



# **Open Reforestation Protocol**

## **NFT Research Analysis & Architecture**

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# Introduction

The following document will provide a framework for understanding the applicability of non-fungible tokens towards the [Open Reforestation Protocol](#) (ORP). This document will begin with outlining how [non-fungible tokens](#) (NFTs) have so far been applied to blockchain-based land-management solutions. Next, it will develop what an NFT designed to suit the needs of ORP would look like. Then, it will explain how this NFT will be integrated into the ORP mechanism design and user interface. Finally, future opportunities that arise from the implementation of NFT technology will be sketched out, including implementation on the [NEAR Protocol](#).<sup>1</sup>

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<sup>1</sup> This paper will continue on the assumption that the reader possesses a basic understanding of blockchain technology, NFTs, and the Open Reforestation Protocol. For a brief primer on NFTs and how they relate to ORP, please see the following resource - [NFT Primer](#)

# Overview of NFT-based Land Management Solutions

Due to the relative novelty of NFTs and their application to offline assets, this overview will begin with briefly outlining how blockchain technology has been applied to existing land registries and real estate transactions. This is done so as to provide context for existing NFT applications and the use of NFTs by ORP. Then, this paper will detail how NFTs have been used to represent plots of land in virtual worlds so as to provide insight into how this process can be recreated offline. Finally, contemporary reforestation efforts utilizing blockchain technology will be reviewed to assess the progress that has been made in utilizing NFTs for land management purposes.

## Land Registries and Blockchain

Blockchain technology enables opportunities for innovative land management solutions and aids in the digitization of real estate transactions across the globe. Most if not all countries maintain a form of a [land registry](#) - a record of land/real estate ownership and transactions over time. Land registries are critical for maintaining private property rights and ensuring economic prosperity, yet despite their importance, [only a third](#) of all existing countries maintain digital records of property ownership. The need for an accurate, immutable, and distributed ledger that stores and maintains land registries is present and perhaps great for many nations. In the aftermath of the 2010 Haitian earthquake it was revealed that decades of land records had been destroyed, leaving thousands without a legal claim to their home. This sort of devastation, while thankfully uncommon, is a brutal reminder that blockchain technology has the potential to greatly improve existing legal and governmental processes for the benefit of people everywhere.

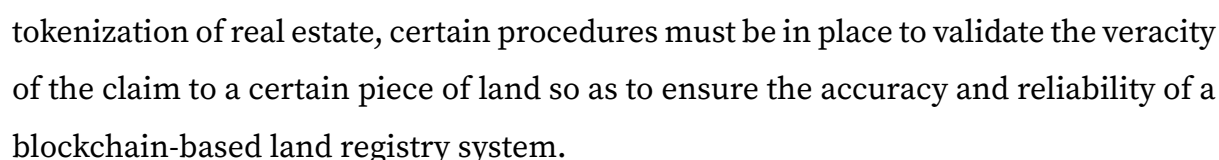
Many nations have begun to experiment with, and even implement, blockchain solutions that will help them store land registries and conduct transactions digitally. For example, [Georgia](#) has moved to using a private permissioned blockchain to

keep land records, and utilizes Bitcoin's public blockchain for hash publication and validation. Similar efforts have been implemented in countries as varied as [Ukraine](#), [Brazil](#), and [Sweden](#). Many of these efforts are still in development, and the interest and demand for further innovation in this area is increasing seemingly unabated.

In addition to government applications of blockchain, there have been various private initiatives to apply blockchain technology to the real estate industry. Of particular note is the organization [OpenLaw](#), a ConsenSys-backed blockchain protocol that aims to utilize blockchain for the creation and execution of [legal contracts](#). In 2018, OpenLaw worked with various Australian lawyers to create an end-to-end real estate transaction platform that is built on the Ethereum blockchain and backed by [ERC-721 NFTs](#). The platform enables the smooth transfer of properties through the minting of NFTs using the Australian government's centralized records of all official land titles. While the platform is operable and successfully demonstrates the possibility of transferring land and real estate titles through blockchain technology, it would be necessary to first make [changes](#) to Australian law for the platform to be widely implemented.

If the platform was widely accepted and available, then anytime an individual used the OpenLaw protocol to buy or sell a property, a smart contract would be created and both parties would use OpenLaw's various tools to fill the smart contract with the necessary terms or parameters that are typical in most land sale contracts. The [contract](#) would ultimately include: 1) the Ethereum addresses of both buyer and seller, 2) the purchase price, loan amount, and deposit amount, and 3) the NFT string identifier that syncs up with the property's physical address. This final piece tokenizes the plot of land and enables real estate to evolve into the liquid realm of crypto exchanges.

