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Terms Index

**Afforestation/Reforestation (AR)** | afforestation is converting previously unforested land into forest; reforestation is restoring previously forested land into forest

**Application programming interface (API)** | facilitator of communication between two platforms; a software interface whereby third-party developers can leverage proprietary software of a platform to integrate functionality.

**Carbon credits** | an asset record representing a ton of carbon dioxide\(^1\). Credits can be accounted for in different ways and be generated through multifarious activities that either avoid, or remove credits.

**Carbon sink** | any natural store of CO\(_2\) (e.g. trees, soil, forests, etc.)

**COP27** | The 27th annual UN meeting on climate, held in November 2022

**Deforestation-based emissions** | the greenhouse gasses released upon clearing forested areas

**Digital Measurement, Reporting and Verification (dMRV)** | digital MRV methodologies which aspire for transparency, accuracy and efficiency

**Double counting** | selling (and retiring) more than one carbon credit per ton of sequestered greenhouse gasses; often claimed by one or more marketplace buyers and/or the host nation of the nature based project

**Distributed ledger technology** | the use of independent computers to record, share and synchronize transactions in their respective electronic ledgers\(^2\) (e.g. blockchain technology)

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\(^1\) Peluso, N. & Vandergeest, P. (2020). Writing Political Forests, *(Antipode)* | For an overview of carbon credits, see: *(Corporate Finance Institute)*

Measurement, Reporting and Verification (MRV) | the methodologies required to register and track the status of an environmental asset

FAO | Food and Agriculture Association

Fiat information | information stored with insecure methods e.g. in notebooks, or at best, in organizationally-restricted databases. Fiat information requires trust in the issuing entity and is not verifiable through openly accessible data

IETA | International Emissions Trading Association

L1 blockchain | or Layer-1 blockchain; the blockchain layer responsible for carrying out a blockchain’s core operations (e.g. consensus mechanisms, programming languages, protocols, etc.³)

Nature based projects | see Nature based solutions (NbS) definition

Nature based solutions (NbS) | natural solutions to creating and protecting carbon sinks. Nature-based solutions include, but are not limited to: afforestation/reforestation, conservation, blue (marine) carbon and others. NBS typically come with ecosystem-based co-benefits as well such as biodiversity and/or watershed protection

NEAR | or Near Protocol, is the L1 blockchain which OFP is built on

Net zero targets | the goal of an emitter (e.g. corporation, nation) to either stop emitting greenhouse gasses altogether or to reduce their emissions and offset the remaining ones by retiring the corresponding volume of carbon credits

OPN | the governance and internal value exchange mechanism of OFP. An officially designated utility token with FINMA, the Swiss Financial Market Supervisory Authority

**Paris Climate Agreement** | legally binding international treaty, adopted at COP21, to limit global warming to below 2°C (preferably 1.5°C) compared to pre-industrial (c. 1850) levels⁴.

**Photosynthesis** | the process by which plants and some other organisms use sunlight to synthesize nutrients from carbon dioxide (CO₂) and water, drawing CO₂ out of the atmosphere and releasing oxygen

**Protocol** | refers to a blockchain’s consensus methods (i.e. the processes put in place to reach consensus and validate transactions on a blockchain)

**Refi** | or regenerative finance; creating financial incentives for positive social, biospheric, or climate outcomes, e.g. drawing down carbon emissions

**Results-based financing** | release of capital to projects upon the verification of their successfully uploaded data

**Software development kit (SDK)** | suite of software-building tools for a specific platform, e.g. NEAR SDKs

**UNFCCC** | United Nations Framework Convention on Climate Change

**Validation/verification bodies** | bodies within the carbon credit supply chain that carry out (part of) the MRV process

**Waterfalls** | the repayment structure to contributors in order of their tier, e.g. ranked by proposed risk

**Web2** | umbrella term for the second iteration of the World Wide Web, which saw a shift towards user-generated content and centralized ownership of data by companies providing internet services

**Web3** | umbrella term for the third iteration of the World Wide Web, which achieves decentralization through blockchain technology

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⁴ UNFCCC. (2022). The Paris Agreement. [UNFCC]
Introduction to OFP

Human activity has resulted in the destruction of over 1/3 of total global forest coverage with approximately 15 billion more trees cut down annually\(^5\). The result is a net loss of 47mm ha of forested land between 2010–2020\(^6\). To this day, deforestation and degradation of forested lands generates roughly 15% of global annual emissions\(^7\)\(^8\).

It is thus no surprise that one of the many solutions towards preventing an unlivable or severely altered climate is to harness the power of photosynthesis by sustainably regenerating and conserving natural ecosystems. When effectively implemented, afforestation and reforestation plans could achieve 30% of the Paris Climate Agreement emissions reduction targets, while providing numerous co-benefits to life on Earth\(^9\). Despite decades of effort, market-based approaches have yet to achieve the reach necessary to effectively utilize nature’s capacity to absorb carbon.

