ROSY

Introduction

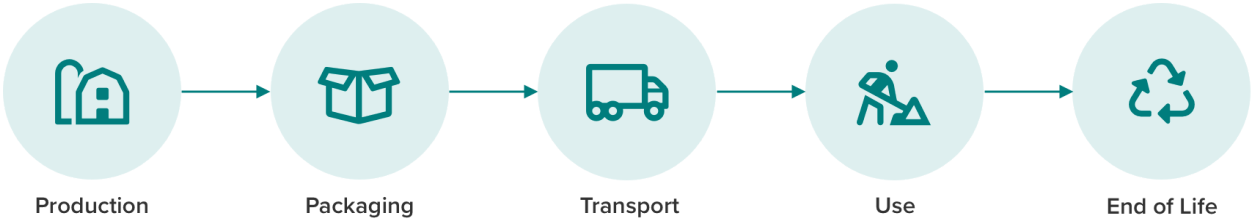
Rosy Soil is on a mission to help gardeners nurture soil, plant, and planet health. We work to make sustainable gardening as easy as possible by offering win-wins: eco-friendly choices that don't sacrifice performance. Our products celebrate the joy of growing plants without harming nature because we believe that growing plants shouldn't come at the expense of the Earth. To accomplish this, we've tested and optimized new soil options that have been proven to pull carbon out of the atmosphere.

Soil has an amazing ability to store atmospheric carbon. In fact, the Earth's soil holds four times more carbon than its plants. However, as lifelong gardeners, we were frustrated and disappointed to realize that most mainstream "soil" products, especially soil-less media made from peat, have a significant carbon footprint. We knew there had to be a better way. So, we've specifically designed our products from the ground up to be better for your plants and better for the planet.

To accomplish our mission, we've committed to making the highest quality soils with the lowest possible environmental footprint. Our goal is to minimize our carbon footprint from the get-go, and lay a climate centered foundation to keep us poised for smart growth as we scale. Before we can work to reduce our impact, we have to fully understand what that impact is, and identify opportunities to reduce emissions or waste throughout our supply chain. Measurement is always our first step in a continuous effort to improve and minimize our environmental impact.

This is why we've taken the time to conduct a Life Cycle Analysis (LCA) of our products. An LCA is a comprehensive assessment of the emissions generated when manufacturing and using a single unit of a product. We evaluate the carbon impact produced at each stage of the product's "life cycle." The life cycle commences when the product's raw materials are produced, covers every phase of its production and distribution across the supply chain, and concludes when our customers use and eventually discard the item.

In accordance with standard LCA methodology, we've measured the net emissions created across the following 5 key stages in the product life cycle:



For our LCA, we measured impact in terms of carbon emissions because this best describes the total amount of Carbon Dioxide (CO_2) emitted throughout our product's life cycle. You will see this listed as "CO_2 eq," or the equivalent emissions in kilograms of CO_2.

Data

To measure the carbon impact of our ingredients' production, the impact of their transportation, as well as the impacts of packaging and waste disposal, we collected data from a number of sources.

In most cases, this meant working with our ingredient suppliers to understand their production processes, and applying those insights to EcoInvent, a globally trusted carbon impact measurement database. We used the same accredited databases to measure the impact of transportation throughout each product's lifecycle.

When we considered the impacts of our packaging and final shipment to customers, we trusted the data provided by our suppliers, our fulfillment partners, the EcoInvent database, and Puro Earth, whom we've chosen to work with on account of their commitment to sustainability. For biochar specifically, since it makes up such a key part of our LCA, we collected multiple academic studies of biochar's production impacts as well as its carbon sequestration rate.

Production

The first step of the LCA was to measure the carbon emitted when producing each ingredient that makes up our potting mixes

When considering our products, our full list of ingredients is:

- Biochar

- Compost
- Vermicompost
- Pine Bark Fines
- Large Fir Bark Fines
- Orchid Fines
- Mycorrhizae
- Pumice
- Recycled Cellulose Fiber
- Sand
- Worm Castings
- Kelp Meal
- Bokashi
- Diatamaceous Earth

Biochar

Biochar is our hero ingredient and helps us fulfill our mission: to offer customers a soil product that not only improves soil health and plant growth, but helps mitigate climate change through a production process that captures and stores high amounts of atmospheric carbon dioxide. Encouraging studies like this one have shed light on how and why this process is so effective.

