Decentralized and transparent certification system for food producers with sustainability incentive mechanism on the Ethereum network

Sustainable Agriculture Certification

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Abstract

This document introduces the Sintrop certification project and the SAC token, an erc-20 token on the Ethereum blockchain as an incentive mechanism for a decentralized rural certification system. This project aims to solve several problems and challenges that agriculture is currently facing. On one hand, the market is fully dominated by *latifundium* and big land properties that only care about the production and financial returns, not being worried about nature and the environmental impact of its production. Depending on the location, government subsidies help sustain this business model, with the argument that they are producing food for the population, when in most cases they are commodity producers. There are some agricultural practices, especially the monoculture industrial farming, that every time and every crop make the place worse than before, extracting soil resources that contribute to erosion, contaminating the area with chemicals, killing the biodiversity, using huge amounts of water and so on. On the other hand, a small group of undervalued ecological farmers put the environment before the economy, producing food and other land resources in harmony with nature. Today we see the still shy development of sustainable agricultural techniques, such as agroforestry and syntropic agriculture, a technique that follows the laws of nature and adapts its principles to food production, working together with biodiversity, making the soil increasingly rich and using less resources over time. Another problem is the lack of transparency of centralized organic or sustainability inspection and certification organizations. As consumers, it is very difficult to know where the food we are eating came from or how it was produced. Our choices are either not to care or to rely on a third-party certification organization, which often delivers seals with little or no information. Another problem is social inequality in agriculture, where a small portion of large farmers, pesticide multinationals and agricultural machinery manufacturers hold the money from agribusiness, while family farming works to produce the population's food.

The goal of this project is to develop a decentralized, community driven, open source certification system using blockchain technology with a proof of sustainability mechanism to reward sustainable producers. Capitalism and profit maximization at any cost makes money often the choice, regardless of the environment. If, somehow, ecological agriculture becomes equal or even more profitable than unsustainable agriculture, it will no longer make sense to produce food harming the planet. Our goal is to make agriculture sustainable in the world and this whitepaper describes how the Sintrop software and ecosystem and the SAC token work.

Our mission

The mission of this project is to **make agriculture sustainable in the world** through technology. We want to contribute to making the world a better place. A planet with more biodiversity, less carbon emissions, less global warming, more life in the soil and more wise use of natural resources.

Everything that will be developed will be to protect, regenerate and care for nature.

Introduction

The mission of making agriculture sustainable is not the easiest of all. And if there is any possibility of achieving this, it is through a strong community of people fighting every day for this purpose. And transparency is key in this case. That's why the software developed will be open source and, with the exception of the network fees of the Ethereum network, free for everyone to use. Community-driven open-source projects are our best chance, as individuals, to break free from large companies and organizations that often put their own interests first.

We have a few groups of people in our ecosystem, each with different roles. The food producer, the environmental activist, the researcher, the developers, the contributors, advisers, investors and the final buyers. For final buyers, the main benefit will be transparency about food production. The system will provide, in addition to a simple stamp, data collected in a decentralized way with much more information about the producer and the food he bought. And yet a platform for choosing the most ecological producers. For environmental activists, it is the opportunity to fight against the current system, contribute to a better distribution of income in agriculture and help family farmers and agroecological producers, being rewarded for this when carrying out inspections. The researchers are expected to act as environmental scientists, studying and researching the best practices of sustainability in agriculture to develop the Sustainability in Agriculture Index (or ISA). Developers, contributors and advisors will be the team members supporting and developing the system. Investors, or token holders, will be able to participate by funding agroecology and using their tokens to vote in the ISA categories. For the rural producer, the system will provide a non-bureaucratic, decentralized and open-to-all certification process, which can be used to prove its sustainability. In addition to a rewards system that will benefit and deliver more tokens to the most sustainable. For non-ecological rural producers, the system is an opportunity to optimize, change their form of production and be part of the ecosystem. To become an environmental activist or apply for certification as a producer, the only requirement needed is a wallet on the Ethereum network, which can be easily installed via common web browsers. The system is open to everyone to participate. The only costs involved are the Ethereum network transaction fees.

The main product is the certification program. A centralized certification is usually an organization, a government or similar that decides the rules of the program and private companies that carry out the inspection and issue the seals and authorization documents.

Instead of certifying centrally, our proposal is to certify in a decentralized and participatory manner. Researchers will be able to study, share their knowledge about sustainable agriculture, create the program rules and all token holders will be able to vote on the categories that they believe are more important. Rural producers will be able to request inspections in a certification process without bureaucracy or restrictions. And then the activists will oversee and carry out the inspection process. Instead of each time being the same organization or the same team carrying out the inspection, each inspection that the producer receives will necessarily be different activists who will carry it out. The result of the inspection process will be the ISA score, or the producer's Agricultural Sustainability Index score. This index aims to change the way rural producers are evaluated and measure the level of sustainability of the producer in several aspects, mainly in relation to the level of emission/atmospheric carbon sequestration, the level of biodiversity of the system and use of natural resources. The result being evaluated on a sustainability scale where the producer can be more sustainable or less sustainable, according to the inspection result. The result will be permanently stored on the Ethereum blockchain, making certification a simple read of data from the blockchain.

The Sustainable Agriculture Credit Token, or SAC (Sustainable Agriculture Credit Token), will be the system's utility and fuel token. For token holders, each token will act as a voting right in the ISA categories. And it will also work as a reward to the community for the services provided. For sustainable rural producers, the SAC token will be the reward for their work in harmony with nature.

This project has absolutely no relationship with any government or any kind of organization. It is a project with the ambition to be done by people, for people, with the aim of changing the way agriculture is done today, bringing more trust and transparency to the food production system.

The end result will be a certification system that will measure producers on a scale, which will benefit the most sustainable producers according to their sustainability score with the Sustainable Agriculture Token Credit and a transparent certification where everything done and carried out in platform will be open and available for end consumers to know more information about the products they buy and consume. So that they can choose to buy from those who work in harmony with nature.

Value proposition

Our value proposition is mainly in three points:

1. Transparency in food production and consumer information
2. Scale assessment of food producers through the sustainability index in agriculture
3. Reward token to encourage and fund sustainability in agriculture

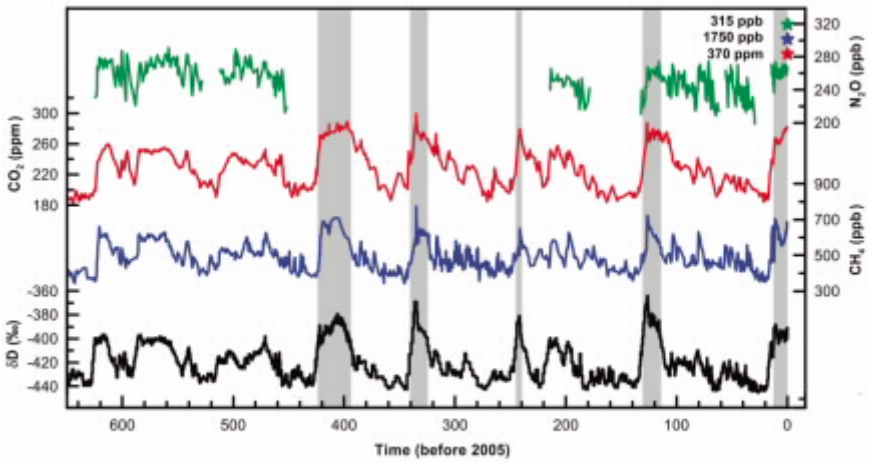
The first point has the objective of making public all the information regarding the certification process and of displaying the result so that the consumer has access and knows how that food was produced, in which points it was sustainable and in which not, in a way that he can choose the most sustainable.

The second point aims to change the way rural producers are currently evaluated and do this on a scale, where they can be more or less sustainable according to their production.