Meanwhile, despite the shortcomings of market-based approaches, we have seen a 370% increase in the traded volume of voluntary carbon credits between 2019–

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\(^5\) Our World in Data (2022) \(\text{(Our World in Data)}\)
\(^6\) FAO. (2020). Global Forest Resources Assessment 2020, \(\text{(FAO)}\)
\(^7\) Environmental Defense Fund \(\text{(EDF)}\)
\(^8\) Global Forest Watch. (2022). The Latest Analysis on Global Forests & Tree Cover Change Data, \(\text{(WRI)}\)
Roe, S. et al. (2021). Land–based measures to mitigate climate change: Potential and feasibility by country, \(\text{(Global Change Biology)}\)
This demand is driven by corporates making and fulfilling public net zero targets\textsuperscript{10}. Almost 50\% of these purchases are for Nature-based Solutions (NBS) – and it is projected that NBS could represent 65–85\% of the total globally-traded volume by 2030\textsuperscript{12}.

Properly harnessed, this kind of interest could turn the tide on global forest loss and begin to set the stage for net annual forest gain. Yet, it is clear that current strategies are not penetrating the heart of the issue. The reasons for which will be discussed in more detail later in this paper.

It is time for a solution that is truly accessible to the masses. One that presents an economic opportunity equally, to all human beings on the planet, with a simple value proposition: care for nature, create value.

Open Forest Protocol (OFP) is conceived as a system that can deliver on this simple proposition. Through accessible digitization and verification of real-world forest data, OFP efficiently links human stewardship of nature with value creation.


\textsuperscript{11} World Wildlife Fund (WWF). (2021). Power Forward 4.0, \textit{(WWF)}

\textsuperscript{12} McKinsey. (2020). How the voluntary carbon market can help address climate change, \textit{(McKinsey)}
Why does the current MRV hold us back, and what can be done about it?

The bottleneck of present MRV

Environmental assets such as carbon credits are unique commodities because they do not entail delivery of a physical product. Rather, in order to create and “deliver” an environmental asset, one must perform the tri-part process of measuring data, reporting the data, and verifying the data.

Measurement, Reporting and Verification (MRV) is the process by which environmental assets are backed by validated environmental data. The goal of MRV (in the case of forest-carbon) is to create confidence in a credit-based representation of forest growth and carbon storage that ensures accurate accounting. MRV is a data-based pipeline for the creation of non-extractive data-based assets derived from the conservation and restoration of our natural world.

For the last few decades, MRV has been the domain of a few very specialized project developers. These developers directly profit from the MRV process, controlled by non-regulated and biased standards. These centralized organizations are gatekeepers for nature-based projects and their ability to access value from the voluntary carbon market.

More recently, climate tech startups have emerged applying remote sensing technologies such as LiDAR and satellite imagery, sometimes paired with machine learning (ML) to improve monitoring frequency, and reduce monitoring costs. However, reliance purely on these technologies often comes at the sacrifice of accuracy and cost. While ground truthing has to date been viewed as largely unscalable due to pervasive views that forest owners and proponents can’t be trusted in the collection of such data and thus “expert” project developers must be handled to undertake this process.

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13 Afforestation, reforestation, avoided deforestation, improved forest management, and others are included in the term, “nature based”.

As a result of stagnation in MRV, several key challenges must be overcome:

- **High Cost and Size Limitations Exclude Most Projects**: Current MRV processes are long and arduous, taking anywhere from 2–5 years to bring carbon assets to market. Costs often start at $50,000 to employ the necessary 3rd parties to carry out the labor intensive process. Due to these high entry costs, projects must typically meet a minimum threshold size in order to be profitable. This tends to start around 1,200 ha (3,000 acres). The result is that only the largest, most well connected and funded projects gain access to credit issuance and accompanying results-based financing, leaving the majority of the market without access to MRV or value-creation.

- **Lack of Data Transparency**: The organizations issuing credits today rely on the collection and issuance of “fiat” information and data to back their credits. Data is collected in notebooks, or at best, in organizationally-restricted databases and spreadsheets (where it could be lost or tampered-with). This necessitates trust in fallible organizations issuing restricted-access data.

- **Project Funding and Local Inclusion**: In the legacy verification system, legitimacy of forestation efforts is defined by the project’s capacity to acquire financial support from reputable backers to afford MRV tools. Communities, land managers, and forest project operators that lack sufficient financial and social capital to access these markets are left out of the forestation economy, with no way to bring their assets to market. This leaves marginalized players with little access to the benefits and opportunities offered by the MRV system. A more inclusive approach is needed to ensure that forests and the people who manage and benefit from them are valued and supported.

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15 Basak, R. (2016). Monitoring, reporting and verification requirements and implementation costs for climate change mitigation activities, (CCAFS).
choice but to turn to unsustainable and extractive income generating activities, such as logging, grazing, or intensive agriculture.