It is important to note that OpenLaw chose Australia to testrun their protocol specifically because of Australia's centralized land registry. All real estate transactions are registered with the Australian government's land title office, and as a result the issue of false information or "garbage in" getting uploaded to the Ethereum blockchain is much less likely to occur. It is clear that in order for the successful and accurate

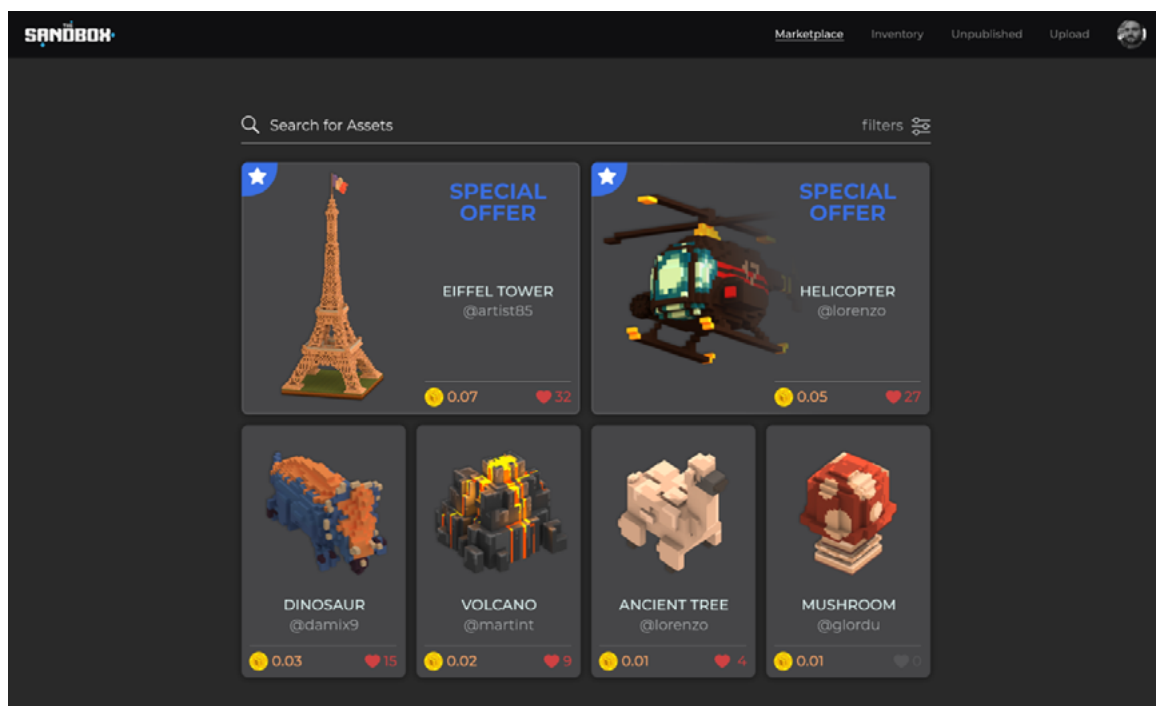


In conclusion, while many nations are now implementing or considering implementing blockchain to augment or replace their land registries, no governments have yet applied NFT technology to land registries. In addition, no private organization has successfully implemented NFTs in a land registry or widespread real estate transaction platform. There are several reasons for this. Primarily, the novelty of NFTs and blockchain technology generally has a lot to do with the lack of implementation. Additionally, existing laws are in place that would make NFT land transactions complicated and difficult to widely implement. However, the intended utilization of NFTs for the purposes of the ORP does not seem to be threatened in any significant way in light of these findings.

## Virtual Real Estate

It is important to consider land registries and how they are being adapted with blockchain technology due to the foundational similarities between what the

Open Reforestation Protocol aims to achieve and what has been accomplished by governments and private organizations around the world. However, there are no current real-life projects that have accomplished the widespread implementation of NFT-tokenized plots of land on the scale that the ORP aims to do. The only projects that have succeeded on this front are those of digital gaming platforms. There are [many](#) different digital applications and platforms that offer unique plots of “land” that are tokenized as NFTs. This overview will specifically cover a voxel-style game called The Sandbox.



