RegenIQ: A Scalable Framework for Advancing Regenerative Agriculture

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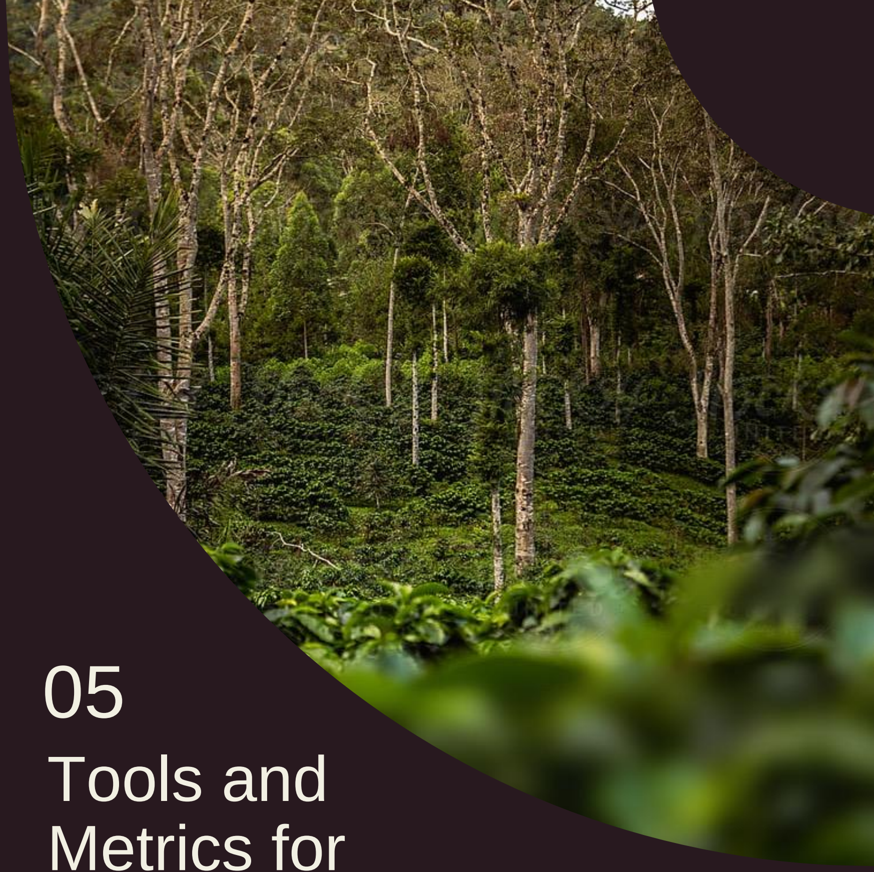

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01 Introduction

This white paper outlines the strategic framework of RegenIQ, powered by Agmatix, aimed at advancing regenerative agriculture and addresses one of the most pressing challenges: the lack of a consistent and acceptable measurement system at scale. By connecting agrifood companies to real-time field-level activities, RegenIQ enables them to tailor regenerative agriculture practices to specific crops and conditions through a standardized, data-driven approach. This not only enhances environmental effectiveness but also strengthens supply chain resilience. With RegenIQ, companies can confidently track and achieve their ESG goals and Scope 3 requirements by actively working with growers at scale.

RegenIQ, an adaptable and scalable framework that accelerates the adoption of regenerative agriculture, is uniquely designed to provide a structured method for assessing the impact of field-level practices relative to the key impact areas of soil health, water, biodiversity, and climate, meeting the diverse needs of modern agriculture. It represents a commitment to dynamic, flexible, and impact-driven methodologies that ensure the long-term viability and resilience of agricultural ecosystems. By delivering actionable insights, RegenIQ ensures both environmental sustainability and enhanced productivity.

This framework not only addresses the symptoms of agricultural challenges but also tackles their root causes through a science-based, structured approach to sustainability monitoring, ensuring meaningful monitoring and outcomes.

Additionally, RegenIQ accounts for the economic impact on growers, particularly smallholders, by integrating cost analysis and yield-loss considerations into its framework. This aspect is crucial for large agrifood companies committed to enhancing growers' well-being and economic status by providing valuable solutions that increase their profits and yields. Implementing these practices may pose challenges and costs, but by reducing complexities and highlighting the benefits through our buyer-centric value propositions, RegenIQ makes a compelling case for its adoption.

Aligned with the world’s leading definitions and frameworks in regenerative ag, RegenIQ meets the critical need for a consistent and reliable measurement system at scale. This paper provides an essential guide for our partners, customers, and the general public.

Learn how **RegenIQ** is setting new standards for sustainable farming, preparing agriculture to meet current challenges and future demands with innovative, data-based solutions.

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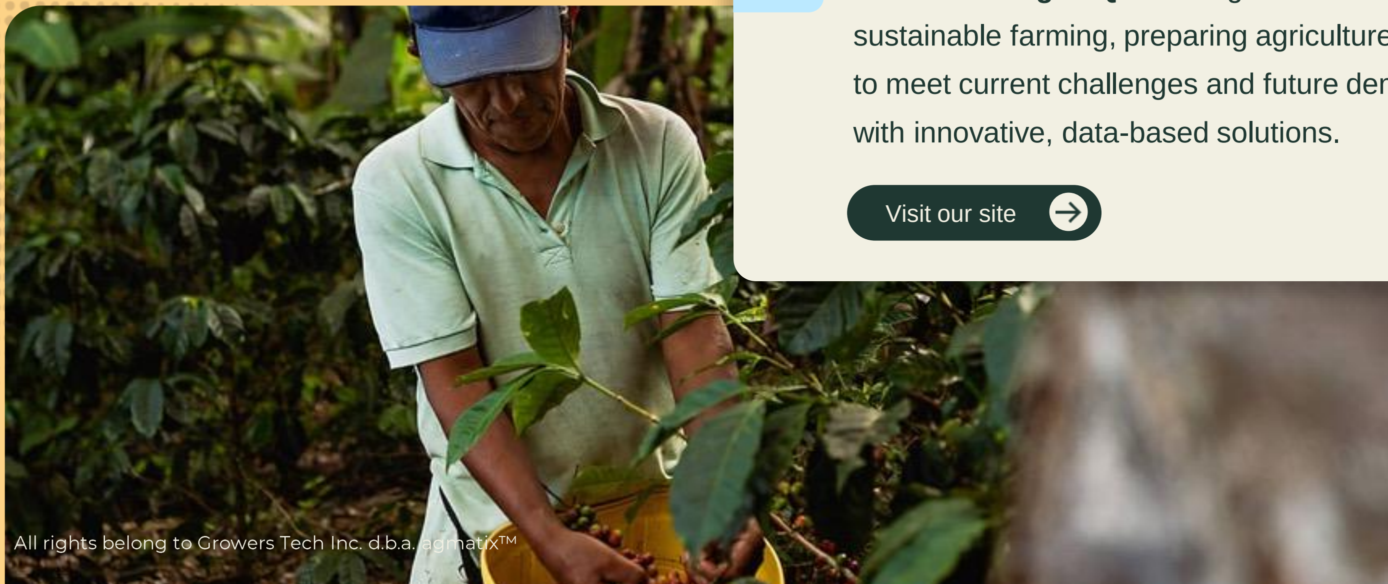
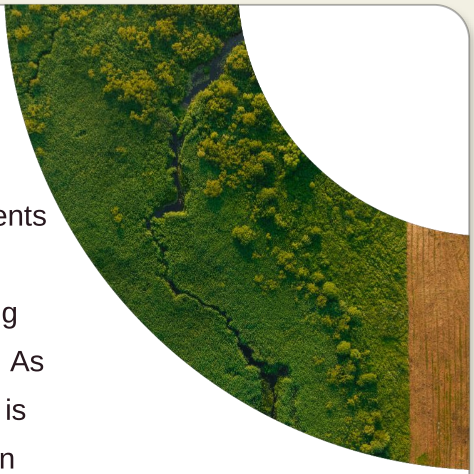


02 The Challenge

Agriculture today stands at a critical crossroads. Faced with ever-growing environmental challenges, the traditional methods that once fueled global food production are increasingly proving unsustainable. The impacts of climate change, soil degradation, water scarcity, and biodiversity loss are becoming more pronounced, posing significant risks to food security and the livelihoods of growers worldwide.

