June 2021

Agriculture Criteria

Climate Bonds Standard & Certification Scheme

Document number	Date	Summary of changes
2.	June 2021	Addition of livestock criteria Restructured to improve usability
1.	August 2020	Initial publication with Criteria for crops

Definitions

Agriculture: Agriculture is the management of plants and domesticated animals to produce food, feed, fibre, fuel, and other products.

Agricultural Production Unit: The collection of assets and activities associated with the management of plants and domesticated animals to produce food, feed, fibre, fuel, and other products. The most likely production unit is a farm.

Certified Climate Bond: A Climate Bond that is certified by the Climate Bonds Standard Board as meeting the requirements of the Climate Bonds Standard, as attested through independent verification.

Climate Bond Certification: allows the issuer to use the Climate Bond Certification Mark in relation to that bond. Climate Bond Certification is provided once the independent Climate Bonds Standard Board is satisfied the bond conforms with the Climate Bonds Standard.

Climate Bond: A climate bond is a bond used to finance – or refinance - projects needed to address climate change. They range from wind farms and solar and hydropower plants to rail transport and building sea walls in cities threatened by rising sea levels.

Climate Bonds Initiative (CBI): An investor-focused not-for-profit organisation, promoting large-scale investments that will deliver a global low carbon and climate resilient economy. The Initiative seeks to develop mechanisms to better align the interests of investors, industry and government so as to catalyse investments at a speed and scale sufficient to avoid dangerous climate change.

Climate Bonds Standard (CBS): A screening tool for investors and governments that allows them to identify green bonds where they can be confident that the funds are being used to deliver climate change solutions. This may be through climate mitigation impact and/ or climate adaptation or resilience. The CBS is made up of two parts: the parent standard (Climate Bonds Standard v3) and a suite of sector specific eligibility Criteria. The parent standard covers the certification process and pre- and post-issuance requirements for all certified bonds, regardless of the nature of the capital projects. The Sector Criteria detail specific requirements for assets identified as falling under that specific sector. The latest version of the CBS is published on the Climate Bonds Initiative website.

Climate Bonds Standard Board (CBSB): A board of independent members that collectively represents $34 trillion of assets under management. The CBSB is responsible for approving i) Revisions to the Climate Bonds Standard, including the adoption of additional sector Criteria, ii) Approved verifiers, and iii) Applications for certification of a bond under the Climate Bonds Standard. The CBSB is constituted, appointed and supported in line with the governance arrangements and processes as published on the Climate Bonds Initiative website.

Critical interdependencies: The asset or activity's boundaries and interdependencies with surrounding infrastructure systems. Interdependencies are specific to local context but are often connected to wider systems through complex relationships that depend on factors 'outside the asset fence' that could cause cascading failures or contribute to collateral system benefits.

Green Bond: A Green Bond is where proceeds are allocated to environmental projects. The term generally refers to bonds that have been marketed as "Green". In theory, Green Bonds proceeds could be used for a wide variety of environmental projects, but in practice they have mostly been the same as Climate Bonds, with proceeds going to climate change projects.

Industry Working Group (IWG): A group of key organisations that are potential issuers, verifiers and investors convened by CBI. The IWG provides feedback on the draft sector Criteria developed by the TWG before they are released for public consultation.

Investment period: The interval between the bond's issuance and its maturity date. Otherwise known as the bond tenor.

Technical Working Group (TWG): A group of key experts from academia, international agencies, industry, and NGOs convened by CBI. The TWG develops the Sector Criteria - detailed technical criteria for the eligibility of projects and assets as well as guidance on the tracking of eligibility status during the term of the bond.

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Contents

1. Introduction

1.1 Overview of this document and supplementary information available

This Criteria document provides all the requirements that must be met for agriculture related assets and projects to be awarded Climate Bonds Certification. The purpose is to provide instruction to issuers and verifiers about the requirements of the Agriculture Criteria. The Criteria document is supported by a background document that captures the various dialogues and inputs and substantiates the reasoning behind the requirements set in the Agriculture Criteria.

The Criteria are developed through a consultative process with Technical Working Groups (TWGs) and Industry Working Groups (IWGs), and through public consultation. The TWGs comprise academic and research institutions, civil society organizations, multilateral banks and specialist consultancies, whereas IWGs are represented by industry experts including potential bond issuers and investors. The list of TWG and IWG members is provided in Appendix 7. A period of public consultation offers the opportunity to any member of the public to comment on the Criteria.

This document describes:

- The scope of agriculture-related activities and associated assets and projects eligible for certification under the Climate Bonds Standard (Section 2)
- The Criteria that the related use of proceeds must meet to be certifiable for a Certified Climate Bond (Section 3)

Supplementary information available in addition to this document includes:

1. Agriculture Criteria Brochure: a short summary of the Agriculture Criteria.
2. Agriculture Background Paper: full background to the process of determining these Criteria, including issues raised and discussed by the TWG, and arguments and rationales for the approaches and decision taken.
3. Climate Bonds Standard V3.0: the umbrella document laying out the common requirements that all Certified Climate Bonds need to meet, in addition to the sector-specific Criteria (V3.0 is the most recent version).
4. Climate Bonds Standard & Certification Scheme Brochure: an overview of the purpose, context, and requirements of the Climate Bonds Standard & Certification Scheme.

For more information on the Climate Bonds Initiative and the Climate Bonds Standard & Certification Scheme, see https://www.climatebonds.net/standard. For the documents listed above, see https://www.climatebonds.net/standard/agriculture

1.2 The Climate Bonds Standard

Investor demand for Green Bonds and Climate Bonds is strong and will increase in line with the delivery of quality products into the market. However, investor questions about the credibility of green labelling are also growing. Standards, assurance, and certification are essential to improve confidence and transparency, which in turn will enable further strong growth in the market.

The Climate Bonds Standard & Certification Scheme is an easy-to-use screening tool that provides a clear signal to investors and intermediaries on the climate integrity of Certified Climate Bonds.

A key part of the Standard is a suite of sector-specific eligibility Criteria. Each set of Sector Criteria sets climate change benchmarks for that sector that are used to screen assets and capital projects so that only those that have climate integrity, either through their contribution to climate mitigation, and/or to adaptation and resilience to climate change, will be certified. Where a bond encompasses a mixed portfolio of assets across several sectors, each sub-category of assets will be subject to the relevant Sector Criteria for those assets.

As noted above, the Sector Criteria are determined through a multi-stakeholder engagement process. They are reviewed and approved by the Climate Bonds Standard Board.

The second key part of the Climate Bonds Standard is the overarching Climate Bonds Standard V3.0. This gives the common fund management and reporting requirements that all Certified Climate Bonds must meet, in addition to meeting the sector-specific Criteria.

1.3 The need for Agriculture Criteria

Agriculture plays a crucial role in achieving global decarbonisation targets. In 2014, the IPCC[1] estimated that the sector accounted for approximately 10 to 12% of anthropogenic greenhouse gas (GHG) emissions or 5 to 5.8 $GtCO_2e$ /year in 2000-2010. In the period 2007-2016,[2] agriculture contributed 6.2 $GtCO_2e$/year, with a range of 2.6. This is 12% of anthropogenic GHG emissions, showing that agriculture's contribution is growing year-on-year. Agriculture is also a major driver of deforestation, contributing at least an additional 2.3 $GtCO_2$ in annual emissions in 2010-2014[3] due to the expansion of cropland and pastureland in forest areas.[4]

Implementation of sustainable agricultural practices is necessary for the industry to successfully reduce emissions, adapt to changes in weather patterns, and withstand the pressures placed on food security by population growth. Simultaneously, limiting deforestation and forest degradation is imperative to ensure that forests act as a net carbon sink rather than a GHG emitter. Estimates suggest that between USD 7 billion and 7.6 billion are required per year for adaptation measures in the Agriculture, Food and Forestry sectors.[5] Despite the need for more finance flows directed towards addressing climate impacts on these sectors, investment remains small, accounting for USD 37.3 billion or just over 3% of the climate-aligned bond universe.[6]

1.4 Environmental objectives addressed in the Criteria

The Climate Bonds Standard aims to screen for use-of-proceeds that meet climate goals. Specifically, in the context of agriculture, they aim to screen for and enable certification of bonds where the use-of-proceeds enable:

- Low-emissions agriculture; and
- Agriculture which is adapted for and resilient to climate change, and does not harm the climate resilience of the systems within which it is carried out.

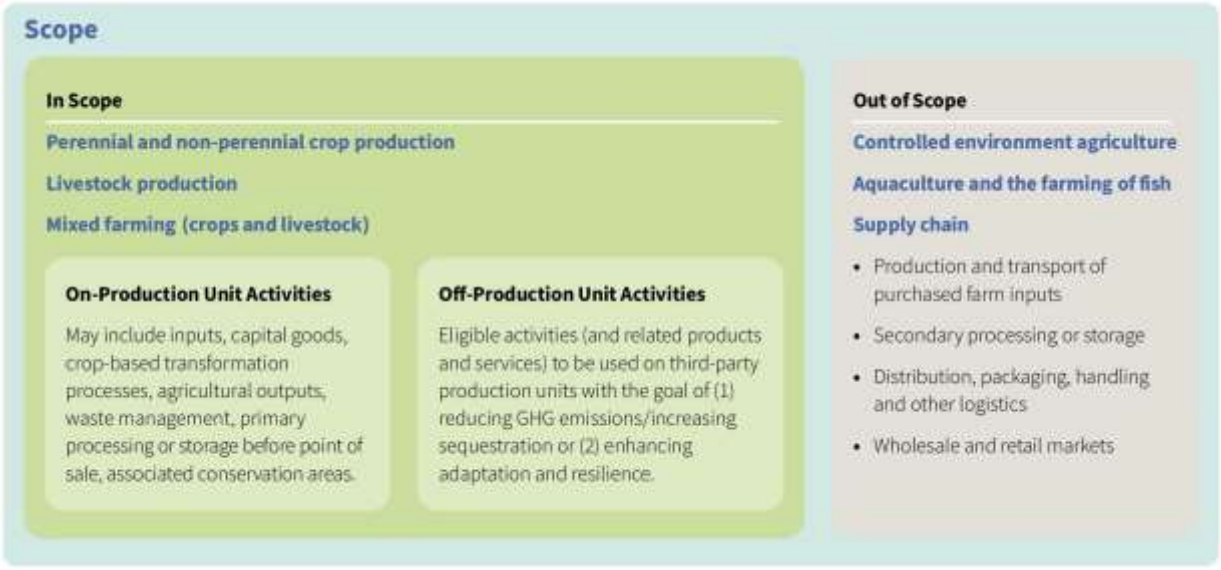
1.5 Assets and projects in scope for the Criteria

These Criteria cover farm-level production of crops (including agroforestry) and livestock, and activities off-farm that provide products or services to enable GHG mitigation and climate adaptation and resilience on farms.

Supply chain activities related to the production or supply of inputs purchased by farms, or the processing or distribution of agricultural products post the farmgate or after the first point of sale are not within scope. Figure 2 Scope of the Agriculture criteria provides a high-level summary of this scope, which is explained in more detail in Section 2.

