
PHYLA
earth
SUSTAINING
NATURE'S
CAPITAL
Investing in biodiverse assets that
build resilience and grow in value.



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I was trained as an energy and environmental engineer at a time when the word sustainability was rarely spoken of in the business world. But for me, sustainability and the efficient use of energy has always guided my design strategy.

For the past three decades, I've taken great pride in the projects we have delivered for the built environment, providing renewable energy and holistic benefits to clients and communities, whilst minimizing ecological damage.



FOREWARD

Rabih El Fadel, CEO, Phyla Earth

When I began work on the Great Green Wall, I saw firsthand the devastating impacts of land degradation and have been working to understand the historical lessons and pitfalls in addressing desertification. Beyond the environmental consequences of land erosion, people living on degraded lands also have to contend with migration, famine, conflict and possible terrorism. One lesson from "unsustainable" economic development is that it often doesn't account for communities. For sustainable economic progress to truly take hold, we must empower local communities.

And that's a huge part of Phyla's mission: empowering communities to ensure future generations have access to the basic ecosystem services many of us take for granted - clean air, food, energy and water. These simple things are intricately linked to peace and prosperity. Take these things away and the future doesn't look bright for any of us. Restoring our ecosystems is thus the greatest challenge of our generation and all of us at Phyla have devoted a great deal of energy to finding solutions to these challenges. Early on, our team recognized the resilience of natural systems and began asking critical questions on how we could harness this power to achieve true systems change. The answer: combining nature, technology and human enterprise. We've been building a portfolio of climate resilient plant species that are able to address challenges not only on climate, but around food security, nutrition, biodiversity as well as societal indicators.

Our vision spans the entire value chain and our discernment for projects and partners has enabled successful restoration of ecosystems heavily degraded by mining and intensive agriculture to provide triple bottom line benefits for people, profits and the planet. Investing in natural assets is the strongest commitment we can make to ensure the wellbeing of current and future generations and I'm delighted to share with you our mission and the extraordinary work Phyla is doing worldwide to create sustainable offerings tied to our vision of building a regenerative global economy.

MISSION / VISION

Scaling the regenerative economy



Phyla Earth Zambia Elite Propagation Nursery, a World's first bringing strong competitive advantage.

We are on the ground scoping landscape regeneration projects worldwide.

We are on the ground scoping landscape regeneration projects worldwide, with a platform to commercialise biodiverse agroforestry systems for the production of renewable bioenergy, food proteins and biocompounds whilst mitigating climate change and restoring life to degraded ecosystems.

MISSION: To convert degraded landscapes into productive assets that contribute to food security, produce essential renewable energy, create jobs and empower local communities.

VISION: Phyla aspires to displace extractive economic models with regenerative ones to make sustainable, inclusive growth achievable. By 2035, we aim to scale our biodiverse agroforestry systems and regenerate over one million hectares of degraded land. By 2050 we estimate this will produce XX GW of bioenergy and 1.5 million tons of regenerative alternative proteins per annum.



Elite Pongamia maturing at the mine restoration demonstration site in Zambia.

TIMELINE

1960

Phyla's team, (led by Dr. Prasad) identified Pongamia pinnata alleviating poverty during droughts in Rajastan

In 1980's, the team led plant breeding programs on genetics and breeding of groundnut and castor crops.

In 1990's, Phyla conducted a comprehensive study on 60+ species for biofuel production, concluding Pongamia as the best choice. Equally members (Rabih, Ben) of the team were heavily involved in sustainable development.

Between 1998 and 2003, Phyla implemented a program in partnership with the World Bank to identify high-yielding cashew species for global deployment.

In 2006, CleanStar Energy (now Phyla Biodiversity (India) was established to develop plant-based bioenergy production systems.

2009

Phyla's team, conducted a field survey to identify Elite Pongamia. They pioneered the methodology for establishing stable propagation of the plant.

In 2009, a 3-year contract farming initiative commenced led by Phyla (Latha), across 200 Indian Villages to cultivate castor.

2010

A successful proof of concept for mine regeneration via Elite Pongamia was conducted by Phyla's team in JSW's Lignite Mine in Rajasthan and Iron Ore Mine in Karnataka.

2012

Phyla's team led the first commercial production of Elite Pongamia saplings, initiating the first international export of live grafted Pongamia saplings.

2013/2014

BetterWorld Energy (now PHYLA Earth Zambia) was founded by Dr Warr in sub-Saharan Africa to demonstrate and develop Elite Pongamia pinnata for the first time.

PHYLA Earth Zambia won EEP grant funding, provided by the Nordic Development Fund (NDF) and support from DFID and SIDA through MUSIKA.

2015

Rabih El Fadel was commissioned by the Nigerian Ministry of energy and the MDG's international team to revisit the concept of the Great Green Wall of Africa.

2017

Phyla implements the world's first Elite Pongamia mine regeneration by the plantation of 2,500 imported saplings into a Zambia Coppermine's tailings facility.

In 2018, Phyla's team achieves Best Agricultural Innovation Zambia Award and secures a grant from SAIS to develop a Hyperlocal Soil Advisory Service.

2019

Phyla won IAPRI and MUSIKA's best Innovation in Rural Agriculture Marketing Impacting environment and climate change.

2020

Phyla Earth was established in the United Kingdom to unify the historical and future efforts of diverse teams working across India, Zambia, Nigeria, and other countries. The organization focuses on Pongamia cultivation, agroforestry systems, soil improvement, and carbon quantification and reporting. This initiative brings together various projects under a single mission to advance sustainable agricultural practices and promote environmental conservation on a global scale.

2021

PEZ conducting detailed in-situ and pot trials with University of Reading, GRIP Project to determine tolerance of Pongamia to extreme conditions

2022

Working with Zambia's fastest growing agricultural company to design appropriate strategies for soil information systems and the potential for soil carbon in their projects.

2023

- **AgriFibre™** Trials Begin in India: Initiation of trials to develop and test different AgriFibre™ systems aimed at improving agricultural sustainability.
- **Phyla Earth Zambia:** Establishment of the first 8,500 Mother Tree Propagation Facility in Zambia, capable of producing X trees by ABCD.
- **SDG Centre for Africa:** Our Chief Sustainability Officer is conferred as Regional Director of the SDG Centre for Africa, joining a board with prominent members XYZ, advising the Government of Zambia and other SADC countries.
- **USAID WE4F Project:** Phyla partners with Nature's Nectar in a United Stated Agency for International Development (USAID) Water and Energy for Food (WE4F) project, collaborating with 70% female head-of-household farmers to establish and train for Sunflower/Bioferts before planting 2,500 elite Pongamia trees in 2024/25.
- **African Forest Soil Carbon Project:** Phyla consults on a leading first African forest soil carbon project, training staff in soil carbon data collection for one of Africa's most prestigious REDD+ carbon projects.
- **Conservation Lower Zambezi Report:** Phyla carry's out a bespoke artisanal mining and livelihood options report for Conservation Lower Zambezi, a World Heritage Site.
- **Phyla Nursery in Nigeria:** Initiation of work on a new nursery in Nigeria.
- **Phyla Nurseries South African formed:** Phyla signs joint venture to propagate Phyla, elite pongamia signed with experienced local operators. Ambition penned to regenerate 100,000 hectares over the coming decade. Preparation work begins on building the nursery ready for initial saplings Q2 2024.

