

Introduction

ECOSYS unifies several EO-based, agri-environmental projects into a single platform for natural capital measurement and evaluation in agriculture. Mainly stemming from GeoFusion ST 3 as ESA Business Applications & Space Solutions-supported service, it is designed to make Earth-observation data more usable for organisations in need to monitor or evaluate nature-based solutions (NCS) and land management activities or nature-finance initiatives with a primary focus on Agriculture. The service brings relevant satellite-derived information (backed by official InVekos/IACS compliance data) into an accessible workflow, helping users monitor land-management and vegetation dynamics, assess site conditions, and generate outcome-based evidence that can support project planning, implementation, and reporting.

Purpose of this document

The paper is designed to describe ECOSYS in detail as it unifies several EO-based, agri-environmental projects into a single platform for natural capital measurement and evaluation in agriculture. It aims to communicate what the platform does today (MVP) and where it can go, in order to gather feedback from project developers, agri-tech experts, and investors before full-scale deployment.

Intended audience

The primary audience includes project developers, agri-tech experts, and investors who are exploring investment-grade nature outcomes, portfolio construction, and monitoring solutions in agriculture. A secondary audience is policy makers and institutions interested in country-scale dMRV, compliance-based scenarios (IACS/LPIS), and landscape-scale analytics to support green transition and climate adaptation.

How it should be used

The document should be used as a high-level guide to understand the ECOSYS value proposition, what the MVP can already deliver (portfolio selection, baseline reports, proof of change, scenario modelling), and how indicators roll up into BCFI and TEIV metrics. Readers should treat it as a basis for dialogue: to test use cases, stress-test assumptions, and co-design pilots rather than as a finalized methodology or commercial offer.

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Concept & Overview

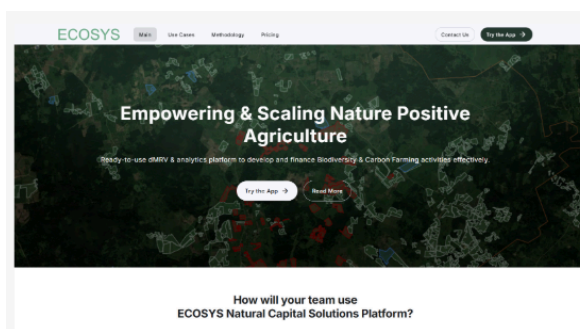
Natural Capital Solutions Platform for Agri

Powered by EOX in partnership with PRO-NATUR, AgrEO & GeoVille.

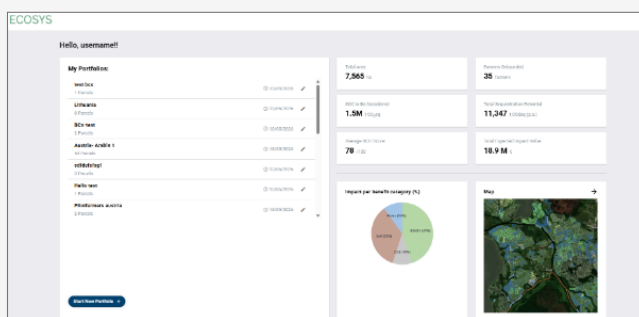
Earth observation (EO) satellite image contents turned into ecosystem indicators to monitor investment-grade nature outcomes in the Agricultural Sector

For Project Developers, Agri-Tech-Experts (Food) Corporates & Investors it offers:

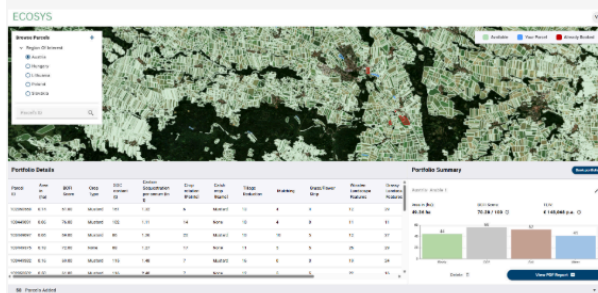
- **Ready-to-use web-based analytics**
- Portfolio Selection & Management plus Baseline Reporting
- **Aggregation of biodiversity and carbon farming indicators into single-metric** plus EUR-based Evaluation framework measuring the outcomes/performance of land management activities
- **Compliance-based (IACS/LPIS Data) data backbone** that can be enriched with in-situ and local ground-truth information
- **Objective measurement, evaluated by agri-environmental expertise**
- **Full country scale comparable metrics** derived from parcel level data (1:5000 mapping scale)
- *Future Proof of Change & Scenario Modelling*



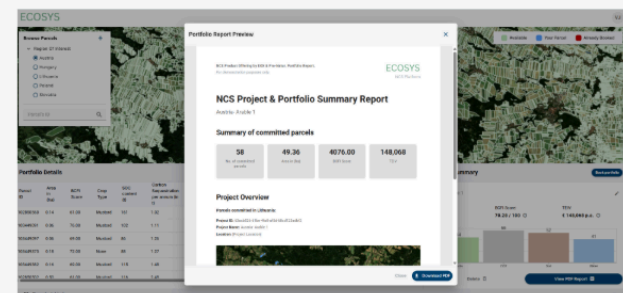
Landing page & Methodology Overview - ncs.eox.at



Dashboard incl. Total Values across Booked and reserved Portfolios & EUR Impact



Mapping-View Parcel Details & Selection across available/booked parcels & EUR Impact Evaluation



Direct Reporting & book to registry Functionality per parcel or Portfolio

At its core, the platform turns parcel-level and landscape-level data into indicators, indices and impact metrics, and then makes these available through analytics tools that support portfolio structuring, grant and project design, corporate reporting and policy analysis.

The platform plays three main roles. First, it acts as a data and methodology engine, harmonising EO, compliance and soil datasets into a modular indicator framework and composite indices like BCFI. Second, it serves as a decision-support environment, offering dashboards and scenario tools for different user groups: project developers, finance actors, corporates and public authorities. Third, it operates as an integration hub for partners, allowing consultants, nature-tech providers and verification platforms to plug in methodologies, algorithms and services via APIs and combined offerings.

From a user perspective, ECOSYS is designed as a digital agriculture and nature-finance platform: project developers can score parcels and assemble investable portfolios; investors can screen and monitor nature value-at-risk and resilience; corporates can verify supplier-level regeneration outcomes and feedstock compliance; public actors can build country-scale analytics for NRL and CAP reporting.

[GTIF SCALABLE LANDSCAPE ANALYTICS:](#)

Powered by EOxHub in partnership with PRO-NATUR, AgrEO.

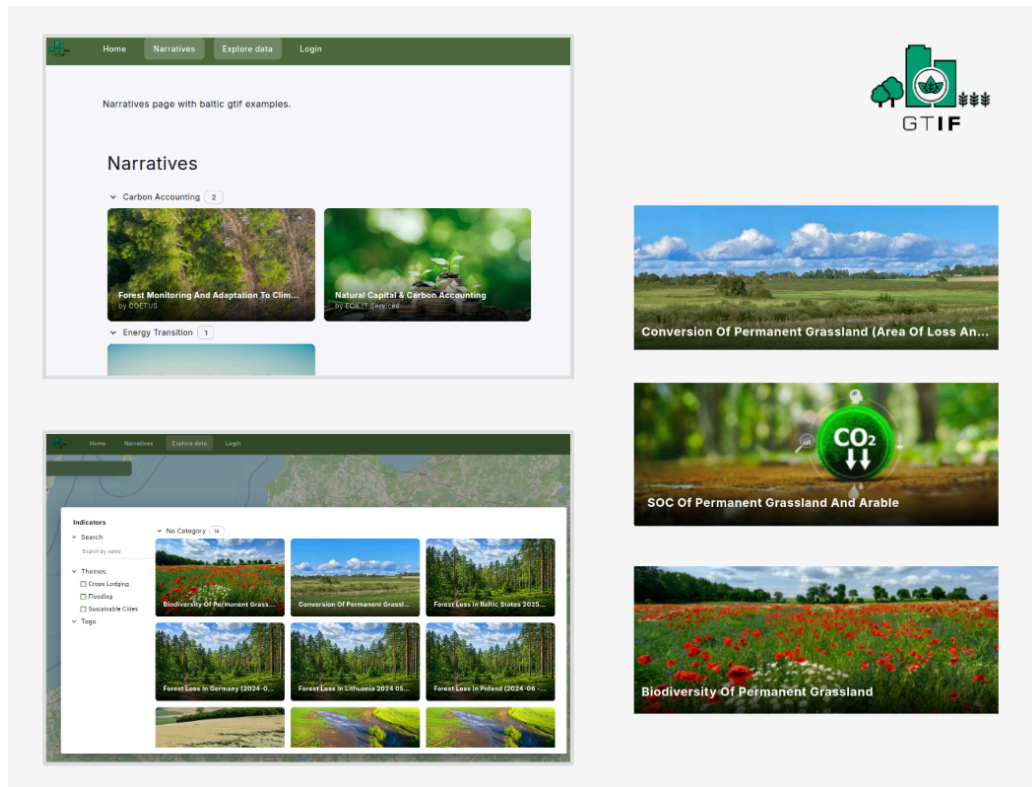
Decision-making at scale

Linked to the ECOSYS Platform is our dMRV change tracking, scenario modelling, decision & policy support tool at country scale including:

- ecosystem indicators by **integration of various EO-based thematic datasets & reuse of EO markers** of Area Monitoring System and expert evaluation matrixes;
- evaluating land status and management activities along multiple target areas:
 - soil
 - climate
 - biodiversity
 - water
- applying top-down logic, to reach comparability via large/full country models and relative scales,
- ensuring timely repeatability to present progress, degression, critical risky areas due to change intensity

The technology used:

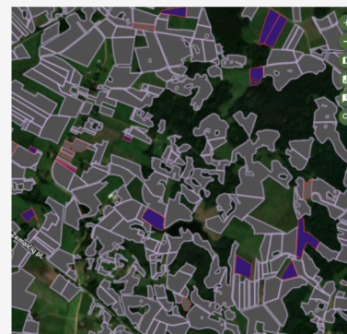
- based on open source cloud native EOxHub Workspace,
- open value chain: data processing pipelines & inter-operability
- cloud native EO-Dashboard with no spatial upscaling challenge any more.