Below are a few of the challenges we need to address:

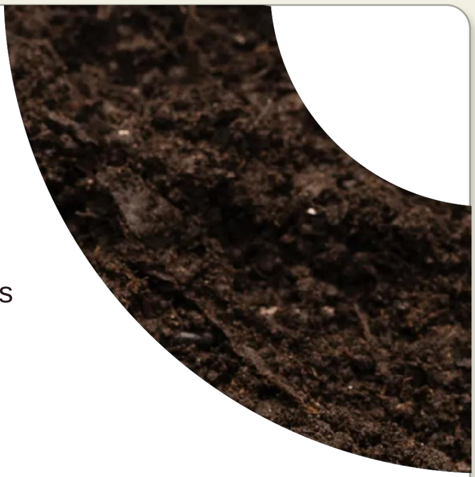


CLIMATE CHANGE

Climate change is a major disruptor of agricultural systems. Unpredictable weather patterns, increased frequency of extreme events such as droughts and floods, and rising temperatures are all making farming challenging. There is no doubt that these changes are having tangible effects on crop yields and the reliability of growing seasons. As the global temperature continues to rise, the stress on food systems is expected to intensify, making it harder for growers to predict and plan their efforts effectively.

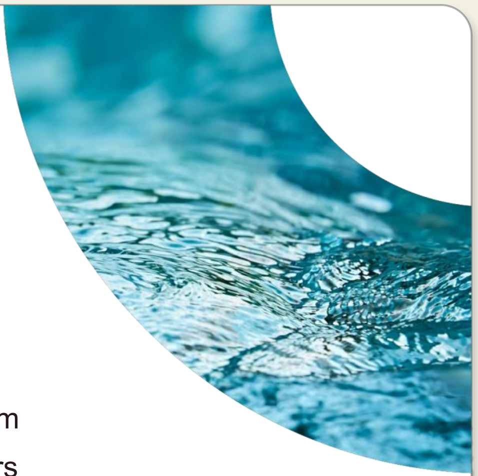
Recent research underscores the necessity for robust, science-based methodologies to monitor and verify the effectiveness of sustainable agricultural practices, highlighting significant gaps in current monitoring approaches that RegenIQ aims to fill.

SOIL DEGRADATION



The health of our soil is fundamental to agriculture, yet it is under threat like never before. Modern agricultural practices, particularly those that involve heavy tillage and the excessive use of chemical inputs, have led to significant soil degradation. This includes the loss of soil organic matter, increased erosion, and a decline in soil fertility. Degraded soils are less able to retain water and nutrients, making crops more vulnerable to drought and disease.

WATER SCARCITY



Water is an essential resource for agriculture, but it is becoming increasingly scarce. Agriculture accounts for about 70% of global freshwater use, and in some regions, this figure can be as high as 90%. However, water resources are dwindling due to overuse, pollution, and the effects of climate change. Many regions are experiencing more frequent droughts, while others are suffering from the contamination of their water supplies due to runoff from fertilizers and pesticides. This creates a paradox where agriculture, which depends on water, is also one of the major contributors to water scarcity and pollution.

BIODIVERSITY LOSS

Agricultural practices have also contributed to a significant loss of biodiversity. The simplification of agricultural ecosystems through single-crop farming, the widespread use of pesticides, and the destruction of natural habitats have led to a decline in both wild and agricultural biodiversity. This loss of biodiversity reduces the resilience of agricultural systems to pests and diseases and undermines ecosystem services that are essential for agriculture, such as pollination and natural pest control. As a result, growers are finding it increasingly difficult to manage their crops without relying on chemical inputs, which has a detrimental effect on the environment.

Economic Pressures on Growers

Growers today are under immense pressure to produce more food with fewer resources, all while contending with unpredictable markets and increasing costs. The push towards maximizing yields has often led to the adoption of practices that are not sustainable in the long run. Moreover, as consumers become more aware of environmental issues, there is a growing demand for sustainably produced food, adding another layer of complexity to the challenges that growers face. These economic pressures are driving the need for innovative solutions that can help growers maintain profitability while transitioning to more sustainable farming practices.

The Need for a Regenerative Approach

Given these challenges, it is clear that a new approach is needed. One that not only addresses the symptoms of these problems but also tackles their root causes. By focusing on restoring and enhancing the natural processes that support agriculture, regen farming can help rebuild soil health, improve water efficiency, and enhance biodiversity, all while making farming systems more resilient to climate change. There is no formal definition of regenerative agriculture, and its distinctions from conservation agriculture or climate-smart agriculture remain a topic of debate. In RegenIQ we adopt the definition proposed by Schreefel et al. (2020):

> “An approach to farming that uses soil conservation as the entry point to regenerate and contribute to multiple provisioning, regulating and supporting ecosystem services, with the objective that this will enhance not only the environmental but also the social and economic dimensions of sustainable food production".

We recognize the importance of the economic and social dimensions, but currently, RegenIQ supports only the environmental dimension of food production. Similar to Rhodes (2012), we do not exclude the use of agrochemicals in regenerative agriculture farming but strive to minimize their use. By integrating data-driven insights with regenerative growing practices, we help growers adapt to changing conditions, optimize resource use, and ensure the long-term sustainability of their farming operations. In the sections that follow, we will explore how RegenIQ’s innovative framework is making a difference in the lives of growers and the health of our planet.

03 The RegenIQ Model for Regenerative Agriculture

RegenIQ serves as an advanced Decision Support System (DSS), offering an adaptable framework that evaluates the effectiveness of regenerative ag practices right in the fields. This system leverages ground-truth data to validate its outcomes, ensuring that the practices implemented are both scientifically sound and practically effective. The RegenIQ model is specifically designed to support agricultural professionals in optimizing their field trials, managing data collection, and making informed decisions that drive sustainability and productivity.

RegenIQ is built on five key principles that guide its implementation and scalability across diverse agricultural environments:

- **Adaptable:** Tailored to the unique conditions of each site- what you cultivate and where you cultivate it.
- **Impact Driven:** Sets realistic and achievable targets for producers.
- **Growth Oriented:** Scales effortlessly from individual model farms to vast multi-regional operations.
- **Value Driven:** Equips users with insights into the environmental effects of their growing practices, offering recommendations for prioritizing these impacts.
- **Farmer-first:** Provides insights and recommendations into general cost impacts with consideration of potential yield benefits and associated risks.