Biochar's potential to remove billions of tons of carbon from the atmosphere each year, through the process of carbon sequestration, is well established according to experts. Harnessing this potential is at the heart of our mission. We are committed to doing our part to support the growth of the biochar industry, as its expansion translates directly to an increase in carbon sequestration.

Biochar’s superpower arises from transforming waste materials into a carbon-rich soil enhancer. All organic materials, such as the wood waste and crop residues we obtain, are composed of carbon. When left to decompose over extended periods, this carbon gradually dissipates into the atmosphere. We can prevent this by creating biochar instead of letting the organic waste go to a landfill and decay, locking the carbon inside and reducing the potential for carbon emissions.

Rosy Soil's biochar is produced using pyrolysis, a process that involves heating wood or crop residues to high temperatures in an oxygen-deprived environment. Since there's no oxygen, the organic material can't ignite, which would otherwise release carbon into the

atmosphere. Instead, the material remains in a solid form and retains all the carbon inside. Once the biochar is generated, the organic carbon becomes much more resistant to decay, as it is converted into a porous, carbon-dense material with a high surface area. This makes it an excellent soil nutrient holder, water retainer, and promoter of plant growth. Moreover, when we blend it with the other components in our potting mix, it yields a top-quality product specifically designed to support plant growth.

At Rosy, we believe in collaborating with partners who share our dedication to carbon sequestration. That's why we choose to work with folks who follow sustainable production practices and, most importantly, have their carbon footprint certified by established partners like Puro. Through these partnerships, we can guarantee that our biochar ingredient is verified net carbon neutral by trustworthy third parties. Opting for a certified supplier allows us to achieve our target of zero carbon impact for our main ingredient, resulting in an impact of **0 kg CO2 eq**.

Compost

We've sourced compost from a local operation, where green and wood waste scraps are collected into large piles. As it composts, each pile becomes hot enough to break down those inputs into high-quality organic material. After it's turned regularly over the course of many months, the result is a nutrient-rich soil ingredient.

Vermicompost

Vermicompost is a nutrient-dense soil amendment created with composting worms, typically Red Wigglers. As worms break down organic matter, they transform food scraps into stable, biologically active organic material.

The result is a rich input that supports microbial life and delivers essential nutrients in a plant-available form.

Bark Fines

Bark fines are sourced from bark that remains after lumber milling. These materials are screened and sized to create consistent, breathable particles similar to small wood chips.

By using diverted bark from lumber production, we repurpose an existing byproduct stream while improving soil structure, aeration, and drainage.

Mycorrhizae

Although mycorrhizal fungi make up a small fraction of our potting soil, their presence brings enormous benefits. It's all due to the mutually beneficial relationship between these fungi and root systems. Plants entice mycorrhizal fungi to attach to their roots by releasing sugars. In return, the thread-like structures of these fungi increase the area, and consequently, the amount of nutrients and water available to the plant. With the help of these fungi, plants can reach far down into the soil for those typically hard-to-reach nutrients like phosphorus, calcium, and zinc. What's more, mycorrhizal fungi have been shown to play a key role in natural soil sequestration, helping to store carbon in their structures.

This ingredient is great from the standpoint of sustainable production as well. It's produced by growing a plant, often some kind of grass, adding a spore of the fungus into the soil, and allowing fungi to grow using the plant as the medium. Therefore, manufacturing this ingredient is little more than the process used to grow plants.

Of course, there are some very minor carbon emissions produced by the process of farming, mainly due to the energy used when operating equipment and disturbing the soil.

Pumice

Pumice is a naturally occurring volcanic rock that is lightweight and porous. We use it as a low-carbon alternative to perlite, to ensure our soil has good drainage and aeration. It's made by taking fully formed pumice rocks and grinding them into a fine powder.

To calculate the carbon impact created by pumice in our mix, we considered the emissions of extracting the rocks, transporting those to the quarry, and grinding those at the quarry.

Recycled Cellulose Fiber

Recycled cellulose fiber is produced by lightly processing post-consumer paper and cardboard, and stabilizing it through composting. This process transforms recovered paper into a consistent, biologically stable soil amendment.