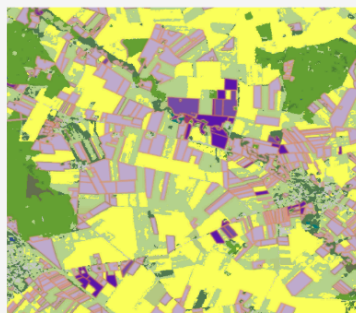
Overview for the example of Lithuania



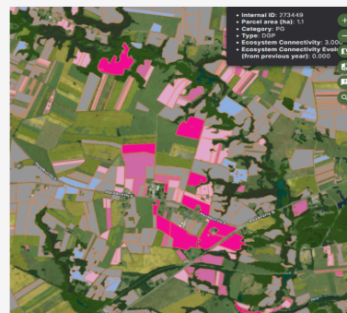
Conversion of Permanent Grassland parcel (2024) into another category (2025)



Soil Organic Carbon Loss when permanent grassland is converted to AL



LULCF stack + Ecosystem Connectivity, weighted by habitat distance (relative scale from [1:10])



Policy target for biodiversity, supporting landscape features, buffer strips and natural habitats

Use Case Overview

Background

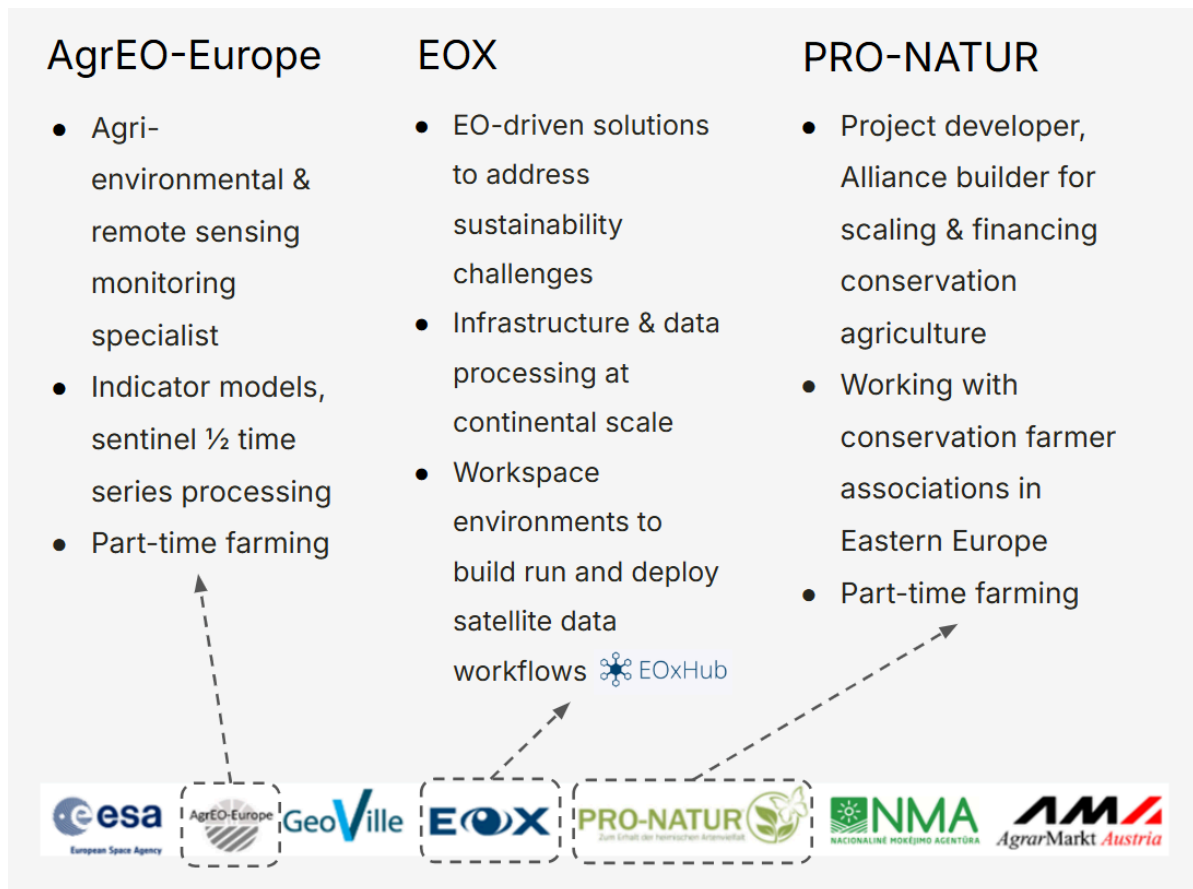
Agricultural systems in Europe face simultaneous pressures from climate change, biodiversity loss, soil degradation and evolving market and regulatory demands. Regenerative and conservation-oriented practices are emerging as critical strategies to build resilience, but their ecological performance and financial value are hard to measure consistently at scale. Many MRV approaches remain fragmented, costly or narrow in focus, making it difficult to link ecological outcomes to finance, risk or corporate reporting in a robust way.

ECOSYS NCS is designed to address several gaps: the lack of comparable, EO-enabled indicators for soil, biodiversity and management at parcel and landscape level; the difficulty of turning these indicators into portfolio-ready metrics for banks, funds and corporates; and the need for scalable verification pathways that reduce manual field assessments while remaining scientifically grounded. By integrating EO data, CAP/IACS/LPIS records and soil information into a unified indicator framework, ECOSYS aims to provide decision-ready metrics that can support grant allocation, blended finance structures, risk pricing and supply-chain reporting.

The regulatory backdrop includes evolving requirements under CSRD, TNFD, the EU Nature Restoration Law (NRL), CAP eco-schemes and sector-specific regimes such as CORSIA for aviation fuels. These frameworks increase the need for credible, outcome-based MRV systems that can report on biodiversity, soil and broader nature outcomes across large portfolios and supply chains. ECOSYS positions its methodology concept as a building block that can help stakeholders align agricultural finance, corporate reporting and policy implementation with these emerging standards, while staying flexible enough to adapt as regulations and market expectations evolve.

Governance & Team

ECOSYS is a spin-off initiative based on a number of projects relating to Natural Capital Measurement and Evaluation for Agriculture:



Key projects (excluding PRO-NATUR Pilot-Finance Development for 2026):

Regional Earth-Observation (EO) services to support the green transition and climate adaptation gtif-baltic.info/ Baltic GTIF - BETA Green Transition Information Factory	AI-based Earth Observation and proximal sensing data fusion for CAP Monitoring and Nature Capital Valuation ncs.eox.at  ARTES 4.0 Business Applications
→ Country-Scale Analytics Dashboard & key metrics	→ Parcel-level monitoring, evaluation & portfolio selection + reporting
For: National & Env. Agencies, JRC, policy consultants, NGOs	For: Project developers, impact investors, (food) corporates, municipalities/agencies
Outputs: LULUCF baselines, ecosystem indicators, change maps	Outputs: Biodiversity & Carbon Farming score Methodology, Total Expected Impact Value in EUR/ha, dMRV reports

Combined aim: a full-stack natural capital accounting - from national baselines to farm-level finance-ready outputs.

Value Proposition

For project developers and land stewards

Project developers, farmers and nature-finance originators gain a consistent, data-driven way to establish ecological baselines, demonstrate proof of change and compare interventions across parcels and landscapes. ECOSYS provides parcel scoring via CAP/IACS data, automated dMRV, portfolio and baseline assessment, nature-value monitoring, and grant-ready KPIs that make it easier to secure grants, blended finance and outcome-based funding. This supports fund development in arable and grassland spaces by identifying and scoring parcels for nature-finance eligibility and pre-certification logic for biodiversity credits.

For investors and financial institutions

Banks, insurers, fund managers and brokers gain comparable, investment-grade indicators that translate complex ecological reality into portfolio-ready signals. Through nature-value-at-risk scoring, resilience indicators and continuous satellite monitoring, ECOSYS helps them screen, price and monitor agricultural and nature-related portfolios. TNFD-aligned metrics, parametric risk indicators and portfolio dashboards reduce the work of harmonising fragmented ecology data and support the design of green loans, labels and nature-linked instruments.^{documents1}.

For corporates and reporting actors

Food companies, input providers, aviation and energy actors, and other corporates with large supply chains gain supplier- and parcel-level regeneration metrics that go beyond CO₂-only views. ECOSYS supports CSRD-ready Scope 3 nature outcomes, NRL Article 4–10 compliance and CORSIA/SAF feedstock verification by providing EO-based supplier-level regen verification, euro-denominated nature scores at supplier level, NUTS-3 aggregation APIs and ILUC risk-screening dashboards. This helps corporates verify biodiversity and soil outcomes across thousands of suppliers, align procurement with nature-positive goals and meet emerging reporting and certification requirements.

For public authorities and programmes

Public authorities, NRL agencies and CAP paying agencies gain country-scale, repeatable analytics that support design and monitoring of agri-environmental policies, eco-schemes and nature-related regulation. ECOSYS provides field-level dMRV that can complement or replace manual assessments, identify hotspots and leverage points, and generate standardised indicators for national reporting cycles. This strengthens the evidence base for policy decisions while reducing administrative burden.

User Guide

TBU

Methodology & MRV

Methodology & MRV

This section describes how ECOSYS NCS turns raw data into decision-ready indicators and impact metrics, and how those metrics are monitored, reported and verified over time. The methodology is presented as a concept in active development, meant to be stress-tested in pilots and refined with partners before formal standardisation.

Design principles

The ECOSYS methodology is built around four guiding principles: scientific robustness, transparency, scalability and usability. Scientific robustness means grounding each indicator in established soil, biodiversity, climate and agronomic science and using documented calculation steps. Transparency means that data sources, assumptions, scoring rules and aggregation weights are explicitly described and open to review. Scalability means the system must work consistently from parcel level to portfolio and country level, based largely on EO and compliance data. Usability means outputs are designed for real decisions by project developers, investors and public authorities, not only for research.

Data sources and monitoring

Monitoring combines multiple data sources into a single quantification framework. Core inputs include: Earth Observation products (vegetation dynamics, land cover, landscape features), agricultural compliance datasets (e.g. IACS/LPIS parcel declarations and crop types), digital soil maps (E.g. from FAO) and field measurements where available. These datasets are harmonised in time and space, processed through cloud-native pipelines, and converted into parcel-level and landscape-level indicators that can be updated regularly. The goal is, to add further in-situ information over time or as required by verification standard or client-demand.

Indicator framework

ECOSYS uses a modular indicator framework grouped into four main dimensions: soil health, biodiversity and habitat quality, climate and carbon, and management practices. For each dimension, dedicated indices (such as Crop Rotation Index, Catch Crop Index, Soil Organic Carbon Index, Landscape Feature Index, Length of Vegetated Period, Connectivity Index) quantify specific aspects of ecological performance on a 0–10 or similar scale. These indices are designed to be comparable across parcels and regions, with clear rules for handling special cases like set-aside parcels or nitrogen-fixing crops.

Reporting and aggregation

At reporting stage, parcel-level indicators are aggregated into composite indices such as the Biodiversity & Carbon Farming Index (BCFI) and rolled up to portfolio or country level using defined weighting schemes. Reporting outputs include maps, dashboards and summary metrics that show baselines, changes over time and scenario outcomes under different management or

investment strategies. The reporting logic is designed to be compatible with impact finance, carbon farming and public policy MRV requirements.

Biodiversity & Carbon Farming Index

ECOSYS Methodology Description

The **Biodiversity Carbon Farming Index (BCFI)** is our core metric to quantify parcel-level ecosystem-performance and to derive the **Total Expected Impact Value (TEIV)** on various aggregation levels as farm or user-selected portfolios.