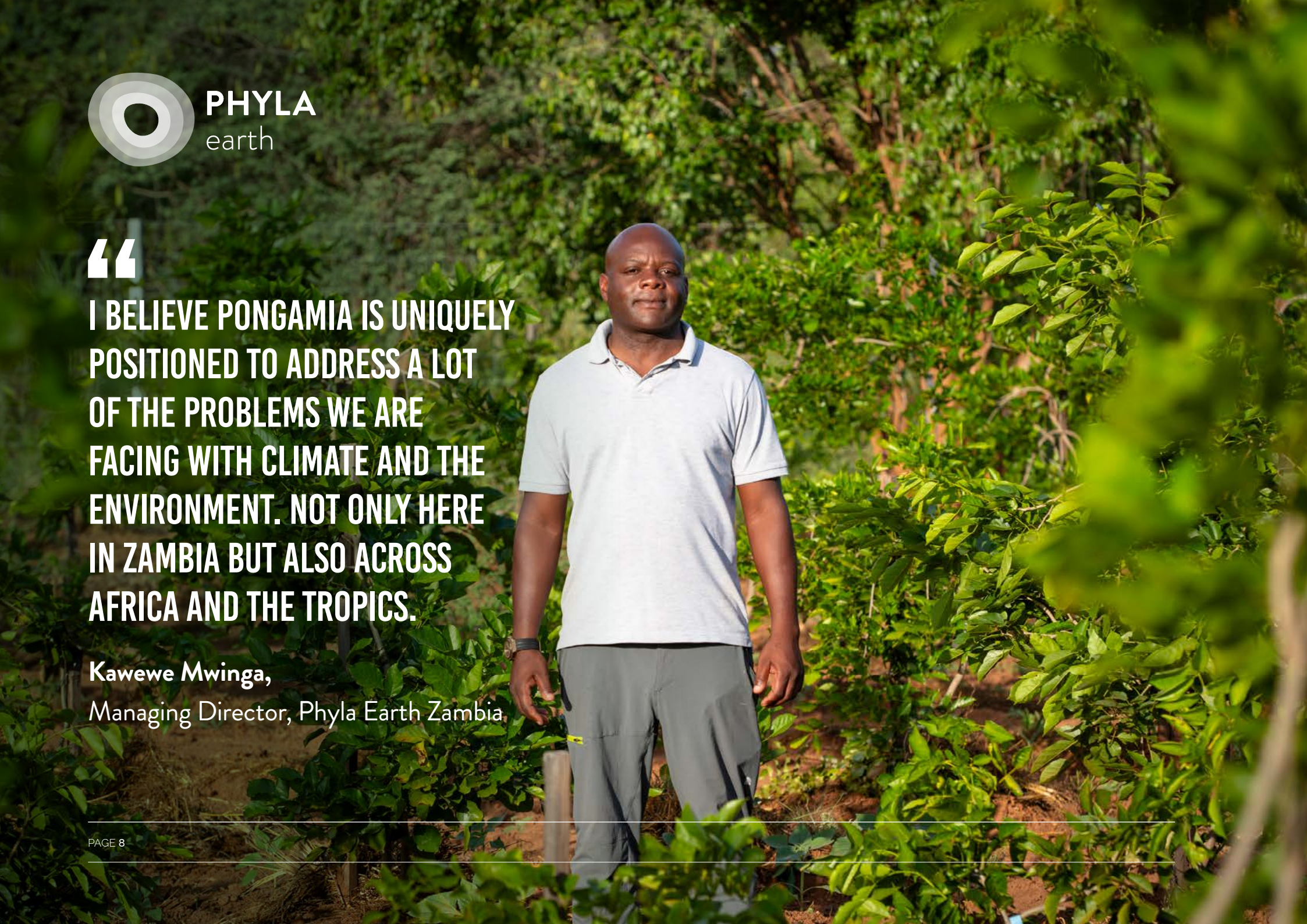
2024

- **MoU with Zambian Chief and Community:** Signing of a Memorandum of Understanding with a Zambian Chief and community to regenerate 5,000 hectares of Pongamia and 15,000 hectares of forest, revitalizing a biodiversity hotspot.
- **Soil Laboratories Representation:** Phyla's soil laboratories become the private sector representative for Zasolan, part of Glosolan, FAO.
- **MoU with Musika and SDGCA:** Agreement to develop BFV in collaboration with Musika and the SDG Centre for Africa.

Partnerships

- **Nature Metrics:** Establishing a partnership to enhance biodiversity measurement and reporting.
- **OneNature Institute:** Collaboration to integrate sustainable development and community well-being.
- **Resolve/Regeneration:** Joining forces to further mine restoration and regenerative agricultural and environmental conservation.
- **Phyla South Africa & Nigeria:** Phyla South Africa and Nigeria prepare newly built nurseries for commencing production.

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I BELIEVE PONGAMIA IS UNIQUELY POSITIONED TO ADDRESS A LOT OF THE PROBLEMS WE ARE FACING WITH CLIMATE AND THE ENVIRONMENT. NOT ONLY HERE IN ZAMBIA BUT ALSO ACROSS AFRICA AND THE TROPICS.

Kawewe Mwinga,
Managing Director, Phyla Earth Zambia

PONGAMIA

Elite pongamia pinnata

Laying the foundation to restore ecological function and biodiversity to degraded lands.

We identify elite varieties with proven stable yields suitable for a wide range of production systems, weather conditions and soil types.

Meticulous selection and combination of Elite varieties uniquely chosen for each project reduces risks for optimal yields.



Demonstrated yields in the toughest of environments.





PONGAMIA

Truly Unique Opportunity

Our elite pongamia agroforestry system brings together 5 linked forces, offering unique advantages for productive land regeneration of mining sites, facilities and landscapes.

LAND REGENERATION



Low input, N fixing, drought tolerant and agroforestry.

NATURAL CAPITAL VALUATION



Building an asset class in biodiverse carbon removal systems.

RENEWABLE BIOENERGY



Generating low carbon bioenergy.

VALUE CHAIN



Financing and adding value through processing and market linkages.

EDUCATION & TRAINING



Supporting individuals to succeed as communities.

Protein
Yields high-protein meal ranging from 4 to 6 tons per hectare.



Honey and Biodiversity
Regenerates ecosystems increasing natural capital for sustainable products.



Pest Resistance
Selected for resistance to pests and disease, minimising the need for chemical interventions.

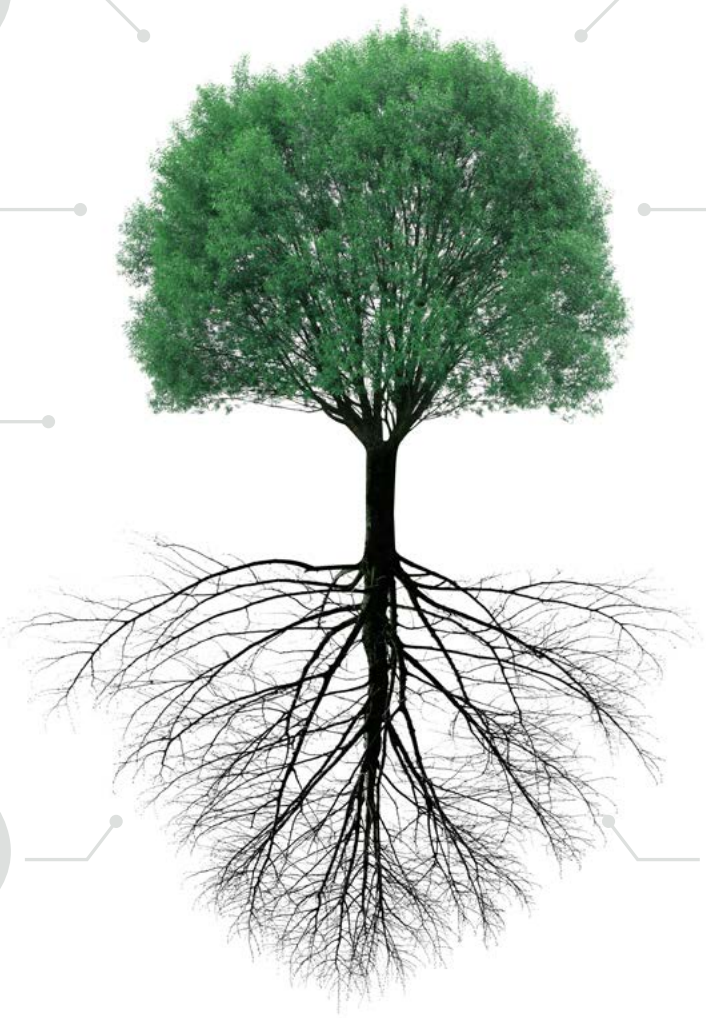


Phytoremediation
Tolerates heavy metals and contributes to soil remediation.



Nitrogen Fixing and Carbon Removal
Facilitates natural nitrogen production reducing fertiliser requirements while sequestering carbon in the biomass and soil.





Biomass
Generates high-calorific biomass, producing up to 14 tons per hectare.



Feedstock for Biofuel
Produces 2.5 to 3.5 tons of fatty acids per hectare for producing SAF and biodiesel.



Natural Cosmetic Products
Bioactive compounds for healthcare and cosmetics, enriching natural product lines.



Saline Tolerance
Thrives in challenging conditions, including saline and flooded environments.



Drought Tolerance
Taproot accesses water from deep in the soil, avoiding competition with shallow rooted intercrops.



PHYLA & PONGAMIA

A brief history 50 years in the making



PHYLA's "tree technology" has been the result of groundbreaking work that began during the devastating droughts in Northern India, which occurred in 1972 and 1974.

"As a consequence of the poor monsoons in those years, India faced food shortages, inflation and threats of famine across a number of states. Yet, in spite of such harsh conditions, a handful of villages where pongamia trees were pervasive sustained themselves, demonstrating the almost miraculous resilience of this species." **Dr. MVR Prasad.**

The by-products of pongamia provided a vital source of income for villages impacted by the droughts, subsequently inciting the curiosity of PHYLA's dryland agricultural expert Dr. MVR Prasad on the tree's unique ability to withstand drastic climate variability.

There had been little understanding of the productivity and management of pongamia prior to Dr. Prasad's comprehensive study of the tree's special attributes. Working alongside an expert plant breeding team, he has spent several decades on R&D and has identified a few exceptional "Elite Mother" trees exhibiting significantly higher yields, which form the basis of PHYLA's Elite Pongamia portfolio.

The "Elite Mother" trees identified by Dr. Prasad surpass the average output of standard pongamia varieties up to tenfold, making them commercially viable for a variety of derivative products. This discovery led PHYLA to develop its proprietary "tree technology."

PONGAMIA

Multiple products of value
Pongamia production profile

- >15 litres of vegetable oil per tree, provides over >3000 litres per hectare suitable for direct use in energy devices or value-addition to biodiesel and even jet-fuels.
- Afforestation pongamia produces carbon negative oils. Farmers can use leaf or biomass as green manure to replace inorganic fertilisers.
- Pongamia regeneration provides a habitat for pollinators and provides a landscape stimulus to honey production, shade and a source of nitrogen for other plants.
- Pongamia contains karanjin and pongamol, which are very high value biocompouonds with uses in agriculture (biological pest control and fertiliser use efficiency), healthcare and cosmetics.



BIOMASS
from podshell used for soil health products or as an alternative to charcoal and coal in industry.

BIOENERGY
from oil produced and used for biodiesel and Sustainable Aviation Fuels (SAF).

