# FORM FOR ParametErisATION OF 4C

The following table is thought as a tool for structured documentation of the parameter values and related information. The format does not need to stay unchanged. If it happens to be more convenient to rearrange the columns, add new ones or present the information in a totally different manner feel free to do so.

Table: Species-specific parameters for species: *Pinus ponderosa*

| **Variable** | **Unit** | **Parametervalue for new species** | **description of parameter and of data sets required for parameterisation** | **Sources from which the parameter values have been determined** | **additional sources or information which has not yet been exploited (hints)** |
| --- | --- | --- | --- | --- | --- |
| amax | [years] | 250 | maximal tree age of individual trees in absence of major disturbances |  | (Tapias et al. 2004) : 250 years |
| pst | [-] |  | shade tolerance, high = 5, low = 1 |  |  |
| pfext | [-] |  | Light extinction coefficient, average coefficient for Lambert-Beer law type description of light transmission |  |  |
|  |  |  | **Physiological parameters** |  |  |
| σn | [kg N (kg root dM)-1 y-1] |  | specific nitrogen uptake capacity of fine roots |  |  |
| respcoeff | [-] | 0.52 | fraction of gross production which is respired by the whole plant (autotrophe respiration) for the model variant which uses a fixed fraction (see Landsberg) | GOTILWA+: für Holz: 35 cal g-1 DM y-1 \* 0,08  Blätter:  Rl = 55,5\*[C mobil]\*Q10 + 33,3\*(1-Cm)\*Q10 | Pinus sylvestris: 0.52 |
| prg | [-] |  | fraction of carbon lost as growth respiration during growth (= gC respired as growth respiration /(gC respired for growth respiration + gC laid down in products of growth) |  |  |
| prms | [d-1] |  | specific respiration rate of sap wood (generally at a base temperature of 15 °C, if other base temperatures were used, report these and if available information on temperature sensitivity as Q10) = fraction of mass repired per day for maintenance purposes | GOTILWA+:  für Holz: 35 cal g-1 DM y-1 \* 0,08  at 25 °C |  |
| prmr | [d-1] |  | specific respiration rate of fine roots (generally at a base temperature of 15 °C, if other base temperatures were used, report these and if available information on temperature sensitivity as Q10) = fraction of mass respired per day for maintenance purposes | GOTILWA+: Rfr = BM(fr) \* q10\*((0,1\*33,3)+(1-0,1)\*55,5)  (Annahme: 10% structural C in roots) |  |
| psf | [y-1] | 0,73  0,4  0,36  0.5 | senescence rate of leaves (= 1/life span), in case of cold deciduous trees = 1 | GOTILWA+ (Gracia et al. 2004):  0.002 day-1  🡪 **0.73** year-1  Sabate et al. 2002  Sabate et al. 2002  (Lopez-Serrano et al. 2005) : mea nage of needles 24 month 🡪 **0.5** |  |
| pss | [y-1] | 0 | senescence rate of sap wood (1/(time till stop of functioning as active water conducting xylem)) | GOTILWA+ | Pinus sylvestris? |
| psr | [y-1] | 1,095 | senescence rate of fine roots (= 1/life span) | GOTILWA+ (Gracia et al. 2004):  0.003 day-1 🡪 1.095 year-1 |  |
| pncr | [gN gC-1] |  | average plant nitrogen-carbon ratio: for calculation needed: typical nitrogen and carbon content of individual organs and mass of these organs (where possible report age and size of the trees) |  |  |
| alphac | [-] | 0,5616  OR 0.694  🡪 0,63 | average growth increment of branches, twigs and gross roots relative to the sap wood increment (where possible report age and size of the trees) | GOTILWA+:  branches : stem = 0,28 OR: %abground = branches = 0.28-  BM below : BM above = 0,22  🡪 = 0.28 + (0.22\*1.28) = 0.5616 |  |
