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## Carbon Offset Backgrounder

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### KEY TAKEAWAY

Voluntary carbon markets are a great tool for helping to fund environmentally-friendly projects that reduce global greenhouse gas (GHG) emissions, despite some [recent-year criticism](#) related to agriculture, forestry, and other land use (AFOLU) projects, in particular. Agroforestry Partners fully intends to list carbon offsets for its various projects, and the company is confident in its ability to properly produce monitoring, reporting and verification (MRV) to defend anticipated benefits to carbon buyers and society overall. AP recently engaged Terra Global to review its options for carbon offset development and listing, with Terra providing an initial analysis that could allow for the removal of over 800,000 metric tons of CO<sub>2</sub>e across the total life of AP projects, equating to 0.85 tons/acre/year. This rate of removal is below a scientific metadata analysis of agroforestry carbon removals, however the latter generally pertains to higher density plantings in the Tropics. No matter, Agroforestry Partners intends to review all of its available options, accordingly. As a side note, AP's projected carbon offset revenue represents 1% of incremental return to LP investors in the fund.

### KEY POINTS

**Carbon Market 101.** In their simplest form, carbon markets are a way to turn carbon dioxide (CO<sub>2</sub>) and its greenhouse gas (GHG) counterparts like methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O) into a commodity by giving them a price. In this way, the hope is that society can begin to financially account for environmental harm when producing goods and services.

The size of the global voluntary carbon offset market is estimated at over \$1 billion for the primary market, as of 2021, with roughly 400 million metric tons of offsets issued that year. Over the past six years up through 2021, offset issuance in the primary market has grown at an average rate of just over 30%. As of 2021, the secondary market was estimated at \$2-\$3 billion in size. In the voluntary space, the primary market refers to combination registries that identify emissions reductions at the source, while reporting and tracking offset project information in their own databases using their own standards. The four main registries in the voluntary market are Verra's Verified Carbon Standard (VCS), the American Carbon Registry (ACR), Climate Action Reserve (CAR), and Gold Standard (GS). The secondary market consists of "accounting" registries and a surrounding ecosystem that implement and track the secondary market trading of carbon offsets. Examples of common accounting registries include Xpansiv CBL, the AirCarbon Exchange (ACX), the CME Group (responsible for CBL GEO, N-GEO, and C-GEO products), the Intercontinental Exchange (ICE), and Carbonplace/Project Carbon. S&P Global Platts is a prominent resource for tracking secondary market pricing for carbon offsets.

**Terra Analysis of Agroforestry Partners.** Agroforestry Partners ("AP" or "the company") engaged Terra Global to conduct a feasibility study regarding the company's planned agroforestry projects across 10,000 acres in northern Kentucky and southern Ohio. The goal of the study was to A) provide AP with the information needed to understand whether emissions reductions/removals from its agroforestry work could be adopted by eligible farmers, and B) determine whether these reductions/removals can be verified under a reputable registry/market GHG standard. Terra found that the Afforestation, Reforestation, and Revegetation (ARR) Area-Based approach from VCS offers the highest net carbon potential for removal at 2.03 metric tons of CO<sub>2</sub>e per hectare (ha) per year (0.85 tons CO<sub>2</sub>e per acre per year) over the life of the measured project (120 years). Additionally, the first 20 years of the project (fund 1 investment duration) would equate to ~1.5 metric tons of CO<sub>2</sub>e removals per acre per year. These numbers are below scientific research that shows an average agroforestry CO<sub>2</sub>e removal rate of 2-5 metric tons per acre per year, however the latter is generally focused on higher density plantings in the global Tropics region.

**Forward Plan.** Agroforestry Partners plans to review other registries and their methodologies, so as to procure the best possible offset volumes and pricing for our partners and investors. In addition to the four main registries named herein, additional registries include Plan Vivo, The Climate Registry (TCR), and the Architecture for REDD+ Transactions (ART). The company is also actively engaged with carbon offset buyers in an effort to line up ongoing offtake of its offsets. AP sees carbon sequestration and pertinent offsets as a key part of its mission to enact agroforestry within the eastern U.S., alongside the protection and rejuvenation of soils, reduced nutrient leaching into freshwater supplies, and increased biodiversity rates. The company currently models total carbon revenue of ~\$3.6 million across its 20-year investment term, based on 270,000 metric tons of CO<sub>2</sub>e removed from the atmosphere and an average offset price near \$13.25 per metric ton. AP's projected carbon offset revenue represents 1% of incremental return to LP investors in the fund.