- A Lack of Standardization for Carbon Credits: Carbon markets remain fragmented, illiquid, and prone to double counting. Variability in accreditation standards and siloed transactions through opaque brokered transactions makes it difficult to enable proper price discovery and create a unified carbon credit marketplace across existing markets.

The Need for a Transparent Digital Pipeline for Nature-based Data

Verra has registered less than 300 afforestation/reforestation (AR) projects since introducing its AR methodology 11 years ago\(^\text{16}\). With a macro-condition of continued net global forest loss, it is clear that the current methods of extracting nature-based data to create tradeable financial assets/credits simply aren’t scalable.

There are several reasons why the use of a transparent digital infrastructure (to extract, organize, verify, and financialize nature-based data) has not yet gained greater global traction.

- To truly open the flow of data and value between nature-based projects and the rest of the world, the entire process must be reimagined from a digitally-native perspective. Just as a team is only as good as its weakest player, a pipeline can only flow as much as its tightest bottleneck. While parts of the data verification process have seen attempts at digitization in the past, utilizing any aspect of the legacy system introduces bottlenecks that reduce access, increase costs, and slows overall delivery within that pipeline. A fully digital process that still requires verification from non-digital legacy systems is set up for failure.
- Legacy players have had little incentive to adapt or adjust their protocols to fit the landowners needs, or prioritize scalability, because they benefit from the present centralized structure.

\(^{16}\) Verra. (2022). Verra Registry, filtered by “Registered” and “Agriculture Forestry and Other Land Use”, [Verra]
• In general, methodological organizations such as Verra, Gold Standard, the American Carbon Registry, and the Climate Action Reserve are set up as nonprofits – they are less focused on growth than operational stability.\(^\text{17}\)

• Amidst an increased loss of global forests and other natural habitats\(^\text{18}\), increased demand over the past few years for standards bodies (and the ecosystem of project developers and VVBs\(^\text{19}\) that support them) means that however antiquated the business models may be, these organizations have never been busier – they are, after all, the only show in town.

• Leapfrogging the existing system in favor of a 100% digitally-native approach requires a unique application of web3 skills, and a level of “outsider status” to truly consider the problem from a logical perspective, without being tainted by old paradigms.

Despite these barriers, the evidence of a growing, global conclusion that digital MRV (dMRV) is critical to unlocking the market is further supported by a growing body of recognized organizations:

• International Emissions Trading Association’s (IETA) Council Task Group on Integrity in Digital Markets who found that dMRV can improve market “efficiency, accuracy, and transparency”.

• At COP27, Former Bank of England Senior Advisor Michael Sheren said carbon is moving “very quickly into a system where it’s going to be close to a currency”\(^\text{20}\).

• The United Nations Framework Convention on Climate Change (UNFCCC) explains, beyond simply planting trees, there remains a strong need to:

> “Establish monitoring systems that use an appropriate combination of remote sensing and ground-based forest carbon inventory approaches... All estimates should be transparent, consistent, as accurate as possible, and should reduce uncertainties, as far as national capabilities and capacities permit.”\(^\text{21}\)

\(^\text{17}\) While OFP will also be managed by a Swiss-based non-profit, the incentive structure of value distribution and sharing across the protocol is intentionally designed to result in significantly different outcomes.

\(^\text{18}\) The term “VVB” refers to validation/verification bodies in the carbon credit supply chain.

\(^\text{20}\) The Sociable. (2020). ‘Carbon is going to be very close to a currency,’ tokenizing nature is next: COP27, (Sociable).

Beyond the need for a spectrum of different monitoring solutions, the UNFCCC additionally emphasizes the “need to involve local communities in the implementation and measuring and monitoring [of] carbon stocks,” as well as in the general preservation of the forest in question.22

Based upon these considerations, the Food and Agriculture Organization (FAO), and the authors of a report commissioned by the European Union23 have put forward a number of general recommendations for how data collection and management can be done in an organized and secure manner:

• Data must be stored in a way that allows it to be retrieved using future technologies, including hardware and software.24

• Both raw field data and “clean” [remote] data needs to be permanently stored and backed up.

• The documentation should include a description of the data (including its source, methodologies and assumptions), the database information system (including the database structure) and the metadata (i.e. a set of terms and definitions that describes the data in terms of availability, location and accessibility). Methods for data production need to be publicly available.25

Finally, the World Bank Group has its Digital For Climate initiative, which seeks to build an end-to-end digital marketplace for carbon credits, including transparent MRV on a distributed ledger.26

These global organizations independently conclude and support the thesis that the future of environmental assets requires a level of digitization only made possible with distributed ledger technology.

