Appendix A

The following is a South African patent written in collaboration with a local patent law firm. The patent was based on the research done for this thesis.

The patent reads as follows:

THIS INVENTION relates to ecological management. In particular, the invention provides a method of ameliorating the ecological effects of carbon emissions. The invention also relates to a system for calculating the quantity of carbon sequestered by a tree over a predetermined time period. The invention further extends to carbon credits for offsetting carbon emissions.

The invention provides a method of ameliorating the ecological effects of carbon emissions, which method includes providing carbon credits to an entity to offset a quantity of emitted carbon, the quantity of emitted carbon offset by the carbon credits being equal to a calculated quantity of carbon sequestered by an associated plurality of trees over a predetermined time period, the method including the step of calculating the quantity of carbon sequestered by each of the trees over the predetermined period by estimating the value of the stem circumference *(c)* of one of the trees at ground level at the end of the predetermined time period by use of the following equation:

$$c_i = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x_i + 1\right)\right)\right)\right\}$$

where:

c_i	=	the estimated value of the stem circumference of the i^{th} tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x_i	=	the value of the age of the i^{th} tree, in years,

and by using a value for *A* of 4.44032 - 4.72672, a value for *b* of 2.17927 - 2.70242, and a value for *MSE* of 0.11467 - 0.19853.

The stem circumference *(c)* is preferably estimated by using a point value for *A* of 4.58352, a point value for *b* of 2.44085, and a point value for *MSE* of 0.14804.

The method defined above is typically used when the trees in respect of which the quantity of sequestered carbon is calculated are of the species *Combretum erythrophyllum*. It should be appreciated, though, that the abovementioned values and equation could also be applied to trees of other species. In particular, the values given below for use in respect of trees of various associated species can be used for any tree which has a sufficiently similar size for such application to be made with botanical assurance.

By the natural logarithm is meant $\log_e$, also referred to as ln.

It will be appreciated that trees assimilate atmospheric carbon during their growth process. To curb carbon emissions, which serve to increase the atmospheric carbon concentration and contribute to global warming, industrially active entities may be set limits as to the quantity of carbon they are allowed to emit. Application of the method enables such entities to exercise the option of buying carbon credits in respect of trees which have been planted by themselves or by

others, thus increasing the quantity of carbon which that entity may emit by the quantity of carbon sequestered by the associated trees.

It should further be appreciated that the carbon credits relate to a predetermined time period, and that the quantity of carbon offset by the carbon credits is equal to the quantity of carbon sequestered by the associated trees over the predetermined period. If the predetermined period starts at planting of the trees, calculation of the quantity of carbon sequestered by the trees at the end of the period will provide the quantity of carbon emissions which the carbon credits permit. Otherwise, the quantity of carbon sequestered by the trees at the start of the period is subtracted from the quantity of carbon sequestered at the end of the period, to provide the total quantity of carbon sequestered by the trees in the predetermined period.

Stem circumference or stem diameter at ground level implies a measurement taken at 0 - 20 cm above the ground or appropriately measured above the basal swelling. Furthermore, the basic equation and associated values of *A*, *b* and *MSE* are intended for use in respect of trees having an age of up to about thirty years, with the accuracy of the equation declining for trees above that age. For trees of the species *Combretum Erythrophyllum*, the given equations are accurate up to an age of about 47 years, while the equations are accurate in respect of *Rhus lancea* up to 32 years and up to 15 years for *Rhus pendulina*.

The above equation implies a relationship between appropriately paired values of tree age and the stem circumference of a plurality of trees. By use of pre-estimated point values for *A*, *b* and *MSE*, an estimated stem circumference *(c)* for one of the trees can be found. It should be appreciated that the stem circumference which is estimated in this way represents the stem circumference of a tree which is statistically representative of the plurality of trees. This representative tree is referred to in the above equation as the i^{th} tree. In other embodiments of the invention, which are defined below, there is provided equations which describe a relationship between appropriately paired values of tree age and stem diameter.

The point values for *A*, *b*, and *MSE* are statistically the best estimates to use in estimating the stem circumference or stem diameter, as the case may be, of one of the plurality of trees, while the ranges of values for *A*, *b*, and *MSE* represent the 95% confidence intervals for each. It will be appreciated that the values of *A*, *b*, and *MSE* vary for different tree species. This applies also to the point values and to the value ranges for use in respect of the respective tree species.

The invention extends to a method of ameliorating the ecological effects of carbon emissions, which method includes providing carbon credits to an entity to offset a quantity of emitted carbon, the quantity of emitted carbon offset by the carbon credits being equal to a calculated quantity of carbon sequestered by an associated plurality of trees over a predetermined time period, the method including the step of calculating the quantity of carbon sequestered by each of the trees over the predetermined period by estimating the value of the stem circumference *(c)* of one of the trees at ground level at the end of the predetermined time period by use of the following equation:

$$c_i = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x_i + 1\right)\right)\right)\right\}$$

where:

c_i	=	the estimated value of the stem circumference of the i^{th} tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x_i	=	the value of the age of the i^{th} tree, in years,

and by using a value for *A* of 4.84110 - 5.01122, a value for *b* of 1.60305 - 1.89217, and a value for *MSE* of 0.044657 - 0.076904.

The stem circumference *(c)* may be estimated by using a point value for *A* of 4.92616, a point value for *b* of 1.74761, and a point value for *MSE* of 0.057522. The method defined above is typically used when the trees in respect of which the quantity of sequestered carbon is calculated are of the species *Rhus lancea*.

The invention further provides a method of ameliorating the ecological effects of carbon emissions, which method includes providing carbon credits to an entity to offset a quantity of emitted carbon, the quantity of emitted carbon offset by the carbon credits being equal to a calculated quantity of carbon sequestered by an associated plurality of trees over a predetermined time period, the method including the step of calculating the quantity of carbon sequestered by each of the trees over the predetermined period by estimating the value of the stem circumference *(c)* of one of the trees at ground level at the end of the predetermined time period by use of the following equation:

$$c_i = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x_i + 1\right)\right)\right)\right\}$$

where:

c_i	=	the estimated value of the stem circumference of the i^{th} tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x_i	=	the value of the age of the i^{th} tree, in years,

using a value for *A* of 4.32945 - 4.73904, a value for *b* of 1.91382 - 2.51685, and a value for *MSE* of 0.038070 - 0.074931.

The stem circumference *(c)* is preferably estimated by using a point value for *A* of 4.53425, a point value for *b* of 2.21533, and a point value for *MSE* of 0.051892.

The method defined above is typically used when the trees in respect of which the quantity of sequestered carbon is calculated are of the species *Rhus pendulina*.

It may sometimes be necessary to calculate the quantity of carbon sequestered by trees which are not of the species *Combretum erythrophyllum*, *Rhus pendulina*, or *Rhus lancea,* and of which the mean approximate tree size is not sufficiently similar to one of the abovementioned species to justify application of the equation and values for one of said species. In such case, values of *A, b* and *MSE* are used for an appropriate combination of the abovementioned three species.

The invention thus extends to a method of ameliorating the ecological effects of carbon emissions, which method includes providing carbon credits to an entity to offset a quantity of emitted carbon, the quantity of emitted carbon offset by the carbon credits being equal to a calculated quantity of carbon sequestered by an associated plurality of trees over a predetermined time period, the method including the step of calculating the quantity of carbon sequestered by each of the trees over the predetermined period by estimating the value of the stem circumference *(c)* of one of the trees at ground level at the end of the predetermined time period by use of the following equation:

$$c_i = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x_i + 1\right)\right)\right)\right\}$$

where:

c_i	=	the estimated value of the stem circumference of the i^{th} tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x_i	=	the value of the age of the i^{th} tree, in years,

using a value for *A* of 4.68409 - 4.85555, a value for *b* of 1.90258 - 2.20418, and a value for *MSE* of 0.093359 - 0.13699.

The stem circumference *(c)* is preferably estimated by using a point value for *A* of 4.76982, a point value for *b* of 2.05338, and a point value for *MSE* of 0.11204.

The method as defined above is typically used when the trees in respect of which the quantity of sequestered carbon is calculated are of a species of indigenous African savannah tree of which the mean approximate tree size lies between the mean approximate tree size of trees of the species *Combretum erythrophyllum* and the mean approximate tree size of trees of the species *Rhus lancea.*

The invention also extends to a method of ameliorating the ecological effects of carbon emissions, which method includes providing carbon credits to an entity to offset a quantity of emitted carbon, the quantity of emitted carbon offset by the carbon credits being equal to a calculated quantity of carbon sequestered by an associated plurality of trees over a predetermined time period, the method including the step of calculating the quantity of carbon sequestered by each of the trees over the predetermined period by estimating the value of the stem circumference *(c)* of one of the trees at ground level at the end of the predetermined time period by use of the following equation:

$$c_i = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x_i + 1\right)\right)\right)\right\}$$

where:

c_i	=	the estimated value of the stem circumference of the i^{th} tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x_i	=	the value of the age of the i^{th} tree, in years,

using a value for *A* of 4.79386 - 4.95424, a value for *b* of 1.65237 - 1.90861, and a value for *MSE* of 0.048428 - 0.073722.

