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The Science Behind The Soil:

The Ecological Impact of Human Compost

by Earth Funeral



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Introduction

For most of human history, our bodies returned to the earth naturally.

Ancient cultures understood the cycle of life, death, and renewal, allowing the body to rejoin the soil and nourish new life.

Modern practices broke this cycle.

Today, concrete vaults, embalming chemicals, and energy-intensive methods have replaced the simple return to nature.

Soil Transformation reconnects us with that natural cycle.

Also known as Natural Organic Reduction, human composting, or terramation, soil transformation combines nature's wisdom with modern science to carefully accelerate decomposition in a controlled environment.

The result is clean, nutrient-rich soil that can be used to restore ecosystems and sustain new life.

It enhances water retention, strengthens soil structure, and supports new plant growth, offering tangible ways for a single life to continue nurturing the planet long after death.

In this report, we explain:

- The science behind Soil Transformation
- What makes the resulting soil ecologically valuable
- Why it matters for our environment
- How testing confirms the soil meets health and safety standards
- How it compares with compost available in garden centers

When we see how the body can become soil, we see death differently.

Our remains are not waste to be managed, but a resource that restores balance to the natural world.

Biological Processes of Transformation

Soil Transformation accelerates the same natural processes that have existed since life began.

In nature, a human body buried in soil can take eight to twelve years to fully decompose.

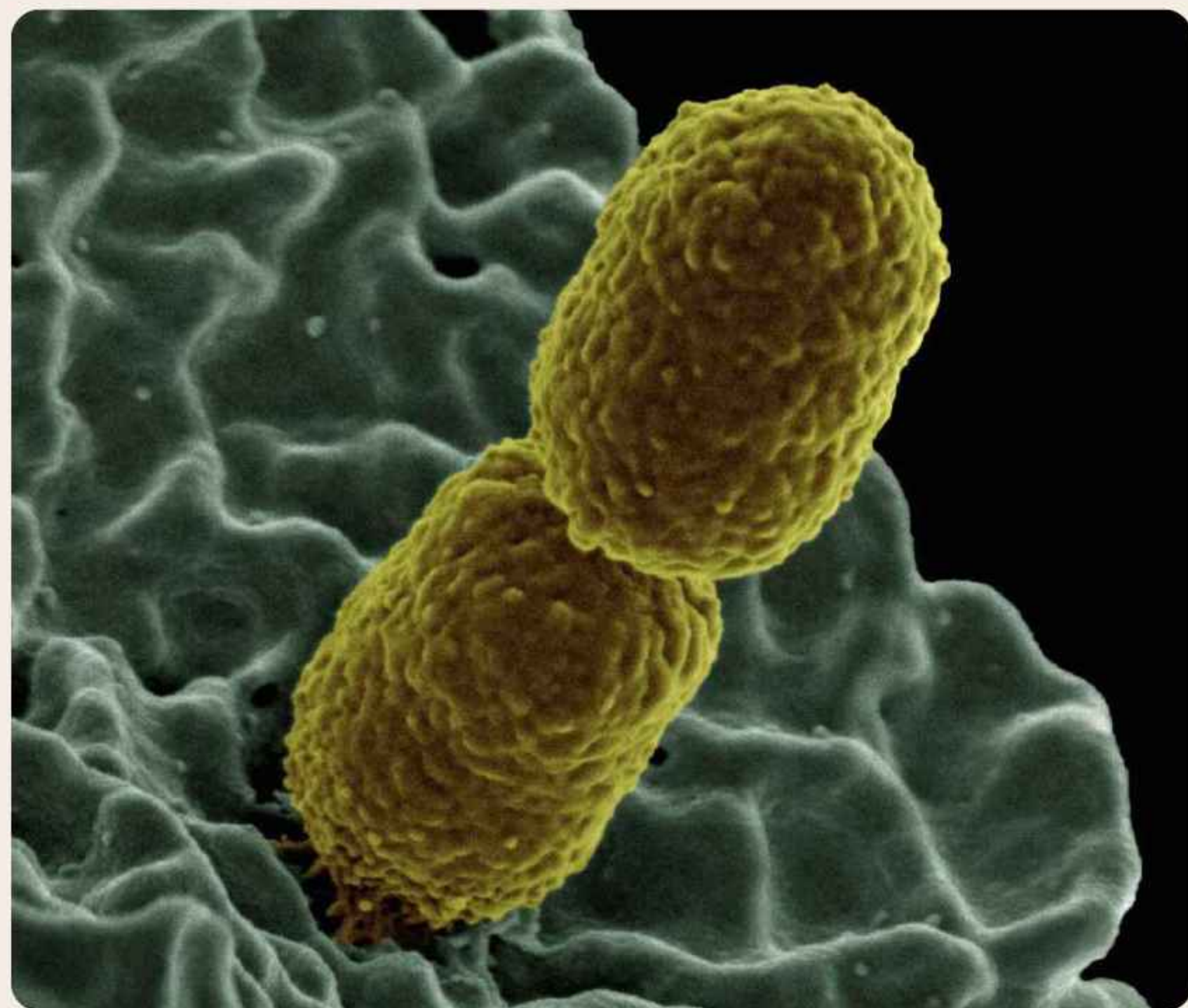
Today, Soil Transformation creates optimal conditions to complete this process in approximately four to six weeks.

