ECONOMIC PROPOSAL FOR THE ECOLOGICAL RESTORATION OF DEFORESTED AND DEGRADED LANDS IN THE AMAZON

Images: Jason Houston [1] & Oleksandr Sushko [2]

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STRATEGIC ALLIES

With love from
Serbia for Peru
and Latin America

Grupo Seedsem S.A. is an internationally experienced company that provides inputs and high-precision technological solutions to farmers, with the aim of developing the agricultural sector and achieving food sovereignty in different countries. The company prioritizes the conservation of land, water, and the environment through the application of Good Agricultural Practices (GAP).

The company's vision is to promote the development of countries in Latin America and the Caribbean, as well as in other regions, by creating new direct and indirect job opportunities. It prioritizes the economic and ecological development of industries such as agribusiness and manufacturing, and supports countries in transitioning to a sustainable and environmentally responsible economy that adheres to all ESG principles.

https://seedsem.com/

Sacha Inti is a scientific biomass research company. The purpose of its biorefinery is to conclude the scientific research of more than 12 years, developed and supported by scientists with a long career and international recognition.

The Sacha Inti biorefinery is a step towards creating a country that is in harmony with nature and has zero CO_2 emissions through the responsible use of its natural resources. The country will be powered by renewable energy and other sustainable practices, leading to a more environmentally and economically sustainable future. This initiative has the potential to positively impact the lives of everyone on Earth, including future generations.

https://sachainti.pe/

The Institute of Field and Vegetable Crops in Novi Sad (IFVCNS) is a top agricultural research institute in Europe and worldwide, with a strong focus on plant breeding which has made it the leading plant breeder in Serbia. IFVCNS has established its global recognition over the span of 80 years, by creating over 1,200 cultivars and hybrids from a list of 50 plant species. Out of these, more than 1,000 cultivars and hybrids have been registered and grown in over 30 countries across the world.

Presentation video:

https://www.youtube.com/watch?v=vJQRIXwBb_g

BioSense, Research and Development Institute for IT in biosystems, is a pioneer in digital transformation of agriculture in Serbia, founded in 2015. Exploring scientific and technological frontiers regarding the application of IT in agriculture, the Institute strives to deliver state-of-the- art digital solutions to the farming sector in Serbia and the world, in order to ensure higher yields with smaller investments.

https://biosens.rs/en

INTRODUCTION

We are currently living in times in which the climate is highly variable as a consequence of the last 150 years of human evolution, that focused merely on the economy and completely forgot about sustainability, polluting the air, land and water, essential elements for the life of current and future generations.

In addition, there is evidence of an inefficient development of clean and renewable energies for the development of different daily activities, due to the low budget allocated to this task, which triggers a new alarm about global warming and climate change.

Global warming, defined as the increase in the planet's average temperature level caused by emissions of greenhouse gases (GHG) such as carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and other industrial gases into the atmosphere as a result of human activity, is causing variations in weather patterns that affect the development of human life as we know it.

The 18th edition of the "Global Carbon Budget" report, developed as part of the 2023 agenda, provides a global vision of the carbon cycle. The report reveals that total global CO2 emissions from fossil fuels and land usage change were around 40.9 billion tons in 2023, setting a new record due to insufficient efforts to reduce GHG emissions and, to develop and promote the use of clean renewable energy.

The latest reports of the Intergovernmental Panel on Climate Change (IPCC) reiterate that a temperature increase of more than 1.5°C would cause unprecedented and irreversible climate disruptions in the environment. In assessing all scenarios, the experts agree that this increase will occur in 2040 or earlier if emissions are not drastically reduced.

One of the consequences of climate disruptions is the melting of the poles, which increases average ocean levels, which could rise by 82 cm by 2100 according to the IPCC, leading to more frequent and more severe coastal flooding.