The [Sandbox](#), set to release its public alpha version in early 2021, is a marketplace, gaming ecosystem, and virtual world all in one. Developed by Animoca Brands, this complex NFT-based game provides users with the opportunity to create their own voxel-based NFTs, buy and sell other user’s NFTs, and purchase plots of land that are themselves NFTs. There are two main NFT categories within The Sandbox. First, there are the LAND tokens. These ERC-721 NFTs represent a 96x96 meter in-game patch of [virtual land](#) that the owner can customize, populate with NFT assets, invite friends over to explore, and generally use to engage with the game. Something to note is that the user will completely own this plot of virtual land. The NFT is stored on the Ethereum blockchain, and the user is even able to rent out the LAND token to

others who wish to use it. The economic and gameplay mechanics of The Sandbox are intricately tied to LAND ownership.

The second NFT category of The Sandbox is that of the digital assets that users can create using voxels. These NFTs utilize the [ERC-1155](#) standard and are completely unique items that can be edited, sold, and replicated [by the creator and/or owner](#). The [metadata](#) of these NFTs includes: 1) Name & Genre, 2) Description, 3) Thumbnail (picture), 4) Price, 5) Transaction Type (fixed price or auction), and 6) Duration (how long the asset will appear on sale). The Sandbox also provides asset creators the option to determine how many copies and uses per copy may be allowed for each asset they create. These digital assets can vary from a replicated Eiffel Tower that will be admired on your LAND to a hammer with which to whack your virtual neighbor.

Whether it is possible to translate the land NFT principles developed in The Sandbox into the real world is yet to be seen. The concepts introduced in The Sandbox are seemingly replicable - a geographic area is delineated and purchased by an entity that then owns the full rights to that land. On top of that, this whole process is recorded on a public blockchain, so land rights are verifiable and legitimized by a distributed network. The implementation of the ERC-721 standard for LAND tokens, but the ERC-1155 standard for other digital assets, is interesting. This design choice provokes the question of whether NFTs that represent land could be created with a standard different from the common ERC-721 token design. So long as the metadata of the token is sufficient for the purposes of the given protocol, it seems possible that innovation and experimentation, such as has been seen with The Sandbox, will benefit future NFT-based land management solutions.

## **Existing Land Management & NFT Platforms**

There are various contemporary projects currently working to also apply blockchain technology to reforestation efforts. Few platforms come close to addressing the full scope of the ORP, but those that are similar are detailed below.

There is a project called [CorcoCoin](#) that is being developed by [Corcovado Project](#). As of September, 2020 they have planted over 1,000 trees, all of which in Scotland, and are hoping to scale their project to enable individuals to “invest” in single trees that are represented by NFTs. The platform is built on the Telos blockchain, and rewards owners of trees with CorcoCoins, which represent 1 kilogram of CO2.

A second project is [Eco Matcher](#) which provides a user-friendly interface through which individuals or companies can participate in their process of [reforestation](#). They recently released what they call “Treechain”, a blockchain application built on the EOSIO protocol that records each tree that passes through the system. There were no details provided on how this blockchain ecosystem operates. Similarly to CorcoCoin, it seems Eco Matcher is hoping to entice mostly individuals or corporate entities looking to buy single trees.

A third effort is called [Treelion](#). Treelion’s ambitious [goals](#) include creating a carbon trading standardization, creating the world’s largest green digital asset ecosystem, improving the liquidity of green assets, and improving global environmental protection. Their main reason for focusing on reforestation is to prevent desertification rather than the climate change focus of the previous enterprises. Treelion released an app in April of 2020 that allows donations, tracked through their blockchain, towards various green projects.

Lastly, an organization called [Treejer](#) utilizes a sophisticated crypto economic mechanism design to create an incentive structure that [validates](#) the existence of data-backed carbon credits. Individual trees are planted and minted as NFTs on the Treejer platform, and these trees can be traded on exchanges.

The aforementioned enterprises provide a brief overview of contemporary projects that seek to combine blockchain technology and reforestation efforts. In some, NFTs are not utilized at all. In none are NFTs utilized to encompass anything greater than a single tree. Some other enterprises are utilizing crypto economic mechanisms to incentivize desirable behavior, while many seem to be relying on a centralized entity



to manage the validation of data on the ground. Nearly all of them seem to prioritize the front end application that the user will interact with rather than address the need for better MRV tools for reforestation project operators. While this last observation could be a result of the marketing material made available, the problem of insufficient MRV tools was mentioned only by Eco Matcher, whose proposed solution is to provide the NGOs and foundations they partner with an app with which to record photos of the trees as they are planted.