For impact modeling, we account for both the mechanical processing of the recycled paper and the composting phase that prepares it for horticultural use.

Sand

Sand has large grain size, coarse texture, and high silica content. For us, that all means good drainage in our soil mix. When considering the impact of sand production, it’s all about the energy used to collect and dry it.

Worm Castings

Worm castings, a key ingredient in our soil mixes, embody sustainability and the circular economy at their core. This remarkable material is produced through the natural process of vermicomposting, where earthworms consume organic waste materials, transforming them into a nutrient-rich, organic fertilizer. For Rosy Soil, incorporating worm castings into our products represents a commitment to enhancing soil health and plant growth while contributing to waste reduction. The production of worm castings leverages organic waste that might otherwise end up in landfills, thus reducing methane emissions—a potent greenhouse gas. Our process not only diverts waste from landfills but also enriches the soil, making it more fertile and water-retentive.

Kelp Meal

Kelp meal is another integral component of our soil mixes, derived from the dried and ground biomass of seaweeds. It stands out for its rich content of micronutrients, vitamins, and amino acids, offering a sustainable, slow-release source of nutrients to support plant health and growth. The inclusion of kelp meal in our products reflects Rosy Soil's dedication to leveraging natural, renewable resources that foster a harmonious balance with the environment. The cultivation and harvesting of seaweed for kelp meal have a low environmental footprint, contributing positively to ocean ecosystems by providing habitats and helping to absorb carbon dioxide. Furthermore, the use of kelp meal as a

soil amendment aligns with our commitment to organic and natural gardening practices, avoiding synthetic fertilizers and promoting biodiversity in the soil.

Bokashi

Bokashi is a composting method that converts plant waste into a microbially active, nutrient-dense soil enhancer through active fermentation. To do this, an inoculant is added to scrap organic materials such as sawdust, wood chips, and grains. By carefully controlling the temperature and moisture of the environment, and allowing plenty of time to pass, the mixture breaks down just like compost would, but with an added amount of microbial activity within.

Diatomaceous Earth

Diatomaceous earth is a naturally occurring mineral material formed from the fossilized remains of ancient aquatic microorganisms. It is mined, milled, and ground into a fine powder for horticultural use.

In soil applications, it helps manage pests through physical desiccation and can contribute to improved structure and drainage.

For impact modeling, we account for both the mining process and the mechanical grinding required to produce the finished material.

Packaging

We source our packaging from a sustainability-focused packaging company, who conducts its own LCA to measure the impact of the packaging they make. This helps us monitor the impact of the packaging stage of our product life cycles. Specifically, we use a 60% recycled plastic bag.

Our packaging supplier has specifically committed to purchase both carbon and plastic offsets to ensure that the full lifecycle of the packaging is completely carbon and plastic neutral.

Transport

The transport stage includes the carbon emitted by three key transport phases:

- Ingredients travel from our suppliers to our blending facility
- The blended bags travel to our warehouse
- The bags then travel from our warehouse to our retailers and growers

To calculate the impact produced by our transport, we accounted for the weight of the item (ingredient or full product mixture depending on the transport phase), the transportation method used, and the distance traveled.

Use

This was the most straightforward stage for us to measure. For our products, the “use” stage is the first in the product life cycle that involves our growers directly. This encompasses adding the soil mix to a pot or a garden bed.

As doing so doesn’t produce any carbon emissions, we have concluded an impact of 0 kg CO2 for this stage for each of our products.

End of Life

The final stage of the LCA is called “End of Life.” This accounts for the potential carbon impact produced when packaging and/or the product itself is discarded as waste.

For our products, we’ll consider two variables:

- Discarded Packaging
- Discarded Soil

Discarded Packaging

As mentioned, our packaging is 60% recycled. By providing clear instructions about recycling our packaging both online and on the product label, we make it simple for our customers to recycle.

Our packaging supplier has accounted for both scenarios in their LCA , so the emissions in this stage are already covered in the previously outlined calculations of packaging production.

Discarded Soil

To better understand what our customers are doing with the potting mix they do not use, we've conducted a survey.