The Step-by-Step Process

- 1. Preparation:** The body is gently washed and wrapped in a biodegradable shroud. Any battery-powered medical devices such as pacemakers are removed for safety.
- 2. Placement:** The body is then placed gently in a purpose-built vessel atop a carefully balanced blend of organic woody bulking agent. This blend provides the ideal ratio of carbon and nitrogen that naturally occurring microbes need to begin their work.
- 3. Microbial Action:** Within hours, these naturally occurring microorganisms already present in the body and the environment begin breaking down organic matter.
- 4. Heat Release Phase:** As microbial activity intensifies, the process generates significant heat. Insulation and a controlled environment ensure the material reaches and maintains temperatures sufficient for natural sanitization and pathogen reduction.
- 5. Active Breakdown:** Over the following weeks, bacteria continue to break down soft tissues into simpler components such as water, carbon dioxide, and organic matter.
- 6. Maturation:** The contents of the vessel stabilize as beneficial microorganisms flourish, creating balanced, safe, and living soil ready to support new life.
- 7. Final Steps:** Once maturation is complete, all remaining inorganic or non-decomposable materials, including joint implants, dental fillings, prosthetics, and unpowered medical devices, are respectfully separated and recycled. The entire contents of the vessel are then processed together. This includes the transformed soil, remaining organic material, and bone or teeth fragments. The full mixture undergoes a gentle size-reduction step to create a uniform soil texture.

Nature's Tiny Transformers

Within every Soil Transformation, billions of microorganisms work together to complete the process.



Each group plays a vital role in breaking down organic material and creating healthy, living soil.

- **Aerobic Bacteria:** The first decomposers to act, breaking down readily available nutrients and releasing energy.
- **Heat-Loving Bacteria:** Thrive at elevated temperatures, driving rapid decomposition during the heat release phase.
- **Actinomycetes:** Thread-like bacteria that break down tougher materials such as cellulose and lignin, helping to build soil structure.

How Your Body Becomes Soil

The human body transforms in specific, measurable ways. Each component contributes to the creation of stable, nutrient-rich soil.

- **Organic Compounds:** Microorganisms break down the body's natural components (carbohydrates, proteins, and fats) into heat, water, and carbon dioxide, while retaining key nutrients such as nitrogen, phosphorus, and potassium. These elements stabilize within the resulting soil, creating mature compost that enriches and fertilizes plant life.
- **Bones:** Made of calcium phosphate and collagen, bones supply essential minerals that strengthen plant growth and soil structure.
- **DNA and Cells:** Break down completely at the molecular level, returning trace nutrients to the environment.

This process retains more than 90 percent of the body's nutrients and converts them into stable, plant-available forms:

- **Carbon:** A significant portion becomes humus, the long-lasting organic matter that improves soil structure, fertility, and water retention.