FOOD PROTEINS
from pea flour used to provide food security from marginal land.

BIOCOMPOUNDS
that substitute for toxic chemicals used in agriculture to reduce environmental damage.

CARBON
sequestered in trees and soil while bioenergy products offset industrial fossil fuel GHG emissions.

PONGAMIA

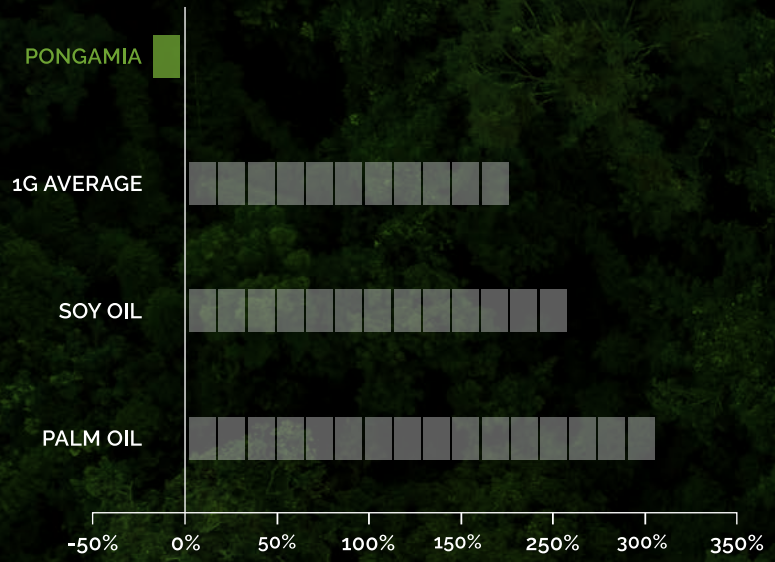
Demonstrating viable economic yields

Producing fuels for mine operations from marginal landscapes unsuitable for other forms of agriculture.



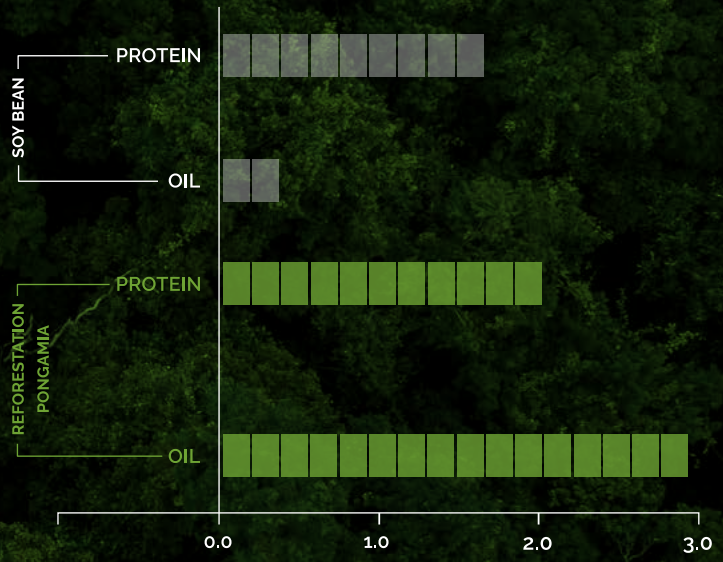
Carbon removal, climate change resilient food and energy production

COMPETITIVE LOW CARBON FUELS



% of carbon emissions compared to fossil fuel (diesel = 100%)

HIGHER YIELDS PER HECTARE THAN SOYBEAN



Metric tonnes per hectare

Pongamia produces low carbon fuels

- Avoided GHG emissions (N-fixing, no fertilizers)
- Low Carbon Footprint - Minimal energy and water requirements
- Sequestration above and below ground in trees and soil
- *1 hectare can sequester over 150mt CO2eq (trees) 90mt CO2eq (soil)
- Bioenergy products substitute for fossil fuels and generate offset carbon credits

*forecast based on Zambia Agroecology Zone 1 <800mm rainfall.

Pongamia produces proteins for food and feed

- Yield advantage of perennial tree-based crops
- Low maintenance and input costs
- Environmental and habitat benefits
- Resilient to adverse weather conditions
- Ease of production in outgrower systems.



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HEALTHY FUNCTIONING SOILS SUSTAIN PLANT AND ANIMAL PRODUCTIVITY, MAINTAIN AND ENHANCE WATER AND AIR QUALITY AND SUPPORT HUMAN HEALTH AND HABITATION.

Dr M.V.R. Prasad

THE CHALLENGES

Perennialisation For resilience and productivity

The transition from annual crops to perennial systems provides a **permanent cover crop**, removes the need for crop rotations (that require more land), creates vertical productivity, decreases weather and climate risks and creates year to year security of feedstock supply.



Threatened by land degradation caused by acidification, salinisation and erosion.

Transforms degraded and marginal land into a productive asset with high yields.

- INCREASING -



Pressure on limited land resources threatens remaining forests, savannahs and wetlands.

Can incorporate intercrops, livestock and apiculture and multiple product revenues.

- SPARING -



Threatens the agricultural resilience to pests, disease and the negative impacts of climate change.

Pest and disease resistant varieties and multispecies plantations build biodiversity

- BUILDING -



Caused by excessive demand for irrigated agriculture, sealed and compacted soils.

Drought tolerant deep rooted agroforestry systems suitable for rainfed systems.

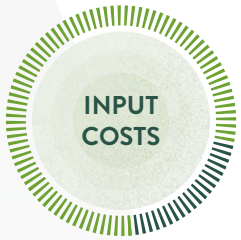
- CONSERVING -



Causing crop failure from high temperatures and erratic low rainfall, threatening livelihoods and food security.

Able to withstand temperatures as high as 50degC, shading soils and making efficient use of limited rainfall.

- ADAPTING -



Increasing annual costs (fertiliser, fuel, water) and risks (climatic, market) driving down profits margin for producers.

Nitrogen fixing, with deep roots that access (micro) nutrient and water rich subsoils de-risk production.

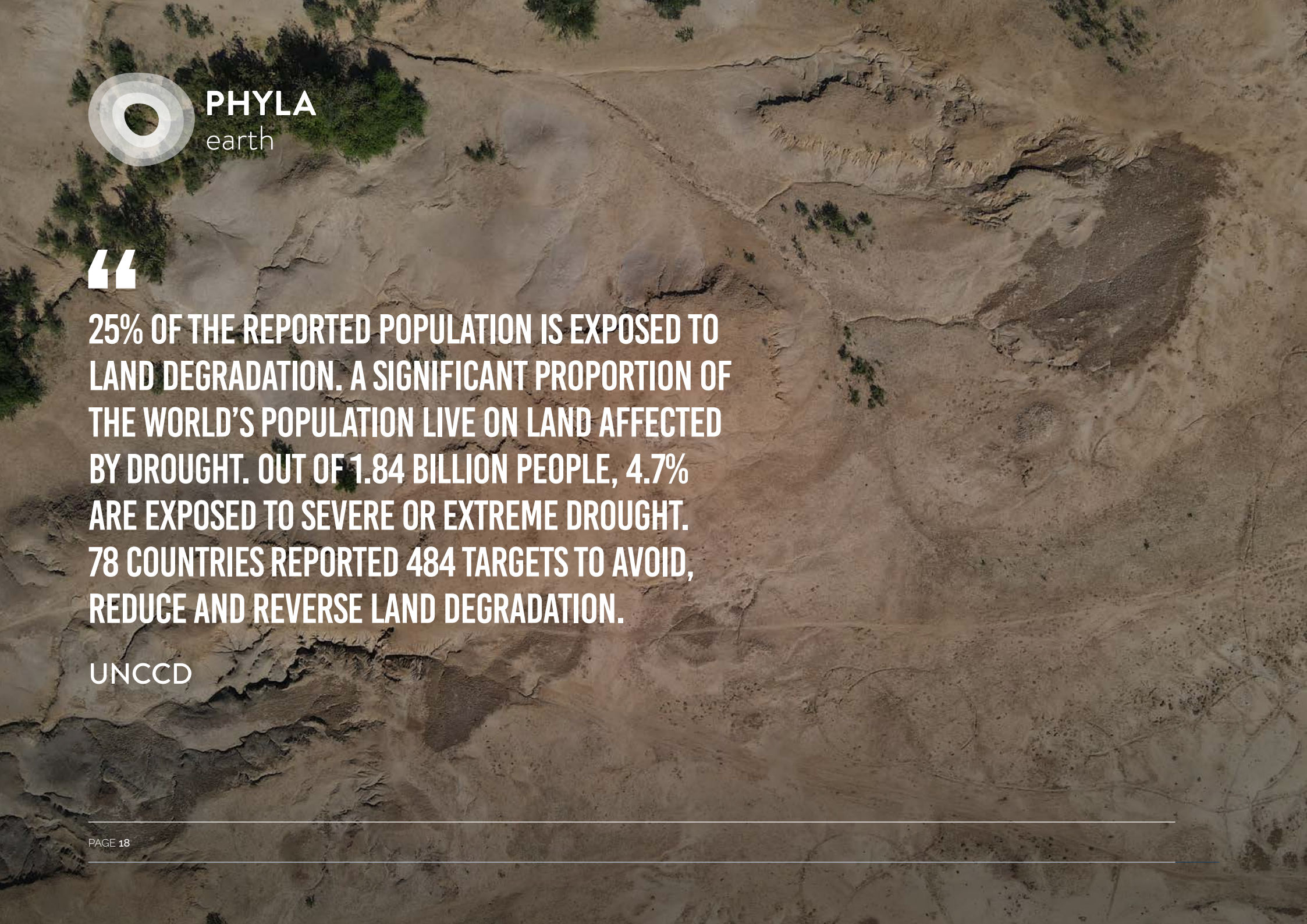
- DE-RISKING -



Loss of soil carbon, nutrient imbalance, erosion, acidification and salinisation threaten agricultural soils.