Response	Percent
Throw in trash	5.1%
Compost	16.2%
Use as topsoil/throw in the garden	10.8%
Save for future use	67.5%

Considering the "compost" and "use as topsoil/throw in the garden" options, there are also no carbon emissions, as both ultimately end up back in the soil. The only true end of life carbon emissions result from the "throw in trash" response, which we're thrilled to see is the smallest portion of responses, and have accounted for accordingly.

Results

Houseplant (4qt)

Inputs	Impacts (kg CO2)					
Ingredient	Production	To Manufacturer	To Distributor	To Consumer	Packaging	End of Life
Pine Bark Fines	0.020	0.019	0.648	0.275	0.000	0.001
Biochar	0.000	0.000				

Compost	0.024	0.000				
Vermicompost	0.010	0.020				
Diatomaceous Earth	0.001	0.001				
Mycorrhizae	0.000	0.000				
					Total:	**1.020**

Houseplant (8qt)

Inputs	Impacts (kg CO2)					
Ingredient	**Production**	**To Manufacturer**	**To Distributor**	**To Consumer**	**Packaging**	**End of Life**
Pine Bark Fines	0.040	0.038	1.296	0.551	0.000	0.001
Biochar	0.000	0.000				
Compost	0.048	0.000				
Vermicompost	0.020	0.039				
Diatomaceous Earth	0.002	0.003				
Mycorrhizae	0.000	0.000				
					Total:	**2.039**

Houseplant (16qt)

Inputs	Impacts (kg CO2)					
Ingredient	**Production**	**To Manufacturer**	**To Distributor**	**To Consumer**	**Packaging**	**End of Life**
Pine Bark Fines	0.081	0.076	2.592	1.102	0.000	0.002
Biochar	0.000	0.000				
Compost	0.097	0.000				
Vermicompost	0.040	0.078				
Diatomaceous Earth	0.003	0.005				

Mycorrhizae	0.000	0.000				
					Total:	**4.078**

Cactus (4 qt)

Inputs	Impacts (kg CO2)					
Ingredient	**Production**	**To Manufacturer**	**To Distributor**	**To Consumer**	**Packaging**	**End of Life**
Pine Bark Fines	0.015	0.014	0.648	0.275	0.000	0.001
Pumice	0.010	0.010				
Biochar	0.000	0.000				
Compost	0.009	0.000				
Vermicompost	0.005	0.010				
Sand	0.004	0.000				
Diatomaceous Earth	0.001	0.001				
Mycorrhizae	0.000	0.000				
					Total:	**1.003**

Cactus (8qt)

Inputs	Impacts (kg CO2)					
Ingredient	**Production**	**To Manufacturer**	**To Distributor**	**To Consumer**	**Packaging**	**End of Life**
Pine Bark Fines	0.030	0.029	1.296	0.551	0.000	0.001
Pumice	0.019	0.019				
Biochar	0.000	0.000				
Compost	0.018	0.000				
Vermicompost	0.010	0.020				
Sand	0.008	0.000				
Diatomaceous Earth	0.002	0.003				
Mycorrhizae	0.000	0.000				

					Total:	**2.006**

Seedling (4qt)

Inputs	Impacts (kg CO2)					
Ingredient	**Production**	**To Manufacturer**	**To Distributor**	**To Consumer**	**Packaging**	**End of Life**
Recycled Cellulose Fiber	0.030	0.286	0.648	0.275	0.000	0.001
Pine Bark Fines	0.010	0.010				
Biochar (hard wood)	0.000	0.000				
Biochar (pecan)	0.000	0.159				
Compost	0.010	0.000				
Vermicompost	0.005	0.010				
Mycorrhizae	0.000	0.000				
					Total:	**1.444**

Seedling (8qt)

Inputs	Impacts (kg CO2)					
Ingredient	**Production**	**To Manufacturer**	**To Distributor**	**To Consumer**	**Packaging**	**End of Life**
Recycled Cellulose Fiber	0.060	0.572	1.296	0.551	0.000	0.001
Pine Bark Fines	0.020	0.019				
Biochar (hard wood)	0.000	0.000				
Biochar (pecan)	0.040	0.319				
Compost	0.020	0.000				
Vermicompost	0.010	0.020				
Mycorrhizae	0.000	0.000				
					Total:	**2.928**

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Plant Food (2qt)