These principles ensure that RegenIQ addresses the immediate needs of agricultural professionals while driving long-term, sustainable growth.

Key Components of the RegenIQ Model

RegenIQ's high-level structure includes three components *(Figure 1)*:

Data collection of field and management indicators using remotely sensed data or field measurements

An adaptive, cropping system-specific expert-based model for prioritization and normalization of indicators weight

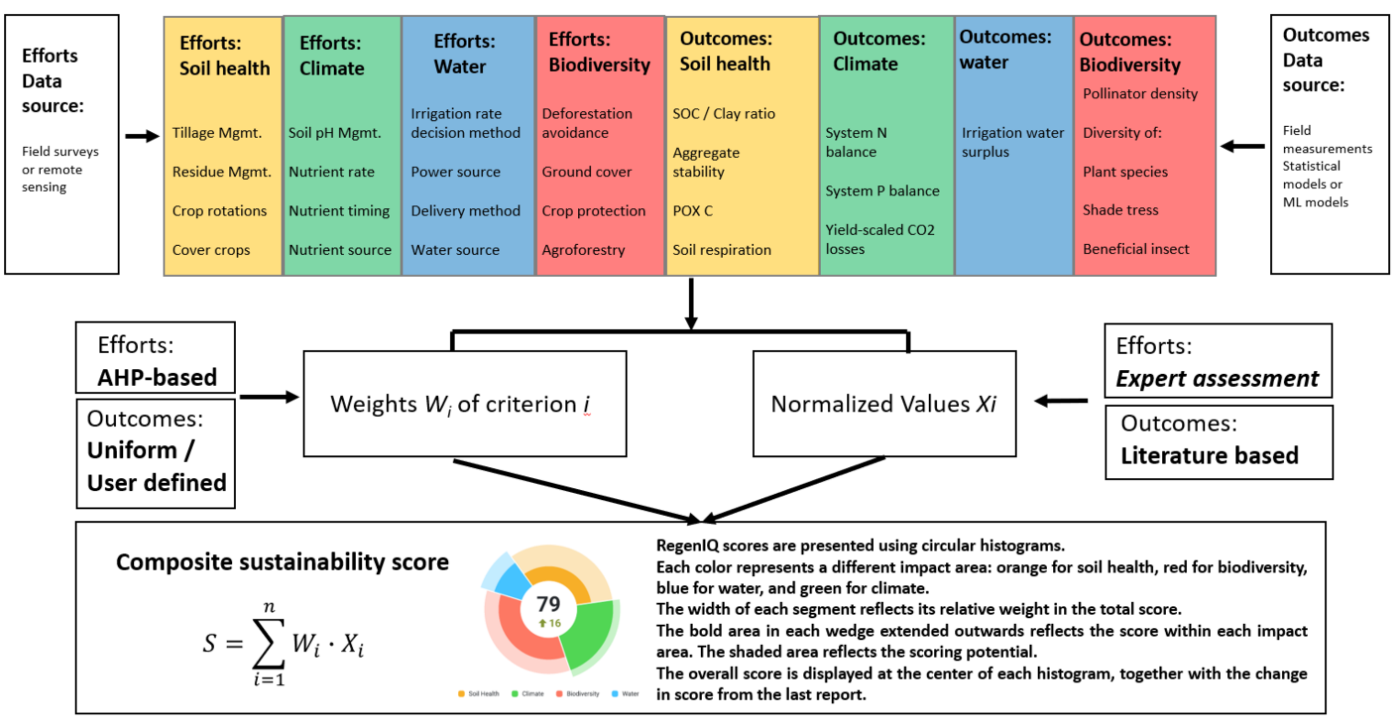
Weighted linear combination to assign a composite sustainability score.

RegenIQ scores are presented using circular histograms. Each color represents a different impact area:

WATER CLIMATE SOIL HEALTH BIODIVERSITY

The width of each segment reflects its relative weight in the total score—In the example presented in Figure 1 – the biodiversity impact area has the highest weight. The extent to which each wedge is extended outwards reflects the score within each impact area. In the example of Figure 1, the climate impact area has the highest score. The overall score is displayed at the center of each histogram, together with the change in score from the last report.

Figure 1



Efforts and Outcomes

RegenIQ identifies and monitors a set of key indicators that represent practices used to impact regen agriculture. These **efforts** are categorized into four impact areas: climate, water, soil health, and biodiversity.

The **outcomes** of those efforts are measured using a comprehensive set of indicators that track the sustainability levels achieved through the implementation of regenerative agriculture practices. Like the effort indicators, the outcome indicators are categorized into the four impact areas. The working hypothesis is that improvements in a specific effort within an impact area will lead to progress in the respective impact area outcome indicators.

CLIMATE RESILIENCE:

Efforts

Efforts such as nutrient timing, rate and source are monitored to utilize their potential to reduce the environmental footprint of crop production.

Outcomes

Indicators such as yield-scaled CO2 losses, N and P balance.

WATER MANAGEMENT

Efforts

Irrigation rate, timing, delivery method, and water source are monitored to ensure efficient water use and reduce runoff and erosion.

Outcomes

Indicators such as irrigation water surplus or water productivity. Accounting for dual land use irrigation requirements (i.e., main crop + cover crops).

SOIL HEALTH

Efforts

Practices like cover cropping and ground cover, reduced tillage, and organic amendments are tracked to assess their impact on improving soil structure, fertility, and carbon sequestration.

Outcomes

Indicators such as SOC % / Clay % ratio, aggregate stability, soil respiration, or Permanganate-oxidizable carbon.

BIODIVERSITY CONSERVATION:

Efforts

Crop rotation, intercropping, buffer strips, and agroforestry practices are evaluated for their role in enhancing biodiversity and creating resilient ecosystems.

Outcomes

Indicators such as pollinator density, diversity of plant species, diversity of Shade trees, or diversity of beneficial insects.

