Carbon Credits (Carbon Farming Initiative—Avoided Deforestation 1.1) Methodology Determination 2015

I, Greg Hunt, Minister for the Environment, make the following determination.

Dated   25 : 3 : 2015

Greg Hunt

Greg Hunt
Minister for the Environment

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Part 1—Preliminary

1 Name

This is the *Carbon Credits (Carbon Farming Initiative—Avoided Deforestation 1.1) Methodology Determination 2015*.

2 Commencement

This determination commences on the day after it is registered.

3 Authority

This determination is made under subsection 106(1) of the *Carbon Credits (Carbon Farming Initiative) Act 2011*.

4 Duration

This determination remains in force for the period that:
- (a) begins when this instrument commences; and
- (b) ends on the day before this instrument would otherwise be repealed under subsection 50(1) of the *Legislative Instruments Act 2003*.

5 Definitions

(1) In this determination:

above-ground biomass means:
- (a) the stem, stump, branches, bark, seeds and foliage of a living tree; and
- (b) dead matter (other than dead roots) attached to a living tree.

Act means the *Carbon Credits (Carbon Farming Initiative) Act 2011*.

allometric equation means an equation that quantifies the allometric relationship between different dimensions of an organism.

avoided deforestation project—see section 7.

basal area means the cross-sectional area of the stem or stems of a plant or of all plants in a stand, measured at a constant height above ground level.

baseline deforestation plan—see section 25.

below-ground biomass means living biomass of the root system.

biomass means vegetation-derived organic matter, and includes living and non-living matter.

biomass fraction means the proportion of biomass in a tree component relative to the tree of which the component is a part.

biomass residue means the estimated biomass in an area following the deforestation of the area.

biomass stock means the amount of biomass held in a native forest or part of a native forest.

biomass survey means a field-based survey of biomass.

carbon estimation area—see section 21.

carbon stock means the amount of carbon held in a native forest or part of a native forest.

CFI Mapping Guidelines means the guidelines of that name, as published from time to time, and available on the Department's website.

clearing means the conversion, caused by people, of native forest to a land cover other than forest.

clearing buffer—see section 21.

clearing consent: where, under Commonwealth, State or Territory law, an area of land cannot be cleared without an approval issued by the appropriate authority, such an approval is a *clearing consent* for the area of land.

CO₂-e means carbon dioxide equivalent.

conservation covenant has the meaning it has in section 995-1 of the *Income Tax Assessment Act 1997*.

controlled burn means the controlled application of fire within a carbon estimation area.

cropland has the meaning it has in the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*.

debris pool means the biomass from trees cleared.

deforestation means the direct human-induced conversion of forest, on or after 1 January 1990, to non-forest.

degradation means a detectable reduction in the biomass of the native forest in the project area where, notwithstanding the reduction, the area remains, or has the potential to remain, a native forest, and includes a reduction caused by management activities.

disturbance means:
  (a) degradation; or
  (b) natural disturbance.

eligible native forest—see section 10.

exclusion area—see section 21.

forest means land of a minimum area of 0.2 of a hectare on which trees:
  (a) have attained, or have the potential to attain, a crown cover of at least 20% across the area of land; and
  (b) have reached, or have the potential to reach, a height of at least 2 metres.

forest cover—land has *forest cover* if the land covers at least 0.2 of a hectare and is dominated by trees that:
  (a) have attained a crown cover of at least 20% of the area of land; and
  (b) have reached a height of at least 2 metres

fuel wood means biomass collected from trees for burning.

grassland has the meaning it has in the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*.

growth form means a general habit of growth of a plant determined by the direction and extent of growth, and any branching of the main-shoot axis or axes and includes: subshrub form; mallee form; shrub form; and tree form.

IBRA bioregion means a region described in the latest version of the Interim Biogeographic Regionalisation for Australia published by the department that administers the *Environment Protection and Biodiversity Conservation Act 1999*.

irregular feature—see section 22.

Major Vegetation Group means a category of vegetation described in the National Vegetation Information System published by the department that administers the *Environment Protection and Biodiversity Conservation Act 1999*.

National Inventory Report means the most recently published document that is:
  (a) known as the National Inventory Report; and
  (b) prepared by the Department in fulfilment of obligations that Australia has under the Climate Change Convention.

National Inventory System means the national inventory of greenhouse gas emissions published by the Department.

native forest means an area of land that:
  (a) is dominated by trees that:
    (i) are located within their natural range; and
    (ii) have attained, or have the potential to attain, a crown cover of at least 20% of the area of land; and
    (iii) have reached, or have the potential to reach, a height of at least 2 metres; and
  (b) is not a plantation.

NGER Regulations means the *National Greenhouse and Energy Reporting Regulations 2008*.

non-project tree—see section 25.

non-project tree buffer means the proportion of non-project tree biomass to tree biomass in a carbon estimation area.

pre-existing clearing consent—see section 10.

project commencement means the day on which the declaration in relation to the project under subsection 27(2) of the Act takes effect.

project mechanism—see section 12.

project native forest—see section 12.

pseudo-random number generator means computer software used for generating a sequence of numbers that approximates the properties of random numbers.

residual means the deviation of one of a set of observations or numbers from the mean of a set.

root:shoot ratio means the ratio of below-ground biomass to above-ground biomass.

seed number means a number input into a pseudo-random number generator for the purposes of generating a sequence of numbers that approximates the properties of random numbers.

shrub means a living plant with a stem diameter of less than 50 millimetres at a height of 1.3 metres.

stratification means the division of the project area into strata in accordance with Division 2 of Part 4.

stratum—see section 21.

Targeted Precision—see section 45.

thinning means the selective removal of trees from native forest, where the removal does not:
  (a) amount to clearing; or
  (b) result in a reduction of estimated abatement below that already credited under the determination.

tree means a perennial plant that has primary supporting structures consisting of secondary xylem.

wildfire means a fire that is not a controlled burn.

Note   Other words and expressions used in this determination have the meaning given by the Act. These terms include:

> *Australian carbon credit unit*
>
> *crediting period*
>
> *eligible offsets project*
>
> *emission*
>
> *greenhouse gas*
>
> *natural disturbance*
>
> *offsets project*
>
> *offsets report*
>
> *project*
>
> *project area*
>
> *project proponent*
>
> *Regulator*
>
> *reporting period*

6 Crediting period

For the purposes of paragraphs 69(2)(b) and 70(2)(b) of the Act, the crediting period for an avoided deforestation project is the period of 15 years.

Part 2—Avoided deforestation projects

7 Avoided deforestation projects

(1) For paragraph 106(1)(a) of the Act, this determination applies to an offsets project that:

    (a) involves:

        (i) removing carbon dioxide from the atmosphere by sequestering carbon in trees in one or more native forests; and

        (ii) avoiding emissions of greenhouse gases attributable to the clearing of one or more native forests; and

    (b) can reasonably be expected to result in eligible carbon abatement.

(2) A project covered by subsection (1) is an *avoided deforestation project*.

Part 3—Project requirements

Division 1—General

8 Operation of this Part

For paragraph 106(1)(b) of the Act, this Part sets out requirements that must be met for an avoided deforestation project to be an eligible offsets project.

Division 2—Requirements relating to project area

9 Location

The project area must be within Australia.

10 Project area to include eligible native forest

(1) The project area must include native forest:
    (a) that has forest cover at the time of the application under section 22 of the Act; and
    (b) for which there is clearing consent that:
        (i) was issued before 1 July 2010; and
        (ii) is valid at the time of the application under section 22 of the Act; and
        (iii) provides that clearing is permitted for the purpose of converting the native forest to cropland or grassland; and
        (iv) does not provide that clearing is permitted for the purpose of converting the native forest to plantation or settlements; and
        (v) provides that the conversion of the native forest to cropland or grassland must be maintained in perpetuity; and
        (vi) does not require an offset to mitigate any effect from the clearing to which it relates; and
    (c) from which removal of wood for the purposes of creating timber or wood products is not authorised by law; and
    (d) for which there is no permit for the collection of fuel wood.

(2) Such native forest is *eligible native forest* and the clearing consent is the *pre-existing clearing consent* for the forest.

11 Evidence relating to eligible native forest

(1) An application under section 22 of the Act for a declaration of an eligible offsets project to which this determination applies must be accompanied by evidence as provided by this section.

(2) In relation to paragraph 10(1)(a) the project proponent must provide:
    (a) the most recent National Inventory System forest cover layer data expressed in a vector or raster array in relation to the project area; or
    (b) aerial or remotely-sensed imagery of the project area produced no later than one year before the day on which an application under subsection 22(1) of the Act is made.

(3) The project proponent must provide a copy of the pre-existing clearing consent.

Division 3—Requirements relating to project mechanism

12 Project mechanism

(1) The project must be one in which the eligible native forest that is in a carbon estimation area or clearing buffer (the *project native forest*) is protected.

(2) In particular, the project must be one in which the project native forest:
   (a) is not cleared; and
   (b) is managed in order to achieve a mix of native trees, shrubs and understorey species that reflects the structure and composition of a vegetation community in:
      (i) if the IBRA bioregion in which the project area is situated contains a national park, flora reserve or state forest—any such national park, flora reserve or state forest; and
      (ii) otherwise—a native forest in the IBRA bioregion.

(3) To avoid doubt, if a tree monoculture can naturally occur within the IBRA bioregion in which the project area is situated, the mix of native trees can be a monoculture.

Division 4—Restrictions on activities

13 No commercial harvesting

The project must be one in which biomass is not removed from a carbon estimation area or clearing buffer for commercial purposes.

14 Wood for personal use, fencing and thinning

The project must be one in which, in carbon estimation areas and clearing buffers:
   (a) if:
      (i) wood is removed for personal use; or
      (ii) wood is removed for the purposes of erecting or repairing fences;
   no more than 5% of carbon stocks are removed; and
   (b) if trees are thinned for the purposes of:
      (i) promoting biodiversity; or
      (ii) enhancing carbon stocks;
   95% of the biomass thinned remains within the carbon estimation area or clearing buffer in which it was thinned.

Division 5—Other requirements

15 Requirement in lieu of regulatory additionality

(1) For the purposes of subparagraph 27(4A)(b)(ii) of the Act, this requirement applies in lieu of the regulatory additionality requirement.

(2) The project must not be required to be carried out by or under a law of the Commonwealth, a State or a Territory.

(3) A requirement to carry out an activity under a conservation covenant entered into with:
   (a) the Commonwealth, a State, a Territory or a local governing body; or
   (b) an authority of the Commonwealth, a State or a Territory;

is not a requirement for the purposes of subsection (2).

Part 4—Net abatement amount

Division 1—Preliminary

16 Operation of this Part

For paragraph 106(1)(c) of the Act, this Part specifies the method for working out the carbon dioxide equivalent net abatement amount for a reporting period for an avoided deforestation project that is an eligible offsets project.