## CARBON MARKET 101

### Basics

In their simplest form, carbon markets are a way to turn carbon dioxide (CO<sub>2</sub>) and its greenhouse gas (GHG) counterparts like methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O) into a commodity by giving them a price. In this way, the hope is that negative externalities not being priced into profits or operations by industries and societies will now have an associated cost that all stakeholders can more clearly track and use for decision-making across the broader economy. In short, carbon markets begin to afford society a way to financially account for environmental harm when producing goods and services.

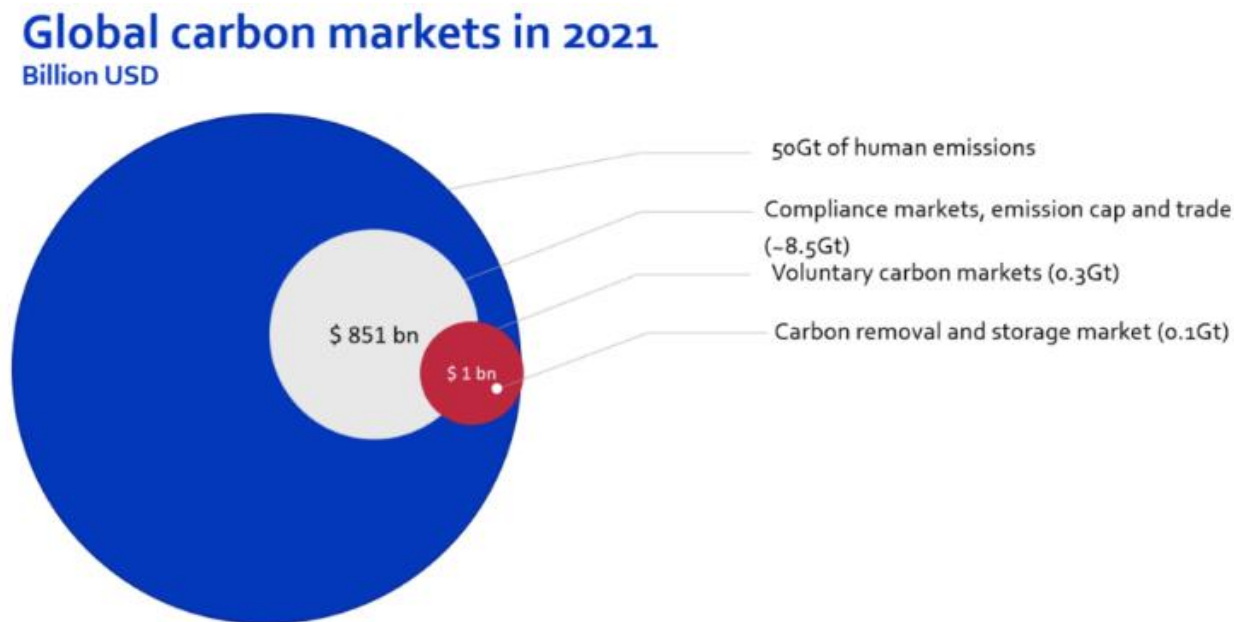
Carbon markets were born as a result of two international climate accords: the Kyoto Protocol of 1997 and the Paris Agreement of 2015, both struck as part of the annual United Nations Framework Convention on Climate Change (UNFCCC) meeting that takes place each year to organize the world's governments and citizens on a common approach to climate change. These two agreements gave rise to many countries implementing national emissions targets amid plans to lower GHG emissions over time (common targets coming out of Paris were to reduce GHG emissions by 50% by 2030 and realize net-zero emissions by 2050), with an ultimate goal of keeping global warming to +1.5°C or “well below +2.0°C” relative to the pre-industrial era. This dynamic is what has created a bifurcation in carbon markets between 1) mandatory/compliance schemes and 2) voluntary markets.