The third point aims to create a reward system for sustainability in agriculture, finance and accelerate the shift to agroecology.

The problem

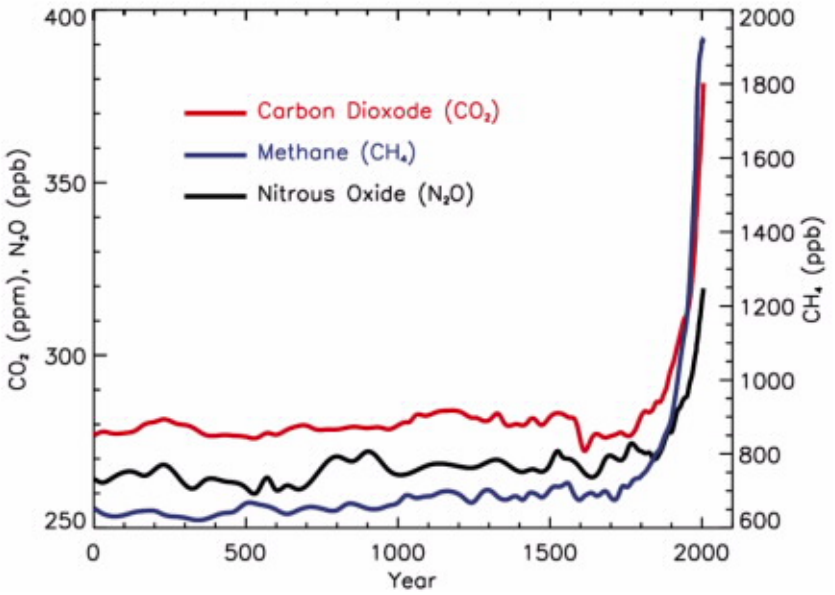
The earth was in balance before the industrial revolution. A balanced world means that life here would remain for an infinite amount of time and if something happens to threaten the planet or human lives, it would be for a third party event like an asteroid or a pandemic disease and not a reaction for the human acts. But since the industrial revolution the human beings started to change this balance.



Source: From Figure 6.3, IPCC Fourth Assessment Report (2007), Chapter 6

Accordingly to ACS [1], the atmospheric concentrations of naturally occurring greenhouse gases, such as carbon dioxide (CO2, red), methane (CH4, blue), and nitrous oxide (N2O, green), have varied over the past 650 millennia as the Earth has cooled and warmed several times. Concentration units are parts per million (ppm) or parts per billion (ppb), the number of molecules of the greenhouse gas per million or billion molecules in a dry atmospheric sample. Until the past two centuries, the concentrations of CO2 and CH4 had never exceeded about 280 ppm and 790 ppb, respectively. Current concentrations of CO2 are about 390 ppm and CH4 levels exceed 1,770 ppb. Both numbers are much higher than at any time during the last 650,000 years. Data for the past 2000 years show that the atmospheric concentrations of CO2, CH4, and N2O, three important long-lived greenhouse gases, have increased substantially since about 1750. Rates of increase in levels of these

gases are dramatic. CO2, for instance, never increased more than 30 ppm during any previous 1,000-year period in this record but has already risen by 30 ppm in the past two decades.



Source: Figure 1, FAQ 2.1, IPCC Fourth Assessment Report (2007), Chapter 2

And this change is largely attributed to the industrial revolution. If we don't change the way that we organize as a society to establish the world's balance, we will put the earth, or more probably the human beings existence in check. And it is better for us to start now to avoid future generations' problems. And agriculture is a foundation area to this problem. If we make it sustainable, it will be a huge step for us.

The monoculture commodity based large-scale agriculture has several negative impacts on the social-environment. The chemicals and pesticides largely used can degrade and damage the community of microorganisms living in the soil, can contaminate the water and bring several other prejudices to the ecosystem. The solution isn't the medicine-disease industry that produces genetically modified seeds and sells toxic pesticides that make farmers hostage to these products, taking a large share of the profit that should be the farmer. Not to mention the damage to the health of those who consume the food.

A living soil has organic matter and an ecosystem within it, with countless organisms and microorganisms inhabiting the place. It usually has a darker color and a high fertility for agriculture. Soil erosion is a gradual process in which life and existing ecosystems are lost. Industrial monoculture contributes significantly to soil erosion, as it extracts more resources, kills biodiversity and creates a negative balance in the system that contributes to the erosion process.

Soil plays a very important role in the carbon sequestration cycle. Soil carbon capture implies the transfer of atmospheric CO2 to a unit of land through its plants. The benefits of carbon sequestration in the soil are numerous, especially with regard to combating global

warming. We already have carbon capture and sequestration technology, it's called nature. Restoring soil quality requires management practices that create a positive carbon balance [2].

We urgently need an agricultural production system that restores life to the soils instead of killing it.

Biodiversity, one of the planet's most precious assets, is fundamental to its existence. Human beings, as the dominant species, often believe they are superior to others when in fact they do not understand that they are just part of an intelligent system called nature. We need to protect the planet's biodiversity, not destroy it. Chemical pesticides, or pesticides, widely used in industrial agriculture are poisons applied with the intention of killing and destroying all the biodiversity of the place other than the crop produced. They contaminate not only the place but also the water, which causes an even greater contamination that impacts rivers, groundwater and even the oceans.

We cannot allow this system that destroys all the planet's biodiversity to be the main form of food production in the world. We urgently need a system that works in harmony with nature and that creates biodiversity instead of destroying it.

Agriculture contributes in several aspects to the level and emission of atmospheric CO2, ranging from the manufacturing process of inputs, production resources to the processing and sale of products. Some of the critical points that emit a high amount of greenhouse gases in the food production process:

- Manufacture of fertilizers and pesticides
- Source of electrical energy
- Used packaging
- Transport of goods
- Deforestation

We need to reduce and neutralize these impacts to produce food with the smallest possible carbon footprint.

The solution: Agroecology

We will assume that agroecological agricultural production are food production techniques that, in the sum of all the production factors involved, generate a positive impact on the planet.

An incredible agricultural technique that generates a positive energy balance, including a positive carbon balance, is syntropic agriculture, popularized by Ernst Götsch. Entropy is a measure of the degree of disorder in a system, the loss of energy that generates a negative energy balance. While syntropy is the measure of order or predictability of a system, energy gain through processes. Syntropic agriculture is agriculture that contributes to improving the energy of a system: it makes the soil more fertile, brings more and more life and biodiversity,

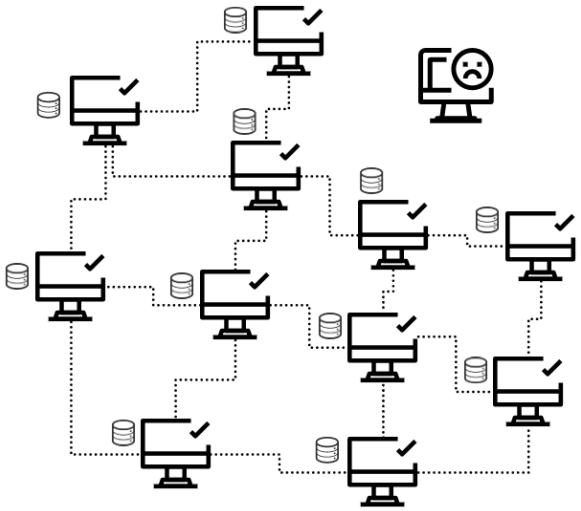
uses fewer resources, etc. A rural property that consumes soil resources, uses extensive amounts of water and other natural resources, contributes to making the place worse over time, generating a negative energy balance and impoverishing the area. On the other hand, a rural property that generates life, makes the soil more fertile, uses less resources over time and brings biodiversity to the region, contributes to making the system better than before, with a positive energy balance. There is an urgent need to spread a production system that, while producing tons of delicious products and food, regenerates degraded areas and brings our forests back [3].

