**Parameters in the grasstree.100 file**

| **Parameter Name** | **Description** | **Units** | **Comments or Valid Range** | **Suggested or Default Value** | **Original Parameter file** |
| --- | --- | --- | --- | --- | --- |
| PRDX(3) | Coefficient used when calculating the potential production as a function of solar radiation outside of the atmosphere | g biomass produced m‑2 month‑1 langley-1 | 0.1 – 5.0 |  | tree.100  crop.100  (param.inc) |
| **PPDF(\*) – parameters for a Poisson Probability Density Function** | | | | | |
| PPDF(1) | Optimum temperature for production for parameterization of a Poisson Density Function curve to simulate temperature effect on growth | ºC | 10.0 – 40.0 |  | tree.100  crop.100  (param.inc) |
| PPDF(2) | Maximum temperature for production for parameterization of a Poisson Density Function curve to simulate temperature effect on growth | ºC | 20.0 – 50.0 |  | tree.100  crop.100  (param.inc) |
| PPDF(3) | Left curve shape for parameterization of a Poisson Density Function curve to simulate temperature effect on growth |  | 0.0 – 1.0 |  | tree.100  crop.100  (param.inc) |
| PPDF(4) | Right curve shape for parameterization of a Poisson Density Function curve to simulate temperature effect on growth |  | 0.0 – 10.0 |  | tree.100  crop.100  (param.inc) |
| GTBIOFLG | Flag indicating whether production should be reduced by physical obstruction; 0=production should not be reduced; 1=production should be reduced. | index | 0, 1 |  | crop.100 |
| GTBIOK5 | Level of aboveground standing dead + 10% strucc(1) C at which production is reduced to half maximum due to physical obstruction by dead material. Used only when GTBIOFLAG = 1. | g C m-2 | 0.0 – 2000.0 | 60 | crop.100 |
| ~~GTPLTMRF~~  Not used. Removed 9/5/2019 | ~~Planting month reduction factor to limit seedling growth; set to 1.0 for perennial grasstrees.~~ | ~~fraction~~ | ~~0.0 – 1.0~~ | ~~1.0~~ | ~~crop.100~~ |
| GTBIOMC | Grams of dry matter biomass per gram plant C. This is for the whole plant, not just for leaves (see photosynthesis parameter cfracleaf(3)). | (g dm) /  (g C) | ~2.0-3.0 | 2.5 | **NEW** |
|  |  |  |  |  |  |
| GTFRTCINDX | **1** - perennial plant; **2 – annual plant**. | index | 1, 2 | 1 | crop.100 |
| **Dynamic C allocation parameters** | | | | | |
| GTFRTC(1) | Fraction of C allocated to roots at planting, with no water or nutrient stress, for an annual grasstree plant (GTFRTCINDX = 2). | fraction | 0.0 – 1.0 | new for annual plants | crop.100 |
| GTFRTC(2) | Fraction of C allocated to roots at time GTFRTC(3), with no water or nutrient stress, for an annual grasstree plant (GTFRTCINDX = 2). | fraction | 0.0 – 1.0 | new for annual plants | crop.100 |
| GTFRTC(3) | Time after planting (days with soil temperature greater than GTRTDTMP) at which the GTFRTC(2) value is reached, for an annual grasstree plant (GTFRTCINDX = 2). | number of days |  | new for annual plants | crop.100 |
| GTFRTC(4) | Maximum increase in the fraction of C going to the roots due to water stress, for an annual grasstree plant (GTFRTCINDX = 2). | fraction | 0.0 – 1.0 | new for annual plants | crop.100 |
| GTFRTC(5) | Maximum increase in the fraction of C going to the roots due to nutrient stress, for an annual grasstree plant (GTFRTCINDX = 2). | fraction | 0.0 – 1.0 | new for annual plants | crop.100 |
|  |  |  |  |  |  |
| GTFRTCN(1) | Maximum fraction of C allocated to roots under maximum nutrient stress, for a perennial grasstree plant (GTFRTCINDX = 1). | fraction | 0.0 – 1.0 |  | crop.100, tree.100 |
| GTFRTCN(2) | Minimum fraction of C allocated to roots with no nutrient stress, for a perennial grasstree plant (GTFRTCINDX = 1). | fraction | 0.0 – 1.0 |  | crop.100, tree.100 |
| GTFRTCW(1) | Maximum fraction of C allocated to roots under maximum water stress, for a perennial grasstree plant (GTFRTCINDX = 1). | fraction | 0.0 – 1.0 |  | crop.100, tree.100 |
| GTFRTCW(2) | Minimum fraction of C allocated to roots with no water stress, for a perennial grasstree plant (GTFRTCINDX = 1). | fraction | 0.0 – 1.0 |  | crop.100, tree.100 |
| GTLVBIOMAX | Aboveground live leaf biomass level above which the minimum and maximum C/E ratios of new leaf increments =  CERGTMN2(1,\*) and CERGTMX2(1,\*) respectively. | g biomass m-2 | 0 – 1000 |  | crop.100 |
| GTSTMBIOMAX | Aboveground live stem biomass level above which the minimum and maximum C/E ratios of new stem increments = CERGTMN2(2,\*) and CERGTMX2(2,\*) respectively. | g biomass m-2 | 0 – 1000 |  | crop.100 |