Overview

Role of the BCFI

The BCFI aggregates agrodiversity, soil health, ecosystem connectivity and carbon performance indicators into a single **index** that directly links multi annual land management practices to biophysical outcomes and economic value. Higher BCFI scores indicate more regenerative soil management, greater biodiversity and stronger climate resilience. BCFI is used in the current NCS Marketplace Prototype (MPV) to differentiate and provide book values for assets (not equaling market price or willingness to pay which is linked to other factors). The live implementation of the index logic and user journey is available in our current MPV: <https://ncs-seller-app.hub-int.eox.at/>

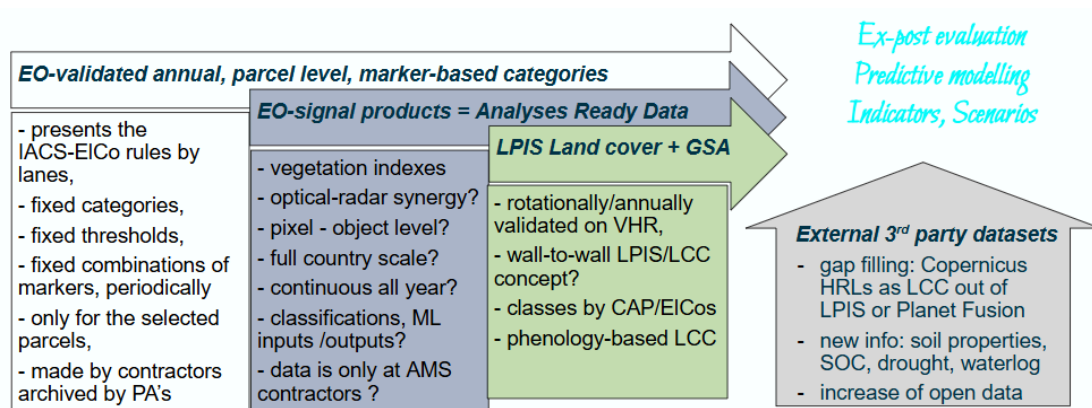
How the BCFI Works

The Biodiversity and Carbon Farming Index (BCFI) is a composite scoring system that translates observable farm and landscape management practices nearby the agricultural parcels into a single index value, reflecting the overall ecological and carbon performance of a parcel. A higher BCFI score is assigned to soil and crop management activities having

- benefits by crop rotation, such as nutrient restoration, soil structure and organic matter improvement by alternating deep-rooted and shallow-rooted plants breaks up hard dirt and lets water flow better, diseases and weed control,
- higher soil regenerative performance by keeping the soil covered, reducing chemical inputs, and supporting soil microbial life;
- contribution to decline soil organic carbon and begin sequestering more carbon over time;
- reduced negative impact on agrodiversity and biodiversity of natural and semi-natural habitats being directly adjacent to an agricultural parcel.

The reuse of the IACS-GIS data ensures that indicators are derived on agricultural parcel level with seamless comparability. IACS data sharing is the pre-requisite of this methodology, as we interoperate the data of annual geospatial aid application (GSA) and Area Monitoring System (AMS) results with various soil thematic layers, land use/land cover/forestry (LULCF) data and farm activity logbook data. As all input data has country-wide categorisations and weighting factors allow correct comparison of impacts even in cases if the measurement of an absolute value is not sufficient, but a relative scaling is possible based on scientific evidence.

For the sake of objectivity and comparability Earth-Observation is the preferred information collection method. It is designed to be satellite- and field-data verifiable, making it directly usable as a monitoring and impact scoring tool within ECOSYS.



Impacts scaled in **BCFI** are shared among four benefit categories - biodiversity, carbon, soil and water - and translates them into a unified score for each parcel. Each category is scored using observable and verifiable indicators (from EO, in-field data and management records), then normalised and weighted to reflect its contribution to overall regenerative agriculture and ecosystem performance and resilience. The resulting index value can be used at parcel, farm and portfolio level.

From farmer practices to outcome evaluation

Put simply- it evaluates performance and impacts by 4 main benefit categories in order to:

- Scale valuation methodologies for Sustainable Ecosystem Management & Financing
- Supporting CAP/PMEF & Nature Restoration
- Promote ecosystem services
- Create a combined approach and “market” creation for natural capital in the agri-space

Who this is relevant for and why::

- Project developers: identify and score parcels for nature finance eligibility
- (Agri-) Consultants & NGOs: prioritise restoration interventions by impact per hectare
- Food corporates: Regen Ag. Monitoring or Insetting project-tracing
- Agri-Tech Platforms: Apply & Combine your methodology, apply your ground-truth algorithm
- Impact investors: De-risk allocation with (additional) continuous satellite evidence & reporting

The BCFI aggregates weighted inputs across five broad categories: soil carbon status, active management practices, landscape features, input reduction, and climate risk. The resulting score runs from 0 to 100, classified as:

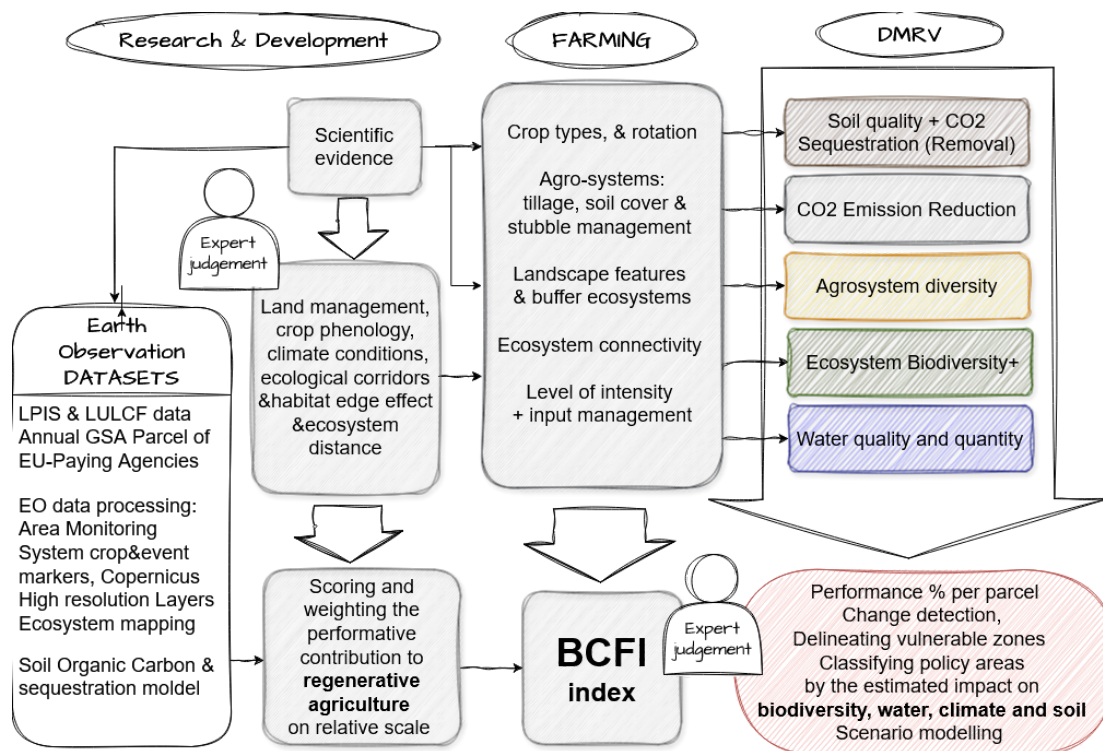
Score Range	Classification	Meaning
0–50	Low	Conventional, input-intensive, minimal biodiversity features to potentially some practices in transition, partial adoption of regen measures
51–80	Good	Active regen management, notable landscape features, reduced inputs to strong biodiversity and carbon performance

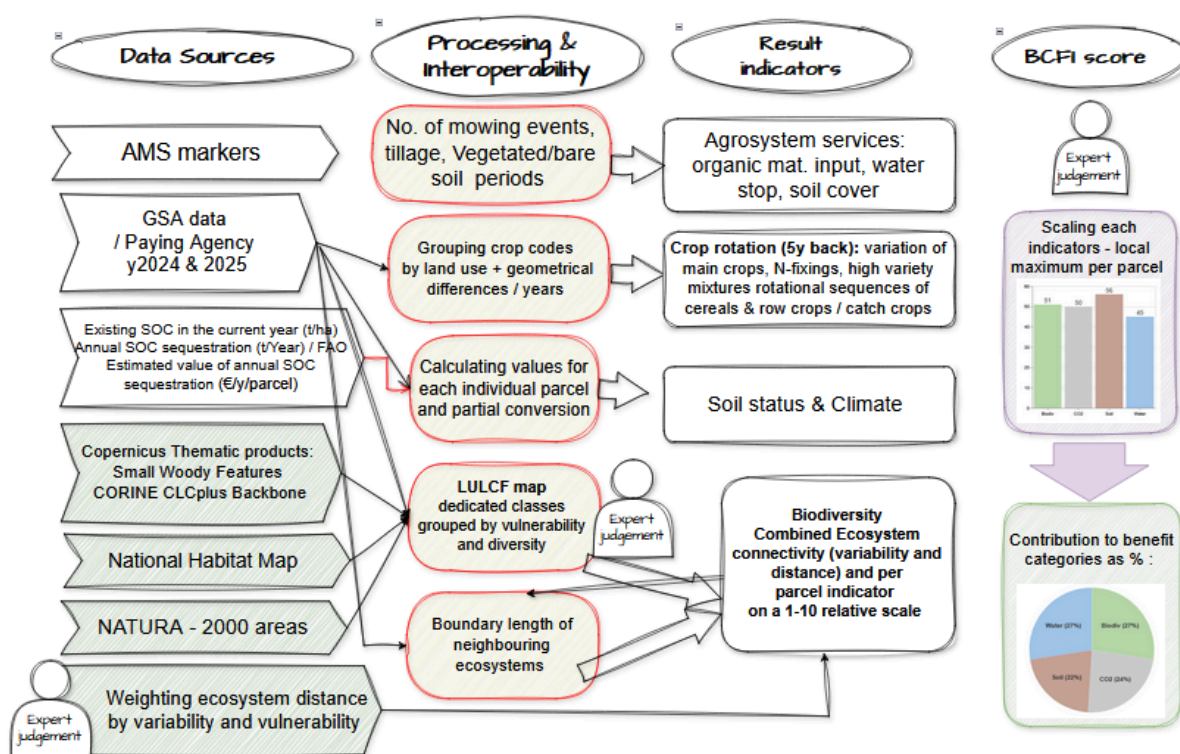
80–100	High	Approaching best practice to exemplary, multi-practice regen system with high landscape complexity to exemplary, multi-practice regen system with high landscape complexity
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Example: A score of 65 sits solidly in the good tier - above conventional farming, with measurable ecosystem service delivery, but with clear headroom for improvement that ECOSYS can track over time.

Data inputs and verification

The index is explicitly designed to be satellite- and field-data verifiable, which means all scoring components must be traceable to measurable signals rather than self-declared claims. Management practices and landscape conditions “nearby the agricultural parcels” are translated into indicators such as agrobiodiversity, soil health, connectivity and carbon performance, which can be cross-checked via ECOSYS’s regional Earth Observation services and partner datasets. This ensures continuous monitoring, makes scores auditable over time and allows integration into CAP/PMEF and Nature Restoration reporting frameworks.