The stem circumference *(c)* is typically estimated by using a point value for *A* of 4.87405, a point value for *b* of 1.78049, and a point value for *MSE* of 0.059088.

The method as defined above is typically used when the trees in respect of which the quantity of sequestered carbon is calculated are of a species of indigenous African savannah tree of which the mean approximate tree size is between the mean approximate tree size of trees of the species *Rhus pendulina* and the mean approximate tree size of trees of the species *Rhus lancea.*

The invention yet further provides a method of ameliorating the ecological effects of carbon emissions, which method includes providing carbon credits to an entity to offset a quantity of emitted carbon, the quantity of emitted carbon offset by the carbon credits being equal to a calculated quantity of carbon sequestered by an associated plurality of trees over a predetermined

time period, the method including the step of calculating the quantity of carbon sequestered by each of the trees over the predetermined period by estimating the value of the stem diameter *(d)* of one of the trees at ground level at the end of the predetermined time period by use of the following equation:

$$d_i = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x_i + 1\right)\right)\right)\right\}$$

where:

d_i	=	the estimated value of the stem diameter of the i^{th} tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x_i	=	the value of the age of the i^{th} tree, in years,

and by using a value for *A* of 3.29559 - 3.58199, a value for *b* of 2.17927 - 2.70242, and a value for *MSE* of 0.11467 - 0.19853.

The stem diameter *(d)* is preferably estimated by using a point value for *A* of 3.43879, a point value for *b* of 2.44085, and a point value for *MSE* of 0.14804.

The method defined above is typically used when the trees in respect of which the quantity of sequestered carbon is calculated are of the species *Combretum erythrophyllum*.

The invention also extends to a method of ameliorating the ecological effects of carbon emissions, which method includes providing carbon credits to an entity to offset a quantity of emitted carbon, the quantity of emitted carbon offset by the carbon credits being equal to a calculated quantity of carbon sequestered by an associated plurality of trees over a predetermined time period, the method including the step of calculating the quantity of carbon sequestered by each of the trees over the predetermined period by estimating the value of the stem diameter *(d)* of one of the trees at ground level at the end of the predetermined time period by use of the following equation:

$$d_i = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x_i + 1\right)\right)\right)\right\}$$

where:

d_i	=	the estimated value of the stem diameter of the i^{th} tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x_i	=	the value of the age of the i^{th} tree, in years,

using a value for *A* of 3.69637 - 3.86649, a value for *b* of 1.60305 - 1.89217, and a value for *MSE* of 0.044657 - 0.076904.

The stem diameter *(d)* is preferably estimated by using a point value for *A* of 3.78143, a point value for *b* of 1.74761, and a point value for *MSE* of 0.057522.

The method defined above is typically used when the trees in respect of which the quantity of sequestered carbon is calculated are of the species *Rhus lancea*.

The invention further provides a method of ameliorating the ecological effects of carbon emissions, which method includes providing carbon credits to an entity to offset a quantity of emitted carbon, the quantity of emitted carbon offset by the carbon credits being equal to a calculated quantity of carbon sequestered by an associated plurality of trees over a predetermined time period, the method including the step of calculating the quantity of carbon sequestered by each of the trees over the predetermined period by estimating the value of the stem diameter *(d)* of one of the trees at ground level at the end of the predetermined time period by use of the following equation:

$$d_i = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x_i + 1\right)\right)\right)\right\}$$

where:

d_i	=	the estimated value of the stem diameter of the i^{th} tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x_i	=	the value of the age of the i^{th} tree, in years,

and by using a value for *A* of 3.18472 - 3.59431, a value for *b* of 1.91382 - 2.51685, and a value for *MSE* of 0.038070 - 0.074931.

The stem diameter *(d)* is typically estimated by using a point value for *A* of 3.38952, a point value for *b* of 2.21533, and a point value for *MSE* of 0.051892.

The method defined above is typically used when the trees in respect of which the quantity of sequestered carbon is calculated are of the species *Rhus pendulina*.

The invention also provides a method of ameliorating the ecological effects of carbon emissions, which method includes providing carbon credits to an entity to offset a quantity of emitted carbon, the quantity of emitted carbon offset by the carbon credits being equal to a calculated quantity of carbon sequestered by an associated plurality of trees over a predetermined time period, the method including the step of calculating the quantity of carbon sequestered by each of the trees over the predetermined period by estimating the value of the stem diameter *(d)* of one of the trees at ground level at the end of the predetermined time period by use of the following equation:

$$d_i = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x_i + 1\right)\right)\right)\right\}$$

where:

d_i	=	the estimated value of the stem diameter of the i^{th} tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x_i	=	the value of the age of the i^{th} tree, in years,

and by using a value for *A* of 3.53936 - 3.71082, a value for *b* of 1.90258 - 2.20418, and a value for *MSE* of 0.093359 - 0.13699.

The stem diameter *(d)* is preferably estimated by using a point value for *A* of 3.62509, a point value for *b* of 2.05338, and a point value for *MSE* of 0.11204.

The method defined above is typically used when the trees in respect of which the

quantity of sequestered carbon is calculated are of a species of indigenous African savannah tree of which the mean approximate tree size lies between the mean approximate tree size of trees of the species *Combretum erythrophyllum* and the mean approximate tree size of trees of the species *Rhus lancea.*

The invention extends to a method of ameliorating the ecological effects of carbon emissions, which method includes providing carbon credits to an entity to offset a quantity of emitted carbon, the quantity of emitted carbon offset by the carbon credits being equal to a calculated quantity of carbon sequestered by an associated plurality of trees over a predetermined time period, the method including the step of calculating the quantity of carbon sequestered by each of the trees over the predetermined period by estimating the value of the stem diameter *(d)* of one of the trees at ground level at the end of the predetermined time period by use of the following equation:

$$d_i = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln(\ln(x_i + 1))\right)\right\}$$

where:

d_i	=	the estimated value of the stem diameter of the i^{th} tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x_i	=	the value of the age of the i^{th} tree, in years,

and by using a value for *A* of 3.64913 - 3.80951, a value for *b* of 1.65237 - 1.90861, and a value for *MSE* of 0.048428 - 0.073722.

The stem diameter *(d)* is preferably estimated by using a point value for *A* of 3.72932, a point value for *b* of 1.78049, and a point value for *MSE* of 0.059088.

The method as defined above is typically used when the trees in respect of which the quantity of sequestered carbon is calculated are of a species of indigenous African savannah tree of which the mean approximate tree size is between the mean approximate tree size of trees of the species *Rhus pendulina* and the mean approximate tree size of trees of the species *Rhus lancea.*

The estimated stem diameter at ground level *(d)* may be used to obtain an estimated stem circumference at ground level *(c)*.

Typically, the calculation of carbon sequestered by said one of the trees includes the intermediate step of calculating an aboveground dry biomass of said tree, preferably by use of the following equation:

$$\log TDM = 2.397(\log c) - 2.441$$

where:

TDM	=	the estimated aboveground dry biomass of the tree in kilograms; and
c	=	the stem circumference of the tree at ground level, in centimetres.

The method may include the step of calculating the quantity of carbon sequestered by said one of the trees by estimating a fraction of the calculated aboveground dry biomass of the tree which is constituted by sequestered carbon. Calculating the quantity of carbon sequestered by the tree may for instance be by multiplying the aboveground dry biomass (*TDM*) by a factor of 0.6 - 0.9, preferably by a factor of 0.7 - 0.8, and most preferably by a factor of 0.7533.

The abovementioned factor is arrived at by assuming that the total belowground dry biomass is equal to 65-87%, preferably 78% of the aboveground dry biomass (*TDM*). Furthermore, it is assumed that 3-10%, preferably 5.4% of aboveground dry biomass (TDM) is leaf- or foliage dry biomass and should be disregarded. It is estimated that 40-55%, preferably 45% of aboveground dry biomass (*TDM*) is comprised of carbon and in respect of belowground dry biomass, it is estimated that 40-55%, preferably 42% thereof comprises carbon. These estimates translate, when the preferred values are used, to a ratio of 0.7533 of sequestered carbon to aboveground dry biomass.

The method may include calculating the total quantity of carbon sequestered by one of the trees at the end of the predetermined time period, calculating the total quantity of carbon sequestered by that tree at the beginning of the predetermined time period, and subtracting the one calculated value from the other to find the total quantity of carbon sequestered by that tree in the predetermined time period.

Typically, the quantity of sequestered carbon is calculated simultaneously for a plurality of trees of the same species and of the same age, the calculated quantity of carbon sequestered by one of the trees over the predetermined time period being multiplied by the number of trees, to obtain the total quantity of carbon sequestered by the plurality of trees. It should be appreciated that the carbon sequestered by a plurality of trees of varying but similar ages may also be used, the age (*x*) used for this purpose being the mean age of the trees.

The method may include the prior step of planting the trees in respect of which the carbon credits are provided. The method may in such case further include cultivating the trees for the extent of the predetermined time period.

The method will further typically include receiving financial compensation, e.g. payment, in return for providing the carbon credits.