| GTBTOLAI | Biomass to leaf area index (LAI) conversion factor for grasstrees. | units LAI / g biomass | Biome specific  0.001 – 0.02  (see below) |  | tree.100 |
| GTKLAI | Stem mass at which half of theoretical maximum leaf area (GTMAXLAI) is achieved. | g C m-2 |  | **100-200** | tree.100 |
| GTLAITOP | Parameter determining the relationship between LAI and grasstree production: LAI effect = 1 - exp(GTLAITOP \* LAI). |  |  | -2.0 to ‑0.47 | tree.100 |
| GTMAXLAI | Theoretical maximum leaf area index achieved in a mature plant. | m2 / m2 | 0.0 – 50.0 |  | tree.100 |
| GTMINLAIPRD | The minimum LAI required for plant production to occur at optimal rate. An LAI below this value will severely limit production. This was hard coded as 0.2 until Aug. 16, 2022. | m2 / m2 | 0.01-0.5 |  | New August 16, 2022 |
| **GTCFRAC(\*)** | **Relative C allocation fraction of new production after C has been allocated to leaves and fine roots** |  |  |  | tree.100 |
| GTCFRAC(2) | (2) = stems | fraction | 0.0 – 1.0 |  | tree.100 |
| GTCFRAC(4) | (4) = coarse roots | fraction | 0.0 – 1.0 |  | tree.100 |
|  |  |  |  |  |  |
| **CERGTAMN(part,E)** | ***minimum* C/E ratio for live grasstree aboveground parts** |  |  |  | tree.100 |
| CERGTAMN1(1,1) | (1,1) = C:N, leaf  biomass=0 | C/N ratio | 1.0 – 200.0 |  | tree.100 |
| CERGTAMN1(1,2) | (1,2) = C:P, leaf  biomass=0 | C/P ratio | 1.0 – 9999.0 |  | tree.100 |
| CERGTAMN1(1,3) | (1,3) = C:S, leaf  biomass=0 | C/S ratio | 1.0 – 9999.0 |  | tree.100 |
| CERGTAMN1(2,1) | (2,1) = C:N, stems  biomass=0 | C/N ratio | 1.0 – 200.0 |  | tree.100 |
| CERGTAMN1(2,2) | (2,2) = C:P, stems  biomass=0 | C/P ratio | 1.0 – 9999.0 |  | tree.100 |
| CERGTAMN1(2,3) | (2,3) = C:S, stems  biomass=0) | C/S ratio | 1.0 – 9999.0 |  | tree.100 |
| CERGTAMN2(1,1) | (1,1) = C:N, leaf  biomass > GTLBIOMAX) | C/N ratio |  |  |  |
| CERGTAMN2(1,2) | (1,2) = C:P, leaf  biomass > GTLBIOMAX) | C/P ratio |  |  |  |
| CERGTAMN2(1,3) | (1,3) = C:S, leaf  biomass > GTLBIOMAX) | C/S ratio |  |  |  |
| CERGTAMN2(2,1) | (2,1) = C:N, stems  biomass > GTSBIOMAX) | C/N ratio |  |  |  |
| CERGTAMN2(2,2) | (2,2) = C:P, stems  biomass > GTSBIOMAX) | C/P ratio |  |  |  |
| CERGTAMN2(2,3) | (2,3) = C:S, stems  biomass > GTSBIOMAX) | C/S ratio |  |  |  |
| **CERGTAMX(part,E)** | ***maximum* C/E ratio for live grasstree aboveground parts** |  |  |  |  |
| CERGTAMX1(1,1) | (1,1) = C:N, leaf  biomass = 0 | C/N ratio | 1.0 – 200.0 |  | tree.100 |
| CERGTAMX1(1,2) | (1,2) = C:P, leaf  biomass = 0 | C/P ratio | 1.0 – 9999.0 |  | tree.100 |
| CERGTAMX1(1,3) | (1,3) = C:S, leaf  biomass = 0 | C/S ratio | 1.0 – 9999.0 |  | tree.100 |
| CERGTAMX1(2,1) | (2,1) = C:N, stems  biomass = 0 | C/N ratio | 1.0 – 200.0 |  | tree.100 |
| CERGTAMX1(2,2) | (2,2) = C:P, stems  biomass = 0 | C/P ratio | 1.0 – 9999.0 |  | tree.100 |
| CERGTAMX1(2,3) | (2,3) = C:S, stems  biomass = 0 | C/S ratio | 1.0 – 9999.0 |  | tree.100 |
| CERGTAMX2(1,1) | (1,1) = C:N, leaf  biomass > GTLBIOMAX | C/N ratio |  |  |  |
| CERGTAMX2(1,2) | (1,2) = C:P, leaf  biomass > GTLBIOMAX | C/P ratio |  |  |  |
| CERGTAMX2(1,3) | (1,3) = C:S, leaf  biomass > GTLBIOMAX | C/S ratio |  |  |  |
| CERGTAMX2(2,1) | (2,1) = C:N, stems  biomass > GTSBIOMAX | C/N ratio |  |  |  |
| CERGTAMX2(2,2) | (2,2) = C:P, stems  biomass > GTSBIOMAX | C/P ratio |  |  |  |
| CERGTAMX2(2,3) | (2,3) = C:S, stems  biomass > GTSBIOMAX | C/S ratio |  |  |  |
| **CERGTBMX(part,E)** | ***minimum* C/E ratio for live grasstree belowground parts** |  |  |  |  |
| CERGTBMN(3,1) | (3,1) = C:N, juvenile fine root | C/N ratio | 1.0 – 1000.0 |  | tree.100 |
| CERGTBMN(3,2) | (3,2) = C:P, juvenile fine root | C/P ratio | 1.0 – 9999.0 |  | tree.100 |
| CERGTBMN(3,3) | (3,3) = C:S, juvenile fine root | C/S ratio | 1.0 – 9999.0 |  | tree.100 |
| CERGTBMN(4,1) | (4,1) = C:N, coarse root | C/N ratio | 1.0 – 1500.0 |  | tree.100 |
| CERGTBMN(4,2) | (4,2) = C:P, coarse root | C/P ratio | 1.0 – 9999.0 |  | tree.100 |
| CERGTBMN(4,3) | (4,3) = C:S, coarse root | C/S ratio | 1.0 – 9999.0 |  | tree.100 |
| CERGTBMN(5,1) | (5,1) = C:N, mature fine root | C/N ratio |  |  |  |
| CERGTBMN(5,2) | (5,2) = C:P, mature fine root | C/P ratio |  |  |  |
| CERGTBMN(5,3) | (5,3) = C:S, mature fine root | C/S ratio |  |  |  |
| **CERGTBMX(part,E)** | ***maximum* C/E ratio for live grasstree belowground parts** |  |  |  |  |
| CERGTBMX(3,1) | (3,1) = C:N, juvenile fine root | C/N ratio |  |  |  |
| CERGTBMX(3,2) | (3,2) = C:P, juvenile fine root | C/P ratio |  |  |  |
| CERGTBMX(3,3) | (3,3) = C:S, juvenile fine root | C/S ratio |  |  |  |