Overview including Sources and data-processing of BCFI

As part of the tables visible in the [tool](#) (Austrian Arable land), the following outlines an example how the inputs contribute to the score:

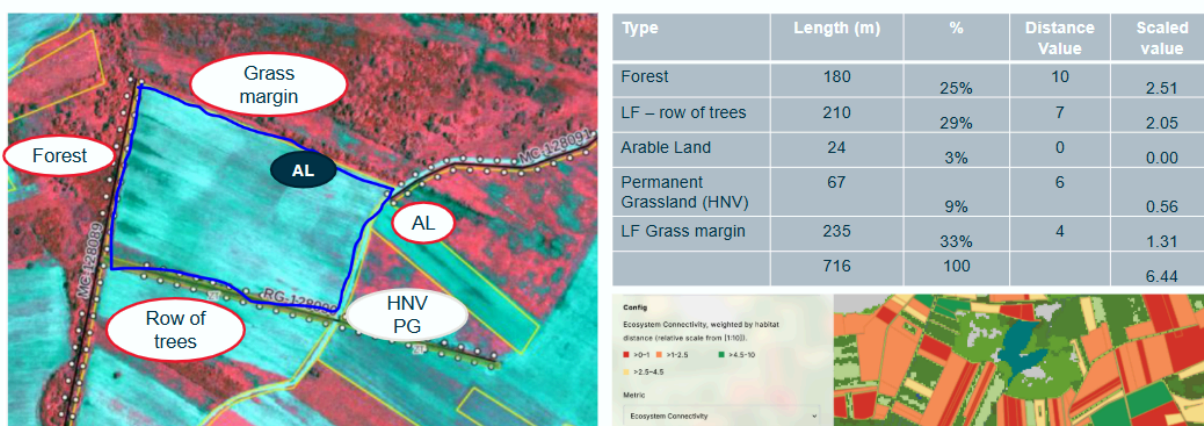
Input	Value	Role in BCFI
Crop Rotation	Max 15 points	Baseline modifier – monoculture scores lower than crop type diverse rotations back to 5 years, N-fixing crops, deep rooted crops brings higher rates etc. Rotation diversity reduces fertilizer and pest pressure, keeps water and supports SOM.
Annual Carbon release	Max 10 points 43t/ha/year	Loss of soil organic carbon (SOC) due to ploughing or tillage activities, calculated from the base of SOC content and CO2 release by the type of tillage activity.
Catch Crop	5 points	Increases SOC, can be N-fixing, creates better soil structure
Ecosystem Connectivity index	Max 15 points	Boundary share of various LCLU categories adjacent to the parcel weighted by the dissimilarity in habitat phenology conditions (also called as ecological distance)

Inner-parcel Landscape features	Max 15 points	Isolated natural vegetation spots inside the AL parcels: isolated trees, group of trees, inner anti erosion strips, ponds&wetlands for parcels bigger than the average of the zone (calculated by the parcels overlapping in a 10 km round)
Length of vegetated period	10 points	keeps the water as it covers the soil, avoids drying out, supports weed management etc.
Tillage Reduction	10 points	Positive - reduced soil disturbance supports structure and SOM retention
Mulching	5 point	Small but positive contribution to surface protection
N/Pest Use	15 points	Input reduction score - lower chemical use = higher points; 29 suggests moderate reduction, not yet minimal

		SEE sheet "BCFI_InputData"	BIODIVERSITY & CARBON FARMING INDEX (BCFI)	ESTIMATION OF IMPACT % per Target areas						
		Source data	INDICATOR - AL Crop management activity	Scoring Criteria - Directly Parcel related	MAX point	CARBON FARMING		BIODIVERSITY+	WATER QUALITY	SUM / activity
Land use/land management activity category						HUMUS+ Soil quality status	Climate - CO2 flux: sequestration and emission reduction	Biodiversity - both agrosystem and ecosystem around	Water regulation/management&preserve quality	
AGROSYSTEM SERVICES	Crop management	GSA	CROP ROTATION (Point System Matrix)	Points are based on the type of crop rotation systems, avoiding bad combinations leading to the increase of soil degradation Back to 5 years on parcel level: 1- variation of main crops in the rotation 2- rotational sequences of cereals row crops 3 - making use of N-fixing and deep-rooted crops 4 - High variety crop mixtures (for AT, use scale-2 points of normal crop rotation index)	20	10	10	80		100,00
		GSA - rule based + AMS - implementation based	CATCH CROP	Categories by the combination of winter cereals, bi-annual crops and catch crops after cereal harvest and before spring sown crops continuously covering the parcels Each year covered by crop = 2 points	10	70		20	10	100,00
		GSA (rule based) + SOC	Annual Carbon release	Loss of soil organic carbon (SOC) due to ploughing or tillage activities, calculated from the base of SOC content and CO2 release by the type of tillage activity.	10	40	40	10	10	100,00
		AMS	Length of vegetated period during the year	0-5 points - 20% (73 days) = 2 points / single year	10	40	30	10	20	100,00
		GSA / (AMS ???)	REDUCED (NO) TILLAGE & Direct Seeding	- 10 points if no tillage at all - 5 if subsoiler or cultivator - 3 if disked - 0 if tilled	10	30	35	15	20	100,00

		SEE sheet "BCFI_InputData"	BIODIVERSITY & CARBON FARMING INDEX (BCFI)	ESTIMATION OF IMPACT % per Target areas						
		Source data	INDICATOR - AL Crop management activity	Scoring Criteria - Directly Parcel related	MAX point	CARBON FARMING		BIODIVERSITY+	WATER QUALITY	SUM / activity
Land use/land management activity category						HUMUS+ Soil quality status	Climate - CO2 flux: sequestration and emission reduction	Biodiversity - both agrosystem and ecosystem around	Water regulation/management&preserve quality	
BIODIV	Ecological network and ecosystem variability	INVEKOS or AMA data, Forest type LMS Waldkarte forest Copernicus SWF Austrian habitat map	Ecosystem connectivity index, using the boundary share and the distance weighting - based on LULCF map	Direct adjacency to the agricultural land (share of the boundary length of the feature in % of the parcel boundary) multiplied by the ecosystem distance coefficient	20			100		100,00
	Inner Landscape features	SWF+LPIS	Isolated natural vegetation spots inside the AL parcels: isolated trees, group of trees, inner anti erosion strips, ponds&wetlands	100% direct adjacency to the agricultural land multiplied by the ecosystem distance coefficient	10			80	20	100,00
	On-parcel diversity features	GSA	GRASS/Flower Strips planted with high variety of species, inside the area of the parcel is > 2500 ha	- can be unpermanant (<5 years, as AL), always artificially sown - % of the area of the parcel,	10			80	20	100,00
			TOTAL		100	190	115	395	100	800,00
Share of measured performance per target areas						23,75%	14,38%	49,38%	12,50%	100,00%

Detailed IMPACT Estimation per Benefit Category (Example)



Satellites-based Connectivity Index

Why this is unique

The BCFI combines AMS-based Compliance Data, processed EO-signal-based thematic maps, and additional ground-truth information (later stage working with experts/AI processing), and leads to a monetisable impact metric supporting Scope 3, NRL and project finance.

BCFI logic explicitly links multi-annual land management practices to biophysical outcomes (e.g. resilient soils, higher biodiversity, improved climate resilience) and then to economic valuation. Higher BCFI scores signal better ecosystem performance, which is used in the NCS Marketplace prototype to differentiate assets and assign book values as a basis for nature finance, while explicitly not equalling market price or willingness to pay. On top of this scoring layer, TEIV aggregates expected yields, prices, carbon factors and soil organic matter value assumptions at parcel and portfolio level to support scalable valuation methodologies for sustainable ecosystem management and financing.

BCFI sub-indexes

BCFI subindexes for Arable Land parcels

The BCFI (for Arable Land parcels) aggregates weighted 'sub-indexes' calculated as following:

Crop Rotation Index

The **Crop Rotation Index** [yearly submetric precision declaration] is a sustainability metric that evaluates a parcel's overall soil health and ecological balance over a five-year timeline. Instead of just tracking annual changes, it aggregates five distinct sub-indexes into a single score to assess how effectively a crop rotation sustains soil structure and disrupts pest cycles. To properly reward ecological and soil-building practices, the calculation applies a special exception for set-aside (fallow) and N-crop (nitrogen-fixing) types: in the first two sub-indexes, consecutive years of these crops are treated as different varieties.

- **Variation of Main Crops:** Counts the total number of unique crop types grown over the five years, prioritizing broad botanical diversity over a simple, repetitive two-crop alternation.
- **Rotational Sequences:** Analyzes planting patterns to minimize pest and disease build-up by checking how often demanding crops (like cereals or row crops) immediately succeed themselves.
- **Nitrogen-Fixing Crops:** Measures soil fertility restoration based on the frequency and integration of legumes, catch crops, or temporary grasslands that naturally boost soil organic status.
- **Deep-Rooted Crops:** Assesses the inclusion of deep-rooting species within the five-year window to help break up soil compaction and recycle nutrients from deeper soil layers.
- **Additional Advantages:** Rewards the proactive use of high-variety plant mixtures and intercropping to further maximize biodiversity and ecological resilience.

Catch Crop Index

The **Catch Crop Index** [yearly submetric precision declaration] measures how effectively a parcel maintains active vegetation during winter to prevent soil erosion and nutrient leaching. Over a five-year period, a parcel can earn up to 10 points by receiving points for each year it maintains continuous cover. This status is achieved if:

- The year's main crop naturally provides winter cover,
 - Or if the main crop does not, if a winter catch crop is declared to protect the soil (for example, a 2025 declaration covering December 2025).
- If neither condition is met, the soil is considered bare, earning 0 points for that year.

Soil Organic Carbon (SOC) Index

The **Soil Organic Carbon (SOC) Index** corresponds to the SOC content. The quantification of topsoil SOC stocks relies on a pedotransfer function (PTF) framework developed by the German Soil Science Society (Deutsche Bodenkundliche Gesellschaft - DBG, Renger et al., 2008). This approach derives physical soil parameters, specifically baseline dry bulk density from categorical soil texture and

humus data (from Bodenkarte, 1km grid, 2016), and dynamically adjusts them based on organic content.

The calculation of the SOC stocks is done with the following steps:

1. The conversion of the organic matter into SOC content
2. The determination of the Effective Packing Density (Ld)
3. The determination of the structurally adjusted dry bulk density
4. The volumetric accounting of the absolute organic carbon mass per unit area

Landscape Feature Index

The **Landscape Feature (LF) Index** evaluates and scores parcels (on a 0–10 points scale) based on their spatial proximity and area ratio relative to nearby ecological features. Here is how the key spatial parameters and filters work together in the pipeline:

- Search for neighboring parcels around the LF area within a two meters search radius (a LF area can be close to multiple parcels). The parcel(s) must share a minimum continuous edge length with an LF of 0.5 meter to qualify as valid neighbor(s).
- The total area of adjacent landscape features is summed per parcel. The parcel receives 1 point per 1% of LF area coverage relative to its total size, rounded to the nearest integer and capped at a maximum of 10 points.

Length of Vegetated Period Index

The **Length of Vegetated Period Index** (0–10 points scale) [yearly submetric precision declaration] calculates the total days of active green cover and the corresponding score for agricultural parcels within a target assessment year (2 points for every 73 days).

Ecosystem Connectivity index

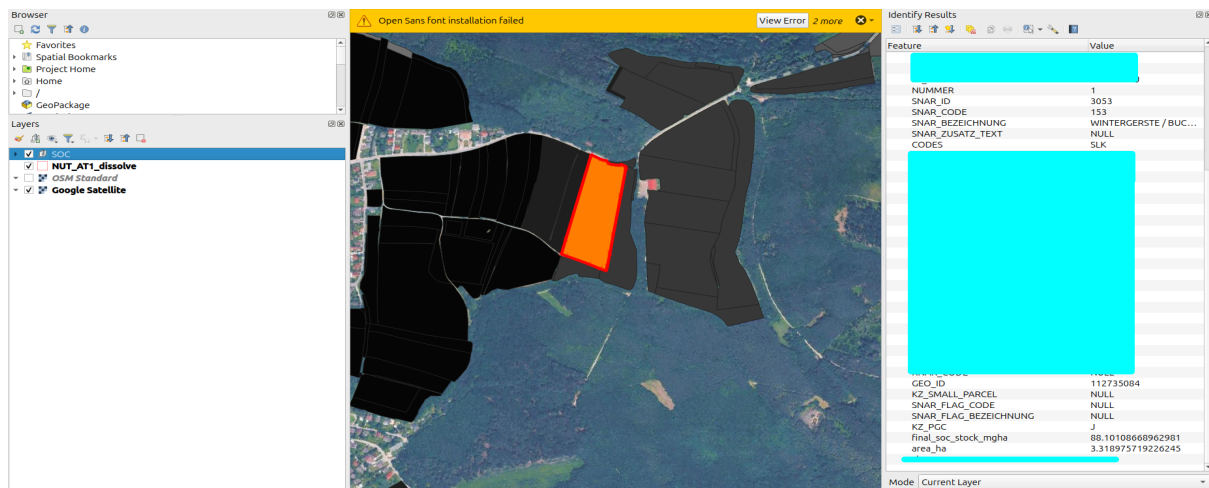
Annual Carbon release = SOC LOSS tillage