The invention also provides a system for calculating the quantity of carbon sequestered by a tree over a predetermined time period, the system being arranged to estimate the stem circumference *(c)* at ground level of the tree at the end of the time period by means of the following equation:

$$c = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x + 1\right)\right)\right)\right\}$$

where:

c	=	the estimated value of the stem circumference of the tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x	=	the value of the age of the tree, in years,

and by using a value for *A* of 4.44032 - 4.72672, a value for *b* of 2.17927 - 2.70242, and a value for *MSE* of 0.11467 - 0.19853.

The system is preferably arranged to calculate the stem circumference *(c)* by using a point value for *A* of 4.58352, a point value for *b* of 2.44085, and a point value for *MSE* of 0.14804. The system is typically arranged automatically to use said values for *A, b,* and *MSE* when the tree in respect of which the quantity of sequestered carbon is calculated is of the species *Combretum erythrophyllum*.

The invention yet further provides a system for calculating the quantity of carbon sequestered by a tree over a predetermined time period, the system being arranged to estimate the stem circumference *(c)* at ground level of the tree at the end of the time period by means of the

following equation:

$$c = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln(\ln(x+1))\right)\right\}$$

where:

c	=	the estimated value of the stem circumference of the tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x	=	the value of the age of the tree, in years,

and by using a value for *A* of 4.84110 - 5.01122, a value for *b* of 1.60305 - 1.89217, and a value for *MSE* of 0.044657 - 0.076904.

The system is preferably arranged to calculate the stem circumference *(c)* by using a point value for *A* of 4.92616, a point value for *b* of 1.74761, and a point value for *MSE* of 0.057522. The system is typically arranged automatically to use said values for *A, b,* and *MSE* when the tree in respect of which the quantity of sequestered carbon is calculated is of the species *Rhus lancea*.

The invention extends to a system for calculating the quantity of carbon sequestered by a tree over a predetermined time period, the system being arranged to estimate the stem circumference *(c)* at ground level of the tree at the end of the time period by means of the following equation:

$$c = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln(\ln(x+1))\right)\right\}$$

where:

c	=	the estimated value of the stem circumference of the tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x	=	the value of the age of the tree, in years,

and by using a value for *A* of 4.32945 - 4.73904, a value for *b* of 1.91382 - 2.51685, and a value for *MSE* of 0.038070 - 0.074931.

The system is preferably arranged to calculate the stem circumference *(c)* by using a point value for *A* of 4.53425, a point value for *b* of 2.21533, and a point value for *MSE* of 0.051892. The system is typically arranged automatically to use said values for *A, b,* and *MSE* when the tree in respect of which the quantity of sequestered carbon is calculated is of the species *Rhus pendulina*.

The invention further extends to a system for calculating the quantity of carbon sequestered by a tree over a predetermined time period, the system being arranged to estimate the stem circumference *(c)* at ground level of the tree at the end of the time period by means of the following equation:

$$c = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln(\ln(x+1))\right)\right\}$$

where:

c	=	the estimated value of the stem circumference of the tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x	=	the value of the age of the tree, in years,

and by using a value for *A* of 4.68409 - 4.85555, a value for *b* of 1.90258 - 2.20418, and a value for *MSE* of 0.093359 - 0.13699.

The system is preferably arranged to calculate the stem circumference *(c)* by using a point value for *A* of 4.76982, a point value for *b* of 2.05338, and a point value for *MSE* of 0.11204. The system is typically arranged automatically to use said values for *A, b,* and *MSE* when the tree in respect of which the quantity of sequestered carbon is calculated is of a species of indigenous African savannah tree of which the mean approximate tree size lies between the mean approximate tree size of trees of the species *Combretum erythrophyllum* and the mean approximate tree size of the trees of the species *Rhus lancea*.

The invention also provides a system for calculating the quantity of carbon sequestered by a tree over a predetermined time period, the system being arranged to estimate the stem circumference *(c)* at ground level of the tree at the end of the time period by means of the following equation:

$$c = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x + 1\right)\right)\right)\right\}$$

where:

c	=	the estimated value of the stem circumference of the tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x	=	the value of the age of the tree, in years,

and by using a value for *A* of 4.79386 - 4.95424, a value for *b* of 1.65237 - 1.90861, and a value for *MSE* of 0.048428 - 0.073722.

The system is preferably arranged to calculate the stem circumference *(c)* by using a point value for *A* of 4.87405, a point value for *b* of 1.78049, and a point value for *MSE* of 0.059088. The system is typically arranged automatically to use said values for *A, b,* and *MSE* when the tree in respect of which the quantity of sequestered carbon is calculated is of a species of indigenous African savannah tree of which the mean approximate tree size is between the mean approximate tree size of trees of the species *Rhus pendulina* and the mean approximate tree size of trees of the species *Rhus lancea.*

The invention yet further provides a system for calculating the quantity of carbon sequestered by a tree over a predetermined time period, the system being arranged to estimate the stem diameter *(d)* at ground level of the tree at the end of the time period by means of the following equation:

$$d = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x + 1\right)\right)\right)\right\}$$

where:

d	=	the estimated value of the stem diameter of the tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x	=	the value of the age of the tree, in years,

and by using a value for *A* of 3.29559 - 3.58199, a value for *b* of 2.17927 - 2.70242, and a value for *MSE* of 0.11467 - 0.19853.

The system is preferably arranged to calculate the stem diameter *(d)* by using a point value for *A* of 3.43879, a point value for *b* of 2.44085, and a point value for *MSE* of 0.14804. The system is typically arranged automatically to use said values for *A, b,* and *MSE* when the tree in respect of which the quantity of sequestered carbon is calculated is of the species *Combretum erythrophyllum*.

The invention also extends to a system for calculating the quantity of carbon sequestered by a tree over a predetermined time period, the system being arranged to estimate the stem diameter *(d)* at ground level of the tree at the end of the time period by means of the following equation:

$$d = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x+1\right)\right)\right)\right\}$$

where:

d	=	the estimated value of the stem diameter of the tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x	=	the value of the age of the tree, in years,

and by using a value for *A* of 3.69637 - 3.86649, a value for *b* of 1.60305 - 1.89217, and a value for *MSE* of 0.044657 - 0.076904.

The system is preferably arranged to calculate the stem diameter *(d)* by using a point value for *A* of 3.78143, a point value for *b* of 1.74761, and a point value for *MSE* of 0.057522. The system is typically arranged automatically to use said values for *A, b,* and *MSE* when the tree in respect of which the quantity of sequestered carbon is calculated is of the species *Rhus lancea*.

The invention further provides a system for calculating the quantity of carbon sequestered by a tree over a predetermined time period, the system being arranged to estimate the stem diameter *(d)* at ground level of the tree at the end of the time period by means of the following equation:

$$d = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x+1\right)\right)\right)\right\}$$

where:

d	=	the estimated value of the stem diameter of the tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x	=	the value of the age of the tree, in years,

and by using a value for *A* of 3.18472 - 3.59431, a value for *b* of 1.91382 - 2.51685, and a value for *MSE* of 0.038070 - 0.074931.

The system is preferably arranged to calculate the stem diameter *(d)* by using a point value for *A* of 3.38952, a point value for *b* of 2.21533, and a point value for *MSE* of 0.051892. The system is typically arranged automatically to use said values for *A, b,* and *MSE* when the tree in respect of which the quantity of sequestered carbon is calculated is of the species *Rhus pendulina*.

The invention yet further extends to a system for calculating the quantity of carbon sequestered by a tree over a predetermined time period, the system being arranged to estimate the stem diameter *(d)* at ground level of the tree at the end of the time period by means of the following equation:

$$d = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x + 1\right)\right)\right)\right\}$$

where:

d	=	the estimated value of the stem diameter of the tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x	=	the value of the age of the tree, in years,

and by using a value for *A* of 3.53936 - 3.71082, a value for *b* of 1.90258 - 2.20418, and a value for *MSE* of 0.093359 - 0.13699.

The system is preferably arranged to calculate the stem diameter *(d)* by using a point value for *A* of 3.62509, a point value for *b* of 2.05338, and a point value for *MSE* of 0.11204. The system is typically arranged automatically to use said values for *A, b,* and *MSE* when the tree in respect of which the quantity of sequestered carbon is calculated is of a species of indigenous African savannah tree of which the mean approximate tree size lies between the mean approximate tree size of trees of the species *Combretum erythrophyllum* and the mean approximate tree size of trees of the species *Rhus lancea*.

The invention also provides a system for calculating the quantity of carbon sequestered by a tree over a predetermined time period, the system being arranged to estimate the stem diameter *(d)* at ground level of the tree at the end of the time period by means of the following equation:

$$d = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x + 1\right)\right)\right)\right\}$$

where:

d	=	the estimated value of the stem diameter of the tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x	=	the value of the age of the tree, in years,

and by using a value for *A* of 3.64913 - 3.80951, a value for *b* of 1.65237 - 1.90861, and a value for *MSE* of 0.048428 - 0.073722.