As stated above, and in the attempt to contribute significantly to the reduction of greenhouse gas (GHG) emissions in the atmosphere, companies **SACHA INTI S.A.** and **GRUPO SEEDSEM S.A.** have collaborated and developed a project based on over 12 years of scientific research focused on biomass, specifically the STAR crop, which allows the ecological restoration of deforested and degraded lands, and has shown exceptional success in its ability to absorb CO_2. Furthermore, its biomass is highly effective in generating renewable and green electricity (it absorbs and sotres more CO_2 than it emits), this plant can also produce synthetic fuels and sustainable aviation fuels (SAF). Additionally, it can create biodegradable and compostable bio-polymers that can replace everyday use products that harm the planet.

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The apocalypse: Is the world coming to and end? (*)

Accordingly, there is a clear need to address the complex problem of the climate crisis that affects the entire world by considering 3 fundamental axes: the ecological restoration of degraded and deforested lands, promoting the sowing of crops that stand out for their CO_2 absorption capacity and using their biomass to generate green and clean renewable energy, as well as other derivatives that are currently obtained from crude oil.

STAR

Bioenergy crops can be defined as any plant that is used to produce bioenergy (i.e., renewable energy from biological sources). Currently, sugarcane, oil crops, and cereals such as maize and wheat are the primary contributors to bioenergy production.

In order to provide a viable and feasible alternative for the mitigation of climate change and decarbonization of the planet, the collaboration between the companies **SACHA INTI S.A.** and **GRUPO SEEDSEM S.A.** has allowed the evaluation and study of the crop called STAR, developed by the Institute of Field and Vegetable Crops **(IFVCNS)**. STAR is a **C4 plant** that adapts to all types of soil conditions, **with high tolerance to salinity and climatic conditions present in Peru where it will show its maximum growth potential in tropical and subtropical zones.**

Consecutively, the following is a comparison chart of the yields of the STAR crop in contrast to the yields of a traditional crop such as sugarcane.

CHART 1. COMPARISON CHART - IMPORTANT PRODUCTION DATA HECTARE/YEAR

CROP	Water requirement (m^3)	CO_2 absorbency (Tn)		CO_2 Emission (Tn)	Energy value (kcal/kg)	Degrees BRIX	Biogas (m^3)	Ethanol (L)	Electrical energy (kWh)	Production cost (USD)	Productivity (Tn)	Sugar obtained (Tn)
		Aerial biomass	Underground biomass									
STAR	2.400 - 4.200	237	14,2	1,2	5.600	17 - 20	56.100	20.886 - 24.572	266.475 [8]	1.000	330	40,9
SUGARCANE	15.000 - 20.000 [3]	15,84 [4]	0,333 [4]	1,3 [5]	2.300 - 2.400 [6]	9 - 11	24.300 [7]	4.998	115.425 [8]	3.200	90 [9]	9,8

As shown in the Chart 1, STAR shows better results compared to sugarcane cultivation. It has a much lower water requirement and a high biomass productivity, which would allow at least 3 hectares of sugarcane to be replaced by other important alternative crops for human and animal food. It should be noted that the STAR crop is more profitable than sugarcane in all evaluated parameters for farmers and the industry. STAR has a high absorption of carbon dioxide in aboveground biomass (237 Tn ha/year), and in underground biomass (14.2 Tn ha/year) improving soil structure; It has a high productivity of more than 330 tonnes of green matter per hectare per year or more than 99 tonnes of dry matter per hectare per year.

Therefore, growing STAR on deforested and degraded land will allow to achieve the ecological restoration of the ecosystems, a high CO2 absorption, and the increase of atmospheric humidity, which can positively impact the water cycle in a short amount of time. This, in turn, can increase rainfall in the Amazon and help to recover the flow of the tributaries of the Amazon River. This will ultimately reduce the risk of climate change consequences in the world's largest freshwater reserve.

Due to various anthropogenic activities, deforestation and degradation of land in the Peruvian Amazon have left unimaginable scenarios that increasingly resemble a desolate and infertile desert. Natural forest recovery could take many decades or even hundreds of years before the biotic pump can fully regulate the Amazonian water regime. As a short-term solution, planting **STAR** in these lands can help restore balance to the flying rivers and support the restoration of the ecosystem.