22 Ibid.
26 (Climate Warehouse)
It is clear that web3, and its capacity to be accessible, transparent, and immutable is a perfect use-case, when designed and implemented correctly. Web3 can be used to recreate the system of valuing natural resources with the following outcomes:

- Global distributed inclusion: all project sizes can permissionlessly participate in value creation.
- Transparent data collection and storage: data is open to continuous and freely accessible review, critique, and underwriting.
- Immutable data storage: no centralized authority has the capacity to tamper with or hide data.
- Web3 incentives structure: coordination of a global network of entities to create value by participating in the system, as independent, yet coordinated verifiers of data.
- Composability through code and augmentation through democratic, participatory structures means that public protocols can be self-regulating and adaptable as the community grows and supporting technologies develop.

The use cases of a full Web3 toolkit to completely redesign and open up the data flow and value from nature to the rest of the world are numerous and become quite obvious once you dive under the surface. Let’s now explore how OFP is heeding the call and applying its team’s one-in-a-million collective brain to build the preeminent digital MRV solution of our time.
OFP as a Solution

System Introduction

At its core, OFP is an open platform allowing forest projects of any size, anywhere in the world, to measure, report and verify their forestation\textsuperscript{27} data on a blockchain. Through OFP, individuals, groups, NGO’s, entrepreneurs, and even governments are able to create transparent and immutable proof-of-impact data that is comprehensively verified by a network of independent (and unbiased) experts. This foundational architecture serves as the jumping off point from which an ecosystem of supporting products, developed initially by OFP, (and ultimately open-sourced to entrepreneurs who wish to access and build upon the open system), will emerge. OFP has created an inclusive, scalable, and more data-backed mechanism for incentivizing the proliferation of climate solutions.

At the center of OFP’s innovative approach is the incentivization and coordination of a validator network whose sole responsibility is to ensure that only verified data passes through, while incorrect, or malicious data is rejected from the platform. The incentive structures for this system, described below, ensure that validator bias is eliminated in favor of an incentive structure to discover the truth. This network coalesces around the ground truth data provided to the platform. The field data is stress-tested against the multitude of unique capabilities, data sets, and remote-sensing technologies that each validator brings to the table. As a result, every single data set is reviewed by an ever-growing network of remote sensing companies, statistical modelers, space agencies, University ecology departments, VVBs, and others.

The MRV system will be supported by a suite of products, described below, that create global transparency, and improve liquidity and price discovery. These products will ensure that capital looking for a home in NbS has access to information, investment opportunities, and a trusted infrastructure to facilitate its movement.

\textsuperscript{27} Forestation for the duration of this whitepaper is used as an umbrella term to refer to all potential methodologies for which OFP may ultimately provide MRV to. This includes, but is not limited to afforestation, reforestation, mangroves, biodiversity, avoided deforestation and natural forest regeneration or preservation.
Through the unique implementation of a web3 tech stack, made possible by the unique depth and breadth of our team’s experience, OFP is positioned to become the preeminent issuer of nature-based Digital Environmental Assets (DEAs) to the market within the next 10–15 years.

**Products Suite Overview**

As a full ecosystem, OFP’s product suite can be parsed into three main categories based on their function:

1. Forest data collection, verification and management tools
2. Project finance, value creation and value management tools
3. System governance

Here we will discuss the individual products that support each purpose and ultimately describe the interaction between the individual parts.

**Forest data collection, verification and management tools**

This suite of tools provide the core functionality that enables a permissionless, globally-accessible system to transparently gather, upload, manage, and verify ground-truth data. This is the core entry point and ultimately comprises the two largest networks that we are building through OFP: the project operator network and the validator network.
Project Operator Dashboard

Central to OFP’s mission of providing open, permissionless access forestation data management is our open, web2 application, the Project Operator Dashboard. This dashboard represents the entry point through which forest projects can designate and assign field agents for the smartphone-based collection of field data, and through which all smartphone-collected data points are ultimately submitted for validation.

The Project Operator dashboard is also responsible for the algorithmically determined assignment of geo-randomized sample plots. The location of these sample plots is navigated by forest operators and field agents in the Forester mobile application (see next section).

To accommodate the blockchain-based technological foundation of the protocol, the dashboard interface mints geolocated Non-Fungible Tokens (NFTs) for each designated forestation zone. These NFTs are a digital representation of land ownership, as well as the resultant data and value streams associated with the land.

Forester App

Through the Project Operator Dashboard, field agents are designated and assigned sample plots to collect data from, and upload this data directly in the field using the Forester Application. The Forester App is a Mobile application available in both the iOS and Google Play Store. It is the on-the-ground tool used to collect forest data for projects.

A smartphone application was implemented as the primary data collection tool due to
the ubiquity of global mobile access\textsuperscript{28}, as well as the functionality for data and geolocation to be recorded even when internet connection or mobile signals cannot be reached. The Forester App actively tracks the location of the Field Agent and prohibits data collection until the user is standing at the designated sample plot location. This is a key safeguard against the falsification of the location of data collection.

Data is collected every 6 months for the first two years of a project, and then annually thereafter.

**Validation Area**

When data collection by the Field Agents is complete and submitted by the Project Operator, it enters the Validation Stage. Validators can view all projects that are open for validation in a separate “Validation Dashboard” where they are able to accept Validation tasks, and review and vote on the data from each project.

