

Materiom

11th March 2024





Imagine a world where plastics are plant food.

It's 2050 and the world no longer relies on fossil fuels. The materials revolution brought with it a new set of tools and materials to make the products we need, while enriching rather than harming the world around us.



Regenerative materials are 100% biobased, 100% biodegradable, and sourced from biomass that does not compete with food security. At the end-of-life these materials transform into compost - regenerating soils and natural ecosystems.



Biomaterials can be converted into soil amendment & compost

20x



Seaweed sequesters 20x more carbon dioxide than trees



Food waste diverted from landfill avoids CO₂ and methane emissions

Agricultural waste

Leaves, stalks, husks, stems



Glucose / Dextrose / Glycerol

Industry byproducts

Shellfish waste, nut shells



Chitin / Chitosan / Starch

Non-competitive biomass

Seaweed, mycelium



Agar agar / Alginate / Carageenan

Unavoidable food waste

Coffee grounds, peels, pits



Pectin / Cellulose / Gelatin

Municipal green waste

Mown grass, culled trees

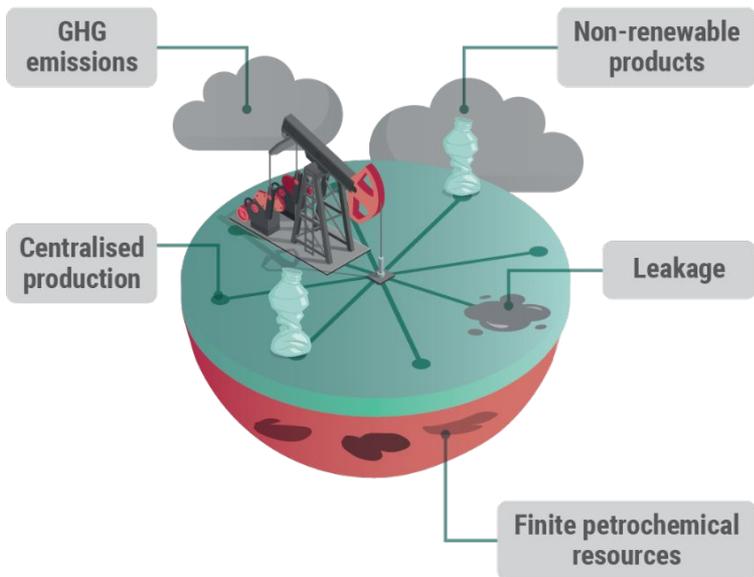


Cellulose / Glycerol / Starch

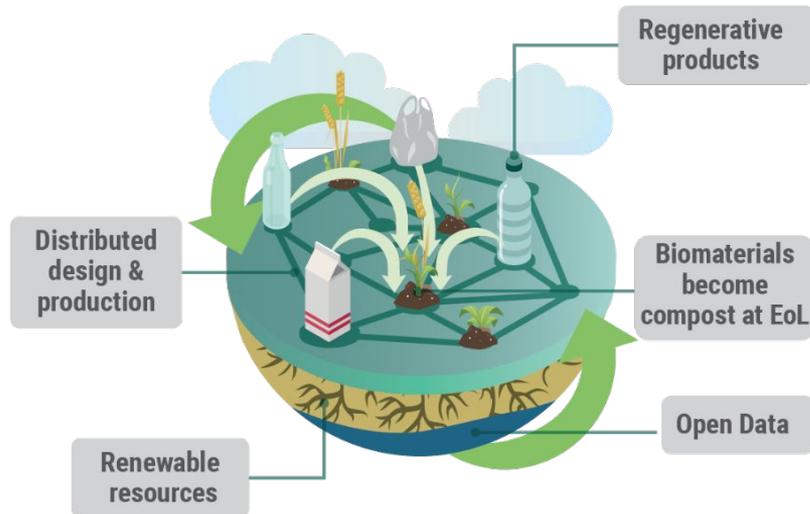
BIOPOLYMERS



From a centralized, fossil-based economy



To a decentralized, renewables-based economy



To tackle climate change and create a waste-free world, we must transform how materials and products are made. Biomaterials made of renewable sources can not only replace petrochemical plastics, but regenerate our planet by becoming compost at end-of-life.

Materiom is an innovation platform specialising in biomaterials R&D. We provide open data and AI software to help scientists, producers, and brands design, make, and use materials that positively impact the planet.



Our **open-access database** of biomaterials - the world's largest - acts as a commons: democratising R&D and seeding a groundswell of innovators to develop bio-based alternatives to plastics.



Our **AI Software** uses our database to create novel biomaterials that meet the needs of market leaders and targets of policy makers - accelerating R&D by 10x.



We convene and support an **extensive network of leaders** across the value chain: from manufacturers and brands seeking solutions to municipalities and communities looking to create value from waste.



Materiom's GenAI is designed to use the information generated by our database to provide novel biomaterial for our community.