[1] https://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_summary-for-policymakers.pdf
[2] https://www.ipcc.ch/site/assets/uploads/2019/08/4.-SPM_Approved_Microsite_FINAL.pdf
[3] These were low deforestation years in Brazil. https://rainforests.mongabay.com/amazon/deforestation_calculations.html
[4] Pendrill et al. 2019. https://www.sciencedirect.com/science/article/pii/S0959378018314365#sec0080. Pendrill et al. indicate that 2.6 $GtCO_2e$ of deforestation emissions were due to agriculture and forest plantations. Based on their data for cropland and pastureland, we derived that 2.3$GtCO_2e$ can be attributed to agriculture only.
[5] World Bank (2009) The Costs to Developing Countries of Adapting to Climate Change: New Methods and Estimates. The Global Report of the Economics of Adaptation to Climate Change Study.
[6] Climate Bonds Initiative, (2018). Bonds and Climate Change - The State of the Market 2018. Available: https://www.climatebonds.net/files/reports/cbi_sotm_2018_final_01k-web.pdf. Also Buchner 2017. https://climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-2017/. Climate-aligned bonds are defined as either labelled green bonds or bonds from issuers that derive more than 75% of revenue from 'green' business lines.

Figure 1 Scope of the Agricultural Criteria



The boundary of the production unit

Issuers are expected to clearly define the land boundaries of the production unit in line with the 'farmgate to farmgate' guidance in Section 2 and according to the scope of the use of proceeds. Normally this will be the farm holding, including riparian buffer zones, conservation set asides, grassland, or forest areas.

For clarification, conservation and set aside areas may be considered as part of the agriculture production unit if they constitute part of the land property of the farm production unit owned or leased by the same unit as the production property and are not used as offsets for other GHG emissions sources.

2. Activities, assets, and projects in scope

2.1 Overview

2.1.1 Agricultural production systems in scope

The following agricultural production systems are within scope:

- Perennial & non-perennial crop production - including alfalfa, fruit trees, oil palm, coffee, tea, cocoa, rubber, oil seeds, cereals, paddy rice, sugarcane, soy, and cotton. Crops grown for bioenergy. Agroforestry[7] production systems where crops take up more than 50% of the land area.
- Livestock production – Extensive and Intensive production systems for cattle, buffalo, sheep, goats, dairy, pigs and poultry, their waste (manure) and related grassland or pasture. There are specific additional requirements for intensive production systems with respect to animal welfare and feed sourcing.

For mixed farms, unless the crops are just for fodder, the crop production elements should follow criteria for crop production and the livestock elements follow the criteria for livestock.

The boundary of the eligible crop and livestock production system is, in essence, 'farmgate to farmgate'. For clarification, these 'farmgate to farmgate' boundaries can include non-contiguous lands and production systems. The farm is treated as the production unit and thus includes areas such as any forest holdings linked to the agricultural production system by ownerships or ecosystem function. Non-contiguous production activities are eligible if they are related to farm production prior to the sale of the product (such as storage, manure management, or composting) and managed by the production unit. These Criteria are neutral regarding the future use of crops and livestock once they have left the agricultural production unit and do not have provisions for tracking.

Eligible activities and associated assets and projects include those integral to the whole production unit (such as land purchase costs for an entire farm) or only a part of the production unit (such as equipment or infrastructure for particular aspects of production or the purchase of additional land for expansion of the farm). The Criteria vary according to whether the use of proceeds covers the whole production system or a component of it.

Examples and further information are given in Table 1.

2.1.3 Agricultural production systems not in scope

Controlled environment agriculture such as greenhouse or hydroponic production are out of the scope of these Criteria due to the special considerations associated with their infrastructure and energy use. These are covered in the criteria for protected agriculture (currently only available for a single country: Mexico).

Aquaculture and the farming of fish is out of scope.[8]

2.1.4 Supporting activities in scope

These Criteria also cover activities undertaken outside of specific agricultural production units that generate or provide products and services which enable agricultural production units to reduce emissions and/or increase climate adaptation and resilience. Examples are given in Table 1.

2.1.5 Eligible types of expenditures

According to the overarching Climate Bonds Standard V3.0, which sets out the framework for all certified bonds, eligible expenditure includes:

- Related and supporting expenditures for projects or physical assets, where the projects or physical assets meet the relevant Sector Eligibility Criteria (such as these Criteria in this document);
- Capital expenditures undertaken to increase the value and/or lifetime of the assets or projects;

[7] Agroforestry is defined by the FAO as land use systems and technologies where woody perennials (trees, shrubs, palms, bamboos etc) are deliberately used on the same land management units as agricultural crops and/or animals, in some form of spatial arrangement or temporal sequence. See www.fao.org/forestry/agroforestry/80338/en.
[8] A separate TWG has considered potential criteria for fisheries but was not able to propose criteria at this time. See CBI's discussion paper for further information. https://www.climatebonds.net/standard/fisheries

- Related and supporting expenditures including relevant installation and routine maintenance expenditure and upgrades undertaken to maintain the value and/or lifetime of the asset.

In line with this, eligible use of proceeds relating to agriculture production systems might include capital and operating expenditure relating to (1) inputs (e.g., land, seeds, fertilizer,[9] energy, information), (2) capital goods (e.g., land, equipment, housing), (3) crop-based transformation processes (e.g., crop cultivation and planted trees), (4) agricultural outputs (e.g., grains, vegetables, fibre, meat, dairy products[10]), (5) waste management on the production unit (composting, manure, crop residue processing, recycling), and (6) primary processing and storage before point of sale.

And in broad terms, eligible uses of proceeds relating to supporting activities generated outside of the production system that enable mitigation or climate adaptation and resilience on production systems can include a variety of capital and operating expenditure associated with the provision of the qualifying product or service.

For the avoidance of doubt, what will not be considered eligible are activities, assets, or projects where the climate benefits are unclear or have an unclear time horizon, for example:

- Research and development programs where climate benefits are unclear;
- Biodiversity projects with unclear climate benefits;
- General behaviour change training;
- Any project with an unclear time horizon for climate benefits;
- Expenditure relating to general corporate purposes.

2.2 Additional requirements for Livestock

For livestock in intensive production systems, standards of animal welfare must be met and demonstrated by certification to one of the schemes listed in Section 3.10.1.

Feedlot/stall-fed and in-house livestock must consume feed that is sustainably sourced and from areas not recently converted from natural habitats as demonstrated by certification to one of the schemes listed in Section 3.10.2.

Livestock production systems that do not meet these requirements are not eligible for certification.

2.3 Examples of potentially eligible use of proceeds

Table 1 provides signposting as follows:

- An amber square indicates that the eligibility of these activities or projects is conditional on meeting specific requirements.
- For certain activities, eligibility is not conditional on meeting specific mitigation requirements; this is indicated by “N/A”.

[9] Future iterations of the Criteria will preferably include (subject to developments in labelling by fertiliser producers) requirements for fertiliser to be only from domestic sources and produced in line with International Fertiliser Association's guidelines.
[10] This includes the raw milk provided by the farmers and the processing.

Table 1: Illustrative eligible activity types and examples of use of proceeds

	Eligible activity types and examples of use of proceeds	Section	Mitigation	Adaptation & Resilience
Crops, **Whole Production Unit**	Establishment, expansion, or ongoing operation of the production unit as a whole, e.g., conversion of degraded land for agricultural production, or maintenance of climate-friendly farming practices Examples of use of proceeds: • Land acquisition and/or conversion costs • Acquisition of inputs • Planting and management costs • Acquisition or operation of facilities, e.g., storage or drying facilities on the production unit • Acquisition or operation of machinery on the production unit • Training in climate-friendly practices • Costs of advisory services • Performance monitoring costs, such as cost of monitoring GHG emissions or developing farm management plans	3.2.1		
Crops, **Intervention** aimed at addressing GHG emissions/carbon sequestration	Specific interventions within the production unit to implement GHG emission reduction or carbon storage activities, e.g., • Agroforestry practices • New fertiliser application systems • New low-till agricultural systems Examples of uses of proceeds: • Land acquisition and/or conversion costs • Acquisition of inputs • Planting and management costs • Acquisition or operation of facilities, e.g., storage or drying facilities on the production unit • Acquisition or operation of machinery on the production unit • Training in climate-friendly practices • Costs of advisory services • Performance monitoring costs, such as cost of monitoring GHG emissions or developing farm management plans	3.2.2		
Crops, Intervention aimed at enhancing adaptation and resilience	Specific interventions within the production unit to enhance the adaptation and resilience of the production unit are limited to: • Use of microorganisms to substitute for or to reduce use of mineral N fertiliser or pesticides or to promote crop growth • Precision agriculture (PA) • Satellite farming or site-specific crop management (SSCM) • Use of species and breeds adapted to changes in CO_2 and climate, e.g., temperature, water regimes, extreme events • Ecological buffering of climate impacts such as water or microclimate management, e.g., irrigation; water storage; increased soil water holding capacity; agroforestry to buffer extreme temperatures or enhanced soil organic carbon; ecological diversification, including shifting land use from monoculture to polyculture or other diversified production; riparian buffer strips; soil and water conservation; mangrove management; habitat restoration • Physical relocation of vulnerable assets or activities	3.2.3	N/A	

	Eligible activity types and examples of use of proceeds	Section	Mitigation	Adaptation & Resilience
Crops, **Supporting Activities** which reduce GHG emissions/increase sequestration	Only the following activities which reduce GHG emissions/increase sequestration are eligible: • Activities that enable the measurement, monitoring, reporting and verification of emissions reductions • Research and development of ruminant feed that reduces methane emissions • Research into alternative meat and dairy products that might substitute for meat and dairy consumption • Provision of capacity building or education services relating to low carbon agricultural practices • Training in one of the approved best practices (see Tables 3 and 4)	3.2.4	N/A	
Crops, **Supporting Activities** which increase climate adaptation and resilience	Only the following activities which increase climate adaptation and resilience are eligible: • Development and distribution of public-release seeds for crops that are more resistant to the impacts of climate change using conventional breeding or CRISPR[11] technology. Eligible traits include drought tolerance, flood tolerance and pest resistance. • Information technology and information services, e.g., climate information services, monitoring and evaluation (M&E) imagery systems, soil analysis tools and weather monitoring services • Training in climate adapted and resilient agricultural techniques	3.2.5	N/A	
Livestock, **Whole Production Unit**	Establishment, expansion, or ongoing operation of the production unit as a whole, e.g., conversion of degraded land for agricultural production, herd expansion or maintenance of climate-friendly farming practices Examples of use of proceeds: • Acquisition and management of livestock • Land acquisition and/or conversion costs • Acquisition of inputs • Planting and management costs • Acquisition or operation of facilities, e.g., storage or drying facilities on the production unit • Acquisition or operation of machinery on the production unit • Training in climate-friendly practices • Costs of advisory services • Performance monitoring costs, such as cost of monitoring GHG emissions or developing farm management plans	3.3.1		
Livestock, Intervention aimed at addressing GHG emissions/carbon sequestration	Specific interventions within the production unit to implement low GHG practices, e.g., • New manure management or treatment system • New feed regimes for ruminant livestock Examples of use of proceeds: • Acquisition and management of livestock • Land acquisition and/or conversion costs • Acquisition of inputs • Planting and management costs • Acquisition or operation of facilities, e.g., storage or drying facilities on the production unit • Acquisition or operation of machinery on the production unit • Training in climate-friendly practices	3.3.2		

[11] CRISPR stands for clustered regularly interspaced short palindromic repeats and refers to a simple tool for editing genomes. It allows researchers to easily alter DNA sequences and modify gene function.