The Validator Forum is an embedded feature of the Validation Dashboard that allows validators to anonymously discuss validations and share insights and data on different ongoing validations.

Validators earn $OPN (Open Tokens) in exchange for their verification. Figure 1 describes the validation process. The detailed incentive structures (Figure 1) are discussed in some additional detail later; a separate Mechanism Design paper can be provided upon request.

In summary, the validation process coordinates a network of experts around an embedded gamified structure to provide validation at no up-front cost to Project Operators. Uploaded project data is verified by a communal network of Validators, and is stored transparently on the blockchain, creating an immutable timeline of forest growth, and an ever-growing data set for Validators to compare against.

**Project Explorer**

The OFP Project Explorer is the basis for viewing the story, overview, and registry of each of the live projects on the protocol. In addition to the project upload data and validation history, the Project Explorer displays the project location, area, description, goals, co-benefits, stakeholders and local communities involved, trees species, and remaining project duration.
Project Finance, Value creation, and value-management tools

While the provision of free and accessible MRV, regardless of project size, is a significant leap forward, the system’s capacity to scale is greatly enhanced by a suite of value-creation and management tools that cover the end-to-end requirements of project lifecycle financing.

**OFP Verticals**

OFP will be developing and releasing a set of verticals characterized by specific methodologies that run verified earth-state data through open-sourced Green House Gas (GHG) quantification equations, and create tokenized representations of that data. Currently, OFP is anticipating the release of the following verticals:

1. Afforestation/Reforestation (AR)
2. Mangroves
3. Biodiversity
In building out these verticals, OFP will involve a cadre of industry experts to provide feedback and review during development to ensure methodological accuracy and efficacy. All methodologies will also be subject to the ongoing feedback of subcommittees within the Open Forest Congress (DAO).

**OFP Wallet**

A place to manage $OPN, the governance and internal value exchange mechanism of the protocol, and DEAs that result from the system. The wallet will contain custom retirement functions for DEAs and options to manage portfolio-based retirement of credits to maximize transparency/sharing and discoverability/re-verifiability.

**Carbonhouse**

Modeled after traditional commodity auction houses, the Carbonhouse is a digital wholesale offramp for value creation on OFP. It is the point of sale for marketplaces and other offtakers to gain access to OFP supplied credits. It is a simple way for forest projects to automate the exchange of value created through the OFP platform for fiat, or crypto-based forms of value of their choice.

Forest projects can choose a floor price and set their credits to automatically list on the carbonhouse exchange. When credits are purchased, value flows automatically back to the project that created or listed the credits. For forest projects, this represents a simple offramp for the value they create.

For corporates, intermediaries and marketplaces, this comprises a simple, single point of entry to purchase wholesale credits from OFP projects.

**OFP Starter**

While the OFP system as described thus far has the potential to create results-based value, OFP Starter is a funding mechanism designed to overcome first-cost barriers. It allows for funders to both individually and collectively pre-fund projects in exchange for future offtake of value created. The capital will be securely locked in smart contracts and can be deployed at predefined intervals. Initial capital is
returned automatically if the project fails to meet the predefined milestones.

OFP Starter additionally opens the way for the fractionalization of funding so that a single project can be easily funded by a blend of either partnered or unrelated entities. In short, it will allow for offtakers to “pre-fund” future supply of value, ultimately delivered through OFP’s MRV platform.

This should be attractive to entities looking to generate future forward contracts such as project contributors, impact DAOs, non-profits, governments, and carbon-focused contributors, to name a few.

**System Governance**

**Open Forest Congress (DAO)**

The Open Forest Congress manages core mechanics and rates pertaining to validation, data upload timers, collateral rewards, carbon fees, and other smaller features. Access to the DAO will be designated in part through $OPN tokens. Additional participation will be possible using the NEAR account structure, enabling forest projects or indigenous communities access to this organization without needing to own any tokens. The DAO will encompass a representative ecosystem of individuals and entities with vested and diverse interests in the success of OFP as a system. OFP has designated specific token supply to support the building of a diverse and globally representative DAO that ultimately stewards the public protocol along a healthy evolutionary path over the years.
The different stakeholders involved in OFP represent different specific interests (uploading data for MRV; Earning Fees and Managing DAO Governance) and DAO will be structured by committees governing various aspects of the system.

OFP Tokenomics and Value Creation

A robust crypto-economy is a fundamental component of every open-source protocol running on a public blockchain. As the platform’s core function is the collection, verification, and transparent provision of earth-state data, a crypto-economy naturally encompasses the diverse functions from different stakeholders within the ecosystem. These functions notably include: data upload onto the protocol, validation of project data and potentially the tokenization of this data into digital environmental assets. In this crypto-economic model, the: $OPN Tokens function as the fundamental governance and potential internal value exchange mechanism of the protocol.