Impact-driven material SMEs & brands
Meeting performance and impact targets



Scientists & educators
Generating novel materials for cutting edge research



Generative AI use case: Accelerating R&D for biomaterial entrepreneurs



Can you help me find a recipe for a 100% biobased leather for fashion that uses banana fibers, minimizes carbon emissions and water consumption?

Sure, here is a recipe that meets your desired performance:

Ingredients:

- 70% banana fibers
- 25% chitosan
- 5% glycerol

You can extract starch from potato waste instead of primary crops. Here is an extraction technique that minimizes energy and water use...

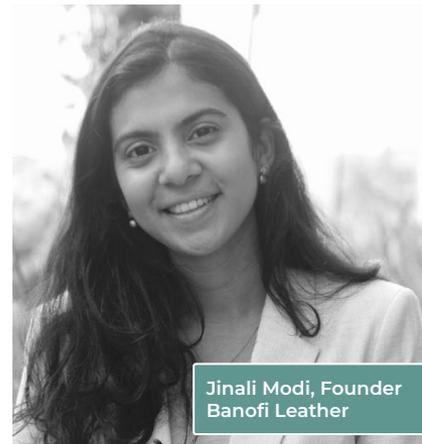


Can this material be used as compost to enhance soil fertility in banana plantations and drawdown carbon?

The soil in banana plantations in Southern India are poor in nitrogen. I suggest adding some collagen to your recipe to make it higher value for soil amendment. Here is a new recipe:

Ingredients:

- 60% banana fibers
- 30% starch
- 10% collagen



Jinali Modi, Founder
Banofi Leather



Enter a prompt here



Article

Biomaterials and Regenerative Agriculture: A Methodological Framework to Enable Circular Transitions

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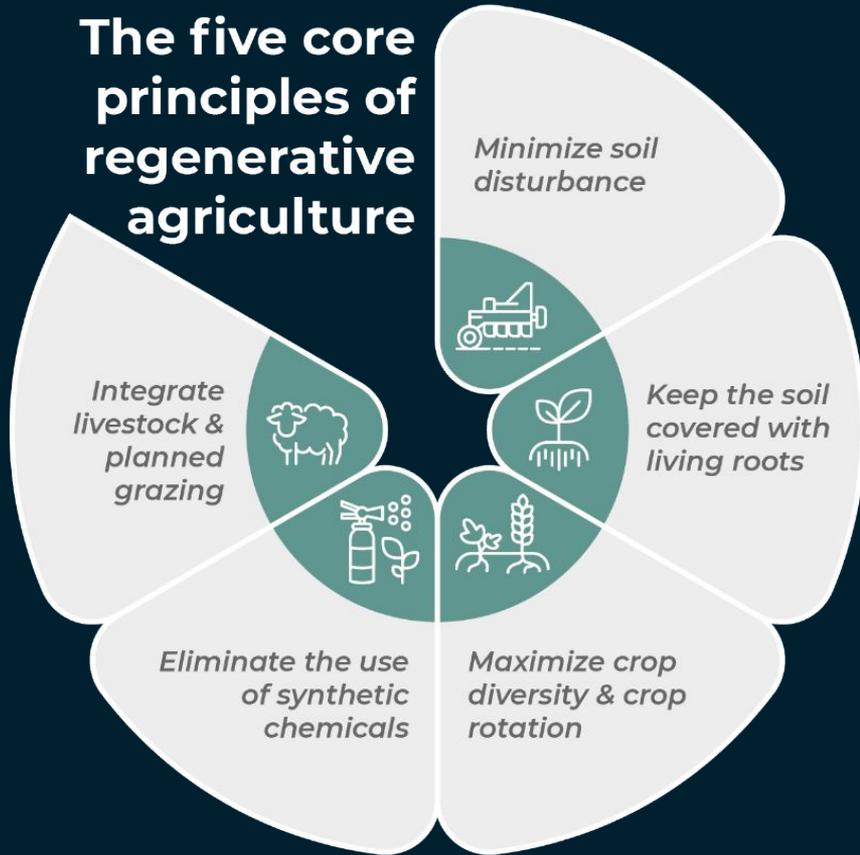
Abstract: Biomaterials, used here to signify 100% biobased and biodegradable materials, can offer a promising solution for transitioning away from fossil-based resources, addressing the climate crisis, and combating plastics pollution. To ensure their environmental benefits, biomaterials must derive from regenerative, non-polluting feedstocks that do not compete with food or feed production. From this perspective, agricultural residues and by-products present a favorable feedstock option for biomaterials production. Although this is an improvement over sourcing them from primary crops, the sustainability of underlying agricultural systems must be considered. Furthermore, the nutrient value of biomaterials for specific soil ecosystems is often overlooked despite their compostability. In this research, we investigate the linkages between biomaterials development and regenerative agriculture, a set of farming practices that can effectively sustain the growing human population while enhancing, rather than degrading, ecosystem health. We explore interdependencies between biomaterials' production and regenerative agriculture for biomass sourcing and nutrient return and suggest a methodological framework to identify mutual benefits. The extent to which regenerative farms can provide biomaterials feedstocks without compromising crop cultivation and ecosystem health is analyzed together with the potential of biomaterials to deliver beneficial nutrients and services to regenerative systems. Applying this framework to the Great Lakes Region, Michigan USA, an agricultural hub facing environmental degradation and plastics pollution, reveals synergistic linkages that unlock novel circular economy opportunities, including local production of renewable biomaterials for various applications, enhancing food security and bolstering socio-ecological systems.



