A Blueprint to Return to The Garden Of Eden:
"A Comprehensive Study: Ernst Gotsch's Agroecological Farm - Fazenda Olhos D'aggua, Bahia, Brazil"
By Philip Barton, Minds Of Soil.

In the face of impending environmental challenges, as our planet nears critical tipping points, society is confronted with the daunting task of providing for 8.1 billion people while simultaneously regenerating ecosystems. The urgency is underscored by the existence of 5 billion hectares of man-made deserts, and conventional agriculture's role in contributing to 80% of all ecological damage through deforestation, pollution, excessive water usage, and desertification.

1- Deforestation - Agricultural expansion drives 90% of global deforestation [1].
2- Pollution - Air, water and soil. Agriculture contributes 30% of greenhouse gas emissions.[2]. 78% of global ocean and freshwater pollution [3]
3- Water - 70% of global freshwater withdrawals are used for agriculture. [3]
4- Desertification - 5.8 billion hectares of manmade dessert [4] Half of the world's current habitable land is used for agriculture. [3]

Albert Einstein's famous quote, "We cannot solve the problem with the same kind of thinking we used when we created it," resonates more than ever, demanding a re-evaluation of our approach to land management. As we grapple with the need to find sustainable alternatives, it becomes imperative to seek solutions that feed a growing population without further environmental degradation.

The case study, "A Blueprint to Return to The Garden of Eden," conducted by Minds of Soil in collaboration with Ernst Gotsch, addresses these pressing questions. Gotsch's agroecological model prioritizes crop vigour, productivity, and soil microbiology, particularly the role of fungi in enhancing land succession. This model emphasizes natural processes such as photosynthesis and complex systems driven by natural succession, aligning with Ernst Gotsch's philosophy that "Knowledge is our biggest input."

Focusing on Gotsch's agroecological farm, Fazenda Olhos D'aggua, in Bahia, Brazil, the study explores a paradigm shift in the role of agriculture within the ecosystem. Gotsch demonstrates a method that matches the productivity of top cocoa farms globally while stewarding the land toward a successional stage akin to a climax ecosystem. This approach transforms agriculture into a tool for ecological regeneration, addressing present needs while safeguarding the environment.

The research delves into the soil food web (SFW) at Ernst Gotsch's agroecological cocoa farm, comparing it with a neighbouring conventional cocoa farm, a 70-year-old secondary forest, and a similar landscape that Gotsch initially managed over 40 years ago. SFW analysis serves as a window into the ecological succession of the land, its soil health, and its ability to support life, providing crucial insights into ecosystem regeneration.

The findings highlight the potential of Gotsch's agroecological model for crop production and ecosystem regeneration, attributing its success to the elevated fungal biomass akin to late deciduous forests. These results underscore the model's efficacy in achieving high crop production, disease and pest reduction, soil building, hydrological cycle regeneration, carbon cycling, and ecosystem development through conscious interaction.

In conclusion, the data and results presented by Minds of Soil affirm the capacity of Ernst Gotsch's agroecological model as a blueprint for a sustainable return to The Garden of Eden. The model not

only addresses the challenges of conventional agriculture but also offers a purposeful relationship between humans and the planet.

Methodology:

To substantiate the capacity of Ernst Gotsch's agroecological model as a blueprint for returning to The Garden of Eden, Minds of Soil conducted a comparative study focusing on the soil food web (SFW). Four distinct locations were strategically chosen for their representativeness: Ernst Gotsch's agroecological farm, a conventional cocoa farm, a native secondary forest, and an original landscape encountered by Ernst 40 years ago. The 'original landscape' underwent identical land management practices encountered by Ernst four decades ago, maintaining the same vegetation composition.