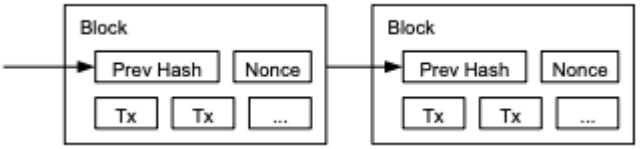
Regenerative agriculture is the way forward for our and future generations. Agroecology is the only way we have to make agriculture sustainable in the world. And making the world sustainable is the only path that exists for the longevity of human beings on earth.

Photo of a highly productive agroforestry in harmony with nature.

Blockchain introduction

Since the publication of Satoshi Nakamoto in 2008 [4], blockchain technology has been introduced to the world. Using a peer-to-peer system, with a distributed storage of data, governed by a proof-of-work consensus algorithm. This technology emerged with the aim of decentralizing “conventional” organizations. One of the main features of this technology is the structure of data storage in blocks, where a block carries the hash of the previous block in order to connect them algorithmically. Another important feature is the distributed data structure, in which instead of storing data centrally on a server with private access, the data is stored in the participants, called network nodes. That is, each computer that participates in the network stores a copy of the record of the transactions carried out, so that if only one node changes some information in a malicious way, it will not have a result since the value is in the chain where most participants accept it. as valid.

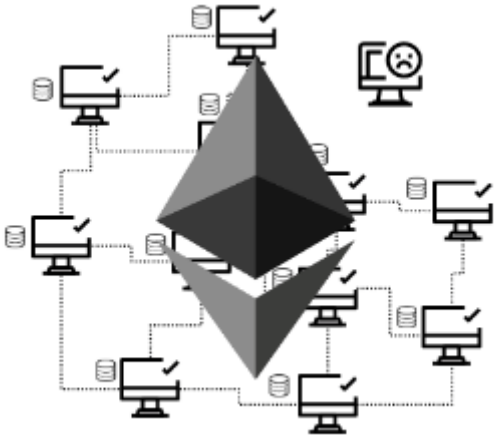




If we go back in time and study how our ancestors and previous generations organized themselves, especially before electricity and the internet, communication was a big problem for humanity. Before writing, all human knowledge and data could not be stored, which made development very difficult. Even after writing, paper is biodegradable, which does not make it the best material for storing human knowledge and data. With the advancement of computer science and telecommunication, remote communication has greatly changed the way our society is organized, helping to solve problems that were once difficult, such as avoiding wars or violence through faster diplomacy. And to face these problems and help us to thrive as a species, each generation has developed a way of structuring itself within the technology of its time. Without remote connection and communication, centralized organizations were the movement to control society. Private banks, corporations, kingdoms, religions and political structures were the answer to trust. We trust the country's fiat currency because the government regulates it. We trust the money in our bank accounts because it is in the banks. We trust the origin of organic food because there is a seal on the packaging that we know nothing about. The question is: is there a better way to organize ourselves as a society than the centralized way we used to be? Maybe the answer is the decentralized ecosystem that blockchain technology allows us to develop, maybe not. But probably if there's anything that has the potential to change our society in the future, it's technology.

Contributing to decentralization, Buterin, Gavin Wood and Ethereum’s team [5-6] launched a new blockchain with a different purpose: Developing an open source, globally decentralized computer infrastructure that executes programs called smart contracts. The Ethereum platform enables developers to build powerful decentralized applications with built-in functions. While providing high availability, auditability, transparency and neutrality [7]. Our system is being developed on top of the Ethereum platform. Instead of recording system information and data in a centralized database with restricted access, we will store all transactions, including inspection results, the ISA, information from activists, producers and also the votes and sustainability categories in the Ethereum blockchain. In an open, transparent way for everyone and distributed on several computers that are part of the

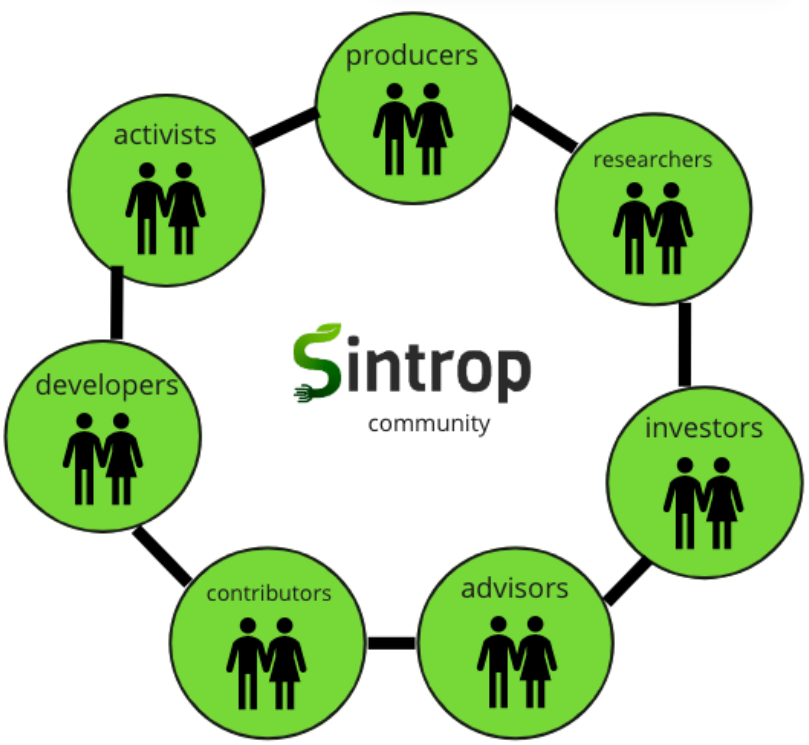
network. And that is why we will use the blockchain, to allow the development of the application in a decentralized way.



To further increase the level of decentralization and reduce network costs we will use IPFS, or Inter Planetary File System as a storage system [8-9] to apply unique hashes to our texts.

System architecture

Community



The main group of the system are the food producers who participate in the Sintrop certification process.

Environmental activists will be responsible for auditing and carrying out the inspection process of rural producers. Their role will be to accept the audits you want to carry out, go to the rural property in question and carry out the inspection. They should also act as promoters of the project, to teach about agroecology and convince more rural producers to enter the system and change their way of production towards agroecology.

The researchers will be responsible for defining the rules and developing the Sustainability in Agriculture Index. Their role will be to add categories to the ISA according to their knowledge of what is sustainable and what is not in agriculture. The most voted categories will be used in the inspection process by activists.

Developers are responsible for the technical development of the project. Contributors are responsible for support, education, marketing and other tasks for the development of the project.

Investors will be the token holders who invest in the project through public and private sales to use their tokens to vote in the ISA categories.

Index for Sustainable Agriculture (ISA)

To begin with, let's assume that sustainable is a state of the planet where living beings do not contribute to increase, even a little, the probability of an environmental disaster in the future because of their actions.

To evaluate the sustainability of rural producers, the system will be based on the ISA, or Index for Sustainable Agriculture. Researchers can contribute to developing and defining the ISA rules. The index calculation will be based on sustainability categories, and each researcher will be able to add as many categories as desired. Each category will have a title and five descriptions that must be technical and extremely well detailed, defining what in that category is totally sustainable, mostly sustainable, neutral or not applicable, mostly non-sustainable and totally unsustainable. They must also add instructions and recommendations for the evaluation of the same.

We will evaluate the impact on the planet of food production by analyzing various factors based on sustainability pillars and factors. The entire cycle of the products involved must also be evaluated, from their use on site to their manufacturing process.