Updates July 2026

Dataset & Product Expansion

While interfering with potential user groups the ecosystem indicator metrics and the visualisation had been further sophisticated. Thematic products had evaluation are the followings:

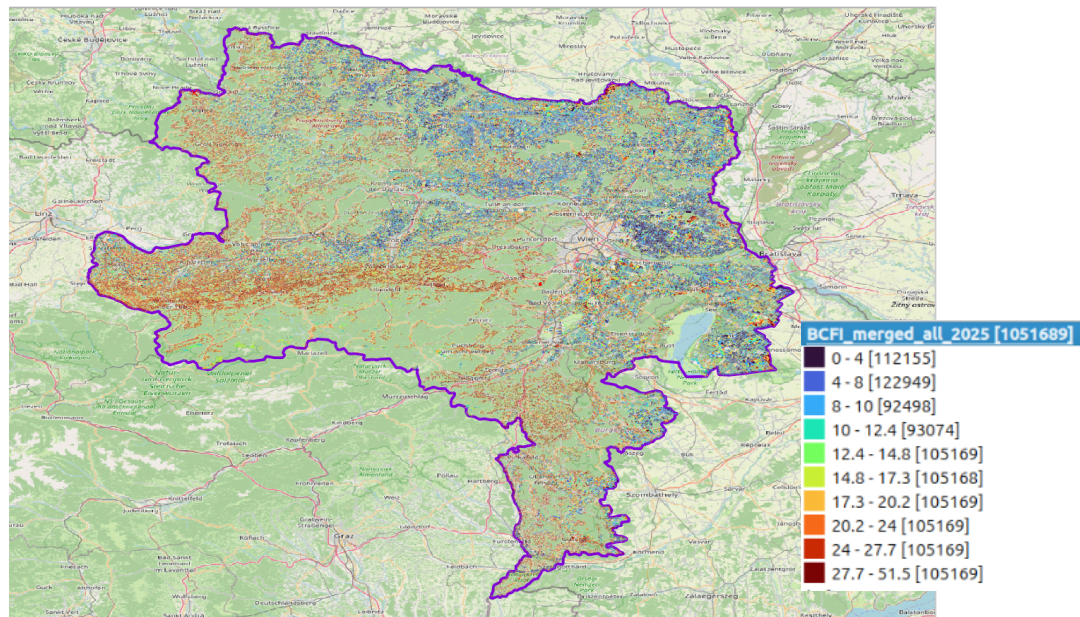
- **Austria (NUT-AT1 pilot site): SOC Stock Estimation:** further refinement of the SOC stock estimation script based on 5-year Bodenkarte datasets (soil composition and texture) to compute absolute SOC stock content ($\{t/ha\}$ and $\{tCO_2 \text{ eq./ha}\}$). Process steps included:
 - Organic matter to SOC content (%) conversion
 - Effective Packing Density (L_d) determination
 - Structurally adjusted dry bulk density ($TRD_{adjusted}$) calculation
- **SOC Loss Estimation:** Development of a script to model 5-year SOC loss resulting from tillage and ploughing management events. Categorising the % of SOC loss of arable parcels in case of ploughing using sand and clay content from the Bodenkarte datasets (soil composition and texture)



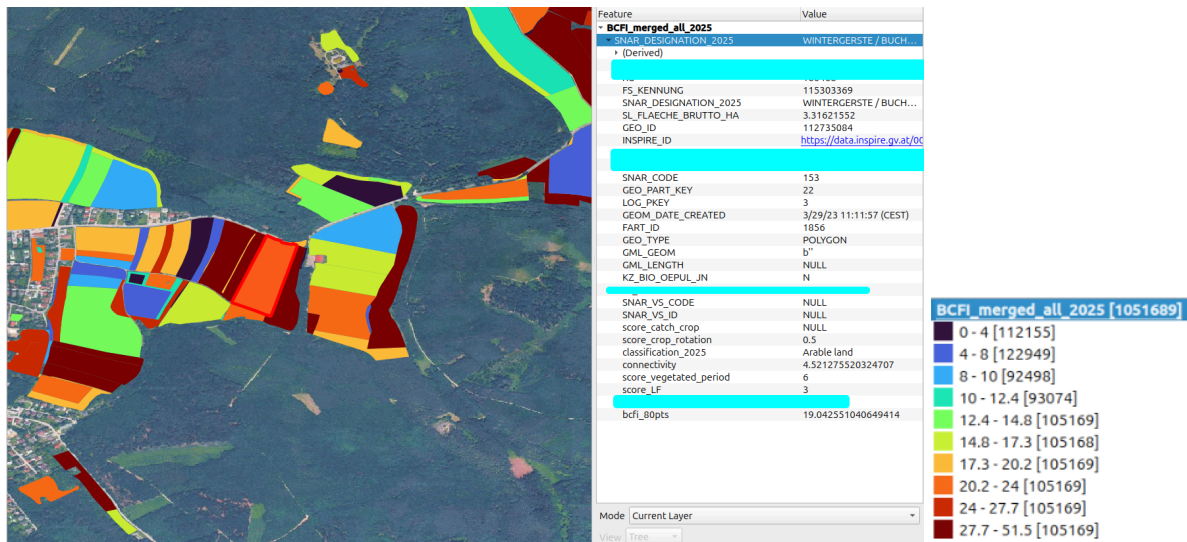
Example of SOC Stock estimation result for a 'WINTER BARLEY BUCKWHEAT' parcel

BCFI Refinement & Index Optimization

- **Biodiversity Carbon Farming Index (BCFI) Score:** Refined spatial aggregation models specifically tailored for the Austrian region.
- **Code Optimization & Documentation:** Cleaned and optimized scripts. Production of internal technical methodology documentation and external communication materials for the BCFI index.



Overview of the BCFI score for all the parcels inside the NUT-AT1 region



Example of parcel indexes outcome

An arable parcel or farm is assessed across a series of regenerative and conservation management practices. Each activity has a designated **Maximum Points** cap (typically ranging from 5 to 20 points), which sum up to a total benchmark baseline of 100 points (or 80 points depending on the regional matrix). Points are awarded based on specific implementation criteria:

- **Crop Rotation:** Points are given based on the number and variety of crops rotated over a 5-year period to avoid soil degradation.
- **Catch Crops / Cover Crops:** Points are awarded based on the percentage of fields with cover crops or the time length of the bare soil period.
- **Vegetated period of the annual crop management cycle:** Points are based on the percentage of vegetated time period (NR of days) during the entire year life cycle of the parcels.
- **Ecosystem Connectivity index:** using the boundary share and the distance weighting - based on LULCF data. Direct adjacency to the agricultural land (share of the boundary length of the feature in % of the parcel boundary) multiplied by the ecosystem distance coefficient.
- **Landscape Features Index:** Points are awarded based on the percentage of grass/flower strips, tree rows, hedge management, and the direct adjacency/connectivity index to natural ecosystems. Area of directly adjacent and on-parcel LFs - grassy, woody, wet & stony - is

expressed in % of the area of the parcel. LFs are linked to parcels with the longest direct adjacency, using the same logic as for the ecosystem connectivity (max in 2 meters buffer). Complementary to the above index in the matter of accuracy.

- **SOC loss by tillage tCO₂eq or t/ha**: Loss of soil organic carbon (SOC) due to ploughing or tillage activities, calculated from the base of SOC content and CO₂ release by the occurrence / type of tillage activity: number of crop types in 5 years multiplied by an annual tillage factor based on the plant is typically cultivated (BAU). Catch crops also count.

The Overall BCFI Score for a specific parcel or farm is the direct sum of the points achieved across all evaluated management activities: $\text{Overall BCFI Score} = \sum (\text{Points Scored per Activity})$.

The next step is to calculate an Impact Weighting across Environmental Benefit Categories. To understand the specific environmental outcomes, the points from each management activity are mapped across **5 Core Benefit Categories** using a percentage weight matrix (where the weights for each activity total 100%):

1. **Agrosystem and Ecosystem Biodiversity**
2. **Soil Health** (Humus quality status / CO₂ Sequestration)
3. **Climate Mitigation** (CO₂ Emission Reduction)
4. **Water Protection**

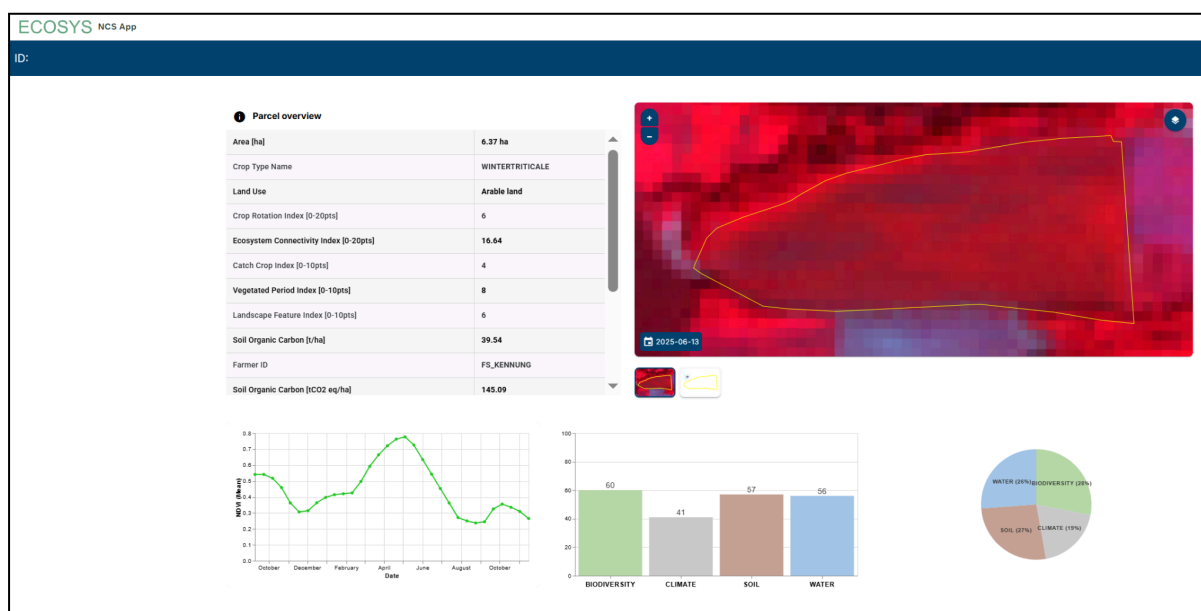
By multiplying the achieved activity points by these category weights, the system calculates a breakdown of the specific target area impacts (e.g., Total Climate Score, Soil Health impact percentage, and estimated ecosystem service value created per hectare).

NCS Application Updates

- Fine tuning of visualizing the BCFI as tabular data by updating the database table to align with new output data structures-both at the backend and frontend .
- Frontend: Refined portfolio UI components, including field titles, value displays and portfolio summary dashboards.
- Creating and testing a permanent grassland parcel's portfolio for the entire area of Lithuania: new logical set-up of the already existing database and integrating the data content into the existing UI design framework.
- Presenting the outcomes to external stakeholders.



Example of arable land parcel's portfolio in Austria



The data represents a scoring framework and evaluation model for the Biodiversity & Carbon Farming Index (BCFI). It is designed to measure, score, and financially value the environmental impact of various agricultural and land management practices.

Example of a permanent grassland parcel's portfolio in Lithuania

PGs are one of the main long term carbon storages on agriculture lands. Although we know that AL management technologies have stronger effect on the carbon fluxes, and on SOC sequestration, natural and semi-natural species-rich grasslands with no ploughing also serve as significant carbon storage with essential additional ecosystem services. The CO₂ accumulation potential varies a lot according to the bio-physical conditions of a PG. The uptake of the SOC in PGs, the carbon sinking potential, is more stable than in the AL systems.