- **Nitrogen:** Derived from proteins and converted into stable forms that sustain plant growth over time.
 - **Phosphorus:** Slowly released into soil and vital for root and shoot development.
 - **Other Minerals:** Potassium, magnesium, calcium, and additional elements are returned to the soil to support healthy ecosystems.
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Carbon Transformation

Soil Transformation is part of nature's carbon cycle, which continually moves carbon through plants, animals, soil, and the atmosphere.

Human bodies accumulate carbon throughout life in order to grow and maintain their tissues, obtaining this carbon from plants that originally sequestered it from the atmosphere through photosynthesis.

When a person dies and their body undergoes Soil Transformation, microorganisms oxidize a portion of that stored carbon and return it to the atmosphere as carbon dioxide.

This mirrors the natural decomposition that occurs in forests and grasslands, where fallen leaves, plants, and animal tissues break down and release carbon back into the soil and atmosphere.



During the NOR process, microorganisms convert organic carbon from the body into natural forms that circulate through living systems. About 30 to 40 percent of this carbon becomes carbon dioxide through microbial respiration, the same biological process that occurs in healthy soil. This is not added pollution, but a natural exchange within the earth's fast carbon cycle.



The remaining carbon follows several beneficial paths:

- **Stable Carbon:** Some forms long-chain organic compounds known as humus, which stay locked in soil for decades or centuries, enriching its structure and fertility.
- **Living Carbon:** Some becomes part of microbial biomass, supporting the growth of beneficial organisms that sustain healthy soil ecosystems.
- **Short-Term Carbon:** A smaller portion forms simple organic molecules that continue to cycle through plants and soil after the material is returned to the land.

Unlike other disposition methods, Soil Transformation keeps carbon within this natural loop:

- **Cremation** uses fossil fuels and converts nearly all organic carbon into atmospheric CO₂.
- **Traditional burial** can generate methane (CH₄), a greenhouse gas more than 25 times stronger than CO₂.
- **Aquamation** releases dissolved carbon into wastewater systems.

By returning carbon to living soil, Soil Transformation sustains Earth's cycles of renewal, keeping a portion of the carbon in motion through life rather than releasing it into the air.

The Unique Properties of Transformed Soil

Independent laboratories certified through the U.S. Composting Council's Seal of Testing Assurance (STA) program regularly test Earth Funeral's soil and confirm its exceptional quality.

Nutrient Profile: Nature's Perfect Balance

Transformed soil contains a balanced range of nutrients essential for healthy plant growth. Exact values vary slightly with each transformation, but typically fall within the following ranges:

- **Total Nitrogen** (1.5–1.9%) — Two to three times higher than typical topsoil. Nitrogen drives chlorophyll production, fueling leafy growth and overall plant vitality.
- **Phosphorus** (0.3–0.5%) — Supports strong root systems and stimulates flowering and fruiting.
- **Potassium** (0.5–0.7%) — Improves plant strength, water balance, and resistance to stress.
- **Calcium** (1.3–1.5%) — Strengthens cell walls and enhances soil structure for better water and nutrient flow.
- **Organic Matter** (55–65%) — Significantly higher than ordinary topsoil, creating an ideal environment for the organisms that maintain fertility and support plant life.

These nutrients are stored within stable organic compounds that release slowly over time, feeding plants gradually and sustainably, just as nature intended.

Biological Vitality and Physical Properties



A defining feature of transformed soil is its rich biological life and resilient structure. Together, these qualities create a living, self-sustaining ecosystem that promotes plant growth and lasting soil health.

- **Plant Growth Tests:** Bioassays consistently show 90–100% seed emergence and vigor, confirming the soil's safety and fertility.

- **Stability Rating:** Independent laboratory tests classify the soil as stable to very stable, indicating that most of the carbon has been naturally converted into humus or carbon dioxide through microbial activity.
- **Maturity Classification:** Rated safe for use on gardens and fields, meeting all U.S. Composting Council criteria.
- **Water Retention:** High organic matter content (typically 55–65%) allows the soil to retain moisture longer, supporting plants during dry periods.
- **pH (6.4–7.5):** Near-neutral conditions create an optimal environment for nutrient availability and microbial life.
- **Carbon-to-Nitrogen Ratio (18–28:1):** Falls within the ideal compost range, supporting gradual nitrogen release and long-term fertility.