Minimising soil disturbance, building dense carbon rich and biodiverse root and mycorrhizal networks.

- INCREASING -



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25% OF THE REPORTED POPULATION IS EXPOSED TO LAND DEGRADATION. A SIGNIFICANT PROPORTION OF THE WORLD’S POPULATION LIVE ON LAND AFFECTED BY DROUGHT. OUT OF 1.84 BILLION PEOPLE, 4.7% ARE EXPOSED TO SEVERE OR EXTREME DROUGHT. 78 COUNTRIES REPORTED 484 TARGETS TO AVOID, REDUCE AND REVERSE LAND DEGRADATION.

UNCCD

PHYLA REGENERATION

Landscape regeneration approach

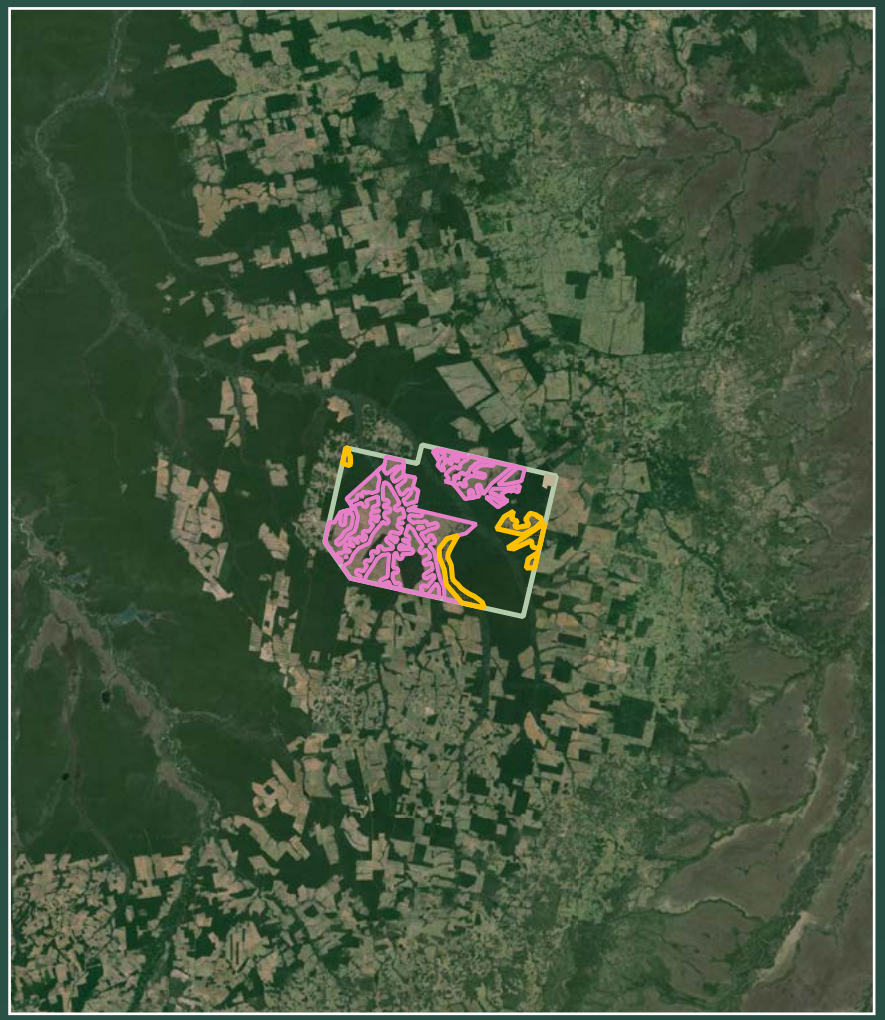
Phyla embraces a holistic approach to landscape-scale regeneration and conservation, ensuring that our afforestation projects are impactful and beneficial to local communities. With Pongamia as our anchor species and integrating ecological, economic, and social components, we we create a strong commercial incentive for land restoration.

Each project is framed within a fully accounted carbon landscape, integrating multiple elements to maximize environmental and social benefits.

- **Forest Conservation:** Conserving local forest areas under a REDD+ or similar scheme to reduce emissions from deforestation and forest degradation.
- **Riparian Ecosystem Regeneration:** Restoring riparian zones to protect waterways, enhance biodiversity, and improve water quality.
- **High-Value Timber Forest Regeneration:** Regenerating forests with high-value timber species to support sustainable timber extraction and economic growth.
- **Tree Propagation Nurseries:** Establishing nurseries to propagate saplings, ensuring a sustainable supply of planting material.
- **Native Tree Integration:** Recognizing the importance of native species, we plant endemic species alongside our Elite Pongamia to restore resilient, healthy landscapes.
- **Biological Approaches to Soil Carbon:** Enhancing soil carbon sequestration and improving soil productivity through biological methods.
- **Organic, Nutritious Food Production:** Cultivating a variety of climate-smart crops with regenerative certification to enhance food security.
- **Natural Fibers and Regenerative Materials:** Producing carbon negative materials that are both environmentally friendly and economically viable.
- **Processing and Value Addition:** Developing local processing facilities to add value to raw materials, creating jobs and boosting local economies.

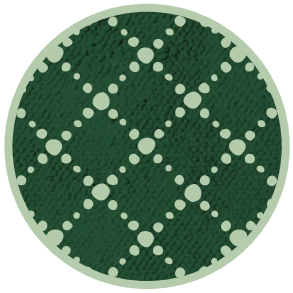
Typical project Design

Phyla's landscape regeneration approach ensures that our projects are not only environmentally sustainable but also economically beneficial and socially impactful. By integrating native species in agro-biodiverse systems, conserving forests, and enhancing local economies through a fully accounted carbon landscape, we create resilient landscapes that support thriving communities and a healthy planet.

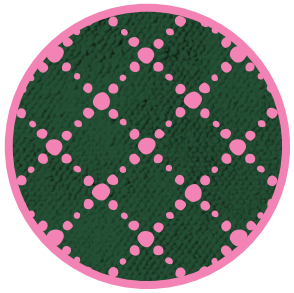




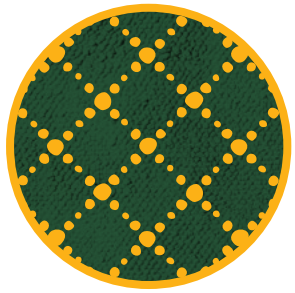




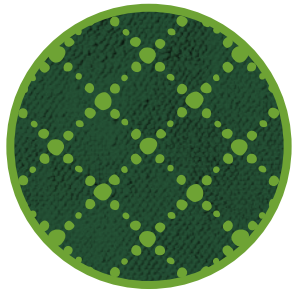
Conserved Forest
Under REDD+
86,000 Ha



Riparian Ecosystem
Regeneration:
50,000 Ha



Forest Regeneration
with High Value Timber:
16,000 Ha



Mother tree propagation and
product procession and value
addition facilities: **1000 Ha**

PHYLA REGENERATION

Stepping stones and corridors

Over the past decade, Phyla's expert sustainability and modelling team have meticulously analysed the effects of systems regeneration across rural Africa. The diagram on page 51 illustrates three phases of regeneration, where each dot signifies a village in rural Africa.