17 Overview of gases accounted for in abatement calculations

The following table provides an overview of the greenhouse gas abatement and emissions that are relevant to working out the carbon dioxide equivalent net abatement amount for an avoided deforestation project.

Table 1: Carbon pools and events accounted for in the abatement calculations

Carbon pool or emission source	Greenhouse gas
Above-ground biomass	Carbon dioxide (CO_2)
Below ground biomass	Carbon dioxide (CO_2)
Emissions from fire—wildfire and controlled burn	Methane (CH_4) Nitrous oxide (N_2O) Carbon dioxide (CO_2)
Emissions from non-fire disturbances	Carbon dioxide (CO_2)
Emissions from fossil fuel use	Methane (CH_4) Nitrous oxide (N_2O) Carbon dioxide (CO_2)

18 Carbon dioxide equivalent net abatement amount

This section sets out an outline of the method for calculating the carbon dioxide equivalent net abatement amount.

- *First*, the project area is stratified into carbon estimation areas, clearing buffers and exclusion areas. See Division 2.

- *Second*, a baseline deforestation plan is developed, indicating the clearing that would have been carried out in the absence of the project. See Division 3.

- *Third*, the carbon dioxide equivalent net abatement amount for the reporting period is calculated. See Division 4. This calculation involves the following steps:

  – First, allometric equations are developed and/or validated, in accordance with Subdivision 1.

  – Then, a biomass survey is conducted in accordance with Subdivision 2. The biomass survey is used to calculate the carbon stock in the forests that would have been subject to clearing in the absence of the project.

> – These equations, and the results of this survey, are then used to calculate baseline emissions in accordance with Subdivision 3. The method calculates baseline emissions by modelling the clearing and decay of the carbon stock over 100 years, from which a long term average baseline is calculated.
>
> – Project emissions and removals are then calculated in accordance with Subdivision 4. The calculations take into account emissions from natural disturbances such as fire, and can also take into account enhancements of carbon stocks through tree growth.
>
> – The net greenhouse gas abatement in the crediting period, as calculated at the end of reporting period r, is then calculated as the difference between the net greenhouse gas emissions in the baseline from planned deforestation (as determined in accordance with Subdivision 3) and the net project carbon dioxide equivalent emissions (as determined in accordance with Subdivision 4). See Equation 39 in Subdivision 5.
>
> – Finally, the carbon dioxide equivalent net abatement amount for reporting period r, A_r, in tonnes of CO_2-e, is worked out by averaging this total abatement across the crediting period, and issuing it pro-rata. See Equations 40A and 40B of Subdivision 5.

19 References to factors and parameters from external sources

(1) If a calculation in this determination includes a factor or parameter that is defined or calculated by reference to another instrument or writing, the factor or parameter to be used for a reporting period is the factor or parameter referred to in, or calculated by reference to, the instrument or writing as in force at the end of the reporting period.

(2) Subsection (1) does not apply if:
   (a) the determination specifies otherwise; or
   (b) it is not possible to define or calculate the factor or parameter by reference to the instrument or writing as in force at the end of the reporting period.

20 Use of data—pre-existing projects

If:
   (a) the project was previously an eligible offsets project registered under the *Carbon Credits (Carbon Farming Initiative)(Avoided Deforestation) Methodology Determination 2013*; and
   (b) data had previously been collected in accordance with that determination; and
   (c) the data was accepted by the Regulator for a previous offsets report;

the project proponent may use that data for Subdivision 3 and Subdivision 4 of Division 4.

Division 2—Stratification

21 Stratification of project area

(1) Before the submission of the first offsets report, the project area must be divided into areas, each of which is one of the following:

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     (a) a carbon estimation area;

     (b) a clearing buffer;

     (c) an exclusion area.

(2) Each such area is a ***stratum***.

Clearing buffers

(3) If the pre-existing clearing consent includes conditions that require that an area of the eligible native forest not be cleared, the strata must include clearing buffers that are sufficient to satisfy the conditions.

Definitions

(4) In this determination:

carbon estimation area means an area of eligible native forest that:
     (a) in the absence of the project, would have been cleared in accordance with the pre-existing clearing consent; and
     (b) in which the project mechanism will be applied.

clearing buffer means an area (if any) of eligible native forest that:
     (a) in the absence of the project, would have been left uncleared in order to comply with conditions of the pre-existing clearing consent; and
     (b) under the project, will not be cleared.

exclusion area means an area of the project area that is neither:
     (a) a clearing buffer; nor
     (b) a carbon estimation area.

22 Remotely-sensed imagery of project area

(1) Remotely-sensed imagery of the project area must be acquired for the purposes of stratification and re-stratification.

(2) The remotely-sensed imagery must:
     (a) be consistent with the requirements of the CFI Mapping Guidelines; and
     (b) be pre-processed in order to correct for irregular features.

(3) If an irregular feature comprising more than 10% of the total area of the carbon estimation area or areas and the clearing buffer or buffers is detected:
     (a) the irregular feature must be deleted; and
     (b) the remotely-sensed imagery must be filled from the same imagery source within the nearest possible data range.

(4) For this section, ***irregular feature*** includes the following:
     (a) cloud cover;
     (b) shadows;
     (c) geometric distortions;
     (d) radiometric distortions;
     (e) sensor errors.

23 Re-stratification of carbon estimation areas

(1) This section applies to each carbon estimation area in which:

(a) disturbance has been detected; and

(b) the disturbance has resulted in a crown cover loss of more than 5% over an area larger than 5% of the project native forest; and

(c) the disturbance has not previously been re-stratified.

(2) Before the next offsets report following the detection of the disturbance, the spatial extent of the disturbance must be delineated as a new carbon estimation area.

(3) Any carbon estimation area the boundary of which encloses or is crossed by the carbon estimation area in subsection (2) must be re-stratified to exclude the carbon estimation area in subsection (2) before the next offsets report following the detection of the disturbance.

24 Strata boundaries

The geographic boundaries of each stratum within the project area must be identified on a geospatial map in accordance with the CFI Mapping Guidelines.

Division 3—Baseline deforestation plan

25 Baseline deforestation plan

(1) A plan of the project area that complies with this section (the *baseline deforestation plan*) must be prepared before the first offsets report.

(2) The plan must identify the following:

(a) for each area of eligible native forest that would have been cleared but for the project—the land use that would have applied following the clearing;

(b) the spatial extent of each of the following:
    (i) the project area;
    (ii) the eligible native forest;
    (iii) any part of the eligible native forest that would have been left uncleared in order to comply with conditions of the pre-existing clearing consent;
    (iv) any part of the eligible native forest in relation to which clearing is not possible or practicable;
    (v) each carbon estimation area;
    (vi) each clearing buffer;
    (vii) each proposed land use referred to in paragraph (a);

(c) any requirements, whether in accordance with the pre-existing clearing consent or otherwise, to not clear certain kinds of trees (*non-project trees*);

(d) an estimate of canopy cover had the authorised clearing occurred.

(3) The plan must include a map prepared in accordance with the CFI Mapping Guidelines depicting the spatial information in subsection (2).

Division 4—Net abatement amount

Subdivision 1—Allometric equations

26 Allometric equations to be validated or developed

(1) This section applies in relation to:

(a) each tree species to which an allometric equation is applied; and

(b) each group of species to which an allometric equation is applied.

(2) The project proponent must:
    (a) develop and validate a new allometric equation; or
    (b) validate an existing allometric equation in accordance with section 38, if:
        (i) the allometric equation has been published in a peer-reviewed journal as a valid allometric equation; and
        (ii) the allometric equation was developed using a dataset of more than 15 trees; and
        (iii) the allometric domain is known; and
        (iv) the allometric domain is consistent with the carbon estimation area to which the allometric equation is to be applied; and
        (v) the measurement protocols for the allometric equation are known and are consistently applied; or
    (c) validate an allometric equation developed in accordance with this determination for another avoided deforestation project.

27 Validating or developing allometric equations

Each allometric equation must be validated and developed using destructive sampling by carrying out the steps specified in this Subdivision.

28 Step 1—Scope of allometry

(1) Allometric equations developed or validated in accordance with this Subdivision apply only to the above-ground biomass of the project native forest.

Note   The below-ground biomass of the native forest in the project area is determined using root:shoot ratios as provided by section 41.

(2) The use of an allometric equation is restricted to its allometric domain as defined in section 29.

29 Step 2—Determination of allometric domains

(1) An allometric domain describes the specific conditions under which an allometric equation is likely to apply because the assumptions that underpin the allometric equation are satisfied.

(2) Allometric domains must be determined in accordance with the requirements of this section.

(3) For each allometric equation that is to be developed or validated, the following must be defined:
    (a) a unique identifier and reference;
    (b) the species or group of species for which the allometric equation has been or will be developed;
    (c) the species growth form for which the allometric equation has been or will be developed;
    (d) the range of values of measurements for each variable used to develop the allometric equation.

(4) If a new allometric equation is to be developed, the allometric domain must include the spatial extent in which the allometric equation applies.

(5) If a pre-existing allometric equation is to be validated, the allometric domain must include the spatial extent in which the allometric equation applies if the spatial extent is defined.

(6) If an allometric equation is developed in respect of a group of species:

    (a) the growth form of each species to which the allometric equation applies must be the same; and

    (b) each species must be identified prior to the commencement of destructive sampling as provided by this Subdivision; and

    (c) individual trees in the group of species must be selected independently of their species for destructive sampling.

30 Step 3—Sample size

(1) For each allometric equation to be validated, at least 6 trees must be selected for destructive sampling, including at least one tree from each class size as defined in section 34.

(2) For each new allometric equation to be developed, at least 20 trees must be selected for destructive sampling, including at least one tree from each class size as defined in section 34.

31 Step 4—Determination of plot design for tree selection

(1) The plot design for tree selection must be determined in accordance with section 42.

(2) Enough plots must be allocated to capture at least 100 trees per species or species group represented by the allometric equation across the area mentioned in section 32.

32 Step 5—Allocation of plots for tree selection

(1) When developing an allometric equation, plots for tree selection must be allocated within:

    (a) one or more carbon estimation areas; and

    (b) the spatial extent of each allometric domain as defined in section 29.

(2) When validating an allometric equation, plots for tree selection must be allocated across the carbon estimation area or areas in which the allometric equation is to be applied.

(3) Waypoints for plot locations within the areas mentioned in subsection (1) or (2) must be allocated using a pseudo-random number generator with a known seed number.

33 Step 6—Survey and random selection of trees for destructive sampling

(1) Waypoints must be established using a GPS device with an accuracy of at least ± 4 metres.

(2) A plot at each waypoint must be established as provided by section 31.