Pillars:

- Carbon footprint
- Biodiversity
- Natural resources

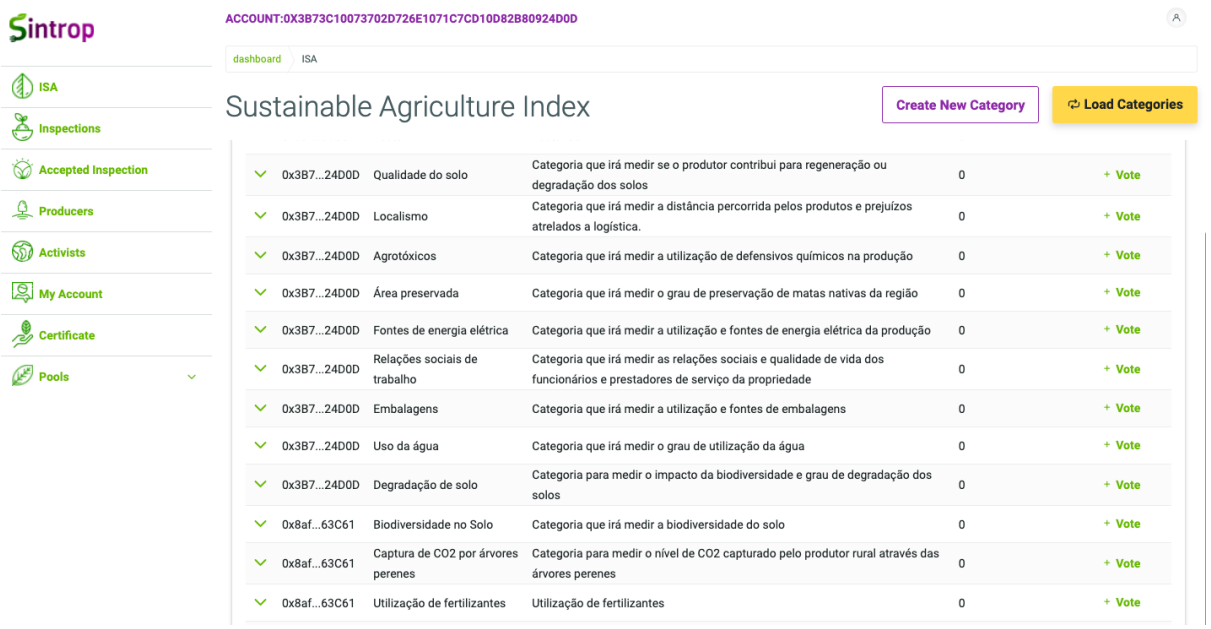
The more the producer contributes to the sequestration of atmospheric carbon and to the increase of life on the planet, the better its sustainability score should be.

Sustainability factors:

- Electricity
- Inputs
- Defensive
- Water
- Soil
- Labor force
- Carbon sequestration
- Packaging
- Waste

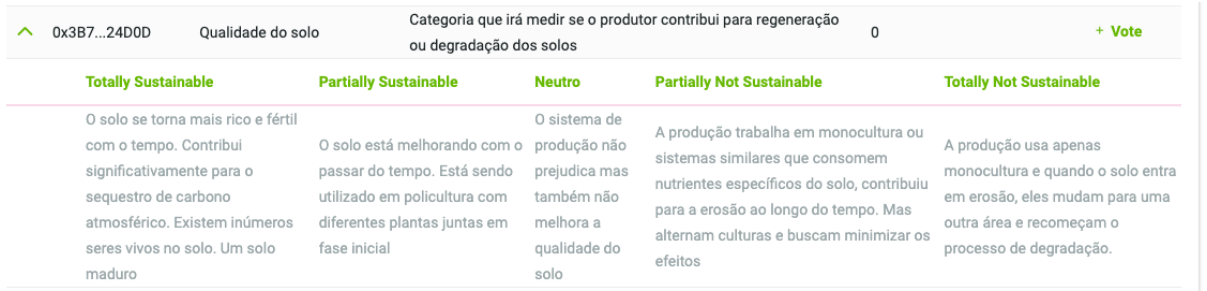
The result will be in a new category, that of producers and syntropic foods, which in the sum of the production factors involved contribute positively to the planet..

Categories



We emphasize that the exemplification in this document is just an outline, and that the categories in the future should be technical and with a much more elaborate and descriptive text created by agroecological researchers with experience in the subject.

Example of possible categories:



category 1 {

title = “Soil quality”

totally sustainable = “The soil becomes richer and more fertile over time. It contributes significantly to the sequestration of atmospheric carbon. There are countless living things in the soil. a mature soil”

mostly sustainable = “The soil is improving over time. It is being used in polyculture with different plants together in the initial phase”

neutro or does not apply = “The production system does not harm but also does not improve the quality of the soil”

mostly not sustainable = “Production works in monoculture or similar systems that consume specific nutrients from the soil, contributing to erosion over time. But they alternate cultures and seek to minimize the effects”

totally not sustainable = “Production uses only monoculture and when the soil erodes, they move to another area and start the degradation process again”

}

category 2 {

title = “Localism”

totally sustainable = “They only sell products locally (<80km). Zero use of fossil fuels”

mostly sustainable = “Only sell products locally (<250km). Use some fossil fuel in small vehicles”

neutro or does not apply = “They sell products regionally (<500km). They use fossil fuels moderately for land transport”

mostly not sustainable = “Sell products in national or large region coverage, using a lot of fossil fuel by land transport”

totally not sustainable = “They sell products over long distances and internationally, using a lot of fossil fuel due to land, air or sea transport”

}

category 3 {

title = “Pesticides”

totally sustainable = “Property does not use any type of chemical or similar product of any nature. Work with processes rather than inputs”;

mostly sustainable = “They only use organic products, produced in their own way or of natural origin”

neutro or does not apply = “Does not apply”

mostly not sustainable = “Property uses biological chemicals from private multinationals”

totally not sustainable = “Property uses pesticides, chemicals and similar products from private multinationals such as Glyphosate, Atrazine, Diurom, Paraquat Dichloride, Mesotrione or any other type of pesticide”

}

category 4 {

title = “Preserved area”

totally sustainable = “Property has more than 30% native protected area and/or uses regenerative agriculture techniques”

mostly sustainable = “Property has more than 15% native protected area and/or is starting to apply regenerative agriculture techniques in its early years””

neutro or does not apply = “Indoor solutions or not applicable”

mostly not sustainable = “Property has less than 15% of native protected area and the area of questionable origin was probably the target of deforestation years ago”

totally not sustainable = “Deforestation property, native vegetation was burned for commercial purposes”