	Eligible activity types and examples of use of proceeds	Section	Mitigation	Adaptation & Resilience
	• Costs of advisory services • Performance monitoring costs, such as cost of monitoring GHG emissions or developing farm management plans			
Livestock, Intervention aimed at enhancing adaptation and resilience	Specific interventions within the production unit to enhance the adaptation or resilience of the production unit are limited to: • Use of microorganisms to substitute for or to reduce use of mineral N fertiliser or pesticides or to promote crop growth • Precision agriculture (PA) • Satellite farming or site-specific crop management (SSCM) • Use of species and breeds adapted to changes in CO_2 and climate, e.g., temperature, water regimes, extreme events • Ecological buffering of climate impacts such as water or microclimate management, e.g., irrigation; water storage; increased soil water holding capacity; agroforestry to buffer extreme temperatures or enhanced soil organic carbon; ecological diversification, including shifting land use from monoculture to polyculture or other diversified production; riparian buffer strips; soil and water conservation; mangrove management; habitat restoration • Physical relocation of vulnerable assets or activities	3.3.3	N/A	
Livestock, **Supporting Activities** which reduce GHG emissions/increase sequestration	Only the following activities which reduce GHG emissions/increase sequestration are eligible: • Activities that enable the measurement, monitoring, reporting and verification of emissions reductions • Research and development of ruminant feed that reduces methane emissions • Research into alternative meat and dairy products that might substitute for meat and dairy consumption • Provision of capacity building or education services relating to low carbon agricultural practices • Training in one of the approved best practices (see Tables 3 and 4)	3.3.4	N/A	
Livestock, **Supporting Activities** which increase climate adaptation and resilience	Only the following activities which increase climate adaptation and resilience are eligible: • Development and distribution of public-release seeds for crops that are more resistant to the impacts of climate change using conventional breeding or CRISPR[12] technology. Eligible traits include drought tolerance, flood tolerance and pest resistance. • Information technology and information services, e.g., climate information services, monitoring and evaluation (M&E) imagery systems, soil analysis tools and weather monitoring services • Training in climate adapted and resilient agricultural techniques	3.3.5	N/A	

[12] CRISPR stands for clustered regularly interspaced short palindromic repeats and refers to a simple tool for editing genomes. It allows researchers to easily alter DNA sequences and modify gene function.

2.4 Alignment with other sector criteria

Where uses of proceeds from multiple sectors are bundled into one bond, proof of compliance with multiple sector criteria may be required across the portfolio. For example, if the bond is financing both crop production activities and solar wind farms, then the issuer would need to prove compliance with the Agriculture Crop Production Criteria in respect of the former and the Solar Criteria in respect of the latter.

In some cases, it may not immediately be clear whether activities or projects might fall under these criteria or other sector criteria. The most common examples, and appropriate sector criteria to be used, are clarified in Table 2.

Table 2. Guidance on appropriate sector Criteria

Potential use of proceeds	Sector criteria
Agricultural waste management associated with the agricultural production unit	Agriculture Criteria
Food waste collected through municipal waste management services	Waste Management
Facilities not associated with the agricultural production unit dedicated to the processing of biomaterials for the production of biofuels or generation of electricity, heating, or cooling	Bioenergy
Production of timber or forest restoration or conservation	Forestry
Pesticide or fertilizer production	Manufacturing (not yet in development)
Within Mexico: Protected agriculture, horticultural greenhouses and shade-houses that operate or are under construction to operate, including PVC film or glass greenhouses and shade houses	Protected Agriculture in Mexico
Vehicles on a production unit	Transport
Solar panels or wind turbines on agricultural land/buildings to either power the farm or sell to the grid	Solar/Wind, respectively
Irrigation systems, water treatment, distribution, or storage on a production unit. Flood and drought defences and storm water management. Ecological restoration for watershed management. Wetlands management	Water infrastructure
Conservation areas (forested and not forested)	Forestry
Conservation areas associated with agriculture production systems, such as cropland set aside or riparian buffer zones. A link to a specific agricultural production system should be strongly justified, for example if the area is managed and used by the same producer or if the area plays a functional role in agricultural production (e.g., flood control, attracting pollinators).	Agriculture

3. Eligibility Criteria

3.1 Overview

The Criteria relate to two types of agricultural production:

1. Perennial and non-perennial crop production (includes agroforestry systems where crops make up more than 50% of the area)
2. Livestock production

Mixed farming is simply a combination of the above and unless the crops are just for fodder, the crop production elements should follow criteria for crop production and the livestock elements follow the criteria for livestock.

For crop and livestock production respectively, 5 different sets of Criteria are provided, per the following categories:

A. Use of proceeds related to the whole Agricultural Production Unit e.g., Re-mortgaging a whole farm, or (re)financing land cost.
B. Use of proceeds related to a component of, or specific intervention in, the Agricultural Production Unit, which are divided into:
    i. Interventions aimed at reducing GHG emissions/ increasing sequestration e.g., switching to no-till systems
    ii. Interventions aimed at enhancing adaptation and resilience, e.g., investing into drought resistant crops
C. Use of proceeds related to supporting activities outside of the Agricultural Production Unit, which are divided into:
    i. Interventions aimed at reducing GHG emissions/ increasing sequestration e.g., planting cover crops.
    ii. Interventions aimed at enhancing adaptation and resilience e.g., investments in climate forecasting/weather monitoring systems

Bond issuers should determine which of these categories their type of agricultural production and use of proceeds fall into and use the appropriate Criteria accordingly.

Criteria are made up of three components:

I. Mitigation component (where applicable)
II. Adaptation and resilience component
III. Additional requirements for livestock (where applicable)

Special provisions to demonstrate compliance are set out where the use of proceeds is allocated to a large number of separate producer units. Specifically, where proceeds are allocated to over 50 producers, with single producers not being allowed to represent more than 20% of the portfolio and with the maximum concentration of the top five producers not exceeding 35%. Examples might be where a large number of smallholder farmers receive finance via a co-operative, supply chain partner or bank. We call this a 'highly dispersed bond'.

These provisions are provided where applicable. Where these special provisions are utilised, issuers must also demonstrate that there are procedures in place for ensuring collective compliance and dispute resolution. If there are no special provisions indicated for highly dispersed bonds, issuers should assume that the requirements are identical to those for non-highly dispersed bonds.

An overview of the eligibility criteria is provided in Table 3.

Table 3: Matrix showing how each component of the eligibility criteria applies to different types of agriculture and related activities

		Whole Production Unit	Intervention: Mitigation Intervention aimed at addressing GHG emissions/ carbon sequestration	Intervention: Adaptation Intervention aimed at enhancing adaptation and resilience	Support: Mitigation Supporting activities which reduce GHG emissions/ increase sequestration	Support: Adaptation Supporting activities which increase adaptation and resilience
Mitigation component	No conversion of high stock carbon lands	✓	✓	N/A	N/A	N/A
	Land use status	✓	N/A	N/A	N/A	N/A
	Low-emission crop and animal management	✓	N/A	N/A	N/A	N/A
	The intervention must enable or support the relevant low GHG best practices	N/A	✓	N/A	N/A	N/A
	No need to meet mitigation criteria but eligible activities are limited in scope	N/A	N/A	✓	✓	✓
Resilience component	Meet criteria in adaptation and resilience checklist:					
	1. Identification of interdependencies	✓	✓	✓	N/A	N/A
	2. Identification of physical climate hazards	✓	✓	✓	N/A	N/A
	3. Mitigating measures will render unit 'fit for purpose'	✓	N/A	✓	N/A	N/A
	4. Do no harm	✓	✓	✓	✓	✓
	5. Monitoring/evaluation of risks and resilience measures	✓	N/A	N/A	N/A	N/A
	6. Product(s) or service(s) should not substantially increase impacts of material physical climate risk	N/A	N/A	N/A	✓	✓
Animal welfare/feed sourcing component	For livestock in intensive production systems, standards for animal welfare are certified to an approved scheme	◔	◔	◔	◔	◔
	For feedlot/stall-fed and in-house livestock, sourcing of feed must be certified to an approved scheme	◔	◔	◔	◔	◔

✓ Requirement applies

N/A Requirement does not apply

◔ Requirement applies to Livestock Production

3.2 CROPS

3.2.1 CROPS: Requirements for whole Agricultural Production Units

Requirement 1: Mitigation component

Requirement	Demonstration of Compliance	
M1: No conversion of high carbon stock lands *(See Section 3.5)* **AND**	Submission of maps (see Global Forest Watch maps), georeferenced photographs or satellite imagery of land use change and burning, for example. Forest inventory surveys or other formal government data can also be used.	For Highly Dispersed Bonds: Aggregated data may be used if there are too many production units to submit individual maps, photographs, or satellite imagery (sampling is allowed if the sample is randomly selected and representative of the population).
M2: Land use status *(See Section 3.6)* **AND**	Submission of maps (see Global Forest Watch maps), georeferenced photographs or satellite imagery of land use change and burning, for example. Vegetation inventory surveys or other formal government data can also be used.	As above
M3: Low-emission crop and animal management *(See Section 3.7 for exemption to M3)* Demonstrate via one of two options:		
Option M3.1: Climate-aligned % reduction in GHG emissions (tCO_2e) over the investment period compared to emissions at the start of that period *(See Section 3.8)* OR	Verified GHG assessment	For Highly Dispersed Bonds: Targets may be met in aggregate across all production units to which proceeds have been allocated, rather than by every production unit individually
Option M3.2: Evidence of following low-emission agricultural best practices *(Best practice requirements for crop production and livestock production are provided in Section 3.9, Tables 3 and 4)*	Verified farm management plan	For Highly Dispersed Bonds: 80% of aggregate production units' land holdings must meet best practices by the maturity of the bond

Requirement 2: Adaptation & Resilience component

Requirement	Demonstration of Compliance	
Meet criteria in adaptation and resilience checklist (Appendix 1)	Compliance with checklist criteria (see Section 3.13)	

3.2.2 CROPS: Requirements for specific interventions within Agricultural Production Units aimed at addressing GHG emissions or carbon sequestration within the production unit

Requirement 1: Mitigation component

Requirement	Demonstration of Compliance	
M1: No conversion of high carbon stock lands *(See Section 3.5)* **AND**	Submission of maps (see Global Forest Watch maps), georeferenced photographs or satellite imagery of land use change and burning, for example. Forest inventory surveys or other formal government data can also be used.	For Highly Dispersed Bonds: Aggregated data may be used if there are too many production units to submit individual maps, photographs, or satellite imagery (sampling is allowed if the sample is randomly selected and representative of the population).
M2: The intervention must enable or support the relevant low GHG best practices Demonstrate via one of two options:		
Option M2.1: Climate-aligned % reduction in GHG emissions (tCO_2e) over the investment period compared to emissions at the start of that period *(See Section 3.8)* OR	Verified GHG assessment	For Highly Dispersed Bonds: Targets may be met in aggregate across all production units to which proceeds have been allocated, rather than by every production unit individually
Option M2.2: Evidence that the intervention supports low-emission agricultural best practices *(Best practice requirements for crop production and livestock production are provided in in Section 3.9, Tables 3 and 4. The issuer must identify which best practice category(ies) the intervention impacts and meet the core practices set for those categories)*	Verified farm management plan	For Highly Dispersed Bonds: 80% of aggregate production units' land holdings must meet best practices by the maturity of the bond