| CERGTBMX(4,1) | (4,1) = C:N, coarse root | C/N ratio | 1.0 – 1500.0 |  | tree.100 |
| CERGTBMX(4,2) | (4,2) = C:P, coarse root | C/P ratio | 1.0 – 9999.0 |  | tree.100 |
| CERGTBMX(4,3) | (4,3) = C:S, coarse root | C/S ratio | 1.0 – 9999.0 |  | tree.100 |
| CERGTBMX(5,1) | (5,1) = C:N, mature fine root | C/N ratio | 1.0 – 1000.0 |  | tree.100 |
| CERGTBMX(5,2) | (5,2) = C:P, mature fine root | C/P ratio | 1.0 – 9999.0 |  | tree.100 |
| CERGTBMX(5,3) | (5,3) = C:S, mature fine root | C/S ratio | 1.0 – 9999.0 |  | tree.100 |
|  |  |  |  |  |  |
| GTLIG(1) | Lignin fraction of live leaves | g lignin C/  g C | 0.0 – 1.0 | 0.20300 | tree.100 |
| GTLIG(2) | Lignin fraction of live stems. | g lignin C /  g C | 0.0 – 1.0 | 0.25000 | tree.100 |
| GTLIG(3) | Lignin fraction of juvenile fine roots. | g lignin C /  g C | 0.0 – 1.0 | 0.08000 | tree.100 |
| GTLIG(4) | Lignin fraction of coarse roots. | g lignin C /  g C | 0.0 – 1.0 | 0.20000 | tree.100 |
| GTLIG(5) | Lignin fraction of mature fine roots. | g lignin C /  g C | 0.0 – 1.0 | 0.20000 | tree.100 |
| HIMAXGT | Maximum harvest index maximum, the fraction of aboveground live C (gtleavc) allocated to grain at the time of harvest. | fraction | 0.0 – 1.0 | new for annual plants | crop.100 |
| HIWSFGT | Harvest index water stress factor: 0=no effect of water stress; 1= no grain yield with maximum water stress. | fraction | 0 – 1 | new for annual plants | crop.100 |
| HIMONGT(1) | Number of months prior to harvest in which to begin accumulating water stress effect on harvest index. | number of months | 1 – 12 | new for annual plants | crop.100 |
| HIMONGT(2) | Number of months prior to harvest in which to stop accumulating water stress effect on harvest index. | number of months | 1 – 12 | new for annual plants | crop.100 |
| EFRGRNGT(1) | Fraction of live leaf N (gtleave(1)) which goes to grain. | fraction | 0.0 – 1.0 | new for annual plants | crop.100 |
| EFRGRNGT(2) | Fraction of live leaf P (gtleave(2)) which goes to grain. | fraction | 0.0 – 1.0 | new for annual plants | crop.100 |
| EFRGRNGT(3) | Fraction of live leaf S (gtleave(3)) which goes to grain. | fraction | 0.0 – 1.0 | new for annual plants | crop.100 |
| VLOSSGT | Fraction of above ground plant N which is volatilized (occurs at death). | fraction | 0.0 – 1.0 | 0.04 | crop.100 |
| **Death and senescence** |  |  |  |  |  |
| GTFSDETH(1) | Maximum leaf death rate at very dry soil conditions (fraction/month); to get the daily leaf death rate, this fraction divided by the number of days in a month then multiplied by a reduction factor which decreases with increased soil moisture (dthppt = 1.0 – bgwfunc). Live leaves that die are transferred to dead attached leaf pool. N from dying leaves is retranslocated to internal storage. Death due to dry soil conditions will not occur during a senescence event. | fraction | 0.0 – 1.0 |  | crop.100 |
| GTFSDETH(2) | Maximum stem death rate at very dry soil conditions (fraction/month); to get the daily stem death rate, this fraction divided by the number of days in a month then multiplied by a reduction factor which decreases with increased soil moisture (dthppt = 1.0 – bgwfunc). Live stems that die are transferred to standing dead stem pool. Death due to dry soil conditions will not occur during a senescence event. | fraction | 0.0 – 1.0 |  | crop.100 |
| GTFSDETH(3) | Fraction of leaves which die on the day of a SENM (senescence) event. Live leaves that die are transferred to dead attached leaf pool. N from dying leaves is retranslocated to internal storage. | fraction | 0.0 – 1.0 |  | crop.100 |
| GTFSDETH(4) | Fraction of stems which die on the day of a SENM (senescence) event. Live stems that die are transferred to standing dead stem pool. | fraction | 0.0 – 1.0 |  | crop.100 |
| GTFSDETH(5) | Additional fraction of leaves which die (per month) when aboveground live leaf C is greater than GTFSDETH(6) and senescence is not occurring. Live leaves that die are transferred to dead attached leaf pool. N from dying leaves is retranslocated to internal storage. | fraction | 0.0 – 1.0 |  | crop.100 |
| GTFSDETH(6) | Level of live leaf C which shading occurs and leaf death increases (see GTFSDETH(5)). | g C m-2 | 0.0 – 500.0 |  | crop.100 |
| GTFSDETH(7) | Maximum leaf death rate during a frost (fraction/day); this fraction is multiplied by a reduction factor, dthcold, which decreases linearly from 1.0 to 0.0 as minimum daily air temperature increases from, TLSKILL(1) to TLSKILL(2). Live leaves that die are transferred to dead attached leaf pool. With frost kill there is no N retranslocation from dying leaves is to internal storage. | fraction day‑1 | 0.0 – 1.0 |  | New 9/21/2021 |
