembles just after daybreak at the 93-acre Prairie Creek Conservation Cemetery (PCCC) outside of Gainesville, Florida. At a spot marked by four yellow flags in the restored loblolly pine uplands and cypress wetlands, a crew of five senior men begins to dig. They whistle while they work, at first, and then they fire up their Native American flute playlist on Pandora. It’s Buddy Irby’s 35th grave, but “Uncle” Mike Myers has lost count of how many graves he has volunteered to dig. At 72, Myers swears that digging graves keeps him fit and further from his own.

This particular grave — one of about 600 so far at PCCC — is for a woman named Donna, who has chosen to be buried directly in the ground, without a casket or chemicals, in order to return naturally to the earth over a period of a few years and to save her family unnecessary expenses.

Some prefer a more direct path back to nature, like at the Prairie Creek Conservation Cemetery in Gainesville, Florida. Volunteers dig the graves, while then-assistant director David Ponoroff manages the plots. The restored habitat will benefit native ecosystems for the long haul. (Credit: Joan Meiners)

PCCC is one of 10 cemeteries offering people the choice to make land conservation their final act: three in Ohio, two in Florida and one each in North Carolina, South Carolina, Tennessee, Georgia and Washington state. Mortician and self-proclaimed death tourist Caitlin Doughty calls this activist option “chaining yourself to a tree postmortem.” Even more common are “green burial” grounds, which also prohibit embalming and non-biodegradable materials but, unlike conservation cemeteries, don’t go the extra step of setting aside land to preserve as wildlife habitat with each burial. Over 160 have sprung to life as their own sites or new sections of conventional cemeteries, most smaller than PCCC. Options for home wakes and death midwives to help families grieve are on the rise as well. Death culture is changing.

One of the people changing it is 25-year-old David Ponoroff, who learned about the PCCC in his sustainability class at the University of Florida in 2015. One spring day after class, he hopped into his Honda Accord, drove out to help dig a grave and never looked back.

While standing in the finished hole that evening, as the last person who would occupy it before its eternal resident was lowered there by volunteers the next day, Ponoroff described a moment of connection, to the beyond and to his fellow volunteers. Soon after, he would turn a cemetery intern position into a role as assistant director of the PCCC.

As he kneels to adjust the hockey puck-sized marker atop one gravesite while giving a tour, Ponoroff rattles off a list of environmental woes caused by the modern funeral industry, including destructive mining of precious metals for luxury casket trim. On top of that, he says, many cemeteries require caskets to be placed within a metal vault underground to prevent the settling earth from making the plot harder to mow.

“Your body has bacteria already in it. The degradation is going to happen anyway,” Ponoroff says. “So, really, the question is: Are you going to sequester yourself [and] your nutrients? Or are you going to give them back to the Earth?”

Conventional burial commonly costs American families between $8,000 and $25,000. In the U.S., the Green Burial Council reports the custom also results in an estimated 64,500 tons of steel; 1.6 million tons of concrete; 20 million feet of hardwood; 17,000 tons of copper and bronze; and 827,000 gallons of toxic formaldehyde, methanol and benzene embalming fluid being placed underground with the deceased. That’s not to mention the lead, zinc and cobalt used in some casket designs that might also leach out into the surrounding environment.

Donna’s funeral will add only her body wrapped in an elegant red shroud to the ground — costing just around $2,000 and conferring a conservation easement on the land in the process. As they gently covered her shrouded body with Florida sand, Donna’s family admitted to having been wary of her desire to be placed in the ground so exposed. By the time Ponoroff and the Society of the Pick & Spade had helped them finish the burial with a mound of loblolly pine needles, they were asking how long a mockernut hickory would take to grow in her place.

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