The system is preferably arranged to calculate the stem diameter *(d)* by using a

point value for *A* of 3.72932, a point value for *b* of 1.78049, and a point value for *MSE* of 0.059088. The system is typically arranged automatically to use said values for *A, b,* and *MSE* when the tree in respect of which the quantity of sequestered carbon is calculated is of a species of indigenous African savannah tree of which the mean approximate tree size is between the mean approximate tree size of trees of the species *Rhus pendulina* and the mean approximate tree size of trees of the species *Rhus lancea.*

In instances where the system is arranged to calculate the stem diameter at ground level, the system will preferably be arranged to convert the calculated stem diameter at ground level *(d)* to a corresponding stem circumference at ground level *(c)*.

The system may be arranged to calculate an aboveground dry biomass of the tree as an intermediate step to calculating the quantity of carbon sequestered by the tree, preferably by means of the following equation:

$$\log TDM = 2.397(\log c) - 2.441$$

where:

TDM	=	the estimated aboveground dry biomass of the tree in kilograms; and
c	=	the stem circumference of the tree at ground level, in centimetres.

The system may advantageously be arranged to calculate the quantity of carbon sequestered by the tree by estimating a fraction of the calculated dry biomass of the tree which is constituted by sequestered carbon. The system may thus be arranged to calculate the quantity of carbon sequestered by multiplying the estimated aboveground dry biomass (*TDM*) by a factor of 0.6 - 0.9, preferably by a factor of 0.7 - 0.8, and most preferably be a factor of 0.7533.

The system may further be arranged to calculate the quantity of carbon sequestered by the tree at the end of the predetermined time period, to calculate the total quantity of carbon sequestered by the tree at the beginning of the predetermined time period, and to subtract the one calculated value from the other to find the total quantity of carbon sequestered by the tree in the predetermined time period.

Conveniently, the system may be arranged to calculate the quantity of carbon sequestered by a plurality of trees of the same species and of the same age by multiplying the calculated quantity of carbon sequestered by one of the trees by the number of trees. As explained above, the system may instead be used for a plurality of trees of varying but closely related ages.

Typically, the system comprises an electronic processor and a computer program which contains computer readable instructions for enabling the processor to calculate the quantity of carbon sequestered by a tree or by a plurality of trees, when the program is executed on the processor. The system will thus typically have input means for receiving input from a user, and display means for displaying a calculated quantity of sequestered carbon. The system may preferably be arranged to receive input as to the species of the tree/trees in question, the age of the tree/trees at the start and at the end of the predetermined time period respectively, and the number of trees. The electronic processor, through operation of the computer program, then automatically calculates the quantity of carbon sequestered by the said trees in the time period.

The invention yet further provides carbon credits for offsetting or permitting a particular quantity of carbon emissions, the carbon credits relating to a plurality of trees which sequester carbon over a specific period of time, the particular quantity of emitted carbon permitted or offset by each of the trees being equal to 0.6 - 0.9 times the aboveground dry biomass of the tree, the aboveground dry biomass (*TDM*) of the tree, in kilograms, being such as to satisfy the equation:

$$\log TDM = 2.397(\log c) - 2.441$$

where:

c = the stem circumference of the tree at ground level, in centimetres, and c equals:

$$EXP\left\{\frac{MSE}{2}+\left(A+b.\ln\left(\ln\left(x+1\right)\right)\right)\right\}$$

wherein:

x = the age of said one of the trees at the end of the period, in years,

a set of values for *A, b* and *MSE* being selected from the group of value sets comprising:

A = 4.58352, *b* = 2.44085, *MSE* = 0.14804;
A = 4.92616, *b* = 1.74761, *MSE* = 0.057522;
A = 4.53425, *b* = 2.21533, *MSE* = 0.051892;
A = 4.76982, *b* = 2.05338, *MSE* = 0.11204; and
A = 4.87405, *b* = 1.78049, *MSE* = 0.059088.

It should be appreciated that the values for *A, b* and *MSE* are selected from one of the five listed groups of value sets, and that the combination of values in different value sets does not form part of the invention.

The particular quantity of carbon offset by the carbon credits for each tree may be equal to 0.7 - 0.8 times the aboveground dry biomass (*TDM*) of the tree. Preferably, the particular quantity of carbon offset by the carbon credits for each tree is equal to about 0.75 times the aboveground dry biomass (*TDM*) of the tree, most preferably being equal to 0.7533 times the aboveground dry biomass (*TDM*) of the tree.

The carbon credits will typically relate to a plurality of trees of a species of African Savannah tree. When the carbon credits relate to a plurality of trees of the species *Combretum erythrophyllum,* the values of *A, b* and *MSE* will typically be equal to 4.58352, 2.44085 and 0.14804 respectively.

In cases where the carbon credits relate to a plurality of trees of the species *Rhus lancea*, the values of *A, b* and *MSE* will typically be 4.92616, 1.74761 and 0.057522 respectively. However, when the carbon credits relate to a plurality of trees of the species *Rhus pendulina,* the values of *A, b* and *MSE* will preferably be equal to 4.53425, 2.21533 and 0.051892 respectively.

In cases where the carbon credits relate to a plurality of trees of a species of indigenous South African Savannah tree of which the mean approximate tree size is between the mean approximate tree size of trees of the species *Combretum erythrophyllum* and the mean approximate tree size of trees of the species *Rhus lancea*, the values of *A, b* and *MSE* may be equal to 4.76982, 2.05338 and 0.11204 respectively. Instead, in cases where the carbon credits relate to a plurality of trees of a species of indigenous South African Savannah tree of which the mean approximate tree size is between the mean approximate tree size of trees of the species *Rhus lancea* and the mean approximate tree size of trees of the species *Rhus pendulina,* the values of *A, b* and *MSE* may be equal to 4.87405, 1.78049 and 0.059088 respectively.

As explained above, the carbon credits may relate to a quantity of carbon equal to the quantity of carbon sequestered by a representative one of the trees multiplied by the total number of trees.

The invention will now be further described, by way of example.

In this example, a city Municipality plants 500 trees of the African Savannah species *Combretum erythrophyllum*. As an additional source of revenue, the Municipality wishes to sell carbon credits in respect of these trees to an entity, typically a manufacturing company, which emits

carbon during manufacture of its products.

It will be appreciated that in terms of international protocols and national guidelines, such companies may be restricted as to the quantity of carbon which may be emitted, and purchase of carbon credits by such a company will serve to offset a particular quantity of carbon emissions, thus increasing the quantity of carbon which the company may emit. It will further be appreciated that, during the growth of a tree, carbon is sequestered from the atmosphere in biochemical processes, thus increasing the dry biomass of the tree, and it is this carbon sequestration which forms the basis for allowing the company to increase its carbon emissions in return for obtaining carbon credits from the Municipality. The total quantity of carbon offset by the carbon credits will thus be equal to the quantity of carbon sequestered by the trees.

The carbon credits are time-based, in that they apply to a predetermined time period. The quantity of carbon emissions offset by the carbon credits is thus equal to the quantity of carbon sequestered by the trees over the predetermined time period. Thus, when the carbon credits apply to, for instance, the first five years of the life of the trees, the total sequestered carbon in the trees at the end of the five years will be offset. However, when the predetermined time period, for instance, applies to years 5 - 10 of the trees' life, the carbon credits will offset the difference between the sequestered carbon at ten years and the sequestered carbon at five years.

In this example, the quantity of carbon offset by the carbon credits relating to the abovementioned 500 *Combretum erythrophyllum* trees is calculated by use of a system for calculating carbon sequestered by the trees. The system comprises an electronic processor provided by a conventional desktop personal computer, and a computer program loaded on the computer. The computer program contains program instructions for enabling the processor of the computer to perform calculation of the quantity of carbon sequestered by the trees, as is explained in more detail below.

When the computer program is executed on the computer, a user is prompted to enter the species of trees in respect of which the sequestered carbon is to be calculated, the number of trees, and the age of the trees at the start and at the end of the time period respectively. In this case, the user will thus enter or select *Combretum erythrophyllum*; 500 trees; an end age of 5 years and a start age of 0 years. The computer then automatically calculates the quantity of carbon sequestered by the trees, and displays the result of this calculation on a display screen.

The computer program is arranged to calculate the quantity of sequestered carbon with reference to the following equation, established by P.J. Peper, E.G. McPherson and S.M. Mori:

$$c = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln(\ln(x+1))\right)\right\} \quad \text{..... (1)}$$

where:

c	=	the estimated stem circumference of one of the trees at ground level, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x	=	the value of the age of the tree, in years.

It should be appreciated that the computer program can be arranged to estimate either the stem circumference *(c)* of one of the trees at ground level, or to estimate the stem diameter *(d)* at ground level. In this example, the stem circumference *(c)* is calculated. Furthermore, the values of *A, b,* and *MSE* vary from species to species, and the computer automatically assigns appropriate values to these constants with reference to Table 1 below:

Species	*A*	*b*	*MSE*
Combretum erythrophyllum	4.58352	2.44085	0.14804
Rhus lancea	4.92616	1.74761	0.057522
Rhus pendulina	4.53425	2.21533	0.051892
Combined *C. erythrophyllum* *R. lancea*	4.76982	2.05338	0.11204
Combined *R. lancea* and *R. pendulina*	4.87405	1.78049	0.059088

Table 1

Naturally, these constants will also be different when the computer program is arranged to calculate the stem diameter *(d)* of one of the trees. The respective values of the constants for such a case are set out in Table 2 below.