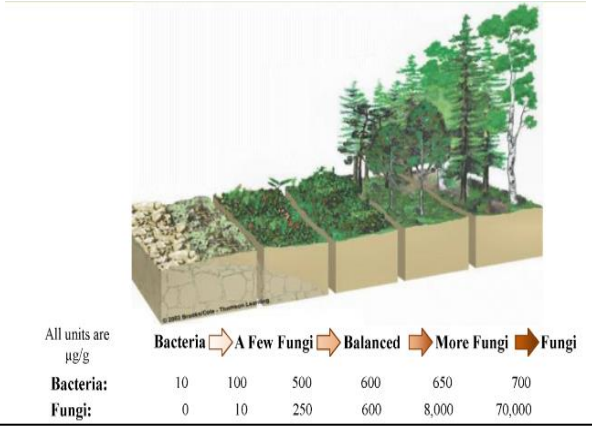
The selected locations were further subdivided into four distinct sub-areas. Within each sub-area, a systematic grid was established, and five soil samples (sub-reps) were meticulously collected. Notably, these sub-representative samples covered 40% of the total sub-area. The average SFW for each sub-area was calculated based on the data derived from the five samples. These averages were then aggregated to establish an overall average for the entire area, incorporating findings from all four sub-areas.

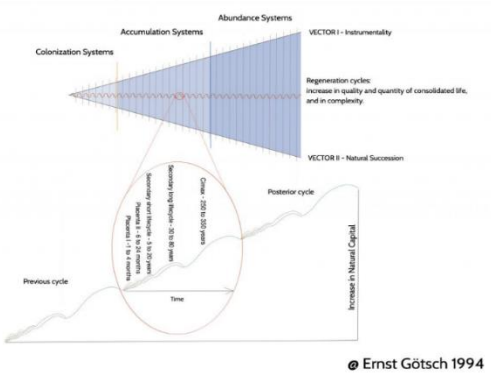
Each sub-area was identified as homogeneous, taking into consideration factors such as orientation and terrain. In the case of cocoa farms, samples were exclusively obtained from cocoa trees, with no bias towards healthy or diseased cocoa. This rigorous and standardized methodology ensured a comprehensive and unbiased assessment of the soil food web across the diverse locations, forming the basis for the conclusive insights into the viability of Ernst Gotsch's agroecological model as an innovative blueprint for regenerative agricultural practices.

DATA

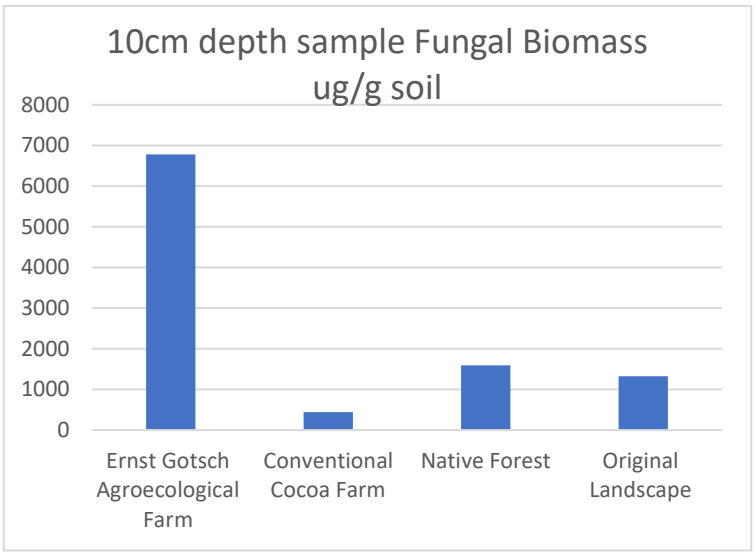
Soil Sample at 10cm depth	Fungal to Bacterial Ratio
Ernst Gotsch Agroecological Farm	16:1
Conventional Cocoa Farm	0.49:1
Native Forest	4:1
Original Landscape	1.4:1