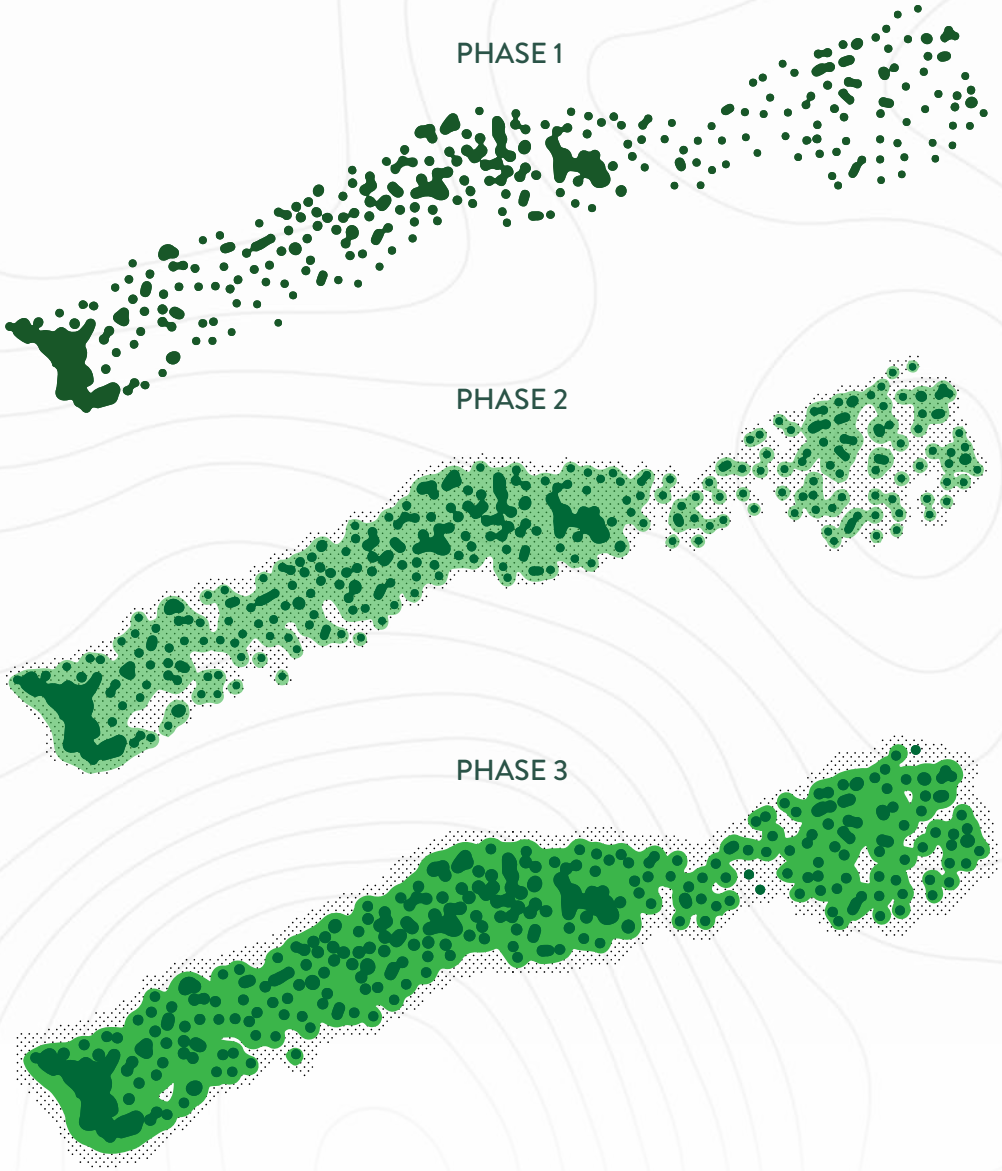
PHYLA REGENERATION

Phyla's Expert Modelling of Regeneration across 5,000 Villages: Our comprehensive models incorporate all relevant information, identifying the measures and its hierarchy, quantifying the impact and requirements for successful regeneration.

Through careful analysis of the socio-economy and biodiversity of landscapes, we have established stepping stones and corridors of regeneration. With Pongamia serving as a foundational agroforestry system, we provide resilience and productivity.

By integrating appropriate decentralised renewable structures, water harvesting practices, farmer-managed natural regeneration to revive hidden trees, and the careful identification of suitable species combinations, a mosaic web of regeneration is both possible and necessary. Our findings indicate that with the correct measures a typical village in a degraded landscape will experience a temperature decrease of 8 degrees C in less than 7 years. Productive Energy usage will be integrated by few folds, and Biodiversity will increase immensely.

Phyla's rigorous and dosed approach ensures that these regenerative practices are not only beneficial but also sustainable, leading to long-term improvements in rural African communities.





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MINE FACILITY REGENERATION IS ABOUT MORE THAN JUST RESTORING LAND, IT’S ABOUT CREATING A VIBRANT LOCAL BIOECONOMY.

Dr Benjamin Warr, CSO, Phyla Earth

PHYLA MINES

Regenerating mining landscapes

Regeneration aligned with core business and wider stakeholder benefits.

International mining companies are setting ambitious net zero targets and increasingly seeking ways to minimize their environmental impact and maximise the long-term benefits of mining for communities during life of mine, but also once mining stops.

PHYLA mine regeneration services align with core business requirements by providing low carbon biofuels for mine operations, that can be produced on degraded mine facilities, regenerating them and providing essential jobs for the wider community for the long-term.



New jobs are created caring for the trees over their > 50 year lifespan



PHYLA MINES

Transforming end-of-life mine facilities

Our trees produce bioenergy for mine use and our systems create jobs for communities surrounding the mine, contributing to the creation of a vibrant Green Economy.



Community Engagement
Building consensus through expert engagement with extended stakeholders to reduce risk and build trust.



Water Management
Managing water resources to minimise use and depollute waste streams.



Precision Mapping
Characterisation of mine facilities and landscapes using state-of-the-art technology and algorithms.



Landform Creation and Stabilisation
Healing soils and streams by intelligent design from micro-indentation to large landscape features.



Reprocessing and Revalorisation
Bespoke design and implementation of physical, chemical and biological processes to recover value from waste.



Reafforestation
Ensuring every planted tree survives creating biodiverse incipient novel ecosystems in the most challenging of landscapes.


2017
2019
2024

IMPACT

Productive cover crops for food and energy

Phyla is working to reinforce food security and nutritional quality using climate-resilient 'underutilised' crops and agro-biodiverse cropping systems. Alongside Pongamia, we are introducing endemic plants that have been shown to successfully intercrop with this anchor species including castor, cowpea, groundnut, black gram, sorghum, pearl millet, pigeon pea, soybean, mung bean, chickpea, sunflower, safflower, avocados, macadamia, [try to get more info out of Dr. Vijay for other regions]. Phyla's agroforestry and intercropping systems provide a variety of crops for consumption and clean energy usage whilst improving organic soil carbon and increasing the availability of key nutrients. As climate variability and soil degradation threatens traditional crop yields, Phyla is incorporating indigenous and underutilized crops with demonstrated resilience into our agroforestry systems.

"Global food security is a massive concern that is calling upon us to change course ASAP. Up until now, staple commercial crops like wheat, maize and rice have dominated international trade and our diets. But there are countless underutilized crops across the African continent that have potential to strengthen nutritional outcomes, local resilience to climate risk and get us to refocus on sustainable food systems. We are finally seeing the development of offtake markets for resilient crops that support biodiversity. And that is promising."
Harry Vernon, Chief Commercial & Operating Officer

Phyla is sourcing climate-resilient crops across the Great Green Wall. We are committed to transparency and have built traceability into our supply chains to ensure positive social outcomes. (I am assuming this is true?)





CAMELINA



LESQUERELLA



CRAMBE



CARINATA



CUPHEA



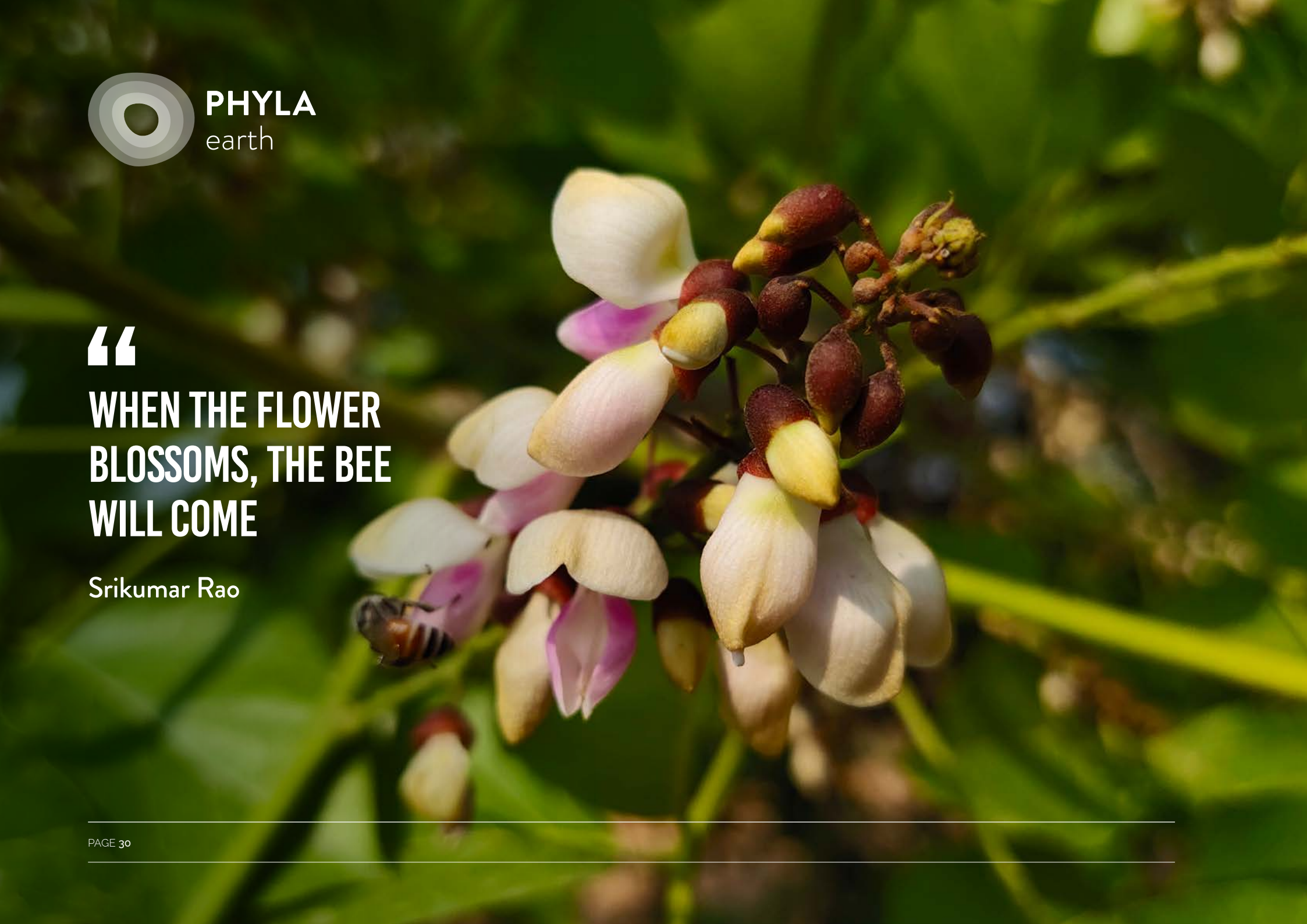
CANOLA

In each of it's projects PHYLA is investigating the potential to integrate non-edible annual oilseed intercrops, to initiate the production of oils in years 1 to 5, as our Pongamia trees mature. The choice of species depends on the site specifics of each project, soil, climate and market.