$OPN Tokens

OPN tokens are the representation of utility and governance on the Open Forest Protocol. OPN's are used for the following purposes:

- Granting access to Open Forest Protocol
- Used by Validators to Accept or Challenge Project Data Uploads
- Govern the Open Forest Protocol via DAO Vote
- *Indirect Function: Earn Fees in OPN tokens for Validation of Data

OPN tokens are a utility token used to provide stakeholders with an interest in securing the protocol access to the system. OPNs are used to verify or challenge the accuracy of a specific MRV data upload and to govern different parameters of the protocol. OPNs are not used by project owners, but rather rewarded to validators and possibly collateral providers.

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29 OFP has received official determination from the Swiss Financial Regulatory body, FINMA, of the $OPN’s utility-token status.
30 At a future date, project operators may be able to earn rewards in the form of $OPN to gain deeper buy-in and participation in DAO decision making.
Validation

The validator’s job is to determine if the data uploaded is a true representation of what is happening on the ground at that project (accept) or if it is not (reject).

This is accomplished by coordinating Open Forest Protocol’s diverse network of forestation expert organizations.

Once a forest project has completed a required data upload, the 30-day validation window timer begins. During this time period, validators can choose to participate in the validation of that specific data upload so long as they are validating at least 70% of projects in aggregate (this threshold will change over time as the network grows).

The incentive structure to perform validation is based on an $OPN token rewards pool attached to each individual project’s data upload. Larger projects will contain greater amounts of data and require more time from the validators. Thus, larger projects will also come with a greater rewards pool which the validators can yield a portion of, if their validation response is deemed to be correct through the consensus mechanism. Validators are unable to see how others are voting, so they must make their own best judgment.

At the end of the 30 day period, regardless of which decision (affirm or deny) was reached by the majority of validator votes, the data upload will enter a ‘challenge’ period. This is a 7 day period in which validators may attempt to overturn the standing decision if they believe it to be incorrect.

During this time, validators may present evidence and data available to them supporting their position to challenge the data provided. It is at this point that validators may also choose to change their original decision based on compelling evidence presented by other validators that they may not have been privy to (i.e. a LiDAR-based validator presenting information that a satellite-based validator was unaware of).

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31 Data uploads to OFP are required every 6 months for the project’s first two years, and then annually thereafter.
Ultimately, rewards for validators will be greater for the rejection of data than for the acceptance of data. This is accomplished via a project staking mechanism. The incentive for data rejection, however, is counter-weighted by the fact that no real value accrues to the protocol unless good, verified data is actually approved, which counters any incentive to simply reject all data to maximize personal gain.

<table>
<thead>
<tr>
<th>Validator Response</th>
<th>Response deemed “correct”?</th>
<th>Validator Value Accrual</th>
<th>Community/Network Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approve data upload</td>
<td>Y</td>
<td>Gains $OPN</td>
<td>Gains CC distribution</td>
</tr>
<tr>
<td>Deny data upload</td>
<td>Y</td>
<td>Gains 2x $OPN</td>
<td>None</td>
</tr>
<tr>
<td>Approve data upload</td>
<td>N</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Deny data upload</td>
<td>N</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

Figure 2: Validation Structure

With such a structure, the veracity of the data being uploaded is naturally incentivized to be more accurate, while actors are financially dissuaded from behaving maliciously.

For a far more in-depth review of the tokenomics and incentives behind this mechanism, OFP has created a Mechanism Design paper, which can be accessed, with permission, by OFP.

The $OPN token is the utility which drives all internal mechanisms in the protocol, including governance, and perhaps most importantly, validation. On the other hand, the potential $OCC token (see next section), or any other future DEAs validated through OFP, will be the methods by which the protocol creates an asset that to be valued by the world at large.

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32 For a more detailed description of the game theory behind validation, as well as the collateral provision mechanism, please see the OFP Mechanism Design paper.
Open Carbon Credits (OCCs)

Among the variety of possible solutions that can be incorporated with OFP, one of the most promising would be the issuance of DEAs, aka credits. For the sake of reference, referred herein as “Open Carbon Credits” or “OCCs”.

OCCs can be built as a separate integration on top of OFP. OCCs could be automatically created when data relating to trees or other carbon sequestration initiatives mature to a point in which the forestation zone sequesters carbon of a required quantity. This maturation point may be openly decided upon by the Open Forest Congress, and may be changed via future governance decisions. That is to say, the initial parameters for what constitutes an OCC and at what point in a projects’ life cycle they can be yielded based upon the carbon sequestration rate of the forestation zone, can be a prime governance opportunity for the Open Forest Congress. The Open Forest Congress may eventually manage this process and alter it as needed into the future.

As digital representations of carbon proven to be in forests, OCCs could hypothetically be tradeable on the open-market through digital infrastructure such as the Carbonhouse. Due to the parallel nature of OCCs (i.e. OCCs may only be created once data confirming the maturation of the trees is uploaded) combined with the growth of the trees in question, OCCs can serve as a truly data-backed carbon credit directly tied to a specific forestation project.