## **Moving Forward**

Through this overview of existing NFT and blockchain-focused land management solutions, it is clear that the mission and purpose of ORP is as important and unique as ever. There are very few examples of blockchain-based land management solutions that incorporate NFTs, and the ones that have done this successfully so far have mainly done so through virtual gaming platforms or unscalable DApps. This cutting-edge approach of using NFTs to delineate project areas and serve as the project operator's representative hub has the potential to greatly improve the efficiency of the entire protocol. The precise design of the NFTs for the Open Reforestation Protocol will be outlined next.

## NFT Design

The Open Reforestation Protocol has been designed with the purpose of providing reforestation initiatives with a digital representation of their project that will last for as long as their trees are growing. This digital representation will be an NFT that exists within the ORP ecosystem, which will itself be built upon a [Layer 1 blockchain](#). The reason for using an NFT rather than a more traditional username/password account-based system is directly tied to the needs of project operators and what ORP promises to provide if they utilize the protocol. This section will sketch out what ORP's needs are for project operators, explain the necessity of using an NFT to satisfy those needs, provide a brief overview of existing NFT standards, and outline what a technical implementation of ORP's NFT will look like.

### What does ORP need?

*First*, ORP's digital representation of reforestation projects will need to be a blockchain-interoperable asset that can gain the benefits of transparency, cryptographic security, and scalability that come with blockchain technology. This is critical to the open-source nature of ORP, as well as for the flourishing of projects on the ORP ecosystem.

*Second*, the reforestation projects will need to store various types of information and data about the progress of their project on their blockchain-interoperable asset, as well as [Google Plus Codes](#) that will delineate where the project exists in the world. Google Plus Codes are open-source, allow a precise delineation of land, and will be implemented to prevent multiple projects from overlapping on the same space and thus double counting.

*Third*, the data associated with any given reforestation project needs to be able to be updated over time as the projects upload new data for validation on the protocol. This kind of data can range from pictures to videos to text files.

*Fourth*, in the future, these digital assets should be capable of producing and/

or distributing tokenized carbon credits that will also interact with blockchain ecosystems. These carbon credits will be certified by the data that has been recorded on chain in previous data upload cycles.

*Lastly*, these digital representations of reforestation projects need to be easily accessible for project operators. This last need will be largely dependent on ORP's user interface and various design decisions on what to hide from the user.

Based upon these needs, it is possible to see how the utilization of an NFT will address what is necessary for the successful digitization of reforestation projects. An NFT will be able to operate within any blockchain ecosystem, and with the proper standardization of metadata be able to interact with any number of blockchain-based applications. Depending on the type of data storage utilized by ORP, this metadata stored or accessible in the NFT will be able to be updated throughout time, with the main concern being the cost of data storage for the owner of the NFT rather than the mutability of the data. Additionally, a mechanism can be implemented during the data upload process that enables the distribution of any carbon credit tokens “created” by the project's NFT, and could be as simple as having the project operator input the recipient's addresses (more on this later). Finally, while NFTs are still a novel and developing technology, with the proper user interface it will be possible to expose non-crypto familiar users to the opportunities that lie with the implementation of NFTs for reforestation digitization. However, proper planning will need to be done first in order to anticipate most if not all user concerns going forward. What ORP's NFT will look like, and enable users to do, will be discussed next.

## **Which NFT?**

All NFTs are managed by smart contracts that contain specific functions and data that make them unique among all other tokens, fungible or otherwise. However, not all NFTs are designed in the same way. There have been [many](#) different types of NFTs created to solve many different types of problems. The key difference between these different types of NFTs lie in the standardization of data and functions of each

token. In order to determine what NFT design will most benefit ORP, contemporary examples of NFT standards will be analyzed to assess suitability for the protocol.

The first NFT standard to gain prominence was the Ethereum Request for Comment [721](#) Non-Fungible Token Standard. The abstract of the token's design purpose is as follows:

"The following standard allows for the implementation of a standard API for NFTs within smart contracts. This standard provides basic functionality to track and transfer NFTs.