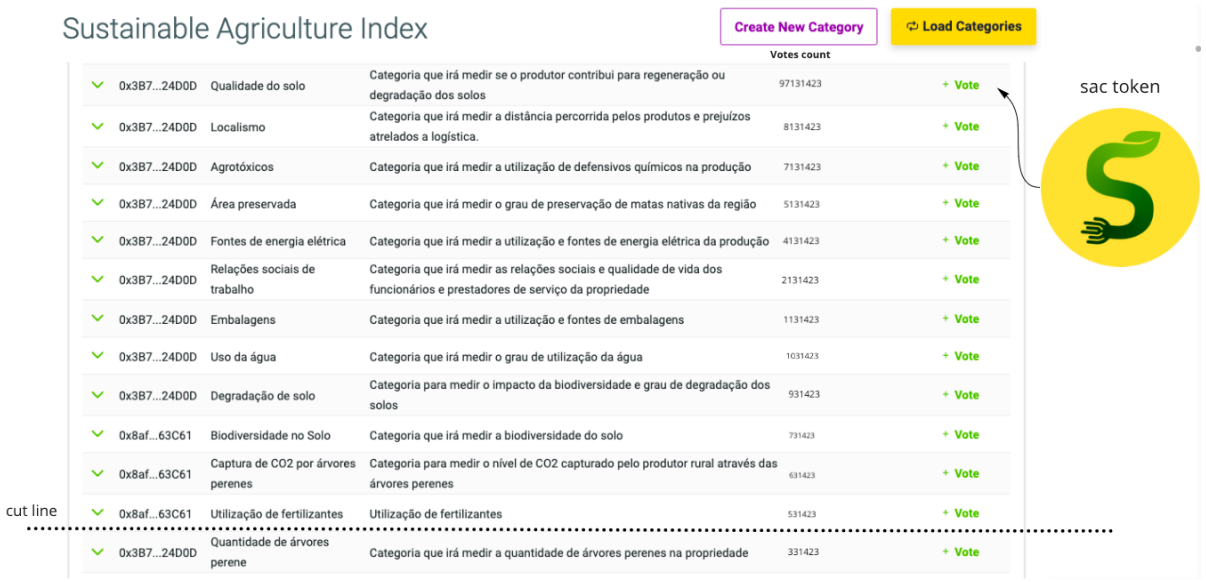
}

Token Utility

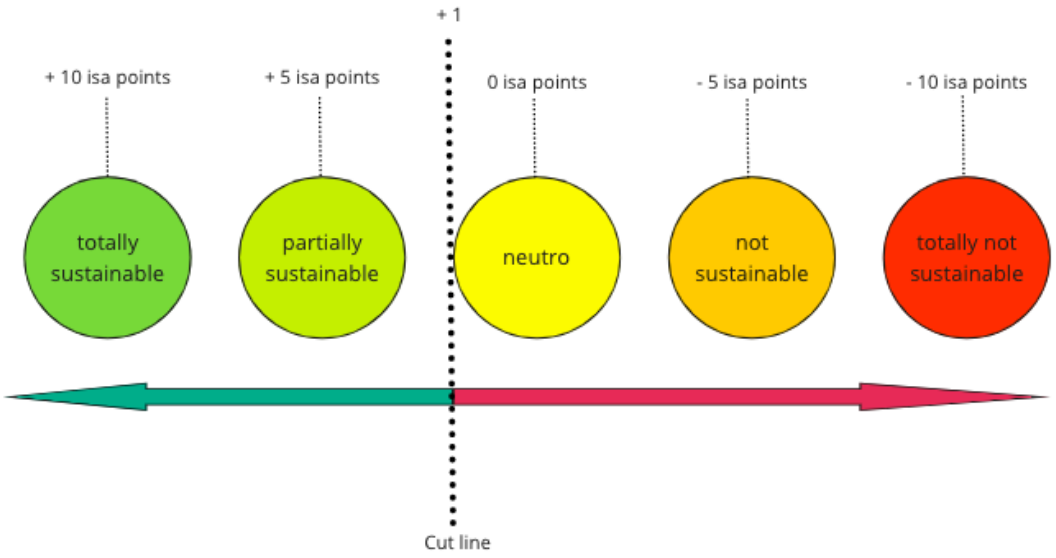
The sustainable agriculture credit token, or SAC token, will serve as the fuel of the system and vote in the ISA categories.

Researchers can add as many categories to the system as they wish, but only the most voted by token holders will be used in the inspection process. At first we will limit this number to 12, that is, the 12 most voted ISA categories will be used in the inspection process. However, this number may vary in the future based on our field tests. We have the view that the more categories are used, the better for the system. On the other hand, the more categories the greater the network cost for the activist to carry out the inspection and therefore we will seek to find a balance between these two factors.

The number of votes that each portfolio can vote per category will also be limited, a number that will be defined later according to the studies.



Scoring system



Each category will have a score that will be computed according to the following sustainability criteria:

totally sustainable = + 10 isa points
mostly sustainable = + 5 isa points
neutral or not applicable = 0 isa points
mostly not sustainable = -5 isa points
totally not sustainable = -10 isa points

–-
n = number of categories used

ISA score = (C1 + C2 + C3 + … + Cn)

for n = 12,

ISA score = (C1 + C2 + C3 + … + c12)

Onde *C* é a nota da categoria que foi atribuída pelo ativista.
—

*ISA average = (ISA score * 10) / (Cmáx1 + Cmáx2 + Cmáx3 + … + Cmáx(n))*

for n = 12 and Cmáx = 10,

*ISA average = (ISA score * 10) / 120*

ISA average range [-10, 10]

—

ISA score < 1 = producer not sustainable

ISA score > 1 = sustainable producer

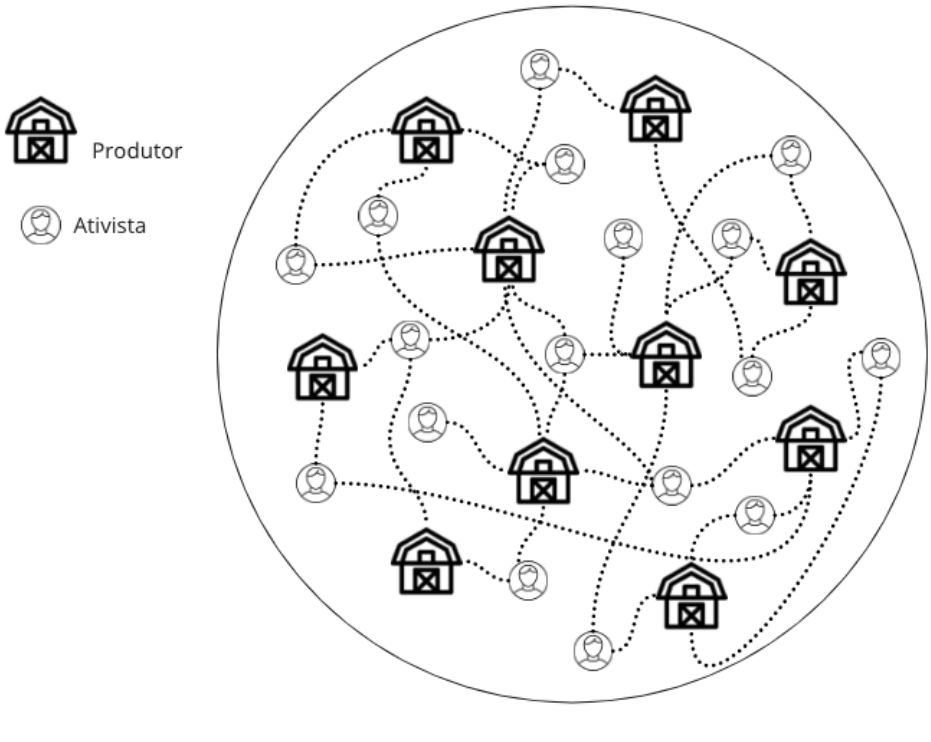
ISA average = 10 = producer high level (Gaia)

Only rural producers with an average ISA score greater than 1, with a minimum of 3 inspections carried out and a maximum of 12 months without receiving inspections will be approved to receive the rewards.

Inspection system

The system will be open so that any registered producer can request an inspection for their certification without bureaucracy. The activists in turn will be able to accept the inspections they want to make and then go to the property and carry out the audit.

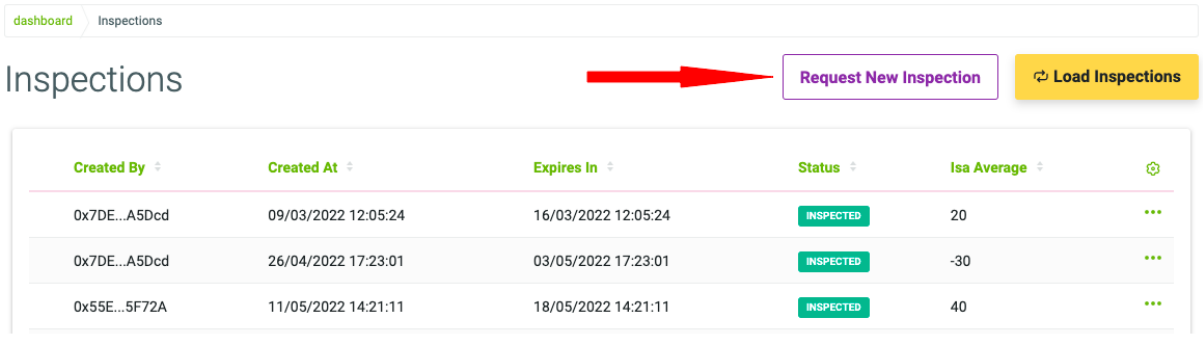
The inspection system will be decentralized, with audits carried out by activists following the logic described in this document.