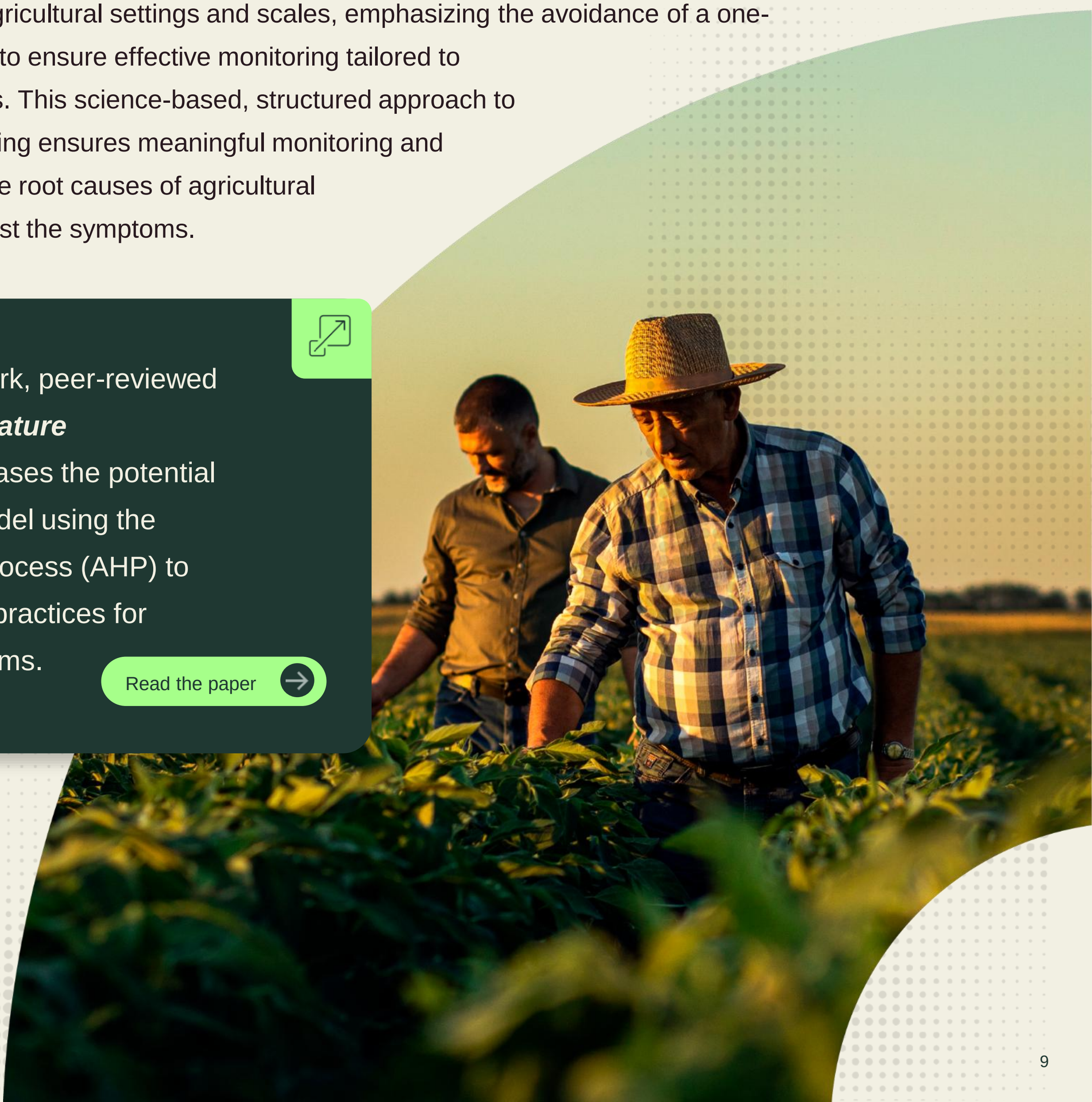
The efforts and outcome indicators are benchmarked for the cropping system-specific conditions (crop X climate X soil) to provide a clear picture of progress and areas that need improvement. By aligning these outcomes to the world's leading definitions and frameworks in regenerative agriculture, RegenIQ ensures consistency in its assessments while allowing for local adaptations. In addition to serving as an assessment tool, RegenIQ is a catalyst for driving the adoption of regenerative agriculture practices at scale. By maximizing outcomes and providing actionable insights, RegenIQ helps agricultural professionals to scale successful regenerative practices, leading to broader adoption and greater impact.

> "This approach ensures that developments in sustainable agriculture are practical, scalable, and aligned with both environmental sustainability and economic viability".

Our model integrates a flexible yet coherent framework for selecting indicators that are relevant to specific agricultural settings and scales, emphasizing the avoidance of a one-size-fits-all approach to ensure effective monitoring tailored to unique site conditions. This science-based, structured approach to sustainability monitoring ensures meaningful monitoring and outcomes, tackling the root causes of agricultural challenges and not just the symptoms.

The RegenIQ framework, peer-reviewed and published in ***npj Nature Sustainability***, showcases the potential of an expert-based model using the Analytical Hierarchy Process (AHP) to prioritize regenerative practices for specific cropping systems.

Read the paper



04 Implementation Strategy: Adapting to Local Conditions and Needs

Matching the right regenerative ag practices to specific crops and field conditions can be complex. A recent study considered three diverse cropping systems (Vineyards, Maize, and Soybean) in three different climates (Semi-arid, Continental, and Tropical), and found that the importance of regenerative agriculture practices varies between cropping systems (Sela et al. 2024).

RegenIQ's strategy is thoughtfully designed to adapt to diverse environmental and cultural contexts, ensuring effective and relevant solutions. This approach ensures that our recommendations for regenerative agriculture methods are not only relevant but also highly effective, specifically tailored to meet the distinct conditions of each crop, climate, and soil type. Adaption is implemented in RegenIQ using 6 clusters of soil and climate groups. This flexibility can ensure that RegenIQ scoring and targets represent different growing conditions that can be found even within the same region.

For example, As seen in Figure 2., 150 locations where coffee is grown in Brazil, are classified into 6 different RegenIQ clusters. AI – Aridity Index. Locations in this example were retrieved from the CROPGRIDS database (Tang et al. 2024).

Figure 2

Using the scientifically validated Analytical Hierarchy Process (AHP, Saaty 1977), RegenIQ accurately adjusts the importance of each agricultural effort to match specific cropping systems and environmental clusters, and enable the prioritization of efforts.

This expert-based method uses standardized questionnaires to extract knowledge from experts, who compare the importance of pairs of efforts for a specific cropping system. An ensemble approach, incorporating input from multiple experts, increases the robustness of the results. This standardized approach allows us to compare the importance of efforts between cropping systems and across the production supply chain.

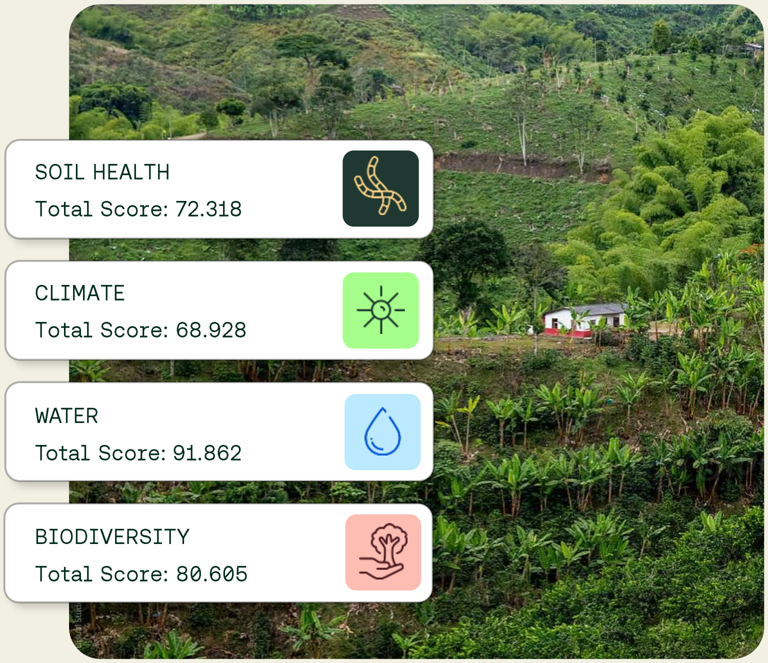
Current regenerative ag assessment methods present several challenges for agrifood companies, agronomists, and growers. Most existing programs are generic and fail to account for the specific needs of different crops, limiting their effectiveness in providing meaningful insights. These frameworks often lack scalability and rely on limited data, either due to insufficient access to accurate ground truth data or an over-reliance on remote sensing data that may not capture all critical aspects of regenerative practices.

