CarbonCrop

Permanent Native Forest Restoration

Methodology and Basis

V0.5

Purpose

This document provides an overview of key elements of CarbonCrop's processes for the attribution, issuance, and assurance of Native CarbonCrop Units (CCUs) for Permanent Native Forest Restoration.

Contents

Summary Description and Guiding Principles of Methodology

CarbonCrop's Permanent Native Forest Restoration methodology is intended for the recognition of carbon sequestration through the creation/restoration/preservation - by any combination of natural and human-triggered mechanisms - of permanent native forest, a Nature-Based Solution for carbon sequestration. The methodology is specifically designed to minimise overheads and obstacles to the activities of monitoring and planning, so as to maximise the applicability to landscape-scale native forest carbon sequestration initiatives with mixed species, environments, and regeneration timelines, while maintaining the integrity of the sequestration attribution and resulting CarbonCrop Units (CCUs).

This methodology is informed by a combination of the CarbonCrop philosophy and environmental objectives, and existing best-in-class guidance, including:

- CarbonCrop's goal is to enable carbon sequestration through the creation/restoration and preservation of forest comprising indigenous species and supporting high biodiversity ecosystems.
- The New Zealand Ministry for the Environment's *Interim Guidance for Voluntary Climate Change Mitigation* Guidelines, 15 March 2022, available here.
- The Microsoft/CarbonDirect *Criteria for High-Quality Carbon Dioxide Removal*, 2022, available here.
- The Forestry Methodologies used for the NZ ETS Compliance Scheme *(Note that CCU can not be used to meet compliance market obligations - see CarbonCrops ETS offering for this)*
- The TaskForce on Scaling Voluntary Carbon Markets indications on Core Carbon Principles detailed in their Phase 2 Report, available here.

We welcome assessment of and feedback on this methodology against the above guidelines and others.

Attention is drawn to our specific position on baselines and additionality, which are core to each of these. This methodology does not fully align to the strict interpretation of 'additionality' (where units ***must*** *not have been sequestered in the absence of a carbon payment), and instead recognises sequestration relative to a 'net zero' baseline. This means we neither penalize landholders for existing sequestration activities, nor reward them for existing emissions. The specifics and implications are covered in this methodology and expanded on in our other material.*

In particular, the methodology aims to deliver:

- Accuracy of carbon accounting, and recognition of carbon removals through sequestration relative to baselines reflecting the pre-restoration/protection activity. Accuracy of sequestration attribution and robust accounting are paramount to the integrity of the CCUs, in particular avoidance of over-attribution, and *effective* durability.
- The minimisation of double counting. Any known areas which would result in double-counting of sequestration within a given temporal window are excluded.
- The avoidance of and accounting for leakage
- Durability and permanence
- The avoidance of environmental harms
- Environmental and social justice
- Project co-benefits

The focus is on the pursuit of carbon sequestration through the restoration and regeneration and preservation of indigenous forest species on historical forest land. Assisted natural regeneration processes are favoured. These projects generally have significant co-benefits considering biodiversity, ecosystem resilience, and water quality, as widely acknowledged by decades of peer reviewed research in New

Zealand around the benefits of Native Forest restoration and protection, underpinning various public and private initiatives to boost support for such forest.

Two key practices are seen as harmful as follow:

- The introduction of exotic species to ill-suited/inappropriate environments
- The loss of food security through conversion of high value agricultural land with no history of forest cover.

We attempt to avoid incentivising either practice through the exclusion of exotic species from carbon sequestration recognition, meaning that the economic incentives resulting from the methodology will not drive the introduction of exotics to existing native forest areas and are unlikely - due to uncompetitive returns - to drive the conversion of high value agricultural land.

Definitions

Carbon Tracking Region (CTR)

An area registered in connection with carbon removal accounting under this methodology, and against which carbon sequestration is attributed and tracked. The geometry of CTRs are precisely mapped and stored in regionally appropriate projections, and the CTR's and their associated issuances are available for review.

CarbonCrop Unit (CCU)

A tokenised, uniquely identifiable unit issued in connection to a CTR in recognition of attributed ex-post carbon sequestration within that CTR equivalent to one tonne of carbon dioxide equivalent over the sequestration period. Where CCU is referred to within this document it refers to CCU issued under the provisions and constraints of this methodology. Each CCU can be traced to the methodology and version under which it was issued.

Landowner

The entity(s) with verifiable legal ownership of the area(s) of land within the CTRs comprising the project. In New Zealand, this is the entity(s) indicated by Linz for the title encompassing the intersecting parcels.