Requirement 2: Adaptation & Resilience component

Requirement	Demonstration of Compliance	
Meet criteria in adaptation and resilience checklist (Appendix 2)	Compliance with checklist criteria (see Section 3.13)	

3.2.3 CROPS: Requirements for specific interventions within Agricultural Production Units aimed at addressing climate adaptation and resilience within the production unit

Interventions aimed at addressing climate change adaptation and resilience within the production unit do not need to meet mitigation criteria, but eligible activities are limited to the following:

- Use of microorganisms to substitute for or to reduce use of mineral N fertilizer or pesticides or to promote crop growth
- Precision agriculture (PA)
- Satellite farming or site-specific crop management (SSCM)
- Use of species and breeds adapted to changes in CO_2 and climate, e.g., temperature, water regimes, extreme events
- Ecological buffering of climate impacts such as water or microclimate management, e.g., irrigation, water storage, increased soil water holding capacity, agroforestry to buffer extreme temperatures or enhanced soil organic carbon; ecological diversification, including shifting land use from monoculture to polyculture or other diversified production; riparian buffer strips; soil and water conservation; mangrove management; habitat restoration
- Physical relocation of vulnerable assets or activities

Requirement 1: Mitigation component

Requirement	Demonstration of Compliance
None	

Requirement 2: Adaptation & Resilience component

Requirement	Demonstration of Compliance	
Meet criteria in adaptation and resilience checklist (Appendix 3)	Compliance with checklist criteria (see Section 3.12)	

3.2.4 CROPS: Requirements for supporting activities (and resulting products or services) outside of the Agricultural Production Units aimed at enabling GHG emission reductions or carbon sequestration in third-party Agricultural Production Units

Supporting activities (and resulting products and services) aimed at enabling GHG emissions reductions or carbon sequestration in third-party Agricultural Production Units do not need to meet mitigation criteria, but eligible activities are limited to the following:

- Activities that enable the measurement, monitoring, reporting and verification of emissions reductions
- Research and development of ruminant feed that reduces methane emissions
- Research into alternative meat and dairy products that might substitute for meat and dairy consumption
- Provision of capacity building or education services relating to low carbon agricultural practices
- Training in one of the approved best practices (see Tables 3 and 4)

Requirement 1: Mitigation component

Requirement	Demonstration of Compliance
None	

Requirement 2: Adaptation & Resilience component

Requirement	Demonstration of Compliance	
Meet criteria in adaptation and resilience checklist (Appendix 4)	Compliance with checklist criteria (see Section 3.13)	

3.2.5 CROPS: Requirements for supporting activities (and resulting products or services) outside of the Agricultural Production Units aimed at enabling climate adaptation and resilience in third-party Agricultural Production Units

Supporting activities (and resulting products or services) aimed at enabling climate adaptation and resilience on third-party production units do not need to meet mitigation criteria, but eligible activities are limited to the following:

- Development and distribution of public-release seeds for crops that are more resistant to the impacts of climate change using conventional breeding or CRISPR13 technology. Eligible traits include drought tolerance, flood tolerance and pest resistance.
- Information technology and information services, e.g., climate information services, monitoring and evaluation (M&E) imagery systems, soil analysis tools and weather monitoring services
- Training in climate adapted and resilient agricultural techniques

Requirement 1: Mitigation component

Requirement	Demonstration of Compliance
None	

Requirement 2: Adaptation & Resilience component

Requirement	Demonstration of Compliance	
Meet criteria in adaptation and resilience checklist (Appendix 5)	Compliance with checklist criteria (see Section 3.13)	

[13] CRISPR stands for clustered regularly interspaced short palindromic repeats and refers to a simple tool for editing genomes. It allows researchers to easily alter DNA sequences and modify gene function.

3.3 LIVESTOCK

3.3.1 LIVESTOCK: Requirements for whole Agricultural Production Units

Requirement 1: Mitigation component

Requirement	Demonstration of Compliance	
M1: No conversion of high carbon stock lands *(See Section 3.5)* **AND**	Submission of maps (see Global Forest Watch maps), georeferenced photographs or satellite imagery of land use change and burning, for example. Forest inventory surveys or other formal government data can also be used.	For Highly Dispersed Bonds: Aggregated data may be used if there are too many production units to submit individual maps, photographs, or satellite imagery (sampling is allowed if the sample is randomly selected and representative of the population).
M2: Land use status *(See Section 3.6)* **AND**	Submission of maps (see Global Forest Watch maps), georeferenced photographs or satellite imagery of land use change and burning. Vegetation inventory surveys or other formal government data can be used.	As above
M3: Low-emission crop and animal management Demonstrate via one of two options:		
Option M3.1: Climate-aligned % reduction in GHG emissions (tCO_2e) over the investment period compared to emissions at the start of that period *(See Section 3.8)*	Verified GHG assessment	For Highly Dispersed Bonds: Targets may be met in aggregate across all production units to which proceeds have been allocated, rather than by every production unit individually
OR Option M3.2: Evidence of following low-emission agricultural best practices *(Best practice requirements for crop production and livestock production are provided in Section 3.9)*	Verified farm management plan	For Highly Dispersed Bonds: 80% of aggregate production units' land holdings must meet best practices by the maturity of the bond.

Requirement 2: Adaptation & Resilience component

Requirement	Demonstration of Compliance	
Meet criteria in adaptation and resilience checklist (Appendix 1)	Compliance with checklist criteria (*see Section 3.13*)	

Requirement 3: Animal Welfare/Feed Sourcing

Requirement	Demonstration of Compliance	
For livestock in intensive production systems, standards of animal welfare are met (*see Section 3.11*). Feedlot/stall-fed and in-house livestock use feed that is sustainably sourced and from areas not recently converted from natural habitats *(See Section 3.12)*	Provide evidence of certification with the animal welfare and feed schemes enumerated in Section 3.11 and 3.12.	

3.3.2 LIVESTOCK: Requirements for specific interventions within Agricultural Production Units aimed at addressing GHG emissions or carbon sequestration within the production unit

Requirement 1: Mitigation component

Requirement	Demonstration of Compliance	
M1: No conversion of high carbon stock lands *(See Section 3.5)* **AND**	Submission of maps (see Global Forest Watch maps), georeferenced photographs or satellite imagery of land use change and burning, for example. Forest inventory surveys or other formal government data can also be used.	For Highly Dispersed Bonds: Aggregated data may be used if there are too many production units to submit individual maps, photographs, or satellite imagery (sampling is allowed if the sample is randomly selected and representative of the population).
M2: The intervention must enable or support the relevant low GHG best practices Demonstrate via one of two options:		
Option M2.1: Climate-aligned % reduction in GHG emissions (tCO_2e) over the investment period compared to emissions at the start of that period *(See Section 3.8)* OR	Verified GHG assessment	For Highly Dispersed Bonds: Targets may be met in aggregate across all production units to which proceeds have been allocated, rather than by every production unit individually.
Option M2.2: Evidence that the intervention supports low-emission agricultural best practices *(Best practice requirements for crop production and livestock production are provided in in Section 3.9,. The issuer must identify which best practice category(ies) the intervention impacts and meet the core practices set for those categories)*	Verified farm management plan	For Highly Dispersed Bonds: 80% of aggregate production units' land holdings must meet best practices by the maturity of the bond.

Requirement 2: Adaptation & Resilience component

Requirement	Demonstration of Compliance	
Meet criteria in adaptation and resilience checklist (Appendix 2)	Compliance with checklist criteria (see Section 3.13)	

Requirement 3: Animal Welfare/Feed Sourcing

Requirement	Demonstration of Compliance	
For livestock in intensive production systems, standards of animal welfare are met (see Section 3.11). Feedlot/stall-fed and in-house livestock use feed that is sustainably sourced and from areas not recently converted from natural habitats *(See Section 3.12)*	Provide evidence of certification with the animal welfare and feed schemes enumerated in Section 3.11 and 3.12.	

3.3.3 LIVESTOCK: Requirements for specific interventions within Agricultural Production Units aimed at addressing climate adaptation and resilience within the production unit

Requirement 1: Mitigation component

Interventions aimed at addressing climate change adaptation or resilience within the production unit do not need to meet mitigation criteria, but eligible activities are limited to the following:

- Use of microorganisms to substitute for or to reduce use of mineral N fertilizer or pesticides or to promote crop growth
- Precision agriculture (PA)
- Satellite farming or site-specific crop management (SSCM)
- Use of species and breeds adapted to changes in CO_2 and climate, e.g., temperature, water regimes, extreme events
- Ecological buffering of climate impacts such as water or microclimate management, e.g., irrigation, water storage, increased soil water holding capacity, agroforestry to buffer extreme temperatures or enhanced soil organic carbon; ecological diversification, including shifting land use from monoculture to polyculture or other diversified production; riparian buffer strips; soil and water conservation; mangrove management; habitat restoration
- Physical relocation of vulnerable assets or activities

Requirement	Demonstration of Compliance
None	

Requirement 2: Adaptation & Resilience component

Requirement	Demonstration of Compliance	
Meet criteria in adaptation and resilience checklist (Appendix 3)	Compliance with checklist criteria (see Section 3.13)	

Requirement 3: Animal Welfare/Feed Sourcing

Requirement	Demonstration of Compliance	
For livestock in intensive production systems, standards of animal welfare are met (see Section 3.11). Feedlot/stall-fed and in-house livestock use feed that is sustainably sourced and from areas not recently converted from natural habitats *(See Section 3.12)*	Provide evidence of certification with the animal welfare and feed schemes enumerated in Section 3.11 and 3.12.	

3.3.4 LIVESTOCK: Requirements for supporting activities (and resulting products or services) outside of the Agricultural Production Units aimed at enabling GHG emission reductions or carbon sequestration in third-party Agricultural Production Units

Supporting activities (and resulting products or services) aimed at enabling GHG emissions reductions or carbon sequestration on third-party production units do not need to meet mitigation criteria, but eligible activities are limited to the following:

- Activities that enable the measurement, monitoring, reporting and verification of emissions reductions
- Research and development of ruminant feed that reduces methane emissions
- Research into alternative meat and dairy products that might substitute for meat and dairy consumption
- Provision of capacity building or education services relating to low carbon agricultural practices
- Training in one of the approved best practices (see Tables 3 and 4)

Requirement 1: Mitigation component

Requirement	Demonstration of Compliance
None	

Requirement 2: Adaptation & Resilience component

Requirement	Demonstration of Compliance
Meet criteria in adaptation and resilience checklist (Appendix 4)	Compliance with checklist criteria (see Section 3.13)

Requirement 3: Animal Welfare/Feed Sourcing

Requirement	Demonstration of Compliance
For livestock in intensive production systems, standards of animal welfare are met (*see Section 3.11*). Feedlot/stall-fed and in-house livestock use feed that is sustainably sourced and from areas not recently converted from natural habitats *(See Section 3.12)*	Provide evidence of certification with the animal welfare and feed schemes enumerated in Section 3.11 and 3.12.