Species we are looking at include Castor bean (Ricinus communis) known for its ability to grow in arid and semi-arid conditions; Camelina (Camelina sativa), also known as false flax.

It has a short growing season, making it suitable for rotation with other crops; Carinata (Brassica carinata), also called Ethiopian mustard, is a drought-tolerant oilseed crop; Lesquerella (Lesquerella spp.) a native North American oilseed plant; Cuphea (Cuphea spp.) that is adaptable to different climate; Crambe (Crambe abyssinica) has its origins in eastern Africa and is known for its ability to grow in marginal lands and under adverse conditions; Indian Mustard (Brassica juncea) referred to as canola is another member of the Brassicaceae family with great potential as a low-cost substrate for biodiesel production within a longer term, more productive and land efficient pongamia agroforestry system.

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“WHEN THE FLOWER BLOSSOMS, THE BEE WILL COME

Srikumar Rao

PHYLA BIODIVERSITY

Bees and livestock in perennial agroforestry systems

At Phyla, we restore ecological function to landscapes depleted of life, using perennial anchor species. Perennial agroforestry systems offer significant advantages over annual systems, including minimal soil disturbance, increased carbon sequestration, and enhanced land productivity through the integration of bees (apiculture) and livestock (silvopasture).

Enhancing Biodiversity and Honey Production

Bees play a crucial role in our perennial agroforestry systems. Our carefully designed agro-biodiverse agroforestry systems interweave native tree species endemic to the regions where we work. By supporting pollinators, we ensure the health of our ecosystems and the sustainability of our agricultural practices.

Phyla's commitment to resilience and biodiversity allows us to produce a variety of crops, natural products, and honey. Perennial systems with abundant flowering plants have the potential to produce large yields of honey per hectare, making them highly productive and beneficial for both the environment and local economies. **Honey production provides early revenue within the system, offering early financial returns even as other perennial crops continue to mature.**

The Unique Benefits of Pongamia Honey

Pongamia honey is a natural sweetener infused with bioactive compounds karanjin and pongamol, which provide antioxidant, antiseptic, and antibacterial properties, similar to the healing properties for which Manuka honey is renowned. Pongamia honeys is sustainably produced, carbon negative and nature positive.

AGRIFIBRE™

Biomass for energy and sustainability



Regenerative biomass provides the feedstocks for AgriFibre™ our proprietary, high-yielding blend of perennial grasses.

AgriFibre™ offers a variety of fibres in diverse formats, to meet our buyers unique requirements. It serves as an ideal alternative or complement to conventional raw materials derived from wood and fossil fuels.

AgriFibre™ can be utilized in numerous industrial, manufacturing and agricultural purposes for the production of furniture, fabrics, packaging and other products that are presently made using plastics or crops that rely on irrigation and/or heavy pesticide use. It is cultivated for its rapid growth and substantial yield, producing up to 30-40 dry tons per acre annually. Not only is AgriFibre™ resilient, withstanding pests and tolerating droughts, it's also robust thriving in diverse climates and soil conditions—including marginal, saline or contaminated soils. AgriFibre™ can be planted on these lands to restore productivity and reduce pressure on prime agricultural land..

The ecological impact of AgriFibre™ is profound. It is carbon negative sequestering significant amounts of carbon both above and below ground, mitigating greenhouse gas emissions, fostering healthy soils whilst improving livelihoods, thereby aligning strongly with sustainable development goals. Remarkably, a single AgriFibre™ rhizome can produce stalks for over two decades from just one planting. Post-establishment, this crop requires minimal upkeep and no further tilling, preserving soil structure and ensuring that the stored carbon remains sequestered in the soil.

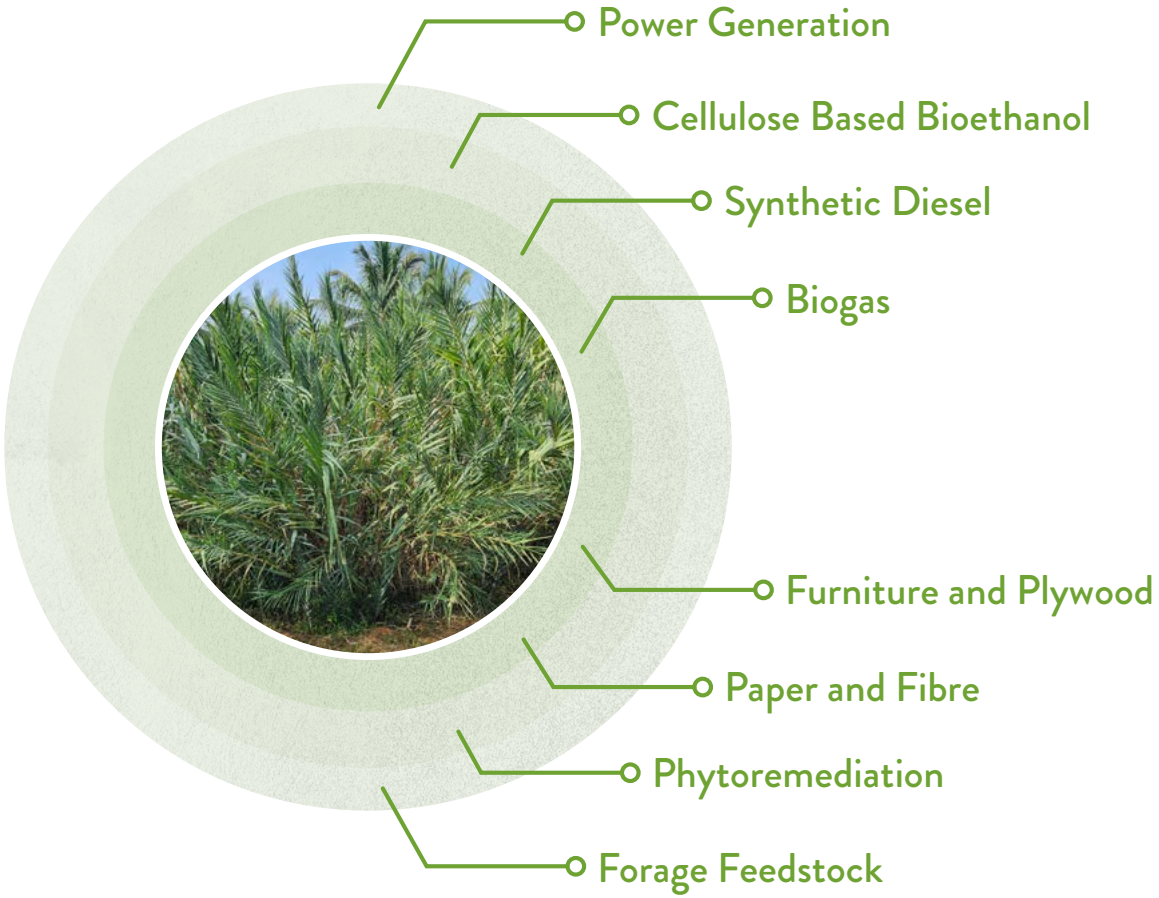
Our exclusive partnership with leading state-of-the-art European biotechnology laboratories produces large volumes of homogenous, genetically stable and virus-free AgriFibre™. With the capability to scale production and maintain low costs, we can efficiently ship quantities into demand markets.

AGRIFIBRE™

Sustainable production materials

PHYLA grows a variety of regenerative rhizotamous grasses to produce our AgriFibre™. This biomass product has many industrial, manufacturing and agricultural uses. Agrifibre is a regenerative alternative to plastics or forest timber for the production of energy, packaging, fabrics, furniture, and many other products.

AgriFibre is planet friendly, curbing deforestation, sequestering carbon, nurturing biodiversity and generating sustainable income for rural communities. The use of Phyla selected perennials ensures long-term production with minimal maintenance for regeneration that's environmentally economical.



Metrics to measure and report regenerative impact

At Phyla, we are committed to continuously building and refining systems to measure and report our regenerative impact to a wide range of stakeholders, including local communities, environmental organizations, policymakers, investors, and consumers. Our advanced metrics including both independent partnerships with third party provider and our own proprietary tools to provide transparent, comprehensive insights into our efforts and achievements.



REPORTING WITH THIRD-PARTY METRICS





Collaboration with NatureMetrics

We have partnered with NatureMetrics, a global leader in nature intelligence, specializing in eDNA technology. This revolutionary approach translates the complexities of the natural world into tangible data, offering deep insights into the biodiversity of any given site. Through testing small samples of soil, sediment, water, and air, eDNA biodiversity surveys reveal thousands of species that are often hard to detect, providing a comprehensive assessment of life in a particular location.