When introduced into native soils, this biological vitality helps build a regenerative soil environment that continues to improve over time, making nutrients more accessible to plants, fostering diverse microbial communities, and helping the soil naturally resist disease.

Safety: Thoroughly Tested and Verified

Independent laboratory testing confirms that the soil produced by Earth Funeral is fully processed, rigorously monitored, and meets all state safety and quality standards.

- **Safe:** Independent compost laboratories verify that each sample meets pathogen test criteria for safe use on gardens and landscapes.
- **Contaminant-Free:** No detectable plastic, glass, or metal is found in any test sample.
- **Metals Compliance:** All measured heavy metals fall well below state limits for compost products, including arsenic, cadmium, lead, and mercury.
- **Ongoing Verification:** Regular third-party testing through a US Composting Council STA-certified laboratory to ensure continued safety.



Through this rigorous testing program, Earth Funeral ensures its transformed soil is safe, stable, and ready for use in gardens, landscapes, and ecological restoration projects.

How Transformed Soil Interacts with Nature

The soil created through Soil Transformation doesn't just contain nutrients, it becomes part of a living ecosystem that supports renewal and balance in the natural world. When added to gardens or landscapes, it returns essential elements to the earth:

- Nitrogen from body proteins fuels leafy growth and supports photosynthesis.
- Phosphorus from bones and DNA promotes root development, flowering, and fruiting.
- Potassium from cellular fluids strengthens plant tissues and increases resilience to drought and stress.
- Calcium from bones enhances plant structure and stabilizes soil.
- Trace Minerals such as iron, zinc, and magnesium drive key plant functions, from enzyme activity to chlorophyll formation.

Unlike synthetic fertilizers that wash away in rain, transformed soil's high organic matter helps retain nutrients and release them slowly and steadily, mirroring natural systems and making nutrient runoff far less likely.

Water Retention and Soil Structure

Transformed soil naturally improves how water moves through landscapes and supports plant health in all conditions.

- **Enhanced Water Holding:** With 55–65% organic matter, the soil can hold up to 150–200% of its weight in water, keeping moisture available to roots.
- **Reduced Runoff:** High organic content and stable structure slow water movement, reducing erosion and nutrient loss during heavy rain.
- **Drought Resilience:** Plants grown in transformed soil retain moisture longer, need less frequent watering, and recover more easily from dry periods.



This living soil acts as a natural water management system, absorbing, storing, and slowly releasing water back into the environment. In a changing climate marked by more frequent droughts and intense rainfall, its ability to stabilize landscapes and conserve water makes it an increasingly valuable resource.

Carbon Sequestration

Transformed soil helps store carbon and reduce greenhouse gas emissions in multiple ways.

- **Direct Carbon Storage:** With roughly 30–35% organic carbon, transformed soil locks a substantial portion into stable organic matter that can remain in the ground for decades or longer.
- **Stable Humus Formation:** About 30–40% of the carbon becomes long-lasting humus compounds that resist decomposition and keep carbon securely bound in the soil.
- **Enhanced Plant Growth:** The nutrient-rich soil supports vigorous plant and root growth, which captures additional carbon through photosynthesis.
- **Avoided Emissions:** Soil Transformation prevents the large carbon releases associated with cremation and conventional burial.

By storing carbon directly in the soil and supporting new plant life, each transformation contributes to long-term climate stability and the regeneration of living ecosystems.

Biodiversity Support

The complex structure and nutrient balance of transformed soil create ideal conditions for a thriving web of life.

- **Microbial Communities:** Rich in beneficial microorganisms, transformed soil strengthens soil health and stability by enhancing nutrient cycling and aggregation.
- **Soil Ecosystem:** When applied to natural landscapes, these microbes support diverse life underground, including nematodes, protozoa, and earthworms.
- **Plant Diversity:** Restoration sites using transformed soil often sustain more plant species, helping ecosystems recover more quickly.
- **Wildlife Habitat:** The resulting improved vegetation attracts birds, pollinators, and other wildlife, expanding habitat diversity above ground.