(3) A unique identifier must be assigned to each tree within each plot.

(4) For each tree, each variable to be used in an allometric equation must be measured.

(5) Enough plots to achieve the sample size prescribed in section 31 must be established.

34 Step 7—Size classes

(1) The trees mentioned in section 33 must be:
   (a) classified according to the species or group of species for which an allometric equation is to be developed; and
   (b) further classified into at least 3 size classes per species or group of species mentioned in paragraph (a).

(2) Each size class must have:
   (a) a minimum range identifying the smallest variable for tree selection; and
   (b) a maximum range identifying the largest variable for tree selection; and
   (c) a defined class size interval.

(3) Use a pseudo-random number generator with a known seed number to rank the trees mentioned in subsection (1) within the class sizes mentioned in subsection (2).

(4) At least the first tree in each class size ranked in accordance with subsection (3) must be selected for destructive sampling in accordance with section 35.

(5) If more than one tree per class size is needed to achieve the sample size specified in section 30:
   (a) trees must be selected sequentially within each size class according to the ranking in subsection (3); or
   (b) the trees with the maximum or minimum variable in relation to each size class must be selected.

35 Step 8—Destructive sampling procedure

Step 8.1—Wet weight of sample trees

(1) Each sample tree selected in section 34 must be cut down at ground level.

(2) The wet weight of each sample tree must be measured.

   Note   Trees may be cut into smaller parts for the purposes of measuring their wet weight.

Step 8.2—Allometric equations for single species

(3) If an allometric equation is to be developed for a single species:
   (a) select:
      (i) at least every fourth tree cut down in accordance with subsection (1) in the order of cutting; and
      (ii) at least one tree from each class size mentioned in section 34; and
   (b) cut each tree into its component parts.

(4) For the purposes of this section, component parts include the following:
   (a) stem;
   (b) branches;
   (c) crown;
   (d) dead material, including dead branches, dead stem and dead crown, attached to the sample tree.

Step 8.3—Allometric equations for groups of species

(5) If an allometric equation is to be developed for a group of species, each of the trees cut down in accordance with subsection (1) must be cut into component parts

36 Step 9—Biomass analysis

(1) For each tree cut into its component parts in accordance with section 35:

    (a) estimate its dry weight by the following steps:

       (i) record the wet weight of each component part (the **component wet weight**);

      (ii) cut at least 3 representative subsamples from each component part;

     (iii) for each subsample, undertake the following steps:

         (A) record its wet weight immediately after being cut (the **subsample wet weight**);

         (B) dry it in an oven with a temperature between 70 and 80 degrees Celsius until it has achieved a constant weight;

         (C) record its weight after drying (the **subsample dry weight**);

         (D) divide the subsample dry weight by the subsample wet weight (the **subsample dry to wet weight ratio**);

      (iv) average the subsample dry to wet weight ratios of the subsamples of each component part (the **component average dry to wet weight ratio**);

      (v) multiply the component wet weight by the component average dry to wet weight ratio (the **estimated component dry weight**);

      (vi) sum each estimated component dry weight for each component part of the sample tree to estimate the dry weight of the sample tree; and

    (b) estimate the whole tree dry to wet weight ratio of the sample tree by dividing its estimated dry weight calculated in accordance with paragraph (a) by its wet weight measured in accordance with subsection 35(2).

(2) If:

    (a) an allometric equation is to be developed for a single species; and

    (b) each of the trees cut down in accordance with subsection 35(1) was not analysed in accordance with this section;

the coefficient of variation of tree dry to wet weight ratio must be estimated by dividing the standard deviation of tree dry to wet weight ratio by its average.

(3) If the coefficient of variation estimated in accordance with subsection (2) exceeds 15%:

    (a) all measurements associated with trees not analysed in accordance with this section must be discarded; and

    (b) destructive sampling for the equivalent number of sample trees discarded in accordance with paragraph (a) must be repeated in accordance with subsection 35(1); and

    (c) analysis of the sample trees must be completed in accordance with this section.

(4) If the coefficient of variation calculated in accordance with subsection (2) is equal to or less than 15%, the dry weight of any sample trees not analysed in accordance with this section must be estimated by multiplying the tree wet weight by the average tree dry to wet weight ratio.

37 Step 10—Data exploration and analysis

(1) The whole tree dry weight data obtained in section 36 must be compiled into a database or spreadsheet suitable for statistical analysis or importation into a statistical analysis software package.

(2) If an existing allometric equation is to be validated, Step 10.1 in this section must be skipped and Step 11 in section 38 must be completed.

(3) If a new allometric equation is to be validated, Step 10.1 in this section must be completed.

Step 10.1—Allometric development

(4) An allometric equation being developed must take the form of a statistical model fitted using:
  (a) simple linear regression; or
  (b) multiple regression; or
  (c) polynomial regression; or
  (d) non-linear regression.

(5) Each allometric equation developed must satisfy the assumptions that:
  (a) the response variables change in a systematic way with variation in the explanatory variable; and
  (b) errors are:
    (i) independent; and
    (ii) normally distributed.

(6) To satisfy the assumptions in subsection (5), data may be transformed.

(7) If data is transformed, power transformations may be used.

(8) If a logarithmic transformation is applied to the response variable, the proportional bias must be estimated and applied using the ratio of the arithmetic sample mean to the mean of the back-transformed predicted variables.

(9) Each explanatory variable used in an allometric equation must be statistically significant.

(10) For the purposes of subsection (9), a variable is statistically significant if the outcome of an F-test or a two-tailed t-test has a probability value of less than 5%.

(11) Each allometric equation developed must be verified by comparing the predictions from the corresponding allometric equation with observations of trees mentioned in subsection (1).

(12) The mean of the weighted residuals for the observed and predicted biomass estimates of the dataset of trees used to derive the allometric equation must be computed by completing Equation 1 and Equation 2.

$$WR_{j,m} = WF_{j,m} \times \left(Q_{ob,j,m} - Q_{Pr,j,m} \right)$$	**Equation 1**

Where:

$WR_{j,m}$ = weighted residual (kilograms) for tree (j, m).

j,m = a test tree (j) from the data set (m) used to derive the allometric equation.

$Q_{ob,j,m}$ = observed biomass (kilograms) for tree (j, m) measured by destructive sampling.

$Q_{Pr,j,m}$ = biomass (kilograms) for tree (j,m) predicted from the allometric equation.

$WF_{j,m}$ = weighting factor applied to tree (j,m) calculated in accordance with Equation 2.

$$WF_{j,m} = \frac{1}{\left(BA_{j,m}\right)^{0.5}}$$

Equation 2

Where:

$WF_{j,m}$ = weighting factor applied to tree (j, m).

$BA_{j,m}$ = basal area of tree (j, m) (square metres).

j, m = a test tree (j) from the data set (m) used to derive the allometric equation.

(13) The mean of the weighted residuals calculated in Equation 1 must not be significantly different from zero, as determined by applying a two-tailed student t-test where $\alpha = 0.05$.

(14) If the allometric equation satisfies subsection (13), proceed to Step 11 in section 38.

(15) If the allometric equation does not satisfy subsection (13):
   (a) an existing equation must be selected in accordance with section 26 and validated using the procedure outlined in section 38; or
   (b) a new equation must be developed following the procedure outlined in this Subdivision.

38 Step 11—Validation of allometric equation

(1) Each allometric equation must be validated in respect of the native forest to which the pre-existing clearing consent applies.

(2) Each allometric equation must be validated in:
   (a) the first reporting period in which the allometric equation is applied; and
   (b) the last reporting period in the crediting period.

Step 11.1—Confirmation of allometric domain

(3) Once a biomass survey has been completed in accordance with Subdivision 2, an allometric domain must be confirmed in accordance with this section for each allometric equation to be applied.

(4) Before applying an allometric equation, the project proponent must confirm that the characteristics of the species or group of species whose biomass is to be predicted fall within a valid allometric domain as defined in section 29.

(5) For trees measured in the biomass survey, a table must be prepared listing the following:
   (a) the species of tree(s);
   (b) the species growth form;
   (c) the spatial extent of the species;
   (d) the range of values of all explanatory variables measured.

(6) The information collated in the table mentioned in subsection (5) must fall within the range of values described by the dataset used to develop the allometric equation.

(7) Trees that do not fall within the allometric domain must be excluded from the results of the biomass survey.

Step 11.2—Predicted biomass of sample trees

(8) An estimate of the biomass contained within each sample tree mentioned in section 30 must be predicted using the allometric equation to be validated.

(9) For the purposes of subsection (8), the explanatory variable measurements collected for each test tree must be used as inputs.

Step 11.3—Comparison between predicted and observed biomass

(10) The validity of each allometric equation for prediction must be established by comparing its predictions with observed values estimated by the destructive sampling of trees selected in accordance with sections 30 to 36.

(11) Destructively sampled trees used for the validation of an allometric equation must not have been included in the development of the allometric equation.

(12) The mean of weighted residuals for the observed and predicted biomass estimates of the set of test trees generated in accordance with Step 11.2 in this section must be computed using Equation 3 and Equation 4.

$$WR_j = WF_j \times (Q_{ob,j} - Q_{pr,j})$$	**Equation 3**

Where:

WR_j = weighted residual in kilograms (kg) for tree (j).

j = a test tree from a dataset not used to derive the allometric equation.

$Q_{ob,j}$ = observed biomass (kilograms) for tree (j) measured through destructive sampling.

$Q_{pr,j}$ = biomass (kilograms) for tree (j) predicted from the allometric equation.

WF_j = weighting factor applied to tree (j) calculated in accordance with Equation 4.

$$WF_j = \frac{1}{(BA_j)^{0.5}}$$	**Equation 4**

Where:

WF_j = weighting factor applied to tree (j).

BA_j = basal area (square metres) of tree (j).

j = a test tree from a dataset not used to derive the allometric equation.

Step 11.4—Minimum requirements for validation of allometric equations

(13) An allometric equation is validated and may be applied only if:
   (a) the characteristics of the species or group of species, the biomass of which is to be predicted, fall within the valid domain of the allometric equation to be applied, in accordance with Step 11.1 in this section; and
   (b) the mean of the weighted residuals calculated by applying Equation 3 is not significantly different from zero, as determined by applying a two-tailed student t-test where $\alpha = 0.05$.

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39 Procedure if allometric equation cannot be validated

If an allometric equation cannot be validated:

(a) select another equation to validate in accordance with section 26; or

(b) develop a new equation in accordance with section 26.

Subdivision 2—Biomass survey

40 Determination of native forest biomass

(1) A field-based survey must be undertaken by following the steps in this Subdivision in order to determine the biomass stocks in the native forest in each carbon estimation area.

(2) A biomass survey must be undertaken for all carbon estimation areas within 6 months of the submission of the first offsets report for the project.