Applicability Conditions

The following are assessed in determining the eligibility of given Carbon Tracking Regions to receive CCUs under this methodology. In some respects the eligibility criteria may be applied variably *within* a Carbon Tracking Region - for example a Carbon Tracking Region may have both eligible and exempt tree species establish within its boundary either at inception or as the forest progresses, however carbon stock increases associated with any identified instances of exempt species would be excluded from CCU issuances. Carbon stock changes for those same point locations might later become eligible through the replacement of the ineligible species with eligible species.

Double Counting Detection and Elimination

Sequestration over a given time frame and for a given change in total carbon stock must *not* also be attributed based on any other scheme which CarbonCrop is made aware of for any given CTR geometry.

Past schemes under which carbon is no longer being awarded are acceptable; however, carbon will only be awarded by CarbonCrop vs the greater of a baseline of the assessed carbon stock at the *completion* of the previous scheme and the result of the temporal baseline application.

At a minimum:

- A commitment must be secured from the landowner to avoid multiple registrations for a given CTR spatial coverage and time window, or other multiple issuance of CCUs for a given quantity of sequestered carbon over the

sequestration period of 100 years from the date of issuance of any CCU for that quantity of sequestered carbon.

- Details of registered CTR's including issued CCUs must be made available to other programs to support double-counting audits by them.
- Alignment must be sought with national level programs to avoid double counting within Nationally Determined Contributions under the IPCC Paris Agreement. Specifically, within New Zealand, CCUs will not be issued to any area of any CTR which intersects a forest area assessed as Post89 forest under the LUCAS land use map distributed by the Ministry for the Environment. Where a LUCAS designation changes in a future map such that any area becomes Post89 forest, CCU issuances for intersecting areas of CTR's will cease from the date of the change.
- An audit must be completed at the commencement of the project to ensure there is no active registration for the affected land area under any of the following registries: Verra, Gold Standard, American Carbon Registry, Plan Vivo, Climate Action Reserve.

Leakage Assessment and Allowance

Leakage effects (the displacement of emissions from one location to another as a consequence of the sequestration activities) directly offset the benefits of a given unit of sequestration, and may introduce further negative impacts that exceed the benefits of the sequestration activity. Due to the significant negative impact of leakage, and the difficulty of fully accounting for its extent, the methodology focuses on the elimination of leakage through the selection of sequestration activities.

This methodology makes no allocation for leakage, and instead protects against leakage by attributing CCUs only to activities which are:

- Strictly net removals vs baselines. CCUs will not be issued for avoided emissions, for example through avoided deforestation of mature forest.

- On areas that we assess as being of marginal agricultural productivity, or provisioned for agricultural amenity/ecosystem services, and hence, unlikely to result in an increase in agricultural conversions elsewhere.
- In regions that we assess as having robust protections of mature native forest, and unlikely to be subject to illegal logging or unsustainable logging.

Potential Harms and Environmental+Social Justice

Targeted potential harms and environmental justice impacts are managed under this methodology through the project admission criteria.

Specifically, the key factors are:

- Net positive environmental impact considering biodiversity and water quality
- Alignment of incentives with beneficial ownership
- Legitimacy of beneficial ownership
- Ecological integrity and consistency with 'natural state'.

Projects are eligible only where they:

- Involve the restoration of indigenous species, with carbon sequestration attribution limited to increases in biomass within that indigenous vegetation.
- Are undertaken with the approval of, and to the benefit of, the legitimate land owner.
- Are in regions that we assess as having strong protections for rights and land ownership, including recognition of indigenous land rights.
- Are in areas environmentally consistent with the character of the restored forest.

Environmental Co-benefits

CCUs will be issued under this methodology only for carbon sequestration associated with the restoration of native forest.

This results in a number of intrinsic co-benefits relating to indigenous species habitat restoration, landscape resilience improvements, water quality improvements, erosion control, and drought/flood tolerance improvements.

The extremely high ecological value of certain environments is acknowledged. Mechanisms should be supported in the future that may recognise improvements to such value through, for example, biodiversity credits, however such attributes are not presently assessed nor attributed value under the methodology.

Note: co-benefits are not explicitly quantified nor attributed value at an individual project level in connection with CCUs issued. To do so would require value judgements and qualitative and quantitative assessments which cannot be made with sufficient reliability with current systems, and are largely parallel to the underlying goal of sequestering carbon through restoration of native ecosystems.

Determination of ownership and entitlements

The project registrant and recipient of CCUs must be the registered owner of the land (the **project participant**). Projects are only undertaken in areas with strong land ownership protections and transparent evidence of ownership mechanisms.

- Project participants must provide proof of identity in a form accepted by the same authority as that responsible for managing the land in question.