Additionally, many assessments are still conducted using outdated tools like Excel sheets rather than digital platforms. For agrifood companies, there is a critical need to de-risk their supply chains by accurately reporting on the practices their producers and growers are implementing at the field level. Growers, in turn, face concerns that adopting regenerative ag practices could increase costs without guaranteeing improved yields or sustainability benefits, leaving them uncertain about the financial viability of such methods.

How RegenIQ tailors its approach to local needs and conditions, supporting the adoption of **regenerative agriculture:**

Scalable and Flexible Framework

RegenIQ's strategies are designed to be scalable, allowing the successful application of practices from individual model farms to large-scale multi-regional operations. RegenIQ has the ability to identify a minimal set of indicators, enabling companies to begin with a focused pilot and seamlessly scale their operations. This flexibility ensures that the practices can be adjusted as per the scale of operation and specific local needs. This makes the implementation both practical and effective across different agricultural settings.



Collaborative Stakeholder Engagement

Active engagement with local growers, agricultural professionals, and agrifood companies is a cornerstone of our implementation strategy. We ensure that all stakeholders are actively involved throughout the process—from planning and implementation to monitoring and fine-tuning practices—facilitating continuous improvement and adaptation. Our collaborative, cloud-based approach simplifies implementation and enhances sustainability, fostering a community of innovation and shared learning.

Continuous Monitoring and Feedback

RegenIQ employs continuous monitoring and feedback to align practices with local needs, ensuring that the strategies implemented deliver the desired outcomes effectively. This includes the use of advanced data analytics and field data to track the performance of applied practices and make adjustments as needed.

Education and Training

At Agmatix, we understand the importance of comprehensive education and smooth onboarding for our users. Our Customer Support team is dedicated to assisting agrifood companies, agronomists, and their growers throughout the implementation of regenerative growing practices. From the initial onboarding process to ongoing support, we ensure that every participant is well-equipped to maximize the benefits of the RegenIQ framework.

Additionally, becoming a member of the RegenIQ community opens doors to an extensive array of resources such as up-to-date news, deep insights, and the latest developments in sustainable agriculture. Our community platform encourages the exchange of knowledge and best practices among agronomic experts, encompassing both global and local perspectives, and spanning enterprises of all sizes. This cooperative setting cultivates leadership and drives innovation in sustainable agriculture globally, enabling you to grasp the overarching concepts and implement practical, ground-level changes.

Economic Viability

RegenIQ helps improve the economic aspects of sustainable farming by guiding resource use and adopting regen ag practices. Our framework categorizes the potential cost impacts of new farming practices into broad categories—high, medium, and low. This categorization provides agrifood companies and growers with a clearer picture of the financial implications of their choices.

Aligned with our 'Farmer-first' principle, RegenIQ incorporates economic considerations by offering insights into the general cost impacts associated with various farming practices. This supports stakeholders in effectively managing changes, balancing the potential benefits of increased yields with the cost implications and risk of yield loss.

By focusing on cost management and operational efficiency, RegenIQ aims to enhance the economic sustainability and profitability of farming operations, thereby supporting the resilience of food systems globally.

RegenIQ integrates the selection of context-specific indicators that are pivotal for tailoring regenerative practices that effectively address local agricultural systems, socio-economic conditions, and environmental factors.

05 Tools and Metrics for Measuring Impact

To effectively measure the impact of regenerative ag practices, RegenIQ implements a comprehensive framework with specific technical tools and methodologies. RegenIQ uses an extensive list of effort and outcome indicators, adapted to different cropping systems *(page 7, Figure 1).*

Prioritizing Field Input Management Practices

Our assessment strategy prioritizes field management practices based on their influence on sustainable and regenerative agriculture. This involves detailed monitoring and evaluation across different agricultural practices:

Cover Cropping: RegenIQ helps quantify cover crops' protective role against erosion and thermal variation.

Residue Management: Residues are scored based on whether they are removed, burned, incorporated into the soil, or left on the field surface. Each method's impact on soil health and biodiversity is closely evaluated.

Tillage Management: Different tillage intensities, including no-till, minimal (conservation) tillage, and conventional tillage, are assessed. The interactions between tillage intensity and residue management practices are also analyzed to determine their combined effect on soil structure and fertility.

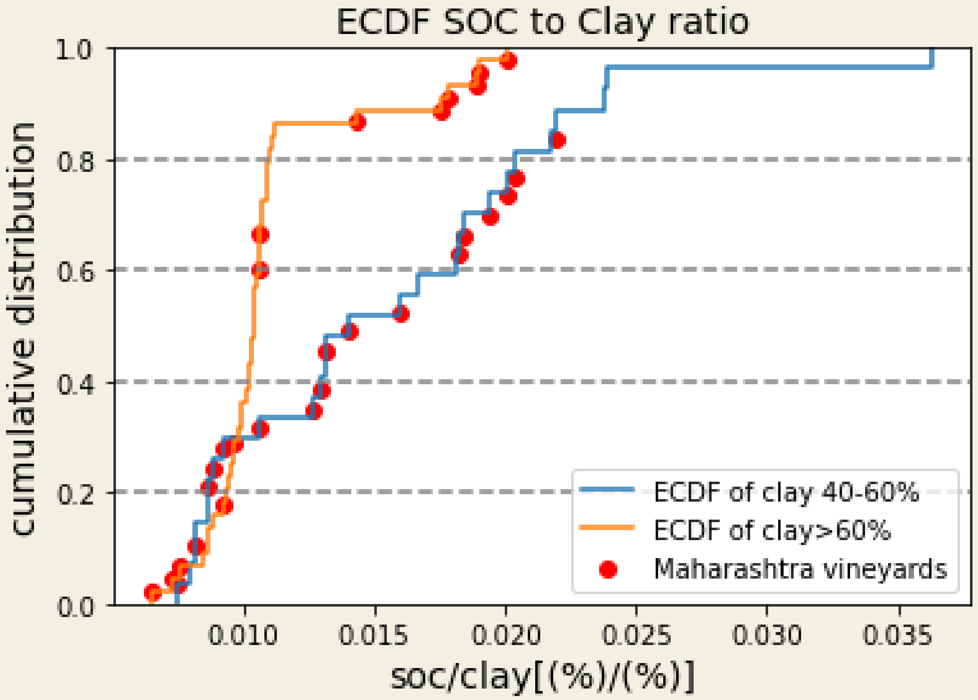
Systematic Evaluation of Agricultural Inputs: Integrating Expertise and Technology

We enhance the robustness of our metrics by integrating insights from a diverse group of experts. Scoring for various practices such as nutrient timing, nutrient rate optimization, and integrated pest management (IPM) is performed individually by experts for each cluster combination *(illustrated in Figure 2 for Coffee Crops)* and then averaged to ensure consistency and reduce bias. This collaborative approach leverages diverse expertise to effectively refine our metrics and adapt them to varying agricultural contexts.

Outcome indicators are calculated for each RegenIQ cluster, ensuring the field-based indicator performance is evaluated against similar cropping conditions, enabling the setting of realistic and achievable targets. For each outcome indicator, in each cluster, plausible indicator values are mapped based on a literature review. This is exemplified in Figure 3, showing an Empirical Cumulative Distribution Function (ECDF) for the SOC / Clay indicator, generated for vineyard systems, in a semiarid climate and fine textured soil (Sela et al. 2024).