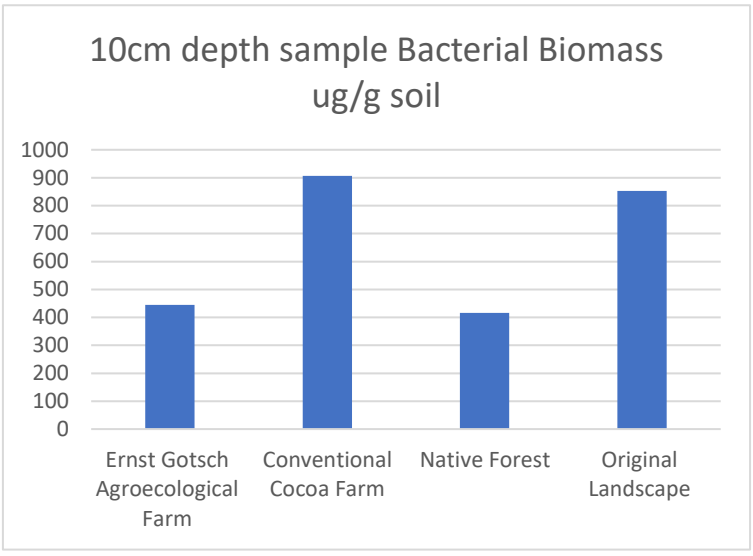
Soil Sample at a depth of 40cm	Fungal to Bacterial Ratio
Ernst Gotsch Agroecological Farm	5:1
Conventional Cocoa Farm	0.1:1
Native Forest	2:1
Original Landscape	0.24:1