We considered use cases of NFTs being owned and transacted by individuals as well as consignment to third party brokers/wallets/auctioneers ("operators"). NFTs can represent ownership over digital or physical assets. We considered a diverse universe of assets, and we know you will dream up many more:

- Physical property — houses, unique artwork
- Virtual collectables — unique pictures of kittens, collectable cards
- "Negative value" assets — loans, burdens and other responsibilities

In general, all houses are distinct and no two kittens are alike. NFTs are *distinguishable* and you must track the ownership of each one separately."

The motivation for creating such a token standard was to enable blockchain-interopability for unique digital assets, regardless of whether these digital assets originated online or not. This interoperability enables ERC-721 tokens to interact with any wallet/broker/auction application on the Ethereum blockchain, a design decision that the consequences of which are only starting to become understood. NFT [marketplaces](#), [minting platforms](#), and [wallets](#) have all appeared and gained steady popularization since the introduction of the ERC-721 standard.

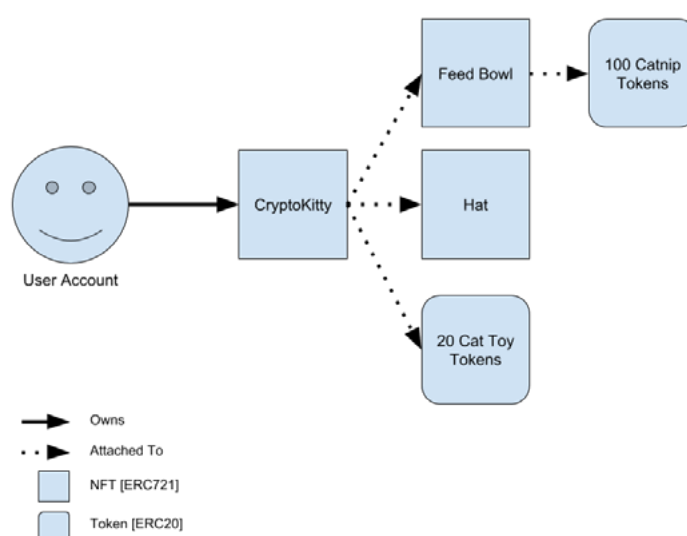
The reason these tokens are able to interact with so many different types of applications lie in the API standardization. By having a standard way of organizing information and smart contract functions, any token adhering to a token standard will be able to seamlessly interact with a blockchain application utilizing an API that is attuned to the token standard, thus enabling the API to read, record, and transmit the information contained within the NFT. This enables an NFT marketplace such as Opensea to take any NFT that adheres to an Ethereum-approved standard and display the NFT's metadata in a way that is more attractive and [user-friendly](#). Thus, the ERC-721 standard is not only valuable because it enables the tokenization of all kinds of assets, but it presents this token's data in such a way so that it is able to interact with the entire Ethereum ecosystem.

Despite the significance of the ERC-721 standard, there are limitations in the design of this particular NFT, namely that the standard only allows for the [creation of a single "class" of token](#). These tokens can represent nearly any kind of asset, but the smart contract is limited to creating only NFTs. This same limitation is present in the [ERC-20 fungible token standard](#), which is the fungible token standard used by [most tokens on the Ethereum network](#). This limitation is significant in that it means each ERC-721 or ERC-20 contract will have significantly reduced flexibility with representing multiple types of tokens, as well as potentially requiring significantly higher gas fees to conduct transfers. If the goal of an individual is to create many different NFTs and fungible tokens within the same contract, the 721 standard would not be the best solution.



In an attempt to overcome this limitation of the 721 standard, the company Enjin created a new NFT standard that allows the creation of multiple token classes within a single smart contract. The ERC-1155 standard, known as the multi-token standard, is notable in that it has various features and functions that allow it to save on gas fees by eliminating the need to create a new smart contract for each new token class. Rather, it allows multiple token classes to exist within the same smart contract, represented by the ERC-1155 token. This means that a single 1155 token can “hold” multiple ERC-721 and ERC-20 equivalent tokens in the same place and under the same address. A common analogy used to explain the difference between 721 and 1155 tokens is that a 721 token is like a vending machine that can only sell one single item, whereas a 1155 token is like a fully stocked vending machine filled with lots of different items. Additionally, the 1155 standard allows batch transfers of tokens, further cutting down on gas and data fees.