Project Boundary

Geographical Boundaries

CCUs are issued and traceable to uniquely coded and precisely mapped Carbon Tracking Regions. These regions must fall within the legal boundaries of the titles/parcels of which the project participant is the registered owner.

Each Carbon Tracking Region will have a:

- Linked Property Title, and through that title a legal entity entitled to the CCUs for the CTR, and responsible for the durability of CCUs issued to the CTR.
- Unique identifier, referenced by associated CCUs.
- Geographic polygon definition in a locally appropriate projection, capturing the bounds of the CTR at resolution of at least 1m horizontally. Vertical boundaries are not captured.

For most practical purposes, a CTR is the unit of monitoring/verification/reporting under this methodology; while most 'projects' will include multiple CTR's with common stakeholders, these CTR's can change ownership or even - under certain conditions - be split.

Leakage is eliminated by the project eligibility criteria, and therefore no leakage boundary is specified or required. Where a regional boundary is assumed for the purposes of a leakage eligibility condition check, that boundary will be of the country in which the CTR is located.

Temporal Boundaries

The temporal boundary of a CTR is specified on a case-by-case basis, and may be amended. Double counting avoidance checks and commitments are secured to minimise the risk of multiple crediting of sequestration alongside CCUs. This methodology permits recognition of sequestration under alternative methodologies and issuing authorities as long as they do not result in double counting of carbon sequestration by year nor total carbon stock.

Historic sequestration can be recognised under this methodology within the current IPCC reporting windows for the country in question. At the time of writing, for New Zealand this is the period 2018-2022 inclusive.

The temporal boundary resolution is of one calendar year - any sequestration attributed to a given year should not be claimed under any other scheme for that year.

An issued CCU for a CTR has an obligated durability term of 100 years. This obligation survives the deregistration of the CTR, until such time as the CCU is revoked (and any penalty paid) or the 100 year sequestration term is completed.

Carbon Pools

The carbon pools included within the project boundary are shown below

Carbon Pool	Included?	Justification
Above ground trees	Included	Stock change monitored under methodology
Above ground non-tree woody biomass	Included	Stock change monitored under methodology
Above ground non-woody biomass	Excluded	Accurate measurement impracticable at present, annual variation may be large, reversal risk high. Exclusion is conservative.
Below ground associated with monitored above-ground biomass	Included	Significant fraction of total sequestration, attributed based on established models in connection with measured above ground biomass
Dead wood	Included	Baseline scenario under eligibility criteria is for a non-forest state. Deadwood is an expected

		and additional contributor to carbon stock.
Litter	Excluded	Accurate measurement impracticable, exclusion is conservative.
Soil organic carbon	Excluded	Accurate measurement impracticable at present, exclusion is conservative.

Procedure for Determining the Baseline Scenario

The baseline against which project sequestration is assessed has both a temporal component and a 'base rate' component.

Base sequestration rate: The base sequestration rate is set by the activity that was in place prior to establishment of the activity resulting in sequestration. However, the base sequestration rate is constrained by a combination of a maximum and minimum limit of zero, as explained below. These constraints mean the effective base sequestration rate applied will *be* zero for all eligible projects, and as such the base sequestration rate may be omitted for simplicity from those calculations where it has no effect.

The minimum rate value limit of zero arises because CCUs are only issued for new removals (CCUs are *not* issued under this methodology for deforestation or degradation avoidance, or cessation of agricultural activities with any associated emissions).

The maximum rate limit of zero for any area within a CTR eligible for CCUs is a consequence of the limitation of CCU issuance to native forest in a state of ongoing regeneration, constraining the pre-establishment activity to one inconsistent with mature native forest. Such activities will have a time-average net carbon flux which is either zero or a net emission (negative rate), whether that's grazing, periodic scrub

clearance by spraying or burning, historic ongoing logging, or other land use not being mature forest.

Temporal sequestration boundary: Temporal baselines must be established to avoid the overattribution of CCUs for historic sequestration within the permissible attribution window. These are determined based on the back-casting of the Carbon Tracking Region specific models over the relevant period - details are provided under Quantification of Removals. In the case of New Zealand, historic sequestration is recognised back 4 years from the date of registration (with exclusions where this would result in double counting). Even where net carbon is assessed as having been sequestered prior to this temporal baseline, no further CCU are issued, even where the associated carbon stocks remain durably sequestered. This is to ensure that CCUs issued represent *recent* atmospheric removals and hence can reasonably be applied to offset *recent/current* atmospheric emissions.

Procedure for Demonstrating Additionality

The intent of this methodology is to issue CCUs to represent sequestration that is *supported*, either in advance or retrospectively, by the finance the CCUs enable, and for which the payments are a key mechanism by which durability of the sequestration is incentivised.

