The Open Reforestation Protocol (ORP) Whitepaper

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Table of Contents

Introduction and Scope of Problem

With temperatures predicted to increase by at least 1.5 degrees Celsius above pre-industrial levels, the current global climate crisis has the future of life on earth changing on an unsustainable trajectory. Not only does such a climate threaten biodiversity and wildlife in all parts of the globe, but it also promises to drastically challenge human-made systems and existing infrastructure that hundreds of millions of people depend upon.

One generally accepted solution towards working against an unlivable or altered climate is to sustainably reforest large swaths of land so as to create carbon sinks for handling runaway emissions. To date, reforestation remains a prime opportunity for mitigating the effects of runaway climate change in a natural and environmentally conscious manner. It nonetheless remains plagued by notable barriers to adoption. These barriers include:

1. **A Lack of Accurate Measurement, Reporting, and Verification (MRV) of Reforestation Data:** Organizations and governments alike remain hesitant to commit to funding reforestation projects without a clear mechanism by which the project success can be verified. With no coordination between projects, each initiative makes due with the best verification tools it possesses on hand. Not only are projects difficult to consistently scale because of this problem, but there is no quantifiable means of knowing how successful previous projects have been in reducing emissions or planting trees due to a lack of consistent measurement, reporting, and verification standards. For the few certifications that do exist (1) many projects do not have the resources to implement or comply with them, while (2) there is no common consensus on one unique label, and (3) even a label does not guarantee complete transparency over time.

2. **Data Accuracy and Precision:** Due to the numerous methods of measuring, verifying and reporting the status of a project, the data that is collected is either manually recorded using paper-based records (and thus is at a risk of being misplaced, illegible or incomplete), or remotely verified using satellite imagery (but lacking in ground level precision). As such, gaps of information for any given reforestation project exist, and can vary significantly according to the precision,

magnitude, and quality of data collected. Without a structure from which projects can be geographically and qualitatively standardized, the legitimacy of the reforestation effort, as well as any carbon credits or resultant data from a project is siloed and left to stand on its own.

3. **Project Funding and Local Inclusion:** Legitimacy in particular reforestation efforts is defined by the capacity to afford MRV tools and financial support from reputable backers. In a symbiotic relationship, those who can afford to prove the veracity of their project, are also those who have the opportunity to raise funds for their project, at scale. Meanwhile, projects that cannot guarantee measurement, reporting, and verification that trees have actually been planted and that they are healthy and growing, have more difficulties convincing funders to put forward capital. The end result is that there are less opportunities for new reforestation projects to start, with more green capital left on the sidelines. Accompanying this relationship is also the involvement of local communities, when a project is actually deployed: Local communities wishing to be involved with the management of the forest in question, are often overlooked in place of independent verifiers who infrequently monitor the forest without little familiarity or connection to it.

4. **Collaborative Funding Mechanisms:** To date, due to limited oversight and monitoring, it is difficult to collaboratively fund a reforestation project: Most frequently, funding is expected to be linked to one source, so as to avoid double counting from different organizations and to ensure accountability for the allocation of all funds. As a result capital allocation for reforestation projects is 'siloed' and project funding from multiple funders remains limited.

5. **A Lack of Standardization For Carbon Credits:** Carbon Credit markets today are only emerging as a globally traded asset. As a result, existing carbon markets remain fragmented, illiquid, and prone to problems of double spending and price volatility. In short, different standards for what constitutes a carbon credit, and where that credit has come from has made it difficult to create a standard carbon

credit marketplace across existing markets.

In response to these five challenges, this document puts forward a blueprint for a comprehensive solution for digitizing reforestation measurement, reporting, and verification processes in a trustless manner. This solution is known as the Open Reforestation Protocol: A layer two blockchain-based platform and ecosystem for reliably measuring, reporting, and verifying reforestation initiatives at scale in a permissionless, and open manner. As a foundation for future MRV practices, ORP also has the capacity to pioneer a data-backed carbon economy: A world first at a time when carbon markets are undergoing pivotal developments.

Not only does the document detail the primary characteristics of the protocol itself, including its open-source application, and non-fungible token based grid management system, but it also explains how future digitization initiatives centered around the development of Satellite Imagery, Drone Technology, Artificial Intelligence and the Internet of Things (IoT) provide a technological pathway for improving the veracity of the protocol over time - as the world becomes more digital, and technology more pervasive.

ORP Documentation Outline

The current Whitepaper provides a general overview of the most important facets of the Open Reforestation Protocol. However, further documentation exists for more details on specific protocol features. For a comprehensive overview of the ORP mechanism design including the responsibilities and incentives of the different ecosystem stakeholders, see Open Reforestation Protocol Crypto-Economics and Mechanism Design. A shorter annotated version of this document can be found under the title of ORP Mechanism Design - The Spark Notes Version. For the purposes of governance of ORP, the document ORP DAO Governance details the responsibilities and composition of the ORP DAO while also outlining voting and conflict resolution procedures. The ORP Technologies Yellow Paper fully outlines the technical architecture of the protocol, including a rationale for its software design and infrastructure choices. For a specific

overview of the role that NFT's play in the ORP Ecosystem, ORP NFT Research Analysis and Architecture puts forward a comprehensive analysis of the how and why for NFT's on ORP. Finally, for those interested in materials on ORP relating to specific stakeholders such as Collateral Providers, Investors, Technology Integrators, and the like, a full suite of one-pagers and slide-decks are available on the Website. Note: All of the publicly available materials will be listed on the website at openreforestation.org.

Part 1: The Need For A Trustless Protocol For Digitizing Reforestation Initiatives

As climate consciousness has become more widespread among non-governmental organizations, environmental organizations, and companies, new sustainability initiatives have received significant funding commitments from governments, international organizations, and charities. One of the most widespread and far reaching initiatives - known as the trillion tree initiative (1t.org) - has been embraced by concerned stakeholders around the world as a sustainable means by which carbon levels can be reliably reduced by up to 1/4 of their current levels, in the coming decades. According to the World Economic Forum: "The 1t.org project aims to unite governments, non-governmental organisations, businesses and individuals in a 'mass-scale nature restoration campaign'".

