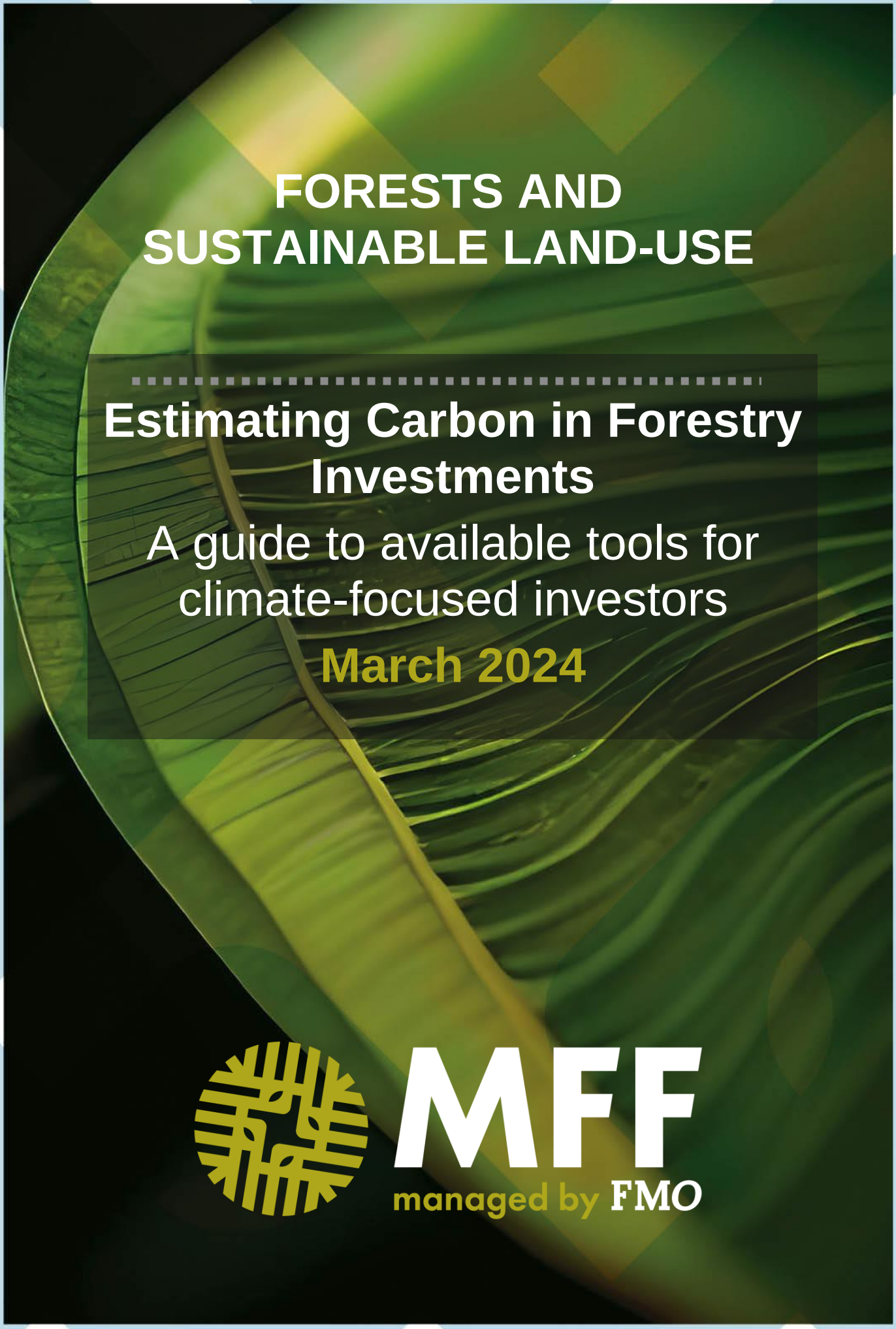

FORESTS AND SUSTAINABLE LAND-USE

Estimating Carbon in Forestry Investments

A guide to available tools for climate-focused investors

March 2024

MFF
managed by FMO

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The Mobilising Finance for Forests program is managed by FMO and funded by the UK Government

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About this guidance

As DFIs and other investors intensify efforts to combat climate change, the role of nature-based investments are becoming increasingly important. Reliable tools can help to both assess opportunities and mitigate the risks associated with investing in nature, facilitating the allocation of funds to projects that deliver essential climate mitigation outcomes. This guide aims to help users navigate the landscape of available carbon impact measurement tools, understanding their purpose and application. Covering both individual and portfolio-level analyses in the guiding, screening, due diligence and monitoring stages, it explores projecting carbon impact and measuring greenhouse gas emissions across portfolios. Emphasizing neutrality, the guide supports users in discerning between tool capabilities, accurately assessing projections, understanding limitations, and comparing information generated by different tools.

The Mobilising Finance for Forests (MFF) LCIP (Learning, Convening and Influencing Platform) has developed this guide to support investors and other project decision makers to better select the right carbon measurement tool for the right purpose.

About Mobilising Finance for Forests

Delivered by FMO with funding from the UK's International Climate Finance Fund, the Mobilising Finance for Forests programme was established in 2021 as a blended finance investment program to combat deforestation and other environmentally unsustainable land use practices contributing to global climate change.

Mobilizing Finance for Forests investments will, over time, contribute to a reduction in deforestation rates by stimulating the growth of private sector investment in markets that create value from standing forests and incorporate forest protection into sustainable agricultural practices.

More information about MFF can be found here: https://www.fmo.nl/mobilising-finance-for-forests

Contents

1 Introduction

Introduction

Investing in nature is key to fighting the climate crisis

The prevailing scientific consensus underlines that to achieve the targets set by the Paris Agreement, we must reduce greenhouse gas emissions by nearly half[1] within the next decade. Forests play a critical role as both a carbon sink, and as a result of deforestation and degradation, a significant source of emissions. To date, as much as half of the world's forests have been lost and ongoing deforestation accounts for between 0.9 and 2.3 gigatonnes of carbon each year[2] (approximately 15% of annual anthropogenic carbon emissions). It's important to recognize though that nature can also serve as an ally in combating the climate crisis.

Measuring carbon: a challenge for investors

Investors too, are increasingly recognizing the significance of nature-based solutions[3] (NbS) in effectively mitigating the climate crisis by reducing greenhouse gas emissions, and are increasingly looking to include NbS alongside other climate positive investments in their portfolio. Supporting initiatives that safeguard and rehabilitate natural environments, particularly tropical forests, can be a pivotal component of financial institutions' efforts towards sustainable transitions. However, accurately assessing the carbon sequestration and reduction potential of such projects is complex, and the lack of transparency or comprehension regarding the carbon impacts of investments can impede financiers considering investments in new sectors and projects. Additionally, inaccurate carbon modelling, which may over or underestimate the carbon benefits of projects, can lead to potential reputational risks in the commercial sphere, such as accusations of greenwashing, further complicating efforts to expand nature-focused financing.

Numerous carbon modelling tools are available in the market, each with their unique features, designed to aid investors, project developers, and decision-makers in evaluating and contrasting carbon removals and avoidance in various NbS projects. This document aims to guide readers on how to effectively utilize these tools, how they stack up against one another, which specific questions each tool can address, and what decisions can be informed by the information provided by each tool.

Making sense of carbon modelling tools

Methodologies amongst tools can vary significantly, with some tools aligning with international greenhouse gas inventory standards, while others rely on counterfactual scenarios based on baseline assumptions. These methodological distinctions mean that the tools serve diverse purposes, from modelling potential impacts to contributing to climate targets, monitoring outcomes, or assessing project risk. Different tools can provide insights at both project and portfolio levels of analysis. For detailed assessments of project carbon removal or avoidance, certain tools necessitate precise data inputs, while others use broader assumptions to enable quicker activity-based analyses, yielding an approximate range of carbon impact.

For instance, an investor seeking advice on optimizing carbon sequestration in their portfolio may utilize a tool that relies on activity-based assumptions to estimate how various investment combinations will progress towards a predefined carbon removal goal. Such a tool proves beneficial during the initial stages of fund or portfolio strategy development. Conversely, an investor aiming to assess how a particular project will perform in terms of carbon removal or avoidance per unit currency invested would require a different tool. This tool would leverage detailed project data to provide insights into the project's carbon return. It may also play a crucial role in the decision-making process regarding whether to proceed with a specific investment.

Choosing the appropriate carbon modelling tools is critical for making well-informed investment choices that deliver positive climate and environmental outcomes, in addition to financial returns for investors. Maintaining the integrity of carbon modelling is crucial. However, investors must strike a balance between granularity and practicality to ensure a smooth flow of funding into nature-based solutions, rather than impeding it. Various tools offer different levels of precision in addressing specific questions. Hence, investors will benefit from familiarizing themselves with the array of available carbon modelling tools and may opt to employ a range of tools throughout the investment process, building the capacity to deploy the ones pertinent to them.