3.4.5 LIVESTOCK: Requirements for supporting activities (and resulting products or services) outside of the Agricultural Production Units aimed at enabling climate adaptation and resilience in third-party Agricultural Production Units

Supporting activities (and resulting products or services) aimed at enabling climate adaptation and resilience on third-party production units do not need to meet mitigation criteria, but eligible activities are limited to the following:

- Development and distribution of public-release seeds for crops that are more resistant to the impacts of climate change using conventional breeding or CRISPR[14] technology. Eligible traits include drought tolerance, flood tolerance and pest resistance.
- Information technology and information services, e.g., climate information services, monitoring and evaluation (M&E) imagery systems, soil analysis tools and weather monitoring services
- Training in climate adapted and resilient agricultural techniques

Requirement 1: Mitigation component

Requirement	Demonstration of Compliance
None	

Requirement 2: Adaptation & Resilience component

Requirement	Demonstration of Compliance
Meet criteria in adaptation and resilience checklist (Appendix 5)	Compliance with checklist criteria (see Section 3.13)

Requirement 3: Animal Welfare/Feed Sourcing

Requirement	Demonstration of Compliance
For livestock in intensive production systems, standards of animal welfare are met *(see Section 3.11)*. Feedlot/stall-fed and in-house livestock use feed that is sustainably sourced and from areas not recently converted from natural habitats *(See Section 3.12)*	Provide evidence of certification with the animal welfare and feed schemes enumerated in Section 3.11 and 3.12.

[14] CRISPR stands for clustered regularly interspaced short palindromic repeats and refers to a simple tool for editing genomes. It allows researchers to easily alter DNA sequences and modify gene function.

3.5 No conversion of high carbon stock lands

The production unit is not operating on land that has been converted from high carbon stock (HCS) lands spanning more than one hectare after Jan 1, 2010[15] or according to the cut-off date required in national law in the country of issuance or as defined by regional green financing initiatives if this is prior to 2010.[16] This includes wetlands, peatlands, forested areas or other designated HCS areas, as defined by the threshold of 35 tC/ha.[17]

3.6 Land use status

No clearing of woody vegetation over 3 metres in height after 2020 on the production unit in question.[18]

3.7 Exemption to low emission crop and animal management requirements

If the production unit can meet all the following requirements, it is exempt from the requirement to demonstrate low-emission crop and animal management on the basis that it has low responsibility for mitigation and high vulnerability to climate change:

- It is located in a low-income country, defined by World Bank standards, or falls below the World Bank poverty line based on the average expected annual value of yields sold from the farm.
- Agricultural products are used only for domestic consumption in the country and not exported.
- The issuer demonstrates that mitigation options were reviewed and provide a justification as to why the constraints to meeting the requirements could not be overcome.

[15] January 1 2010 was selected as a cutoff date as this accommodates most major certification or standards requirements for "no deforestation." Major standards relevant to agriculture include the Round Table for Responsible Soy, Soy Moratorium, G4 Cattle Agreement; 2008 European Union Renewable Energy Directive I and RED II, European Union Sustainable Finance technical expert group recommendations (p115, https://ec.europa.eu/info/sites/info/files/business_economy_euro/banking_and_finance/documents/190618-sustainable-finance-teg-report-taxonomy_en.pdf), International Sustainability and Carbon Certification (ISCC), and the Roundtable on Sustainable Palm Oil (RSPO). All of these standards use 2009 as a cut-off date for deforestation. The Forest Stewardship Council, which focuses more on sustainable forest management, uses 1994. The TWG considered the 2020 zero deforestation commitments of many companies but using a future or more recent date was not considered ambitious and could incentivize more deforestation.

[16] As the EU taxonomy for sustainable activities has stated a 2008 cut-off date for conversion of high-carbon stock land, 2008 will be the cut-off date for EU issuances looking for CBI certification. https://ec.europa.eu/info/publications/sustainable-finance-teg-taxonomy_en

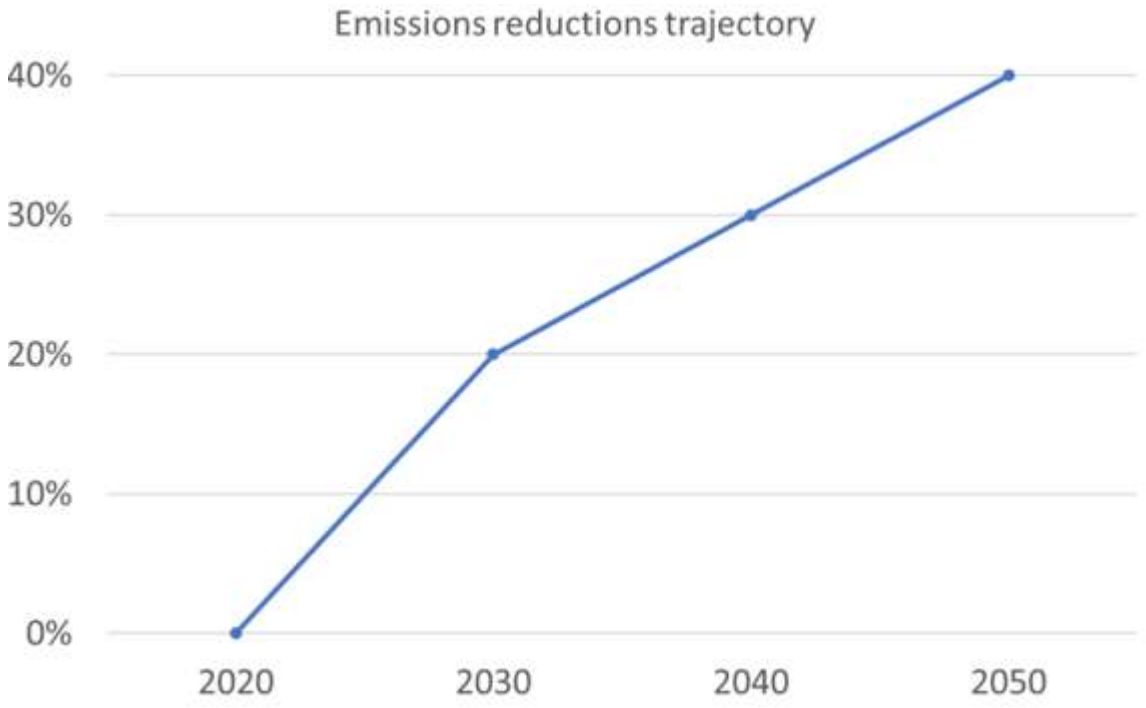
[17] High carbon stock (HCS) land assessment was developed for the purpose of avoiding land use change due to oil palm conversion that resulted in net carbon losses. As a result, any land use with more than the average C stock per hectare of oil palm, i.e., more than 35 tC/ha, is considered high carbon stock. Forest classification types can be used as a proxy for the classification. For example, in Indonesia, lands classified as "Mostly young re-growth forest, but with occasional patches of older forest within the stratum," or above in terms of biomass are considered HCS land, in contrast to "Recently cleared areas, some woody re-growth and grass-like ground cover. Below this, BM (young scrub) and LT (cleared/open land)" and below, which are not. See for example Highcarbonstock.org for a definition. High Conservation Value/High Carbon Stock assessment and the IFC Performance Standard 6, with its Critical and Natural Habitat assessments are the two most commonly adopted assessment tools.

[18] This requirement is designed to prevent clearing to increase the area of grazed or tilled land. It should not be applied to disqualify clearing as a necessary adjunct to the commercial operation of the enterprise. For example, clearing is permissible to build farm infrastructure such as roads, dams or fences or to create a firebreak or around power lines or to otherwise mitigate fire risk around farm infrastructure. Additionally, removal of commercial trees planted as part of an agroforestry system is allowed. If the use of proceeds refers to the Cerrado in Brazil, then the 3-metre rule does not apply for the vegetation. For the Cerrado, no native woody vegetation should be cleared after 2020 on the production unit in question. Tools such as Info Amazonia's can be useful: https://infoamazonia.org/en/datasets/monthly-deforestation-brazil-deter/.

3.8 Climate-aligned percentage reduction in GHG emissions

The production unit must achieve a reduction in GHG emissions (tCO_2e) in line with the trajectory displayed in Figure 2 below. For example, over the 10-year period from 2020-2030, a 20% reduction in GHG emissions would be required. Over the 20-year period of 2020-2040, a 30% reduction in GHG emissions would be required.[19]

Figure 3 Emissions reductions trajectory - % mitigation needed 2020-2050 relative to base year



GHGs to include in GHG assessments

'Emissions' is used here to refer to the *net emissions* resulting from GHG emissions and carbon sequestration. So, mitigation is defined here as a net reduction in GHG emissions or increase in carbon sequestration relative to the start year of the investment (known as the *base year*) and measured as tCO_2e.

Where the Criteria require a GHG assessment, the following emissions should be included in the assessment:

- Emissions embedded in fertilizer inputs and transportation of farm inputs
- Emissions resulting from on-farm production, use of capital goods, or outputs on the farm
- Emissions from the processes required for primary processing or storing outputs on farm, such as washing or simple packaging
- Emissions from land use and land use change in addition to agricultural uses

Emissions resulting from natural disturbances not related to weather or climate shall be excluded from assessment. Extreme weather or climate events will not be a basis for force majeure exceptions. The issuer is expected to address extreme weather and climate hazards according to the resilience criteria of the Standard.

[19] Technical Annex to Technical Expert Group's Final Report on the EU Taxonomy, March 2020

Tools to estimate GHGs

Estimates of emissions and mitigation must be based on carbon accounting calculators.

Acceptable calculators for estimating emissions include the Carbon Benefits Tool, Ex-Act Tool, the Cool Farm Tool and the GHG Protocol Agricultural Guidance Tools. For supply chains, the AtSource Eco-Calculator is also acceptable. Standard accounting methodologies such as the Sustainable Agriculture and Land Management methodology of Verra may also be used. This is not an exhaustive list. Country-level or regional calculators can be better calibrated to conditions and values for that region.

3.9 Best practices for low emissions agriculture

Demonstrating compliance with the best practice requirements

Compliance with best practices can be demonstrated by submission of farm management records, including nutrient management plans, maps, and georeferenced photographs, detailing agricultural practices undertaken for the year and their extent (e.g., size of area) for each season of each production system associated with the investment.

Documentation of each practice should be provided, such as records of fertilizer purchase, evidence of energy efficiency ratings, satellite imagery of land use change and burning, georeferenced photos of inputs used or manner of usage. Other formal government data can be used as well.

In addition, some best practices require estimates of emissions and mitigation; this will be based on the carbon accounting calculators mentioned above for determining compliance.