Natural grasslands in Lithuania (and further European countries) are currently under pressure due to intensified food production and the conversion of permanent grasslands (PG) into arable land (AL). As

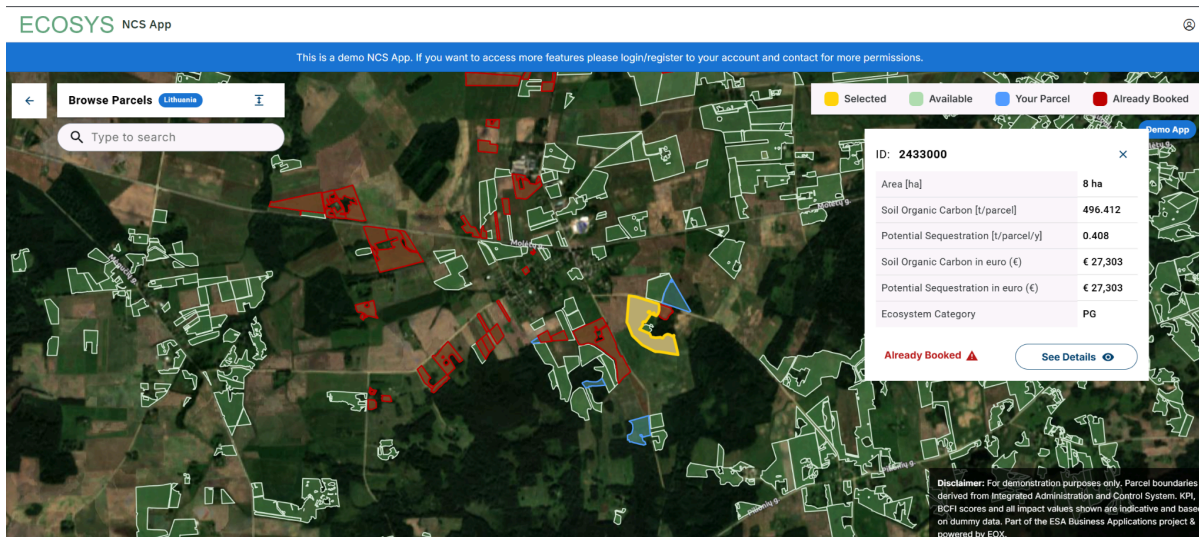
the availability of former Common Agricultural Policy (CAP) land is insufficient to meet the new production demand and/or it is more profitable, farmers increasingly plough their grassland parcels based on logistic-driven decisions, without evaluating the ecosystem services of a particular agricultural parcel soil health, buffer capacity, ecosystem connectivity and biodiversity. However and notably, old meadows and biodiversity-rich grasslands:

- can store up to 320t CO₂E/hectare of which a larger proportion will be emitted due to ploughing while restoration takes up to 20+ years;
- serves as part of ecological network enabling the spread of species, the variability of biotopes;
- serving as a security buffer against nitrogen leakage from intensively managed arable parcels along water bodies and vulnerable wetland habitats.

This trend has raised concern within NGOs and national administrations, prompting the need for a deeper understanding of the drivers, spatial extent, and environmental impacts of PG-to-AL conversions. Ministries seek data and tools that can support evidence-based policymaking to balance economic competitiveness with sustainable land management and CAP compliance. To implement really performance-based CAP adjustments, ministries across EU Member States aim to:

- ensure sustainable agricultural productivity while aligning with EU Green Deal targets;
- prevent irreversible permanent grassland losses by monitoring and regulating land conversions;
- promote higher value-added agri-food exports without degrading ecosystems or violating CAP greening requirement;
- develop data-informed land use governance integrating sustainability with economic, environmental and biodiversity objectives.





Example of a permanent grassland parcel's portfolio in Lithuania

The following indicators were derived and integrated into the Lithuanian PG use case:

Soil Organic Carbon (SOC) data is based on the various FAO predictions - on a sample zone for grassland and for arable land parcels as separate thematic layers:

- Ecosystem Connectivity index: using the boundary share and the distance weighting - based on LULCF data created by us, with the integration of various open sources, including Copernicus HRLs,
- Existing SOC content {y2025} [t/parcel]
- Annual SOC sequestration potential [t/parcel/y]
- Estimated value of existing SOC content {y2025} [€/parcel]
- Estimated value of Potential annual SOC sequestration [€/parcel]
- Estimated value of carbon loss by tillage [t/parcel/y]

Values of the FAO SOC calculations are related to conventional land management practices and to 20 years of sustainable soil management practice

Detailed explanations

How to Prevent Soil Carbon Loss

1. Keep the Soil Covered Year-Round

- Cover crops and perennial plants help maintain continuous carbon inputs.
- Residue management reduces oxidation and protects microbial life.

2. Practice No-Till Farming

- No-till preserves **soil structure** and protects organic matter from excessive oxidation.
- It also supports **fungal networks**, which stabilise carbon into humus.

3. Reduce Pesticide & Herbicide Use

- Instead of frequent herbicide applications, integrate **cover crops and crop rotations** to manage weeds naturally.
- Reduce synthetic pesticides to preserve beneficial microbial communities.

4. Limit Synthetic Fertilisers

- Use **humic substances like fulvic and humic acids** to buffer fertilisers and prevent soil oxidation.
- Introduce **biological sources of nitrogen**, such as legumes, to reduce reliance on synthetic inputs.

5. Implement Regenerative Grazing

- Use **holistic or adaptive multi-paddock (AMP) grazing** to prevent overgrazing.
- Allow **sufficient recovery time** for pasture regrowth, ensuring continuous photosynthesis.

Key Practices That Contribute to Soil Carbon Loss

1. Short Growing Seasons

- Limited photosynthesis means **less carbon is pumped into the soil** via root exudates.
- Without living plants for most of the year, carbon losses outpace inputs.

2. Overuse of Pesticides & Herbicides

- Many pesticides and herbicides **oxidise soil carbon**, releasing it as CO₂.
- These chemicals **harm beneficial microbes**, especially mycorrhizal fungi, which help convert carbon into stable humus.

3. High-Analysis Fertilisers (e.g., Synthetic Nitrogen)

- Excessive use of synthetic nitrogen and phosphorus **inhibits mycorrhizal fungi**, reducing their ability to stabilise carbon.

- Nitrogen fertilisers can also **accelerate soil oxidation**, leading to faster carbon depletion.
- 4. **Tillage**
 - Tillage **breaks apart soil aggregates**, exposing organic matter to oxygen and **accelerating microbial decomposition**.
 - It also disrupts fungal networks, which are essential for converting organic carbon into long-term stable humus.
- 5. **Overgrazing in Pastures**
 - Overgrazing **reduces plant recovery time**, leading to less photosynthesis and fewer root exudates feeding soil microbes.
 - Bare soil is exposed, increasing oxidation and microbial decomposition rates.

Cover Crop Goals

The following are goals you can select for your cover crop. You can select up to three goals where the primary goal will receive the greatest weighing for mixing, then secondary and finally tertiary. Secondary and tertiary goals are optional.

Weed Suppression

Cover crops selected for weed suppression grow quickly and form dense canopies that outcompete weeds for sunlight, moisture, and nutrients—naturally reducing weed pressure without herbicides.

Nitrogen Fixation

Legume cover crops form symbiotic relationships with soil bacteria to convert atmospheric nitrogen into plant-available forms, reducing the need for synthetic fertilisers and boosting nitrogen levels in the soil.

Recover Nutrients

These species scavenge leftover nutrients—particularly nitrogen and phosphorus—from the soil profile after a crop cycle, preventing leaching and making nutrients available for the next crop.

Biofumigant

Certain brassicas and other plants release natural compounds when decomposed that suppress soil-borne pests, diseases, and nematodes—helping to reduce chemical inputs.

Improve Soil Health

This goal focuses on increasing soil microbial activity, organic matter, structure, and overall function, supporting long-term fertility and resilience through biological processes.

Reduce Erosion

Species selected for erosion control have fast establishment and extensive root systems that hold soil in place, protecting topsoil from wind and water erosion.

Provide Lasting Residue

These crops leave behind high-biomass or lignin-rich residues that decompose slowly, offering extended ground cover, moisture retention, and erosion protection into the next growing season.

Break Topsoil Compaction

Shallow-rooted species with strong root systems help loosen surface compaction caused by machinery or livestock, improving aeration and root penetration in the topsoil.

Break Subsoil Compaction

Deep-rooted species with strong tap roots can penetrate hardpans and compacted subsoil layers, improving water infiltration and access to deeper nutrients.

Supplemental Grazing

These cover crops are palatable and nutritious, making them ideal for rotational grazing systems and providing additional livestock feed while benefiting the soil.

Attract Beneficial Insects

Species that flower or provide habitat for predatory and pollinating insects support natural pest control and ecological balance in the farm system.

Mycorrhizal Fungi Growth

Plants that support mycorrhizal fungi help form networks that enhance nutrient and water uptake. These symbiotic fungi are key to long-term soil health and biological fertility.

The Importance and Benefits of Practicing Crop Rotation

Improving Soil Fertility

There's probably nothing more important to a farmer than maintaining the health of their soil — and it is also one of the main objectives of crop rotation. Crop rotation has long been recognized as the best way to keep a field healthy and thriving, making it possible to naturally add nutrients to the soil and improve biodiversity.

Reducing Soil Erosion

Soil erosion can also be an issue with mono-cropping, especially if the farmer is only planting crops with deep roots. This leaves the topsoil loose and easily disturbed by wind and rain.

A crop rotation system can help with this in two ways. First, by varying up the types of root systems — shallow vs deep — it can help maintain the overall structure of the soil. In addition, many grains and cereals produce residue and detritus that helps bind the topsoil together, helping prevent erosion.

Protecting Biodiversity

Healthy soil contains a rich ecosystem of microorganisms, many of which are beneficial to the growth of crops, or even necessary for crops' survival. However, mono-cropping combined with an increased use of chemical fertilizers can harm this ecosystem, or even wipe it out. In time, this creates a dangerous cycle where the farm must keep using more and more fertilizer, without ever allowing the soil to rebuild the ecosystem. Crop rotation can help prevent this issue and promote healthy thriving soil year-round.

Reducing Pests, Diseases, and Weeds

Pests, diseases, and weeds all thrive in a monoculture. The longer the same crop is raised in the same field, the more it will invite threats that feed off of that crop. However, if crops are constantly rotated on multi-year cycles, that makes it much harder for these sorts of threats to take root.

Good rotation planning means also taking pests and weeds into account, moving between crops that are hostile to the pests that might have thrived on the previous crop.

Reducing the Chances of Crop Failure

Mono-culture farming is inherently risky. All it takes is a single disease ravaging the harvest, and it could be ruined. Worse, these diseases can live in the soil for years, making it difficult to restart farming. Likewise, soil fatigue is real, and sometimes the soil is so damaged that even fertilizer begins to lose its effectiveness.

There are also market factors to consider. A farm that only grows one crop is always at risk of market fluctuation. Crop rotation can also be seen as a form of investment diversification, so that there are more income sources than one single crop.

Making Environmental Improvements

Another side effect of erosion and unhealthy soil is that more irrigation is typically needed. This, in turn, leads to water waste — which is bad for your budget and for the planet. It's even worse if that water runoff is full of dangerous chemicals. Greenhouse gas emissions can be reduced as well, through less mechanical labor being needed to maintain the soil and crops.