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[1] https://unfccc.int/news/climate-plans-remain-insufficient-more-ambitious-action-needed-now
[2] https://www.nature.com/articles/s41586-023-06723-z
[3] The International Union for Conservation of Nature (IUCN) defines Nature-based Solutions as "actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits".

It is important to note that disclosing carbon data generated through use of carbon modelling tools may engender reputational risks if external parties question the accuracy of the data or contest the assumptions that are used to arrive at a certain estimate. To mitigate this risk, it is important that tool users be transparent about which tool is used for the calculation and the margin of error involved in using that tool. Tool users must also be careful not to misrepresent carbon data as a certainty, but rather clearly communicate the estimate nature of carbon modelling. Understanding carbon modelling tools' methodologies, use cases and inherent limitations is the first step to selecting the appropriate tool and communicating carbon data generated in an accurate, robust manner.

This guide aims to assist users in navigating the array of available carbon modelling tools in the market and understanding their purpose, use case, and application. This, in turn, will empower investors to make well-informed decisions when investing in nature. It's important to note that this guidance document will not endorse the use of one tool over another. Instead, it will support users in discerning between tool capabilities, accurately assessing the value of tool projections, understanding their limitations, and comparing information generated by different modelling tools.

Target audience

Investors (impact and other types), DFIs, commercial carbon/NBS fund managers, and other purchasers of carbon credits seeking a clearer understanding of how to monitor for and measure the carbon potential of their portfolios.

How the guide was produced

This guide was prepared by the MFF LCIP. First, a comparative framework was developed to clearly distinguish between the tools. This framework was reviewed with the help of Form International, and draws from feedback from members of the UNEP's ESKEN[4] (Environmental and Social Knowledge Exchange Network) collected during an in-person practitioner workshop. Following this, tools were identified and then compared against the framework prior to being categorized against the framework's distinguishing characteristics.

[4] https://www.unep.org/resources/newsletter/environmental-and-social-knowledge-exchange-network-esken

2 Comparative methodology and framework

Comparative framework

A comparative framework has been used to systematically analyse and evaluate the series of carbon modelling tools against a set of predefined criteria. It provides a methodical way to assess distinct aspects of the tools, allowing for informed decision-making around suitability. By employing a comparative framework, individuals or organizations can gain a clearer and more objective understanding of the attributes and outcomes associated with each tool, facilitating a more rational decision-making process.

The following table introduces the indicators used in the comparative framework alongside an example of how each has been used.

Indicator	Description	Sample data point
Headline indicators	**Website**: indicating where the information about the tool, or the tool itself, can be found. **Developer**: the organisation that developed the tool (possibly on behalf of another organisation). **Type**: Tools can be categorised into several groups including: • Guiding tool (explaining how carbon accounting etc. works) • Calculation tool (to quantify carbon, approximation) • Due diligence tool (to inform investment decisions) • Monitoring (for post-investment use) **Accessibility**: The availability of the tools varies depending on given access and funder requirements and could be one of several options: • open-source • commercial • internal use/by request only	*N/A*
Overview	A high-level overview of the tool.	*N/A*
Purpose	The main purpose for using the tool. Options could include one or more of the following: • pre-investment due diligence, • scenario analysis at portfolio and project levels, • post-investment monitoring etc.	*This tool can be used for projecting carbon balance prior to making an investment.*
Format	Although it may not make any difference to the outputs, the tool format is important to note. Options may include: • Online application • Offline executable application • Excel • Other offline	*Online*
Geographic scope	Not all tools are globally applicable. This indicator distinguishes between the geographical/biome applicability of the tools. Options may include: • Global • Temperate only • Tropical only • ODA eligible countries only	*Tropical application only*
Tool scope	Certain tools offer the ability to focus on projects only, or portfolios only. Some tools focus on both. This indicator	*Allows project level calculation only.*

	distinguishes between the scope of tools in relation to a project/portfolio focus.	
Carbon credit type	If the tool offers scope for initial scoping in the setup of a carbon project then carbon credit type whether that be for avoidance or removal is a useful distinguishing factor.	*Does not distinguish between avoidance and removals (carbon balance).*
Carbon project type	Similarly to carbon credit type, this indicator distinguishes between the three main FSLU carbon project types: • ARR (Afforestation, Reforestation, Restoration), • IFM (Integrated Forest Management) and • REDD+ (Reducing Emissions from Deforestation and Forest Degradation)	*Used only in REDD type projects.*
Carbon pools	Projects may require calculation (or have available data which may aid calculation) against one or more of the following carbon pools: • AGB – Above Ground Biomass • BGB – Below Ground Biomass • SOC – Soil Organic Content / Peat Content • HWP - Harvested Wood Products • LI – Leaf litter • DW – Dead Wood	*Accounts for AGB and BGB only.*
Methodology	A high-level overview of the methodology used in the carbon modelling calculations. It is important to include the transparency of data and methods in this section.	*The methodology uses a counterfactual assessment between what may have happened in the absence of the project and the case the intervention is effective.*
Assumption basis	This field exposes any key assumptions used in the main calculations. For example, does the tool rely on IPCC values (i.e. for AGB and root-to-shoot) or does it use forest reference emission level (FREL) values or other input sources.	*The tool draws upon the IPCC methodological principles with the option to supplement with project specific data.*
Minimum requirements for use	Here we assess the minimum requirements for use in relation to data and user experience level. Options here include: • Expert vs 'lay-man' user level • Tier 1* data or project specific data (demanding or easy data collection) * A description of the three tiers can be found in the call out box below	*Both lay-man and expert options available. Tier 1 and Tier 3 data inputs possible.*
Tool outputs	This indicator distinguishes tools by the unit measure of output. Options include: • Tonnes of carbon per $ invested • Carbon balance • Cumulative carbon removal by activity	*Carbon balance (prior to and after the intervention)*
Co-benefits	Certain tools offer information on the co-benefits of the project alongside the carbon benefit. These may include various SDGs (social and environmental), and/or financial returns.	*The tool includes the option to model social impact data alongside carbon.*

Each of the following tools was assessed against the comparative framework:

- MFF Forestry Carbon Intensity Matrix and Impact Model
- EDFI Frescos
- FSC Forest Carbon Monitoring Tool
- FAO Ex-Act Tool
- USAID AFOLU carbon calculator
- P4F/BII Carbon Project Appraisal Tool

In the following section, the guide will present use cases for each of the tools by target audience group. A decision tree to aid decision-making on which tool is most appropriate for the desired purpose is also presented. The next section showcases each of the tools and their evaluation against the framework.

Understanding the IPCC three-tier system

Carbon modelling tools typically come in different tiers based on their complexity, scope, and intended application. These tiers help users choose the most suitable tool for their specific needs and level of expertise. **Tier 1 carbon modelling tools** are often the most basic, offering simple calculations and estimations of carbon emissions. They are user-friendly and require minimal data input, making them suitable for investors looking to undertake a **quick assessment** of a project. Critically, these tools rely on industry averages and simplified methodologies to provide estimates, making them **less precise but more accessible**.

Tier 2 carbon modelling tools are more advanced and offer greater accuracy and flexibility compared to Tier 1 tools. They typically incorporate **more detailed data inputs** to calculate carbon emissions. They may offer features such as scenario analysis, carbon intensity benchmarks, and customizable reporting, allowing users to tailor their analysis to specific goals and requirements. However, they may still have **some limitations in terms of data granularity** and modelling complexity compared to Tier 3 tools.

Tier 3 carbon modelling tools represent the highest level of sophistication and complexity in carbon footprint analysis. These tools are typically used to conduct **detailed lifecycle assessments and comprehensive carbon accounting**. Tier 3 tools offer the most advanced features, such as detailed process modelling, integration with other sustainability metrics, and advanced scenario analysis capabilities. They require **extensive data inputs and expertise** to operate effectively but provide the most accurate and comprehensive insights into carbon emissions across the entire value chain.