While this plan holds serious potential to prevent runaway emissions, it has faced considerable hurdles when it comes to coordinating different initiatives, as well as measuring, reporting on and verifying (MRV) global reforestation initiatives in a reliable manner. As 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 with a focus on estimating anthropogenic forest-related greenhouse gas emissions by sources, removals by sinks, forest carbon stocks and forest area changes. All estimates should be transparent, consistent, as accurate as possible, and should reduce uncertainties, as far as national capabilities and capacities permit."[1]

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.[2]

1 Martin Herold and Margaret Skutsch, 2011, *Environ. Res. Lett.* 6 014002.
2 Herold and Skutsch, 2011.

Based upon these considerations, the Food and Agriculture Organization (FAO), and the authors of a report commissioned by the European Union[3] have put forward a number of general recommendations for how data collection and management can be done in an organized and secure manner, summarized here:

- Data must be stored in a way that allows it to be retrieved using future technologies, including hardware and software.[4] Data systems require regular updates and consistent estimates over time.[5]

- Both raw field data and "clean" [remote] data needs to be permanently stored and backed up. Ideally, a single, current copy of the data will be stored on a central server (with an exact copy on another server), rather than as multiple versions on multiple individual PCs.[6]

- Once the information management system has been designed and installed, the entire system has to be documented. 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), if possible, in internationally standard format in accordance with data collection protocols[7], and datasets should include accuracy assessments and uncertainties.[8] Methods for data production need to be publicly available.[9]

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3 Böttcher, H., Herrmann, L.M., Herold, M., Romijn, E., Román-Cuesta, R.M., Avitabile, V., de Sy, V., Martius, C., Gaveau, D.L.A., Fritz, S., Schepaschenko, D., Dunwoody, A., 2018. Independent Monitoring: Building trust and consensus around GHG data for increased accountability of mitigation in the land use sector. 112 pp. Publications Office of the European Union, Luxembourg. https://doi.org/10.2834/513344

4 Food and Agriculture Organization of the United Nations (FAO), *Voluntary Guidelines on National Forest Monitoring*, http://www.fao.org/3/a-i6767e.pdf. Accessed on April 21st, 2019, 55.

5 Böttcher et al., 2018, 14

6 Food and Agriculture Organization of the United Nations (FAO), *Voluntary Guidelines on National Forest Monitoring*, http://www.fao.org/3/a-i6767e.pdf. Accessed on April 21st, 2019, 55 - 57.

7 Food and Agriculture Organization of the United Nations (FAO), *Voluntary Guidelines on National Forest Monitoring*, http://www.fao.org/3/a-i6767e.pdf. Accessed on April 21st, 2019, 55.

8 Böttcher et al., 2018, 14

9 Böttcher et al., 2018, 14

1.1 Summary of Current Challenges

Altogether, the current challenges that reforestation efforts face are largely consolidated around the need to digitize reforestation systems so that verification is more precise, transparent and accurate:

- Robust digital monitoring systems are needed that can guarantee that trees have been planted, monitored, and preserved as they grow up to sequester carbon.

- Data about the trees must be managed effectively so that all parties involved can have access to the data according to international standards, and including data backups.

- Local engagement in monitoring forest carbon stocks, and forest area changes from reforested trees should be inclusive, open and non-exploitative especially in relation to the local population involved.

- A standardized system for creating carbon credits, based upon the verification and monitoring of reforested trees is required if these credits are ever to be traded or exchanged on an open-market as offsets for government or company emissions.

1.2 A Protocol Level Solution

A blockchain-based protocol pegged to a digital token is an innovative solution for providing the technical foundation and incentive structure of an inclusive, open, and permissionless ecosystem for managing reforestation around the world. A layer 2 protocol provides the following benefits to the problem of reforestation management specifically as it pertains to MRV mechanisms, and local inclusion concerns:

1. **Decentralized Access and Global Inclusion**: By definition, an open protocol provides a technical basis from which any stakeholder can participate in a reforestation process according to the protocols' decentralized standards and tools; a common crypto-economy guarantees the same rules for all players - from

governance to utility, to verification on the platform.

2. **Standardization and State Concurrence:** With a protocol that is both open and permissionless, a community of stakeholders has the opportunity to create a uniform scheme from which data pertaining to reforestation projects can be uploaded: this scheme can be democratically enhanced or altered based on community governance mechanisms of the protocol (i.e. DAO vote)[10]. As a result, protocol based - reforestation allows for the standardization of how tree data is managed, uploaded and ultimately used to create carbon credits that can be traded on an open market. State concurrence meanwhile, guarantees that all data is universally available and permanently backed up.

3. **Trustless Security:** As a decentralized protocol, no single entity will own or manage the network and the rules governing the network: full decentralization means that decisions are taken collectively by all of the stakeholders invested in the future of reforestation and the mechanisms used to measure, report, and verify the veracity of projects. Data uploaded onto the protocol, is unalterable and immutable.

4. **A Sustainable Foundation for Future Innovation and Development Surrounding Reforestation Management:** As a general purpose technology, blockchain provides a robust foundation for integrating future technologies into the protocol as they become more pervasive and cost effective into the future. Beyond software integrations with other IT systems, a protocol is also capable of managing and integrating data from Satellite Imagery, Drone technology, Artificial Intelligence and the Internet of Things devices. As such, a protocol is not only a solution for solving current problems relating to reforestation, it is also a foundation for enhancing future initiatives.