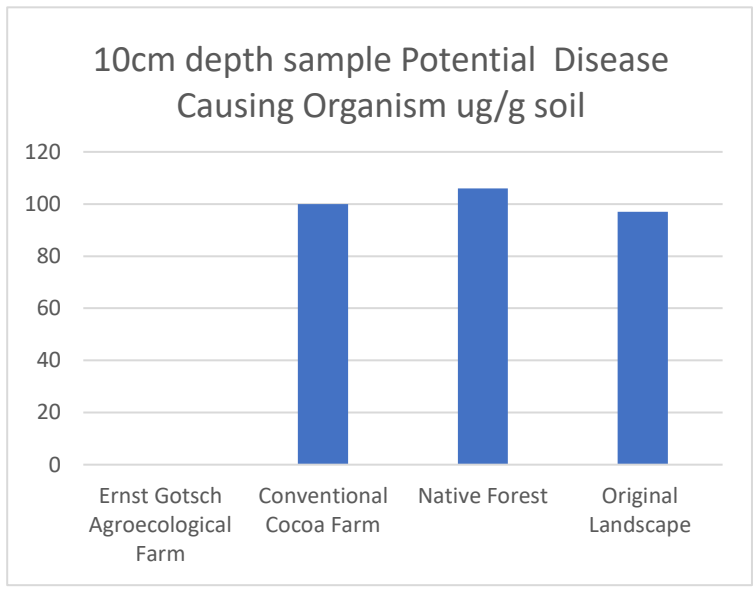


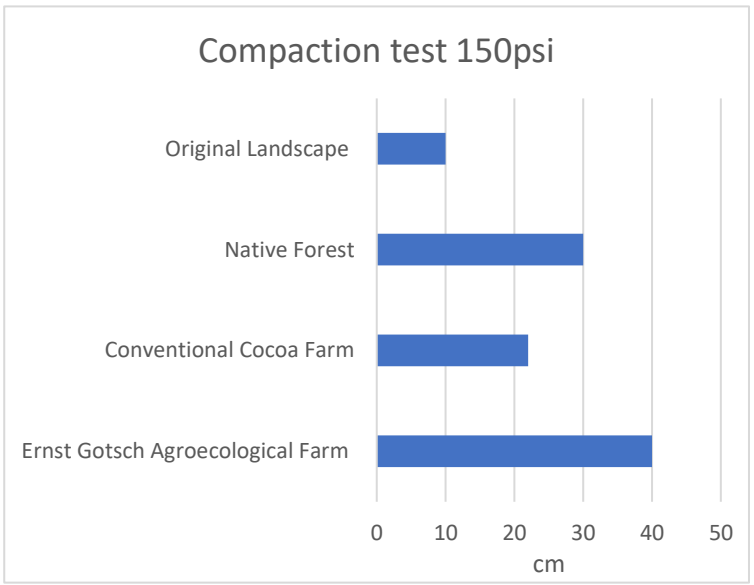


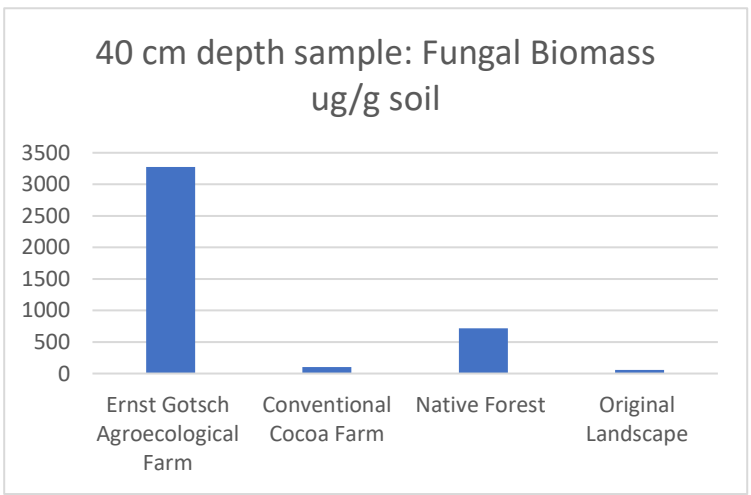
Land Succession in relation to Fungal:Bacteria ratio.
Image source - Soil Food Web School.

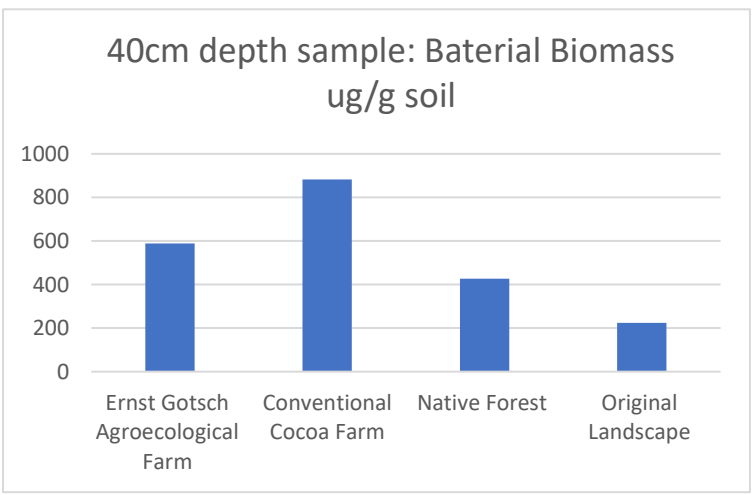

10cm depth sample Fungal Biomass ug/g soil
8000
7000
6000
5000
4000
3000
2000
1000
0
Ernst Gotsch Agroecological Farm
Conventional Cocoa Farm
Native Forest
Original Landscape