Tier	Tool examples*	Data Types Used
Tier 1	FAO Ex-Act (also Tier 2)	National-level statistics, aggregated data
Tier 2	USAID AFOLU carbon calculator	Sector-specific data, regional statistics
Tier 3	EDFI Frescos	High-resolution spatial data, technology-specific parameters, policy scenarios

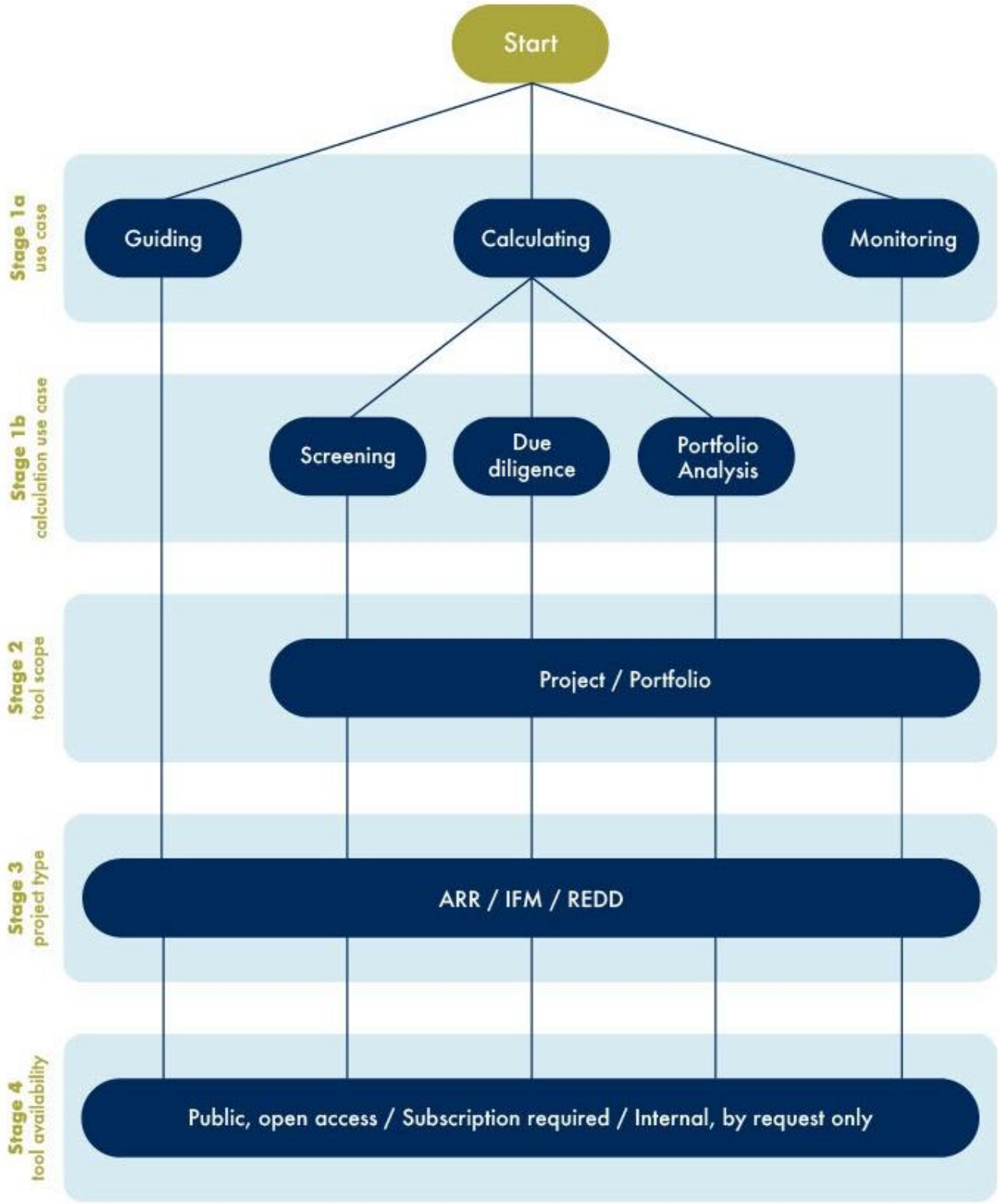
* certain tools also offer calculation at multiple tiers.

3 Guidance on tool selection

Decision guidance

The following decision tree aims to help investors and other stakeholders to systematically evaluate the various carbon modelling tool options and their potential outcomes. Starting from an initial decision point, the tree branches out into multiple paths, each representing a different desired outcome and use case. Readers can use the diagram to map out the decisions that need to be made to select the right tool for the right purpose.

Each stage of the tree represents a decision stage. The following tables then describe each of the decision stages in detail and identify the carbon modelling tools that meet that use case, tool scope, project scope or tool availability.



Stage 1a - use case

The following table lists each of the main use cases for the carbon tools, describes them, and suggests the most appropriate tool for each case.

Use Case	Description	Relevant tools
Guiding	To explain how carbon accounting works, or to guide organisations through the process. These can be specialised software or frameworks designed to provide direction and assistance in navigating the complexities of carbon-related processes. Rather than calculating for the carbon itself, these tools often offer instruct step-by-step instructions through the process, including what data inputs are required at what point to help users make more informed decisions.	BII/P4F carbon project appraisal tool [page 29]
Calculating	To estimate the carbon impact of the project/investment with varying levels of scrutiny. Screening tools offer preliminary estimates of carbon sequestration or avoidance before project investment, primarily relying on Tier 1 data. In contrast, due diligence tools provide a higher level of scrutiny that closely matches what the investment/asset is expected to yield in terms of carbon outcomes. Portfolio level tools have the added value that they can inform strategy, assess portfolio performance and build potential scenarios.	MFF Forestry Carbon Intensity Matrix and Impact Model [page 19] EDFI Frescos [page 21] FSC Forest Carbon Monitoring Tool [page 23] FAO Ex-ACT Tool [page 25]
Monitoring	To monitor carbon performance on an ongoing basis. To track and continuously gather real-time data on carbon-related processes. These tools can provide a means to observe and analyse changes in carbon emissions, sequestration, and other relevant factors over time. They may incorporate various monitoring technologies, such as remote sensing, ground-based sensors, and data collection networks, to capture comprehensive and accurate information. By offering up-to-date insights, a 'monitoring' tool enables investors to effectively manage their strategies in relation to carbon impact.	FSC Forest Carbon Monitoring Tool [page 23]

Stage 1b – calculation use case

Calculation	Description	Relevant tools
Screening	To provide estimates of the carbon sequestered or avoided prior to investing in a project. These tools mostly have Tier 1 (default) level data requirements or can be customized and play a critical role in rapidly evaluating and identifying key parameters or variables that have significant impacts on carbon-related processes. They serve as an initial filter, allowing investors to efficiently focus their efforts on the most influential projects. By identifying the most influential projects, 'screening' tools enables a more targeted and efficient investment approach, ultimately leading to more accurate and actionable insights on mitigation strategies. It is important to note that the calculation outputs in	MFF Forestry Carbon Intensity Matrix and Impact Model [page 19] EDFI Frescos [Tier 1] [page 21] FSC Forest Carbon Monitoring Tool [Tier 1] [page 23] FAO Ex-ACT Tool [page 25]

	screening tools are relatively coarse, not yet at the detail required for due diligence.	
Due diligence	To provide detailed information on carbon returns to inform investment decisions. These tools meticulously assess and validate the integrity of carbon-related data, models, and methodologies. They ensure that all aspects of the carbon modelling process meet rigorous standards of accuracy, reliability, and transparency in relation to internationally recognised methodological principles e.g. IPCC. A 'due diligence' tool can serve as a critical quality control mechanism, instilling confidence in the results and enabling investors to make informed decisions based on robust and trustworthy assessments.	EDFI Frescos [Tier 3] [page 21] FSC Forest Carbon Monitoring Tool [Tier 3] [page 23] FAO Ex-ACT Tool [page 25]
Portfolio Analysis	To evaluate the collective and/or incremental impact of a range of carbon sequestration and emissions reduction projects/investments. These tools integrate data from various projects, assessing factors such as afforestation, reforestation, improved forest management, and sustainable land use practices. They provide an overview of the carbon balance within the portfolio, offering insights into the net carbon sequestration, emissions avoided, and overall climate impact to facilitate strategic decision-making by identifying high-performing projects, potential areas for improvement, and opportunities for optimising the overall carbon impact. In some cases, these tools also incorporate project finance to make estimates of carbon intensity per currency unit invested.	MFF Forestry Carbon Intensity Matrix and Impact Model [page 19]

Stage 2 – tool scope

Scope	Description	Relevant tools
Project	These tools analyse carbon impact at the singular, project/investment level and are suitable for analyses on a case-by-case basis. They may be used when screening for an investment or at a later stage when conducting due diligence. They are not suitable when looking to estimate the impact of a portfolio of investments or the cumulative impact an additional project may have on an existing portfolio.	EDFI Frescos [page 21] FSC Forest Carbon Monitoring Tool [page 23] FAO Ex-ACT Tool [page 25]
Portfolio	Portfolio level tools provide added value by informing strategic decisions, evaluating portfolio performance, and constructing potential investment scenarios. Through comprehensive portfolio assessments, decision-makers can use these tools to better understand the carbon impact of different assets and projects, enabling them to prioritise initiatives effectively. Additionally, portfolio calculation tools capabilities in building scenarios allow organizations to simulate and analyse various future pathways, helping to identify optimal strategies for emissions reduction and overall portfolio optimisation. Carbon impact of the constituent projects that make up the portfolio is also analysed and presented.	MFF Forestry Carbon Intensity Matrix and Impact Model [page 19]