Importantly, the creation of carbon credits could be directly correlated with the growth of a plot of reforested land. As a tree matures over time to sequester more carbon, more credits will be created. However, in the event that a tree or plot of land is destroyed or dies prematurely, carbon credits are no longer created (with the buffer pool offsetting the equivalent of the lost amount).

OCCs could thus become the world’s first open-data backed credit from which all provenance data is readily traceable in the metadata. To jump start the new carbon economy, certain projects using OFP may be eligible to receive carbon credits in virtue of uploading data onto the network. Not only does this increase the reliability of all future carbon credits issued through the protocol (as all data
is backed by the project’s creation), but it also provides new business models for forestation companies, land holders, and entrepreneurs alike.

**Token Interaction and Value Distribution**

The $OPN token can be programmed to be staked (or “planted” in the parlance of OFP), to earn protocol rewards, which could come in the form of a protocol-wide take rate on all value created. OFP can potentially import value from the world at large through the creation and sale of OCCs and other DEAs. This value may be imported to the protocol at the point of sale of the OCCs and the value may be distributed back to the network in the following proportions:

A. Project operators may receive 85% of the value created;
B. 7% of the DEAs are pushed to a buffer pool;
C. The remaining 8% may be distributed back to the network.\(^33\)

Planted tokens are thus exposed to a pro-rata portion of 8% of the overall value created by the system. For example, the issuance of 10,000,000 OCCs would see 800,000 OCCs automatically and proportionately distributed to the protocol participants, relative to the volume of $OPN they planted.

To build on this example, imagine there are 10,000,000 total OPN tokens planted, and protocol participant “X” has planted 10,000 OPN tokens of their own. Protocol participant X’s pro-rata share of planted tokens would be 0.1%. Protocol participant X would thus passively receive a total value yield of 800 OCCs.

If the going market rate for each of these OCCs is $25.00, participant X has potentially received a passive yield of $20,000.00 in value.

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( (10,000 / 10,000,000) \times (10,000,000 \times 0.08) ) \times 25.00 = 20,000
\]

In summary, the tokenomics of the system is based on the value created through MRV which can lead to the creation of blockchain-native OCCs. The number of OCCs created is, of course, a reflection of the platform’s capacity to grow its

\(^33\) These proportions can be adjusted in the future based on the will and voting outcomes of the OFP Congress.
network of projects utilizing its core MRV capabilities to create OCCs with attractive attributes to contributors.

Value creation is thus subject to two key features:

1. It is limited only by two factors:
   - Biospheric boundaries of feasible implementation\textsuperscript{34}
   - OFP’s capacity to gain market share
2. This value is yielded and distributed to a finite and known number of $OPN tokens

One can conclude that the key potential form of value creation through the OFP system is the creation of, and protocol-wide yield of OCCs and other DEAs, which are forms of endogenous value creation that are disaggregated from bull/bear markets and overall hype in global capital markets.

**OFP’s 10 year vision: A system for non-linear scaling**

Climate Tech 2.0 is only just getting launched. As reported by Quartz\textsuperscript{35} investors (contributors), entrepreneurs, and technologists are preparing for another wave of climate innovation in the hopes of mitigating the most damaging and catastrophic effects of climate change.

Many, if not most, climate tech businesses rely on the assumption of an increasing market for environmental assets, whether those are carbon, biodiversity, or other. One thing is clear: no environmental asset has been or will be created without some form of MRV, and the more trusted (i.e. transparent), accessible, and efficient that MRV system, the larger the potential delivery pipeline of that asset to the market.

\textsuperscript{34} OFP’s total addressable market (TAM) includes: c. 800mm ha of eligible land for re/afforestation; c. 210mm ha of land for biodiversity conservation; 200–600mm ha of land for improved forest management; c. 650mm ha of land for agroforestry; and 14–15mm ha of land for mangrove restoration, planting and maintenance

\textsuperscript{35} Quartz. (2020). The second climate tech boom is here. (Quartz)
The long-term vision of the Open Forest Protocol is to provide an open, permissionless, and easily accessible platform for a new generation of forestation projects (reforestation, afforestation, and conservation) backed by clear MRV practices, and a new ecosystem of nature-based carbon removal initiatives with truly data-backed carbon credits.

While forestation solutions have been noted as the most immediate need for companies, governments, and NGO’s everywhere, the core design of the protocol is such that it can also easily accommodate solutions beyond forestation, such as:

- Biodiversity
- Blue Carbon
- Soil and Ag-based Carbon
- Mineralization and Biochar
- Watershed Protection
- Ecosystem Protection

In the future, we envision an Open Planet Network forming around the Open Forest Protocol. To facilitate this vision, OFP is built as an open system upon which entrepreneurs and other businesses can imagine and build upon to serve particular markets. This consequently primes the OFP system for non-linear scaling over time, as multiple entities begin to integrate with OFP, utilizing the core system of verification to deliver transparency and digital efficiency to new asset classes.