| prhos | kg DM cm-3 Fresh volume | 0.00062 | density of sap wood, will often be approximated by wood density | GOTILWA+ (Gracia et al. 2004) | Tapias et al.: 0.000548 |
| pnus | [kg DM cm2] | 0.0157  0.0245 | leaf mass to sap wood area (whole tree leaf mass and sap wood cross sectional area at the base of the living crown) | GOTILWA+:  Leaf area/sapwood area: 0.069m2/cm2  SLM( specifoc leaf mass): 22.75mg/cm2  🡪 0,0156975  baq – 01 (Baquedano and Castillo 2006) | Other GOTILWA+-source: SLM = 28  From Lopez-S. et al. (lop-04, lop-05): 0,09886 |
|  |  |  | **isometric and allometric relationships** |  |  |
| pha | [cm kg-1] |  | for the determination of all pha parameters data sets of leaf mass and tree height for as many individual trees in different social position are needed, a desciption of the procedure for parameter fits to the data will be provided separately |  | Tapias et al.: max. tree height : 22m |
| pha\_coeff1 |  |  | " |  |  |
| pha\_coeff2 |  |  | " |  |  |
| pha\_v1 |  | 210 | H – height [m]  Wf – leaf biomass [kg] | Lopez-Serrano et al. 2005, FEM 215(1-3) : 251-270 (lop-04) |  |
| pha\_v2 |  | 0.08 | " | Lopez-Serrano et al. 2005, FEM 215(1-3) : 251-270 (lop-04) |  |
| pha\_v3 |  | 0.6 | " | Lopez-Serrano et al. 2005, FEM 215(1-3) : 251-270 (lop-04) |  |
| crown\_a | m cm-1 |  | for the determination of the parameters related to crown diameter - BHD - relationship data sets of crown diameter or crown projection area and breast height diameter for as many individual trees as available are needed, the instructions for parameter fits to data will be given separately | (Lopez-Serrano et al. 2000) |  |
| crown\_b | m |  |  |  |  |
| crown\_c | m |  | " |  |  |
| psla\_min | [m2 kg-1 TM] | 4.396  5.28  🡪 4.84 | typical specific leaf area (SLA) = projected leaf area / leaf dry mass  for this and the following parameter measurements of SLA of the uppermost fully exposed sun leaves and of leaves at known relative quantum flux density are needed | GOTILWA+: 22,75 mg cm-2  Baq – 01(Baquedano and Castillo 2006): seedlings, 3yrs | Other GOTILWA+-source: SLM = 28  fue-01(Fuentes et al. 2007): 4,8 – 5,4 |
| psla\_a |  |  | change in SLA for a 100% drop in relative quantum flux density = slope of SLA – quantum flux relationship |  |  |
|  |  |  | Photosynthesis parameters  all photosynthesis parameters are currently non species specific, i.e. it is not essential for model application to provide information on photosynthesis. Yet, a collection of any kind of informationen on photosynthetic capacities is useful, as: maximal carboxylation capacity (Vm), electron transport capacity (Jmax), maximal light saturated photosynthetic rate (Amax) and the correlation of these capacities with leaf nitrogen contents including a description of growth and experimental conditions |  |  |
| phic |  |  | efficiency parameter, different for evergreen and deciduous trees |  |  |
| pnc |  |  | leaf C/N ratio |  |  |
| kco2\_25 |  | 0.000404 | Michaelis constant for CO2 at 25 °C | GOTILWA+ |  |
| ko2\_25 |  | 24.8 | Michaelis constant for O2 at 25 °C | GOTILWA+ |  |
| pc\_25 |  |  | CO2/O2 specificity value at 25 °C |  |  |
| Q10\_kco2 |  |  | Q10 of Michaelis constant for CO2 |  |  |
| Q10\_ko2 |  |  | Q10 of Michaelis constant for O2 |  |  |
| Q10\_pc |  |  | Q10 of specificity ratio |  |  |
| pb | [-] | 1/41,5 | mitochondrial respiration rate (Rd) / maximal carboxylation rate (Vm) | GOTILWA+ |  |