Stage 3 – project type

Project scope	Description	Relevant tools
ARR	Tools for ARR (**Afforestation, Reforestation, and Revegetation**) projects focus on estimating the carbon sequestration potential of newly established forests or restored ecosystems. These tools typically consider factors such as tree species, growth rates, and land use change to quantify carbon removals over time. The emphasis is on assessing the net increase in carbon stocks, and possibly – if relevant - providing a basis for carbon credit issuance. ARR-specific tools may also consider factors like biodiversity enhancement and ecosystem services to offer a holistic evaluation of the project's environmental impact.	MFF Forestry Carbon Intensity Matrix and Impact Model [page 19] EDFI Frescos [page 21] FAO Ex-ACT Tool [page 25]
IFM	In relation to IFM (**Improved Forest Management**) projects, carbon calculation tools are tailored to assess the impact of sustainable forestry practices on carbon stocks. These tools evaluate extraction activities, forest growth rates, and changes in carbon density resulting from improved management strategies. IFM tools may also account for avoided emissions by preventing deforestation, considering the carbon sequestration potential of standing forests. The nuanced nature of IFM projects requires tools that can accurately measure carbon fluxes, including emissions from logging and decomposition, to determine the overall carbon balance.	MFF Forestry Carbon Intensity Matrix and Impact Model [page 19] FSC Forest Carbon Monitoring Tool [page 23] FAO Ex-ACT Tool [page 25]
REDD	Carbon calculation tools for REDD (**Reducing Emissions from Deforestation and Forest Degradation**) projects aim to quantify the emissions reductions achieved by preventing deforestation and degradation activities. These tools consider baseline emission levels, potential emissions without intervention, and the actual emissions resulting from project implementation. REDD-specific tools often incorporate satellite imagery, remote sensing data, and on-the-ground monitoring to assess changes in land cover and forest health. The tools may also account for the social and environmental co-benefits associated with forest conservation, providing a comprehensive evaluation of the project's contribution to climate change mitigation and sustainable development.	MFF Forestry Carbon Intensity Matrix and Impact Model [page 19] FAO Ex-ACT Tool [page 25]

Stage 4 – tool availability

Accessibility	Description	Relevant tools
Public, open access	These tools – often publicly funded - are freely available and open for public use. They may require sign up, after which the tool can be used by registered users.	EDFI Frescos [page 21] FSC Forest Carbon Monitoring Tool [page 23] FAO Ex-ACT Tool [page 25]
Internal / by request only	Tools that are currently by request only although may be released publicly in the future.	MFF Forestry Carbon Intensity Matrix and Impact Model [page 19]

Sample use case

An **impact investor**, focused on FSLU (Forests & Sustainable Land-use) investments, is considering a potential investment in a project aimed at enhancing **carbon sequestration and avoiding emissions** within the agricultural sector. The investor recognizes the importance of accurately estimating the carbon impact of the proposed project to align with their environmental objectives and meet **climate change mitigation goals**. After evaluating various tools available for estimating greenhouse gas (GHG) emissions and carbon sequestration potential, the investor opts for the **Food and Agriculture Organization's (FAO) EX-ACT tool** (page 25) due to its comprehensive coverage and suitability for their specific purpose. It provides a consistent method for **estimating and tracking** the outcomes of agricultural interventions on GHG emissions, making it a valuable resource for investors seeking to understand the environmental impact of their investments.

One key factor influencing the investor's choice is the tool's ability to **support policymakers and stakeholders** in integrating climate change mitigation objectives into policies and international commitments. The global applicability of the EX-ACT tool aligns with the investor's diversified portfolio, allowing them to **assess projects on a global scale**.

The investor is interested in **comparing two scenarios**: one with the implemented project and one without (baseline scenario). The Ex-ACT tool allows the calculation of the GHG emissions and carbon stock changes resulting from the project, providing a clear **carbon balance**. The tool's flexibility in using default coefficients or user-provided values (Tier 1 and Tier 2 approaches) offers adaptability to different project complexities.

The investor also acknowledges the importance of considering the **assumptions underlying the tool's results**. EX-ACT provides valuable estimates, but these are based on a set of assumptions and default values. While the EX-ACT tool **doesn't calculate co-benefits**, its outputs, including carbon balance (with and without intervention) and carbon balance by activity type, align with **international standards and guidelines** for greenhouse gas accounting. The investor recognizes the need for familiarity with agricultural and forestry practices and specific data related to the activities being assessed to ensure accurate input and interpretation of results.

In conclusion, by selecting the FAO EX-ACT tool, the impact investor gains a **reliable and globally applicable instrument** for estimating the carbon impact of their agricultural investments. The tool's comprehensive approach and alignment with international standards make it a valuable asset in the investor's decision-making process, ensuring that carbon balance is a key consideration in their portfolio.

4 Tools analysis

Tools analysis

MFF Forestry Carbon Intensity Matrix and Impact Model

Website: NA

Developer: Form International on behalf of MFF (Managed by FMO)

Type: Screening / due diligence

Accessibility: Internal / by request

Overview

This Excel model permits users to input both financial and technical details of forestry investments, facilitating the estimation of the investment's carbon intensity - the carbon return per Euro or dollar invested. The tool accommodates the input of up to 100 projects, allowing assessment of the overall impact at the portfolio level. Additionally, the tool has a specific focus to return project and portfolio metrics by 2030 and 2050.

Purpose

The tool was designed to enable FMO as well as Impact Investors to make well-informed assumptions and projections supported by data and expertise regarding the carbon 'intensity'[5] of various types of forestry and land use projects. With this information, along with assessments of overall impact, risk, and return, investors can confidently formulate and justify their decisions on which projects align with their ambition for their forestry portfolios and overall portfolio emissions targets.

Format

The tool uses the offline Excel format.

Investment portfolio						
			Investments			
		Unit	**1**	**2**	**3**	**4**
General investment details	Project	[text]				
	Subproject (if applicable)	[text]				
	FMO forest subsector	[drop down]				
	Carbon project type	[drop down]				
	Carbon credit type	[automatic]				
	Country	[drop down]				
	Continent	[automatic]				
	Ecological zone (IPCC)	[drop down]				
	Forest type	[drop down]				
	Number of additional years in a rotation (IFM - ERA)	years				
	Agroforestry type	[drop down]				
	Species	[drop down]				
	Type of investment	[drop down]				
	Total investment amount	mio€				
	Investment share	%				

Scope

Geographic scope

The tool can be used in all tropical forested landscapes (tropical dry, rainforest, moist deciduous and mountain forests) across a wide range of forestry subsectors.

[5] Meaning the amount of carbon sequestration/avoidance per dollar invested (tCo2/$)

Tool scope	Carbon credit type	Carbon project type	Carbon pools included
Project and/or portfolio level	*Avoidance and/or removal*	*IFM, ARR, REDD+, NTFPs (Non-timber forest products)*	*AGB, BGB, SOC (depending on significance)*

Methodology

In order to account for the emission reductions, avoidance, and removals financed by the investor, the tool adheres to IPCC guidelines and methodologies endorsed by both the Clean Development Mechanism (CDM) and Verified Carbon Standard (VCS). These methodologies are widely recognized in the forest carbon sector and have undergone continuous refinement and scrutiny since 1992. Additionally, the tool developers adopted an approach for compatibility with the draft emission removal quantification framework of PCAF (the Global GHG Accounting and Reporting Standard for the Financial Industry, Draft for Pilot Testing and Review, September 2022).

Assumption basis

It is important to note that the tool provides ex ante estimates (forward looking estimates) of carbon intensities and is designed to strategically analyse a portfolio of current and future investments. As a result, the tool streamlines the calculation methods compared to the comprehensive carbon accounting methodologies used for carbon project certification. Some of the simplifications include the adoption of simplified calculation methods, ensuring that carbon projections achieve the highest attainable level of accuracy for the tool's purpose, and within the constraints of user-friendliness for non-forestry carbon specialists. The tool also employs default sub-sector emission factors rather than intricate project-specific factors, often by grouping and averaging.

However, the tool also allows for more granularity by offering the option to select either default factors or project-specific factors. The tool documentation provides brief descriptions of all the specific methodologies applied to each sub-sector. To establish the default emission factors for these sub-sectors, the tool developers gathered evidence from market and scientific studies, taking into account changing variables. In cases where evidence from external sources was limited, evidence was supplemented by in-house data, market intelligence, and FMO's own sources on other impacts, perceived risks, and returns associated with different sub-sectors.

Minimum requirements for use

The minimum data requirements differ for different project types but may include: forest sub-sector, carbon project type, carbon credit type, country, continent, ecological zone, forest type, rotation period, agroforestry type, species, investment details, risk information. The tool offers default values with the ability to override if specific detail is known.

Co-benefits

The tool also uses proxies (such a project type, country, etc) to estimate the likely social impact on a high level against SDGs 8 (Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all) and 10 (Reduce inequality within and among countries). The output is a social impact score between 1.5 and 13.5.

Tool outputs

Total carbon impact in tonnes.

Carbon impact per Euro m invested.

Carbon impact per activity type.