Laboratory testing confirms this biological richness, showing stable respiration and strong plant growth—key indicators of living soil capable of supporting vibrant, self-renewing ecosystems.

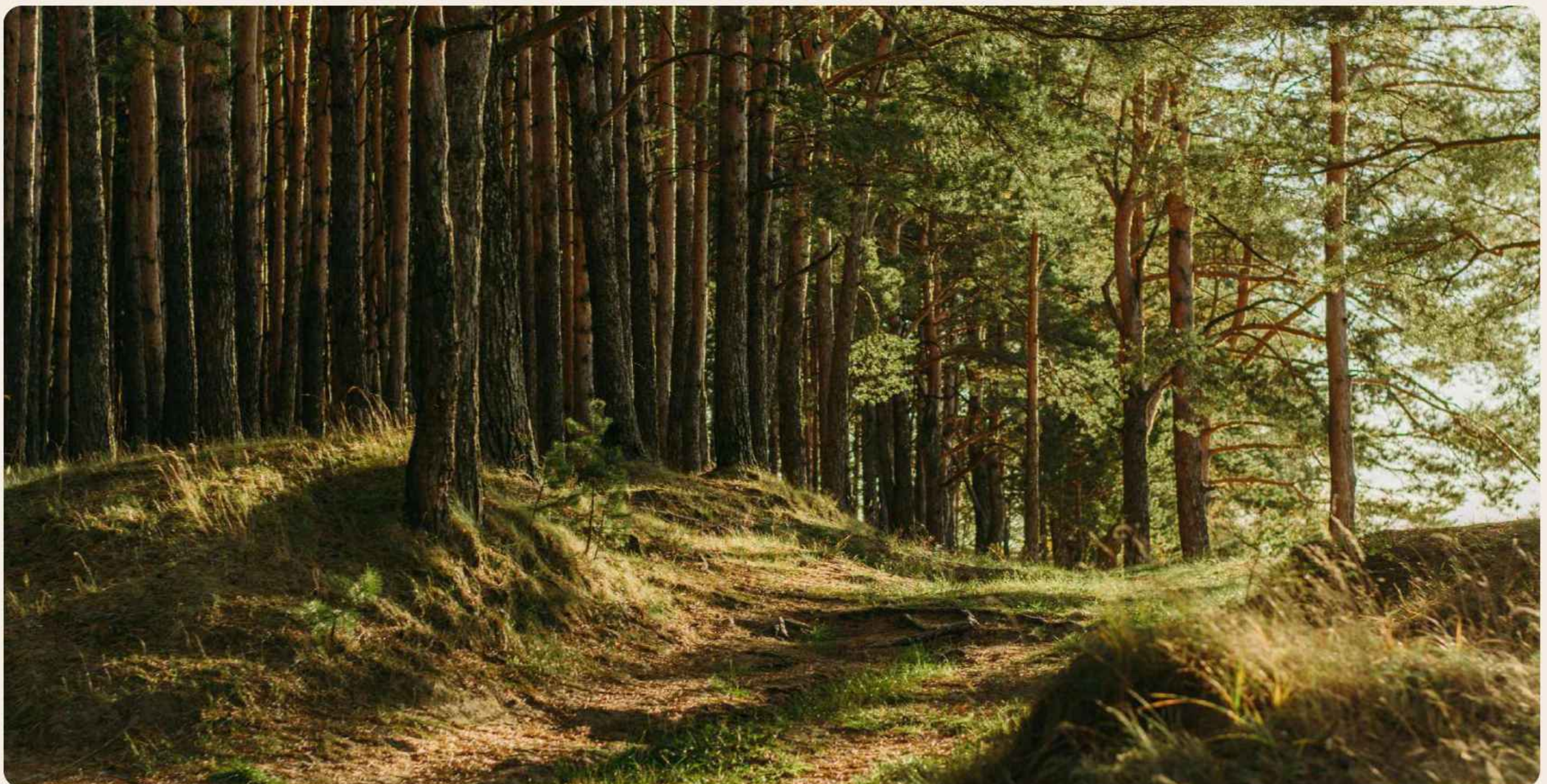
Environmental Restoration Applications

Based on its known structure and chemistry, transformed soil is a strong candidate for environmental restoration and land improvement projects.