10 A DAO is a decentralized autonomous organization. It refers to a decentralized governance system organized around a specific set of values, projects, or goals. For more see: https://hackernoon.com/what-is-a-dao-c7e84aa1bd69

5. **A Data Backed Carbon Credit:** Aligning carbon sequestration data on a distributed ledger, provides the unique opportunity to directly tokenize a carbon credit. Distributed ledgers give way to ‘data backed carbon credits’ insofar as each credit created can be tied to a specific event and account at a specific time. Furthermore, using carbon credits as offsets can be guaranteed on chain, with the relevant credits being burned and a timestamped certificate being generated.

Overall, a protocol for handling reforestation projects has the opportunity to not only address some of the largest MRV related challenges that the industry is facing today, but it also can provide the foundation for a new, standardized carbon economy based upon permanently uploading project data on-chain for the entire lifetime of the project. The digitization of reforestation projects is thus both commercially appealing, and environmentally essential.

Part 2: The Open Reforestation Protocol

The open-reforestation protocol (ORP) is a layer two blockchain-based platform that denominates a crypto-economic ecosystem for managing reforestation data. As a layer two protocol, the ORP is built on top of an existing L1 blockchain and provides the following parameters for the ecosystem:

- A standardized data model for uploading reforestation data onto the network;

- A grid-management system for quantifying and recording plots of land being reforested based upon minting a Non-Fungible Token (NFT)[11] for each project;

- A crypto-economic model for securely managing the upload and validation of reforestation data, as well as the minting of Open Carbon Credits (OCC's)[12];

- An open-source application and management dashboard for the collection of data surrounding reforested zones;

- Developer tools for integrating with existing software and IT solutions and for developers and entrepreneurs to build new solutions on top.

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11 A Non-Fungible Token is defined as a token which possesses unique information or attributes, making it irreplaceable or impossible to swap for another. See more at https://cointelegraph.com/explained/non-fungible-tokens-explained

12 Data backed carbon-credits minted on the ORP Platform, reflective of the development of a particular project.

2.1 Blockchain-Based Platform, Open Ecosystem

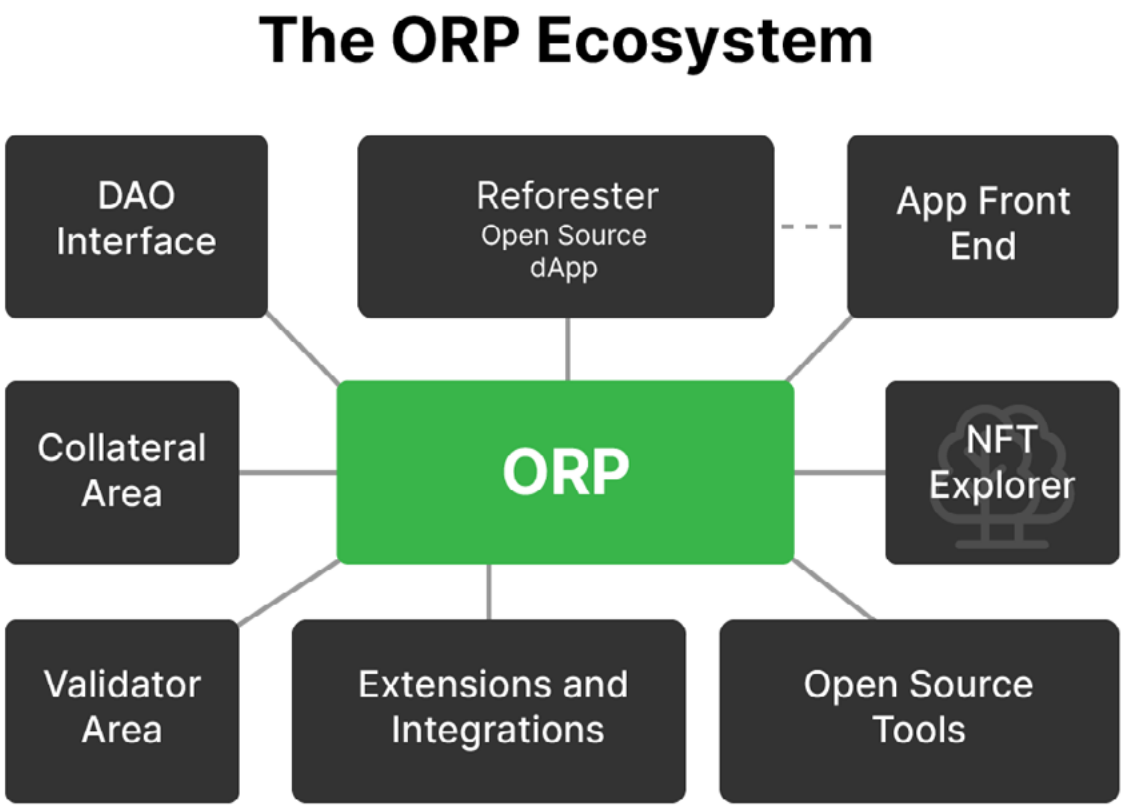


Figure 1: The ORP Ecosystem and Tools for MRV and Entrepreneurs

The Open Reforestation Protocol is first and foremost a platform that establishes a new ecosystem for managing reforestation data in a standardized manner, so as to create a verifiable procedure for producing carbon credits. This ecosystem is characterized by different stakeholders using different facets of the protocol for their own projects:

- Entrepreneurs, Companies, and Nonprofits work to create solutions for measuring, reporting, and verifying the reforestation of a particular plot of land and the trees contained therein. The business context for these stakeholders is explained clearly in the Nature Report: The Business of Planting Trees.