Social impact rating of investments

Risk and return rating of investments

EDFI Frescos

Website: https://www.frescos.earth/

Developer: Simosol Oy / AFRY with funding from Finnfund (Finland), FMO (Netherlands), Swedfund (Sweden) and BII (UK)

Type: Screening / ex-post calculation / modelling

Accessibility: Public, open-access, free to use

Overview

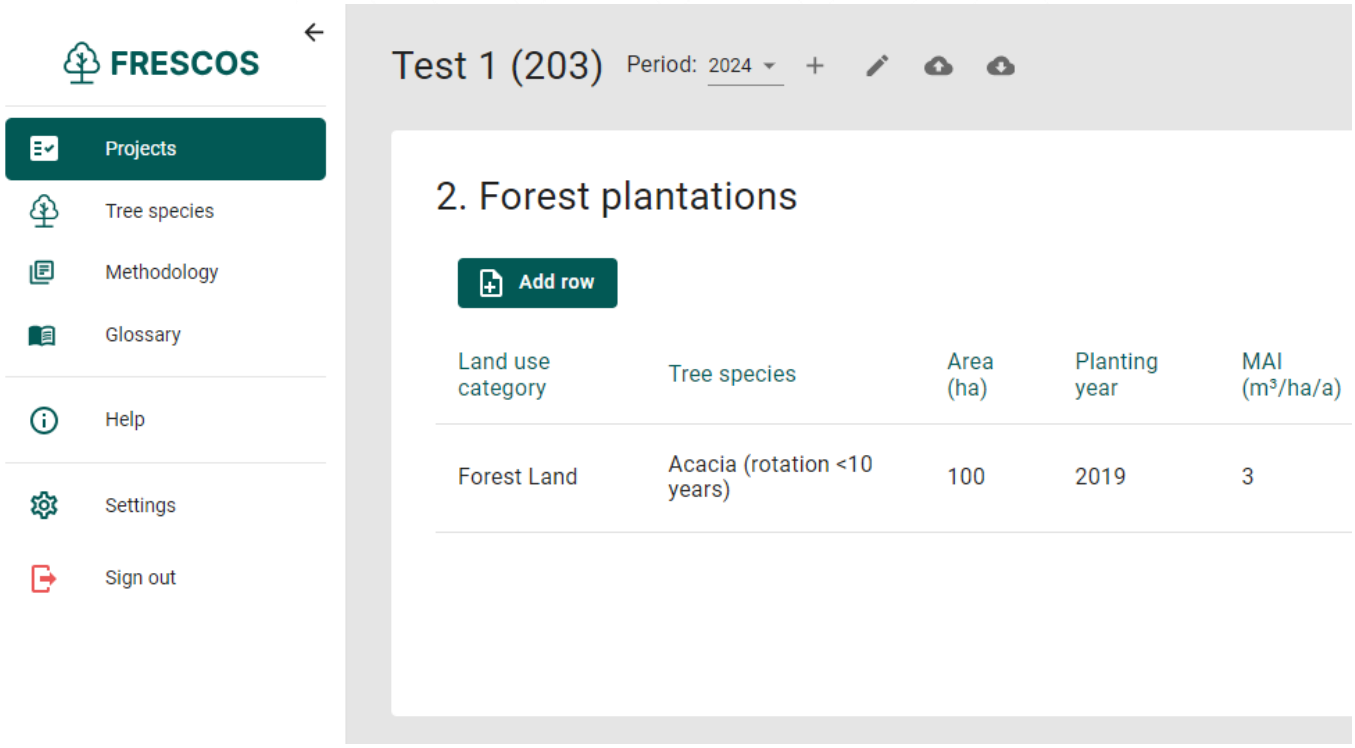
FRESCOS is a freely accessible tool designed for computing the carbon sequestration potential of forestry and agroforestry initiatives. It is available for use by anyone seeking to enhance their comprehension of the emission reductions achieved by their projects. The tool facilitates the computation of annual net carbon impact and supports longer-term scenario analysis, extending up to a span of 100 years.

Purpose

The primary objective of the FRESCOS Tool is to enhance the assessment and analysis of the carbon balance within forestry and agroforestry projects. This data can subsequently be used to calculate the annual net emissions of an investment portfolio.

Format

The tool uses an online format. Users can sign up for free access to the tool.



Scope

Geographic scope

The tool can be used globally across all forest types and IPCC climate zones.

Tool scope	Carbon credit type	Carbon project type	Carbon pools included
Project level	*Carbon removals only*	*ARR - Afforestation, reforestation, restoration Natural forests*	*AGB, BGB, SOC, DW, LI, HWP*

Methodology

The methodology employed by the FRESCOS Tool is based on the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, which provide internationally recognized procedures for conducting GHG inventories. The tool incorporates the latest methods pertaining to Agriculture, Forestry, and Other Land Use (AFOLU) as outlined in the IPCC Guidelines, along with the most recent refinements from 2019 (IPCC, 2019). The tool offers the option of selecting for high or low accuracy (default vs project specific data).

When operating at the higher accuracy level (Tier 3), the FRESCOS tool maintains a stringent level of rigour, albeit at the cost of increased methodological complexity. This is achieved through a more precise localisation of model parameters, heightened spatial resolution, and a broader scope of necessary data. Consequently, the selection of the appropriate Tier necessitates an evaluation of costs and efficiency in relation to data acquisition requirements. Furthermore, the decision regarding the desired level of accuracy should take into account the specific objectives of the assessment and the corresponding criteria needed to fulfil those objectives.

Assumption basis

The tool adheres to the foundational principles of the IPCC (2006) tiered methodology for calculating carbon sequestration and emissions in the AFOLU sector. It provides users with two levels of accuracy: Tier 1, which relies on default IPCC values, and Tier 3, which utilizes project-specific data.

The developers note that in the FSLU sector, numerous processes related to carbon sequestration and emissions can be geographically widespread and highly variable over time, which complicates the management of natural resources. Additionally, forests are susceptible to unforeseeable human activities and environmental pressures. Instances such as illegal logging, forest fires, or pest outbreaks can unexpectedly reverse the anticipated carbon flow, transforming a sustainably managed forest from a carbon sink into a source of emissions. A carbon inventory alone does not account for the permanence or potential revisability of carbon stocks. However, in FRESCOS, specific known uncertainties' direct impacts can be integrated and estimated using the 'disturbance rate' parameter, which indicates the share of the annual biomass growth rate that is lost due to natural processes and other reasons.

Minimum requirements for use

The minimum data requirements depend on the desired level of accuracy. At a minimum (IPCC Tier 1) data requirements include: inputs on the reported climate zone, continent, region, land-use class, soil class and land areas.

Co-benefits

The tool does not calculate for any co-benefits to carbon.

Tool outputs

Annual carbon stock net change by carbon pool.

Carbon stock development by carbon pool.

FSC Forest Carbon Monitoring Tool

Website: https://fsc.org/en/ecosystem-services-for-forest-managers

Developer: UNIQUE on behalf of the Forestry Stewardship Council

Type: Monitoring / modelling

Accessibility: Public, open-access, free to use

Overview

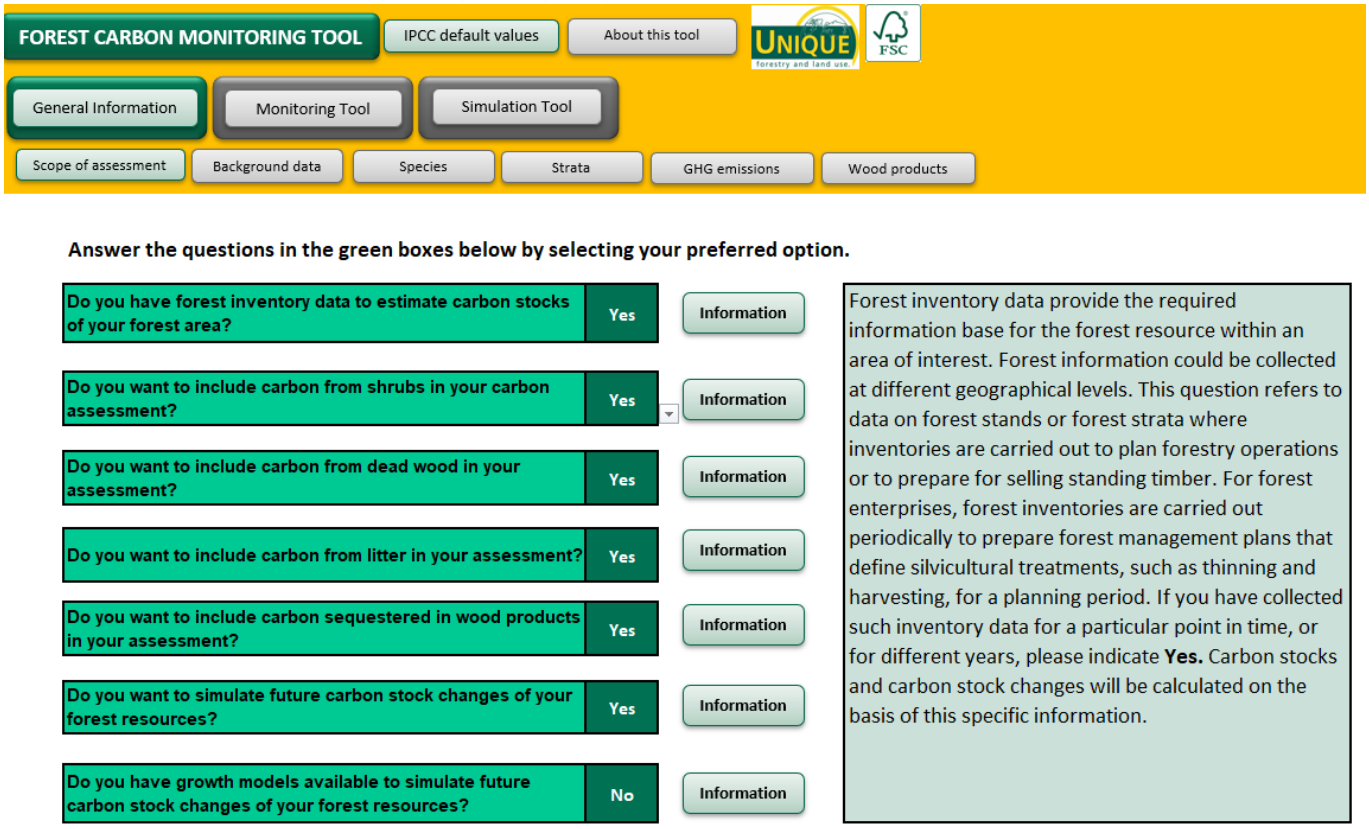
This tool offers FSC forest management certificate holders (and other users) an economical, pragmatic, and reliable solution for evaluating carbon stocks and fluxes associated with responsible forest management practices.