This methodology's emphasis is on establishment, progression, and preservation of indigenous forest where carbon sequestration and biodiversity restoration are key motivations for restoration and preservation. The baseline for land transitions with a history of bare/scrub-land agriculture and other scenarios per Baselines is zero or net negative average carbon sequestration, with all removals through sequestration therefore being additional; however, only new sequestration within the temporal window of the project is eligible for CCUs. All net sequestration within a CTR from Temporal Sequestration Boundary of that CTR is treated as additional, on the basis

that the project participant's active decision to engage in carbon farming and forest restoration enabled by the commercial returns the project offers, with the attendant penalties for reversals, is what drives and economically assures the future sequestration. Past sequestration is not considered additional prior to the temporal sequestration boundary. Additionality within the temporal baseline is assessed based on removals vs the overall base-rate, in recognition of recent restoration activity. All past sequestration is explicitly identified by year.

Where the forest has achieved a carbon steady state, no additional CCUs should be granted.

In regard to the test of additionality, we take the following position:

1. **Credited sequestration must be for ongoing removals:** CCUs are issued only for removals assessed as occurring after the temporal sequestration boundary, and never for 'avoided emissions'.
2. **Credited sequestration must be within a relevant time window:** Credited sequestration must be within the regional IPCC reporting window aligned with the date of registration. Historic sequestration within the current IPCC reporting window is recognised, though note the constraint on double counting.
3. **Sequestration would not have occurred (or would be at risk) in the absence of finance**: The sequestration must be supported by and assured by the CCU payments. Sequestration activities which are already in progress but for which CCU derived revenue was or has become a part of the anticipated or ongoing business case are acceptable.
4. **Sequestration obligations considering laws, regulations, or other binding obligations:** Historic *elective* commitments or activities which result in a current legal commitment (such as covenanting, or the retirement and restoration of land to a state which now qualifies for legal protection) are

acceptable, as the goal of the methodology is to actively support the expansion of such projects and avoid the inadvertent creation of perverse disincentives for future covenanting and restoration activities.

Quantification of Removals

High integrity quantification and attribution of net sequestration is one of the most critical elements of nature based solutions.

This methodology's approach to quantification relies on a combination of:

- Remote data sensing
- In-situ sampling
- Allometric models
- Established sequestration profiles in common use

These are combined to build a stratified model of all vegetation within the tracked region, conservatively attributing initial sequestration to the strata within the model, and then iteratively refining and amending ongoing sequestration based on continued monitoring and calibration across all CarbonCrop CTR's. The intention is to converge over time on the true carbon sequestration for each CTR - with CCU issuances either topped up or withheld to align to the iteratively refined model projections.

The methodology aims to attribute sequestration at the lower end of a 90% confidence interval for each CTR for the carbon pools within scope, and to maximize the project participant's attribution of sequestration within this constraint through ongoing improvements to accuracy, thus narrowing the confidence interval and the shortfall between the 90% lower confidence bound and the mean.

To determine initial sequestration rates in the absence of site-specific or transferrable longitudinal studies, this methodology requires an initial dataset of regionally calibrated sequestration rate data for the vegetation category of interest.

Given the high variability of sequestration across eligible forest types, and the high initial uncertainty, the initial sequestration rates for the methodology are conservative so as to generally *under*-attribute credited sequestration until measurements justifying an increased sequestration rate are captured.

Carbon Tracking Region Boundary Determination

Based on the existing vegetation and the project participant's land use intentions, Carbon Tracking Regions for the project are determined by CarbonCrop's optimisation engine. The project participant reviews and then accepts these Carbon Tracking Regions - these are the areas which will be subject to ongoing monitoring, for which Carbon entitlements/liabilities will be assessed based on changes in carbon stocks, and for which the project participant has obligations under the methodology and carbon management contract.

Carbon Tracking Regions *do not* need to align to vegetation segment boundaries, and for simplicity and continuity will often extend beyond vegetation boundaries. Sequestration inference as detailed below will avoid attribution for non-woody vegetation within the CTR boundary.

In defining Carbon Tracking Region boundaries the following should be considered:

- Where certain practices to encourage sequestration or forest establishment are in effect or are planned - these will inform imputed sequestration rates, and reduce the likelihood that the CTR suffers a reversal.
- Where planting or regeneration are *planned* but not yet implemented, these areas will not be awarded CCUs until carbon is deemed to have been sequestered. Forecasts based on possible actions may be created to support

business cases as appropriate, these are based on intended species mix and environmental factors influencing sequestration rates, but CCUs will be awarded for sequestration on an ex-post basis only.