The following chart presents important data on the production per hectare per year of STAR crop used for the ecological restoration of deforested and degraded lands in the Peruvian Amazon. Likewise, relevant data of a tropical forest per hectare are presented.

CHART 2. IMPORTANT PRODUCTION DATA HECTARE/YEAR OF STAR FOR THE ECOLOGICAL RESTORATION OF DEFORESTED AND DEGRADED LANDS IN THE PERUVIAN AMAZON

CROP	CO_2 absorbency (Tn)		CO_2 Emission (Tn)	Energy value (kcal/kg)	Electrical energy (kWh)	Production cost for deforested and degraded lands (USD)	Productivity (Tn)	Soil humidity retention (m^3)
	Aerial biomass	Underground biomass						
STAR	237	14,2	1,2	5.600	266.475 [10]	5.000	330	600 [11]

CHART 3. IMPORTANT DATA OF A TROPICAL FOREST PER HECTARE

ECOSYSTEM	CO_2 absorbency (Tn/year)		CO_2 Emission (Tn)	Energy value (kcal/kg)	Electrical energy (kWh)*	Productivity in climax forest (Tn)
	Aerial biomass	Underground biomass				
TROPICAL FOREST	17,10 [12]	5,13 [13]	0 [14]	3.897,97 [15]	983.000 [15]	216,8 [15]

***Electrical energy (kWh):** This refers to the amount of electrical energy obtained per hectare in a climax forest, which can be consolidated after 30 to 50 years from its initial formation stage.

Considering the data presented above for STAR and for a climax forest —maturity that a given ecosystem can reach and that is in its maximum state of stability— the importance of CO_2 absorption (Tn/year) associated with its above and below ground biomass is evident, which will allow the recovery of site conditions and mitigate climate change in a shorter period of time, without the need to expand the agricultural frontier.

STAR has also proven to be an excellent alternative to achieve an optimal transition to green energy production, which is evident in the data presented in Chart 2 and 3. STAR can produce 266.475 kWh per ha/year, compared to the production of 983.000 kWh that a climax tropical forest can reach, which, as detailed above, can reach this denomination after 30 to 50 years from its initial formation stage.

Growing **STAR** can provide an immediate solution by creating a large vegetation cover per hectare, which can prevent soil erosion and generate significant atmospheric humidity through transpiration. This, in turn, can help regulate the water regime in the Peruvian Amazon and reduce heat waves and wildfires that are becoming more frequent due to the rise in global temperature.

Recent scientific research has shown that **STAR** is an innovative and sustainable alternative that offers greater profitability in the energy and economic sphere. Its lignocellulosic biomass is a more sustainable, efficient, and high-quality bioenergy raw material compared to other crops. **STAR** requires fewer agricultural inputs, produces more energy, and contributes more to the reduction of greenhouse gas emissions.

SACHA INTI S.A. is committed to contributing to the development of the green economy and has been actively researching, developing, and promoting the generation of **green hydrogen**[16], biopolymers, renewable energies, and other sustainable initiatives. **SACHA INTI S.A.**'s biorefinery operates within a closed green chemical process, which means that it does not emit greenhouse gases. Instead of using fresh water or ocean water, it **collects rainwater and uses water produced by its own technology** to reduce its impact on the environment.

Our project, developed with our own eco-friendly technology through the STAR crop will allow us to restore degraded and deforested areas in the Peruvian Amazon, which will bring the following benefits:

Decrease the concentration of heavy metals in soils, applying Good Agricultural Practices (GAPs) and techniques that do not require the use of chemical products that affect the ecosystem.

Improvement of the physicochemical and biological characteristics of the soil.

Implement an agricultural or forestry production system.

Lower crop fertilization expenses.

Achieve an optimal productivity and product quality, so that they are competitive in the national and international market.

Project phases: The proposal includes 04 technical phases.

Project period: 12 months

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