(3) If no disturbance has been detected in a carbon estimation area:

(a) the data collected in respect of the carbon estimation area and used for the most recent offsets report may be used; and

(b) no further biomass survey must be undertaken.

41 Determination of root:shoot ratios

In order to determine the root:shoot ratio in Equation 8 and Equation 14:

(a) the Major Vegetation Group class in which plot (p) is located must be identified; and

(b) the root:shoot ratio for the class in paragraph (a) must be selected as specified in Schedule 1.

42 Step 1—Plot design

(1) A plot design must be selected in accordance with this section.

(2) Each plot in a carbon estimation area must:

(a) have a fixed orthogonal area and shape with a definite spatial boundary; and

(b) be able to be re-established for auditing purposes; and

(c) be circular, square or rectangular; and

(d) have an area equal to or greater than 0.05 hectares.

(3) If the plot is circular, the plot waypoint is the centre of the circle and the plot must be established around the waypoint.

(4) If the plot is square or rectangular, the plot waypoint is the south-west corner of the plot and the plot must be oriented along a north-south axis.

(5) If the plot is located on a slope greater than 10 degrees, then a correction must be applied in order to achieve a constant orthogonal area.

(6) The plot design selected in accordance with this section must be used for each biomass survey conducted for the purposes of this determination.

43 Step 2—Allocation of plots

(1) At least 200 waypoints must be assigned to each carbon estimation area in accordance with subsection (2).

(2) A pseudo-random number generator must be used with a defined seed number in order to allocate plot points to each carbon estimation area.

(3) The plot points obtained in subsection (2) are the waypoints of the plots.

(4) A pseudo-random generator with a known seed value must be used to assign a different number to each waypoint.

(5) The numbers assigned as provided by subsection (4) must be ranked from lowest to highest.

(6) The lowest ranked plot in subsection (5) is *plot 1* and the highest ranked is equal to the number of waypoints assigned in subsection (1).

(7) For the purposes of a biomass survey, all the plots ranked from 1 until the number of plots obtained in Step 4.2 in section 45 must be surveyed.

(8) The area boundary used to allocate plots as provided by this section must be retained in order to enable the replication of the plot allocation using the defined seed number.

(9) Attributes for each plot waypoint must be assigned, including:
   (a) the project name [NAME]; and
   (b) the carbon estimation area number to which points are allocated [CEA_NUM]; and
   (c) the plot point number [PLOT_NUM]; and
   (d) the X coordinate in decimal degrees [X_VALUE]; and
   (e) the Y coordinate in decimal degrees [Y_VALUE]; and
   (f) the date of allocation points to the carbon estimation area [DATE_REG].

44 Step 3—Pilot survey

(1) For each carbon estimation area, a pilot survey must be undertaken in order to perform a pre-biomass survey estimate of variance in relation to each carbon estimation area.

(2) In order to undertake a pilot survey:
   (a) at least the first 5 plot points allocated in accordance with section 43 must be surveyed; and

   (a) a biomass survey must be undertaken in accordance with sections 46 and 47.

(3) Data collected as part of the pilot survey may be used in order to determine the biomass of plots as provided by section 48.

45 Step 4—Number of plots

(1) In order to determine the final sample size required to estimate carbon stocks in each carbon estimation area, Steps 4.1 and 4.2 in this section must be completed in relation to each carbon estimation area.

Step 4.1—Coefficient of variation of each carbon estimation area

(2) The data from the pilot survey undertaken in accordance with section 44 must be used when completing Step 4.1.

(3) In order to determine the population coefficient of variation within each carbon estimation area, the following formula must be completed:

$$CV_i = \left(\frac{\sigma_{pre,i}}{\bar{x}_i} \right) \times 100 \qquad \textbf{Equation 5}$$

Where:

CV_i= coefficient of variation of pilot sample in carbon estimation area (i).

$\sigma_{pre,i}$ = sample standard deviation from pilot data in carbon estimation area (i) (tonnes of biomass).

$\bar{x}_i$ = sample mean from pilot data in carbon estimation area (i) (tonnes of biomass).

Step 4.2—Number of plots to sample in each carbon estimation area

(4) For the purposes of this determination, carbon stocks for each carbon estimation area must be estimated within ±10% of the true value of the mean at a 90% confidence level.

(5) In this determination, the requirement in subsection (4) is referred to as the ***Targeted Precision***.

(6) In order to estimate the required sample size to achieve the Targeted Precision in each carbon estimation area, the following formula must be completed:

$$n_i = \frac{CV_i^2 \times t_{val}^2}{SE^2} \qquad \textbf{Equation 6}$$

Where:

n_i= estimated number of sample plots required to meet Targeted Precision (i).

CV_i = coefficient of variation in pilot data as calculated in Equation 5 (expressed as a percentage).

t_{val} = two-sided students t-value, at the degree of freedom equal to (n-1) where (n) is the number of plots established in the biomass survey, for a 90% confidence level.

SE = allowable level of sampling error (expressed as a percentage and fixed as 10%).

46 Step 5—Preparation of biomass survey

In order to ensure accuracy in measurements and to minimise error, for each carbon estimation area:

(a) if the tree species or group of species has an associated allometric equation—the explanatory variables required to be surveyed must be identified for all allometric equations used in the project area in accordance with Subdivision 1; and

(b) if the tree species or group of species does not have an associated allometric equation—the diameter of the stem must be recorded as an explanatory variable; and

(c) each plot that must be surveyed must be identified; and

Note   These will be the plots identified in Step 2 numbering from *plot 1* through to *plot n*$_i$.

(d) a survey protocol that states the requirements and processes of the biomass survey must be developed, including for the checking and calibration of measuring equipment.

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47 Step 6—Measurements within plots

(1) Waypoints must be established using a GPS device with an accuracy of at least ± 4 metres.

(2) A plot at each waypoint must be established as provided by section 42.

(3) The explanatory variables identified in section 46 must be measured for all trees in each plot established in accordance with subsection (2).

(4) For the purposes of subsection (3), each explanatory variable required by the allometric equation applicable to each species or group of species within the plot must be measured.

48 Step 7—Biomass of plots

(1) The biomass of each plot surveyed as provided by section 47 must be determined in accordance with Steps 7.1 to 7.4.

Step 7.1—Determination of above-ground biomass by applying allometric equations

(2) The measurements made in the field sample plots as provided by section 47 must be converted into above-ground biomass stock estimates for each tree, $Q_{AGB,j,p,i,r}$, for tree (j) in sample plot (p) in carbon estimation area (i) in reporting period (r).

(3) For the purposes of the conversion in subsection (2), the allometric equation obtained in Subdivision 1 applicable to the species or group of species to which the tree belongs must be used.

Step 7.2—Determination of above-ground biomass in survey plots

(4) The above-ground biomass stock in survey plot (p) in carbon estimation area (i) must be determined using the following formula:

$$Q_{AGB,p,i,r} = \sum_j Q_{AGB,j,p,i,r}$$	**Equation 7**

Where:

$Q_{AGB,p,i,r}$= total above-ground biomass of all trees in sample plot (p) in carbon estimation area (i) for reporting period (r) (tonnes of dry matter).

$Q_{AGB,j,p,i,r}$= above-ground biomass of tree (j) in sample plot (p) in carbon estimation area (j) for reporting period (r) (tonnes of biomass per tree).

j = tree (j) in sample plot (p) in carbon estimation area (i) in reporting period (r).

i = carbon estimation area (i).

p = sample plot (p) in each carbon estimation area (i).

r = reporting period (r).

Step 7.3—Determination of below-ground tree biomass in survey plots

(5) The below-ground tree biomass in each plot surveyed in accordance with section 47 must be determined using the following formula:

$Q_{BGB,p,i,r} = RSR \times Q_{AGB,p,i,r}$	**Equation 8**

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Where:

$Q_{BGB,p,i,r}$ = total below-ground tree biomass stock of trees in plot (p), in carbon estimation area (i) for reporting period (r) (tonnes of dry matter).

$Q_{AGB,p,i,r}$ = total above-ground tree biomass stock of trees in plot (p) in carbon estimation area (i) for reporting period (r) (tonnes of dry matter).

RSR = root:shoot ratio determined in accordance with section 41 (tonnes of root biomass per tonnes of shoot biomass).

i = carbon estimation area (i).

p = sample plot (p) in each carbon estimation area (i).

r = reporting period (r).

Step 7.4—Determination of total tree biomass in each plot

(6) The total tree biomass for each plot surveyed in accordance with section 47 must be determined using the following formula:

$Q_{p,i,r} = Q_{AGB,p,i,r} + Q_{BGB,p,i,r}$	**Equation 9**

Where:

$Q_{p,i,r}$ = total biomass stock in sample plot (p) in carbon estimation area (i) for reporting period (r) (tonnes of biomass).

$Q_{AGB,p,i,r}$ = total above-ground tree biomass stock of trees in plot (p) in carbon estimation area (i) for reporting period (r) (tonnes of dry matter).

$Q_{BGB,p,i,r}$ = total below-ground tree biomass stock of trees in plot (p), in carbon estimation area (i) for reporting period (r) (tonnes of dry matter).

i = carbon estimation area (i).

p = sample plot (p) in each carbon estimation area (i).

r = reporting period (r).

49 Step 8—Edge corrections for plots crossing carbon estimation area boundaries

(1) If a plot crosses the boundary of a carbon estimation area, the resulting edge effects must be corrected in accordance with this section.

(2) If more than 20% of the plot falls outside the carbon estimation area that is to be surveyed, the plot must be omitted from the biomass survey.

(3) If less than 20% of the plot falls outside the carbon estimation area that is to be surveyed, the mirage method must be used.

(4) The effective orthogonal area of plots established using the mirage method must be consistent with the area of all other plots.

(5) In this section:

mirage method means the process whereby the area of the plot falling outside of the carbon estimation area is established within the carbon estimation area that is being surveyed.

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50 Step 9—Validation of sample size

(1) An ex-post analysis of the data obtained in the biomass survey must be performed in order to verify that the survey performed in accordance with this Subdivision has achieved Targeted Precision.

Step 9.1—Standard error

(2) The standard error must be calculated using the following formula:

$$SE_{i,r} = \frac{\sigma_{i,r}}{\sqrt{n_{i,r}}}$$	**Equation 10**

Where:

$SE_{i,r}$ = standard error of the biomass survey in carbon estimation area (i) for reporting period (r).

$\sigma_{i,r}$ = standard deviation of the primary biomass survey data in carbon estimation area (i) for reporting period (r) (tonnes of dry matter).

$n_{i,r}$ = number of sample plots in carbon estimation area (i) for reporting period (r).

i = carbon estimation area (i).

r = reporting period (r).