Inputs	Impacts (kg CO2)					
Ingredient	Production	To Manufacturer	To Distributor	To Consumer	Packaging	End of Life
Compost	0.020	0.000	0.324	0.138	0.000	0.000
Biochar (hard wood)	0.000	0.000				
Sand	0.004	0.000				
Worm Castings	0.001	0.005				
Charkashi, Kelp, Alfalfa Meal, Seabird Guano	0.002	0.004				
Mycorrhizae	0.000	0.000				
					Total:	**0.499**

Plant Food (4qt)

Inputs	Impacts (kg CO2)					
Ingredient	Production	To Manufacturer	To Distributor	To Consumer	Packaging	End of Life
Compost	0.040	0.000	0.648	0.275	0.000	0.001
Biochar (hard wood)	0.000	0.000				
Sand	0.008	0.000				
Worm Castings	0.002	0.010				
Charkashi, Kelp, Alfalfa Meal, Seabird Guano	0.005	0.008				
Mycorrhizae	0.000	0.000				
					Total:	**0.997**

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Booster (8qt)

Inputs	Impacts (kg CO2)					
Ingredient	Production	To Manufacturer	To Distributor	To Consumer	Packaging	End of Life
Compost	0.091	0.000	1.296	0.551	0.000	0.001
Biochar (hard wood)	0.000	0.000				
Worm Castings	0.004	0.019				
Mycorrhizae, Charkashi	0.010	0.017				
					Total:	**1.988**

Aroid (4qt)

Inputs	Impacts (kg CO2)					
Ingredient	Production	To Manufacturer	To Distributor	To Consumer	Packaging	End of Life
Large Fir Bark Fines	0.008	0.012	0.648	0.275	0.000	0.001
Pumice	0.008	0.008				
Pine Bark Fines	0.010	0.010				
Biochar (hard wood)	0.000	0.000				
Vermicompost	0.010	0.020				
Mycorrhizae	0.000	0.000				
					Total:	**1.010**

Orchid (4qt)

Inputs	Impacts (kg CO2)					
Ingredient	Production	To Manufacturer	To Distributor	To Consumer	Packaging	End of Life

Large Fir Bark Fines	0.008	0.012	0.648	0.275	0.000	0.001
Pumice	0.008	0.008				
Orchid Bark Fines	0.010	0.000				
Biochar (hard wood)	0.000	0.000				
Vermicompost	0.010	0.020				
Mycorrhizae	0.000	0.000				
					Total:	**1.000**

Herb Mix (4qt)

Inputs	Impacts (kg CO2)					
Ingredient	**Production**	**To Manufacturer**	**To Distributor**	**To Consumer**	**Packaging**	**End of Life**
Recycled Cellulose Fiber	0.030	0.286	0.648	0.275	0.000	0.001
Biochar (hard wood)	0.000	0.000				
Biochar (pecan)	0.000	0.000				
Pine Bark Fines	0.010	0.010				
Compost	0.010	0.000				
Vermicompost	0.005	0.001				
Mycorrhizae, Kelp	0.000	0.000				
					Total:	**1.276**

Garden (8qt)

Inputs	Impacts (kg CO2)					
Ingredient	**Production**	**To Manufacturer**	**To Distributor**	**To Consumer**	**Packaging**	**End of Life**

Recycled Cellulose Fiber	0.069	0.654	1.296	0.551	0.000	0.001
Biochar (hard wood)	0.000	0.000				
Biochar (pecan)	0.000	0.000				
Pine Bark Fines	0.020	0.019				
Compost	0.020	0.000				
Vermicompost	0.010	0.001				
Mycorrhizae, Kelp	0.000	0.000				
					Total:	**2.642**

Garden (16qt)

Inputs	Impacts (kg CO2)					
Ingredient	**Production**	**To Manufacturer**	**To Distributor**	**To Consumer**	**Packaging**	**End of Life**
Recycled Cellulose Fiber	0.138	1.307	2.592	1.102	0.000	0.002
Biochar (hard wood)	0.000	0.000				
Biochar (pecan)	0.000	0.000				
Pine Bark Fines	0.040	0.038				
Compost	0.040	0.000				
Vermicompost	0.020	0.002				
Mycorrhizae, Kelp	0.000	0.000				
					Total:	**5.284**

Achieving Carbon Neutral

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At Rosy Soil, we are committed to removing as much CO2 from the atmosphere as we possibly can.