This rigorous approach to prioritizing and measuring inputs ensures that RegenIQ provides actionable, accurate, and scientifically validated insights, encouraging the adoption of genuinely impactful regenerative agriculture practices.

Figure 3. An ECDF generated from literature data of the SOC / Clay ratio for vineyards systems in semiarid climate, and fine textured soil. The ECDF lines are generated from literature data, while the red dots represent measured data sampled in 30 vineyards (Sela et al. 2024).



06 Comprehensive Use Cases for RegenIQ

Strategically, RegenIQ applies its regenerative framework to a wide variety of crops, each with its unique environmental challenges. This section provides a detailed walkthrough to demonstrate how we calculate the RegenIQ score. The crop used in this example is Coffee, located in a wet climate (aridity index higher than 1.0), on fine-textured soil.

Tables 1-4 outline the four impact areas: soil health, climate, water, and biodiversity. Each table details the indicator weights assigned by Agmatix experts using the AHP model, the selected management options, their normalized scores, and examples of how these calculations are performed.

Note: The full suite of indicators is not mandatory; users can select a partial list tailored to their needs. When fewer indicators are used, the AHP-generated weights will be recalculated accordingly. The framework allows for the incorporation of new indicators, which involves an initial AHP assessment by experts to determine appropriate weights. Agmatix can assist in this process or collaborate with experts from the client's organization to support integration.

Soil Health Effort Indicators and Regenerative Agriculture Practices

Table 1 *(following page)* displays the soil health indicators used for coffee cropping systems. The indicators are weighted by importance, starting with ground cover as the highest, followed by residue management, organic carbon applications, and soil compaction mitigation efforts.

Keeping the ground covered is essential to support the soil with carbon inputs and to mitigate soil erosion. In this use case, the coffee plantation was kept covered with vegetation 85-95% of the time, earning 85% of the potential score. Leaving crop residues in the field is a key practice to support soil carbon inputs. In the presented use case crop residue was kept on the field, but was incorporated into the soil, losing 50% of the potential score due to the land disturbance.

Routine applications of organic carbon (compost) support soil health and structure and can be used to replace at least some of the nutrient inputs needed by the crop. In this use case, the grower applied organic carbon on an annual basis, gaining 100% of the potential score.

To mitigate soil compaction, growers can adopt several strategies such as minimizing field operations when the soil is wet, localizing wheel traffic, using lighter machinery, reducing tillage, rotating crops, and applying organic carbon regularly. In this example, the grower did not implement these measures, resulting in a 50% penalty to their score.

We account here for two outcome indicators - SOC / Clay ratio, and Aggregate stability. For the first a value of 0.045 [%/%] was measured at the field, placing it in the 40-60 percentiles group compared to fields with similar conditions. For aggregate stability, the sample soil receives a score of 75%, placing it in the 60-80 percentiles group.

Aligning land use with terrain, maintaining soil health, preventing degradation, and promoting the land as a greenhouse gas sink.

Across all indicators, the field received a total soil health score of 72.318, indicating room for improvement.

***Table 1** – An example of the RegenIQ framework calculation for Coffee – soil health impact area*

SOIL HEALTH

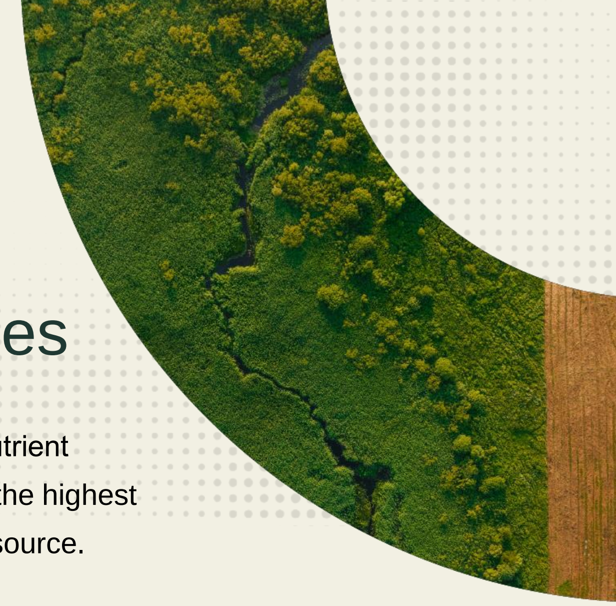
EFFORTS

Indicator	Indicator weight	Management option	Normalized score	RegenIQ score
Residue mgmt.	29.489%	Removed from field	0%	29.489*0.5 = **14.744**
		Burned in field	20%	
		Left in the field-incorporated	50%	
		Left in the field- not incorporated	100%	
Ground cover	38.041%	Soil exposure: less than 5% of the time	100%	38.041*0.85 = **32.335**
		Soil exposure: between 5-15% of the time	85%	
		Soil exposure: between 15-30% of the time	70%	
		Soil exposure: more than 30% of the time	45%	
Organic carbon applications	22.648%	No applications	15%	22.648*1 = **22.648**
		Annually or more	100%	
		Every 2- 3 years	70%	
		Every 3 years or more	55%	
Implementation of a soil compaction mitigation plan?	9.821%	Yes	100%	9.821*0.5 = **4.910**
		No	50%	
Total soil health **efforts** score				14.744 + 32.335 + 22.648 + 4.910 = **74.637**

OUTCOME

Indicator	Indicator weight	Value	Perc. group	RegenIQ score
SOC / Clay ratio	50%	0.045 [%/%]	40-60	50*0.6 = **30**
Aggregate stability	50%	75 [%]	60-80	50*0.8 = **40**
Total soil health **outcome** score				30 + 40 = **70**

Total Soil Health Score (74.637*0.5) + (70*0.5) = **72.318**



Climate Effort Indicators and Regenerative Agriculture Practices

Table 2 *(following page)* details the climate impact area's indicators: nutrient rate, timing, source, and soil pH management, with nutrient rate being the highest priority, followed by nutrient timing, soil pH management, and nutrient source.

Nutrient management strategies significantly impact environmental outcomes. The optimal approach, involving adaptive nutrient applications tailored by leaf or soil tests and spatial management zones, scores the highest. However, in this use case, the grower used a uniform nutrient application rate, resulting in a 50% reduction in the potential score.

The nutrient timing indicator addresses the lack of synchronization between fertilizer application and crop needs, described here as the proportion of nutrients applied in season. The highest score is attributed when more than 50% of nutrients are applied in-season. In the presented use case the grower received a score penalty for applying most of the nutrients out of season.

Monitoring and, if needed, managing soil pH is crucial for crop production. The type of liming material can affect the CO_2 emissions. Applying regular lime can generate inorganic CO_2 emissions when lime dissolves in water, more prominently in low soil pH. Using lime in the oxide or hydroxide form can negate these emissions.

Lastly, the nutrient source can affect the carbon footprint of operations. Agmatix's experts recommend a mix of synthetic and organics-based fertilizers. In the presented use case, the grower applies all of the nutrients in the form of organic (compost), leading to a penalty in the score.

We account here for two outcome indicators - Yield-scaled CO_2 losses, and N balance. The first indicator received a value of 2.72 [kg/ha CO_2 / kg/Ha yield], placing the field in the 40-60 percentiles group compared to fields with similar conditions. For N balance, a moderately excessive value of 65 [kg/ha] of surplus was calculated for the field, leading to a penalty in the score.