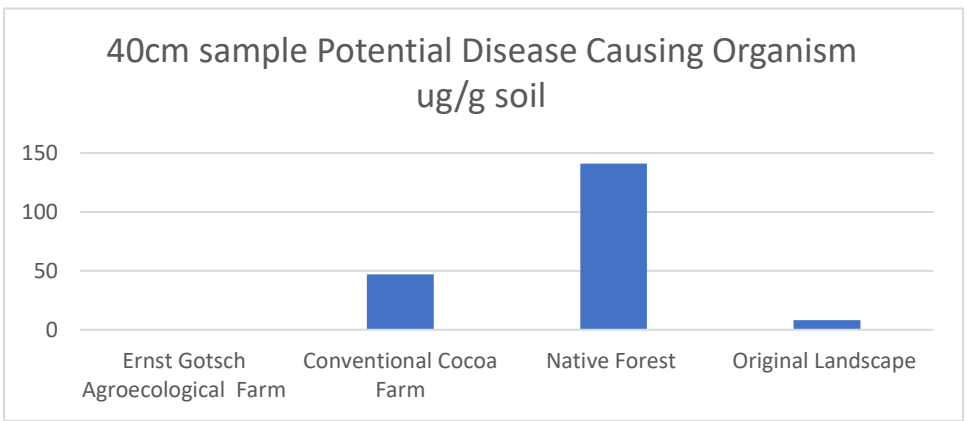

10cm depth sample Bacterial Biomass ug/g soil
1000
900
800
700
600
500
400
300
200
100
0
Ernst Gotsch Agroecological Farm
Conventional Cocoa Farm
Native Forest
Original Landscape


10cm depth sample Potential Disease Causing Organism ug/g soil
120
100
80
60
40
20
0
Ernst Gotsch Agroecological Farm
Conventional Cocoa Farm
Native Forest
Original Landscape


Compaction test 150psi
Original Landscape
Native Forest
Conventional Cocoa Farm
Ernst Gotsch Agroecological Farm
0
10
20
30
40
50
cm


40 cm depth sample: Fungal Biomass ug/g soil
3500
3000
2500
2000
1500
1000
500
0
Ernst Gotsch Agroecological Farm
Conventional Cocoa Farm
Native Forest
Original Landscape


40cm depth sample: Baterial Biomass ug/g soil
1000
800
600
400
200
0
Ernst Gotsch Agroecological Farm
Conventional Cocoa Farm
Native Forest
Original Landscape


40cm sample Potential Disease Causing Organism ug/g soil
150
100
50
0
Ernst Gotsch Agroecological Farm
Conventional Cocoa Farm
Native Forest
Original Landscape

Results:

The Soil Food Web (SFW) report, an integral indicator of ecosystem health, serves as a comprehensive tool for assessing various facets critical to sustainable agriculture. Through meticulous data interpretation, this study provides insights into the soil's capacity to support life, ecological succession stage, suitable crop choices, soil-building processes, nutrient and water retention, pest and disease pressures, production, and carbon cycling within the system. A discernible distinction in the soil food web emerges between Ernst's agroecological farm and the three comparison locations: Conventional Cocoa Farm, Native Forest, and the Original Landscape.

In stark contrast to the conventional practices observed in the Cocoa Farm, Native Forest, and the Original Landscape, Ernst's agroecological model is revealed to play a pivotal role in landscape regeneration. By prioritizing a robust fungal community through a focus on crop vigour, productivity, and soil microbiology, Ernst establishes an optimal fungal-to-bacterial successional equilibrium within the ecosystem. This equilibrium fosters an environment conducive to cocoa cultivation while effectively mitigating the presence of disease-causing organisms.

Critical metrics such as the fungal-to-bacterial ratio, fungal biomass, and bacterial biomass prove instrumental in gauging the successional stage of the ecosystem. Fungi, with their multifaceted contributions, including soil building, nutrient retention, water conservation, organic matter decomposition, and carbon cycling, play a pivotal role. The agroecological model exhibits higher levels of fungal biomass, registering at 6777 micrograms per gram of soil, a figure slightly below that observed in a climax ecosystem (9000 micrograms). Notably, achieving this ecological status in just forty years, as demonstrated by Ernst, contrasts with the centuries-long natural succession typical of such ecosystems.

The conventional Cocoa Farm, by relying on chemical inputs, exhibits a soil composition dominated by bacteria, leading to elevated disease-causing organisms and a suppressed fungal community. The use of pesticides, fungicides, insecticides, and synthetic fertilizers in the region results in substantial financial investments (40% of farmers' profits) and further exacerbates environmental degradation. The detrimental impact on the fungal community triggers a regressive shift towards bacterial dominance, impeding soil structure and nutrient retention.