| GTFSDETH(8) | Maximum stem death rate at during a frost (fraction/day); this fraction is multiplied by a reduction factor, dthcold, which decreases linearly from 1.0 to 0.0 as minimum daily air temperature increases from, TLSKILL(1) to TLSKILL(2). Live stems that die are transferred to standing dead stem pool. | fraction day‑1 | 0.0 – 1.0 |  | New 9/21/2021 |
| TLSKILL(1) | Threshold for maximum leaf/stem frost death. When daily minimum air temperature ≤ TLSKILL(1), the maximum rate of frost leaf/stem death occurs. See also GTFSDETH(7) and GTFSDETH(8). | °C | TLSKILL(1) < TLSKILL(2) < 0.0 | -15 °C | New 9/21/2021 |
| TLSKILL(2) | The warmest minimum daily air temperature that causes leaf/stem frost death. When daily minimum air temperature > TLSKILL(2), no frost leaf/stem frost death occurs. See also GTFSDETH(7) and GTFSDETH(8). | °C | TLSKILL(1) < TLSKILL(2) < 0.0 | -1 °C | New 9/21/2021 |
| SDFALLRT(1) | Fall rate for dead leaves (fraction of attached dead leaves that drop each month). | fraction | 0.0 – 1.0 |  | crop.100 |
| SDFALLRT(2) | Fall rate for dead stems (fraction of standing dead stems that drop each month). | fraction | 0.0 – 1.0 |  | crop.100 |
| ROOTDR(1) | Maximum **juvenile fine root** death rate with very dry soil or very cold/hot soil conditions in the rooting zone (fraction/month); to get the daily root death rate, this fraction is divided by the number of days in the month then multiplied by another fraction that decreases as soil moisture increases and soil temperature approaches optimal conditions (~10 °C).  See watreff\_drootgt\_atanf.xlsx. | fraction | 0.0 – 1.0 |  | crop.100 |
| ROOTDR(2) | Maximum **mature fine root** death rate with very dry soil in the rooting zone or very cold/hot soil conditions in the rooting zone (fraction/month); to get the daily root death rate, this fraction is divided by the number of days in the month then multiplied by another fraction that decreases as soil moisture increases and soil temperature approaches optimal conditions (~10 °C).  See watreff\_drootgt\_atanf.xlsx. | fraction | 0.0 – 1.0 |  | crop.100 |
| ROOTDR(3) | Maximum **coarse root** death rate with very dry soil conditions or very cold/hot temperatures near the soil surface (fraction/month); to get the daily root death rate, this fraction is divided by the number of days in the month then multiplied by another fraction that decreases as soil moisture increases and soil temperature approaches optimal conditions (~10 °C).  Update 9/15/2021: Coarse roots in perennial bioenergy crops such as miscanthus are assumed to be rhizomes close to the surface, therefore the 7-day running air temperature is used instead of soil temperature to compute temperature effects on rhizome death. Maximum coarse root death rate occurs when this 7-day air temperature is ≥ 40 °C or ≤ TCRKILL °C.  The value of this parameter should be reduced for grasstrees that do not have rhizomes close to the surface.  See watreff\_drootgt\_atanf.xlsx. | fraction | 0.0 – 1.0 |  | crop.100 |
| ROOTDR(4) | Maximum **juvenile fine root** death rate under saturated soil water conditions in the rooting zone (fraction/month); to get the daily root death rate, this fraction is divided by the number of days in the month then multiplied by a 0.0 – 1.0 multiplier that is 0.0 at field capacity and increases linearly to 1.0 at soil water saturation. To turn off this flooding effect on root death rate set to 0.0. | Fraction  New 2/22/2022 | 0.0 – 1.0 |  |  |
| ROOTDR(5) | Maximum **mature fine root** death rate under saturated soil water conditions in the rooting zone (fraction/month); to get the daily root death rate, this fraction is divided by the number of days in the month then multiplied by a 0.0 – 1.0 multiplier that is 0.0 at field capacity and increases linearly to 1.0 at soil water saturation. To turn off this flooding effect on root death rate set to 0.0. | Fraction  New 2/22/2022 | 0.0 – 1.0 |  |  |
| ROOTDR(6) | Maximum **coarse root** death rate under saturated soil water conditions in the rooting zone (fraction/month); to get the daily root death rate, this fraction is divided by the number of days in the month then multiplied by a 0.0 – 1.0 multiplier that is 0.0 at field capacity and increases linearly to 1.0 at soil water saturation. To turn off this flooding effect on root death rate set to 0.0. | Fraction  New 2/22/2022 | 0.0 – 1.0 |  |  |