Step 9.2.—Determination of Targeted Precision

(3) In order to determine whether the survey has achieved Targeted Precision, the following formula must be used:

$$TP_{i,r} = \frac{SE_{i,r} \times t_{val}}{\overline{Q}_{i,r}}$$	**Equation 11**

Where:

$TP_{i,r}$ = Targeted Precision error limit of the primary biomass survey for a carbon estimation area (i) for reporting period (r).

$SE_{i,r}$ = standard error of the biomass survey in carbon estimation area (i) for reporting period (r).

t_{val} = two-sided students t-value, at the degree of freedom equal to (n-1) where (n) is the number of plots established in the biomass survey in each carbon estimation area, for a 90% confidence level.

$\overline{Q}_{i,r}$ = sample mean from biomass survey data in carbon estimation area (i) for the reporting period (r) (tonnes of biomass).

i = carbon estimation area (i).

r = reporting period (r).

(4) The 90% confidence level must be used when determining the t-value.

(5) The final value of $TP_{i,r}$ must be less than or equal to 10%.

(6) If $TP_{i,r}$ is greater than 10%, additional plots must be surveyed consistently with the requirements of this Subdivision until the Targeted Precision is less than or equal to 10%.

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Subdivision 3—Calculation of baseline emissions

51 Calculating baseline emissions

The steps outlined in this Subdivision must be followed for the purposes of calculating the baseline emissions in the project area.

52 Baseline relevant carbon pools

For the purposes of this Subdivision, relevant carbon pools are limited to:

(a) above-ground tree biomass;
(b) below-ground tree biomass; and
(c) the burning of biomass for the purposes of clearing.

53 Step 1—Surveying requirements

Data must be collected in accordance with Subdivision 2.

54 Step 2—Calculating carbon stocks in carbon estimation area

Step 2.1—Determination of mean carbon stocks in each carbon estimation area

(1) Following a biomass survey, the mean carbon stock in each carbon estimation area must be calculated using the following formula:

$$\overline{C}_{i,r} = \frac{\left(\sum_p \frac{Q_{p,i,r}}{S_{p,i}}\right)}{n_{i,r}} \times CF \times \frac{44}{12} \times (1 - NPT_i)$$	**Equation 12**

Where:

$\overline{C}_{i,r}$ = mean carbon stock in all pools in carbon estimation area (i) for reporting period (r) (tonnes of carbon dioxide equivalent per hectare).

$Q_{p,i,r}$ = total biomass stock of trees in sample plot (p) of carbon estimation area (i) for reporting period (r) (tonnes of dry matter) as calculated in section 48.

$S_{p,i}$ = area of sample plot (p) in carbon estimation area (i) (hectares).

CF = 0.5, being the fraction of carbon in biomass.

NPT_i = buffer representing the proportion of non-project tree biomass within carbon estimation area (i) as calculated using Equation 13.

i = carbon estimation area (i).

p = sample plot (p) in each carbon estimation area (i).

r = reporting period (r).

$n_{i,r}$ = number of sample plots (n) measured in carbon estimation area (i) for reporting period (r).

Note 1   The factor $^{44}/_{12}$ represents the ratio of the molecular weight of carbon dioxide to the molecular weight of carbon.

Note 2   Equation 12 is also used to calculate the mean carbon stocks in carbon estimation areas for each reporting period in which a biomass survey is undertaken.

Step 2.2—Non-project tree buffer

(2) If the baseline deforestation plan provides that a kind of tree in the project area must not be cleared, the project proponent may:

    (a) do both of the following:

        (i) set the biomass of that kind of tree to zero;

        (ii) not include that kind of tree in the results of any biomass survey; or

    (b) calculate a non-project tree buffer for each carbon estimation area using data collected in the first reporting period, in accordance with Equation 13.

$$NPT_i = \frac{\sum_p Q_{NPT,p,i,r}}{\sum_p Q_{p,i,r}}$$	**Equation 13**

Where:

NPT_i = buffer representing the proportion of non-project tree biomass within carbon estimation area (i) in the first reporting period (r=1) estimated from in-field measurements as provided by Subdivision 2 and expressed as a decimal.

$Q_{p,i,r}$ = total biomass stock of trees in sample plot (p) of carbon estimation area (i) for the first reporting period (r = 1) (tonnes of biomass).

$Q_{NPT,p,i,r}$ = total biomass stock of non-project trees in sample plot (p) of carbon estimation area (i) for the first reporting period (r = 1) (tonnes of biomass) calculated by completing Equation 14.

    i = carbon estimation area (i).

    p = sample plot (p) in each carbon estimation area (i).

    r = reporting period (r).

(3) If, after proceeding in accordance with paragraph (2)(a) in relation to a particular kind of tree, the project proponent subsequently wishes to include that kind of tree in a biomass survey the project proponent must, using data from the first biomass survey:

    (a) calculate the biomass for the kind of tree in accordance with Subdivision 1 and Subdivision 2; and

    (b) recalculate the non-project tree buffer in accordance with Equation 13.

(4) If a carbon estimation area is re-stratified following disturbance, the non-project tree buffer of the carbon estimation area after re-stratification is equal to the non-project tree buffer of the carbon estimation area before re-stratification.

Step 2.3—Total biomass of non-project trees within each plot

(5) For all kinds of tree the biomass for which was not set to zero under subsection (2), the total biomass for those trees in each plot must be calculated using the following formula using data collected in the first reporting period:

$$Q_{NPT,p,i,r} = \sum_j (Q_{NPT,j,p,i,r} + (Q_{NPT,j,p,i,r} \times RSR))$$	**Equation 14**

Where:

$Q_{NPT,p,i,r}$ = total biomass of non-project trees in sample plot (p), in carbon estimation area (i) in the first reporting period (r=1) (tonnes of biomass).

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$Q_{NPT,j,p,i,r}$ = above-ground biomass of trees that may not be cleared under baseline deforestation plan (j) in sample plot (p) in carbon estimation area (i) in the first reporting period (r=1) (tonnes of biomass per tree).

RSR = root:shoot ratio determined in accordance with section 41 (tonnes of root biomass per tonne of shoot biomass).

j = tree (j) in sample plot (p) in carbon estimation area (i) in reporting period (r).

i = carbon estimation area (i).

p = sample plot (p) in each carbon estimation area (i).

r = reporting period (r).

55 Step 3—Calculating carbon stocks in carbon estimation area following clearing

(1) The long-term average carbon stocks in each carbon estimation area if clearing had been carried out in accordance with the baseline deforestation plan must be calculated in accordance with this section.

(2) The long-term average mean carbon stocks in all pools in each carbon estimation area if clearing had been carried out in accordance with the baseline deforestation plan must be calculated using the following formula:

$$\overline{C}_{B,i} = \frac{\left(\sum_{p=1} \frac{\overline{Q}_{lt,p,i}}{S_{p,i}}\right)}{n_{i,r}} \times CF \times \frac{44}{12}$$	**Equation 15**

Where:

$\overline{C}_{B,i}$ = baseline (B) long term average mean carbon stock in all pools in carbon estimation area (i) following clearing in accordance with the baseline deforestation plan (tonnes of carbon dioxide equivalent per hectare).

$\overline{Q}_{lt,p,i}$ = long term average biomass stock of trees in sample plot (p) of carbon estimation area (i) following clearing in accordance with the baseline deforestation plan (tonnes of biomass) calculated in accordance with Equation 20.

$S_{p,i}$ = area of sample plot (p) in carbon estimation area (i) (hectares).

i = carbon estimation area (i).

p = sample plot (p) in each carbon estimation area (i).

CF = fraction of carbon in biomass, set at 0.5 as consistent with the National Inventory System.

$n_{i,r}$ = number of sample plots measured in carbon estimation area (i) in the first reporting period (r=1).

Note   The factor $^{44}/_{12}$ represents the ratio of the molecular weight of carbon dioxide to the molecular weight of carbon.

Step 3.1—100 year average of biomass within sample plots following clearing

(3) Steps 3.1.1 to 3.1.5 must be completed in order to determine the 100 year average biomass stock in the sample plots following clearing in accordance with the baseline deforestation plan.

Step 3.1.1—Model biomass in debris pool

(4) The biomass stock in the debris pool within each plot must be calculated using the following formula:

$$Q_{Debris,p,i} = Q_{p,i,r}$$

Equation 16

Where:

$Q_{Debris,p,i}$ = biomass in the debris pool following clearing in accordance with the baseline deforestation plan in sample plot (p) in carbon estimation area (i) (tonnes of biomass).

$Q_{p,i,r}$ = biomass stock in all pools within plot (p) prior to clearing in accordance with the baseline deforestation plan in carbon estimation area (i) for the first reporting period (r=1) (tonnes of dry matter) as calculated in accordance with Equation 9.

i = carbon estimation area (i).

p = sample plot (p) in each carbon estimation area (i).

r = reporting period (r).

Step 3.1.2—Partition of biomass into Major Vegetation Group tree components

(5) The biomass of each plot must be partitioned into its Major Vegetation Group tree components in order to determine the impact of treatment and decay on each component of the tree.

(6) Biomass partitioning must be performed in accordance with the biomass fractions in Schedule 1.

(7) The biomass of stems, branches, bark, leaves, coarse roots and fine roots in each sample plot in each carbon estimation area must be determined using the applicable biomass fractions in Schedule 1 and the following formula:

$$Q_{k,p,i} = Q_{Debris,p,i} \times QF_{k,p,i}$$

Equation 17

Where:

$Q_{k,p,i}$ = biomass of tree component (k) in sample plot (p) in carbon estimation area (i) as determined for each tree component (k) (tonnes of biomass).

k = tree component (stem, branch, bark, leaves, coarse roots, fine roots).

i = carbon estimation area (i).

p = sample plot (p) in each carbon estimation area (i).

$Q_{Debris,p,i}$ = biomass in the debris pool following clearing in accordance with the baseline deforestation plan in sample plot (p), in carbon estimation area (i) (tonnes of biomass).

$QF_{k,p,i}$ = the value given by subsection (8).

(8) In relation to $QF_{k,p,i}$ the biomass fraction for each tree component is the following:

(a) $QF_{stem,p,i}$ is the biomass fraction of stems for Major Vegetation Group of plot (p) in carbon estimation area (i);

(b) $QF_{branch,p,i}$ is the biomass fraction of branches for Major Vegetation Group of plot (p) in carbon estimation area (i);

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(c) $QF_{bark,p,i}$ is the biomass fraction of bark for Major Vegetation Group of plot (p) in carbon estimation area (i);

(d) $QF_{leaves,p,i}$ is the biomass fraction of leaves for Major Vegetation Group of plot (p) in carbon estimation area (i);

(e) $QF_{coarse\_roots,p,i}$ is the biomass fraction of coarse roots for Major Vegetation Group of plot (p) in carbon estimation area (i);

(f) $QF_{fine\_roots,p,i}$ is the biomass fraction of fine roots for Major Vegetation Group of plot (p) in carbon estimation area (i);

as specified in Table 1.1 and Table 1.2 in Schedule 1.