Carbon Stock and Sequestration Attribution

Once Carbon Tracking Regions and strata within those regions (where necessary) are defined, carbon stocks and sequestration rates are calculated based on the inferred age/biomass/canopy density/species/environmental-factors for each strata (noting that in many cases a CTR will have only a single associated strata). This allows the accurate attribution of sequestration for a range of vegetation types and stages across the CTR, without the need to define arbitrary boundaries or age bundles.

CCUs will be allocated for all attributed sequestration, based on a target attributed carbon stock equal to the lower bound of the 90% confidence interval returned by the model for the CTR carbon stock.

Temporal carbon stock and sequestration increment calculation

Sequestration is attributed in annual increments.

The sequestration attribution is based on an assessed change in carbon stock, with the assessed stock determined by:

- Inference from remotely sensed attributes applied to a carbon stock model calibrated to the environmental characteristics and vegetation signature; as well as,
- Adjustments as appropriate based on any direct measurement of vegetation attributes and application of allometric models.

On CTR registration, an InitialAllocation of CCUs will be made.

Subsequently, IncrementalAllocations of CCUs will be made, or required to be recovered in the case of some reversal scenarios.

BaseSequestrationRate: The time-averaged net carbon flux of the activity that was in place prior to establishment of the activity resulting in sequestration. Per the 'Procedure for Determining the Baseline Scenario', this is limited to a minimum value of zero to eliminate any award of CCU for avoided emissions, and is limited to a maximum of zero for areas able to earn CCU under the methodology based on implicit past-land-use net carbon flux constraints, meaning the value IS zero in practice. As such it may be omitted for simplicity in some calculations; however, it is presented explicitly below for clarity of mechanism.

TemporalSequestrationBoundary: The year being the latter of:

- The beginning of the currently active IPCC/National reporting window *and*
- The end of the most recent alternative accreditation program.

CarbonStock: The carbon stock is determined based on a combination of direct measurements and allometric models, and inference using remote sensing data applied to regionally calibrated models. The stock will be deemed to be the lower bound of the 90% confidence interval of inferred stock. Where there is insufficient data for a statistically robust estimate, the attributed sequestration will be limited to a maximum of 50% of the default values in standard use for the species mix and region in question.

InitialCarbonStock: Initial carbon stocks are assessed for the year of the TemporalSequestrationBoundary.
Where this InitialCarbonStock calculation point is in the past, the stock at this point is determined by backcasting the CarbonStock by adjusting the attributed age under the model. For example, if the assessed current age is 22 years, and the

InitialCarbonStock for a point two years ago is required, this stock will be the value output by the model for an age of 20 years.

InitialAllocation: An initial block of CCUs will be issued to the CTR equal to:

*InitialAllocation = CurrentCarbonStock - InitialCarbonStock - (BaseSequestrationRate * YearsElapsedSinceTemporalSequestrationBoundary)*

IncrementalAllocation: An incremental block of CCUs will be issued to the CTR equal to:

*IncrementalAllocation = CurrentCarbonStock - LastCarbonStock - (BaseSequestrationRate * YearsElapsedSinceLastIncrementalAllocation)*

CurrentCarbonStock: The current carbon stock inferred by the model.

LastCarbonStock: The 'NewCarbonStock' as assessed for the previous attribution event.

ImpliedCarbonStock: The InitialCarbonStock *plus* all net issuances.

ImpliedCarbonStock = InitialCarbonStock + InitialAllocation + SumOf(IncrementalAllocations)

Stock/Sequestration Model Development and Refinement

All sequestration is on the basis of species category specific sequestration profiles, derived from extensive ongoing survey plots, and ground-truthed against representative species mixes using physical sampling methods. These are calibrated to region-specific conditions considering rainfall, temperature, altitude, aspect, wind, and soil type to the extent practicable. Ongoing calibration of regional vegetation models will be supported by longitudinal studies of long term sample plots at representative points within certain CTR's.

Sequestration rates are determined based on the conservatively estimated sequestration rates by forest type published by the NZ Ministry for Primary Industries for use under the NZ emissions trading scheme. Over time, rates are adjusted for forest species mix and environment based on the results of sample plots within the target project and other comparable projects, and in particular for imputed continuous age/biomass across the project area.

The inference method is subject to continuous refinement over the term of the CTR. This does not affect the integrity of historically issued CCUs however, as any historic overallocation of CCUs will be accommodated through a combination of the reserve/buffer pool and the issuance/withholding of future CCUs until issuances align with carbon stock changes - see under-attribution and over-attribution resolution.

Details of the incorporation of CTR specific sample plots and environment/vegetation specific models will be provided in a future methodology version, as the longitudinal studies are not yet available to support these models.