Use of equation (1) for *Combretum erythrophyllum* at age 5 years, automatically using 4.58352 for *A*, 2.44085 for *b*, and 0.14804 for *MSE*, renders a stem circumference of 437.5 mm, or 43.75 cm. Thereafter, the computer automatically uses the following equation, presented by C.M. Shackleton for South African savannah trees, to calculate the aboveground dry biomass of one of the trees:

$$\log TDM = 2.397(\log c) - 2.441 \quad \text{..... (2)}$$

where:

TDM = the estimated aboveground dry biomass of the tree in kilograms; and
c = the stem circumference of the tree at ground level, in centimetres.

This results in an estimated aboveground dry biomass (*TDM*) of 31.07 kilograms. It should be borne in mind that carbon is sequestered not only to form aboveground dry biomass (*TDM*), but also to form roots or belowground dry biomass of the tree. The belowground dry biomass (*RDM*), also referred to as root dry matter, of the tree is estimated to be equal to 0.78 x *TDM*, in this case being equal to 24.24 kilograms. It is estimated that 45% of the aboveground dry biomass (*TDM*) consists of carbon, while an estimated 5.4% of aboveground dry biomass (*TDM*) consists of leaves and foliage, which should be disregarded. The aboveground carbon (*AGC*) of one of the trees is thus equal to 0.45(*TDM* - (0.054x*TDM*)) = 13.23 kilograms. The root carbon (*RC*) is estimated to be equal to 42% of the belowground dry biomass (*RDM*), thus being equal to 10.18 kilograms.

The total carbon sequestered by one of the trees is equal to the sum of the root carbon (*RC*) and the aboveground carbon (*AGC*), thus being equal to 23.41 kilograms. It will be appreciated that the total quantity of carbon sequestered by the tree is thus equal to about 0.7533 times the aboveground dry biomass (*TDM*), and that this ratio remains the same for any calculation.

This calculated quantity of carbon sequestered by one of the trees is multiplied by the total number of trees, i.e. 500, to reach a total quantity of sequestered carbon of 11703 kilograms. The Municipality thereafter sells carbon credits to the quantity of 11.70 metric tons of carbon to the manufacturing company, to offset this quantity of emissions by the company.

Carbon emission and sequestrations are sometimes calculated and/or reported in terms of a corresponding quantity of carbon dioxide (CO_2), and to this end, the calculated total

quantity of carbon may be multiplied by a factor of 3.67, to obtain the quantity of carbon dioxide which may be emitted in return for purchase of the carbon credits. In this example, the quantity of permitted carbon dioxide emissions will be 42.95 metric tons of CO_2.

It should be appreciated that, although calculation of the quantity of sequestered carbon is performed by the computer in this example, the calculation can be performed manually in other examples. For ease of description, the results of the various equations in the above example are shown to have been rounded off, but it should be appreciated that no rounding off will typically take place when using one result to calculate the next.

In another example of the invention, the Municipality plants 200 trees of the species *Rhus leptodictya*. In this example, the carbon credits relate to a ten year period commencing when the trees are five years of age. As in the example above, a user enters into the computer data in the respective data fields, in particular entering a value of 200 for the number of trees, a value of 5 for the start of the time period, and a value of 15 for the end of the time period.

Since the trees are of a species for which there are no specific values for *A, b,* and *MSE*, respective values for a combination of *Rhus lancea* and *Rhus pendulina* are used. These values are used in this example because the mean approximate tree size of trees of the species *Rhus leptodictya* lies between the mean approximate tree size of trees of the specie *Rhus lancea* and trees of the species *Rhus pendulina*.

The computer automatically assigns the values for *A, b,* and *MSE* according to Table 2 below, the computer in this example being arranged to estimate a stem diameter *(d)* of one of the trees at ground level at the start and at the end of the period.

Species	*A*	*b*	*MSE*
Combretum erythrophyllum	3.43879	2.44085	0.14804
Rhus lancea	3.78143	1.74761	0.057522
Rhus pendulina	3.38952	2.21533	0.051892
Combined *C. erythrophyllum R. lancea*	3.62509	2.05338	0.11204
Combined *R. lancea R pendulina*	3.72932	1.78049	0.059088

Table 2

The following equation is used to calculate the respective stem diameters:

$$d = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x + 1\right)\right)\right)\right\} \quad \text{.....(3)}$$

where:

d	=	the estimated value of the diameter of the tree at ground level, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x	=	the value of the age of the tree, in years.

When the values of 3.72932 for *A*, 1.78049 for *b*, and 0.059088 for *MSE*, which are

automatically assigned by the computer, are used in equation (3) above, an estimated stem diameter *(d)* of 121.18 mm is obtained. Assuming a circular stem cross-section, the circumference of the tree at five years of age is thus 38.07 centimetres.

Use of equation (2) for this stem circumference, results in an estimated aboveground dry biomass (*TDM*) of 22.27 kilograms. Multiplication of the calculated aboveground dry biomass (*TDM*) with a factor of 0.7533, as explained above, provides a total quantity of carbon sequestered by one of the trees at age five of 16.77 kilograms.

Similar calculation of the total carbon sequestered by one of the trees at age fifteen provides 108.09 kilograms. The difference between these two values indicates the total quantity of carbon sequestered by one of the trees during the ten year period to which the carbon credits apply, thus equaling 91.32 kilograms. In total, the 200 trees thus sequestered 18.26 metric tons of carbon, and the carbon credits sold in respect of these trees offsets an equal quantity of carbon emissions.

CLAIMS

1. A method of ameliorating the ecological effects of carbon emissions, which method includes providing carbon credits to an entity to offset a quantity of emitted carbon, the quantity of emitted carbon offset by the carbon credits being equal to a calculated quantity of carbon sequestered by an associated plurality of trees over a predetermined time period, the method including the step of calculating the quantity of carbon sequestered by each of the trees over the predetermined period by estimating the value of the stem circumference *(c)* of one of the trees at ground level at the end of the predetermined time period by use of the following equation:

$$c_i = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x_i + 1\right)\right)\right)\right\}$$

where:

c_i	=	the estimated value of the stem circumference of the i^{th} tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x_i	=	the value of the age of the i^{th} tree, in years,

and by using a value for *A* of 4.44032 - 4.72672, a value for *b* of 2.17927 - 2.70242, and a value for *MSE* of 0.11467 - 0.19853.

2. A method as claimed in claim 1, in which the stem circumference *(c)* is estimated by using a point value for *A* of 4.58352, a point value for *b* of 2.44085, and a point value for *MSE* of 0.14804.

3. A method as claimed in claim 1 or claim 2, in which the trees in respect of which the quantity of sequestered carbon is calculated are of the species *Combretum erythrophyllum*.

4. A method of ameliorating the ecological effects of carbon emissions, which method includes providing carbon credits to an entity to offset a quantity of emitted carbon, the quantity of emitted carbon offset by the carbon credits being equal to a calculated quantity of carbon sequestered by an associated plurality of trees over a predetermined time period, the method including the step of calculating the quantity of carbon sequestered by each of the trees over the predetermined period by estimating the value of the stem circumference *(c)* of one of the trees at ground level at the end of the predetermined time period by use of the following equation:

$$c_i = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x_i + 1\right)\right)\right)\right\}$$

where:

c_i	=	the estimated value of the stem circumference of the i^{th} tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x_i	=	the value of the age of the i^{th} tree, in years,

and by using a value for *A* of 4.84110 - 5.01122, a value for *b* of 1.60305 - 1.89217, and a value for *MSE* of 0.044657 - 0.076904.

5. A method as claimed in claim 4, in which the stem circumference *(c)* is estimated by using a point value for *A* of 4.92616, a point value for *b* of 1.74761, and a point value for *MSE* of 0.057522.

6. A method as claimed in claim 4 or claim 5, in which the trees in respect of which the quantity of sequestered carbon is calculated are of the species *Rhus lancea*.

7. A method of ameliorating the ecological effects of carbon emissions, which method includes providing carbon credits to an entity to offset a quantity of emitted carbon, the quantity of emitted carbon offset by the carbon credits being equal to a calculated quantity of carbon sequestered by an associated plurality of trees over a predetermined time period, the method including the step of calculating the quantity of carbon sequestered by each of the trees over the predetermined period by estimating the value of the stem circumference *(c)* of one of the trees at ground level at the end of the predetermined time period by use of the following equation:

$$c_i = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x_i + 1\right)\right)\right)\right\}$$

where:

c_i	=	the estimated value of the stem circumference of the i^{th} tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x_i	=	the value of the age of the i^{th} tree, in years,

using a value for *A* of 4.32945 - 4.73904, a value for *b* of 1.91382 - 2.51685, and a value for *MSE* of 0.038070 - 0.074931.

8. A method as claimed in claim 7, in which the stem circumference *(c)* is estimated by using a point value for *A* of 4.53425, a point value for *b* of 2.21533, and a point value for *MSE* of 0.051892.