Minimizing greenhouse gases, adapting to climate change, and strengthening farm resilience.

Across all indicators, the field received a total climate score of 68.928, indicating room for improvement.

***Table 2** – An example of RegenIQ framework calculation for Coffee – Climate impact area*

CLIMATE IMPACT

EFFORTS

Indicator	Indicator weight	Management option	Normalized score	RegenIQ score
Nutrient rate – decision method	33.582%	Flat rate	50%	33.582*0.5 = **16.791**
		Adaptive and uniform, based on soil or leaf testing	88%	
		Adaptive and variable – based on soil or leaf testing and mgmt. zones	100%	
		Not applying nutrients	20%	
Nutrient timing – What is the proportion of nutrients applied in season?	31.063%	< 25%	70%	31.063*0.85 = **26.404**
		25-50%	85%	
		> 50%	100%	
		Not applying nutrients	20%	
Nutrient source	16.791%	100% Synthetic	65%	16.791*0.78 = **13.097**
		100% synthetic + smart fertilizers	88%	
		Mix of synthetic + organic (compost)	100%	
		100% organic (compost)	78%	
		Not applying nutrients	20%	
Soil pH management	18.564%	Soil pH is managed - no liming is needed	100%	18.564*1 = **18.564**
		Soil pH is managed - Liming source used - Aglime (regular lime)	80%	
		Soil pH is managed - Liming source used - magnesium/calcium hydroxide or oxide	100%	
		Soil pH is managed - liming needed but wasn't applied	40%	
		Soil pH is not managed	30%	
Total climate **efforts** score				16.791 + 26.404 + 13.097 + 18.564 = **74.856**

OUTCOME

Indicator	Indicator weight	Value	Perc. group	RegenIQ score
YS CO_2 losses	50%	2.72	40-60	50*0.6 = **30**
N balance	50%	65	40-70 kg/ha	50*0.66 = **33**
Total climate **outcome** score				30+33 = **63**

Total Climate Score (0.5*74.856) + (0.5*63) = **68.928**

Water Effort Indicators and Regen Ag Practices

In coffee production, the Water impact area evaluates five indicators *(Table 3, following page):* irrigation water source, delivery methods, irrigation rate decision, irrigation power source, and milling operations, each of which significantly affects water footprint. In the presented use case, the mean annual aridity index is higher than 1, indicating no systematic water shortage. As a result, no penalty is applied for cases where irrigation is not used. In drier climates, where the aridity index is lower, the framework incorporates a penalty in the coffee crop score to incentivize irrigation practices that enhance crop production.

Irrigation water sources include surface water, rainfall harvesting, and groundwater pumping. Harvesting rainfall was designated as best management by Agmatix’s experts, with a 100% potential score. In the presented use case, this is also the choice of the grower.

Irrigation water delivery methods can affect irrigation use efficiency and water losses. The RegenIQ framework considers flooding (lowest score), sprinkler or pivot irrigation (intermediate score), and micro-irrigation (considered optimal by our experts for this cropping system, also used by the grower in this presented use case).

Monitoring crop water requirements is essential to prevent yield loss. There are many ways to determine how much water to irrigate. We explore four options – the use of sensors and potential evapotranspiration (ET0), considered optimal here by our experts; irrigation according to growth stages; irrigating at a constant rate, or using other non-precise methods. In this use case, the grower irrigates using a constant rate so the potential score is heavily penalized.

The power source used to deliver irrigation water to the field has a significant impact on the CO2 footprint. We evaluate five options: diesel, gravity, electric (from non-renewable and renewable sources, with the latter deemed optimal by our experts), and biodiesel. In this use case, the grower relies on diesel fuel to pump irrigation water, which results in a significant penalty to the score.

Milling operations also contribute notably to the water footprint. We assess two options: regular wet milling and eco-milling, with the latter offering a lower water footprint and considered optimal in this analysis. In this use case, the grower adopts eco-milling, achieving 100% of the potential score.

We account here for one outcome indicator - irrigation water surplus. Overall irrigation amounts were adequate with a surplus of 10%, earning the maximal score.

Efficiently managing water resources, reducing runoff and pollution, and ensuring fair access to clean water for humans and wildlife.

In this use case, the grower's management decisions in the water impact area resulted in a total score of 91.862.

***Table 3** – An example of RegenIQ framework calculation for Coffee – Water impact area*

WATER IMPACT

EFFORTS

Indicator	Indicator weight	Management option	Normalized score	RegenIQ score
Water source	34.089%	Surface water	60%	34.089*1 = **34.089**
		Rainfall harvest	100%	
		Groundwater pump	60%	
		No irrigation	100%	
Water delivery method	15.052%	Micro irrigation	100%	15.052*1 = **15.052**
		Sprinklers / pivot	75%	
		Flooding	20%	
		No irrigation	100%	
Irrigation rate decision method	22.372%	ET0 / Sensors	100%	22.372*0.45 = **10.067**
		According to growth stages	70%	
		Constant rate	45%	
		Other non-precise methods	30%	
		No irrigation	100%	
Irrigation power source	19.839%	Diesel	35%	19.839*0.8 = **15.871**
		Gravity	80%	
		Electric - non-renewable	65%	
		Electric – renewable	100%	
		Bio-diesel	70%	
		No irrigation	100%	
Milling type	8.646%	Regular wet milling	40%	8.646*1 = **8.646**
		Eco milling - reduced water consumption methodology	100%	
Total water **efforts** score				34.089 + 15.052 + 10.067 + 15.871 + 8.646 = **83.725**

OUTCOME

Indicator	Indicator weight	Value	Perc. group	RegenIQ score
Irrigation Water surplus	100%	10 [% surplus]	100%	100*1 = **100**
Total climate **outcome** score				**100**

Total Water Score (0.5*83.725)+(0.5*100)= **91.862**

Biodiversity Effort Indicators and Regen Ag Practices

In coffee production, the biodiversity impact area within the RegenIQ framework includes five critical indicators *(Table 4, following page)*: deforestation, agroforestry, crop protection strategies, ground cover, and the source of applied nutrients. Our experts identified deforestation as the most significant factor influencing biodiversity, assigning it 44% of the total score. For this use case, we used December 31, 2020, as the cut off date to comply with EUDR regulations. Since the field had not been deforested after this date, it achieved 100% of the potential score for the deforestation indicator. It is worth noting that although we used the 2020 cut-off date, the framework is flexible and can accommodate any historical window specified by users. Agroforestry, crop protection strategies, and ground cover follow similar weights, while the nutrient source has a relatively lower importance weight.

Agroforestry efforts can involve sowing seeds or planting seedlings of native vegetation between commercial crop rows, or fully integrating the commercial crop within existing native vegetation. Agmatix experts designated the latter as the optimal approach. In this use case, the grower sowed seeds of native vegetation, achieving only partial points of the potential score

Excessive pesticide application is costly, contributes to environmental pollution, and leaves residual chemicals in crops and soil. Integrated Pest Management (IPM) is a proven approach to reducing pesticide inputs without compromising yield by applying pesticides based on need rather than routine preventative measures. Within RegenIQ, insecticides, herbicides, and fungicides are addressed separately, with the adoption of IPM scored for each. The optimal approach, as designated by our experts, is the adoption of IPM for all pesticide inputs. In this example, the grower used an IPM approach only for insecticides, resulting in a partial potential score.