Purpose

Based on inventory data and management practices, forest managers can use the tool to calculate the tons of carbon that are stored in their forest and – if desired – include a simulation for the future changes in carbon stocks.

Format

The tool uses an offline Excel format. Users can download the tool from the FSC website.



Scope

Geographic scope

Most functionality of the tool is applicable globally. However, GHG emissions avoidance from reduced deforestation is only available in tropical landscapes.

Tool scope	Carbon credit type	Carbon project type	Carbon pools included
Project level	*The tool is not set up to calculate carbon credits but it does account for*	*The tool is not set up for carbon projects but does use IFM - Integrated forest management*	*AGB, BGB, LI (optional), HWP (optional), SOC (optional), DW (optional)*

	carbon avoidance and removals		

Methodology

The tool monitors and/or simulates forest carbon stocks of the most important forest carbon pools of forest management units (FMUs), or parts of them. The tool provides a flexible framework that allows forest carbon monitoring in tropical, temperate, and boreal forest ecosystems. Its application is broad: it can be used for rough carbon stock assessment and simulations even if no forest inventory data exist, as well as for FMUs. However, it works best, and is most accurate, if forest inventory data for an FMU are available; such data will be converted to CO2-equivalents (CO2e) within the tool. The smallest unit of assessment, 1 ha, can be scaled up to a full FMU.

Similarly to other tools, the reliability of results is highly dependent on the information entered into the spreadsheets. The more detailed the information provided from existing forest inventory data for an FMU, the higher the reliability of the carbon stock assessment. The more pre-set default factors/values used, the more uncertain the carbon stock assessment and/or simulation.

Assumption basis

The FSC tool uses the IPCC (2006) tiered methodology for estimating carbon impact (Tier 1 uses default IPCC values and Tier 3 uses project specific data). FSC recommend that once users become more familiar with carbon stock assessment, the default factors and values may be changed from uncertain international default factors and values to more site-specific information.

Minimum requirements for use

To use the tool, the user needs to define a minimum set of parameters:

- Under Background data, conditions specific to the FMU: Total area, Country/continent, and Biome (Boreal, Temperate, Tropical).
- Under Species, the main species or group of species within the FMU along with the corresponding parameters that convert tree volumes into biomass and carbon, respectively.
- Under Strata, each stratum with unique biological characteristics for which separate carbon monitoring/simulation should be performed, giving minimum descriptors (Area, Elevation, Precipitation).

Co-benefits

The tool does not calculate for any co-benefits to carbon.

Tool outputs

Carbon stock

Carbon stock change

FAO EX-ACT Tool

Website: https://www.fao.org/in-action/epic/ex-act-tool/suite-of-tools/ex-act/en/

Developer: UN FAO

Type: Monitoring / modelling

Accessibility: Public, open-access, free to use

Overview

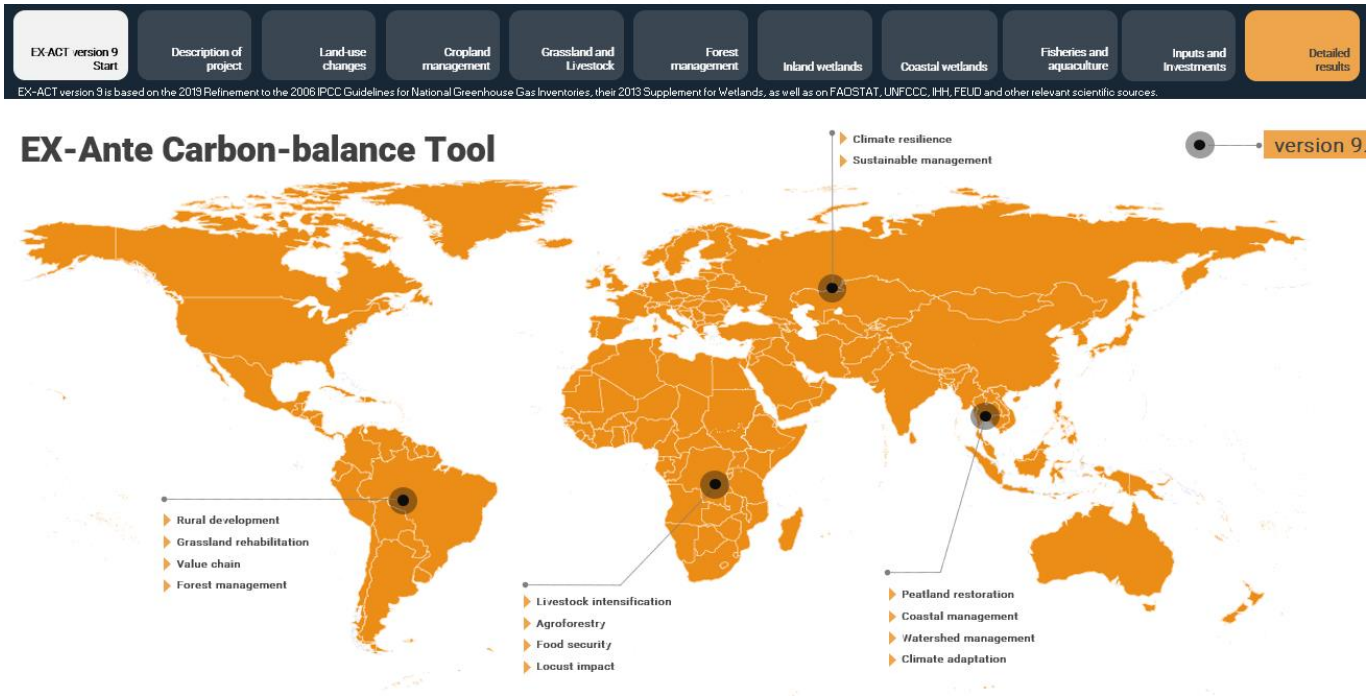
EX-ACT is a greenhouse gas (GHG) accounting tool that encompasses the entirety of the agricultural sector, spanning Agriculture, Forestry and Other Land Use (AFOLU), inland and coastal wetlands, fisheries and aquaculture, as well as agricultural inputs and infrastructure.

Purpose

EX-ACT provides users a consistent way of estimating and tracking the outcomes of agricultural interventions on GHG emissions. It is able to support policymakers and other stakeholders in integrating climate change mitigation objectives into policies and international commitments.

Format

The tool uses an offline Excel format. Users can download the tool from the FAO website.



Scope

Geographic scope

The EX-ACT tool is globally applicable.

Tool scope	Carbon credit type	Carbon project type	Carbon pools included
Project level	*The tool is not set up to calculate carbon credits but it does account for carbon avoidance and removal type activity*	*The tool is not set up for carbon projects but does use forest management, agroforestry, land-use change (deforestation and afforestation/reforestation)*	*AGB, BGB, DW, LI, SOC*

		and other agricultural management calculations	

Methodology

The tool methodology works by comparing two scenarios: a situation when an intervention, for example a project, is implemented and a baseline situation that would prevail in the absence of the project (also referred to as “reference scenario”). The comparison between the GHG emissions and carbon stock changes resulting from the implemented project and those that would occur in the baseline (without the project) gives the final carbon-balance reported in EX-ACT. EX-ACT calculations are based on either default coefficients (Tier 1 approach) or values provided by the user (Tier 2 approach).

Assumption basis

It's important to note that while EX-ACT provides valuable estimates, its results are based on a set of assumptions and default values. Therefore, the tool should be used in conjunction with local data, expert knowledge, and site-specific information for more accurate assessments.