Step 3.1.3—Treatment of the debris pool

(9) The biomass residue following a burning event must be calculated using the following formula:

$$Q_{residue,k,p,i} = Q_{k,p,i} \times (BF - (BF \times BE_k) + UF)$$	**Equation 18**

Where:

$Q_{residue,k,p,i}$ = biomass residue post burning event, of tree component (k) in sample plot (p) in carbon estimation area (i) (tonnes of dry matter).

$Q_{k,p,i}$ = biomass of tree component (k) in sample plot (p) in carbon estimation area (i) as determined for each tree component in Step 3.1.2 in this section (tonnes of biomass).

BF = 0.25, being the fraction of biomass burnt as a result of fire.

BE_k = burn efficiency for tree component (k) (see Schedule 1 for tree component burn efficiencies).

UF = 0.75, being the fraction of biomass unburnt as a result of fire.

k = tree component (stem, branch, bark, leaves, coarse roots, fine roots).

i = carbon estimation area (i).

p = sample plot (p) in each carbon estimation area (i).

Step 3.1.4—Average long term carbon stock of tree components

(10) The long-term average carbon stock of the biomass residue must be calculated using the following formula:

$$\overline{Q}_{lt,k,p,i} = \frac{(\sum_{Y=1}^{100}(Q_{residue,k,p,i} \times (1 - DR)^Y)) + Q_{residue,k,p,i}}{100}$$	**Equation 19**

Where:

$\overline{Q}_{lt,k,p,i}$ = Long term (lt), 100 year, average biomass of tree component (k) in sample plot (p) in carbon estimation area (i) (tonnes of biomass).

$Q_{residue,k,p,i}$ = biomass residue post burning event, of tree component (k), in sample plot (p), in carbon estimation area (i) (tonnes of dry matter).

DR = decay rate for tree component (k) in sample plot (p), as determined in Schedule 1.

Y = the Yth year for each year of decay in the 100 year modelling period where Y = 1 to 100.

k = tree component (stem, branch, bark, leaves, coarse roots, fine roots).

i = carbon estimation area (i).

p = sample plot (p) in each carbon estimation area (i).

Step 3.1.5—Sum of average long term carbon stock of each tree component

(11) The average biomass in each sample plot in each carbon estimation area must be calculated using the following formula:

$$\overline{Q}_{lt,p,i} = \sum_{k} \overline{Q}_{lt,k,p,i}$$

Equation 20

Where:

$\overline{Q}_{lt,p,i}$ = long term average biomass for sample plot (p) in carbon estimation area (i) (tonnes of biomass).

$\overline{Q}_{lt,k,p,i}$ = 100 year average biomass of tree component (k) for sample plot (p) in carbon estimation area (i) (tonnes of biomass).

k = tree component (stem, branch, bark, leaves, coarse roots, fine roots).

i = carbon estimation area (i).

p = sample plot (p) in each carbon estimation area (i).

56 Step 4—Calculating changes in baseline carbon stock in each carbon estimation area

The change in baseline carbon stocks during the crediting period as a result of the implementation of the baseline deforestation plan must be calculated in the first reporting period using the parameters obtained in Step 2.1 in section 54 and Step 3 in subsection 55(2) and the following formula:

$$\Delta \overline{C}_{B,i} = \overline{C}_{i,r} - \overline{C}_{B,i}$$

Equation 21

Where:

$\Delta \overline{C}_{B,i}$ = mean carbon stock changes in all pools in the baseline within carbon estimation area (i) (tonnes of carbon dioxide equivalent per hectare).

$\overline{C}_{i,r}$ = mean carbon stock in all pools within carbon estimation area (i) in carbon estimation area (i) for the first reporting period (r = 1) (tonnes of carbon dioxide equivalent per hectare) calculated in Equation 12.

$\overline{C}_{B,i}$ = mean carbon stock in all pools in the baseline at end of crediting period in carbon estimation area (i) (tonnes of carbon dioxide equivalent per hectare) calculated in Equation 15.

i = carbon estimation area (i).

r = reporting period (r).

57 Step 5—Calculation of emissions in each carbon estimation area in the baseline

(1) The methane and nitrous oxide emissions released as a result of the burning of biomass following clearing in accordance with the baseline deforestation plan must be accounted for in accordance with this section.

Step 5.1—Pre-fire above-ground biomass stock

(2) The above-ground biomass stock in each carbon estimation area that will be burned must be calculated using the following formula:

$$Q_i = \bar{C}_{i,r} \times S_i \times \frac{12}{44} \times \frac{1}{CF}$$	**Equation 22**

Where:

$Q_i =$ biomass within the debris pool from clearing in carbon estimation area (i) (tonnes of biomass).

$S_i =$ area of carbon estimation area (i) (hectares).

$\bar{C}_{i,r} =$ mean carbon stock in all pools in the baseline in the carbon estimation area (i) for the first reporting period (r = 1) (tonnes of carbon dioxide equivalent per hectare) calculated in Equation 12.

$i =$ carbon estimation area (i).

$r =$ reporting period (r).

$CF =$ 0.5, being the carbon fraction of biomass.

Note   The factor $\frac{12}{44}$ is the ratio of the molecular weight of carbon to carbon dioxide.

Step 5.2—Determination of methane and nitrous oxide emissions from biomass burns

(3) The methane and nitrous oxide emissions associated with the burning event must be calculated using the following formulas:

Step 5.2.1—Determination of methane emissions from fire events

$$E_{CH_4,i} = Q_i \times CF \times EF_{CH_4} \times GWP_{CH_4} \times M$$	**Equation 23**

Step 5.2.2—Determination of nitrous oxide emissions from fire events

$$E_{N_2O,i} = Q_i \times CF \times NC \times EF_{N_2O} \times GWP_{N_2O} \times M$$	**Equation 24**

Where:

$E_{CH_4,i} =$ methane emissions due to fire events in carbon estimation area (i) (tonnes of carbon dioxide equivalent).

$E_{N_2O,i} =$ nitrous oxide emissions due to fire events in carbon estimation area (i) (tonnes of carbon dioxide equivalent).

$Q_i =$ biomass within the debris pool from forest conversion activities in carbon estimation area (i) (tonnes of biomass).

$CF =$ 0.5, being the carbon mass fraction of vegetation.

$NC =$ 0.011, being the nitrogen to carbon ratio of the biomass.

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EF_{CH_4} = emission factor for methane (CH_4) in tonnes element in species / tonnes element in fuel burnt, as given by the National Inventory Report.

EF_{N_2O} = emission factor for nitrous oxide (N_2O) in tonnes element in species / tonnes element in fuel burnt, as given by the National Inventory Report.

GWP_{CH_4} = Global warming potential for methane (CH_4) (tonnes of carbon dioxide per tonne of methane) as given by the NGER Regulations.

GWP_{N_2O} = Global warming potential for nitrous oxide (N_2O) (tonnes of carbon dioxide per tonne of methane) as given by the NGER Regulations.

M = factor to convert elemental mass of gas species (g) to molecular mass, as accessed from table 7.22 of the National Inventory Report, 2010: Volume 2.

i = carbon estimation area (i).

Step 5.3—Determination of greenhouse gas emissions from biomass burning

(4) The greenhouse gas emissions associated with the biomass burning event must be calculated using the following formula:

| $$E_{B,Q,i} = E_{CH_4,i} + E_{N_2O,i}$$ | **Equation 25** |

Where:

$E_{B,Q,i}$ = baseline (B) greenhouse gas emissions due to biomass burning in carbon estimation area (i) (tonnes of carbon dioxide equivalent).

$E_{CH_4,i}$ = methane emissions due to biomass burning, as determined in accordance with Equation 23, in carbon estimation area (i) (tonnes carbon dioxide equivalent).

$E_{N_2O,i}$ = nitrous oxide emissions due to biomass burning, as determined in accordance with Equation 24, in carbon estimation area (i) (tonnes of carbon dioxide equivalent).

i = carbon estimation area (i).

(5) The total greenhouse gas emissions from burning in relation to each carbon estimation area must be redefined using the following formula:

| $$E_{B,i} = E_{B,Q,i}$$ | **Equation 26** |

Where:

$E_{B,i}$ = baseline (B) greenhouse gas emissions as a result of clearing in accordance with the baseline deforestation plan within carbon estimation area (i) (tonnes of carbon dioxide equivalent).

$E_{B,Q,i}$ = baseline (B) greenhouse gas emissions due to biomass burning in carbon estimation area (i) (tonnes of carbon dioxide equivalent).

i = carbon estimation area (i).

58 Step 6—Calculating net baseline greenhouse gas emissions

The net baseline greenhouse gas emissions and removals must be calculated using the parameters derived in Equations 21 and 26 and the following formula:

$$E_B = \sum_i \left((S_i \times \Delta\bar{C}_{B,i}) + E_{B,i} \right)$$

| | Equation 27 |

Where:

E_B = net greenhouse gas emissions in the baseline from clearing in accordance with the baseline deforestation plan (tonnes of carbon dioxide equivalent).

S_i = area of carbon estimation area (i) (hectares).

$\Delta\bar{C}_{B,i}$ = baseline (B) mean carbon stock changes in all pools in the carbon estimation area (i) (tonnes of carbon dioxide equivalent) during the crediting period.

$E_{B,i}$ = baseline (B) greenhouse gas emissions as a result of clearing in accordance with the baseline deforestation plan within carbon estimation area (i) (tonnes of carbon dioxide equivalent).

i = carbon estimation area (i).

Subdivision 4—Calculation of project emissions and removals

59 Calculating project emissions and removals

The steps outlined in this Subdivision must be followed for the purposes of calculating the project emissions in the project area.

60 Project relevant carbon pools

For the purposes of this Subdivision, relevant carbon pools are limited to:
   (a) above-ground tree biomass; and
   (b) below-ground tree biomass; and
   (c) the combustion of fossil fuels in vehicles, machinery and equipment; and
   (d) the burning of biomass from fires.

61 Step 1—Project forest carbon stock changes in carbon estimation area resulting from disturbances

Step 1.1—Accounting for degradation and natural disturbances in the project

(1) When an area of degradation or natural disturbance has been re-stratified into a new carbon estimation area as required by section 23, the biomass stocks of that area must be:
   (a) calculated by resurveying the new carbon estimation area in accordance with Subdivision 2; or
   (b) set to zero.

(2) For the purposes of paragraph (1)(a):
   (a) all dead biomass in the new carbon estimation area is taken to have a biomass of zero; and
   (b) the survey must include only standing living trees in the new carbon estimation area.