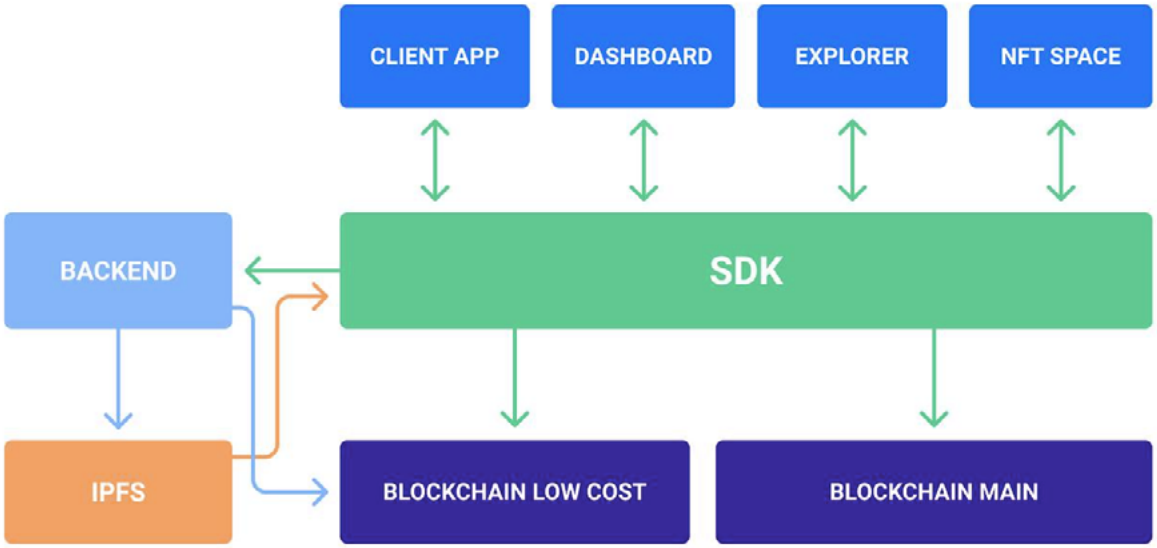
- Open Carbon Credits are created from reforestation projects over time and are able to be traded on the open market. These credits are automatically minted to

the project owner(s), who can then decide to fractionalize ownership or trade credits with other stakeholders looking for offsets (See the documentation Open Carbon Credits for more details).

- Developers can build enterprise specific Apps, markets, or services on top of the protocol for displaying reforestation data, carbon markets, social / local inclusion mechanisms, or funding opportunities for new reforestation projects.

- Any stakeholder, be it a local city government, non-governmental organization, international organization, or corporation can build their own solution on top of the Open Reforestation Protocol, using the tooling and structures embedded into the platform. All solutions built on top of the protocol layer run according to the same state, data, and crypto-economic model in a trustless and open environment.

In unison, startups, governments, environmental organizations, and nonprofits all stand to benefit from the value created by a decentralized, open and permissionless platform for managing reforestation efforts. Not only is ORP a valuable means for project MRV but it also allows project operators on ORP to monetize their projects using a standardized carbon credit from the sequestered carbon. Meanwhile, the protocol layer itself, provides the core tools and immutable data structure for many of these initiatives: The different ecosystem participants jointly utilize these tools and structures over time, to sustainably create an inclusive and innovative environment for better monitoring reforestation initiatives and the value created therein.



As the schematic above demonstrates, ORP is designed as a Layer 2 solution built on top of a larger Layer 1 Protocol. For use of NFT's ORP will integrate with an NFT L2 to provide easy minting for different projects. Above ORP, as a L3, any application can build its own custom solution on top of the protocol be it a dApp, decentralized exchange for carbon credits, or private reforestation solution.

2.2 Non-Fungible Token Based Grid Management

To accommodate the geographical nature of reforestation, the protocol integrates the capacity to mint non-fungible tokens for a designated reforestation zone, spanning multiple plots of land.[13] Not only are such tokens used for ownership purposes and land tenure, but they are also representative of the scope of the project at hand taking place. The grid system is designed around Google Plus Codes - an open source grid software - from which a unique code can be created for a specific plot of land. Such a system allows all Open Reforestation non-fungible tokens (NFT's) to be uniform in their grid structure, while retaining the capacity to modify or update data surrounding possession, trees planted, verification efforts, and Open Carbon Credits yielded. Once created, it is close to impossible to create two geographically overlapping NFT's, due to the protocol mechanics of validators accepting data uploads, and any user able to explore all existing projects on the network.

13 A plot of land refers to a google plus code grid cell, divided according to geographical coordinates. A reforestation zone is a set of plots of land encompassing the scope of the reforestation project at hand.

Users uploading data onto the protocol for a specific reforestation project, will by default mint an NFT with the plus codes of the location and any additional parameters inside of it at the beginning of the project. This process is built into the open-source application, and thus makes grid management of projects a natural extension for managing reforestation data.

2.3 The Open-Source Application: Reforester

Central to the mission of the protocol to provide open, permissionless access to managing reforestation data, is the open-source application Reforester. Reforester provides a single clean interface for any entity or organization to create an account from which standard data surrounding a reforestation project can be uploaded. The data input - manually - includes:

1. Project Banner Image
2. Project Title
3. Project Description
4. Location (country, region) and timestamp
5. Plot of Land = NFT number / Minting details encompassing the set of Google Plus Codes the project spans over.
6. Project Owner / Developer
7. Project Funder(s)
8. Budget:
9. Scope of Project in Surface Area
10. Number of Trees
11. Tree Density
12. Tree Species
13. Co-Benefits
14. UN SDGs:
15. Project Timeline (Start, end, and additional milestones)
16. Documentation Upload (if relevant)
17. User signature
18. Account Wallet for Managing the NFT and paying fees on the protocol for uploading data.

As an open-source application, the application can be cloned and enhanced by private companies looking to provide more holistic or comprehensive solutions: different parameters can be added (such as IoT sensor data, drone footage, and further analytics), while in turn, more robust technologies can be integrated if the MRV demands are more stringent (for more see Section 6 on Vision).

Overall, the open-source application functions as the standard-level tool for collecting reforestation data. Uploading such data is done through the payment of a transaction fee in tokens to the protocol.

2.4 Tools and Integrations of the Protocol

In order to fully benefit from the full scope of services offered by the Open Reforestation Protocol, open-source tools including Software Developer Kits (SDKs) and a general REST API offer developers and companies 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 land grid into other applications, as well as for carbon-credit market purposes.