Minimum requirements for use

Familiarity with agricultural and forestry practices is important for accurately inputting data and interpreting the results. Users will also need specific data related to the agricultural or forestry activities they are assessing including information on land use, land cover, management practices, yields, and other relevant factors.

Co-benefits

The tool does not calculate for any co-benefits to carbon.

Tool outputs

Carbon balance (with and without intervention)

Carbon balance by activity type

USAID AFOLU carbon calculator

Website: https://www.afolucarbon.org/

Developer: Winrock International on behalf of USAID

Type: Modelling

Accessibility: Public, open-access, free to use

Overview

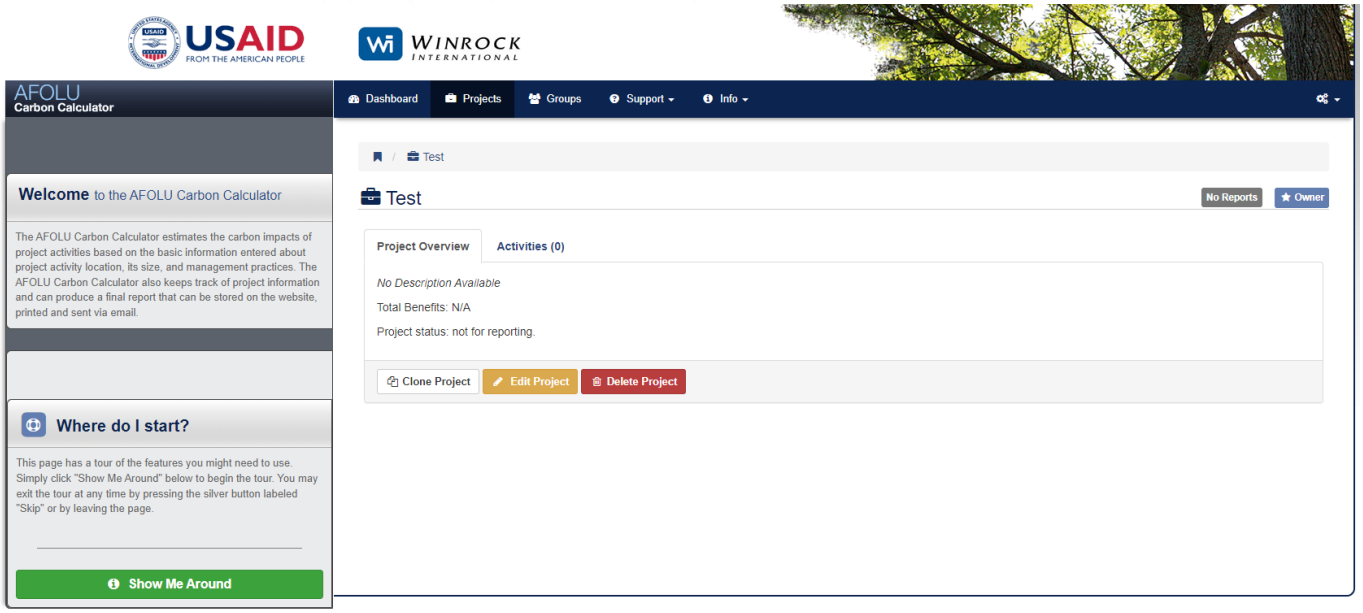
The AFOLU Calculator utilises accounting methods based on IPCC standards, enabling users to gauge the CO2 benefits and potential climate effects of eight distinct categories of land-based project activities. These include forest protection, forest management, afforestation/reforestation, agroforestry, cropland management, grazing land management, forest degradation due to fuelwood, and the promotion/development of policies.

Purpose

The USAID calculator has been designed primarily as a tool for estimating the carbon benefits of individual projects or groups of projects. The Calculator is not designed to provide the level of accuracy needed for carbon financing but may provide an early indication of areas which have potential for such financing.

Format

The tool uses an online format. Users can access the tool on USAID's AFOLU carbon website.



Scope

Geographic scope

The USAID AFOLU carbon calculator tool is globally applicable.

Tool scope	Carbon credit type	Carbon project type	Carbon pools included
Project or portfolio (group of projects) level	*The tool is not set up to calculate carbon credits but it does account for carbon avoidance and removal type activity*	*The tool is not set up for carbon projects but does calculate carbon against the following activities:* *Forest protection* *Afforestation/reforestation* *Forest management* *Agroforestry* *Cropland management*	*AGB, BGB, SOC, LI, DW, HWP*

		Grazing management *Forest degradation*	

Methodology

The calculator uses different methodologies for each of the activity types - each can be found here: https://www.afolucarbon.org/methods-and-sources/. The tool differs from others as it includes what is called an Effectiveness Guide. The Effectiveness Guide generates an effectiveness rating for project activities, which is an estimated measure the overall success a project activity has had in achieving emissions reductions. For example, for an avoided deforestation project to be considered 100% effective, it would successfully prevent 100% of projected baseline deforestation in the project area, thus avoiding 100% of potential emissions caused by deforestation.

The tool allows the most basic of calculations with rudimentary data, but also allows for precision calculation if the user has a multitude of land-use information about the project including forest type, avoided actions, local deforestation history, soil carbon statistics, community offtake, illegal logging etc.

Assumption basis

The tool estimates greenhouse gas emissions and removals associated with land use activities based on assumptions like conservation of mass, default values, and linear relationships between management practices and emissions. The tool also operates at a coarse spatial resolution and provides a static snapshot of emissions at a specific point in time, focusing primarily on greenhouse gas impacts.

Minimum requirements for use

The minimum requirements depend on which functions of the tool are of interest to the user. For example, in the forest protection activity, minimum data requirements are project area, location, and management effectiveness rating. In this scenario, benefits will be calculated only for reducing deforestation from a forested project area. Users can input more data that will improve the accuracy of the results.

Co-benefits

The tool does not calculate for any co-benefits to carbon.

Tool outputs

Total annual and cumulative carbon benefit.

P4F/BII Carbon Project Appraisal Tool

Website: N/A

Developer: Form International on behalf of Partnerships for Forests and British International Investment

Type: Guiding

Accessibility: Currently internal only

Overview

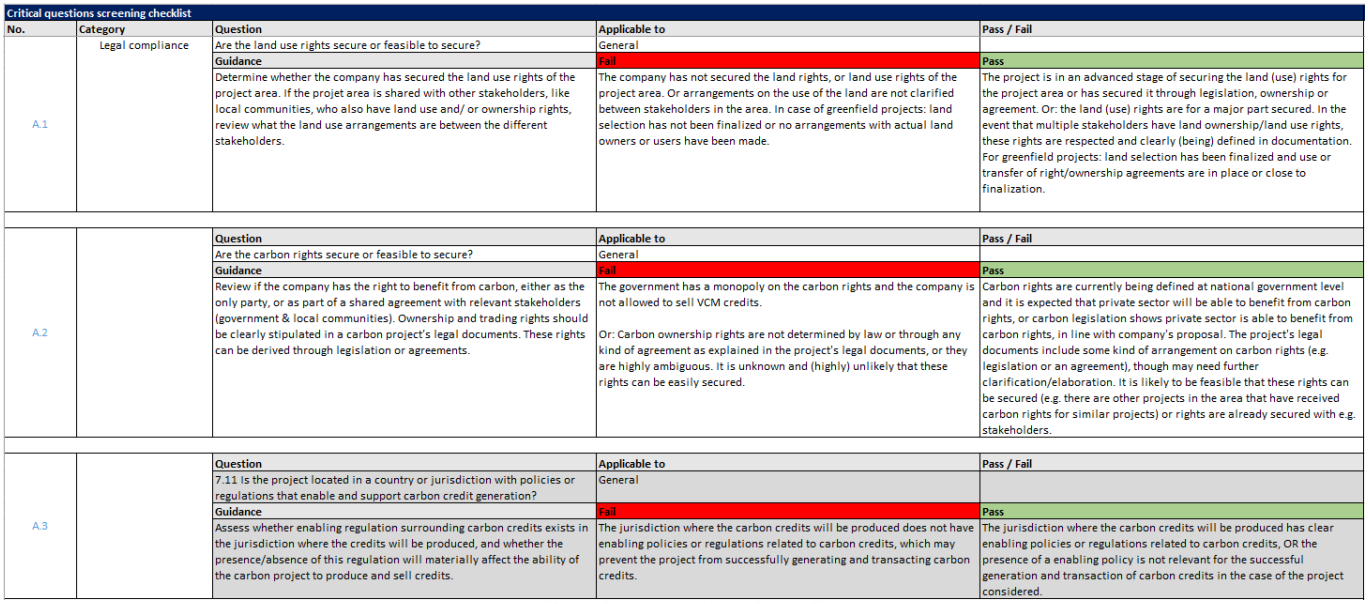
An excel tool to guide DFIs and other investors in conducting risk and benefit assessment for the relevant carbon project types: e.g. plantation forestry, natural forest protection, agroforestry. The tool is presented as a checklist with traffic light responses with separate sections for investors, investees, sector-level impact, carbon quantity, social impact, and wider environmental impact.