Necessary actions

Some actions by producers and activists will be necessary for the certification system to take place. Each action will be a blockchain transaction and with a network cost involved.

Producer:



Request Inspection
// Action that the producer requests an audit

Activist:

// Accept Inspection
Action the activist accepts the inspection he wants to carry out

// Realize Inspection
Action that the activist performs the audit and sends the data to the blockchain

To carry out the inspection, the activist must evaluate the result of that producer in each of the ISA categories. He must record, per category, 3 pieces of information:

1. Category result
2. Detailed report of the result found
3. A photo to prove the result obtained

Rules

1. Each producer can only request one inspection at a time.
2. A producer who has already been inspected will only be able to request a new audit 1 era (=˜ 1 month) after the previous audit has been completed.
3. An activist will not necessarily be able to accept an inspection from a producer he has inspected previously.
4. Once the inspection is accepted, the activist will have 7 calendar days to carry out the audit and send the data to the blockchain.

5. The activist who accepts an inspection and does not carry it out will be penalized with a withdrawal.

Expected results

The result of the inspections carried out will be an information log with the record of the entire process, bringing more transparency to the food marketing system. Producers will be able to use the result as proof of sustainability of their production, and buyers will be able to see all this information when buying food from that producer.

The result after scanning the QR code or searching for the producer's key address in our search engine will be something similar to the result below, but in a more user-friendly and attractive way.

{

{

" _id": "35181",
" _address_wallet": "7d3c4c9995e82231c0b4146dda165f6dd245e8",
" _name": "Farm Exemple",
" _location": "Producer Address",
" _data_producer": "Producer data"

}

Inspection 1 {

{
" _id": "161165",
" _address_wallet": "d034879c4c9995e82231c0b4146d1233544asdfd245e8",
" _timestamp": "27.05.2022",
" _name": "Activist Exemple",
" _data_activist": "Activist data"
}

{
"_category1": "result", “report”,”proof photo”,
"_category2": "result", “report”,”proof photo”,
"_category3": "result", “report”,”proof photo”,
"_category4": "result", “report”,”proof photo”,
"_category5": "result", “report”,”proof photo”,
"_category6": "result", “report”,”proof photo”,
"_category7": "result", “report”,”proof photo”,
"_category8": "result", “report”,”proof photo”,
"_category9": "result", “report”,”proof photo”,
"_category10": "result", “report”,”proof photo”,
"_category11": "result", “report”,”proof photo”,
"_category12": "result", “report”,”proof photo”,

Where,

“category1 = title category 1, category description 1”,
“category2 = title category 2, category description 2”,
“category3 = title category 3, category description 3”,
“category4 = title category 4, category description 4”,
“category5 = title category 5, category description 5”,
“category6 = title category 6, category description 6”,
“category7 = title category 7, category description 7”,
“category8 = title category 8, category description 8”,
“category9 = title category 9, category description 9”,
“category10 = title category 10, category description 10”,
“category11 = title category 11, category description 11”,
“category12 = title category 12, category description 12”,
}

{
ISA score (1) = x
}

}

Inspeção 2 {

{
" _id": "161165",
" _address_wallet": "x1047h9c4c9995e82231230471233544asdfd1o23y4n",
" _timestamp": "27.07.2022",
" _name": "Activist Exempeo 2",
" _data_activist": "Activist data"
}

{
"_category1": "result", “report”,”proof photo”,
"_category2": "result", “report”,”proof photo”,
"_category3": "result", “report”,”proof photo”,
"_category4": "result", “report”,”proof photo”,
"_category5": "result", “report”,”proof photo”,
"_category6": "result", “report”,”proof photo”,
"_category7": "result", “report”,”proof photo”,
"_category8": "result", “report”,”proof photo”,
"_category9": "result", “report”,”proof photo”,
"_category10": "result", “report”,”proof photo”,
"_category11": "result", “report”,”proof photo”,
"_category12": "result", “report”,”proof photo”,

Where,

“category1 = title category 1, category description 1”,
“category2 = title category 2, category description 2”,
“category3 = title category 3, category description 3”,
“category4 = title category 4, category description 4”,
“category5 = title category 5, category description 5”,
“category6 = title category 6, category description 6”,
“category7 = title category 7, category description 7”,
“category8 = title category 8, category description 8”,
“category9 = title category 9, category description 9”,
“category10 = title category 10, category description 10”,
“category11 = title category 11, category description 11”,
“category12 = title category 12, category description 12”,
}

{
ISA score (2) = y
}

}

ISA average = (x + y) / 2

ISA score = x + y
}

This data will be permanently stored on the Ethereum blockchain.

Penalty system

Penalizing users who do not act in accordance with project policies.

Sistema de delação

The system will allow a user to make a complaint if he discovers something that goes against the rules of the system. To open one, the user must, after defining which person will be the whistleblower, add 3 items to the system: Title, testimony and photos of evidence.

The objective is to encourage the community itself to do the work of maintaining the system and the allegations made can be investigated.

Sintrop security

The system will allow the contract owner, Sintrop, to have some smart contract security privileges. The main one will be an onlyOwner function that only Sintrop will be able to call which will have the power to exclude any user from the token distribution pools. The objective is to use this feature only as a last resort to exclude wallets that are trying to circumvent the system.

We are studying possibilities of doing this maintenance by the community itself without the need for this centralization through voting systems for exclusion, still in the study phase.