Supporting Regenerative Agriculture

Crop rotation is a key aspect of [regenerative agriculture](#), an overall strategy for maintaining the health of a field with a minimum of artificial chemicals or methods that create greenhouse gases. [Sustainable farming](#) practices can significantly reduce your carbon footprint and further improve the overall yield.

And all of this adds up to the biggest benefits of all: higher yields and lowered costs. Nor are these benefits theoretical. [Studies](#) have shown that farmers who practice crop rotation see substantially larger yields, often in the 20%-30% range, compared to mono-culture farms.

Soil Health and Fertility

- **Restores nutrients:** Crops like beans and peas add natural nitrogen back into the earth.
- **Improves structure:** Alternating deep-rooted and shallow-rooted plants breaks up hard dirt and lets water flow better.
- **Boosts organic matter:** Diverse root systems increase beneficial soil microbes. [\[1, 2\]](#)

Pest and Weed Control

- **Breaks life cycles:** Changing plant types starves out pests that rely on one specific crop.
- **Stops diseases:** Soil-borne fungi and pathogens die off when their host plant is absent.
- **Reduces weeds:** Different crops shade the ground differently and require varied management, preventing weed adaptation.

Crop rotation helps prevent soil depletion since different types of crops contribute unique nutrients and reduce reliance on chemical fertilizers.

Strategic crop rotation improves soil fertility, reduces erosion, and protects biodiversity, supporting healthier and more productive farmland.

Crop rotation reduces the risk of pests, diseases, and weeds, which often thrive in monoculture systems, by breaking their life cycles.

Effective crop rotation requires thorough research, long-term planning, careful mapping, and record-keeping.

Verification Pathways

MRV definitions and tiers

In the ECOSYS context, MRV follows widely used definitions: Monitoring means collecting data and updating indicators; Reporting means presenting those results in a structured, transparent way; Verification means assessing completeness, consistency and reliability of the reported information through fact-based review. ECOSYS adopts a tiered approach where early pilots focus on internal and consortium-level review, and later phases add independent verification aligned with recognised standards.

Pilot-phase verification workflows

During the pilot phase, verification relies on a combination of automated checks and expert review. Automated checks validate data integrity, spatial consistency and temporal coverage across EO and compliance datasets. Expert reviewers from the consortium examine indicator behaviour, test edge cases and compare outputs with field observations and local knowledge. Where significant discrepancies are found, methodologies or data pipelines are adjusted and changes are documented to build a learning history for each indicator.

Future assurance and independent verification

In later phases, ECOSYS aims to integrate independent verification pathways compatible with carbon, biodiversity and nature-finance standards. This may include accredited third-party auditors reviewing monitoring plans, sampling strategies and indicator outputs, periodic field re-sampling for critical indicators like SOC, and formal validation/verification cycles similar to those used in established MRV frameworks. The exact mix of approaches will depend on use cases and partner requirements, and is therefore a key topic for discussion in this paper.

Total Expected Impact Value

From BCFI to true Value Accounting Approach

As visible in the tool, one major output or insight generated on the platform is the so-called “Expected Impact Value”. This is the conceptual “impact lens” that links ecological performance to potential value creation for projects, portfolios and territories. *It is presented here as a methodology concept, not yet a finalised metric, to invite discussion on design choices and use cases. Expected Impact Value is intended to support portfolio selection, prioritisation of interventions, pricing of outcome-based instruments and impact reporting. At this concept stage, key open questions include: how strongly to weight each dimension of impact, how to reflect uncertainty and data quality, and how to align the metric with emerging nature-finance and regulatory frameworks without losing simplicity. These are areas where pilot results and partner feedback will directly influence the next iteration.*

The **Expected Impact Value** translates a given BCFI score into a monetised expected value per hectare over time by combining several market factors into one overall cost-based impact evaluation. For arable systems (e.g. cereals in Austria with reference yields around 6,800 - 7,000 kg/ha), a higher BCFI is associated with more stable yields over time and reduced downside risk, which we capture through expected crop yield and expected crop price components. Additional TEIV components include flood and erosion prevention, carbon emission prevention and sequestration (e.g. around 1.5 t CO₂/ha at indicative EU ETS price levels), enhanced ecosystem services (pollination, pest control, resilience), reduced input costs over a 10-year transition horizon, water regulation and fresh water benefits (especially for grassland), and the expected nutrient value of increased soil organic matter (e.g. roughly €2,050/ha per additional 1% SOM, or €205/ha per 0.1% SOM). [[evalforearth](#)]

Methodology structure

Methodologically, the BCFI is always calculated for a parcel. By summing up the scores of the parcels a portfolio/farm level value is calculated. BCFI is based on measurable biophysical indicators (soil organic matter, ground cover, crop diversity, landscape features, LULCF layers, carbon balance proxies) - with each indicator normalised and weighted by expert knowledge into a composite score. This BCFI score serves as the main driver in parametric valuation functions for each TEIV component (yield, price, risk reduction, ecosystem services, soil value, etc.), which are then summed into a transparent TEIV per hectare.

Example indicative pricing based on 65% BCFI Score

Component	Expected Value / Factors / Range	Key Info	Notes / Calculation Base	Example Outputs for 1 ha / year (conservative)
BCFI Score for this parcel				65
Crop Type				Maize

Consultation Paper for ECOSYS NCS Platform. Updated June 2026.

Please note the data and indicators are mentioned as underlying assumptions (e.g. for yields, prices, carbon factors, SOM value) For more Info, data sources or any questions please contact anne.gruboeck@eox.at or bernadett.csonka@eox.at.

Expected Crop Yield	e.g. 6,800 kg/ha (cereals)	Austria, 2022: 6,896 kg/ha cereals 4; higher BCFI → more stable yields over time	Higher BCFI leads to more stable yields over time - example Maize: 4 t/ha	7,00
Expected Crop Price	€180–€220/t (cereals, 2024)	Austria, varies by crop, higher BCFI may fetch premiums in future markets 8	Depending on average price in e.g. Austria - the higher the BCFI, the higher the expected price in the coming 10 years - €143/t	1.001,00
Reduced Input Costs	Up to 100 (avg.) €/ha/year	Lower fertilizer/pesticide needs & energy; initial transition may be costly, then average savings ~€100/ha/year	Lower fertilizer, pesticide needs, energy cost e.g. average to be taken from 10 years. initially higher costs, then savings to around 150EUR on average per hectare	65,00
Flood Prevention	100-800+ €/ha/year	Avoided damage, benefit transfer; depends on landscape and risk	Avoided damage, benefit transfer	520,00
Water Regulation (for Grassland)	€370–€1,110/h a/year,	Preventing nitrate cleansing cost	Improvement from regen ag: Cover crops, no-till, and SOM-building reduce nitrate leaching by 30–60% (meta-analysis consensus across European studies) meaning 570–1,710 m³/ha/year of water is effectively cleaned by the soil rather than requiring infrastructure treatment. Austria water cleaning cost €0.65/m³	650,00
Ground Water Recharge / Drought Resilience	50-120 €/ha/year	No-till systems: 50% reduction in nitrate leaching vs. conventional tillage	Groundwater recharge value: €65–€130/ha/year as a conservative standalone component, based on 100–200 m³/ha/year additional recharge at €0.65/m³ avoided treatment cost. Global meta-analysis of 41 studies: cover crops reduce nitrate leaching by 69% vs. fallow — the most rigorous single reference you can cite	65,00

Expected Soil Value	500-2,050 €/ha/year per 1% SOM/ha	Nutrient value: \$832/acre ≈ €2,050/ha for 1% organic matter; +€205/ha per 0.1% SOM increase	Nutrient value of 1% organic matter in the top 6 inches (15 cm) of soil is estimated at \$832 per acre (about €2,050 per hectare). This includes nitrogen, phosphorus, potassium, sulfur, and carbon. Every 0.1% increase in soil organic matter adds about \$83 per acre (€205 per hectare) in nutrient value alone.	1.235,00
Erosion Prevention	50-500+ €/ha/year	Replacement cost, avoided soil loss;	Austria: 9.3 t/ha average soil loss, prevention highly valuable	325,00
Carbon Emission Prevention	115-800+ €/ha/year	Based on €55/t CO ₂ (EU ETS price range 2024) and potential loss of 20% of top soil avoided through no-till	Based on e.g. 20COrg average, €55/t CO ₂	524,81
Carbon Sequestration	0.8-2 t CO ₂ /ha	Depending on BCFI value; higher BCFI = higher sequestration	Between 0,8 to 2t per Hectare depending on BCFI value - average 1.5 t CO ₂ /ha @55 EUR per ton	82,50
Ecosystem Services Enhancement	500-2,000 €/ha/year	Pollination, pest control, resilience; conservative estimate for healthy soils in Austria/EU	Pollination, pest control, resilience /Studies suggest that the ecosystem service value of healthy soils can reach €500–€2,000 per hectare per year (conservative estimate), depending on landscape context and management intensity with HNV grassland representing steady/final state.	975,00

Note: some of these values reflect benefit transfer valuation. It uses the cost of the service that nature replaces, not a direct market price. This is standard methodology in European ecosystem service accounting (e.g., TEEB, EU CAP network soil valuation work) and is fully defensible in that framing.

TEIV as an IMM-Equivalent Metric

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The Total Expected Impact Value (TEIV) produced by the ECOSYS methodology is structurally equivalent to the input required for an **Impact Multiple of Money (IMM)** calculation - the pre-deal impact standard pioneered by The Rise Fund and The Bridgespan Group. IMM asks one decisive question: for every €1 invested, how many euros of societal or environmental benefit are created? The Rise Fund commits capital only when the IMM shows a minimum 2.5× return, i.e., €2.50 of real-world impact per €1 deployed. TEIV answers exactly this question for ecosystem-service-generating assets, grounding it in satellite-verifiable biophysical outcomes.

The Six IMM Steps and How TEIV aims to deliver each

The IMM methodology consists of six structured steps. The table below maps each step directly to TEIV's contribution:

IMM Step	What It Requires	How TEIV / ECOSYS Delivers
1. Assess Relevance & Scale	What is the size of the problem and the addressable impact?	Parcel-level BCFI scores aggregated across farm portfolios establish scale; applicable to any arable or grassland system
2. Identify Target Outcomes	Which social or environmental outcomes will the investment produce?	Erosion prevention, flood risk reduction, water regulation, carbon sequestration, enhanced pollination & pest control, soil nutrient value
3. Estimate Economic Value	Monetise the outcomes in € terms	TEIV calculates all components in €/ha/year using benefit transfer and replacement cost methodology - the standard in EU ecosystem accounting (TEEB, EU CAP)
4. Adjust for Risks	Discount for the probability that impact will actually be delivered	ECOSYS satellite monitoring validates biophysical delivery over time; BCFI trajectory provides evidence-based impact realisation data
5. Estimate Terminal Value	Project value continuing beyond the investment horizon	TEIV uses a 10-year transition horizon with increasing ecosystem service value as BCFI improves; supports terminal NPV calculation
6. Calculate Return per € Invested	$TEIV \div \text{investment cost} = \text{IMM-equivalent ratio}$	E.g. a parcel generating TEIV of €5,400/ha/year against an investment of €1,500/ha produces an IMM-equivalent of 3.6× - well above the Rise Fund 2.5× threshold

What the TEIV Components Represent in IMM Terms

Each TEIV component in the table below constitutes a discrete, monetised outcome line, precisely the format required in IMM Step 3. Values shown reflect conservative outputs for a 1 ha / year example at BCFI score 65 (Maize, Austria), considered a good start for nature-based agri:

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TEIV Component	€/ha/year (conservative)	IMM Outcome Category
Expected Crop Yield & Price	~€1,001	Productivity / economic resilience
Reduced Input Costs	~€65	Cost avoidance
Flood Prevention	~€520	Avoided societal damage
Water Regulation / Nitrate Reduction	~€650	Environmental risk avoided
Erosion Prevention	~€325	Soil & infrastructure risk avoided
Carbon Emission Prevention	~€525	Climate externality avoided
Carbon Sequestration	~€83	Climate benefit
Ecosystem Services Enhancement	~€975	Biodiversity / resilience services
Expected Soil Value (SOM increase)	~€1,235	Long-term natural capital appreciation
TEIV Total (illustrative)	~€3000-5000/ha/year	Full IMM outcome stack

Note: Values use benefit transfer and replacement cost valuation - the standard methodology in European ecosystem service accounting (TEEB, EU CAP network).