Purpose

To enable BII and other peer DFIs to appraise carbon finance for forestry projects and help ensure that they are investing in carbon projects with viable commercial prospects and credible impacts. The tool provides guidance on the likely risks and benefits specific to different kinds of forestry carbon finance projects, along with recommendations to BII and other investors as to how and when to support these forest carbon finance.

Format

The tool uses an offline Excel format.



Critical questions screening checklist				
No.	**Category**	**Question**	**Applicable to**	**Pass / Fail**
	Legal compliance	Are the land use rights secure or feasible to secure?	General	
		Guidance	**Fail**	**Pass**
A.1		Determine whether the company has secured the land use rights of the project area. If the projet area is shared with other stakeholders, like local communities, who also have land use and/ or ownership rights, review what the land use arrangements are between the different stakeholders.	The company has not secured the land rights, or land use rights of the project area. Or arrangements on the use of the land are not clarified between stakeholders in the area. In case of greenfield projects: land selection has not been finalized or no arrangements with actual land owners or users have been made.	The project is in an advanced stage of securing the land (use) rights for the project area or has secured it through legislation, ownership or agreement. Or: the land (use) rights are for a major part secured. In the event that multiple stakeholders have land ownership/land use rights, these rights are respected and clearly (being) defined in documentation. For greenfield projects: land selection has been finalized and use or transfer of right/ownership agreements are in place or close to finalization.
		Question	**Applicable to**	**Pass / Fail**
		Are the carbon rights secure or feasible to secure?	General	
		Guidance	**Fail**	**Pass**
A.2		Review if the company has the right to benefit from carbon, either as the only party, or as part of a shared agreement with relevant stakeholders (government & local communities). Ownership and trading rights should be clearly stipulated in a carbon project's legal documents. These rights can be derived through legislation or agreements.	The government has a monopoly on the carbon rights and the company is not allowed to sell VCM credits. Or: Carbon ownership rights are not determined by law or through any kind of agreement as explained in the project's legal documents, or they are highly ambiguous. It is unknown and (highly) unlikely that these rights can be easily secured.	Carbon rights are currently being defined at national government level and it is expected that private sector will be able to benefit from carbon rights, or carbon legislation shows private sector is able to benefit from carbon rights, in line with company's proposal. The project's legal documents include some kind of arrangement on carbon rights (e.g. legislation or an agreement), though may need further clarification/elaboration. It is likely to be feasible that these rights can be secured (e.g. there are other projects in the area that have received carbon rights for similar projects) or rights are already secured with e.g. stakeholders.
		Question	**Applicable to**	**Pass / Fail**
		7.11 Is the project located in a country or jurisdiction with policies or regulations that enable and support carbon credit generation?	General	
		Guidance	**Fail**	**Pass**
A.3		Assess whether enabling regulation surrounding carbon credits exists in the jurisdiction where the credits will be produced, and whether the presence/absence of this regulation will materially affect the ability of the carbon project to produce and sell credits.	The jurisdiction where the carbon credits will be produced does not have enabling policies or regulations related to carbon credits, which may prevent the project from successfully generating and transacting carbon credits.	The jurisdiction where the carbon credits will be produced has clear enabling policies or regulations related to carbon credits, OR the presence of a enabling policy is not relevant for the successful generation and transaction of carbon credits in the case of the project considered.

Scope

Geographic scope

The P4F/BII carbon project appraisal tool is globally applicable.

Tool scope	Carbon credit type	Carbon project type	Carbon pools included
Project level	*The tool is not set up to calculate carbon credits but provides guidance on ARR, IFM and REDD project types*	*The tool is not set up for carbon projects but provides guidance against the following activities:* *Forest protection* *Afforestation/reforestation* *Forest management*	*N/A*

Methodology

Using the BII carbon credits position paper and risks and benefits checklist as a framework, the developers gathered information from investment policies (IFC PS and other operational safeguards), CSR policies and guidance, carbon policies and certification standards (Verra, CCB Gold Standard, Plan Vivo and other standards). This was combined with information on sector specific carbon projects and sector specific knowledge on risks (deforestation, unsustainable practises, problems in participation and benefit sharing).

Minimum requirements for use

The appraisal tool distinguishes between critical questions and project specific information relating to the investor, investee, sector level impact, carbon impact, social impact, and wider environmental impact. Users of the tool will need to prepare information against each of these categories in order to fully assess a project ahead of an investment. The critical questions have binary answers (pass or fail) and the project specific questions have RAG ratings (Red, Amber, Green) to indicate where a project has satisfactory or exemplary characteristics, and conversely, where a project needs to improve either as part of an action plan conditional to the investment, or prior to any further engagement.

Co-benefits

The tool also offers guidance and appraisal of co-benefits to carbon such as biodiversity and social impact.

Tool outputs

The tool does not calculate carbon but does provide guidance on whether a proposed carbon project should be explored further.

5 Conclusion

Conclusion

Navigating carbon tools

This guide aims to empower readers in navigating the suite of carbon measurement tools available in the market. In this guide, for the first time a structured overview of FSLU carbon modelling tools is provided with a comparative framework and decision guidance for selection of the most adequate tool for a specific purpose (Chapter 3), which assists users to navigate the landscape of carbon modelling tools effectively, making informed decisions aligned with their specific objectives.

By providing clarity on the purpose, use cases, and applications of each tool, the guide equips interested organizations and individuals to make well-informed decisions at both individual investment and portfolio levels. The report refrains from endorsing specific tools, emphasizing instead the importance of understanding tool capabilities, assessing projections' value, recognizing limitations, and comparing information generated by different modelling tools. Produced with the collaborative effort of LCIP and input from environmental experts, this comprehensive guide aims to support those looking to contribute to a sustainable and resilient future through informed nature-based investments. The guide is not a comprehensive analysis of every carbon tool in the market and it is expected that new tools will emerge periodically to replace older tools or to fill gaps where necessary. As such, readers should use the guide to point them in the right direction but may also need to conduct their own research to supplement what is found here.

The report underscores the multifaceted landscape of carbon modelling tools designed to aid investors, project developers, and decision-makers in evaluating nature-based solutions. The challenge lies not only in understanding the tools' methodologies but also in selecting the right tool for specific investment goals. The report navigates through this complexity, elucidating how various tools cater to diverse needs, from assessing project-level carbon removal or avoidance to informing portfolio-level analyses.

A summary table of the tools with associated key information is included below for convenience.

Looking ahead

As DFIs and other investors intensify efforts to combat climate change, the role of nature-based investments becomes increasingly important. This guide serves as a resource for investors navigating the evolving landscape of carbon modelling tools, including investors newly entering the nature-based investment sector and those accelerating efforts towards carbon neutrality across their portfolios. Over the next few years, continued advancements in technology and methodologies will offer even more sophisticated tools to assess and address the complexities of carbon projects. The imperative to strike a balance between precision and practicality will persist, and as the demand for sustainable finance grows, so too will the importance of reliable and high-integrity modelling tools. By fostering a mindset that views these tools as integral to a broader climate mitigation framework, investors can continue to channel resources efficiently into projects that contribute not only to carbon reduction but also to a resilient and sustainable future for generations to come.

Summary table of key information per tool

Tool	Tool scope	Carbon credit type	Carbon project type	Carbon pools included
MFF Forestry Carbon Intensity Matrix and Impact Model	Project and/or portfolio level	Avoidance and/or removal	IFM, ARR, REDD+, NTFPs (Non-timber forest products)	AGB, BGB, SOC (depending on significance)
EDFI Frescos	Project level	Carbon removals only	ARR - Afforestation, reforestation, restoration Natural forests	AGB, BGB, SOC, DW, LI, HWP
FSC Forest Carbon Monitoring Tool	Project level	The tool is not set up to calculate carbon credits but it does account for carbon avoidance and removals	The tool is not set up for carbon projects but does use IFM - Integrated forest management	AGB, BGB, LI (optional), HWP (optional), SOC (optional), DW (optional)
FAO EX-ACT Tool	Project level	The tool is not set up to calculate carbon credits but it does account for carbon avoidance and removal type activity	The tool is not set up for carbon projects but does use forest management, agroforestry, land-use change (deforestation and afforestation/reforestation) and other agricultural management calculations	AGB, BGB, DW, LI, SOC
USAID AFOLU carbon calculator	Project or portfolio (group of projects) level	The tool is not set up to calculate carbon credits but it does account for carbon avoidance and removal type activity	The tool is not set up for carbon projects but does calculate carbon against the following activities: Forest protection Afforestation/reforestation Forest management Agroforestry Cropland management Grazing management Forest degradation	AGB, BGB, SOC, LI, DW, HWP
P4F/BII Carbon Project Appraisal Tool	Project level	The tool is not set up to calculate carbon credits but provides guidance on ARR, IFM and REDD project types	The tool is not set up for carbon projects but provides guidance against the following activities: Forest protection Afforestation/reforestation Forest management	N/A