(3) When the requirements of subsection (1) have been met, the following formula must be completed:

$$\Delta \overline{C}_{DEG,i,r} = \overline{C}_{i,pre} - \overline{C}_{i,r}$$

Equation 28

Where:

$\Delta \overline{C}_{DEG,i,r}$ = mean carbon stock changes in all pools as a result of degradation or natural disturbance in carbon estimation area (i) (tonnes of carbon dioxide equivalent per hectare).

$\overline{C}_{i,pre}$ = mean carbon stock in all pools ($\overline{C}_{i,r}$) in carbon estimation area (i) as reported in the preceding offsets report. For the first offsets report following disturbance, carbon estimation area (i) means the original (not re-stratified) carbon estimation area.

$\overline{C}_{i,r}$ = mean carbon stock in all pools measured in carbon estimation area (i) for reporting period (r) (tonnes of carbon dioxide equivalent per hectare).

i = carbon estimation area (i).

r = reporting period (r).

(4) When Step 1.1 in this section has been completed, Step 1.2 must be completed.

Step 1.2—Net carbon stock changes resulting from degradation or natural disturbance in carbon estimation area

(5) The net project carbon stock changes in all pools as a result of degradation or natural disturbance must be calculated using the following formula:

$$\Delta C_{DEG,i,r} = S_{DEG,i} \times \Delta \overline{C}_{DEG,i,r}$$

Equation 29

Where:

$\Delta C_{DEG,i,r}$ = net project carbon stock changes in all pools as a result of degradation or natural disturbance, in carbon estimation area (i) for reporting period (r) (tonnes of carbon dioxide equivalent).

$S_{DEG,i}$ = area of delineated degradation or natural disturbance event in the carbon estimation area (i) (hectares).

$\Delta \overline{C}_{DEG,i,r}$ = mean carbon stock changes in all pools from the degradation or natural disturbance event, in carbon estimation area (i) for reporting period (r) (tonnes of carbon dioxide equivalent per hectare).

i = carbon estimation area (i).

r = reporting period (r).

62 Step 2—Optional calculation of carbon stock enhancements

(1) Project carbon stock enhancements may be accounted for in accordance with this section.

Step 2.1—Biomass survey to determine current biomass carbon stocks in carbon estimation areas where carbon stock enhancements are occurring

(2) Each carbon estimation area for which carbon stock enhancements are calculated must be surveyed.

(3) The survey must:
   (a) meet the requirements of Subdivision 2; and

(b) achieve the Targeted Precision.

(4) The net carbon stock changes as a result of forest carbon stock enhancement must be calculated using the following formula:

$$\Delta C_{ENH,i,r} = (\bar{C}_{i,r} - \bar{C}_{i,pre}) \times S_{ENH,i}$$

Equation 30

Where:

$\Delta C_{ENH,i,r}$ = net carbon stock changes as a result of forest carbon stock enhancement in carbon estimation area (i) for reporting period (r) (tonnes of carbon dioxide equivalent).

$\bar{C}_{i,r}$ = mean carbon stock in all pools measured in carbon estimation area (i) for reporting period (r) (tonnes of carbon dioxide equivalent per hectare).

$\bar{C}_{i,pre}$ = mean carbon stock in all pools ($\bar{C}_{i,r}$) as reported at the time of the preceding offsets report in carbon estimation area (i).

$S_{ENH,i}$ = area of carbon estimation area (i) in which carbon stock enhancements are being undertaken and monitored (hectares).

i = carbon estimation area (i).

r = reporting period (r).

63 Step 3—Calculating project emissions

(1) The emissions resulting from fire events and the combustion of fossil fuels must be calculated in accordance with this section.

Step 3.1—Determination of emissions from degradation or natural disturbance events involving a fire event

Step 3.1.1—Determination of mass of biomass burnt from fires

(2) The biomass burnt from fires in each carbon estimation area must be determined using the following formula:

$$QB_{ft,i,r} = S_{burn,i,r} \times FL_i \times BE_{ft}$$

Equation 31

Where:

$QB_{ft,i,r}$ = biomass burned from fire type (ft) in carbon estimation area (i) for reporting period (r) (tonnes of biomass).

$S_{burn,i,r}$ = area burned in carbon estimation area (i) during reporting period (r) (hectares).

FL_i = fuel load of carbon estimation area (i) (tonnes of biomass per hectare) (specified in table 7.17 of the National Inventory Report, 2010: Volume 2).

BE_{ft} = burn efficiency for either controlled burning or wildfires (specified in table 7.19 of the National Inventory Report, 2010: Volume 2).

ft = fire type (ft), either wildfire or controlled burn.

i = carbon estimation area (i).

r = reporting period (r).

Step 3.1.2 – Determination of methane and nitrous oxide emissions from wildfires and controlled burns

(3) The methane and nitrous oxide emissions associated with each fire event must be determined using Equations 32, 33 and 34.

Step 3.1.2.1—Determination of methane emissions from fire events

$$E_{CH_4,ft,i,r} = QB_{ft,i,r} \times CF \times EF_{CH_4} \times GWP_{CH_4} \times M \qquad \textbf{Equation 32}$$

Step 3.1.2.2—Determination of nitrous oxide emissions from fire events

$$E_{N_2O,ft,i,r} = QB_{ft,i,r} \times CF \times NC \times EF_{N_2O} \times GWP_{N_2O} \times M \qquad \textbf{Equation 33}$$

Step 3.1.3—Determination of emissions from fire events

$$E_{f,i,r} = \sum_{ft} E_{CH_4,ft,i,r} + E_{N_2O,ft,i,r} \qquad \textbf{Equation 34}$$

Where:

$E_{f,i,r}$ = greenhouse gas emissions due to fire events in carbon estimation area (i) for reporting period (r) (tonnes of carbon dioxide equivalent).

$E_{CH_4,ft,i,r}$ = methane emissions due to fire events in carbon estimation area (i) for reporting period (r) (tonnes of carbon dioxide equivalent).

$E_{N_2O,ft,i,r}$ = nitrous oxide emissions due to fire events in carbon estimation area (i) for reporting period (r) (tonnes of carbon dioxide equivalent).

CF = 0.5, being the carbon mass fraction in vegetation.

EF_{CH_4} = emission factor for methane (CH_4), in tonnes element in species per tonnes element in fuel burnt, as given by the National Inventory Report.

EF_{N_2O} = emission factor for nitrous oxide (N_2O), in tonnes element in species per tonnes element in fuel burnt, as given by the National Inventory Report.

GWP_{CH_4} = Global warming potential for methane (CH_4) (tonnes of carbon dioxide per tonne of methane) as given by the NGER Regulations.

GWP_{N_2O} = Global warming potential for nitrous oxide (N_2O) (tonnes of carbon dioxide per tonne of methane) as given bythe NGER Regulations.

M = factor to convert elemental mass of gas species g to molecular mass (as given by table 7.22 of the National Inventory Report, 2010: Volume 2).

NC = 0.011, being the nitrogen to carbon ratio in biomass.

g = greenhouse gas methane (CH_4) or nitrous oxide (N_2O).

i = carbon estimation area (i).

r = reporting period (r).

ft = fire type (ft), either wildfire or controlled burn.

Step 3.2—Determine emissions from fossil fuel combustion

(4) The emissions from fuel use for each carbon estimation area during each reporting period must be calculated using the following formula:

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$$E_{FC,i,r} = \sum_{g} \sum_{a} E_{g,a,i,r}$$

Equation 35

Where:

$E_{FC,i,r}$ = net emissions of fuel consumption in carbon estimation area (i) for reporting period (r) (tonnes of carbon dioxide equivalent).

$E_{g,a,i,r}$ = emissions of greenhouse gas (g) from consumption of fuel type (a) for carbon estimation area (i) during reporting period (r) (tonnes of carbon dioxide equivalent).

a = fuel type (a) (e.g. diesel, Gasoline, etc.) as specified in Schedule 1, Part 4 of the *National Greenhouse and Energy Reporting (Measurement) Determination 2008*.

g = greenhouse gas type: carbon dioxide (CO_2), methane (CH_4) or nitrous oxide (N_2O).

i = carbon estimation area (i).

r = reporting period (r).

Step 3.3—Calculating emissions for fossil fuel types

(5) Emissions of carbon dioxide, methane and nitrous oxide from the consumption of fossil fuels for reporting period (r) must be calculated using the following formula:

$$E_{g,a,i,r} = \frac{FF_{a,i,r} \times ECF_a \times EF_{g,a}}{1000}$$

Equation 36

Where:

$E_{g,a,i,r}$ = emissions of greenhouse gas (g) from consumption of fuel type (a) for carbon estimation area (i) during reporting period (r) (tonnes of carbon dioxide equivalent).

$FF_{a,i,r}$ = the quantity of fossil fuel type (a) consumed in carbon estimation area (i) during reporting period (r) (kilolitres).

ECF_a = energy content factor of fossil fuel type (a) (gigajoules per kilolitre) determined in Schedule 1, Part 4 of the *National Greenhouse and Energy Reporting (Measurement) Determination 2008*.

$EF_{g,a}$ = emission factor for each gas type (g) for fossil fuel type (a) (kilograms of carbon dioxide equivalent per gigajoule) determined in Schedule 1, Part 4 of the *National Greenhouse and Energy Reporting (Measurement) Determination 2008*.

g = greenhouse gas type: carbon dioxide (CO_2), methane (CH_4) or nitrous oxide (N_2O).

a = fuel type (a) (e.g. diesel, Gasoline, etc.) as specified in Schedule 1, Part 4 of the *National Greenhouse and Energy Reporting (Measurement) Determination 2008*.

i = carbon estimation area (i).

r = reporting period (r).

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(6) The project greenhouse gas emissions during a reporting period must be calculated using the following formula:

$$E_{Pr,i,r} = E_{FC,i,r} + E_{f,i,r}$$ **Equation 37**

Where:

$E_{Pr,i,r}$ = project (Pr) greenhouse gas emissions, for carbon estimation area (i) for reporting period (r) (tonnes of carbon dioxide equivalent).

$E_{FC,i,r}$ = emissions from fossil fuel combustion in carbon estimation area (i) for reporting period (r) calculated in accordance with Equation 35 (tonnes of carbon dioxide equivalent).

$E_{f,i,r}$ = nitrous dioxide and methane emissions due to biomass burnt due to fires in carbon estimation area (i) for reporting period (r), calculated in accordance with Equation 34 (tonnes of carbon dioxide equivalent).

i = carbon estimation area (i).

r = reporting period (r).