Maintaining ground cover, preferably with diverse vegetation species, supports biodiversity. In this example, the grower kept the ground covered 85–95% of the time, earning a near-optimal score.

Finally, the nutrient source plays a key role in supporting belowground biodiversity, particularly through frequent organic carbon applications. In this use case, the grower applied all nutrients from organic sources, achieving the full potential score.

We account here for two outcome indicators - pollinator density and the diversity of shade trees. A pollinator density of 1224 [individuals / Ha] was counted at the field, placing the field in the 60-80 percentiles group compared to fields with similar conditions. For the shade trees, a diversity of 3.3 [Shannon index] was calculated, placing the field in the 60-80 percentiles group compared to fields with similar conditions.

Enhancing biodiversity, supporting pollinators, maintaining genetic diversity, and controlling invasive species.

Altogether, the grower's management decisions in the biodiversity impact area resulted in a total score of 80.605.

***Table 4** – example of RegenIQ framework calculation for Coffee – Biodiversity impact area. Insect – insecticides, Herbi – herbicides, Fungi – Fungicides*

BIODIVERSITY IMPACT

EFFORTS

Indicator	Indicator weight	Management option	Normalized score	RegenIQ score
Deforestation since 31/12/2020?	43.769%	No	100%	43.769*1 = **43.769**
		Yes	20%	
Agro-forestry efforts	16.857%	No efforts are made	0%	16.857*0.3 = **5.057**
		Sowing seeds of native vegetation	30%	
		planting seedlings of native vegetation	50%	
		Integrating commercial crops within existing native veg.	100%	
IPM management	15.905%	Insect - Yes, Herbi - Yes, Fungi - Yes	100%	15.905*0.68 = **10.815**
		Insect - Yes, Herbi - Yes, Fungi - No	88%	
		Insect - Yes, Herbi - No, Fungi - Yes	83%	
		Insect - No, Herbi - Yes, Fungi - Yes	65%	
		Insect - No, Herbi - Yes, Fungi – No	55%	
		Insect - Yes, Herbi - No, Fungi – No	68%	
		Insect - No, Herbi - No, Fungi – Yes	40%	
		Insect - No, Herbi - No, Fungi - No	10%	
Ground cover	14.596%	Soil exposure: less than 5% of the time	100%	14.596*0.87 = **12.699**
		Soil exposure: between 5-15% of the time	87%	
		Soil exposure: between 15-30% of the time	75%	
		Soil exposure: more than 30% of the time	50%	
Nutrient source	8.871%	100% Synthetic	45%	8.871*1 = **8.871**
		100% synthetic + smart fertilizers	60%	
		A mix of synthetic + organic (compost)	85%	
		100% organic (compost)	100%	
		Not applying nutrients	20%	
Total biodiversity **efforts** score				43.769 + 5.057 + 10.815 + 12.699 + 8.871 = **81.211**

OUTCOME

Indicator	Indicator weight	Value	Perc. group	RegenIQ score
Pollinator density	50%	1224 [individuals / Ha]	60-80	50*0.8 = **40**
Diversity of shade trees	50%	3.3 [Shannon index]	60-80	50*0.8 = **40**
Total biodiversity **outcome** score				40+40 = **80**
Total Biodiversity Score				(0.5*81.211)+(0.5*80)= **80.605**

Integrating all Impact Area Efforts and Outcome Indicators into a Total Score

The total score consolidates the individual effort and outcome scores from each impact area. Users can adjust the relative weight of each area; in this example, applying equal weighting results in a comprehensive score of 78 *(Table 5).*

It is recommended that the total score be calculated annually. Tracking this score over time allows for trend analysis, providing insights into how regenerative practices are affecting the production area *(Table 6).*

Table 5 – Total RegenIQ score for Coffee, assuming equal weight for each impact area

Impact area	Total RegenIQ score
Soil Health	72.318
Climate	68.928
Water	91.862
Biodiversity	80.605

72.318*0.25 + 68.928*0.25 + 91.862*0.25 + 80.605*0.25 = **78**

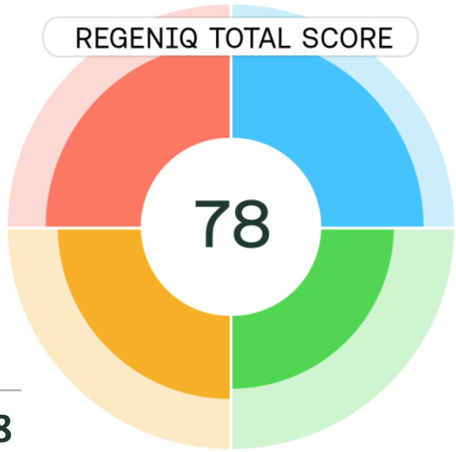
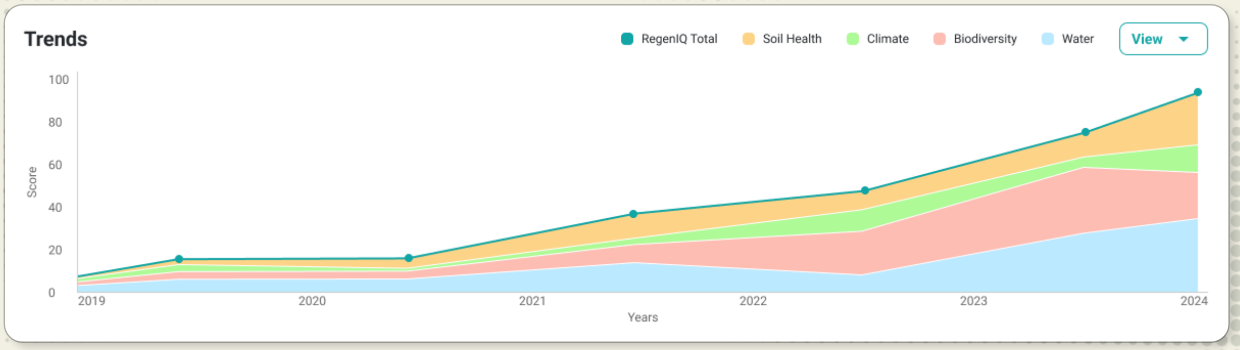


Table 6 – Trends of the total RegenIQ score for Coffee over time for each impact area



07 Advancing the Adoption of Regenerative Agriculture Practices

At RegenIQ, our vision is to drive the widespread adoption of regenerative ag practices, boosting productivity while reducing environmental impact. Our goal is to effectively integrate these practices into sustainable agriculture worldwide.

Measuring Success

For RegenIQ, success means driving the adoption of regenerative farming practices through practical benefits and measurable outcomes. By fostering ecosystems that support biodiversity, maintaining rich soils for carbon sequestration, and managing water resources sustainably, RegenIQ helps balance agricultural demands with environmental needs.

Economically, our approach empowers growers to increase yields and profitability, ensuring agriculture remains a viable career path for future generations. At a community level, we strengthen food systems to enhance both local and global food security.

RegenIQ also supports agrifood companies in scaling their sustainability efforts by providing a scientifically validated framework to track ESG goals and implement sustainable sourcing strategies. By connecting field-level practices to corporate objectives, we enable companies to build resilient supply chains while advancing regenerative agriculture.

RegenIQ
Powered by Agmatix

Contact us to learn more and explore how RegenIQ can support your sustainability goals.

Contact us

regeniq.earth

agmatix.com

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