Table 3. Best practice requirements for low emissions agriculture: Crop production

Category	Core practices	Optional practices
Fertilizer use	A nutrient management plan is in place that identifies the right[20] rate of N fertilizer use for the production unit *PLUS at least <u>three</u> optional practices*	• The nutrient management plan also identifies the right source of fertilizer • The nutrient management plan also identifies the right timing of fertilizer • Right placement of fertilizer[21] • Deep urea or other subsurface placement • Agronomic practices that produce yields in top 25% for the agroecosystem • Fertilizer produced with energy-efficient methods (e.g., steam methane reforming (SMR), green ammonia, or process using <36 gigajoules/t ammonia)[22] • Controlled release fertilizer • Biological N-fixation as the source of nitrogen inputs • Any practice that reduces or offsets N_2O emissions by 20%
Management of soil for net carbon sequestration	• Project length of at least five years • Reduced tillage[23] • Avoided erosion • No open burning • Evidence that soil carbon sequestration is likely to be	• Increase in above-ground biomass (cover crops, agroforestry) and residue retention • Organic matter amendments to the soil (compost) • Any practice that increases soil organic carbon or above-ground or below-ground carbon by 20% over 10

[20] The word 'right' in this category refers to producing the lowest emissions possible while maintaining productivity.
[21] Right placement can be indicated by machinery used.
[22] Threshold based on 2018 benchmark survey conducted by the International Fertilizer Association (IFA) of 78 ammonia plants, representing ~20% of the global ammonia production or 28% excluding China. Thirty-five of the 78 plants that participated in the 2018 survey were in the EU. The average net energy efficiency of participating plants for the 2-year 2016-2017 operating period was 35.8 GJ/mt NH_3 (LHV). All but two of the plants were of conventional design based on reforming hydrocarbon feedstock (usually natural gas) to produce ammonia, the most commonly used technology today for producing ammonia. Hydrogen feedstock-based plants are treated separately. Excluding the hydrogen feedstock-based ammonia plants, the 76 conventional plants had an average net energy efficiency of 36.0 GJ/mt NH_3, which can be considered a moderate global efficiency target, given the high proportion of producers in the EU. The net energy efficiency of the 1st quartile group of 25% most efficient ammonia plants (hydrocarbon feedstock) had an average net energy efficiency 30.9 GJ/mt NH_3 which could be considered an aspirational efficiency target. Hydrogen feedstock-based plants are inherently more energy efficient since the energy needed for converting the hydrocarbon feedstock to hydrogen is not a part of the ammonia process. Information courtesy of Lucia Castillo, Technical & Safety-Health-Environment Analyst, IFA.
[23] Reduced tillage leaves between 15 and 30% crop residue cover on the soil or 500 to 1000 pounds per acre (560 to 1100 kg/ha) of small grain residue during the critical erosion period.

Category	Core practices	Optional practices
	maintained for 20 years[24] or more (secure land rights, low threat of conversion, contractual commitments) or demonstrate 50% higher level of sequestration *PLUS at least <u>one</u> optional practice*	years
Management of biomass for net carbon sequestration	• Increase in above-ground biomass (grassland/pasture productivity, cover crops, agroforestry) by at least 20% • Evidence that above-ground biomass carbon sequestration is likely to be maintained for 20 years[25] or more (secure land rights, low threat of conversion, contractual commitments) or demonstrate 50% higher level of sequestration	N/A
Energy, including energy embedded inputs *Exclusions: use of wood or coal-based energy sources*	• Energy-efficient traction, irrigation, and storage (falls in top 25% of energy efficiency rates for equipment available in country) OR • Use of only renewable energy	N/A
Residue management	Sustainable use of residues	N/A
Food loss	No mycotoxins or other contaminated growing conditions that could result in reduced yields	N/A
Flooded rice (if applicable)	Days of flooding reduced by 10%	N/A
Peatlands (if applicable)	Peatland restoration	N/A

Table 4. Best practice requirements for low carbon agriculture: Livestock production

Category	Core practices	Optional practices
Manure management	Where manure is stored in liquid form (anaerobic conditions), use of at least <u>one</u> optional practice	• Manure is processed in biodigesters to produce energy • Slurry covers • Shifts to aerobic storage or processing methods • Any practice that reduces or offsets CH_4 and N_2O by 20%
Animal management	• Use of high-quality feed (high proportion digestible dry matter) • All animals vaccinated against disease *PLUS at least <u>two</u> optional practices*	• Reduced herd size by at least 20% in each age and production class of animal • Dietary supplements for reduced emissions • Agroforestry, silvopastoralism or grassland/pasture management that offsets CH_4 emissions by at least 20% • Any practice that reduces or offsets CH_4 by 20%
Management of soil for net	• Project length of at least five years • Reduced tillage[26]	• Increase in above-ground biomass (grassland/pasture productivity, cover crops, agroforestry) and residue

[24] The 20-year period is only for evidence of maintenance.
[25] Ibid.
[26] Reduced tillage leaves between 15 and 30% crop residue cover on the soil or 500 to 1000 pounds per acre (560 to 1100 kg/ha) of small grain residue during the critical erosion period.

carbon sequestration	• Avoided erosion • No open burning • Evidence that soil carbon sequestration is likely to be maintained for 20 years[27] or more (secure land rights, low threat of conversion, contractual commitments) or demonstrate 50% higher level of sequestration *PLUS at least <u>one</u> optional practice*	retention • Organic matter amendments to the soil (e.g., compost) • Any practice that increases soil organic carbon or above-ground or below-ground carbon by 20% over 10 years
Management of biomass for net carbon sequestration	• Increase in above-ground biomass (grassland/pasture productivity, cover crops, agroforestry) by at least 20% • Evidence that above-ground biomass carbon sequestration is likely to be maintained for 20 years[28] or more (secure land rights, low threat of conversion, contractual commitments) or demonstrate 50% higher level of sequestration	N/A
Energy, including energy embedded inputs *Exclusions: use of wood or coal-based energy sources*	• Energy-efficient traction, irrigation, and storage (falls in top 25% of energy efficiency rates for equipment available in country) OR • Use of only renewable energy	N/A

3.11 Animal welfare requirements

Where agricultural production includes livestock in intensive production systems, standards for animal welfare must be certified to one of the following schemes:

- Humane Farm Animal Care Certified Humane https://certifiedhumane.org/
- RSPCA Assured https://www.rspcaassured.org.uk/farm-animal-welfare/rspca-welfare-standards/
- Animal Welfare Approved by A Greener World https://agreenerworld.org/certifications/animal-welfare-approved/
- Beter Leven levels 2&3 https://beterleven.dierenbescherming.nl/
- G.A.P levels 4&5 https://globalanimalpartnership.org/

If the issuer demonstrates that none of these schemes certify in the country where the operations are located, then assessment should be undertaken using the requirements (principles and the relevant species-specific mitigation criteria) detailed in the FARMS Initiative RMS (except those criteria relating to transportation and slaughter as these are out of the scope of the Agriculture criteria). These are available at https://farms-initiative.com.

There is no burden of proof required for extensive agricultural systems to *demonstrate* animal welfare standards.

3.12 Sourcing of feed for livestock

For stall-fed/ feedlot and in-house livestock, feed must be sustainably sourced. This means feed has not been grown in areas recently converted from natural habitats and is produced in an environmentally sustainable way. There are two options to demonstrate this:

Option A – Feedstocks used are certified under one of the following, pre-approved best practice standards:

- RSB https://rsb.org/certification/
- RTRS https://responsiblesoy.org/
- ISCC Plus https://www.iscc-system.org/

[27] The 20-year period is only for evidence of maintenance.
[28] Ibid.

- Pro Terra https://www.proterrafoundation.org/

Certification of all source feedstocks must be maintained for the full term of the bond.

Other schemes may be added once it can be demonstrated to CBI that requirements are in place for no conversion of high carbon stock lands and that the chain of custody is comprehensive so that mass balance of feed is not permitted.

Option B – Feedstocks are certified under a standard or a similar scheme where the issuer can prove the standard has sufficient requirements and thus is robust.

For pasture-based livestock that is predominantly grass fed (that is, where feedlots are used only for finishing or for supplementary stall feeding e.g., for dairy), these requirements do not apply.

3.13 Adaptation and Resilience compliance requirements

Issuers must demonstrate that an assessment has been undertaken of the physical climate hazards to which the production unit will be exposed and vulnerable over its operating life. The issuer must also demonstrate that measures have or will be taken to:

i. Address those risks and mitigate them to a level so that the production unit is 'fit for purpose' in the face of coming climate change over its operational life; and
ii. To ensure that the production unit does no harm to the resilience of the defined system it operates within, taking into account the boundaries and critical interdependencies between that system and the production unit.

The issuance is required to demonstrate that there will be ongoing monitoring and evaluation of the relevance of the risks and resilience measures and related project adjustments as needed. Specifically, the Criteria summarised in the checklists must be met. Professional assessments and climate scenario analysis is not required, rather, these are just examples and suggestions to provide guidance.

To demonstrate compliance with this element of the Criteria, all assets and projects must satisfy the requirements of the Adaptation & Resilience Checklist ('the Checklist'), found in Appendices 1 through 5.

The Checklist is a tool to verify that the issuer has implemented sufficient processes and plans in the design, planning and decommissioning phases of a project to ensure that the operation and construction of the asset minimises environmental harm and the asset is appropriately adaptive and resilient to climate change and supports the adaptation and resilience of other stakeholders in the environment.

All elements of the Checklist must be addressed, and appropriate evidence provided that these requirements are being met or are not applicable in respect of the specific assets and projects linked to the bond. It is expected that their evidence will encompass a range of assessment and impact reports and associated data, including but not limited to those reports required to meet national and local licensing and approval processes.

A climate change adaptation assessment may be integrated into a range of appropriate project development steps, which may include, inter alia, strategies and planning, pre-feasibility and feasibility studies, audits, technical assessments, risk assessments, or environmental and social due diligence, e.g., environmental and social impact assessments.

4. Reporting requirements

In accordance with the Climate Bonds Standard, it is the issuer's responsibility to provide to the Approved Verifier the information necessary to demonstrate compliance with each component of the Criteria. Detail on the requirements of this Criteria is detailed below and further detail on post verification and annual reporting is provided in the Standard.

Issuers are required to provide at least the following information during pre-issuance verification depending upon which set of eligibility criteria the issuance is subject to:

- Evidence of no conversion of high carbon stock lands.
- Evidence of land use status.
- Evidence of low-emission crop and animal management demonstrated either through a verified GHG assessment (if compliance is demonstrated by a climate-aligned percentage reduction in GHG emissions over the investment period) or a verified farm management plan (if compliance is demonstrated by evidence of following low emission agricultural best practices).
- Evidence of certification with the animal welfare and feed schemes.
- Assessment against the Adaptation and Resilience Checklist that corresponds to the specific activity/intervention.

Appendix 1: A&R Checklist for Whole Agricultural Production Unit

Adaptation and resilience checklist for the whole Agricultural Production Unit		Submitted
1. Clear boundaries and critical interdependencies between the agricultural production unit and the system it operates within are identified.		
1.1	Boundaries of the production unit are defined using (1) a listing of all farm holdings and associated assets and activities associated with the use of the bond proceeds, (2) a map of their location, and (3) identification of the expected operational life of the activity, asset, or project.	
1.2	Critical interdependencies between the production unit and the system within which it operates are identified. Identification of these interdependencies should consider the potential for adverse impacts arising from the items in Item 4 in Appendix 6.	
2. An assessment has been undertaken to identify the key physical climate hazards to which the production unit will be exposed and vulnerable over its operating life.		
2.1	Key physical climate risks and indicators of these risks are identified in line with the following guidelines: • Risks are identified based on (a) a range of climate hazards, and (b) information about risks in the current local context, including reference to any previously identified relevant hazard zones, e.g., flood zones. • A full list of potential physical climate risks that may be considered is given in Item 7 of Appendix 6. At a minimum, risks in each of the categories in Item 5 of Appendix 6 must be considered.	
3. The measures that have been or will be taken to address those risks mitigate them to a level so that the production unit is able to manage changing climatic conditions over its operational life.		
3.1	Risk reduction measures are implemented for all key risks to the production unit. These should enable the production unit to meet an average annual productivity threshold under a range of expected climate hazards for the duration of the investment period. The minimum productivity threshold is determined by the average level of yield loss, compared to average production over five years, for at least three comparable holdings with five years or more of production. Where comparable holdings are not available, the minimum productivity threshold will be calculated as 10% less than the mean annual productivity over five previous years where no extreme climate events occurred.	
3.2	Risk reduction measures must be tolerant to a range of climate hazards and not lock-in conditions that could result in maladaptation.	
4. The measures that have been or will be taken do no harm to the resilience of the defined system they operate within, as indicated by the boundaries of and critical interdependencies with that system as identified in item 1 in this checklist.		
4.1	An assessment is conducted to demonstrate that the production unit does not pose significant risk of harm to others' natural, social, or financial assets according to the principle of best available evidence during the investment period taking into account the production unit's boundaries and critical interdependencies as defined in item 1 of this checklist. Harm is defined as an adverse effect on any of the items in Item 6 of Appendix 6.	