64 Step 4—Calculating total net greenhouse gas project emissions at the end of the reporting period

(1) The total net greenhouse gas project emissions for each carbon estimation area at the end of the reporting period must be calculated using the following formula:

$$E_{Pr,r} = E_{Pr,r-1} + \left(\sum_i \Delta C_{DEG,i,r} + E_{Pr,i,r} - \Delta C_{ENH,i,r} \right)$$ **Equation 38**

Where:

$E_{Pr,r}$ = project (Pr) emissions (tonnes of carbon dioxide equivalent) in the project area calculated at the end of the current reporting period (r).

$\Delta C_{DEG,i,r}$ = net project carbon stock change as a result of any degradation events in the project area in carbon estimation area (i) during reporting period (r) (calculated in accordance with Equation 29) (tonnes of carbon dioxide equivalent).

$E_{Pr,i,r}$ = emissions within the project area in carbon estimation area (i) during reporting period (r) (calculated in accordance with Equation 37) (tonnes of carbon dioxide equivalent).

$\Delta C_{ENH,i,r}$ = net carbon stock change as a result of forest growth and sequestration during the project in areas projected to be deforested in the baseline in carbon estimation area (i) during reporting period (r) (calculated in accordance with Equation 30) (tonnes of carbon dioxide equivalent).

i = carbon estimation area (i).

r = current reporting period (r).

r-1 = previous reporting period (r-1).

(2) In subsection (1), $E_{Pr,r-1}$ is equal to zero (0) for the first reporting period (r=1).

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Subdivision 5—Calculating net abatement amounts

65 Net abatement amount

(1) The carbon dioxide equivalent net abatement amount for the project for the reporting period must be calculated in accordance with this Subdivision.

(2) The net greenhouse gas abatement in the crediting period, as calculated at the end of reporting period (r), must be calculated in accordance with the following formula:

$$CA_r = E_B - E_{Pr,r}$$	**Equation 39**

Where:

CA_r = net greenhouse gas abatement for the crediting period calculated at the end of current reporting period (r) (tonnes of carbon dioxide equivalent).

E_B = net greenhouse gas emissions in the baseline from planned deforestation (tonnes of carbon dioxide equivalent) as determined in accordance with Subdivision 3

$E_{Pr,r}$ = net project carbon dioxide equivalent emissions (tonnes of carbon dioxide equivalent) as determined in accordance with Subdivision 4.

(3) The project proponent must calculate the carbon dioxide equivalent net abatement amount A_r for each offsets report:

   (a) for the first reporting period under this determination – in accordance with Equation 40A; and

   (b) for subsequent reporting periods – in accordance with Equation 40B.

$$A_r = \left(\frac{CA_r - A_{AD}}{15 - t_{start} + R_r} \right) \times R_r$$	**Equation 40A**

$$A_r = \left(\frac{CA_r - A_{AD} - \sum_{rp=1}^{r-1} A_{rp}}{15 - t_{start} + R_r} \right) \times R_r$$	**Equation 40B**

Where:

A_r = carbon dioxide equivalent net abatement amount for the current reporting period r (tonnes of carbon dioxide equivalent).

CA_r = net greenhouse gas abatement for the crediting period calculated at the end of the current reporting period (tonnes of carbon dioxide equivalent).

A_{rp} = carbon dioxide equivalent net abatement amount (A_r) for each previous reporting period (rp) (tonnes of carbon dioxide equivalent) since project commencement (that is, not including the current reporting period).

A_{AD} = net greenhouse gas abatement already credited to projects under the *Carbon Credits (Carbon Farming Initiative)(Avoided Deforestation) Methodology Determination 2013* determined in accordance with subsection (4) (Equation 41).

t_{start} = number of years since project commencement.

R_r = number of years in the current reporting period (years).

Note 1   Only projects that were registered and credited under *Carbon Credits (Carbon Farming
           Initiative) (Avoided Deforestation) Methodology Determination 2013* will have a non-zero value
           for A_{AD}.

Note 1   Only projects that were registered and credited under *Carbon Credits (Carbon Farming
           Initiative) (Avoided Deforestation) Methodology Determination 2013* will have a non-zero value
           for A_{AD}.

Note 2   The number 15 represents the length of the crediting period.

(4) Project proponents must calculate the abatement already credited under *Carbon Credits
(Carbon Farming Initiative) (Avoided Deforestation) Methodology Determination 2013.*

$$A_{AD} = \dfrac{ACCU}{0.95}$$	**Equation 41**

Where:

A_{AD} =   net greenhouse gas abatement already credited to projects under the *Carbon
            Credits (Carbon Farming Initiative) (Avoided Deforestation) Methodology
            Determination 2013.*

ACCU =   the total number of Australian carbon credit units issued for the project in
         accordance with the *Carbon Credits (Carbon Farming Initiative) (Avoided
         Deforestation) Methodology Determination 2013.*

Note 1   0.95 is a constant which accounts for a risk of reversal buffer of 5%.

Note 2   Credits are not adjusted to account for any relinquished credits associated with adopting a 25-
           year permanence period.

Part 5—Reporting, record-keeping and monitoring requirements

Division 1—Offsets report requirements

66 Operation of this Division

For paragraph 106(3)(a) of the Act, this Division sets out information that must be
included in an offsets project report about an avoided deforestation project that is an
eligible offsets project.

67 Requirements for first offsets report

The first offsets report must include:
    (a) the baseline deforestation plan; and
    (b) evidence of the mix of species mentioned in subsection 12(2); and
    (c) the map referred to in section 24; and
    (d) the information specified in section 68.

68 Requirements for all offsets reports

If a carbon estimation area is re-stratified in accordance with section 23, the next offsets
report that is submitted to the Regulator must include the map referred to in section 24,
amended to show the new strata boundaries.

69 Determination of certain factors and parameters

If, in the circumstances described in paragraph 19(2)(b), a factor or parameter is defined
or calculated for a reporting period by reference to an instrument or writing as in force
from time to time, the offsets report about the project for the reporting period must
include the following information for the factor or parameter:

(a) the versions of the instrument or writing used;

(b) the start and end dates of each use;

(c) the reasons why it was not possible to define or calculate the factor or parameter by reference to the instrument or writing as in force at the end of the reporting period.

Division 2—Record-keeping requirements

70 Operation of this Division

For paragraph 106(3)(c) of the Act, this Division sets out record-keeping requirements for an avoided deforestation project that is an eligible offsets project.

71 Information relating to remotely-sensed imagery

Records must be kept in relation to each of the requirements for remotely-sensed imagery set out in section 22.

Division 3—Monitoring requirements

72 Operation of this Part

For paragraph 106(3)(d) of the Act, this Division sets out requirements to monitor an avoided deforestation project that is an eligible offsets project.

73 Monitoring for disturbance

(1) The project area must be monitored for disturbances in the course of each reporting period.

(2) For the purposes of subsection (1), remotely-sensed imagery of the project area must:

(a) be acquired no longer than one year before the submission of the next offsets report; and

(b) comply with the requirements in section 22.

Division 4—Reporting under section 77A of the Act

74 No division of carbon estimation area

For subsection 77A(2) of the Act, the division of the overall project must not result in the division of a carbon estimation area.

Schedule 1—Partitioning of biomass

Table 1.1: Partitioning of biomass (stems, branches, bark)

National Vegetation Information System Major Vegetation Groups	Biomass fraction to stems (fraction)	Biomass fraction to branches (fraction)	Biomass fraction to bark (fraction)
Rainforest and Vine Thickets	0.78	0.06	0.06
Eucalypt Tall Open Forest	0.67	0.09	0.1
Eucalypt Open Forest	0.45	0.12	0.1
Eucalypt Low Open Forest	0.45	0.12	0.1
Eucalypt Woodlands	0.44	0.15	0.1
Acacia Forest and Woodland	0.42	0.15	0.1
Callitris Forest And Woodland	0.42	0.15	0.1
Casuarina Forest and Woodland	0.42	0.15	0.1
Melaleuca Forest and Woodland	0.42	0.15	0.1
Other Forest and Woodlands	0.42	0.15	0.1
Tropical Eucalypt Woodland/Grassland	0.41	0.18	0.1
Eucalypt Open Woodland	0.41	0.18	0.1
Acacia Open Woodland	0.22	0.165	0.1
Mallee Woodland and Shrubland	0.22	0.165	0.1
Low Closed Forest and Closed Shrubland	0.22	0.165	0.1
Acacia Shrubland	0.22	0.165	0.1
Other Shrubland	0.22	0.165	0.1
Heath	0	0.3	0.18
Chenopod Shrub, Samphire Shrubland, Forbland	0	0.3	0.18
Unclassified Native Vegetation	0.39	0.14	0.09

Table 1.2: Partitioning of biomass (leaves, coarse roots and fine roots)

National Vegetation Information System Major Vegetation Groups	Biomass fraction to leaves (fraction)	Biomass fraction to coarse roots (fraction)	Biomass fraction to fine roots (fraction)	Root:shoot ratio
Rainforest and Vine Thickets	0.01	0.06	0.03	0.10
Eucalypt Tall Open Forest	0.02	0.08	0.04	0.14
Eucalypt Open Forest	0.02	0.25	0.06	0.45
Eucalypt Low Open Forest	0.02	0.25	0.06	0.45
Eucalypt Woodlands	0.02	0.23	0.06	0.41
Acacia Forest and Woodland	0.02	0.25	0.06	0.45
Callitris Forest and Woodland	0.02	0.16	0.15	0.45
Casuarina Forest and Woodland	0.02	0.25	0.06	0.45
Melaleuca Forest and Woodland	0.02	0.25	0.06	0.45
Other Forest and Woodlands	0.02	0.25	0.06	0.45
Tropical Eucalypt Woodland/Grassland	0.02	0.23	0.06	0.41
Eucalypt Open Woodland	0.02	0.23	0.06	0.41
Acacia Open Woodland	0.025	0.42	0.07	0.96
Mallee Woodland and Shrubland	0.025	0.42	0.07	0.96
Low Closed Forest and Closed Shrubland	0.025	0.42	0.07	0.96
Acacia Shrubland	0.025	0.25	0.24	0.96
Other Shrubland	0.025	0.25	0.24	0.96
Heath	0.03	0.25	0.24	0.96
Chenopod Shrub, Samphire Shrubland, Forbland	0.03	0.25	0.24	0.96
Unclassified Native Vegetation	0.02	0.25	0.11	0.56

Carbon Credits (Carbon Farming Initiative—Avoided Deforestation 1.1)
Methodology Determination 2015

Table 2: Burn Efficiency

	Stem	**Branch**	**Bark**	**Leaves**	**Coarse roots**	**Fine roots**
All National Vegetation Information System Major Vegetation Groups	0.9	0.9	0.95	0.95	0.8	0.7

Table 3: Decay Rate

	Leaves	**Stem**	**Branch**	**Bark**	**Coarse roots**	**Fine roots**
All National Vegetation Information System Major Vegetation Groups	1	0.1	0.1	0.5	0.1	0.3