| TCRKILL | Threshold temperature for maximum rhizome kill death due to cold. When 7-day running air temperature ≤ TCRKILL, the maximum rate of coarse root kill occurs. See ROOTDR(3). | °C | < 0.0 °C | -10°C |  |
| FRTDSRFC | Fraction of dead fine roots (juvenile and mature) that are transferred into the surface litter layer (STRUCC(1) and METABC(1)) upon death, the remainder of the dead fine roots will go to the soil litter layer (STRUCC(2) and METABC(2)) | fraction | 0.0 – 1.0 | 0.14 | crop.100, tree.100  see drootgt, gtkillrt and cultivgt |
| CRTDSRFC | Fraction of dead coarse roots that are transferred into the surface litter layer (STRUCC(1) and METABC(1)) upon death, the remainder of the dead coarse roots will go to the soil litter layer (STRUCC(2) and METABC(2)) | fraction | 0.0 – 1.0 | **1.00**  If coarse roots are like rhizomes, they will grow and die at the surface. | crop.100, tree.100  see drootgt, gtkillrt and cultivgt |
| GTRTDTMP | This parameter is used to determine the number of days since planting (number of days where soil temperature >= GTRTDTMP). In turn, the number of days since planting is used to determine fine root allocation for annual plants. GTFRTCINDX =2. See GTFRTC(3). | °C | -5.0 – 5.0 | new for annual plants | crop.100 |
| GTRTF(1) | Fraction of N retranslocated from live grasstree leaves before litterfall when death occurs from dry soil conditions or senescence. | fraction | 0.0 – 1.0 |  | crop.100, tree.100 |
| GTRTF(2) | Fraction of P retranslocated from live grasstree leaves before litterfall when death occurs from dry soil conditions or senescence. | fraction | 0.0 – 1.0 |  | crop.100, tree.100 |
| GTRTF(3) | fraction of S retranslocated from live grasstree leaves before litterfall when death occurs from dry soil conditions or senescence. |  |  |  | crop.100, tree.100 |
| GTMRTFRAC | Fraction of fine root production that goes to mature roots | fraction | 0.0 – 1.0 | 0.05 | crop.100, tree.100 |
| SNFXMX(3) | Maximum symbiotic N fixation for grasstree (actual symbiotic N fixation will be less if available mineral N is sufficient for growth) | g N fixed / g C net production | 0.0 – 1.0 |  | crop.100, tree.100  (param.inc) |
| DEL13C | Delta 13C value for stable isotope labeling |  | -30.0 – 0.0 | -26 | crop.100, tree.100 (local variable used to calculate another variable after input). |
| CO2IPR(3) | In a grasstree system, the effect on plant production (ratio) of doubling the atmospheric CO2 concentration from 350 ppm to 700 ppm | scaling factor | 0.5 – 1.5 |  | crop.100, tree.100  (param.inc) |
| CO2ITR(3) | In a grasstree system, the effect on transpiration rate (ratio) of doubling the atmospheric CO2 concentration from 350 ppm to 700 ppm | scaling factor | 0.5 – 1.5 |  | crop.100, tree.100  (param.inc) |
|  |  |  |  |  |  |
| **CO2ICE(3,\*,\*)** | **In a grasstree system, the effect on C/E ratios of doubling the atmospheric CO2 concentration from 350 ppm to 700 ppm** |  |  |  | crop.100, tree.100  (param.inc) |
| CO2ICE(3,1,1) | (3,1,1) = minimum C/N | scaling factor | 0.5 – 1.5 |  | crop.100, tree.100  (param.inc) |
| CO2ICE(3,1,2) | (3,1,2) = minimum C/P | scaling factor | 0.5 – 1.5 |  | crop.100, tree.100  (param.inc) |
| CO2ICE(3,1,3) | (3,1,3) = minimum C/S | scaling factor | 0.5 – 1.5 |  | crop.100, tree.100  (param.inc) |
| CO2ICE(3,2,1) | (3,2,1) = maximum C/N | scaling factor | 0.5 – 1.5 |  | crop.100, tree.100  (param.inc) |
| CO2ICE(3,2,2) | (3,2,2) = maximum C/P | scaling factor | 0.5 – 1.5 |  | crop.100, tree.100  (param.inc) |
| CO2ICE(3,2,3) | (3,2,3) = maximum C/S | scaling factor | 0.5 – 1.5 |  | crop.100, tree.100  (param.inc) |
| CO2IRS(3) | In a grasstree system, the effect on root‑shoot ratio of doubling the atmospheric CO2 concentration from 350 ppm to 700 ppm | scaling factor | 0.5 – 1.5 |  | crop.100, tree.100  (param.inc) |
| **GTKMRSPMX(\*)** | **These parameters determine the relative maintenance respiration rate for each plant part and are used in subroutine grasstreegrow. Maintenance respiration flux is proportional to live carbon and increases with average daily temperature. For roots, maintenance respiration is reduced by dry soils.** |  |  |  |  |
| GTKMRSPMX(1) | Maximum fraction of live leaf C that goes to maintenance respiration for grasstrees. | fraction | 0.0 – 1.0 | 0.20525 | crop.100, tree.100  (param.inc) |
| GTKMRSPMX(2) | Maximum fraction of live stem C that goes to maintenance respiration for grasstrees | fraction | 0.0 – 1.0 | 0.0045 | crop.100, tree.100  (param.inc) |