In essence, the SDK's and API available on top of the protocol ensure that it can be easily connected - or can easily connect to existing software or developer interfaces for business or financial purposes.

Part 3: Open Reforestation Crypto-Economics

A robust crypto-economy is a fundamental component of every open-source protocol running on a public blockchain. As a platform exclusively focused on reforestation management, 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, upload collateral for all projects on the protocol, and incentives for collateral providers. In this crypto-economic model, two tokens operate as the fundamental value parameters of the ecosystem: ORP Tokens, and Open Carbon Credits (OCCs).

3.1 ORP Tokens

ORP Tokens are the representation of utility and governance on the Open Reforestation Protocol. ORP's are used for the following purposes:

ORP Token Functionality:
Stake to Accept or Challenge Project Data Uploads
Govern the Open Reforestation Protocol via DAO Vote
Yield ORP's for Providing Upload Collateral
Yield OCC's From Protocol Fees

ORP tokens are a utility token used to provide access to stakeholders interested in securing the protocol and the validity of the data transacted therein: ORPs are used to verify or challenge the accuracy of a reforestation project, to govern the many different parameters of the protocol, and as rewards for collateral providers supporting reforestation projects. ORPs are not used by project owners, as all fees and bonds paid by project owners are denominated in nDAI.

With a delegated proof of stake validation model, validators can lock up or incorporate delegated stakes from token holders as a means for securing data uploaded onto the network, and earning the data upload fee paid for by the project owner.

3.2 Upload Collateral and Challenge Fees

Game theory dynamics built into the crypto-economic model center upon the upload collateral function: under the assumption that there is a certain incentive for stakeholders to behave maliciously so as to falsely legitimize their project for business purposes or to mint carbon credits, all projects launching on the protocol require a certain amount of upload collateral locked in nDAI for the different stages of the project. This collateral is determined in proportion to the size of the project as well as the specifics of that project (project duration, project budget, and data upload frequency).

Project owners must convince collateral providers to back their project. Only once collateral has been secured can project owners upload data onto the protocol for their project. All data uploaded is uploaded with a corresponding data upload fee that is rewarded to protocol validators for accurately determining the correctness of the data.

If at any point in the data upload phases of a reforestation project, the trees are shown to not actually exist, the upload collateral for that stage of the data upload cycle is confiscated from the collateral providers and distributed out to the party capable of proving the non-existence. In order to put forward a challenge for upload collateral a stakeholder will have to put forward a challenge fee, that they will have returned to them should their challenge be considered valid.

Challenges are managed by validators staking on the outcome of data uploads using ORP tokens. The validators involved in proving the accuracy of a challenge are entitled to the upload collateral if data is proven false, and the data upload fee if data is proved accurate. 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.

3.3 Open Carbon Credits (OCC's)

Open Carbon Credits are automatically created when data relating to trees mature to a point in which the reforestation zone sequesters carbon of a quantifiable amount. This maturation point is originally decided upon by the Reforestation Foundation but capable

of being changed via governance vote over time. That is to say, while the Reforestation Foundation will set the initial parameters for what constitutes an Open Carbon Credit and at what point in a projects' life cycle they can be yielded based upon the carbon sequestration rate of the reforestation zone.

OCC's are digital representations of carbon sequestration. All OCC's are minted in direct correlation to a specific reforestation project - on an NFT denominated reforestation zone - and with the current state of carbon sequestration by trees. Upon minting, OCC's are dropped into the account wallet of the uploading user, with a small 2% protocol fee taking a portion of the token and distributing it out to ORP token holders. Such OCCs are then tradeable on the open-market or as real representations of carbon backed credits from trees sequestering carbon. Due to the parallel nature of OCCs (i.e. OCCs are only created once data confirming the maturation of the trees is uploaded) with the growth of the trees in question, OCCs are truly data-backed carbon credits directly tied to a specific reforestation project.

The standard for what amount of sequestered carbon qualifies as a carbon credit, and at what point of maturation are carbon credits minted is decided upon by community governance vote. Importantly the minting of carbon credits is directly correlated with the growth or destruction of a plot of reforested land: As a tree matures over time to sequester more carbon, more credits stand to be minted. However, in the event that a tree or plot of land is destroyed or dies prematurely, carbon credits are no longer created until a new project is started in the place of the old one.

In context, OCC's are one of the world's first open-data backed credit schemes, in which all carbon that is credited can be traced back to a specific project and specific data uploads from that project over time. To jump start the new carbon economy, any project using ORP is 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 from the projects creation), but it also provides new business models for reforestation companies and entrepreneurs alike.

For a complete overview of the Open Reforestation Protocol Mechanism Design see: ORP Mechanism Design. For an overview of the carbon credit structure and the burn mechanism see: Open Carbon Credits.

Part 4: The Open Reforestation Foundation

Governance of the Open-Reforestation Protocol will be decentralized with voting on standardization surrounding reforestation, land tenure, and further protocol advancements managed by the community of stakeholders within the ecosystem (this relates to the governance of the protocol described in Part 3).

At its inception however, and in the early years of the protocol, a non-profit foundation will preside over the protocol to manage its technical development, crypto-economic model, business outreach, and original solutions design. This foundation is known as the Open Reforestation Foundation.

The Open Reforestation Foundation maintains the following responsibilities for the initial launch of the protocol:

- Initial Protocol Fundraising and Fund Management
- Technical Development of the Protocol, Developer Tools, and Open-Source Application
- NFT Standardization of Plots of Land
- Business Development and Partner Outreach
- Solutions Design On Top of the Protocol
- Platform Maintenance and Debugging Over Time
- Open Carbon Credit Accreditation and Standardization
- Partnership Development and further financial funding opportunities
- Developer and Entrepreneur Recruitment
- Management of the Ecosystem Development fund
- Reforestation Task Force for MRV Improvements Over Time

The Open Reforestation Foundation's mission is to ensure that the protocol is able to develop and grow at its inception within the guiding spirit of open, permissionless, decentralization for reforestation data management and carbon credit creation. With community voting, responsibilities of the foundation will be incrementally offloaded over this time duration.