Its high organic matter, neutral pH, and stable composition make it a promising material for:

- **Mine Reclamation:** Composts are widely used to balance extreme pH, rebuild soil structure, and reintroduce biological activity in disturbed mining soils.
- **Eroded Lands:** Compost amendments are well documented to add organic matter, improve soil structure, and help stabilize exposed or degraded terrain.
- **Post-Fire Landscapes:** Compost application after wildfires is used to reduce erosion, retain moisture, and support early vegetation recovery.
- **Gardens and Potted Plants:** When blended into existing soils, mature compost reliably improves plant vigor, soil structure, and nutrient availability in both indoor and outdoor settings.

These applications represent future opportunities grounded in established soil science and supported by findings summarized in the [U.S. EPA's Environmental Value of Applying Compost](#). As research and partnerships expand, transformed soil could one day support the recovery of damaged ecosystems and help restore the natural systems that sustain life.



Earth Funeral Conservation Projects

Earth Funeral applies these same ecological principles through active restoration initiatives.



Sierra Riverlands, CA

Converting former farmland into native oak savannah.



Olympic Peninsula, WA

Restoring logged landscapes with native trees and enriched soils that support long-term forest health.

Through projects like these, transformed soil moves from concept to conservation, helping renew the very ecosystems that sustain life.

Safety and Ecological Safeguards

The Soil Transformation process is designed with multiple layers of safety and environmental protection to ensure public health and ecological integrity.

Scientific Validation and Regulatory Framework

- **Scientific Studies:** Researchers at Washington State University conducted pilot studies using human donors and confirmed that Natural Organic Reduction achieves complete decomposition and meets regulatory safety criteria for pathogen reduction.
- **State Regulations:** In Washington and other states where Soil Transformation is permitted, detailed regulations govern the process, facility operations, and the handling of resulting soil to ensure environmental protection and public transparency.
- **Continuous Testing:** Earth Funeral conducts inhouse and independent, third-party laboratory testing beyond regulatory requirements to verify that the resulting soil meets or exceeds all safety and quality standards.

Together, these scientific, regulatory, and procedural safeguards ensure that every aspect of Soil Transformation remains safe, stable, and environmentally responsible.

Pathogen Elimination: Natural Sterilization



The safety of transformed soil begins with the process itself.

- **Natural Heat:** Microbial activity within the vessel generates significant heat, and combined with the insulated, controlled environment, allows the material to reach and maintain temperatures required for effective pathogen reduction in accordance with EPA standards.
- **Constant Monitoring:** Multiple temperature sensors throughout each vessel ensure all material reaches and maintains pathogen-killing temperatures for the required duration.
- **Lab Testing:** Independent laboratories classify the resulting soil as “Very Safe,” the highest level of safety within the testing framework.
- **Biological Verification:** Ongoing plant growth tests, including controlled cucumber bioassays and real-world plantings at Earth Funeral’s Pacific Northwest properties, provide biological confirmation of the soil’s safety, maturity, and quality.

Together, these safeguards confirm that the Soil Transformation process not only meets but exceeds established safety benchmarks, producing clean, healthy soil ready to rejoin natural ecosystems.

Environmental Protection Measures

The Soil Transformation process includes multiple safeguards to protect surrounding ecosystems and minimize environmental impact.

- **Closed-System Design:** A sealed, engineered vessel ensures that liquids, solids, and gases remain fully contained, preventing unintended release into the environment.
- **Medication Breakdown:** Diverse microbial communities help degrade pharmaceutical compounds. One [study](#) found a 95% reduction in diazepam, a common medication and known contributor to soil and water contamination.
- **Water Conservation:** Uses roughly 95% less water than conventional burial preparation.
- **Energy Efficiency:** The process uses far less external energy than alternatives such as cremation.

Together, these measures ensure Soil Transformation produces safe, stable soil while conserving resources and protecting the environment at every stage.