Initial Method

Until sufficient data for a statistically robust improved model is available, carbon stocks and sequestration are attributed by matching the vegetation growth stage to a highly-conservative transformation of the standard MPI lookup tables[1] for carbon sequestration in indigenous forest, using the following process:

1. Split the CTR into inference areas of dimension no more than 10m x 10m.
2. For each inference area within the CTR, scale the default MPI Indigenous Forest age: carbon-stock profile according to the following schedule
    - 0.5 for vegetation below 500m altitude.
    - Linearly decreasing for vegetation above 500m to a scale factor of 0 at 1250m altitude.

[1] Source: MPI lookup tables

3. For each inference area within the CTR, infer (or if available measure) the height of the vegetation canopy over that area. This height value is used to determine the effective age of the vegetation over that area, based on linear interpolation using the inferred height on a profile where an assumed maximum height of 30m corresponds to the maximum ETS lookup table age of 50y.
4. With that inferred age, find the corresponding carbon stock using the ETS lookup tables for Post89 indigenous forest.
5. Using the resulting carbon stock, find the associated *adjusted* age based on the *scaled* age:carbon-stock profile for the inference point in question.
6. The resulting age is an index into the Age:Carbon-Stock profile for that inference point, from which the incremental sequestration over past years can be directly calculated.
7. Any inference area where there is a significant fraction of exotic species will have its assessed carbon stock set to zero.
8. Any inference area deemed to be 'non-forest' based on the output of a vegetation segmentation model will likewise have its assessed carbon stock set to zero.

Example: A 10m x 10m inference area at an altitude of 600m will have an associated age:carbon-stock profile equal to the default MPI profile scaled by

0.5 - 0.5*(600-500)/(1250-500) = 0.433

The inferred average height of the vegetation over the inference area is 8 meters. This gives an inferred nominal age of:

8m/30m * 50y = 13.33y

The corresponding carbon stock based on the MPI Indigenous Post89 lookup table is

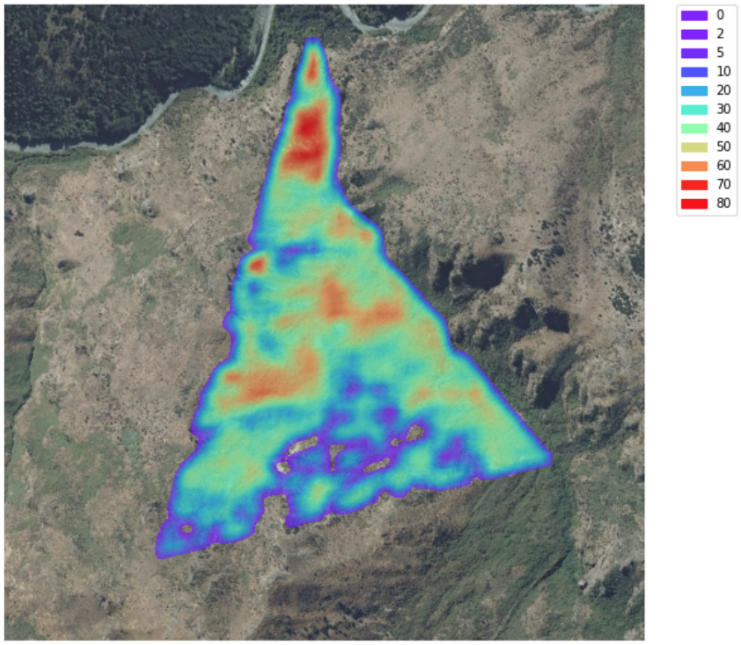
71.5 T/ha

The inferred age of the vegetation over the area is calculated using the altitude adjusted profile, taking the age to be the first year in which the carbon stock is

greater than the inferred carbon stock above. In this case, that is 21 years (at which a scaled carbon stock of 74T/ha is achieved).

The sequestration from the scaled profile at year 23 is 5.07TCO2e/ha/yr

This process is repeated at every inference area within the CTR, to give an assessed aggregated carbon stock and sequestration rate across the CTR, against which CCUs are issued. All issued CCUs are traceable to this CTR for audit purposes, and to allow any future corrections following over or under allocations, and recourse in the event of reversals.



Segmentation and Stratification

CTR specific models may be tailored to incorporate CTR specific characteristics, and this model tailoring may extend to distinct segments/strata within a CTR.

Within a CTR boundary the CTR may be segmented by any/all of:

- Vegetation category: This dimension is used to determine the general eligibility of the vegetation on the land for CCUs, and the general

sequestration rates that would apply. Areas of non-woody vegetation are excluded from attribution.