Part 5: Client Development and Product Deployment

In light of ongoing reforestation initiatives such as the 1 Trillion Tree initiative, it is important to emphasize the compatibility of the Open Reforestation Protocol with other existing initiatives: As a protocol, the ORP provides a data architecture that is open, secure, and permissionless to use. Beyond these basic parameters, the protocol can be integrated with existing applications and reforestation solutions across the spectrum: Among emerging technology providers, existing applications deployed for tracing trees, and with organizations already pursuing reforestation goals. Actively integrating with the reforestation goals of such existing initiatives is important for the development of the protocol in the long term.

In this context, the core 'clients' of the protocol are multiple and varied depending on the type of engagement with the protocol.

First, there are project operators - or the primary clients of the protocol interested in uploading reforestation data for their MRV needs and the sale of OCC's in the near future. Stakeholders of this type of client include:

Project Operator Clients:	**Description**
Existing Reforestation Companies	63 million trees planted by 142 participating projects in the 1 trillion tree campaign.
Non-Governmental Organizations	15,000 environmental organizations just in the US, possibly over hundred thousand across the world
City or State Governments	Developed countries have made a promise to raise $100 billion per year in climate finance, from both public and private sources, by 2020 to help developing countries tackle global warming; by 2025 $100 per year will be the floor.

City or State Governments (continued)	C40 Cities connects 97 of the world's greatest cities (25% of world GDP) to take bold climate action: 80 are committed to develop 1.5C aligned, resilient and inclusive climate action plans and 12 C40 have already completed the plans
Climate Entrepreneurs and Developers	VC invested in climate tech between 2013-19 is $60 billion and has shown a CAGR of 84%; If CAGR is only 20% between 2019-2030 it will get to $450 billion by 2030. 1,200 climate tech startups, 43 of which are unicorns (valued over $1B+). Climate finance flows amounted to USD 548 billion in 2018 (private vs public actors 56%:44%); *"Agriculture, forestry, land-use, and natural resource management"* amounted to USD 20 Billion for 2018

Second, there are 'collateral providers' or those who look to Yield ORP tokens by locking up some form of collateral onto the protocol. These stakeholders also may vary in both size and amount locked onto the protocol:

Upload Collateral Clients	**Description**
Private Companies	$579 Billion USD in global climate-related primary investments.
Banks / Green Neo-Banks	Banks worth 47 trillion (? of global industry) have adopted UN-backed climate financing principles..
Climate Organizations	Developed countries have made a promise to raise $100 billion per year in climate finance, from both public and private sources, by 2020 to help developing countries tackle global warming; by 2025 $100 b per year will be the floor
Retail Traders / Crypto / Consumers	$25 billion USD in decentralized finance as of 28 January 2021

Third, there are 'validators' or those who will be accepting or challenging uploaded data, as well as earning a small fee from every project that utilizes the network. These stakeholders are those willing to purchase and hold ORP tokens for the long term, both for rewards and DAO governance benefits.

ORP Validator Clients	**Description:**
Private Investors / VC's	$326 billion USD in private capital investment over 6 continents $2 billion in commitments from investors in Latin America and Africa to allocate a part of their portfolios to restoration investments.
Climate Organizations	$22 billion annually in 2015 and 2016 of public adaptation and resilience finance from government and bilateral aid agencies, climate funds, and bilateral, multilateral, and national finance institutions
Climate Consultancy / Private Companies	Close to 1,200 companies (and rising weekly) have made net zero before 2050 pledges
Traders	Investors that represent over $52Tr assets under management (AUM) have signed on to drive action on climate change across their portfolios, from portfolio decarbonisation to climate risk disclosure and the use of shareholder levers

Finally, there is a small position for clients who are solely interested in the DAO benefits of voting on the protocol. While more often than not these stakeholders will also stake their ORP for some form of return as validators, there are certain clients for simply managing the governance decisions of a protocol like ORP:

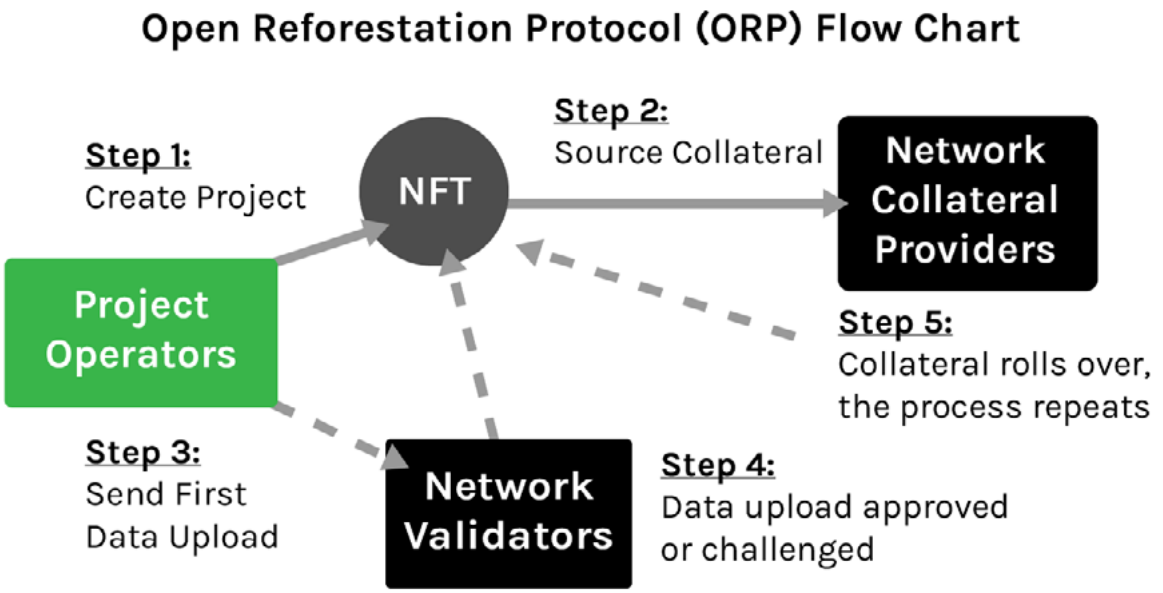
ORP DAO Participants
Climate Advocates
Environmental Organizations
Private Companies
Early Investors / Backers
Non-Governmental Organizations