| GTKMRSPMX(3) | Maximum fraction of live juvenile fine root C that goes to maintenance respiration for grasstrees | fraction | 0.0 – 1.0 | 0.60 | crop.100, tree.100  (param.inc) |
| GTKMRSPMX(4) | Maximum fraction of live coarse root C that goes to maintenance respiration for grasstrees | fraction | 0.0 – 1.0 | 0.007 | crop.100, tree.100  (param.inc) |
| GTKMRSPMX(5) | Maximum fraction of live mature fine root C that goes to maintenance respiration for grasstrees | fraction | 0.0 – 1.0 | 0.20 | crop.100, tree.100  (param.inc) |
|  |  |  |  |  |  |
| GTMRSPLAI(1) | X1 value for line function that decreases maintenance respiration based on optimal leaf carbon when the amount of carbon in the carbohydrate storage pool is less than  (GTMRSPLAI (3) \* optimal leaf carbon) for a grasstree system |  |  | 0.0 | tree.100  (param.inc) |
| GTMRSPLAI(2) | Y1 value for line function that decreases maintenance respiration based on optimal leaf carbon when the amount of carbon in the carbohydrate storage pool is less than (GTMRSPLAI(3) \* optimal leaf carbon) for a grasstree system |  |  | 0.0 |  |
| GTMRSPLAI(3) | X2 value for line function that decreases maintenance respiration based on optimal leaf carbon when the amount of carbon in the carbohydrate storage pool is less than (GTMRSPLAI(3) \* optimal leaf carbon) for a grasstree system  OR  X1 value for line function that decreases maintenance respiration based on optimal leaf carbon when the amount of carbon in the carbohydrate storage pool is between (GTMRSPLAI(3) \* optimal leaf carbon) and (GTMRSPLAI(5) \* optimal leaf carbon) for a grasstree system |  |  | 0.75 | tree.100  (param.inc) |
| GTMRSPLAI(4) | Y2 value for line function that decreases maintenance respiration based on optimal leaf carbon when the amount of carbon in the carbohydrate storage pool is less than (GTMRSPLAI(3) \* optimal leaf carbon) for a grasstree system  OR  Y1 value for line function that decreases maintenance respiration based on optimal leaf carbon when the amount of carbon in the carbohydrate storage pool is between (GTMRSPLAI(3) \* optimal leaf carbon) and (GTMRSPLAI(5) \* optimal leaf carbon) for a grasstree system |  |  | 1.0 | tree.100  (param.inc) |
| GTMRSPLAI(5) | X2 value for line function that decreases maintenance respiration based on optimal leaf carbon when the amount of carbon in the carbohydrate storage pool is between (GTMRSPLAI(3) \* optimal leaf carbon) and (GTMRSPLAI(5) \* optimal leaf carbon) for a grasstree system |  |  | 2.0 | tree.100  (param.inc) |
| GTMRSPLAI(6) | Y2 value for line function that decreases maintenance respiration based on optimal leaf carbon when the amount of carbon in the carbohydrate storage pool is between (GTMRSPLAI(3) \* optimal leaf carbon) and (GTMRSPLAI(5) \* optimal leaf carbon) for a grasstree system  OR  Y value for line function that decreases maintenance respiration based on optimal leaf carbon when the amount of carbon in the carbohydrate storage pool is greater than (GTMRSPLAI(5) \* optimal leaf carbon) for a grasstree system |  |  | 2.0 | tree.100  (param.inc) |
| **GTGRESP(\*)** | **Growth respiration is a fixed fraction of new production. See subroutine grasstreegrow.** |  |  |  |  |
| GTGRESP(1) | Maximum fraction of live leaf production that goes to growth respiration for grasstrees | fraction | 0.0 – 1.0 | 0.233 | tree.100  (param.inc) |
| GTGRESP(2) | Maximum fraction of live stem production that goes to growth respiration for grasstrees | fraction | 0.0 – 1.0 | 0.233 | tree.100  (param.inc) |
| GTGRESP(3) | Maximum fraction of live juvenile fine root production that goes to growth respiration for grasstrees | fraction | 0.0 – 1.0 | 0.233 | tree.100  (param.inc) |
| GTGRESP(4) | Maximum fraction of live coarse root production that goes to growth respiration for grasstrees | fraction | 0.0 – 1.0 | 0.233 | tree.100  (param.inc) |
| GTGRESP(5) | Maximum fraction of live mature fine root production that goes to growth respiration for grasstrees | fraction | 0.0 – 1.0 | 0.233 | tree.100  (param.inc) |
| NO3PREF(3) | Nitrate preference. When both ammonium and nitrate are present, this is the fraction of N uptake that will come from nitrate (if possible). When this value is negative, ammonium and nitrate will be taken up in proportion to the amount available, which is the way DayCent has traditionally computed N uptake. | fraction | -1 or  0.0 – 1.0 | -1.0 | crop.100. tree.100  (param.inc) |