Phyla's collaboration with NatureMetrics allows us to evaluate biodiversity at scale, validating restoration efforts in various protected ecosystems, including forests, savannahs, rivers, and wetlands. These technologies enable effective biodiversity management tools for clients preparing for impending biodiversity regulations and ecosystem service markets. Standardized biodiversity metrics simplify nature reporting requirements, facilitating decision-making for business leaders focused on positive environmental impact.

Collaboration with OneNature

OneNature is a nonprofit that takes a human-centric approach to sustainable development, advancing the interconnection between nature, wildlife, and human well-being. Through data-driven research, community projects, and transformational change strategies, OneNature integrates conservation, climate, and well-being into long-term policy frameworks to help the planet and its inhabitants thrive.

"We measure what we value; we do what we measure–and what we measure can be transformed." – **OneNature**

Phyla's partnership with OneNature underscores our commitment to improving community outcomes. Our metrics measure the link between human happiness, nature, and wildlife. Complementing carbon, soil, and biodiversity metrics, we quantify community impact and wellness factors central to Phyla's drive towards positive social impact and sustainable, inclusive growth.

PHYLA NTAKA

Soil technology and carbon quantification





Phyla utilises cutting-edge technologies to measure and quantify soil and carbon metrics, ensuring the highest standards of environmental stewardship. We leverage innovative earth observation, spectroscopic data, geostatistical methods, and machine learning algorithms to accurately measure and map soil properties essential for estimating soil carbon stocks and the value of ecosystem services.

PHYLA NTAKA

Operating in southern Africa since 2013, our foundational knowledge positions us to design, develop, manage, and monitor projects. Our expertise includes:

- **Machine Learning for Soil Spectroscopy and Geo-Spatial Mapping:** Advanced measurement and estimation techniques provide full coverage data.
- **Optimal Geostatistical Sampling Design:** Cost-effective estimation of soil organic carbon (SOC) stocks and changes across vast landscapes.
- **Understanding Drivers of SOC Change:** Experimental design and data mining offer rationales for implementing project interventions.
- **Biodiversity and Conservation Value Mapping:** Multi-criteria decision analysis ensures stakeholder participation in land use decision-making.
- **Ecosystem Service Valuation and Mapping:** Developing future accounting methods that value nature's role in the global economy.

Our team pioneered the application and development of earth observation and spectroscopic data, geostatistical and machine learning algorithms for the measurement and mapping of soil properties that are essential for estimation of soil carbon stocks and the value of ecosystem services that are critical in growing carbon and biodiversity markets.

Predictive Analytics for Risk Reduction and Optimization
Combining satellite imagery with weather crop cultivation and other data predictive models will optimize yields, reduce costs, and enhance profitability. Integrate data allows monitoring systems to track environmental changes, assess ecosystem health, and predict potential risks. This comprehensive approach allows us to make



informed decisions and implement timely interventions, ensuring the resilience and sustainability of our agroforestry systems.

Commitment to Transparent Reporting and Regulatory Standards
To ensure compliance with regulatory standards such as the EU Deforestation Regulation (EUDR), we will translate data to facilitate Monitoring, Reporting, and Verification (MRV). Our commitment to transparent reporting ensures that all stakeholders, from local communities to global partners, are informed about our progress and impact. By continuously improving our measurement systems and expanding our partnerships, Phyla aims to lead the way in regenerative agriculture and ecosystem restoration, fostering a sustainable and thriving planet for the future.



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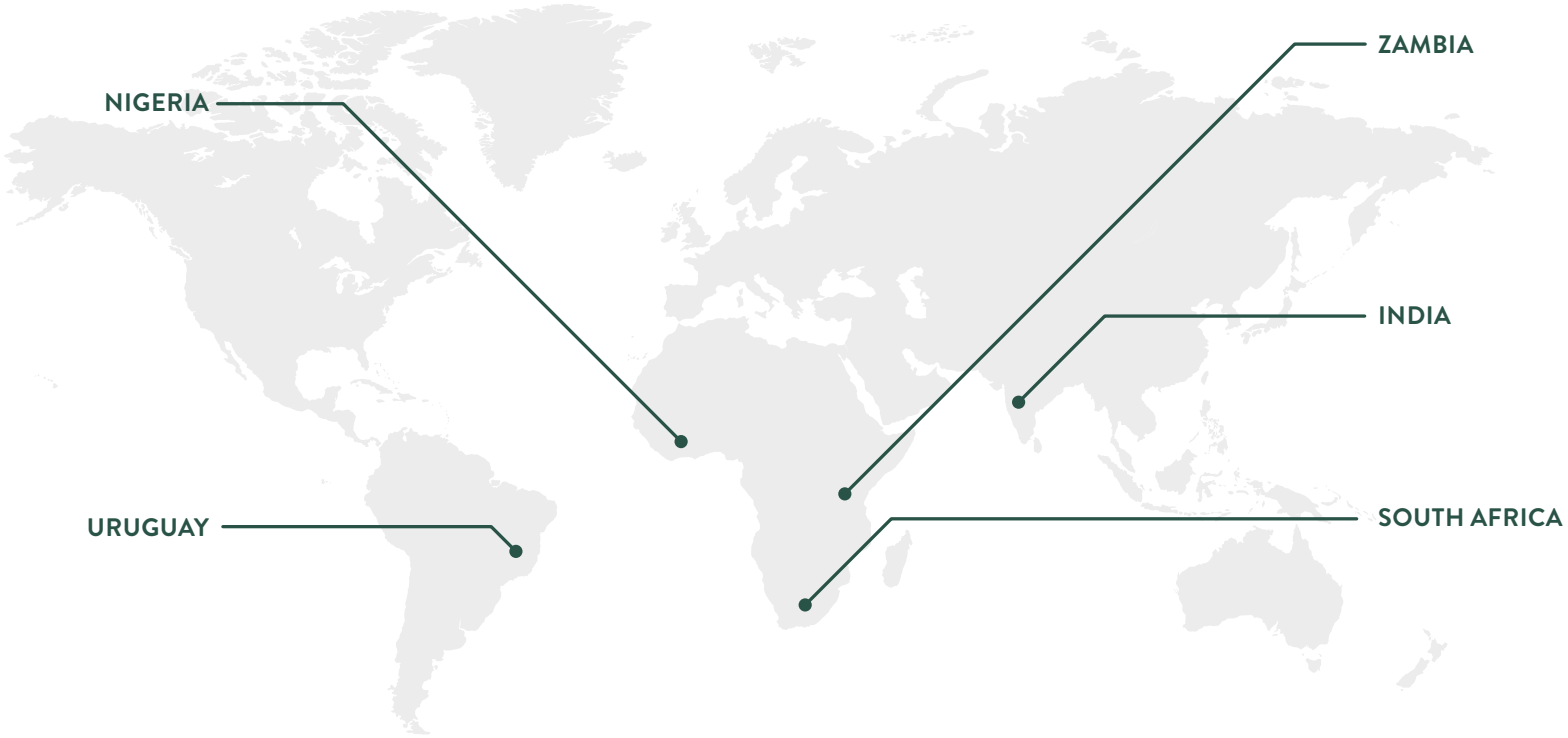
NATIVE PLANTS ARE AN INTEGRAL PART OF REGIONAL ECOSYSTEMS THAT DO NOT FOLLOW POLITICAL BOUNDARIES. CONSERVING AND PROMOTING THESE PLANTS PROMOTES HEALTHY COMMUNITIES OF ALL TYPES AND AT EVERY LEVEL.

Chandradeep PC,
Director of Global Nursery Operations

PHYLA GLOBAL PRESENCE

Phyla's current facilities

Phyla operates internationally with regeneration projects and partnerships on five continents, supported by dedicated teams and nurseries in India, South Africa and Zambia.



PHYLA earth



Building economies of scale

PHYLA INDIA

Phyla India was established in 2006. Our Indian team is built upon a strong foundation of research into oil seed crops and their potential for production of feedstocks for bioenergy. Focused on improving yields under dryland and variable climatic conditions Dr. Prasad has lead R&D efforts alongside Phyla's expert plant breeding team.

Phyla India is headed by Latha Chandradeep whose background in technology and local economic development along with her long experience and deep knowledge of Castor, Pongamia and other resilient plant species, has been a huge resource in building trust with local farmers and cooperatives across the region.

"Looking at food, renewable energy, we wouldn't have these commodities if it weren't for farmers. But they are minimized and not adequately valued in society and I thought we have to fix this system. So, I made it my mission to start from the source of the supply chain and empower the first mile, the farmers, where everything begins."
Latha Chandradeep.

Our nursery operations in India have developed proprietary, robust propagation systems complemented by continuous, rigorous quality control measures.



This ensures that our saplings and plantlets are produced to the highest standards, providing the best possible start in life for each plant.

A Glimpse of our Biodiverse Nursery and Team in India
Photo caption: Nursery Supervisor Uma Shankar (left) has been with Phyla India since 2010 and works on tree propagation with expertise in irrigation systems and weed control. A member of the nursery operations team is inspecting plants for pests and nutritional deficiencies (right).

Committed to Crop Improvement
Dr. Vijay Kumar Yedla, a Research Scientist at Phyla, specialises in enhancing crop yield and sustainability through selective plant breeding. With a PhD in plant physiology from CIMAP, India, and over two decades of experience in R&D and commercial farming, Dr. Vijay's expertise spans a variety of aromatic and medicinal crops. He has worked extensively on improving the cultivation and managed large-scale crop production in Ethiopia. Committed to sustainable agrotech, Dr. Vijay is a leader in developing ecologically friendly organic cropping systems for long-term productivity.