9. A method as claimed in claim 7 or claim 8, in which the trees in respect of which the quantity of sequestered carbon is calculated are of the species *Rhus pendulina*.

10. A method of ameliorating the ecological effects of carbon emissions, which method includes providing carbon credits to an entity to offset a quantity of emitted carbon, the quantity of emitted carbon offset by the carbon credits being equal to a calculated quantity of carbon sequestered by an associated plurality of trees over a predetermined time period, the method including the step of calculating the quantity of carbon sequestered by each of the trees over the predetermined period by estimating the value of the stem circumference *(c)* of one of the trees at ground level at the end of the predetermined time period by use of the following equation:

$$c_i = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x_i + 1\right)\right)\right)\right\}$$

where:

c_i	=	the estimated value of the stem circumference of the i^{th} tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x_i	=	the value of the age of the i^{th} tree, in years,

using a value for *A* of 4.68409 - 4.85555, a value for *b* of 1.90258 - 2.20418, and a value for *MSE* of 0.093359 - 0.13699.

11. A method as claimed in claim 10, in which the stem circumference *(c)* is estimated by using a point value for *A* of 4.76982, a point value for *b* of 2.05338, and a point value for *MSE* of 0.11204.

12. A method as claimed in claim 10 or claim 11, in which the trees in respect of which the quantity of sequestered carbon is calculated are of a species of indigenous African savannah tree of which the mean approximate tree size lies between the mean approximate tree size of trees of the species *Combretum erythrophyllum* and the mean approximate tree size of trees of the species *Rhus lancea.*

13. A method of ameliorating the ecological effects of carbon emissions, which method includes providing carbon credits to an entity to offset a quantity of emitted carbon, the quantity of emitted carbon offset by the carbon credits being equal to a calculated quantity of carbon sequestered by an associated plurality of trees over a predetermined time period, the method including the step of calculating the quantity of carbon sequestered by each of the trees over the predetermined period by estimating the value of the stem circumference *(c)* of one of the trees at ground level at the end of the predetermined time period by use of the following equation:

$$c_i = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x_i + 1\right)\right)\right)\right\}$$

where:

c_i	=	the estimated value of the stem circumference of the i^{th} tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x_i	=	the value of the age of the i^{th} tree, in years,

using a value for *A* of 4.79386 - 4.95424, a value for *b* of 1.65237 - 1.90861, and a value for *MSE* of 0.048428 - 0.073722.

14. A method as claimed in claim 13, in which the stem circumference *(c)* is estimated by using a point value for *A* of 4.87405, a point value for *b* of 1.78049, and a point value for *MSE* of 0.059088.

15. A method as claimed in claim 13 or claim 14, in which the trees in respect of which the quantity of sequestered carbon is calculated are of a species of indigenous African savannah tree of which the mean approximate tree size is between the mean approximate tree size of trees of the species *Rhus pendulina* and the mean approximate tree size of trees of the species *Rhus lancea.*

16. A method of ameliorating the ecological effects of carbon emissions, which method includes providing carbon credits to an entity to offset a quantity of emitted carbon, the quantity of emitted carbon offset by the carbon credits being equal to a calculated quantity of carbon sequestered by an associated plurality of trees over a predetermined time period, the method including the step of calculating the quantity of carbon sequestered by each of the trees over the predetermined period by estimating the value of the stem diameter *(d)* of one of the trees at ground level at the end of the predetermined time period by use of the following equation:

$$d_i = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x_i + 1\right)\right)\right)\right\}$$

where:

d_i	=	the estimated value of the stem diameter of the i^{th} tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x_i	=	the value of the age of the i^{th} tree, in years,

and by using a value for *A* of 3.29559 - 3.58199, a value for *b* of 2.17927 - 2.70242, and a value for *MSE* of 0.11467 - 0.19853.

17. A method as claimed in claim 16, in which the stem diameter *(d)* is estimated by using a point value for *A* of 3.43879, a point value for *b* of 2.44085, and a point value for *MSE* of 0.14804.

18. A method as claimed in claim 16 or claim 17, in which the trees in respect of which the quantity of sequestered carbon is calculated are of the species *Combretum erythrophyllum*.

19. A method of ameliorating the ecological effects of carbon emissions, which method includes providing carbon credits to an entity to offset a quantity of emitted carbon, the quantity of emitted carbon offset by the carbon credits being equal to a calculated quantity of carbon sequestered by an associated plurality of trees over a predetermined time period, the method including the step of calculating the quantity of carbon sequestered by each of the trees over the predetermined period by estimating the value of the stem diameter *(d)* of one of the trees at ground level at the end of the predetermined time period by use of the following equation:

$$d_i = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x_i + 1\right)\right)\right)\right\}$$

where:

d_i	=	the estimated value of the stem diameter of the i^{th} tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x_i	=	the value of the age of the i^{th} tree, in years,

using a value for *A* of 3.69637 - 3.86649, a value for *b* of 1.60305 - 1.89217, and a value for *MSE* of 0.044657 - 0.076904.

20. A method as claimed in claim 19, in which the stem diameter *(d)* is estimated by using a point value for *A* of 3.78143, a point value for *b* of 1.74761, and a point value for *MSE* of 0.057522.

21. A method as claimed in claim 19 or claim 20, in which the trees in respect of which the quantity of sequestered carbon is calculated are of the species *Rhus lancea*.

22. A method of ameliorating the ecological effects of carbon emissions, which method includes providing carbon credits to an entity to offset a quantity of emitted carbon, the quantity of emitted carbon offset by the carbon credits being equal to a calculated quantity of carbon sequestered by an associated plurality of trees over a predetermined time period, the method including the step of calculating the quantity of carbon sequestered by each of the trees over the predetermined period by estimating the value of the stem diameter *(d)* of one of the trees at ground level at the end of the predetermined time period by use of the following equation:

$$d_i = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x_i + 1\right)\right)\right)\right\}$$

where:

d_i	=	the estimated value of the stem diameter of the i^{th} tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x_i	=	the value of the age of the i^{th} tree, in years,

and by using a value for *A* of 3.18472 - 3.59431, a value for *b* of 1.91382 - 2.51685, and a value for *MSE* of 0.038070 - 0.074931.

23. A method as claimed in claim 22, in which the stem diameter *(d)* is estimated by using a point value for *A* of 3.38952, a point value for *b* of 2.21533, and a point value for *MSE* of 0.051892.

24. A method as claimed in claim 22 or claim 23, in which the trees in respect of which the quantity of sequestered carbon is calculated are of the species *Rhus pendulina*.

25. A method of ameliorating the ecological effects of carbon emissions, which method includes providing carbon credits to an entity to offset a quantity of emitted carbon, the quantity of emitted carbon offset by the carbon credits being equal to a calculated quantity of carbon sequestered by an associated plurality of trees over a predetermined time period, the method including the step of calculating the quantity of carbon sequestered by each of the trees over the predetermined period by estimating the value of the stem diameter *(d)* of one of the trees at ground level at the end of the predetermined time period by use of the following equation:

$$d_i = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x_i + 1\right)\right)\right)\right\}$$

where:

d_i	=	the estimated value of the stem diameter of the i^{th} tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x_i	=	the value of the age of the i^{th} tree, in years,

and by using a value for *A* of 3.53936 - 3.71082, a value for *b* of 1.90258 - 2.20418, and a value for *MSE* of 0.093359 - 0.13699.

26. A method as claimed in claim 25, in which the stem diameter *(d)* is estimated by using a point value for *A* of 3.62509, a point value for *b* of 2.05338, and a point value for *MSE* of 0.11204.

27. A method as claimed in claim 25 or claim 26, in which the trees in respect of which the quantity of sequestered carbon is calculated are of a species of indigenous African savannah tree of which the mean approximate tree size lies between the mean approximate tree size of trees of the species *Combretum erythrophyllum* and the mean approximate tree size of trees of the species *Rhus lancea.*

28. A method of ameliorating the ecological effects of carbon emissions, which method includes providing carbon credits to an entity to offset a quantity of emitted carbon, the quantity of emitted carbon offset by the carbon credits being equal to a calculated quantity of carbon

sequestered by an associated plurality of trees over a predetermined time period, the method including the step of calculating the quantity of carbon sequestered by each of the trees over the predetermined period by estimating the value of the stem diameter *(d)* of one of the trees at ground level at the end of the predetermined time period by use of the following equation:

$$d_i = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln(\ln(x_i + 1))\right)\right\}$$

where:

d_i	=	the estimated value of the stem diameter of the i^{th} tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x_i	=	the value of the age of the i^{th} tree, in years,

and by using a value for *A* of 3.64913 - 3.80951, a value for *b* of 1.65237 - 1.90861, and a value for *MSE* of 0.048428 - 0.073722.

29. A method as claimed in claim 28, in which the stem diameter *(d)* is estimated by using a point value for *A* of 3.72932, a point value for *b* of 1.78049, and a point value for *MSE* of 0.059088.