The last notable Ethereum-based NFT standard is the [ERC-998](#) composable non-fungible token. This standard is unique in that it proposes an NFT design whereby there are “parent” and “child” tokens that have unique relationships with one another. An NFT adhering to the 998 standard could have a parent NFT that “owns” either other NFTs or fungible tokens. The example given is that a CryptoKitty could own a scratching post, water bowl, and cat bed, all of which would be ERC-20 fungible tokens. Then, if the CryptoKitty were to change ownership, the new owner would own not only the “parent” NFT (CryptoKitty) but also all of the attached tokens.



An example of an ERC-998 token structure

As ORP will be building on the NEAR Protocol (more details in the “Future Opportunities” section), it has the possibility to utilize the new and in-development NFT standard that will be unique to NEAR. The current NFT standard that is being considered is the [NEP-4](#) standard. This standard is similar to the ERC-721 standard, which is unique to the Ethereum blockchain, in that both are designed to represent unique assets as a token. However, the NEP-4 standard will be able to utilize NEAR’s [contract-based account](#) system and thus enable a greater degree of flexibility for developers.

## **How do these standards relate to ORP?**

The previous standards are all significant when considering how to design the ORP NFT. This section will briefly cover which aspects of each standard could be useful for the ORP NFT, and what features lack from each as well.

Regarding the 721 standard, it might be theoretically possible to utilize a similar standard for the ORP NFT, however the main drawback would be the limitation for future innovation. If the ORP NFTs are standardized to a 721 equivalent, they would be largely unable to own ORP tokens or carbon credit tokens in the future, as would be possible with a 998 standard or possibly even the 1155 standard. Additionally, the inability for the NFT to conduct batch transfers like the 1155 standard would lead to significant cost and time penalties in the future if a project’s NFT wanted to transfer all of the carbon credit tokens it has at one time.

The 1155 standard largely improves upon the above shortcomings of the 721 token, but it is unclear whether the 1155 would “own” the non-fungible and fungible tokens it creates. While the smart contract that manages a 1155 token would be able to manage multiple NFT and fungible tokens, these tokens may not necessarily be a standardized ERC-20 token equivalent, and instead be just a token that the contract itself creates. This would be problematic because it will be important to have a standardized carbon credit or ORP token, and the tokens created by the 1155 contract might not necessarily be of the same type. In short, the efficiency savings of the 1155, such as the batch

transfer function, is very desirable, but the ownership of tokens within the 1155 contract is an unclear and potentially problematic issue.

The 998 standard, while not an official Ethereum standard, is one that promises to most benefit the ORP NFT design. The composability of this token means that we can create a single, main NFT that will own the remaining NFT or fungible tokens that are either awarded, sent to, or created by the main NFT. Any carbon credits, ORP tokens, or even other crypto currencies could be owned by the reforestation's project hub. This would be significant because it would enable the NFT to behave more like a traditional account-based application system whereby someone's account on a digital application is able to store and collect various digital resources. Additionally, this could enable future entrepreneurs to create NFT or fungible tokens for project operators to add onto their project. These future tokens could be used to store various types of data, digital assets, art work or promotional materials for their project, and many more assets that would be very difficult to associate with a project without a composable NFT as the main representation of a reforestation project.

## **The ORP NFT**

Taking into consideration all of the previous NFT standards, it is possible to envision how an ORP NFT would be designed in light of the needs detailed above. To start, the ORP NFT should contain metadata in a certain way so as to be readable and displayable by an accompanying application. This metadata would be standardised so that all ORP NFTs would contain the same types of information. This information could include: the Google Plus Codes and/or location of the project, ownership of the NFT, what types of trees will be planted on the project, what is the timeframe of the project, who are the main sponsors or the project, and any other kind of information desirable by the ORP Foundation. So while all of the NFTs that are created will have different and unique information that differentiates each project from one another, the types and formatting of data will remain the same across all NFTs.



In addition to a standard for organizing metadata, the NFT will need to contain certain functions similar to other types of NFTs. At a minimum the ORP NFT will need to be able to be transferred from one address to another using some form of the `safeTransferFrom` function, as well as have a [tokenURI](#) function to call metadata stored as a JSON file someplace off chain. This function will be critical for the ORP NFT, as it will enable the metadata associated with each NFT to be in part mutable. The data that will remain on chain, such as the unique identifying code of the NFT and the land limits of the project, will remain immutable and a permanent fixture of the NFT even if it is transferred to another owner. The remaining data can be stored off chain on either a centralized database or a distributed data storage platform such as [IPFS](#), but yet accessible through the tokenURI function. Additional data may be able to be stored on a composable NFT and managed separately from the main NFT. Future tech integrators may choose to use composable NFTs or tokens for future project operators to add onto their existing project. Such digital assets can range from accreditations validated by various NGOs or governments, new ways of visualizing, representing, or recording data, and new technological tools for the project operators to use that would benefit their project.