- Species/age/height bracket: This dimension is used to refine the attributed current carbon stock, sequestration rates, and sequestration limits for the area in question, in addition to environmental risk factors and long term progression potential. Areas of age/maturity such that they are deemed likely to have been mature forest in the year 1990 are excluded.
- Environmental factors: As for species mix, this dimension is used to refine the attributed current carbon stock, sequestration rates, and sequestration limits. Where there are environmental factors limiting growth, sequestration rates will be reduced, or sequestration attribution may be curtailed entirely.
- Current vegetation density: Where appropriate, the canopy cover extent may inform the imputed sequestration rate and eligibility.

For every segment identified above, the segments may be either split into further distinct CTR's (for the purposes of isolation and independent management) or combined (in aid of simplification and accuracy/repeatability of administration).

Where a certain variable/dimension or set thereof is better represented as a continuous and varying factor within a segment, rather than a statistical attribute associated with a segment, that value will be attributed to each point of stock/sequestration calculation within the segment.

Resolution of over-attribution and over-allocation

In the event that an overallocation is made for a CTR, where the ImpliedCarbonStock is in excess of the CurrentCarbonStock, no issuances for the CTR will be made until that CTR achieves a CurrentCarbonStock greater than the ImpliedCarbonStock. The period of this suspension of CCU issuances depends on the sequestration rate and the amount by which the ImpliedCarbonStock exceeds the CurrentCarbonStock, and may be several years. The project participant is responsible for allowing forest

growth and carbon sequestration across the CTR to continue uninterrupted over this period to allow the ImpliedCarbonStock to be achieved.

This situation will usually result from model imprecision, and a resulting recalibration or methodology update. Where there has been a fall in the CurrentCarbonStock vs a past assessment due to accidental or deliberate reversal, the appropriate reversal response mechanisms will apply.

Resolution of under-attribution and under-allocation

In the event that an under-allocation is made for a CTR, where the CurrentCarbonStock exceeds the LastCarbonStock by an increment greater than the attributed sequestration for the last year, additional CCUs will be issued to address the underallocation.

This situation will usually result from historic model imprecision, and a resulting recalibration or methodology update, *and is expected to occur regularly due to the deliberately conservative initial issuances under the methodology*.

Monitoring/Verification and Durability

Ongoing monitoring and verification of sequestration is undertaken on an *at least* an annual basis using remote sensing data and the process described above, both as the basis for additional attribution of sequestration for ongoing CCU issuance, and to support the durability assurance and reversal detection processes described below.

Durability assurance

CCUs are sold based on CO2-GWP100 equivalent warming potential, and the obligation period for sequestration is set to 100 years. The project participant is

contractually obligated to remediate any reversals within this period sufficient to meet the committed term, except where guaranteed by the buffer pool.

CarbonCrop anticipates CCUs will continue to be awarded to the project and sold through the course of the sequestration term, with ongoing measurement/reporting/verification of the project occurring in connection with that ongoing CCU issuance - including monitoring for and investigation of any detected reversals, with enforcement to ensure appropriate project participant response. Once the land achieves forest state (if it has not already), which should be within the active monitoring period, it will be afforded protection under the NZ Forests Act as indigenous forest, and subject to associated monitoring under legislative monitoring processes.

The registration and CCU issuance results in a binding contractual commitment linked to the land title, and should survive ownership transfers. Obligations for durability of sequestration for which CCUs have been issued survive any deregistration of a CTR or termination or expiry of the project participant's agreement with CarbonCrop.

Buffer Pool

A standard reversal assurance/buffer pool allocation is held back from all issued CCUs. This pool may be allocated to meet the liabilities of project participants following a buffer pool qualifying reversal event.

CarbonCrop will maintain a limited buffer pool comprising a fraction of total CCUs issued, as an additional provision to manage temporal mismatches between committed/recognised sequestration and true sequestration following any reversals. The default pool allocation is 10% of credits issued, but the required buffer allocation for a given project may be adjusted based on the accidental reversal risk profile of the project. A 10% buffer pool has been allocated due to New Zealand'sstrong land

rights enforcement, low illegal logging incidence, and low incidences of uncontrolled wildfire in indigenous forest as compared to international norms.

The organisation holding the CCUs allocated to the buffer pool must maintain accurate records for these CCUs, and establish appropriate governance processes for their use. These CCUs must only ever be either:

- Deployed in connection with a buffer pool qualifying reversal event, or;
- Returned to the project participant for the associated CTR, in the event that a buffer overallocation is deemed to have occurred for the project.
- Held as part of a mutual buffer for other projects under the same or related methodologies, with equivalent limitations on use.

Buffer pool qualifying reversal event types are:

- Natural events, being Windthrow, Flood, Fire, Landslide, Erosion, Drought, Pest activity, Disease; or
- Accidental fire

Buffer pool qualifying reversal events must be followed by an ongoing commitment to allow regeneration and restoration of the pre-event forest state on the affected area.