The GLR generates \$14.5 bn in annual agricultural sales, yet is facing critical environmental challenges - water quality, loss of essential wildlife habitats, and rising pollution - due to agricultural intensification and climate change.



The five core principles of regenerative agriculture



Environmental benefits:



Enriched soils and resilient land areas;



Enhanced biodiversity/ecosystem services;



Improved water quality;



Increase the capacity of soil to capture carbon & reverse global warming.



Socio-economic benefits:



Improved farmer profitability and increased income;



Reduced exposure of farmers to harmful agricultural chemicals;



Reduced exposure to extreme weather events and climate change impacts;



Climate-resilient and food-secure communities.

Rodale Institute. (2014). Regenerative Organic Agriculture and Climate Change: A Down-to-Earth Solution to Global Warming. /

Rodale Institute. (n.d.). Regenerative Organic Agriculture. / General Mills. (n.d.). Regenerative agriculture. / Newton, P., et al. (2020). What is regenerative agriculture? A review of scholar and practitioner definitions based on processes and outcomes. *Frontiers in Sustainable Food Systems*, p194.



TABLE 3: MEAN DRY WEIGHT OF EXTRACTIVES & LIGNOCELLULOSIC COMPONENTS OF COVER CROPS

Cover Crops	Dry weight (%)			
	Extractive	Hemicellulose	Cellulose	Lignin
Abruzzi rye	46.30	25.17	25.26	2.56
Black oat	52.17	20.82	25.17	1.77
Crimson clover	62.22	9.53	25.58	3.35
Hairy vetch	53.71	14.29	27.24	4.86
Winter barley	53.40	20.88	19.36	1.42

Cellulose: abundant, renewable, and biodegradable.

Cellulosic monomers, derivatives, fibers, & nanocellulose is used for the production of advanced biocomposites, films, & nanomaterials.

In the GLR, an average of 20-30% of cover crop residues can be removed for use as feedstock for biomaterials production.



The potential of residues derived from main and functional crops in polycultural systems

Corn Bio-packaging
Mater-Bi

Corn Husks Vener
Fernando Laposse

Apple Paper
EcoApple

Grape Leather
Vegea

Coconut Palm Particle Board
Pola Salicka

Beetroot Dye
Stephanie Pollard

Japanese Knotweed Paper
Notweed

Asparagus Peel Packaging
Weißensee Kunsthochschule

Banana Fiber
Paivi Suomi

Apple Leather
Leap

Hemp Felt
HempFlax

Project Syntropia

Syntropic Materials

ESSENTIAL CROP NUTRIENTS

N Nitrogen 7	Ca Calcium 20	B Boron 5	Fe Iron 26
K Potassium 19	Mg Magnesium 12	Cl Chlorine 17	Mn Manganese 25
P Phosphorus 15	S Sulfur 16	Cu Copper 29	Mo Molybdenum 42
C Carbon 6	Ni Nickel 28	Zn Zinc 30	

BIOPOLYMERS & INGREDIENTS WITH HIGH NUTRIENT CONTENT

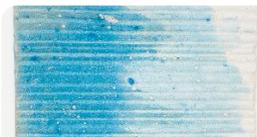
Chitin, Chitosan, Sodium Alginate, Iota-Carrageenan, Kappa-Carrageenan, Gelatin, Keratin, Casein, Collagen, Whey Protein, Calcium Carbonate, Egg Shells, Mussel Shells, Oyster Shells, Silk Fibroin Protein

RECIPES IN MATERIOM'S COMMONS



Walnut Shell & Mycelium Composite

Lab FADEU



Eggshell & Chitosan Biomaterial

Big Circle Studios



Walnut Shell & Keratin Composite

Valentian Dipietro



Gelatin Bioplastic

Margarita Talep Follert



Carrageenan Film

Lugae



Gelatin Bioplastic

FabTextiles



Carrageenan & Avocado Bioplastic

Zoë Powell



Sodium Alginate & Sage Bioplastic

Zoë Powell



Chitosan & Methylcellulose Film

Materiom



Thank you

26th October 2023

 materiom

Generative AI: Learning over time with the Materiom community

Combining the power of generative AI with Materiom's community-driven platform, we can radically accelerate the ability for anyone, anywhere to develop net-positive materials.

Recipes generated by the chatbot will be tested by our community. Once validated, they can be added to our database, helping the AI improve over time.