In order to fully benefit from the full scope of services offered by the Open Forest Protocol, open-source tools including Software Developer Kits (SDKs) and a general RUST\(^{36}\) application programming interface (API) will offer developers and companies alike the capacity to build front-end and back-end solutions on top of the protocol for specific business, design, or non-profit purposes. An additional API allows for the integration of data relating to the NFT-based georeferenced area into other applications, as well as for potential carbon-credit market purposes.

The SDKs and API, available on top of the protocol ensure that it can be easily connected to existing software or developer interfaces for business or financial

\(^{36}\) NEAR’s programming language
purposes, as well as to countless other environmental asset classes that require rapid scaling through digitization in order to align with science-consistent targets.

Context is key in understanding this vision: Over the next 10 years, Nature has estimated that The Business of Planting Trees will grow to become a multi-billion dollar industry\(^{37}\). In parallel to that, McKinsey estimates that the market for carbon credits will increase to be valued at over $50 billion USD value as early as 2030, and up to $300 billion by 2050\(^{38}\). In this environment, OFP is positioned to become a global standard for the long-term future as its value proposition is incomparable to any traditional accreditation or MRV scheme.

**OFP and the larger Refi ecosystem**

In 2021, when OFP started creating its initial architecture, the term “refi” still referred to getting a lower mortgage on your house! A lot has changed and refi is now receiving ever-increasing attention from all avenues of society. What is clear is that no single project can “do it all” and that the ecosystem of projects currently building in refi will increasingly begin to form symbiotic relationships, just like in a natural ecosystem. Currently, most projects are still quite early and naturally focused on their own growth/survival, but over time, will begin to engage with the projects around them.

OFP’s role as a market supplier makes it a blue chip project amongst many of the more niche refi projects. For example, OFP has solidified relationships with a number of web3 marketplaces. These are highly symbiotic relationships that allow OFP to put digital assets in front of curated buyers with simple point-of-sale infrastructure managed by multiple third parties. The marketplaces benefit from having an ever-increasing web3-native source of inventory to “stock their shelves” with.

Similarly, many projects are currently building around the idea of project financing. OFP provides not only a transparent database of projects to provide financing into, complete with historical performance data upon which to underwrite, but through

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OFP Starter, we provide the digital infrastructure to code the deployment of that capital into the projects of their choice.

While OFP is built on NEAR as our L1 blockchain, the future is interchain, and this represents yet another level of interoperability which helps OFP supply greater markets and bring value to new ecosystems.

We expect to become increasingly interconnected within the refi (along with Defi, Tradfi and the global sustainability movement) worlds over time as we follow nature’s lead in becoming more resilient, more sustainable, and stronger through an ecosystem approach.

**The Open Forest Foundation**

Governance of the Open Forest Protocol will eventually be decentralized with voting on standardization surrounding forestation, land tenure, and further protocol advancements managed by the community of stakeholders within the ecosystem. At its inception however, and in the early years of the protocol, a Swiss nonprofit Foundation will govern the protocol and grow the OFP Community Ecosystem. In particular, the foundation will focus on accelerating the implementation of climate and environmental technologies. This foundation is known as the Open Forest Foundation – representative of the first vertical for forestation developed by the OFP Team.

Open Forest Foundation will aim to set up and develop digital tools and a community to increase the transparency and scale of forest-related (reforestation, afforestation, conservation, etc.) activities, in particular:

- Create and develop a permissionless, autonomous and independent Open Forest Protocol Ecosystem on a public blockchain with new, open-source software architecture for measurement, reporting, verification of environmental data and development of solutions, leading to carbon sequestration and financing;
- Research, testing, development and deployment of new open-source software architecture components of Open Forest Protocol;
• Growing the Open Forest Protocol ecosystem and community by increasing the volume of stakeholders using, and thus value flowing through Open Forest Protocol;
• Developing different nature-based verticals to utilize the core validation mechanisms and thus support additional stakeholders and value on OFP

In the longer term, the Open Forest Foundation will:

• Work to scale and promote the value proposition of the Open Forest Protocol with partners and like-minded organizations;
• Create a uniform and consolidated platform for all and any possible nature-related vertical to be developed.

The mission of the Open Forest Foundation is to launch, grow, and develop the Open Forest Protocol guided by the spirit of open, permissionless, decentralized forestation data management. With community voting, responsibilities of the foundation will be incrementally transferred to the DAO.

Conclusion

The Open Forest Protocol creatively draws upon blockchain technology to solve the problem of providing access, trust and transparency in the measuring, reporting, and verifying of forestation projects across the globe. It provides the foundation for rapidly scaling forestation projects through an open, inclusive, and permissionless protocol, so that the world can rapidly draw down greenhouse gasses and, together with the rapid phasing out of fossil fuels, stabilize the climate at levels that will allow for the flourishing of ecosystems and the human community.
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