Compaction readings reveal that Ernst's farm experiences low compaction compared to other locations, indicative of aerobic conditions and a restored "Soil Sponge"[5]. Producing 20,000 kg of dry organic matter annually, Ernst's farm facilitates living carbon dynamics, surpassing the organic matter output of the most vigorous regional forests by fivefold. This substantial increase in organic matter enhances cation exchange, builds soil structure, fertility, and water-holding capacity, leading to the creation of 40cm of topsoil in 40 years, a remarkable achievement compared to the 2.54cm [6] typical of natural ecosystems in tropical humid locations over 150–200 years.

Despite the absence of fertilizer input and minimal disease pressure, Ernst's cocoa harvest remains comparable to the most productive conventional farms globally, averaging 1000–1300 kilograms of dry cocoa beans per hectare per year. The pivotal differentiator across the four locations is identified as soil microbiology. Ernst's agroecological model emerges as a transformative force, nurturing a thriving soil food web that supports the desired crops effectively.

The agroecological model's benefits extend beyond cocoa yields, encompassing the high diversity of plants present in the system. Ernst's strategic approach to planting, beginning with early successional crops and evolving into a climax ecosystem, generates by-products such as timber, fruits, and

vegetables year-round. This diversity imparts genetic resilience, farm flexibility, and resilience against climate extremes, qualities lacking in conventional monoculture.

Ernst's remarkable achievement includes the regeneration of 500 hectares of degraded land, creating a microclimate that mitigates the impact of climate change. The precise stratification of trees through selective pruning mimics climax forests, fostering thermal dynamics that enhance the hydrological cycle. The resulting high density of trees facilitates rain through the biotic pump, a mechanism reliant on bacteria in tree stomata condensing water nuclei into rain droplets. Ernst's agroecological management not only restores the hydrological cycle but also addresses the potential consequences of deforestation, drought, and desertification.

“Agua se planta” – Ernst Gotsch (Portuguese: Water is planted)

In summary, Ernst Gotsch's agroecological model stands as a pioneering blueprint for sustainable agriculture, demonstrating its potential to regenerate landscapes, enhance biodiversity, and address critical environmental challenges while ensuring robust and productive crop yields. The multifaceted benefits observed underscore the transformative impact of conscientious land management practices informed by ecological principles.

Conclusion:

In light of our evolving understanding of the central role humans play in the climate crisis, it becomes imperative to reshape our agricultural and land management strategies to cultivate an environment conducive to the growth of soil microorganisms. This fundamental shift is not only essential for achieving productivity and nutritional goals but is equally critical for fostering regenerative practices. The research findings presented in this study firmly advocate for the adoption of Ernst Gotsch's agroecological model as an effective and regenerative approach to agricultural land management. This model offers a tangible solution to the pressing global challenges we currently confront.

Ernst Gotsch's pioneering approach opens a pathway for humanity to transition into a new paradigm—one that aligns harmoniously with nature. In this envisioned world, the intricate connection between humanity and nature is restored to its intended balance, allowing us to reclaim our role as stewards of ecosystems and fulfil our purpose as a species on this planet. Ernst’s agroecological model stands as a blueprint, offering our society the opportunity to return to The Garden of Eden. This return is not only desirable but urgently needed, providing a transformative framework to address the multifaceted challenges that confront our world today.

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Quotes:

[1] FAO 2021

[2] FAO https://www.iaea.org/topics/greenhouse-gas-reduction

[3] https://ourworldindata.org/environmental-impacts-of-food

[4] Walter Jehne Restoring Water Cycles to Naturally Cool Ecosystems.

[5] Soil Sponge. Didi Perhouse https://lali.teachable.com/

[6] https://www.thedonutwhole.com/how-long-does-it-take-for-topsoil-to-form/