30. A method as claimed in claim 28 or claim 29, in which the trees in respect of which the quantity of sequestered carbon is calculated are of a species of indigenous African savannah tree of which the mean approximate tree size is between the mean approximate tree size of trees of the species *Rhus pendulina* and the mean approximate tree size of trees of the species *Rhus lancea.*

31. A method as claimed in any one of claims 16 to 30 inclusive, in which the estimated stem diameter at ground level *(d)* is used to obtain an estimated stem circumference at ground level *(c)*.

32. A method as claimed in any one of claims 1 to 31 inclusive, in which the calculation of carbon sequestered by said one of the trees includes the intermediate step of calculating an aboveground dry biomass of said tree.

33. A method as claimed in claim 32, in which calculating the aboveground dry biomass of said one of the trees is by means of the following equation:

$$\log TDM = 2.397(\log c) - 2.441$$

where:

TDM	=	the estimated aboveground dry biomass of the tree in kilograms; and
c	=	the stem circumference of the tree at ground level, in centimetres.

34. A method as claimed in claim 32 or claim 33, which includes the step of calculating the quantity of carbon sequestered by said one of the trees by estimating a fraction of the calculated aboveground dry biomass of the tree which is constituted by sequestered carbon.

35. A method as claimed in claim 34, in which calculating the quantity of carbon sequestered is by multiplying the aboveground dry biomass (*TDM*) by a factor of 0.6 - 0.9.

36. A method as claimed in claim 34, in which calculating the carbon sequestered by said tree is by multiplying the aboveground dry biomass (*TDM*) by a factor of 0.7533.

37. A method as claimed in any one of the preceding claims, which includes calculating the total quantity of carbon sequestered by one of the trees at the end of the predetermined time period, calculating the total quantity of carbon sequestered by that tree at the beginning of the predetermined time period, and subtracting the one calculated value from the other to find the total quantity of carbon sequestered by that tree in the predetermined time period.

38. A method as claimed in any one of the preceding claims, in which the quantity of sequestered carbon is calculated simultaneously for a plurality of trees of the same species and of the same age, the calculated quantity of carbon sequestered by one of the trees over the predetermined time period being multiplied by the number of trees, to obtain the total quantity of carbon sequestered by the plurality of trees.

39. A method as claimed in any one of the preceding claims, which includes receiving financial compensation in return for the provision of the carbon credits.

40. A system for calculating the quantity of carbon sequestered by a tree over a predetermined time period, the system being arranged to estimate the stem circumference *(c)* at ground level of the tree at the end of the time period by means of the following equation:

$$c = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln(\ln(x+1))\right)\right\}$$

where:

c	=	the estimated value of the stem circumference of the tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x	=	the value of the age of the tree, in years,

and by using a value for *A* of 4.44032 - 4.72672, a value for *b* of 2.17927 - 2.70242, and a value for *MSE* of 0.11467 - 0.19853.

41. A system as claimed in claim 40, which is arranged to calculate the stem circumference *(c)* by using a point value for *A* of 4.58352, a point value for *b* of 2.44085, and a point value for *MSE* of 0.14804.

42. A system as claimed in claim 40 or claim 41, which is arranged automatically to use said values for *A, b,* and *MSE* when the tree in respect of which the quantity of sequestered carbon is calculated is of the species *Combretum erythrophyllum*.

43. A system for calculating the quantity of carbon sequestered by a tree over a predetermined time period, the system being arranged to estimate the stem circumference *(c)* at ground level of the tree at the end of the time period by means of the following equation:

$$c = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln(\ln(x+1))\right)\right\}$$

where:

c	=	the estimated value of the stem circumference of the tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x	=	the value of the age of the tree, in years,

and by using a value for *A* of 4.84110 - 5.01122, a value for *b* of 1.60305 - 1.89217, and a value for *MSE* of 0.044657 - 0.076904.

44. A system as claimed in claim 43, which is arranged to calculate the stem circumference *(c)* by using a point value for *A* of 4.92616, a point value for *b* of 1.74761, and a point value for *MSE* of 0.057522.

45. A system as claimed in claim 43 or claim 44, which is arranged automatically to use said values for *A, b,* and *MSE* when the tree in respect of which the quantity of sequestered carbon is calculated is of the species *Rhus lancea*.

46. A system for calculating the quantity of carbon sequestered by a tree over a predetermined time period, the system being arranged to estimate the stem circumference *(c)* at ground level of the tree at the end of the time period by means of the following equation:

$$c = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln(\ln(x+1))\right)\right\}$$

where:

c	=	the estimated value of the stem circumference of the tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x	=	the value of the age of the tree, in years,

and by using a value for *A* of 4.32945 - 4.73904, a value for *b* of 1.91382 - 2.51685, and a value for *MSE* of 0.038070 - 0.074931.

47. A system as claimed in claim 46, which is arranged to calculate the stem circumference *(c)* by using a point value for *A* of 4.53425, a point value for *b* of 2.21533, and a point value for *MSE* of 0.051892.

48. A system as claimed in claim 46 or claim 47, which is arranged automatically to use said values for *A, b,* and *MSE* when the tree in respect of which the quantity of sequestered carbon is calculated is of the species *Rhus pendulina*.

49. A system for calculating the quantity of carbon sequestered by a tree over a predetermined time period, the system being arranged to estimate the stem circumference *(c)* at ground level of the tree at the end of the time period by means of the following equation:

$$c = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln(\ln(x+1))\right)\right\}$$

where:

c	=	the estimated value of the stem circumference of the tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x	=	the value of the age of the tree, in years,

and by using a value for *A* of 4.68409 - 4.85555, a value for *b* of 1.90258 - 2.20418, and a value for *MSE* of 0.093359 - 0.13699.

50. A system as claimed in claim 49, which is arranged to calculate the stem

circumference *(c)* by using a point value for *A* of 4.76982, a point value for *b* of 2.05338, and a point value for *MSE* of 0.11204.

51. A system as claimed in claim 49 or claim 50, which is arranged automatically to use said values for *A, b,* and *MSE* when the tree in respect of which the quantity of sequestered carbon is calculated is of a species of indigenous African savannah tree of which the mean approximate tree size lies between the mean approximate tree size of trees of the species *Combretum erythrophyllum* and the mean approximate tree size of the trees of the species *Rhus lancea*.

52. A system for calculating the quantity of carbon sequestered by a tree over a predetermined time period, the system being arranged to estimate the stem circumference *(c)* at ground level of the tree at the end of the time period by means of the following equation:

$$c = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x + 1\right)\right)\right)\right\}$$

where:

c	=	the estimated value of the stem circumference of the tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x	=	the value of the age of the tree, in years,

and by using a value for *A* of 4.79386 - 4.95424, a value for *b* of 1.65237 - 1.90861, and a value for *MSE* of 0.048428 - 0.073722.

53. A system as claimed in claim 52, which is arranged to calculate the stem circumference *(c)* by using a point value for *A* of 4.87405, a point value for *b* of 1.78049, and a point value for *MSE* of 0.059088.

54. A system as claimed in claim 52 or claim 53, which is arranged automatically to use said values for *A, b,* and *MSE* when the tree in respect of which the quantity of sequestered carbon is calculated is of a species of indigenous African savannah tree of which the mean approximate tree size is between the mean approximate tree size of trees of the species *Rhus pendulina* and the mean approximate tree size of trees of the species *Rhus lancea.*

55. A system for calculating the quantity of carbon sequestered by a tree over a predetermined time period, the system being arranged to estimate the stem diameter *(d)* at ground level of the tree at the end of the time period by means of the following equation:

$$d = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x + 1\right)\right)\right)\right\}$$

where:

d	=	the estimated value of the stem diameter of the tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x	=	the value of the age of the tree, in years,

and by using a value for *A* of 3.29559 - 3.58199, a value for *b* of 2.17927 - 2.70242, and a value for *MSE* of 0.11467 - 0.19853.

56. A system as claimed in claim 55, which is arranged to calculate the stem diameter

(d) by using a point value for *A* of 3.43879, a point value for *b* of 2.44085, and a point value for *MSE* of 0.14804.

57. A system as claimed in claim 55 or claim 56, which is arranged automatically to use said values for *A, b,* and *MSE* when the tree in respect of which the quantity of sequestered carbon is calculated is of the species *Combretum erythrophyllum*.

58. A system for calculating the quantity of carbon sequestered by a tree over a predetermined time period, the system being arranged to estimate the stem diameter *(d)* at ground level of the tree at the end of the time period by means of the following equation:

$$d = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x + 1\right)\right)\right)\right\}$$

where:

d	=	the estimated value of the stem diameter of the tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x	=	the value of the age of the tree, in years,

and by using a value for *A* of 3.69637 - 3.86649, a value for *b* of 1.60305 - 1.89217, and a value for *MSE* of 0.044657 - 0.076904.

59. A system as claimed in claim 58, which is arranged to calculate the stem diameter *(d)* by using a point value for *A* of 3.78143, a point value for *b* of 1.74761, and a point value for *MSE* of 0.057522.

60. A system as claimed in claim 58 or claim 59, which is arranged automatically to use said values for *A, b,* and *MSE* when the tree in respect of which the quantity of sequestered carbon is calculated is of the species *Rhus lancea*.