| GTLAYPG | Number of soil layers used to determine water and mineral N, P, and S that are available for grasstree growth | Number of soil layers | 1 – 9 | 6 | crop.100. tree.100  (param.inc) |
| GTMIX | Annual rate that surface SOM2C that is mixed into (transferred to) soil SOM2C in a grasstree system | yr-1 | 0.0 – 1.0 | 0.10 | crop.100. tree.100  (param.inc) |
| **Growing Degree Day parameters** | **Note: The GDD implementation for grasstrees has not get been implemented.** |  |  |  |  |
| TMPGERM | Germination temperature for the growing degree day submodel, will cause a GFST event for a perennial (GTFRTCINDX = 3) | °C |  |  | crop.100 |
| DDBASE | Number of degree days required to trigger a senescence (SENM) event for a perennial (GTFRTCINDX = 3). | number of degree days |  | 1500 | crop.100 |
| TMPKILL | Temperature at which growth will stop when using the growing degree day submodel, will cause a SENM and LAST event for a perennial (FRTCINDX = 3) or a HARV and LAST event for an annual (FRTCINDX = 4) if the required number of thermal units have not been accumulated prior to trigger a SENM or a HARV event. | °C |  | 7 | crop.100 |
| BASETEMP(1) | Base temperature for crop growth, growing degree days will accumulate only on days when the average temperature is greater than the base temperature for the crop. | °C |  | 10 | crop.100 |
| BASETEMP(2) | Ceiling on the maximum temperature used to accumulate growing degree days. | °C |  | 30 | crop.100 |
| MXDYSENE | maximum number of days  after autumnal equinox when  senescence? harvest? must occur if *ddbase*  (or killing frost) has not already triggered senescence |  |  |  | NEW |
| **Photoperiod controls on senescence. Correspond to GSEN event in the schedule file.** | | | | | |
| DYLENSEN | The daylength that triggers a GSEN event. Senescence will commence when daylength ≤ DYLENSEN and daylength is decreasing. | hours |  | ≤ 12.0, and feasible for the latitude of the site. | NEW  Added 9/21/2021 |
| GSENEDYS | Number of days a GSEN event persists. Senescence will commence when daylength ≤ DYLENSEN and daylength is decreasing. | Number of days |  | ~30 | NEW  Added 9/21/2021 |
| GSENDETH(1) | Fraction of leaves which die over the GSENEDYS period with a GSEN (senescence) event. Live stems that die are transferred to standing dead stem pool. | fraction | 0.0 – 1.0 |  | NEW  Added 9/21/2021 |
| GSENDETH(2) | Fraction of stems which die over the GSENEDYS period with a GSEN (senescence) event. Live stems that die are transferred to standing dead stem pool. | fraction | 0.0 – 1.0 |  | NEW  Added 9/21/2021 |
|  |  |  |  |  |  |
| GTMXTURN | Maximum turnover rate per month of juvenile fine roots to mature fine roots through aging | fraction per month |  | 0.12 | crop.100, tree.100 |
| WSCOEFF(3,1) | Water Stress Coefficient used to calculate the water stress multiplier on potential growth based on the relative water content of the wettest soil layer in the rooting zone (*maxrwcf*, 0-1). |  | See wscoeff.xlsx | 0.378 | crop.100, tree.100 |
| WSCOEFF(3,2) | Water Stress Coefficient used to calculate the water stress multiplier on potential growth based on the relative water content of the wettest soil layer in the rooting zone. See comments above. |  | See wscoeff.xlsx | 9.0 | crop.100, tree.100  (param.inc) |
| PS2MRSP(3) | Fraction of gross photosynthesis that goes to maintenance respiration during the growing season. | fraction | 0.20-0.30 |  | crop.100, tree.100  (param.inc)  See subroutine grasstreegrow. |
| SFAVAIL(3) | Fraction of N available per day to plant. This replaces the former FAVAIL(1) in fix.100. | fraction |  |  | crop.100, tree.100  (parfx.inc) |
| **Root Priming Effect on decomposition** |  |  |  |  |  |
| CRPINDX | Flag to indicate the root priming effect to be simulated:  0 = no root priming 1 = total soil respiration (heterotrophic + autotrophic) 2 = heterotrophic soil respiration only  3 = fine root production | index | 0 - 3 | 0  Root priming option has not been tested for grasstree. | crop.100, tree.100  (param.inc) |
| CRPCMN | Minimum respiration or fine root production required for minimum effect on root priming | g C m-2 |  |  | crop.100, tree.100  (param.inc) |
| CRPCMX | Maximum respiration or fine root production required for maximum effect on root priming | g C m-2 |  |  | crop.100, tree.100  (param.inc) |
| CRPMNMUL | Multiplier for root priming effect on som2c(2) decomposition when respiration or root production equals the minimum value | scalar | 0.0 – 1.0 |  | crop.100, tree.100  (param.inc) |