Compliance markets are mandatory emissions reduction schemes created and regulated by national, regional, or international governing bodies. They usually pertain to energy and/or electricity sectors. Voluntary markets function outside of compliance markets and allow private sector actors the ability to create and purchase carbon offsets on a voluntary basis. Although carbon “credits” and carbon “offsets” are used interchangeably quite often, carbon credits are most typically associated with compliance markets as they represent a purchase allowance from a governing body in order to generate one metric ton of CO<sub>2</sub> or CO<sub>2</sub> equivalent (CO<sub>2</sub>e). In contrast, carbon offsets are most typically associated with voluntary markets as they flow horizontally between counterparties and have the ability to continue flowing freely at market-determined rates. Both credits and offsets are categorized as verified emission reductions, or VERs. Our focus for this particular report is on the voluntary carbon offset market.

### Voluntary Market Dynamics

The size of the global voluntary carbon offset market is estimated at over \$1 billion for the primary market, as of 2021, with roughly 400 million metric tons of offsets issued that year. Over the past six years up through 2021, offset issuance in the primary market has grown at an average rate of just over 30%. As of 2021, the secondary market was estimated at \$2-\$3 billion in size.

Figure 1: Carbon Market Comparison



Source: Puro.earth

In the voluntary space, the primary market refers to combination registries that identify emissions reductions at the source, while reporting and tracking offset project information in their own databases using their own standards. The four main registries in the voluntary market are Verra’s Verified Carbon Standard (VCS), the American Carbon Registry (ACR), Climate Action Reserve (CAR), and Gold Standard (GS).

- VCS – global in scope; issues Verified Carbon Units (VCUs) to project developers
- ACR – global in scope; issues Emission Reduction Tonnes (ERTs) to project developers
- CAR – focused on North America; issues Climate Reserve Tonnes (CRTs) to project developers
- GS – global in scope, with a focus on advancing the UN SDGs in developing countries; issues Verified Emission Reductions (VERs) to project developers

VCS is the largest registry today, with roughly 60% of all offsets issued in the primary market. GS holds roughly 10% -15% of primary market issuance. ACR and CAR are each near 5% themselves. As of 2021, VCS delivered an average offset price of \$4.17 per metric ton of CO<sub>2</sub>e. GS delivered an average price of \$3.94 per metric ton, while ACR and CAR delivered an average price per metric ton of \$11.37 and \$2.12, respectively. Prices in the primary market can range up to \$50 or more, per metric ton, on some projects.

Prices for primary market offsets are influenced by a number of factors, including their permanence, additionality, and leakage. Permanence relates to whether the project removes emissions permanently. The idea of additionality asks the question, if the offset project hadn’t been created, would the emissions have been removed anyway? Finally, leakage relates to whether the project is shifting emissions from one source to another. Aside from these three main tests, carbon offset pricing has direct relationships to the ease and ability of data verification, along with the overall volume of offsets being generated/issued, geography, vintage (year), delivery time (when the offset will be available), and co-benefits (secondary positive impacts on the environment and/or society).

#### *Avoidance vs. Removal*

Carbon offsets are generally organized as either avoidance or removal projects, with removal offsets tending to trade at a premium price based on an anticipated higher level of required investment and a perception that they are more powerful in fighting climate change. Avoidance offsets relate to projects that reduce emissions by preventing their release into the atmosphere; examples include stopping the conversion of grasslands into agricultural crop production or limiting the harvest of native timber. Removal offsets relate to projects that pull carbon dioxide and its equivalents out of the atmosphere; examples include the planting of new trees or implementation of direct air capture (DAC) technologies.

#### *Nature-Based vs. Technology-Based*

Another layer of carbon offset segmentation relates to their organization between nature-based projects and technology-based projects (sometime referred to as engineered solutions or non-nature-based offsets). As their names suggest, nature-based projects aim to remove emissions via natural solutions such as reforestation, afforestation, reduced soil tilling, improved grassland management, and mangrove rehabilitation. In contrast, technology-based projects aim to remove emissions via technological approaches involving carbon capture, utilization and storage (CCUS), DAC, bioenergy with carbon capture and storage (BECCS), cookstove deployment, and renewable energy implementation like wind and solar.

Alongside the combination registries in the primary market, an entire ecosystem of independent standard setters, accreditors, guidelines, raters, and carbon programs/schemes exist to help fill out the broader voluntary carbon market. Independent carbon offset standards (as a complement to those from the registries themselves) are issued by groups like The Integrity Council for the Voluntary Carbon Market (ICVCM), which is developing a Core Carbon Principles (CCPs) product. Accreditation companies like the International Carbon Reduction and Offset Alliance (ICROA), EPIC Sustainability, First Environment, and SCS Global are all present in the marketplace. Guidelines are present from entities like the Voluntary Carbon Markets Integrity Initiative (VCMI) and the International Civil Aviation Organization (ICAO), the latter of which guides offset dynamics for the most prominent carbon program/scheme – the United Nations Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). Finally, multiple carbon offset raters exist, to include Sylvera, BeZero, Calyx, and Renoster Systems.