Commitment to Safety and Transparency

Earth Funeral upholds safety and transparency as core principles throughout every stage of the Soil Transformation process.

- **Exceeding Standards:** Performs testing and monitoring beyond regulatory requirements to ensure exceptional safety and consistency.
- **Continuous Improvement:** Refines operational practices using the latest research in composting science, environmental health, and soil ecology.
- **Public Education:** Publishes reports and guides to help families, communities, and policymakers understand the process with clarity and trust.
- **Regulatory Collaboration:** Works closely with regulators and scientists to establish evidence-based standards that protect both people and the planet.

This commitment ensures Soil Transformation remains not only safe and environmentally responsible, but also transparent, accountable, and grounded in scientific integrity.



Addressing Common Concerns

Soil Transformation naturally raises questions. Here are answers to the ones most often asked:

Water Retention and Soil Structure

No. The high temperatures achieved during the process exceed public health standards for pathogen elimination. Independent tests confirm the resulting soil is safe for use.

What about inorganic materials?

All inorganic or non-decomposable materials, such as medical devices, prosthetics, and implants, are respectfully removed and recycled.

What happens to dental fillings or amalgam?

Dental amalgam, which contains trace amounts of mercury, is removed prior to the process whenever present. This precaution prevents metals from entering the transformation system and ensures the resulting soil remains clean and safe.

Is the resulting soil safe to use?

Yes. Independent laboratory testing consistently classifies the soil as "Mature: safe for use on gardens and fields."

How is the process regulated?

Detailed state regulations govern every stage of Soil Transformation, including facility permits, temperature monitoring, and testing protocols that ensure safety and transparency.

The Circle Completed

Human soil transformation reimagines our relationship with death and the natural cycles of life. By viewing the body as a valuable contributor to soil health, the process turns an ending into a beginning—creating new ecological possibilities.

The journey from body to living soil follows nature's oldest rule: nothing is wasted, everything transforms. What once made up human tissue now nourishes trees, flowers, and entire ecosystems.

By becoming nutrient-rich soil, we can help restore landscapes and sustain life in ways traditional funerals cannot. Choosing to become soil is a final act of renewal—joining Earth's ancient cycles and leaving a living legacy for generations to come.



Take Action

Ready to learn more about Soil Transformation?

Visit [EarthFuneral.com](https://earthfuneral.com) to:

- Get answers to your questions
- Receive a custom quote
- Speak with our Care Team

Join us in reimagining what comes after life—and create a positive impact that lasts for generations.

About The Author

As a national leader in Soil Transformation, Earth Funeral has advanced the practice through rigorous testing, environmental stewardship, and compassionate care.

Building on pioneering research from Washington State University and innovators such as Katrina Spade, Earth Funeral developed operational protocols that optimize the transformation process and ensure consistent safety, stability, and soil quality.

Our approach combines deep respect for families with a commitment to transparency, environmental responsibility, and science-driven innovation.

Science, Quality, and Compliance Team



Dr. Geoff Hill, PHD from UBC Vancouver in compost science and pathogen destruction, worked as a compost facility operator of one of Canada's largest compost facilities, compost facility designer for Engineered Compost Systems, regular speaker at national composting conferences such as US Compost Council, Canada Compost Council, Biocycle, and Waste Expo, and founding staff scientist for Mill, in-home food composter.



Josh Forbes serves as Head of Operations at Earth Funeral with 7 years of experience in funeral service operations and regulatory affairs, and has led facility operations for 3 years at Earth Funeral's Auburn, WA and Las Vegas, NV locations. He oversees Earth's funeral compliance strategy across the country and brings operational scaling expertise from his time at Tulip Cremation.



Emily Martin began her career as a military photojournalist before pursuing an Applied Associate Degree in Funeral Service. She is a licensed Funeral Director, Crematory Operator, and Natural Organic Reduction Operator. Emily joined Earth Funeral as a Soil Transformation Specialist and now oversees Process Operations Management across all facilities. Her role brings together hardware, software, soil science, and funeral service.

Glossary of Terms

Aerobic Decomposition: The breakdown of organic matter in the presence of oxygen, preventing methane formation and speeding up natural decay.