The different stakeholders involved in ORP are numerous and largely based on their specific interests (uploading data for MRV and OCC purposes; Yielding ORP; Earning Fees and Managing DAO Governance). It is expected that as the reforestation industry grows in the coming years, more stakeholders will onboard to the protocol for the different incentives outlined above.

5.1 Launching a Project on ORP

Launching a project on ORP starts with creating an account on the ORP Open-Source Application, Reforester. Project Operators are prompted to input project details that will then be shipped to the collateral area for approval and commencement:

- Duration of Project (Start Date, End Date)
- Data Upload Frequency (Minimum is Set Every 12 Months = first 2 years every 6 months)
- Scope of Project (Number of Trees / SURFACE AREA)
- Additional Project Details [Open Input] (Input Species Type, Budget, Connected Organizations, Community Participation Details, Purpose of plantation, etc.)
- Location of Project (Country, Region)
- Coordinates of Location
- NFT Screen Delimiting Location
- Confirmation of Location Delimited NFT Plot
- Pictures/photos upload (w/ option for repeated picture upload) /GPS coordinates (cell phone location?)
- Signature of Project Operator or User Confirming the Validity of Data (Receipt of Signature)



As the graphic above demonstrates, once a project has collateral committed to it, the project operator can then proceed to upload their first data upload onto the protocol 6 months later (6 months from the defined start date of the project). Once that data upload is accepted (or possibly challenged) it then is added to the NFT metadata: Stage 2 effectively commences with collateral already committed rolling over and the project operator waiting to upload the second data upload (6 months after the resolution of the first). This process continues for the entire lifecycle of the project.

5.2 Integrating as a Technology Provider

Technology providers who are able to provide extensions to project operators with their specific technology, can apply to be whitelisted by the ORP DAO and to integrate as a 'plug-in' on the open-source application.

5.3 Developing Solutions on ORP

Building applications on top of ORP is easy using open-source Software Developer Kits as well as the ORP API. Developers can build proprietary or public applications for any aspect of the ecosystem: Collateral Providers, Project Operators, or Validators.

5.4 Accrediting OCC's

Many standards exist for carbon credits today. However most of these standards are centralized and privatized by non-profit environmental consultancies looking to benefit from selling standardization to other companies. The Open Reforestation Protocol is built primarily for Measurement, Reporting and Verification purposes of reforestation projects. Yet, as these projects mature, the data uploaded on-chain can also be used as proof for certification of a carbon credit scheme. As such ORP will funnel OCC's directly to project owners without any intermediary involved.

It is the immediate plan of the Open Reforestation Foundation to work towards accrediting Open Carbon Credits on the Open Reforestation Protocol, as truly data backed and immutable hashed credits that are open and easily accessible to any project willing to prove their data. As such, ORP would offer one of the world's first open-source carbon credit schemes, made possible by its protocol design and ultimately blockchain backbone. With accreditation, every project uploading data - so long as they comply with the requirements of OCC' data uploads - would be eligible to automatically receive OCC's as their project matures over time.

Part 6: The ORP Vision - A 10 Year Plan

Climate Tech 2.0 is only just getting launched. As has been reported by Quartz and many others, investors, 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.

The long-term vision of the Open Reforestation Protocol is to provide an open, permissionless, and easily accessible backbone for a new generation of reforestation projects backed by clear MRV practices, and a new ecosystem of carbon sequestration initiatives with truly data-backed carbon credits. While reforestation is the most immediate need by companies, governments, and NGO's everywhere, the core design of the protocol is such that it can also easily accommodate solutions beyond reforestation. Including:

- Forest Conservation
- Maritime Conservation
- Carbon Sequestration in Soils
- Land Tenure
- Urban Management
- Ecosystem Protection
- PV Solar Farms
- Carbon Credit Markets

The fundamental value proposition of ORP, is that it is a decentralized and communal platform for handling carbon sequestration projects. The underlying principles of transparency, data immutability, open-access, and shared governance, mean that ORP will only become more important as time goes on, and climate entrepreneurs and investors realize the value of an open-protocol that standardizes access and rewards. Accrediting OCC's on top of the protocol, is a further gamechanger that has the long term potential to ground an entirely new carbon economy: One that is not fragmented and individualized among companies, but rather, one that is community governed, and standardized for any project in the world using the protocol.

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. In parallel to that, McKinsey estimates that the market for carbon credits will increase to be valued at over $50 billion USD value. In this environment, ORP is positioned to become a global standard for the long-term future as it's value proposition is incomparable to any traditional accreditation or MRV scheme.

Long-term protocol governance will be handled by a community of invested stakeholders, via the ORP token. The ORP token, beyond being used for validation purposes, is equally important for future protocol politicians, interested in setting protocol rates, adding new requirements for standards, and handling other aspects of ORP that will need upkeep and management over time. As more stakeholders onboard as either project operators, collateral providers, or validators, the importance of proper management will equally increase in importance.

Project operators meanwhile, attracted to ORP for its data transparency and collective MRV benefits, have the unique opportunity of also monetizing their reforestation and carbon-sequestration projects by receiving data backed carbon credits. For the first time a cyclical and commercially viable model for funding, tracking, and rewarding carbon-sequestration projects can be realized by a community of passionate and involved stakeholders.