For clarity, the buffer pool is intended to provide a level of collective insurance *across* projects assessed under the methodology, and therefore a given buffer CCU may be deployed in association with a reversal event from a CTR *other* than that in which the buffer CCU originated and is currently sequestered.

Reversal detection

The primary reversal detection mechanism is ongoing monitoring via analysis of remote sensing data to detect vegetation loss. This monitoring is the responsibility of CarbonCrop, and shall be undertaken for a given CTR at least annually, usually in

connection with an updated carbon stock assessment to support CCU issuance for new sequestration. This is further supported by in-situ measurement points where applicable.

It is material to the ongoing monitoring for and remediation of reversals to note that the forests created in connection with this methodology are permanent, indigenous forest, not intended for clear-fell logging. Once forest state is achieved, New Zealand forest will be protected under New Zealand law through the Forests Act, in addition to protection through the contractual commitments to the project.

Reversal response

If areas deemed for which CCUs have been allocated are cleared, or have vegetation removed, the previously attributed sequestration for those areas is considered reversed, and any attributed CCUs must be revoked using the agreed reconciliation mechanism depending on the reversal trigger, these being:

- In the case of a buffer pool qualifying reversal event; the landowner is obliged to support the ongoing restoration and recovery of the land back to a forest state with equivalent carbon density, and will not be awarded new CCUs until the previously assessed carbon stock is achieved. The holder of the reversed CCUs at the time of the reversal will be allocated substitutes from the buffer pool to the extent they are available, with any reversed CCUs beyond the buffer pool capacity to substitute instead being substituted by the new units created as the carbon stocks of the CTR recover.
- In the event of reversal due to a deliberate act, the landowner will be obligated to secure an equivalent volume and type (Permanent Native Forest, of the same or higher methodology version) of CCUs to those lost through reversal to provide as substitute for the holder of the reversed CCUs at the time of the reversal.

Transparency and Verification

The auditability, traceability, and reproducibility of sequestration attribution under the methodology is an important aspect of delivering high integrity sequestration. The methodology achieves this through sequestration verification and CCU tracing.

Sequestration Verification

The CTR boundaries and attributed sequestration rates by year must be made available for independent third-party review and audit purposes as required, and will include at minimum the following:

- The boundary of each CTR
- Recent aerial imagery of each CTR
- The areas within each CTR to which sequestration has been attributed
- The total CCUs issued to each CTR, by year of issue
- The estimated *total* carbon stock of each CTR according to this methodology (including stocks accrued prior to CTR registration).
- The current methodology version for the CTR.

It is anticipated that future versions of this methodology will further require field audits of a random sample of projects, and that any credits issued will be subject to those terms following CTR methodology version migration; however, the details of a random sample audit are not yet final.

Carbon Unit Tracing

Mechanisms of Trade/transaction for the CCUs resulting from this methodology is outside the scope of the methodology itself; however, the CCUs issued have several mechanisms to support robust trading.

To support the integrity of the CCUs, especially with regard to double counting risks, the CCUs should only be traded on exchanges and registers that robustly prevent multiplicity.

CCUs issued under this methodology must:

- Indicate the issuer of the CCU (**Issuer**)
- Indicate the unique (to the Issuer) ID of the CTR with which the CCU is associated
- Indicate the unique (to the Issuer) ID of the credit.

The issuer must maintain a register indicating:

- The spatial and temporal extent of each CTR
- The Landholder currently responsible for each CTR

Transactions and trading of CCUs are anticipated to be conducted through third party marketplaces and registries designated as an Approved Provider by the Issuer.

Methodology Update and Refinement

This methodology and the models which inform it has been prepared based on best practice and knowledge as at the date they were prepared. The methodology and the models which inform it are under active development and refinement, in support of the principles of the methodology as outlined, and therefore, there may be some limitations to this methodology from time to time.

It is expected that new versions of this methodology will result in, among other things, changes in the carbon sequestration attributed to given CTR's, and increases in the level of confidence relating to the accuracy of CTR/CCU assessments.

Each CTR will be tagged with the methodology version under which its associated CCUs have been attributed and issued. On the release of a new methodology,

project participants will have the option of adopting the terms of that new methodology for their CTR's.

Where the project participant adopts the new methodology, both current and legacy CCUs for the CTR will be recertified under the new methodology, indicating their integrity under that methodology. Where a new methodology is not adopted by a CTR, no further CCUs will be issued, and the currently issued CCUs may be viewed more cautiously by the market; however, in either case the project participant's durability obligations for issued CCUs under the relevant methodology will remain.

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