Actinomycetes: Filamentous bacteria that decompose tough materials like cellulose and lignin, contributing to soil structure and the earthy smell of healthy soil.

Amendment (Soil Amendment): Material added to soil to improve its physical, chemical, or biological properties, including transformed soil from human composting.

Aquamation: Also known as alkaline hydrolysis or water cremation; a process that dissolves human remains in a pressurized water-alkali solution. It reduces energy use compared to flame cremation but produces liquid effluent requiring wastewater treatment.

Biodegradable Shroud: A natural, non-toxic cloth used to wrap the body before Soil Transformation, allowing for full decomposition without synthetic materials.

Biological Transformation: The natural process in which microorganisms convert organic matter into soil components.

Carbon Cycling: The continuous movement of carbon through living organisms, the atmosphere, and the soil as part of Earth's natural balance.

Carbon Sequestration: The long-term storage of carbon in soil, plants, or other natural "sinks" that help reduce greenhouse gases and stabilize climate.

Compost Stability: A measure of how fully organic materials have decomposed, indicating safety and maturity for soil use.

Conventional Burial: A traditional funeral practice involving embalming, caskets, and vaults, which slows decomposition and can introduce chemicals to the environment.

Cremation: The reduction of a body to ashes through combustion, converting nearly all organic carbon into carbon dioxide (CO₂).

Ecological Renewal: The restoration and revitalization of natural systems by returning nutrients and life to ecosystems.

Environmental Legacy: The lasting positive impact on ecosystems that results from choosing environmentally beneficial end-of-life options.

Green Burial: A funeral practice that minimizes environmental impact by using biodegradable materials and avoiding embalming or vaults.

Heavy Metals: Naturally occurring elements such as arsenic, cadmium, and lead. In Soil Transformation, testing shows they occur at levels well below state safety limits.

Human Composting: See Soil Transformation. A natural process that converts human remains into nutrient-rich soil through controlled aerobic decomposition.

Humus: Stable organic matter that gives soil its dark color and nutrient-holding capacity, formed after complete decomposition.

Living Legacy: The ongoing environmental benefit created when human remains become soil that supports new life.

Microbial Action: The work of bacteria and other microorganisms that drive decomposition and create stable soil components.

Microbial Communities: Diverse populations of microorganisms—including bacteria and actinomycetes—that maintain soil health and fertility.

Natural Organic Reduction (NOR): The legal term for the process of transforming human remains into soil under controlled, aerobic conditions.

Natural Return: The practice of allowing human remains to rejoin natural cycles through environmentally responsible methods such as Soil Transformation or green burial.

Nutrient Cycling: The movement of elements like carbon, nitrogen, and phosphorus between organisms, soil, and the atmosphere.

Organic Matter: Decomposed plant and animal material that enhances soil fertility, structure, and water retention.

Pathogen Reduction: The elimination of disease-causing organisms through sustained natural heat (pasteurization) during Soil Transformation.

pH Balance: A measure of acidity or alkalinity; transformed soil typically maintains a near-neutral pH ideal for plant growth.

Regenerative Burial: An end-of-life practice that actively improves soil health and ecosystem function.

Soil Food Web: The interconnected community of soil organisms—bacteria, fungi, protozoa, nematodes, and worms—that sustain fertility and plant health.

Soil Restoration: The rebuilding of depleted soils using nutrient-rich organic matter, including transformed soil.

Soil Transformation: The controlled process of converting human remains into nutrient-rich soil through aerobic decomposition, also known as Natural Organic Reduction or human composting.

Sustainable Deathcare: Funeral practices that minimize environmental impact and promote ecological renewal.

Terramation: A term for human composting, derived from Latin terra (“earth”) and mation (“transformation”).

Thermophilic Phase: The high-temperature composting stage (113–176°F) in which heat-loving microorganisms rapidly decompose organic material and eliminate pathogens.

Water Conservation: The significant reduction in water use achieved through Soil Transformation compared to traditional burial practices.

Woody Bulking Agent: The mix of wood chips, plant material, and wildflowers placed in Soil Transformation vessels to balance carbon and nitrogen for microbial activity.