Part 7: Fundraising and ORP Distribution

The fundraising strategy designed around ORP is based upon identifying long-term partners for the protocol who share a common vision for the future of MRV and Carbon Sequestration Needs. The ORP distribution model, in line with this long term approach, is designed to ensure scarcity of the ORP token over time.

7.1 ORP Distribution

Total Supply: 1.5 million ORPs total supply capped.

- 300,000 for Upload Collateral Locked (□)
- 200,000 for Team and Advisors
- 500,000 for early backers, VC's and ICO (□)
- 300,000 for eventual release at the tail end of projects. (□)
- 200,000 for Ecosystem development and Foundation Management over 10 years (x amount unlocked each year).

Under this model, digital scarcity is built into the distribution of ORP tokens: From the 33% of tokens originally sold in ICO and private rounds, the remaining 66% will be locked for incremental release via ecosystem development or collateral provider yield over an extended period of time. Soon after, the only ORP that will ever be minted again will be directly tied to a deflationary model of new projects onboarding to the network.

7.2 Fundraising Model

Offering	Discount (Cost)	Lock Up	% of Total Sold
First Round	30% ($35.00)	3 years	20%
Second Round	15% ($42.50)	2 years	40%
Third Round (Crypto Public)	None ($50.00)	None	40%

ORP Starting Price: $50.00 USD.

Part 8: ORP Roadmap

Launching the Open Reforestation Protocol involves the development of the ecosystem on multiple fronts. As such, there are multiple different development timelines for the different facets of the protocol. When taken altogether the development of ORP can be broken down into Four Core Stages:

Stage 1: Preliminary Buildout (Q4 2020 - Q2 2021)

Stage One is characterized by the need to build out the very foundational building blocks of ORP. That includes initial prototype development, back-end protocol design, client planning and outreach, finalizing core documentation, core team onboarding, and strategic planning on branding, messaging, and outreach into the future. Deliverables from this stage include:

- Documentation on the Mechanism Design, NFT Structure, Protocol Architecture, Crypto-Economics.
- Initial outline of potential clients across categories: reforestation companies, non-governmental organizations, charities, and environmental organizations, etc.
- Branding, Core Messaging, and Content Planning of Outreach and Promotional Materials.
- Initial Technical Documentation and planning with the creation of a minimum viable product (MVP) featuring Reforester - the open-source dashboard and user application.

Stage 2: Testing and Stealth Development (Q2 2021 - Q4 2021)

Stage two is the longest and most essential stage in the development of ORP. In this stage the original building blocks are built upon further across verticals of the protocol: Back-end development of the actual protocol begins, alongside client and investor outreach, as well as community and entrepreneur development. The initial prototypes are completed, and PoCs begin with selective clients on private test-net. While the core protocol infrastructure remains under heavy development (including the NFT

integration with the protocol, the development of the validator area and collateral space), the other core components that make up the ecosystem are built out: SDK's and API's, management interfaces for validators, collateral providers, and project operators, respectively. Deliverables from this stage include:

- Working Dashboard Prototypes for Clients testing out the protocol
- Protocol Design and Development of the NFT infrastructure, core validator area, and upload collateral functions.
- Launch of ORP on private test-net including QA, optimization and auditing of contracts.
- Rounds 1 and 2 of private fundraise.
- Release of developer tools and documentation for building on top of the core protocol.

Stage 3: Public Launch (Q1 2022)

The public launch of ORP will take place shortly after the public token sale. Stage three is characterized by the incremental release of the different features of ORP protocol: It will become public when ORP validators collectively vote to launch the protocol and ORP DAO simultaneously. This will trigger the charge of data upload fees to projects using the protocol.

- Public Token Sale for ORP Tokens.
- Launch of Main Network V1.
- Launch of Public Validators.
- Launch of ORP DAO.
- ORP is Open for Developers and Entrepreneurs to Build Solutions On Top.

Stage 4: Progressive Decentralization and the Introduction of OCC's

The fourth and final stage of the current ORP Roadmap relates to the progressive decentralization of the protocol after launch, and the introduction of Open Carbon Credits onto the platform. These developments would see ORP become a fully

autonomous and permissionless cloud-platform for MRV and Carbon Sequestration initiatives. Deliverables include:

- Implementation of the OCC's Standard into the protocol architecture.
- Public launch of the Open-Collateral Area for Collateral Providers.
- Decentralization of decisions made via transfer from ORF to ORP DAO.
- Unlock of ORP Community Ecosystem Development Funds for ORF to stimulate ecosystem development.
- Development of Open-Source Dashboards for Other Industry Verticals.

8.1 Early Backers and Stakeholder Outreach:

Early backers refer to Non-Governmental Organizations, Environmental Organizations, Non-Profits, Private Corporations, International Organizations, and Government Agencies interested in participating in the early stage creation and launch of the Open-Reforestation Protocol. Such backers and stakeholders will participate in the pre-public rounds offering ORP's and are expected to play a long-term role in protocol development and governance in collaboration with the Open Reforestation Foundation.

8.2 Early Partner Outreach

Early partner outreach refers to potential companies, environmental organizations, non-governmental organizations, developers, and entrepreneurs interested in building early stage tools and verticals on top of the protocol. Such solutions can relate to niche reforestation services, afforestation, ecosystem restoration, maritime reforestation land-tenure management. Reforestation companies will be invited to participate in early test-net trialing of ORP as early as mid-Q2 2021.

Conclusion

The Open Reforestation Protocol is an innovative solution for creating a new, open, and permissionless economy surrounding the measuring, reporting, and verifying of the beneficial effects of reforestation projects. With open-source tools, incentives for early backers, and climate consciousness increasing across the globe, the ORP is poised to launch at a critical time for the future of the planet. With a general foundation for transparently, and accurately reporting on the status and growth of reforestation projects across the globe, the future of reforestation stands to become more accessible, transparent, and inclusive, for any stakeholder wishing to preserve the environment in a verifiable manner.

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