Another design consideration is the ability to distribute carbon credit tokens to designated recipients. As many NFTs are minted for the purpose of creating and selling art, there have been developments in creating NFTs that enable royalties to be collected and sent to a certain address if the token is ever sold so that the original artist may receive a cut of the sale profits each time their artwork changes hands. However, this mechanism would not benefit ORP as it needs to be hardcoded into the NFTs metadata and thus is unalterable. This would become problematic should new sponsors of a given reforestation project come into play, as they would not be able to receive the carbon credits they are paying for. In addition to split fee structures, there have been innovations in [fractional NFTs](#), such as with the platform [Niftex](#). This approach also does not seem suitable as well for ORP as it involves taking an NFT such as an ERC-721 token, locking that token in a smart contract that divides it up into 100 or so ERC-20 tokens, and then listing those ERC-20 tokens on an exchange for sale. This can be beneficial for a digital art market, as this approach is designed

to increase the liquidity of traditionally illiquid assets such as art, but it would not aid in the distribution of carbon credit tokens on ORP. Rather, the issue of distribution of carbon credits would need to be handled slightly differently for the ORP NFT.

The NFT can be designed so that each data upload cycle, when the carbon credits are minted for each project based on their recorded carbon sequestration, the project operators can be given the option to designate which addresses are to receive what percentage of the carbon credits that will be awarded for the data upload cycle. This would avoid the problem of hard-coded royalties, as well as enable a greater degree of flexibility for the project operators should they need to send their carbon credits to a different entity each data upload cycle. Additionally, if the NFT is built with composable functionality, the project NFTs themselves could own the carbon credit tokens. In the future, there will likely be more sophisticated NFT standards that would enable new ways to distribute or award carbon credits, but given the current state of NFT development, an additional page for project operators to complete during the data upload phase seems to be the most effective solution.

Regarding the ORP NFT, the last design consideration is user-friendliness and accessibility. Many if not most of the project operators will initially be unfamiliar with blockchain technology. As a result, the more ORP can simplify this experience the better. By determining exactly what data will be included in the NFT metadata, an API can be utilized that reads this data and displays it in a user friendly way, just as [OpenSea](#) does for all of its NFTs. Additionally, by determining exactly what kind of data will be uploaded to the NFT, ORP can better calculate the data storage fees for project operators and visually represent how much a project will pay to store their data. These storage fees should be paid upfront along with the first data upload based on an estimation of future storage costs.

As a closing thought on data standardisation, it will not be as important for ORP to have an official NFT standard that extends functionality beyond the ORP ecosystem. While it might be interesting for an ORP NFT to be able to be listed for sale on an exchange, this presents a host of complications for the project operators and their

reforestation projects. As a result, it is unlikely that the interoperability for ORP land NFTs needs to extend far beyond the ORP application, database, and third-party file storage. It will be useful for the ORP NFT to have its own standard, as the open source nature of the protocol will necessitate replication on other platforms and so it would be helpful to establish how future NFTs should be created, but it will not be necessary for this ORP NFT standard to necessarily be compatible or related to existing NFT standards.

## ORP Integration

### NFT as a Hub

A complete and properly designed NFT means it will be possible to be used as the representative hub of reforestation projects. This will work by displaying the NFT's metadata, as explained previously, with a client app and dashboard. The app and dashboard will both be integrated into ORP's backend and built on top of a Layer 1 blockchain.

When a user accesses ORP through either the dashboard or client app, they will be prompted to create a project. This will include the inputting of various data points such as the project operator's contact information and the project's information. All of this data will be stored to write onto the NFT at some point after the project is considered "approved" by collateral providers. The initial minting of the NFT could occur simultaneously with the first data upload, as both will require a fee on behalf of the user. The exact fee for minting the NFT is unknown at this point - it will largely depend on what storage mechanism is utilized, which blockchain ORP is built upon, and what kind of data is going to be regularly uploaded for the project. Until these are known, it will be impossible to estimate what the cost would look like for the project operators.