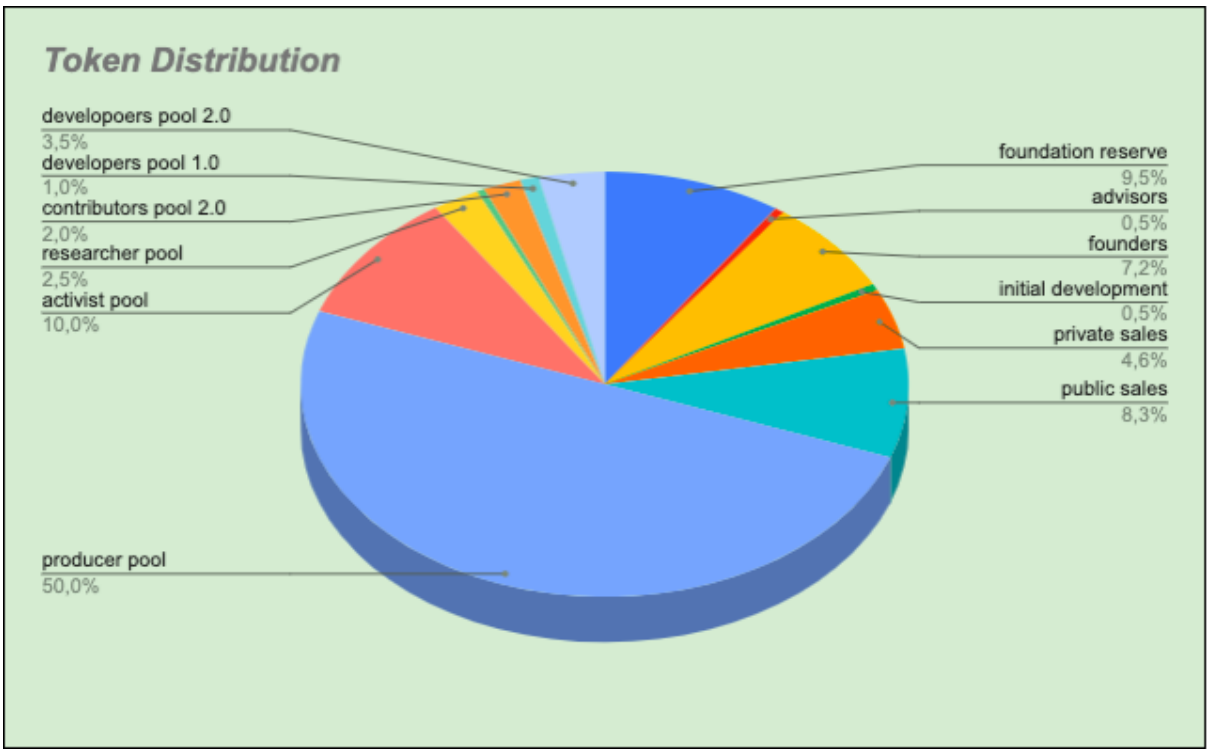
Sustainable Agriculture Credit Token

name	Sustainable Agriculture Credit Token
symbol	SAC
totalSupply	1.500.000.000

Tokenomics

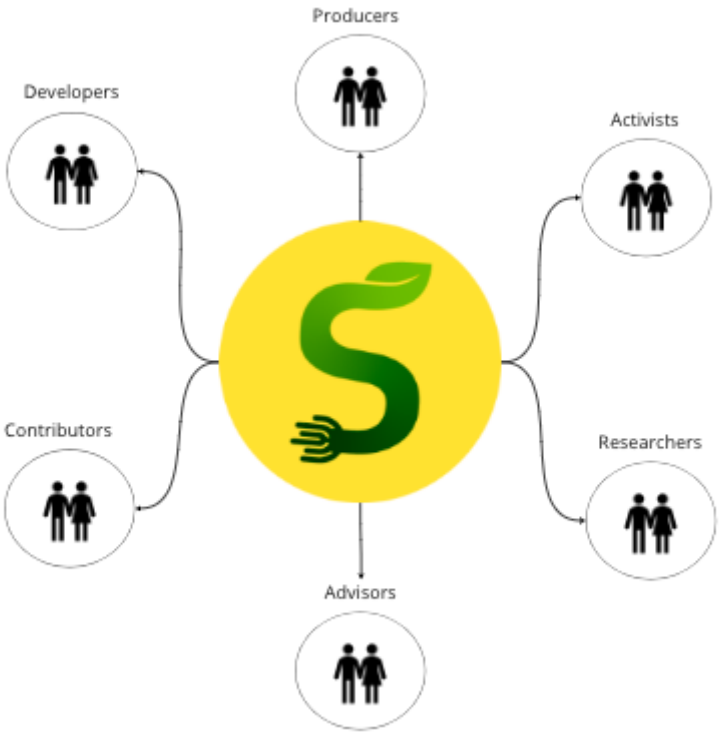
Distribution of tokens by user groups:

Distribution	%	Number of tokens
foundation reserve	9,50%	142.500.000
advisors	0,50%	7.500.000
founders	7,20%	108.000.000
initial development	0,50%	7.500.000
private sales	4,60%	69.000.000
public sales	8,30%	124.500.000
producer pool	50,00%	750.000.000
activist pool	10,00%	150.000.000
researcher pool	2,50%	37.500.000
contributors pool 1.0	0,40%	6.000.000
contributors pool 2.0	2,00%	30.000.000
developers pool 1.0	1,00%	15.000.000
developoers pool 2.0	3,50%	52.500.000
Total	100,00%	1.500.000.000



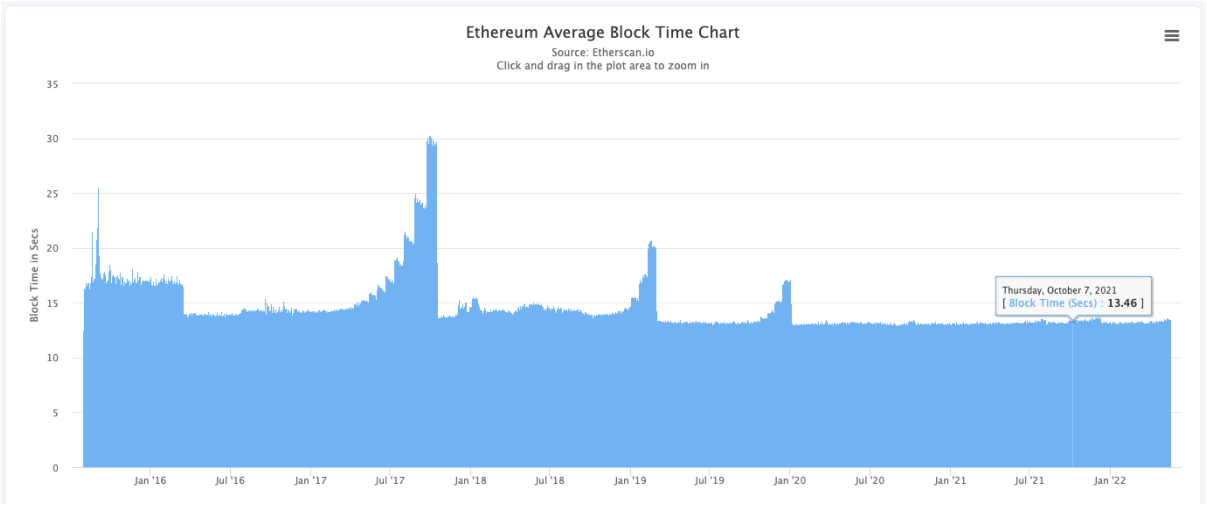
Distribution Pools

The tokens will be distributed through smart contracts, called distribution pools, to each of the ecosystem groups according to certain rules.



The distribution of rewards will be done by eras, with the goal of each being roughly equivalent to a month.

As the blockchain adds new data in the form of blocks, we will use the average time for the creation of each block as a reference for the algorithmic calculations of token distribution.



According to Etherscan, in recent years the average time per block has been approximately 13-14s per block.

Therefore, we will use the value of 13.50s per block as a blocktime for the calculation of our eras.

Blocktime (s)	13,50
Blocks per hour	267
Blocks per day	6.400
Blocks per ERA	192.000

Which gives us that 1 ERA = 192 thousand blocks.

The token distribution system will work with the halving mechanism, at which point the reward per era will be halved. The goal is to prolong the reward and distribution of tokens over the next few decades.

Distribution halving will occur every 72 eras, or approximately 6 years.

Blocktime (s)	13,50
Blocks per hour	267
Blocks per day	6.400
Blocks per ERA	192.000
ERAs per Halving	72
Blocks to Halving 1	13.824.000
Blocks to Halving 2	27.648.000
Blocks to Halving 3	41.472.000
Blocks to Halving 4	55.296.000
Blocks to Halving 5	69.120.000
...	...

Producer Pool

50.00% of tokens distributed to sustainable producers certified according to their sustainability score.

ProducerPool	
Total reward tokens	750.000.000

Period	Mainnet launch	Halving 1	Halving 2	Halving 3	Halving 4	Halving 5	...
Reward per *era*	5.000.000	2.500.000	1.250.000	625.000	312.500	156.250	...
Total period reward	360.000.000	180.000.000	90.000.000	45.000.000	22.500.000	11.250.000	...
% of total	48,00%	24,00%	12,00%	6,00%	3,00%	1,50%	...

For the producer to be approved by the system and be able to receive the rewards, he will have to be approved by the following criteria:

- Result of inspections above the cut-off mark (sustainable producer)
- Minimum of 3 inspections received by 3 different activists
- Maximum 12 eras without receiving inspections

(These numbers will later be evaluated in a field study and are subject to change)

The producer that passes these criteria will be certified by the system and will be able to receive the rewards.