We use the following methods to do this:

1. Leverage biochar to take advantage of its strength as a carbon-fixer
2. Conduct the necessary research to maximize the performance and carbon impact of our products
3. Purchase carbon offsets to cover the difference

For step 3, we're proud to partner with the Future Forest Company because we share their commitment to restoring wetlands, peatlands, and bogs. While many carbon offset companies quantify "carbon saved" by planting new trees (an additive measure), peatland restoration saves carbon by letting important peatlands do what they do best - fix carbon!

By combining the carbon offsets we purchase with the carbon sequestered by the biochar, we are able to achieve a net neutral impact, and even go beyond that by helping to remove carbon from the atmosphere through our support of important partners like our biochar suppliers and the Future Forest Company. In this way, we pride ourselves as playing a core function within the carbon sequestration ecosystem, helping to sequester considerable carbon with every product we sell. We believe that this approach is essential to mitigating the impact of climate change and protecting our planet for future generations.

The full impact of our products can be found in the table below:

Product	CO2 Sequestered via Biochar (kg CO2)	CO2 Sequestered via Offsets (kg CO2)	Total CO2 Sequestered (kg CO2)
Houseplant	4qt	1.107	1.020	2.127
Houseplant	8qt	2.214	2.039	4.253
Houseplant	16qt	4.428	4.078	8.506
Cactus	4qt	1.080	1.003	2.083
Cactus	8qt	2.160	2.006	4.166
Seedling	4qt	0.270	1.444	1.714

Seedling	8qt	0.540	2.928	3.468
Plant Food	2qt	1.080	0.499	1.579
Plant Food	4qt	2.160	0.997	4.076
Booster	8qt	4.860	1.988	6.848
Aroid	4qt	1.080	1.010	2.090
Orchid	4qt	1.080	1.000	2.080
Herb Mix	4qt	1.013	1.276	2.288
Garden	8qt	2.214	2.642	4.856
Garden	16qt	4.428	5.284	9.712

Compared to Traditional

To understand how the total carbon impact of our products compares to the impacts of a traditional bag of soil, we conducted a life cycle analysis on a typical, commercial bag of peat-based soil.

A traditional bag of potting soil typically includes 70% peat moss, 10% perlite, 10% fertilizer, and 10% compost, all packaged in a polyethylene plastic bag.

To ensure we were conducting a good faith comparison that highlights the disparities in carbon impact caused by different ingredient choices, we applied those percentages to an imaginary 8 qt bag of traditional potting soil, and we assumed the same carbon impact for the transport, use, and end of life stages that we applied to our own LCA.

The carbon impact throughout the life cycle of a traditional potting soil alternative was as follows:

Inputs	**Impacts (kg CO2)**					
Ingredient	**Production**	**To Manufacturer**	**To Warehouse**	**To Consumer**	**Packaging**	**End of Life**
Peat Moss	2.240	0.002	1.296	0.550	0.000	0.002
Perlite	0.010	0.002				

Fertilizer	2.040	0.002				
Compost	0.020	0.002				
					Total:	**6.166**

We can immediately observe that a traditional potting soil alternative produces over 3x the carbon impact of our *least* impactful product.

These numbers are a calculation of one bag of potting mix. But it's useful to consider the process on a larger scale. According to the International Union for Conservation of Nature, although harvested peatlands only account for a small percentage of land surface, they are responsible for the release of 1.9 gigatonnes of CO2eq annually.

By opting for biochar instead, we support an industry that has the potential to sequester 2.2-4.4 gigatons of CO_2 per year by 2050.

Conclusion

It’s important to remember that this evaluation is a process of improvement that never ends. As we grow and learn more about carbon impacts and how to better measure them, we’ll improve the precision of our understanding within our supply chain. And with greater certainty we’ll be able to make the right changes to reduce our footprint even more.

And for that, we need your help. We want to hear from our customers who may have questions or feedback. We hope to continue to meet with experts who are well-versed in sustainability. What are we doing right? Where are we missing? Let us know how we’re doing so we can collaborate and continue to improve on our mission. We couldn’t do it without you!

Happy growing,
Team Rosy