| CRPMXMUL | Multiplier for root priming effect on som2c(2) decomposition when respiration or root production equals the maximum value | scalar | 0.0 – 1.0 |  | crop.100, tree.100  (param.inc) |
| **Photosynthesis model** |  |  |  |  |  |
| CARBOSTG(3,1) | Initial value for unlabeled carbohydrate storage pool | g C m-2 | 0 – 250 | 250 | none |
| CARBOSTG(3,2) | Initial value for labeled carbohydrate storage pool | g C m-2 | 0 –1 | 0 | none |
| AMAX(3) | Maximum net CO2 assimilation rate assuming maximum possible PAR, all intercepted, no temperature, water or vapor pressure deficit stress. | nmol CO2 g‑1 (leaf biomass) sec-1 |  | 30.0 | crop.100, tree.100  (photosyn.inc) |
| AMAXFRAC(3) | Average daily maximum photosynthesis as a fraction of AMAX(3). | fraction | 0.0 – 1.0 | 0.75 | crop.100, tree.100  (photosyn.inc) |
| AMAXSCALAR1(3) | Multiplier used to adjust aMax based on growthDays1 days since germination | scalar |  | 0.5 | crop.100, tree.100  (photosyn.inc) |
| AMAXSCALAR2(3) | Multiplier used to adjust aMax based on growthDays2 days since germination. | scalar | 0.8 – 1.6 | 1.6 | crop.100, tree.100 |
| AMAXSCALAR3(3) | Multiplier used to adjust aMax based on growthDays3 days since germination. | scalar | 0.7 – 1.5 | 1.2 | crop.100, tree.100  (photosyn.inc) |
| AMAXSCALAR4(3) | Multiplier used to adjust aMax based on growthDays4 days since germination. | scalar | 0.3 – 0.8 | 0.0 | crop.100, tree.100  (photosyn.inc) |
| ATTENUATION(3) | Light attenuation coefficient. |  |  | 0.58 | crop.100, tree.100  (photosyn.inc) |
| BASEFOLRESPFRAC(3) | Basal foliage respiration rate, as fraction of maximum net photosynthesis rate  respPerGram = base foliar respiration, unmodified by temp, water, light, vpd (nmol CO2 (g leaf)-1 sec-1):  respPerGram = **basefolrespfrac** \* **amax**  \* **amaxscalar**  grossAMax = **amax** \* **amaxscalar** \* **amaxfrac**  + respPerGram |  |  | 0.30 | crop.100, tree.100  (photosyn.inc) |
| CFRACLEAF(3) | factor for converting leaf biomass to carbon (leaf biomass \* cFracLeaf = leaf C)  See equation in **leafcspwt(3)** definition. | (g C) / (g biomass) |  | 0.45 | crop.100, tree.100  (photosyn.inc) |
| DVPDEXP(3) | Exponential value in vapor pressure deficit effect on photosynthesis equation.  dVpd = dVpdSlope \* exp(vpd\*dVpdExp) |  |  | -0.48 | crop.100, tree.100  (photosyn.inc) |
| DVPDSLOPE(3) | Slope value in vapor pressure deficit effect on photosynthesis equation.  dVpd = dVpdSlope \* exp(vpd\*dVpdExp) |  |  | 2.457 | crop.100, tree.100  (photosyn.inc) |
| GROWTHDAYS1(3) | Number of days after germination to start using AMAXSCALAR1. | number of days |  | 1 | crop.100, tree.100  (photosyn.inc) |
| GROWTHDAYS2(3) | Number of days after germination to start using AMAXSCALAR2. | number of days |  | ~20-40 | crop.100, tree.100  (photosyn.inc) |
| GROWTHDAYS3(3) | Number of days after germination to start using AMAXSCALAR3. | number of days |  | ~100-150 | crop.100, tree.100  (photosyn.inc) |
| GROWTHDAYS4(3) | Number of days after germination to start using AMAXSCALAR4. | number of days |  | ~180-230 | crop.100, tree.100  (photosyn.inc) |
| HALFSATPAR(3) | Photosynthetically active radiation (PAR) at which photosynthesis occurs at 1/2 of theoretical maximum. | Einsteins \* m-2 ground area \* day-1 |  | 17.28 | crop.100, tree.100  (photosyn.inc) |
| LEAFCSPWT(3) | Grams of carbon in a square meter of leaf area.  convert units from nmol CO2 (g leaf)-1 sec-1 to gC m-2 day-1  conversion = 12 \* (10-9)  \* (**leafcspwt** / **cfracleaf**)  \* lai \* SEC\_PER\_DAY;  potGrossPsn = grossAMax  \* dTemp \* dVpd \* lightEff  \* conversion | g C (m2 leaf area)-1 |  | 100-270 | crop.100, tree.100  (photosyn.inc) |
| PSNTMIN(3) | Minimum temperature at which net photosynthesis occurs | ºC |  | 4.0 | crop.100, tree.100  (photosyn.inc) |
| PSNTOPT(3) | Optimal temperature at which net photosynthesis occurs | ºC |  | 24.0 | crop.100, tree.100  (photosyn.inc) |
| FLODEFF(3) | Multiplier on potential grasstree production when soil in the rooting zone is saturated. The flood effect on potential production is 1.0 at field capacity (or drier) and is decreased/increased linearly as soil in the rooting zone becomes wetter. A value of 1.0 = no effect of flooding on potential production. To decrease potential production when soils are saturated, use a value < 1.0. FLODEFF(3)=0.0 ceases production when soils are saturated. To increase potential production when soils are saturated, use a value > 1.0. | fraction | 1. – 1.0   or  1.0 – 2.0 | 1.0 | crop.100, tree.100  (param.inc) |