In addition to the primary market, a secondary market is also in place for voluntary carbon offsets. The secondary market consists of “accounting” registries and a surrounding ecosystem that implement and track the secondary market trading of carbon offsets. Examples of common accounting registries include Xpansiv CBL, the AirCarbon Exchange (ACX), the CME Group (responsible for CBL GEO, N-GEO, and C-GEO products), the Intercontinental Exchange (ICE), and Carbonplace/Project Carbon. S&P Global Platts is a prominent resource for tracking secondary market pricing for carbon offsets.

# TERRA ANALYSIS OF AGROFORESTRY PARTNERS

## Existing Scientific Research

In 2016, research published in the journal, “*Agriculture, Ecosystems & Environment*”, referenced a metadata study that showed agroforestry operations with an average age of 14 years sequestering roughly 7 metric tons of CO<sub>2</sub> per hectare (ha) per year, with biomass sequestration accounting for 70% of the total and soil carbon sequestration accounting for 30% of the total. In terms of acres, this equates to 2.9 metric tons of CO<sub>2</sub> per acre per year. It is important to acknowledge that many studies included in this metadata review pertain to projects taking place in the global Tropics region, which include dense plantings of trees and shrubs together with longer sunlight conditions and thus increased photosynthesis across the year, relative to more temperate climates. The study can be accessed, [here](#).

## Terra Results

Agroforestry Partners (“AP” or “the company”) engaged Terra Global to conduct a feasibility study regarding the company’s planned agroforestry projects across 10,000 acres in northern Kentucky and southern Ohio. The goal of the study was to A) provide AP with the information needed to understand whether emissions reductions/removals from its agroforestry work could be adopted by eligible farmers, and B) determine whether these reductions/removals can be verified under a reputable registry/market GHG standard.

Terra Global’s feasibility study for AP evaluated two registries: 1) VCS, and 2) the UN Clean Development Mechanism (CDM), which is largely focused on projects in developing countries. Based on its review, Terra recommended choosing the Afforestation, Reforestation, and Revegetation (ARR) Area-Based approach from VCS, as it offers the highest net carbon potential for removal at 2.03 metric tons of CO<sub>2</sub>e per ha per year (0.85 tons CO<sub>2</sub>e per acre per year) over the life of the measured project (120 years). Importantly, for the first 20 years of the project (fund 1 investment duration), accumulated VCUs amount to ~260,000 metric tons of CO<sub>2</sub>e which, spread over an average acreage count of 8,750 acres during that time, amounts to ~1.5 metric tons of CO<sub>2</sub>e per acre per year. This number is below scientific research, in part due to nitrogen fertilizer accounting from VCS and “buffer” assumptions from Terra, alongside aforementioned geographical differences.

## Deep Dive on VCS

The Verified Carbon Standard (VCS) from Verra is the largest voluntary carbon offset registry in the world, issuing roughly 60% of all offsets in the primary market. It hosts a wide range of projects, to include those pertaining to agriculture, forestry, and other land use (AFOLU). Prior to beginning the development of an offset project, “proponents” are encouraged to ensure that it complies with VCS rules and requirements per the [VCS Standard](#). As well, the broader registration and issuance process can be found, [here](#).

Key steps of project development include:

- 1) Pipeline Listing
  - a. Draft Project Description document; all projects undergo a 30-day public comment period during this phase; comments received during this time must be addressed by the project developer. \*AFOLU projects need to initiate the pipeline listing process within three years of project start date.
- 2) Validation
  - a. Must be done by a third-party auditor (Validation and Verification Body, or VVB); upon completion, this results in a successful Project Registration.
- 3) Verification
  - a. The VVB must verify the project’s monitoring plan to confirm emission reductions and removals; once verification has been completed and approved by Verra, a project proponent can request the issuance of offsets.