Adaptation and resilience checklist for the whole Agricultural Production Unit		Submitted
5. The issuance is required to demonstrate that there will be ongoing monitoring and evaluation of the relevance of the risks and resilience measures, and related adjustments to those measures will be taken as needed.		
5.1	Indicators for risks identified under item 2 in this checklist are provided.	
5.2	Indicators for resilience measures identified under item 3 in this checklist are provided.	
5.3	Indicators for “no harm” to relevant system assets identified under item 4 in this checklist are provided.	
5.4	Issuers have a viable plan to annually monitor (a) climate risks linked to the production unit, (b) climate resilience performance, and (c) appropriateness of climate resilience intervention(s), and to adjust as necessary to address evolving climate risks.	
5.5	Issuers have a process for monitoring and evaluation, and this is done annually.	
5.6	A grievance redress mechanism is in place to enable stakeholders to identify unanticipated adverse impacts, including biases of investments away from high-risk locations and assets.	

Appendix 2: A&R Checklist for Interventions addressing GHG emissions/carbon sequestration within the Agricultural Production Unit

Adaptation and resilience checklist for interventions addressing GHG emissions/carbon sequestration within the Agricultural Production Unit		Submitted
1. Clear boundaries and critical interdependencies between the intervention and the agricultural production unit and wider system it operates within are identified.		
1.1	Boundaries of the farm holding(s) where the resilience measures are being undertaken are defined using (1) a listing of all farm holdings and associated assets and activities associated with the use of the bond proceeds, (2) a map of their location, and (3) identification of the project life timeframe.	
1.2	Critical interdependencies between the intervention, the production unit, and the system within which it operates are identified. Identification of these interdependencies should consider the potential for adverse impacts arising from the items in Item 4 in Appendix 6.	
2. An assessment has been undertaken to identify the key physical climate hazards to which the production unit will be exposed and vulnerable over its operating life.		
2.1	Key physical climate risks and indicators of these risks are identified in line with the following guidelines: • Risks are identified based on (a) a range of climate hazards, and (b) information about risks in the current local context, including reference to any previously identified relevant hazard zones, e.g., flood zones. • A full list of potential physical climate risks that may be considered is given in Item 7 of Appendix 6. At a minimum, risks in each of the categories in Item 5 of Appendix 6 must be considered.	
3. The intervention does no harm to the resilience of the production unit (taking into account the physical climate change hazards it is exposed to as identified in item 2 of this checklist) nor the wider system it operates within (as indicated by the boundaries of and critical interdependencies with that system as identified in item 1 in this checklist).		
3.1	The intervention itself does not pose significant risk of harm to the production unit it is located within or others' natural, social, or financial assets according to the principle of best available evidence during the investment period taking into account the boundaries and critical interdependencies as defined in item 1 in this checklist. Harm is defined as an adverse effect on any of the items in Item 6 of Appendix 6.	
4. If the intervention relates to hard infrastructure, the infrastructure is suitable to climate change conditions over its operational life.		
4.1	The infrastructure must be tolerant to the range of climate hazards identified in item 2 of this checklist and not lock-in conditions that could result in maladaptation.	

Appendix 3: A&R Checklist for Interventions addressing climate adaptation and resilience within the Agricultural Production Unit

Adaptation and resilience checklist for interventions addressing climate adaptation and resilience within the Agricultural Production Unit		Submitted
1. Clear boundaries and critical interdependencies between the intervention and the agricultural production unit and the wider system it operates within are identified.		
1.1	Boundaries of the farm holding(s) where the resilience measures are being undertaken are defined using (1) a listing of all farm holdings and associated assets and activities associated with the use of the bond proceeds, (2) a map of their location, and (3) identification of the project life timeframe.	
1.2	Critical interdependencies between the intervention and the production unit and the wider system within which it operates are identified. Identification of these interdependencies should consider the potential for adverse impacts arising from the items in Item 4 in Appendix 6.	
2. An assessment has been undertaken to identify the key physical climate hazards to which the production unit will be exposed and vulnerable over its operating life.		
2.1	Key physical climate risks and indicators of these risks are identified in line with the following guidelines: • Risks are identified based on (a) a range of climate hazards, and (b) information about risks in the current local context, including reference to any previously identified relevant hazard zones, e.g., flood zones. • A full list of risks is given in Item 7 of Appendix 6. At a minimum, risks in each of the categories in Item 5 of Appendix 6 must be considered.	
3. The intervention(s) being financed form part of a package of measures that will mitigate the physical climate risks (identified in item 2 in this checklist) to a level that will support the production unit in being 'fit for purpose' in the face of coming climate change over its operational life.		
3.1	Risk reduction measures are implemented for all key risks to the production unit within the next five years. These should enable the production unit to meet an average annual productivity threshold under a range of expected climate hazards for the duration of the investment period. The minimum productivity threshold is determined by the average level of yield loss, compared to average production over five years, for at least three comparable holdings with five years or more of production. Where comparable holdings are not available, the minimum productivity threshold will be calculated as 10% less than the mean annual productivity over five previous years where no extreme climate events occurred. The intervention(s) being financed form part of that package of risk reduction measures.	
4. The intervention(s) do no harm to the resilience of the defined system it operates within, as indicated by the boundaries of and critical interdependencies with that system as identified in item 1 of this checklist.		
4.1	The intervention(s) do not pose significant risk of harm to others' natural, social, or financial assets according to the principle of best available evidence during the investment period taking into account the	

Adaptation and resilience checklist for interventions addressing climate adaptation and resilience within the Agricultural Production Unit		Submitted
	farm's boundaries and critical interdependencies as defined in item 1 of this checklist. Harm is defined as an adverse effect on any of the items in Item 6 of Appendix 6.	
5. If the intervention relates to hard infrastructure, the infrastructure is suitable to climate change conditions over its operational life.		
5.1	The infrastructure must be tolerant to the range of climate hazards identified in item 2 of this checklist and not lock-in conditions that could result in maladaptation.	

Appendix 4: A&R Checklist for activities aimed at enabling GHG emissions reductions or carbon sequestration in third-party Agricultural Production Units

Adaptation and resilience checklist for activities (and resulting products or services) aimed at enabling GHG emissions reductions or carbon sequestration in third-party Agricultural Production Units		Submitted
1. The product(s) or service(s) should not substantially increase the impacts of material physical climate risk when applied on-farm.		
1.1	The potential impact on risk should consider the climate risks that particularly affect on-farm production systems (see Item 5 in Appendix 6).	
1.2	Risk impact assessments should consider (a) a range of climate conditions, and (b) information about likely risks in contexts in which those measures might be applied.	
2. The product(s) or service(s) do not/will not cause significant harm to the resilience of the defined system or the wider ecosystems in which they might be deployed.		
2.1	The risk reduction measure(s) do not pose significant risk of harm to natural, social, or financial assets according to the principle of best available evidence during the investment period. Harm is defined as an adverse effect on any of the items in Item 6 of Appendix 6.	

Appendix 5: A&R Checklist for activities aimed at enabling climate adaptation and resilience in third-party Agricultural Production Units

Adaptation and resilience checklist for activities (and resulting products or services) aimed at enabling climate adaptation and resilience in third-party Agricultural Production Units		Submitted
1. The product(s) or service(s) substantially reduces material physical climate risk when applied on-farm.		
1.1	The reduction of risk should relate to the climate risks that particularly affect on-farm production systems: (see Item 5 in Appendix 6).	
1.2	The risk reduction enabled by the product(s) or service(s) is to be tolerant to a range of climate conditions and does not lock-in conditions that could result in maladaptation.	
1.3	Risk reduction assessments should consider (a) a range of climate conditions, and (b) information about likely risks in contexts in which those measures might be applied.	
2. The product(s) or service(s) do not/will not cause significant harm to the ecosystem.		
2.1	The risk reduction measure(s) do not pose significant risk of harm to others' natural, social, or financial assets according to the principle of best available evidence during the investment period taking into account the farm's boundaries and critical interdependencies as defined in item 1 of this checklist. Harm is defined as an adverse effect on any of the items in Item 6 of Appendix 6.	

Appendix 6: Guidance for completion of Adaptation and Resilience Checklists

1. Risk Assessment

Users can choose to apply climate scenarios based on representative concentration pathway (RCP) 4.5 and 8.5 or similar scenarios to ensure consideration for a worst-case scenario.

- A broad range of models can be used to generate climate scenarios.
- Time horizons for assessing climate risk in agriculture can be based on annual seasonal forecasts and every ten-year interval for the lifetime of the assets and projects. Where accurate assessments of climate variability for specific locations are not possible, use worst-case scenarios.
- Risks can be characterized by the associated annual probability of failure or annual costs of loss or damage.
- For risk assessment, the TCFD The Use of Scenario Analysis in Disclosure of Climate-Related Risks and Opportunities is recommended.

Resources for carrying out a risk assessment

Platforms:

- EU Climate Adapt and GRaBS Assessment Tool
- National Agricultural Information System (SNIA, the Spanish acronym), Uruguay
- World Bank Climate Change Knowledge Portal: https://climateknowledgeportal.worldbank.org/
- Climate Risk Agricultural Zoning (ZARC), Brazil
- Global Forecast Drought Tool: http://iridl.ldeo.columbia.edu/maproom/Global/World_Bank/Drought_Monitor/index3.html?gmap=%5B98.56491816776989%2C14.15605487421816%2C2%5D

Tools and Frameworks:

- USAID Climate Risk Screening and Management Tools: https://www.climatelinks.org/resources/climate-risk-screening-and-management-tools
- African Development Bank Climate screening and adaptation review and evaluation procedures
- CEDRIG tool (Climate, Environment and Disaster Risk Reduction Integration Guidance) of the Swiss Development Corporation
- FAO Climate risk assessment and management in agriculture (Selvaraju 2012) See also other 2012 Building resilience for adaptation to climate change in the agriculture sector workshop papers
- WWF Water risk filter
- WRI Aqueduct atlas
- WBCSD Water tool
- UN Food and Agriculture Organization GAEZ Agri tool data portal
- SASB Good practice standards

Climate Data:

- IRI Climate Data Library
- Global Circulation Model GCM) Downscaled Data Portal: http://ccafs-climate.org/data_spatial_downscaling/
- MarkSim GCM, http://gismap.ciat.cgiar.org/MarkSimGCM/, which can provide characteristic daily data for current or future conditions (using Coupled Model Intercomparison Project Phase 5 (CMIP5) GCM data[1]) by pointing and clicking on the map and choosing the GHG scenario/model/year. There is a stand-alone version that can be used to run crop models over large areas.
- IPCC Working Group 1 is producing an online atlas. Until that is available the CIAT climate Wizard is a resource, although it uses older CMIP3 data.
- National governments or national meteorological office climate change projections

2. Measures to take to ensure 'fit for purpose'

- In addition to minimum productivity or loss, resilience also can be indicated by the variation in yield during years/seasons of climate hazards relative to the variation in yields across years/seasons with no climate hazards. This describes how closely yields under climate change hazards compare to normal variability in yields. A score of 1 or more indicates that variation in yields under the climate hazard is the same or more as the yields without climate change, in other words, good performance despite the climate hazard. A score of less than 1 indicates that productivity under the climate hazard is falling below that achieved in normal years.
- The timing of risk management may be considered. What can be done before an asset is built to reduce vulnerability? What are the options to adjust after the system is built? How can operational practices be improved to increase resilience?
- Stakeholder consultations can be used to identify different views of what constitutes significant risk of harm and unacceptable levels of harm to the system. Stakeholders should include members in the community affected.