| Nresp |  |  | slope of photosynthesis response to N-limitation |  |  |
|  |  |  | **phenology related parameters** |  |  |
| zw |  | 0.0 | Schwellwert der Temperatursumme bei Blattaustrieb |  |  |
| m\_bb |  |  | for determination of the parameters m\_bb und n\_bb big data sets of observations of of bud burst and weather data for the same year (temperature) are needed. It is also useful to provide information on any phenology model which has already been fitted for the species (parameter values and information on data to which the model has been fitted). |  |  |
| n\_bb |  |  | " |  |  |
| anf\_bb |  | 1 | average day at which chilling requirements are met, or day with minimal day length which triggers start of heat unit accumulation for bud burst |  |  |
| end\_bb |  | 366 | average day of leaf drop, for evergreen trees = 366 if not known |  |  |
|  |  |  | **Interception** |  |  |
| ceppot\_spec | [mm m-2] |  | interception capacity of leaves in mm water per square meter leaf area | GOTILWA+: parameter value is identical to P. sylvestris, but cannot be identified in param-files … |  |
|  |  |  | **parameters related to regeneration and seedling growth** |  |  |
| αwint |  |  | parameter of Weibull-distribution for intrinsic mortality |  |  |
| αwstress |  |  | parameter of Weibull-distribution for stress mortality |  |  |
| Wseed [g] |  | 0.019 | mass of a single seed | Tapias et al. |  |
| Ns,max [m-1] |  |  | seed density, is prescribed by the model user |  |  |
| psa |  |  | parameter in allometric relationship between seedling shoot mass and leaf mass    Wf – foliage biomass [kg]  Ws – shoot biomass [kg] | Missing data, Gonzalo? |  |
| psb |  |  | siehe psa |  |  |
| ph1 |  | 1.3145 | parameter in allometric relationship between seedling height and shoot mass    H – height [cm]  Ws – shoot biomass | (Royo et al. 2001; Baquedano and Castillo 2006)  Fuentes et al. (fue-01):  bm = 0.0001\*h3.9889  R2 = 0.8362 | Fuentes et al.: D-BM-relation :  bm = 2.404\*D0.7339  R2 = 0.0488 |
| ph2 |  | 0.3426 | parameter in allometric relationship between seedling height and shoot mass |  |  |
| ph3 |  | - | parameter in allometric relationship between seedling height and shoot mass; currently only required for spruce |  |  |
| pc |  |  |  |  |  |
| k\_opm\_fol | [d-1] | 0.002 | for the determination of all k\_opm und k\_syn parameters results of litter incubation studies or mineralisation studies based on the 'litter bag' method are needed. procedure of fit of parameters will be described elsewhere  mineralization constant of foliage litter | GOTILWA+ |  |
| k\_syn\_fol | [-] |  | synthesis coefficient of humus from foliage litter |  |  |
| k\_opm\_frt | [d-1] | 0,0004 | mineralization constant of fine root litter | GOTILWA+ |  |
| k\_syn\_frt | [-] |  | synthesis coefficient of humus from fine root litter |  |  |
| k\_opm\_stem | [d-1] |  | mineralization constant of stem wood litter |  |  |
| k\_syn\_stem | [-] |  | synthesis coefficient of humus from stem wood litter |  |  |
| k\_opm\_tbc | [d-1] |  | mineralization constant of twigs, branches and coarse root litter |  |  |
| k\_syn\_tbc | [-] |  | synthesis coefficient of humus from twigs, branches and coarse root litter |  |  |

GOTILWA+: Handbook to GOTILWA+ and Gracia, C. A., S. Sabaté & A. Sánchez: El cambio climático y la reducción de la reserve de agua en el bosque mediterráneo (jr – gra – 14b)

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