Fees for project development fall into three categories:

- 1) Verra Fees – see Program Fee Schedule, [here](#).
- 2) Project Development Fees – project development, operations, monitoring, and consultant fees.
- 3) Auditing Fees – paid directly to the VVB.

The charge to open an account with Verra is \$500. An additional registration fee is based on a formula and is capped at \$10,000. VCU issuance fees are based on a formula and would approximate \$114,000 over the life of the project for Agroforestry Partners, based on assumptions from Terra Global. Methodology review fees from Verra are listed at \$1,500 to \$13,000. There is also a VVB annual fee of \$2,500. Overall, Terra advises that total fees could exceed \$1 million based on Verra and non-Verra costs across time.

As for timelines, project registration includes a mandatory 30-day public comment period, with the validation process taking up to a year, or longer, in some cases. After validation, the project proponent can request project registration as outlined in Verra’s Registration and Issuance Process document. VCU issuance cannot occur until project activities are implemented and GHG reductions/removals are monitored. The VVB needs to verify these reductions/removals, with Verra then needing to approve the independent verification. Once a project has been registered and VCUs are issued, the project proponent can sell its offsets on the open market.

Carbon offset projects within the VCS need to apply individual methodologies specific to their project type as a way of properly quantifying accurate greenhouse gas benefits. These methodologies can be found, [here](#). The work of Agroforestry Partners falls under projects related to agriculture, forestry, and other land use (AFOLU). There are six AFOLU project categories eligible under the VCS program:

- 1) Afforestation, Reforestation, and Revegetation (ARR)
- 2) Agricultural Land Management (ALM)
- 3) Improved Forest Management (IFM)
- 4) Reduced Emissions from Deforestation and Degradation (REDD)
- 5) Avoided Conversion of Grasslands and Shrublands (ACoGS)
- 6) Wetland Restoration and Conservation (WRC)

Agroforestry Partners would be able to apply the VM0042 Methodology for Improved Agricultural Land Management (ALM), v2.0 approach to its project, or it could potentially apply the Area-Based Approach under the New Methodology for Afforestation, Reforestation and Revegetation (ARR) Project Activities, however it is important to note that the latter is still under VVB assessment and is not considered an approved VCS methodology at this time. It is equally important to note that Terra’s findings of the ARR Area-Based approach as the most attractive to AP include an output of 2.03 metric tons of CO<sub>2</sub>e per ha per year (0.85 tons CO<sub>2</sub>e per acre per year) relative to a VM0042 output of just 0.9 metric tons of CO<sub>2</sub>e per ha per year (0.38 tons CO<sub>2</sub>e per acre per year).

As a whole, the Terra calculations on GHG removals for Agroforestry Partners across the VCS are well below numbers provided in the aforementioned metadata analysis published in *Agriculture, Ecosystems & Environment* in 2016. One meaningful contributor to the delta is Terra’s inclusion of a 10% “buffer” in its analysis, based on requirements by the VCS that pooled buffer accounts be present to hold non-tradeable buffer offsets from the project to cover the non-permanence risk associated with AFOLU and geologic carbon storage (GCS) projects. Buffer offsets get canceled to cover carbon known or believed to be lost. Additionally, methodologies like the ARR Area-Based approach do not account for nitrogen fertilizer emissions in the baseline profile, however they are accounted for in the project scenario. This hurts relative GHG reduction/removal performance.

## **FORWARD PLAN**

Agroforestry Partners plans to review other registries and their methodologies, so as to procure the best possible offset volumes and pricing for our partners and investors. In addition to the four main registries named herein, additional registries include Plan Vivo, The Climate Registry (TCR), and the Architecture for REDD+ Transactions (ART). The company fully intends to make the three-year window required by the VCS for listing on that registry, if indeed AP decides to ultimately choose Verra.

Agroforestry Partners is also actively engaged with carbon offset buyers in an effort to line up ongoing offtake of the company’s offsets. The company sees carbon sequestration and pertinent offsets as a key part of its mission to enact agroforestry within the eastern U.S., alongside the protection and rejuvenation of soils, reduced nutrient leaching into freshwater supplies, and increased biodiversity rates.

The company currently models total carbon revenue of ~\$3.6 million across its 20-year investment term, based on 270,000 metric tons of CO<sub>2</sub>e removed from the atmosphere and an average offset price near \$13.25 per metric ton. AP’s projected carbon offset revenue represents 1% of incremental return to LP investors in the fund.

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