PHYLA
earth



The world's first elite pongamia nursery in Sub-Saharan Africa

PHYLA ZAMBIA

Building on over 10 years of operational excellence providing services in environmental conservation and socio-economic development to major international institutions including the UN and FAO, International and local NGOs, mining companies and the Government of Zambia.

PHYLA's Zambia team has led the establishment of elite Pongamia propagation facilities, mine regeneration demonstrations and soil carbon geospatial analytical and accounting services in the region. With deforestation rates that exceed 250,000 ha per annum and average crop yields less than 2mt there is a dire need for regenerative agroforestry that can raise yields, reverse soil degradation and loss of ecosystem biodiversity and function. The recent 2023/4 drought that hit over a third of Zambia's agricultural area and reduced the yield of certain annual crops by up to 40% is a strong indication of the need for drought tolerant perennial agroforestry systems.

Currently importing all growing fossil fuel requirements, and reliant on forest biomass charcoal for domestic energy needs growth in domestic demand for renewable bioenergy exceeds 4% per annum. Zambia offers a strong domestic market on which to build global export markets for high value products over the coming 30 years. Opportunities exist to develop stand-alone projects on more than 100,000 hectares with institutional land owners, industrial partners, with communities and individual farmers to transform unproductive and degraded land into a source of wealth creation that will be resilient to climate change and future droughts.

Through a strong network of partners with deep operational experience, PHYLA Earth Zambia is actively developing regeneration agroforestry projects at a regional level across degraded peri-urban landscapes, and with rural communities.



Collaboration with MUSIKA Development Initiatives

MUSIKA and PHYLA have been working together since 2015. Musika stimulates and supports private investment in the agricultural market, with a particular focus on the smallholder and emerging farmers. PHYLA's work with MUSIKA is focused on the design of gender positive, inclusive financing mechanisms to capitalize farmer productivity.



Africa's largest economy with the most advanced agricultural systems

PHYLA SOUTH AFRICA

In 2023, PHYLA South Africa was established with robust operational partnership with local operators to develop elite Pongamia propagation facilities at an established nursery, serving Limpopo and North-West Province.

Our nursery is initially designed to regenerate 100,000 hectares over the coming decade. As we progress, we aim to accelerate this expansion and extend our reach into Botswana and Mozambique, where project discussions are already underway. The regional market is characterised by strong demand for bioenergy coupled with availability of degraded land with significant potential for resilient perennial agroforestry.

The local team have been operating producing high-quality grafted saplings for over a decade and the trees they have produces have been responsible vast hectares of commercial agroforestry plantations bringing job creation to rural land-owning communities, diversifying their income and contributing to create sustainable livelihoods, whist producing high value tree commodities for domestic and expert markets.

"Phyla is revolutionizing agriculture, and we're just getting started. Our efforts to regenerate degraded lands and produce carbon-negative biofuels have the potential to make Africa the world's carbon-negative leader. Taking from the earth without giving back is unsustainable. For the sake of my two-year-old, and all our children, we must commit to restoring and nurturing our planet."
Gene Likhanya, CEO Phyla South Africa

Aluwani manages Phyla's nursery operations in South Africa. She first came to the site aged 25 as a single mother with minimal qualifications in search of a job. Gene's philosophy was to nurture from within the community and to train disadvantaged people/marginalized farmers. So he hired her. Aluwani started with tasks like building ridges with rocks, tasks which required less technical knowhow. But she was curious and constantly asking questions. Within a month, she started putting seeds in the ground and today, five years later, she's mastered complicated grafting techniques and is training the next generation in the nursery arts.



Local community employees become experts in plant propagation practices.

Remediating mine sites in the tropics

University of Reading

University of Reading research with PHYLA, led by Professor Mark Tibbett's team confirmed our Elite Pongamia varieties' ability to thrive in previously barren, saline and heavy metal contaminated conditions.

Professor Mark Tibbett is lead research in plant-soil-microbe interactions, soil microbiology, soil science and plant nutrition Joint Editor-in-Chief of Soil Research Editor of Mining In Ecologically Sensitive Landscapes Associate Editor for the Australian Journal of Botany and Restoration Ecology Council member of British Society of Soil Science Founder and co-chair of the international Mine Closure conference series.









PHYLA ACADEMIC PARTNERSHIPS

Green product development

UNIVERSITY of BRADFORD

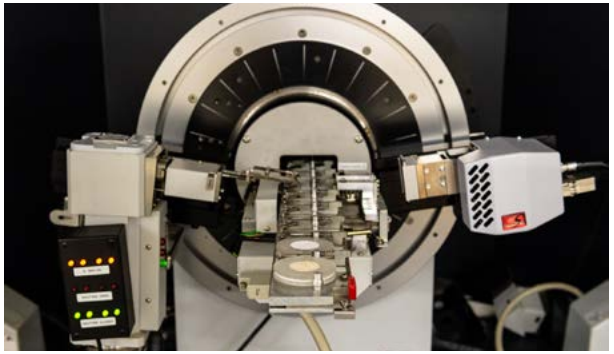
Biocompounds for the food, cosmetics and agriculture industries using nature-based, non-toxic, renewable materials with the University of Bradford, Centre for Pharmaceutical Engineering Science (CPES) created by Professor Anant Paradkar, Interdisciplinary Chair in Pharmaceutical Engineering Science and Director of the Centre for Pharmaceutical Engineering Science.

- Biopesticides
- Nitrification Inhibitors
- UVA/UVB Protection









HISTORY

A long history in sustainability



Our executive team has been at the forefront of sustainability for several decades and have contributed significantly to shaping the green economy with a focus on natural resource use efficiency, clean technology, geospatial analysis and soil fertility.

As a pioneer in environmental engineering, Phyla CEO Rabih El Fadel has been advising multilateral institutions along with governments at the national and municipal level across the Middle East, Africa, Europe and North America on sustainable design.

He has developed sustainability frameworks for the built environment, incorporating renewable energy, low carbon emissions, water, material and energy optimization along with waste management into his signature projects. low carbon emissions, water, material and energy optimization along with waste management into his signature projects.

LEADERSHIP

Guided by strong principles

Phyla cofounder, Benjamin Warr, Leverhulme Scholar, has been at the forefront of paradigm changing scientific research for 25 years, first in the development of advanced monitoring and mapping technologies for soils and then as a thought-leader in Industrial and Ecological Economics.

His work with the late Professor Robert U. Ayres "the Grandfather of Industrial Ecology", recognized by a Nomination for the Nobel Prize in Economic Sciences in 2022, represents a paradigm shift in our understanding of what drives sustainable economic growth, wealth creation and the importance of maximizing natural resource use efficiency through technology to enable sustainable growth for future generations. Phyla is employing these teachings at scale through an ambitious portfolio of projects that will contribute to deliver the necessary transition to a green economy.

"The wealth of future generations is entirely dependent on the supply and efficiency of natural resources. Many of the technological solutions are at hand, but to realise a global regenerative transition and ensure the future well-being of mankind, we must act together". Dr Benjamin Warr, CSO Phyla.

Phyla's historical commitment to accelerating positive impact is further demonstrated by our partnership with The Centre for Business and Public Sector Ethics, Cambridge, led by Dr Rosamund Thomas with whom we have written an Ethical Oath. This pledge sets forth Phyla's core values of openness, trust, integrity and fairness and further outlines nine ethical principles including solidarity; concern for future generations and human rights.

"Today businesses need to reflect deeply on how they value future generations and how much cost they are willing to incur in the present for the benefit of earth's future inhabitants."
Rosamund Thomas, Phyla Advisor, Ethics.



OUR ACADEMIC CONTRIBUTIONS

Phyla and its team have published a wide range of publications spanning various critical fields.

Our expertise and research efforts have led to significant contributions in low energy use, exergy ecosystem service modelling, socioeconomic modeling, thermodynamic economic modeling, industrial ecology, dryland agriculture, climate change adaptation strategies, sustainable resource management, environmental impact assessment, renewable energy systems, and biodiversity conservation.

Our commitment to advancing knowledge and innovation is reflected in our numerous peer-reviewed papers and comprehensive PHYLA Reports. We invite you to explore our publications and the groundbreaking work that drives our mission forward.

Feel free to access our publications, which include an extensive collection of peer-reviewed papers and PHYLA Reports, by scanning the qr code below.

PARTNERS AND CLIENTS

Over the past decade, Phyla Earth has had the distinct privilege of collaborating with and receiving support from some of the world's leading mining companies, development institutions, universities, research institutions, non-governmental organisations, financial institutions, as well as various governments, parastatal organisations, and intergovernmental organisations such as the African Union. Our diverse network of partners and clients is a testament to our unwavering commitment to excellence and innovation in environmental sustainability and land restoration.

Our work is driven by a shared vision of sustainable development and environmental stewardship. We strive to create impactful solutions that promote the health of our planet and the well-being of its inhabitants.

At Phyla Earth, we take particular pride in our role as an accredited organisation under the United Nations Convention to Combat Desertification. This prestigious recognition underscores our dedication to addressing the urgent challenges posed by land degradation and desertification across the globe.

United Nations
Convention to Combat
Desertification

PARTNERS & CLIENTS

PHYLA earth

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