The reward will be distributed weighted by the sustainability score, isa score, of each certified producer.

Being,

r = reward per era
ISA(p) = producer p ISA score
ISA(t) = sum of all producers ISA score

The reward in a given era that must be approved to a producer p will be:

*r(p) = **(** ISA(p) / ISA(t) **)** * r*

As a result, the higher the sustainability score, the more credits the producer will be entitled to receive and he will be able to optimize his earnings by requesting more inspections and improving the sustainability of his production.

Activists Pool

10.00% of the tokens distributed to activists in compensation for the service provided to the rural producers' audit community.

ActivistPool	
Total reward tokens	150.000.000

Period	Mainnet launch	Halving 1	Halving 2	Halving 3	Halving 4	Halving 5	...
Reward per *era*	1.000.000	500.000	250.000	125.000	62.500	31.250	...
Total period reward	72.000.000	36.000.000	18.000.000	9.000.000	4.500.000	2.250.000	...
% of total	48,00%	24,00%	12,00%	6,00%	3,00%	1,50%	...

For the activist to be approved by the system and be eligible to receive the rewards, he will have to be approved by the following criteria:

- Minimum of 3 realized inspections
- Maximum of 3 *eras* without realizing
- Maximum 5 penalties for giving up

(These numbers will later be evaluated in a field study and are subject to change)

The activist who passes these criteria will be approved by the system and will be able to receive the rewards.

The reward in turn will be distributed in a weighted manner according to the number of inspections carried out by each activist.

Being,

d = activists give up penalties number
i = number of inspections carried out by the activist
r = reward per era
q = number of total inspections performed on the system

The reward in a given era of an activist a will be:

*r(a) = [(i - 3*d) / q] * r*

Researcher Pool

2.50% of the tokens distributed to agroecological researchers in compensation for the services provided in the research and development of the Agricultural Sustainability Index.

ResearcherPool	
Total reward tokens	37.500.000

Period	Mainnet launch	Halving 1	Halving 2	Halving 3	Halving 4	Halving 5	...
Reward per *era*	250.000	125.000	62.500	31.250	15.625	7.813	...
Total period reward	18.000.000	9.000.000	4.500.000	2.250.000	1.125.000	562.500	...
% of total	48,00%	24,00%	12,00%	6,00%	3,00%	1,50%	...

The reward for approved researchers will be made equally among all, with the aim of not encouraging competition but cooperation between them.

Developers Pool

4.50% of tokens distributed to developers as remuneration for system development services provided.

The distribution to the developers will be done through two different contracts, one to reward the pre-launch development of the system on the mainnet and the other after the start of operation.

Developers Pool 1.0

1.00% of tokens distributed over a period of 18 eras from the moment the contract is deployed on the Ethereum mainnet.

DevelopersPool 1.0	
Total reward tokens	15.000.000
Period	18 *eras*
Reward per *era*	833.333

The distribution will be weighted according to the level of each developer.

Being,

l = developer level
L = sum of all developers levels
r = reward per era

The reward in a given era, from a developer d, will be:

*r (d) = (l / L) * r*

Developers Pool 2.0

3.50% of distributed tokens

DevelopersPool 2.0	
Total reward tokens	52.500.000

Period	Mainnet launch	Halving 1	Halving 2	Halving 3	Halving 4	Halving 5	...
Reward per *era*	350.000	175.000	87.500	43.750	21.875	10.938	...
Total period reward	25.200.000	12.600.000	6.300.000	3.150.000	1.575.000	787.500	...
% of total	48,00%	24,00%	12,00%	6,00%	3,00%	1,50%	...

Contributors Pool

2.40% of tokens distributed to project contributors as remuneration for services provided in the system.

The distribution to the contributors will be done through two different contracts, one to reward the pre-launch development of the system on the mainnet and the other after the start of the operation.

Contributors Pool 1.0

0.40% of tokens distributed over a period of 18 eras from the moment the contract is deployed on the Ethereum mainnet.

ContributorsPool 1.0	
Total reward tokens	6.000.000

Period	18 *eras*
Reward per *era*	333.333

The distribution will be weighted according to the level of each contributor:

Being,

l = contributors level
L = sum of all contributors levels
r = reward per era

The reward in a given era, for a contributor c, will be:

*r (c) = (l / L) * r*

Contributors Pool 2.0

2.00% of tokens distributed

ContributorsPool 2.0	
Total reward tokens	30.000.000

Period	Mainnet launch	Halving 1	Halving 2	Halving 3	Halving 4	Halving 5	...
Reward per *era*	200.000	100.000	50.000	25.000	12.500	6.250	...
Total period reward	14.400.000	7.200.000	3.600.000	1.800.000	900.000	450.000	...
% of total	48,00%	24,00%	12,00%	6,00%	3,00%	1,50%	...

Advisors Pool

0.50% of tokens distributed to project advisors over 120 eras.

AdvisorsPool	
Total reward tokens	7.500.000

Period	120 *eras*
Reward per *era*	62.500

ICO e token sales

Token sales	%	Number of tokens
Private sales 1	2,60%	39.000.000
Private sales 2	2,00%	30.000.000
ICO	8,60%	129.000.000

Private sales will be intended to finance the project in a pre-release phase of the software on the mainnet. It will be used for development, legal support, marketing, field testing and necessary support.

The ICO will follow the software release on the mainnet and more information will be released later. We will only carry out the ICO when the software is fully developed and ready to start trading on the market.

Final considerations

Roadmap

Phases:

1. We have already developed a prototype of the application with the main logics needed in the system's smart contracts and a simple web interface to interact with them. **[Completed]**
2. We are in the beginning phase of creating the Sintrop community and the first invitations to participate in the community. In this phase we will accelerate and scale the development of the software, as well as start the functional tests. **[Actual]**
3. Fundraising phase via private rounds, investing in legal and strategic support and preparing the project for the ICO. In this phase we will fully develop the system in the test network. We will test everything: technical training for producers, inspection processes, reward system, application operation, etc. We will only make a public offer if the system is fully operational on the test network.
4. The fourth phase will be the public offering of the tokens and launch of the software on the Ethereum mainnet, putting the system up and running and followed by constant software development, marketing and support to the producers.

Open questions

We still have some open questions that are in the study and planning phase:

- **Penalty system.** Run a system that can automatically delete malicious users without the need for centralization.
- **Geographic regions.** Add regional segmentation to the system, for an activist to select which region of the globe he would like to work in and allow only a producer to request inspection in regions that have a minimum number of registered activists.
- **Developers e contributors pool 2.0.** Set up a way to input and output new members without the need for centralization that allows the contract owner to add or remove members.
- **Researcher rules.** Set up a way for researchers to enter and exit without the need for centralization that allows the contract owner to add or remove members. One possibility is to limit the number of researchers in the system and set a maximum time, or researcher mandate, so that he or she is obliged to hand over the position to someone else after a specific number of eras.

Conclusion

We don’t believe that the solution for our problems as a society or to environmental problems relies on governments or non-governmental organizations. I believe that the solution relies on people’s actions to make the world a better place. And we need action, we need to change direction before it's too late. We need to become sustainable. And not just in agriculture but in several other areas.

We have a long long road ahead in the project and it is not going to be easy. This is our attempt to make the world a better place. If this logic functionalities work, perhaps we can use a similar approach to solve others similar problems.

Hopefully you have understood the software functionalities and main properties. If you have any questions, contact the author.

The community is the most important factor of the project. And not just a simple one, but a community of people willing to fight for better agriculture in the world and to make the world sustainable, even if it is just a small tiny step each day. So if you liked the project and would like to fight for it, whether as a farmer, environmental activist, software developer, investor or member of the Sintrop team, get in touch. We will be glad to have you onboard.

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