Examples of resilience practices in agriculture are provided below for information only. The measures selected for the farm holding and associated assets in question must be selected to be appropriate for the identified risks for that holding in its specific context.

- **Improved or more stable productivity (economic buffering of climate impacts):** increasing yields or yield stability, or reducing costs to produce net gains in product or revenue; diversified production; enhancing savings and value of assets; increasing efficiency of water, energy, fertilizer and other inputs; improving product storage capacities; using the agronomic practice best suited to changing climatic conditions; reducing the percentage of area planted to vulnerable crops; increasing the percentage of production under controlled environment agriculture;
- **Adapted stock:** using species and breeds adapted to changes in CO_2 and climate, e.g., temperature, water regimes, extreme events, or seasonality;
- **Ecological buffering of climate impacts:** water or microclimate management, e.g., irrigation, water storage, increased soil water holding capacity, agroforestry to buffer extreme temperatures or enhanced soil organic carbon; ecological diversification, including shifting land use from monoculture to polyculture or other diversified production; riparian buffer strips; soil and water conservation; mangrove management; habitat restoration;
- **Risk management:** hard assets (weather stations, satellites, computing, and communication infrastructure) used for climate information services and early warning systems, crop insurance, monitoring and evaluation of farm performance, identification and addressing of risks beyond design standards (e.g., of levees/embankments, or other physical infrastructure), emergency preparedness, and other services that help avoid or compensate for climate risk at the farm level
- **Physical relocation of vulnerable assets or activities:** avoided use of locations vulnerable to climate risks such as flooding, salinization, or heat stress.

See Background Paper Appendix 5 for a list of indicators of resilience.

3. Resources for monitoring requirements:

Resources for indicators of climate risks include: TAAS (2018)[29], Rosenzweig and Tubiello (2008)[30], Hatfield et al. (2018)[31] Bizikova and Waldick 2019[32].

Resources for monitoring and evaluation of adaptation include:

- Monitoring and Evaluation Framework, NAMA (Nationally Appropriate Mitigation Action) Facility www.nama-facility.org/fileadmin/user_upload/publications/documents/2018-11_doc_nama-facility_me-framework.pdf. Guidance for NAMA Support Projects funded by the NAMA facility for formative evaluation for relevance, efficiency, effectiveness, sustainability and impact.

[29] Trust for Advancement of Agricultural Sciences (www.taas.in)
[30] Rosenzweig and Tubiello (2008) Developing climate change impact metrics for Agriculture, Integrated assessment 9(1): 165-184
[31] Hatfield et al. (2018) Indicators of climate change in agricultural systems. Climatic Change 163 pp1719-1732.
[32] Bizikova and Walkdick, 2019 An indicator set to track resilience to climate change in agriculture 2019, p103676

- Making Adaptation Count: Concepts and options for monitoring and evaluation of climate change adaptation www.wri.org/publication/making-adaptation-count. Report providing a theory-of-change-based and "learning by doing" framework for tracking adaptation achievements and setbacks for projects with development objectives. Includes examples of indicators relevant to agriculture.
- Sendai Framework for Disaster Risk reduction.

4. Identifying critical interdependencies

At a minimum, the following interdependencies should be considered:

1. The effects of water use or pollution on other water users or erosion in the watershed
2. Relationships of the asset/project to nearby flood zones
3. Introduction of pests and diseases
4. Reduction in pollinating insects and birds
5. Reduction in biodiversity of High Conservation Value[33] habitat
6. Damage or reduction in value of neighbours' property due to boundary trees, other structures at risk of falling during storm events, agricultural pests, and disease
7. Fire and other practices that affect air quality
8. Market influences, such as excess supply which drives down prices
9. Appropriation of land or economic assets from nearby vulnerable groups[34]
10. Overuse of inputs

5. Identifying potential physical climate risks

At a minimum, the following potential physical climate risks should be considered:

1. **Temperature**: High/low temperature, change in number of hot nights, heat spell duration, cold waves, frost
2. **Water**:
   a. Precipitation: High precipitation, intense rainfall events, waterlogging, flood, drought, freezing rain (hail, ice)
   b. Water stress: Crop water stress (reflecting combination of temperature, precipitation, and wind), ratio of water withdrawals to availability
   c. Sea-level: Inundation, flooding or storm surges, salinization due to saltwater intrusion or changing water regimes
   d. Glacial melting and lake outbursts: flood, body of water contained by glacier overflows or glacial melts
3. **Wind**: Cyclones (hurricanes, tornadoes, typhoons), dust and sandstorms, blizzards, wind patterns
4. **Soil**: Erosion (including coastal erosion), landslides, avalanches, degradation
5. **Seasonality**: Rain onset, change in seeding date, length of growing season, change in frost-free days in season, other phenological risks specific to crop type
6. **Pests and disease**: New pest and disease patterns, changes in pest and disease vectors
7. **Fire**: Increased incidence and extent of wildfires or control of agricultural fires
8. **CO_2 Concentrations**: Generally expected to create a positive effect due to CO_2 fertilization and stimulate growth and carbohydrate production, but risks changes in nutritional content and density, such as protein, sugars, and essential minerals, for example in wheat, rice, and potatoes[35]

6. Identifying do no harm aspects

At a minimum, the following should be considered in terms of the production unit/ intervention/ enabling measure's potential to 'do harm' to the system it operates within:

1. The effects of water use or pollution on other water users or erosion in the watershed

[33] High Conservation Value (HCV) habitat criteria in accordance with https://www.hcvnetwork.org.
[34] According to IFC Performance Standards
[35] https://health2016.globalchange.gov. See also Loladze, I. (2002) Rising atmospheric CO2 and human nutrition: toward globally imbalanced plant stoichiometry? Trends in Ecology and Evolution 17: 457-461; Müller, C., Elliott, J., and Levermann, A. (2014) Fertilizing hidden hunger. Nature Climate Change 4: 540-541, Myers, S.S., Zanobetti, A., Kloog, I. et.al. (2014). Increasing CO2 threatens human nutrition. Nature 510: 139-142

2. Increased risk of flooding
3. Introduction of pests and diseases
4. Reduction in pollinating insects and birds
5. Reduction in biodiversity or High Conservation Value[36] habitat
6. Damage or reduction in value of neighbours' property due to boundary trees, other structures at risk of falling during storm events, agricultural pests, and disease
7. Fire and other practices that affect air quality
8. Market influences, such as flooding a market with a commodity and driving down prices
9. Appropriation of land or economic assets from nearby vulnerable groups[37]
10. Overuse of inputs
11. Decline in the productivity of an asset
12. Decline in conditions below an applicable policy standard
13. No use of chemicals listed in the Stockholm Convention[38] or 1a or 1b in the WHO classification of pesticides by hazard[39] or not in compliance with the Rotterdam Convention[40]

7. Physical climate change risks to be considered

Classification of climate-related hazards

Changes in climate patterns and in the frequency/severity of climate-related events that are:				
	Temperature-related	**Wind-related**	**Water-related**	**Solid mass- related**
CHRONIC	Changing temperature (air, fresh water, marine water)	Changing wind patterns	Changing precipitation	Coastal erosion
	Heat stress		Coastal erosion patterns and types	Soil degradation
	Temperature variability		Precipitation and/or hydrological variability	Soil erosion
	Permafrost thawing		Ocean acidification	Solifluction
			Saline intrusion	
			Sea level rise	
			Water stress	
ACUTE	Heat wave	Cyclone, hurricane, typhoon	Drought	Avalanche
	Cold wave/frost	Storm (including blizzards, dust and sandstorms)	Heavy precipitation (rain, hail, snow/ice)	Landslide
	Wildfire	Tornado	Flood (coastal, fluvial, pluvial, ground water)	Subsidence
			Glacial outburst	

[36] High Conservation Value (HCV) habitat criteria in accordance with https://www.hcvguidelines.org/.
[37] According to IFC Performance Standards
[38] http://www.pops.int/
[39] https://www.who.int/ipcs/publications/pesticides_hazard/en/
[40] http://www.pic.int/

Appendix 7: TWG and IWG Members

TWG	IWG
TWG Lead Specialist - Lini Wollenberg – CGIAR-CCAFS	Aarti Ramachandran/Iman Effendi - FAIRR Initiative
Amy Dickie - CEA Consulting	Andrew Gazal – ESG Tech
Anna Lorant - Institute for European Environmental Policy	Ankita Shukla - Sustainanalytics
Bob Scholes - Wits University Johannesburg	Aurélie Choiral Gupta - Credit Suisse
Brent Matthies - University of Helsinki	Brian Kernohan - Hancock Natural Resource Group
Christine Negra - Versant Vision	Chang He - CECEP
Clare Stirling - CIMMYT	Dana Muir, Mike Faville - BNZ
Debbie Reed - Ecosystem Services Markets Consortium	Francisco Avendano - Climate Policy IFC
Gerard Rijk - Profundo/Chain Reaction Research	Gustavo Pimentel/Débora Masullo de Goes – Sitawi
Gillian Galford - Gund Institute for Environment	Hamish McDonald - NaturesCoin
Greg Fishbein - The Nature Conservancy	Jacob Michaelsen - Nordea
Jeroen Dijkman - FAO	John Kazer - Carbon Trust
Jonathan Hillier - University of Edinburgh	Mareike Hussels - SAIL Ventures
Kim Schumacher - University of Oxford	Maria De Filippo - Affirmative Investment Management
Mukiri wa Githendu - Kenyatta University	Pedro Moura Costa - SIM/Facility
Ngonidzashe Chirinda - CGIAR	Pip Best - E&Y
Pablo Fernandez de Mello e Souza - BVRio	Robert Rosenberg/Mélanie Comble - ISS ESG
Pedro Luiz Oliveira de Almeida Machado - Brazilian Agriculture Research Corporation (Embrapa)	Roberto Strumpf - Pangea Capital
Raylene Watson - ebsadvisory	Rosemarie Thijssens - Rabobank
Sam Schiller - Kellogg School of Management	Scot Bryson – Orbital Farm
Soora Naresh Kumar, ICAR-Indian Agricultural Research Institute	
Stephen Donofrio - Forest Trends	
Tanja Havemann - Clarmondial AG	
Timm Tennigkeit – UNIQUE	