61. A system for calculating the quantity of carbon sequestered by a tree over a predetermined time period, the system being arranged to estimate the stem diameter *(d)* at ground level of the tree at the end of the time period by means of the following equation:

$$d = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x + 1\right)\right)\right)\right\}$$

where:

d	=	the estimated value of the stem diameter of the tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x	=	the value of the age of the tree, in years,

and by using a value for *A* of 3.18472 - 3.59431, a value for *b* of 1.91382 - 2.51685, and a value for *MSE* of 0.038070 - 0.074931.

62. A system as claimed in claim 61, which is arranged to calculate the stem diameter *(d)* by using a point value for *A* of 3.38952, a point value for *b* of 2.21533, and a point value for *MSE* of 0.051892.

63. A system as claimed in claim 61 or claim 62, which is arranged automatically to use said values for *A, b,* and *MSE* when the tree in respect of which the quantity of sequestered carbon is calculated is of the species *Rhus pendulina*.

64. A system for calculating the quantity of carbon sequestered by a tree over a predetermined time period, the system being arranged to estimate the stem diameter *(d)* at ground level of the tree at the end of the time period by means of the following equation:

$$d = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x + 1\right)\right)\right)\right\}$$

where:

d	=	the estimated value of the stem diameter of the tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x	=	the value of the age of the tree, in years,

and by using a value for *A* of 3.53936 - 3.71082, a value for *b* of 1.90258 - 2.20418, and a value for *MSE* of 0.093359 - 0.13699.

65. A system as claimed in claim 64, which is arranged to calculate the stem diameter *(d)* by using a point value for *A* of 3.62509, a point value for *b* of 2.05338, and a point value for *MSE* of 0.11204.

66. A system as claimed in claim 64 or claim 65, which is arranged automatically to use said values for *A, b,* and *MSE* when the tree in respect of which the quantity of sequestered carbon is calculated is of a species of indigenous African savannah tree of which the mean approximate tree size lies between the mean approximate tree size of trees of the species *Combretum erythrophyllum* and the mean approximate tree size of trees of the species *Rhus lancea*.

67. A system for calculating the quantity of carbon sequestered by a tree over a predetermined time period, the system being arranged to estimate the stem diameter *(d)* at ground level of the tree at the end of the time period by means of the following equation:

$$d = EXP\left\{\frac{MSE}{2} + \left(A + b.\ln\left(\ln\left(x + 1\right)\right)\right)\right\}$$

where:

d	=	the estimated value of the stem diameter of the tree, in millimeters;
EXP	=	the inverse of the natural logarithm;
A, b, MSE	=	pre-estimated constants which have different values for different species of tree; and
x	=	the value of the age of the tree, in years,

and by using a value for *A* of 3.64913 - 3.80951, a value for *b* of 1.65237 - 1.90861, and a value for *MSE* of 0.048428 - 0.073722.

68. A system as claimed in claim 67, which is arranged to calculate the stem diameter *(d)* by using a point value for *A* of 3.72932, a point value for *b* of 1.78049, and a point value for *MSE* of 0.059088.

69. A system as claimed in claim 67 or claim 68, which is arranged automatically to use said values for *A, b,* and *MSE* when the tree in respect of which the quantity of sequestered carbon

is calculated is of a species of indigenous African savannah tree of which the mean approximate tree size is between the mean approximate tree size of trees of the species *Rhus pendulina* and the mean approximate tree size of trees of the species *Rhus lancea.*

70. A system as claimed in any one of claims 55 to 69 inclusive, which is arranged to convert the calculated stem diameter at ground level *(d)* to a corresponding stem circumference at ground level *(c)*.

71. A system as claimed in any one of claims 40 to 70 inclusive, which is arranged to calculate an aboveground dry biomass of the tree as an intermediate step to calculating the quantity of carbon sequestered by the tree.

72. A system as claimed in claim 71, which is arranged to calculate the aboveground dry biomass of each tree by means of the following equation:

$$\log TDM = 2.397(\log c) - 2.441$$

where:

TDM = the estimated aboveground dry biomass of the tree in kilograms; and
c = the stem circumference of the tree at ground level, in centimetres.

73. A system as claimed in claim 71 or claim 72, which is arranged to calculate the quantity of carbon sequestered by the tree by estimating a fraction of the calculated dry biomass of the tree which is constituted by sequestered carbon.

74. A system as claimed in claim 73, which is arranged to calculate the quantity of carbon sequestered by multiplying the estimated aboveground dry biomass (*TDM*) by a factor of 0.6 - 0.9.

75. A system as claimed in claim 73, which is arranged to calculate the carbon sequestered by each tree by multiplying the estimated aboveground dry biomass (*TDM*) by a factor of 0.7533.

76. A system as claimed in any one of claims 40 to 75 inclusive, which is arranged to calculate the quantity of carbon sequestered by the tree at the end of the predetermined time period, to calculate the total quantity of carbon sequestered by the tree at the beginning of the predetermined time period, and to subtract the one calculated value from the other to find the total quantity of carbon sequestered by the tree in the predetermined time period.

77. A system as claimed in any one of claims 40 to 76, which is arranged to calculate the quantity of carbon sequestered by a plurality of trees of the same species and of the same age by multiplying the calculated quantity of carbon sequestered by one of the trees by the number of trees.

78. A system as claimed in any one of claims 40 to 77, which comprises an electronic processor and a computer program having computer readable instructions for enabling the processor to calculate the quantity of carbon sequestered by a tree or by a plurality of trees, when the program is executed on the processor.

79. Carbon credits for offsetting or permitting a particular quantity of carbon emissions, the carbon credits relating to a plurality of trees which sequester carbon over a specific period of time, the particular quantity of emitted carbon permitted or offset by each of the trees being equal to about 0.6 - 0.9 times the aboveground dry biomass of the tree, the aboveground dry biomass (*TDM*) of the tree, in kilograms, being such as to satisfy the equation:

$$\log TDM = 2.397(\log c) - 2.441$$

where:

c = the stem circumference of the tree at ground level, in centimetres, and c equals, in millimetres:

$$EXP\left\{\frac{MSE}{2}+\left(A+b.\ln\left(\ln\left(x+1\right)\right)\right)\right\}$$

where:

x = the age of the tree at the end of the period, in years,

a set of values for *A, b* and *MSE* being selected from the group of value sets comprising:

A = 4.58352, *b* = 2.44085, *MSE* = 0.14804;
A = 4.92616, *b* = 1.74761, *MSE* = 0.057522;
A = 4.53425, *b* = 2.21533, *MSE* = 0.051892;
A = 4.76982, *b* = 2.05338, *MSE* = 0.11204; and
A = 4.87405, *b* = 1.78049, *MSE* = 0.059088.

80. Carbon credits as claimed in claim 79, in which the particular quantity of carbon offset by each tree is equal to 0.7 - 0.8 times the aboveground dry biomass (*TDM*) of the tree.

81. Carbon credits as claimed in claim 79, in which the particular quantity of carbon offset by each tree is equal to about 0.75 times the aboveground dry biomass (*TDM*) of the tree.

82. Carbon credits as claimed in claim 79, in which the particular quantity of carbon offset by each tree is equal to about 0.7533 times the aboveground dry biomass (*TDM*) of the tree.

83. Carbon credits as claimed in any one of claims 79 to 82 inclusive, in which the carbon credits relate to a plurality of trees of a species of African Savannah tree.

84. Carbon credits as claimed in claim 83, in which the carbon credits relate to a plurality of trees of the species *Combretum erythrophyllum*, the values of *A, b* and *MSE* being equal to 4.58352, 2.44085 and 0.14804 respectively.

85. Carbon credits as claimed in claim 83, in which the carbon credits relate to a plurality of trees of the species *Rhus lancea,* the values of *A, b* and *MSE* being equal to 4.92616, 1.74761 and 0.057522 respectively.

86. Carbon credits as claimed in claim 83, in which the carbon credits relate to a plurality of trees of the species *Rhus pendulina,* the values of *A, b* and *MSE* being equal to 4.53425, 2.21533 and 0.051892 respectively.

87. Carbon credits as claimed in claim 83, in which the carbon credits relate to a plurality of trees of a species of indigenous South African Savannah tree of which the mean approximate tree size is between the mean approximate tree size of trees of the species *Combretum erythrophyllum* and the mean approximate tree size of trees of the species *Rhus lancea,* the values of *A, b* and *MSE* being equal to 4.76982, 2.05338 and 0.11204 respectively.

88. Carbon credits as claimed in claim 83, in which the carbon credits relate to a plurality of trees of a species of indigenous South African Savannah tree of which the mean approximate tree size is between the mean approximate tree size of trees of the species *Rhus lancea* and the mean approximate tree size of trees of the species *Rhus pendulina,* the values of *A, b* and *MSE* being equal to 4.87405, 1.78049 and 0.059088 respectively.

89. A method as claimed in any one of claims 1, 4, 7, 10, 13, 16, 19, 22, 25 and 28 inclusive, substantially as herein described and illustrated.

90. A system as claimed in any one of claims 40, 43, 46, 49, 52, 55, 58, 61, 64 and 67 inclusive, substantially as herein described and illustrated.

91. Carbon credits as claimed in claim 79, substantially as herein described and illustrated.