The metadata on display for the NFT will first and foremost consist of the project's geographic location, represented either by Google Plus Code points or by a hand-drawn project outline on a map. Additionally, there could be other visualizations of data, such as different animated trees to represent the species or density of trees that are being reforested. The importance of user-friendliness with the NFT hub cannot be overstated. The novelty of NFTs will present potential difficulty onboarding project operators, and thus it is necessary that ORP provides an easily accessible and visually pleasing representation of their project

The information on display will likely remain unchanged in between data uploads, although there could be some mechanism in place to store any changes to the project data and have them be approved during the next data upload cycle. The project information, phase timeline, and funder/sponsor information could have different sections on the NFT display, and due to the open-source nature of ORP the project operators could choose how they would like this information to be visually represented. In the future, an entreprenuring designer could develop new ways of visually representing all of this project information so as to give the project operators a choice between the ORP default display or something more customized. All in all, the display of the NFT hub will be largely dependent on how ORP chooses to design the user-interface. The design of the user interface is not as important as the standardization of data for each NFT, as with an established standard the data can be visualized in many different ways.

## Future Opportunities

The future opportunities of ORP as an open-sourced application are truly limitless. It is very likely that this project will become a prime example of the utility of non-fungible tokens, as NFTs are frequently lauded as a technology that has the potential to represent real estate assets but, as noted above, no platform has done so successfully in this way. Future NFT standards, capabilities, and interoperable platforms will additionally provide future innovation and improvement for the ORP platform. Better fractionalization for ORP's purposes could help with sharing the rewards generated by any piece of land rather than just carbon sequestration, and greater MRV tools using satellite imagery and drone footage could be more intimately integrated into the NFT hub. It might be possible to record a livestream of various sections of a forest and enable the NFT to broadcast that to anyone on the ORP network. Such innovations will be created as the need arises for users in the ORP ecosystem.

Other, more immediate opportunities exist on the [NEAR Protocol](#) and in various NFT minting platforms such as [Mintbase](#). Mintbase works to simplify the creation of

“shops” for digital artists or really anyone hoping to create NFTs that they can trade on online marketplaces. If the ORP NFT didn’t need such specific design parameters not currently offered by Mintbase, it would be possible to channel ORP project operators through Mintbase and utilize their platform to make the NFT mint process easier and more cost effective. Instead, it seems like each new ORP project operator will instead deploy their own smart contract to create their NFT. So while a partnership with Mintbase may not be advantageous for ORP in the near term, it remains an option and an example of other types of collaborative endeavors available.

The Open Reforestation Protocol will be built as a [Layer 2](#) blockchain application. Its Layer 1 will be the NEAR Protocol. [NEAR](#) is a delegated proof-of-stake blockchain that uses [sharding](#) to enable faster and cheaper transactions. This will be a critical feature for ORP, as this will enable project operators and other users to easily and cheaply utilize ORP for their data uploads and various purposes. Additionally, NEAR will soon enable full interoperability between NEAR and Ethereum through their [Rainbow Bridge](#). This interoperability will enable all kinds of innovative applications and entrepreneurs to build on ORP’s burgeoning ecosystem and provide new technological integrations for project operators and other users on ORP. With NEAR, ORP will be able to scale effectively, provide an efficient platform for all users free from excessive transaction fees, and open the gate for unimaginable future innovation on ORP.

## Conclusion

This report has provided an overview of existing blockchain-based land management solutions and how NFTs have been utilized so far, explained what the design needs are for an ORP NFT, sketched out what an ORP NFT design would look like, assessed how such an NFT could be integrated into the larger mechanism design, and then provided insights into future possibilities. It finally recommends that the ORP NFT be designed with the following considerations in mind:

The ORP NFT will consist of various functions that are similar to existing functions in other NFTs, such as the ability to transfer ownership, call the metadata of the NFT that is stored off chain, and perhaps have composability enabled for token ownership. The NFT will also consist of metadata, the specific substance of which is yet to be determined by the ORP Foundation. However, by utilizing an off-chain storage mechanism, the NFT will be able to update its project details as the data becomes validated during the data upload cycle. This metadata must be standardised with an API in such a way so as to be interoperable with existing and future ORP ecosystem applications, and will as a result be able to be visually represented in various ways on the ORP app and dashboard. There can also be, in the future, an additional part of the data upload process whereby project operators designate who will receive the rewards that are generated by the project, such as carbon credits. **If designed in this way, the ORP NFT will satisfy all design needs previously dictated and leave enough flexibility for future innovation and improvement.**