Parcel ID: **244670067** ×

Area in (ha)	0.56 ha
BCFI Score	74.00 / 100 ⓘ
TEIV	€ 1,670 p.a. ⓘ

[Remove Parcel](#) ⓘ
 [See Details](#) ⓘ

Example showcase for how BCFI Values are shown vs. TEIV

Why This Matters for whom

Different actors plug into the BCFI / TEIV scoring in distinct but interoperable ways.

- Project developers use the index to identify and score parcels for nature finance eligibility and structure project pipelines.
- (Agri-)consultants and NGOs use it to prioritise restoration interventions by impact per hectare and to monitor progress.
- Food corporates use BCFI for regenerative agriculture monitoring, insetting and project tracing across their supply base.
- Agri-tech platforms can embed the methodology into their own tools and enrich it with ground-truth algorithms and farmer data.
- Impact investors use the scores, backed by continuous satellite evidence, to de-risk allocation, monitor performance and report on nature-related outcomes.

Institutional impact investors, including those deploying capital into habitat banks, agri-environment schemes, or NCS portfolios, currently lack a monetised, annualised return metric for nature assets that is comparable to financial multiples. Most nature reporting remains qualitative (biodiversity units, condition scores) or metric-based without a euro-denominated impact return.

TEIV changes this in three ways:

1. Pre-deal underwriting: Investors can calculate the expected TEIV for a parcel or portfolio *before* capital deployment, directly analogous to how IMM is used by the Rise Fund as a go/no-go filter.
2. Ongoing reporting: Satellite-validated BCFI scores update the realised TEIV each monitoring cycle, enabling annual impact reporting in €/ha, the "impact realisation" adjustment that IMM Step 4 requires.
3. Portfolio-level aggregation: TEIV scales linearly across hectares, enabling fund-level IMM calculations across diverse NCS portfolios, from arable transition land to restored grassland, in a single comparable metric.

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Per Annum View (Simple)

Per year, the ratio is straightforward:

- Investor cost (initial pilot): €400/ha/year (Landowner reimbursement + dMRV & Admin)
- TEIV generated: €4,377/ha/year
- Annual impact ratio: 10.9x - meaning every €1 invested generates €10.94 of ecosystem impact value per year

Full IMM (Holding Period - Standard Methodology)

The Rise Fund IMM discounts future impact cash flows back to present value, exactly like a financial DCF. The formula is:

$$IMM = \text{NPV of total impact over holding period} / \text{Total capital invested}$$

Assuming a 10-year holding period and a 5% social discount rate (standard for ecosystem service valuations in EU frameworks):

Parameter	Value
Annual TEIV	€4,377/ha
Discount rate	5%
NPV of TEIV over 10 years	€33,800/ha
Annual investor payment	€400/ha
NPV of total investment over 10 years	€3,089/ha
IMM (10-year)	~10.9x

The IMM ratio stays remarkably stable only for already regenerative parcels/portfolios, but not where there are medium BCFI Scores that will rise as land quality is improved over the initial time span.

The IMM is now not stable – it compounds meaningfully, rising from ~11x at baseline to 25x+ over a 30-year BNG-equivalent holding period.

Year 1 TEIV already delivers an IMM of ~11x. But unlike most impact investments, TEIV grows as the land regenerates - SOC accumulates, landscape features mature, and input costs fall. At a conservative 5% annual improvement, the 10-year IMM reaches 15x.

Methodology Validation

TBU

References

<https://iucn.org/sites/default/files/2024-05/oecms-in-europe-final.pdf>

Annexes

Technology Stack

Technological Implementation & Processing

Backend Infrastructure & Scalable Data Processing

To evaluate Natural Capital on a massive scale, the ECOSYS platform uses EOxHub Workspace in order to ingest, analyze multi-source Earth Observation (EO) datasets, derive critical ecosystem metrics and process millions of individual agricultural parcels seamlessly.

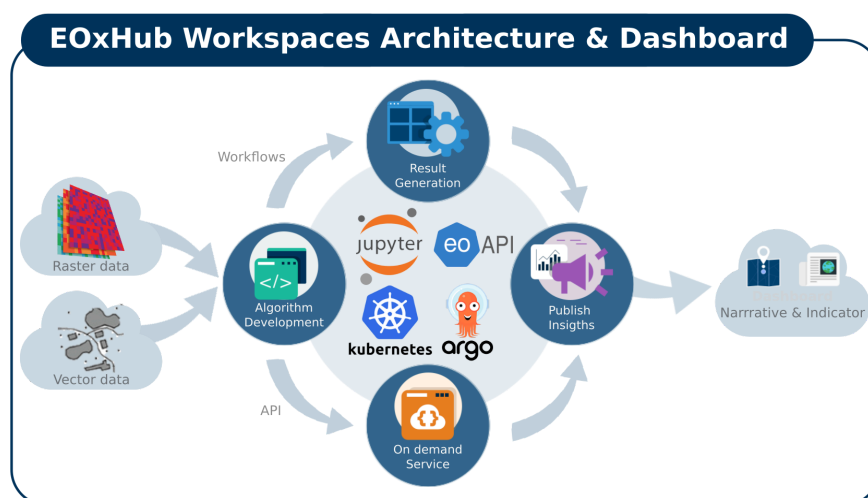
Biodiversity Carbon Farming Index (BCFI):

TheBCFI operates as an automated, modular data pipeline that processes parcels through independent sub-indexes pipelines (ingestion, preprocessing, sub-index computation for each parcel) before aggregating the sub-indexes into the final BCFI score (using a configurable weighted formula)

EOxHub Workspace:

Built on an open-source, cloud-native full-stack processing framework that provides a production-ready GIS/EO environment in the cloud:

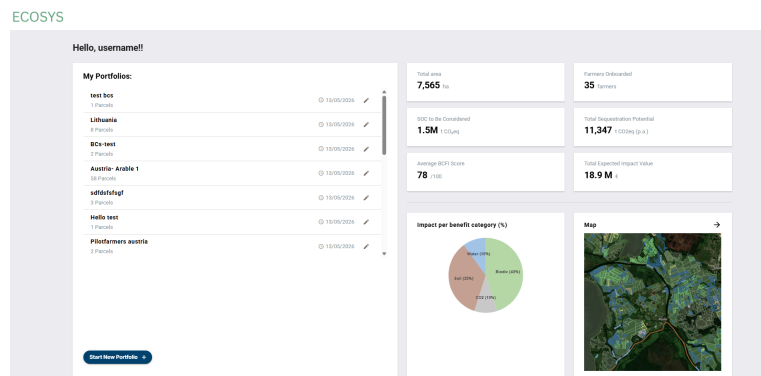
- **Multi-Source Data Analytics:** Automated pipelines ingest and analyze both Raster data (satellite images and datasets) and Vector data (parcel boundaries and datasets) to extract targeted ecosystem monitoring indicators.
- **Scalable Container Orchestration & On-Demand Processing:** Bridges the gap between algorithm development and production by allowing the building of models in Jupyter. Welds Kubernetes and Argo Workflows together to manage scalable data processing pipelines and automate complex computing tasks across millions of parcels. These pipelines can be then deployed as automated, on-demand services to generate results.
- **Relational & Spatial Storage:** Stores all processed parcel data, metadata, geometries and ecosystem metrics in an optimized PostgreSQL database.
- **Secured Isolation:** Utilizes individualized, secure cloud workspaces and storage buckets to keep data processing pipelines isolated and safe.



Frontend Visualization & Analytics

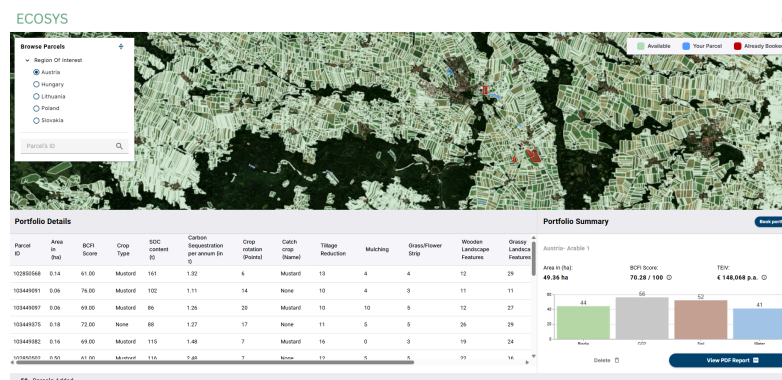
The ECOSYS interactive platform provides intuitive visualization tools and analytics that translate complex markers into clear and actionable Natural Capital insights.

- **Unified Analytics Dashboard:** Combines multiple distinct projects relating to NCS into a single, cohesive, web-based interactive interface.
- **Role-Based Access Control:** Providing different user types / levels of platform access to safeguard confidential information and restrict data visibility based on user permissions.



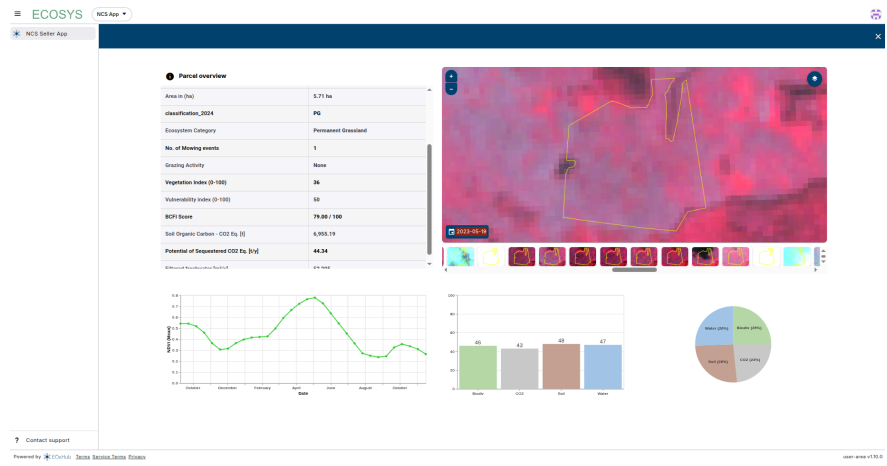
Welcome page of the platform

- **High-Performance API Integration:** The frontend dynamically fetches indicators, parcel metadata and historical time-series data directly from the backend via tailored APIs.
- **Parcel Explorer:** Features a central map element that allows users to browse and visually inspect agricultural parcel data, using responsive mouseover to glimpse parcel metadata.
- **Portfolio Management & Booking:** Allows investors to select, book and add specific parcels to a personal portfolio. The system enforces strict exclusivity controls, ensuring a parcel already reserved in one portfolio cannot be selected by another user.



Parcel Explorer

- **Temporal Signal Tracking & Charts:** Includes an interactive chart element providing insights into changing EO signals or markers over time (such as NDVI).
- **Image Grid & Satellite Verification:** Enables a direct look at the raw imagery used for product generation. Users can view parcel imagery at different dates and toggle between pre-defined color composites or spectral indexes.



Parcel overview

Glossary

