Case 1 – Grass growth model  
List of equations

## Differential equations

The model is described by the following system of differential equations:

|  |  |  |
| --- | --- | --- |
|  |  | (1) |
|  |  | (2) |

Where:  
 [kgC m-2] Storage mass   
 [kgC m-2] Structure mass (can be harvested)

## Supporting algebraic equations

[kgC m-2 d-1] Photosynthetic growth rate

[-] Water availability index (disturbance from water sub-model)  
 [-] Photosynth. fraction for growth (rest for root maintenance)  
 [kg-C kg-1-CO2] CO2 to C mass conversion factor  
 [kg-CO2 m-2 d-1] Photosynthetic growth  
Where:  
 [kgCO2 m-2 d-1]  
 [W m-2] Light intensity over a leaf

Assuming a time-step equal to that of measured data, can be simplified to:

With:  
 [kgCO2 m-2 d-1] Maximum photosynthetic rate   
 [kgCO2 m-2 d-1]

[-] Canopy extinction coefficient  
 [kgCO2 m-2 d-1] Simplification term  
 [-] Leaf area index  
 [m2/kg] Structural specific leaf area  
 [kgCO2 J-1] Leaf photosynthetic efficiency  
 [-] Leaf transmission coefficient  
 [°C] Environment temperature (Disturbance)  
 [J m-2 d-1] Photosynth. active radiation (Disturbance)

[kgC m-2 d-1] Maintenance respiration

[d-1] Maintenance respiration coefficient

[kgC m-2 d-1] Structure weight growth

[d-1] maximum growth rate  
 [kgC m-2 d-1] Total grass weight

[kgC m-2 d-1] Shoot respiration

[-] Yield factor from storage weight to structure weight

Mohtar uses the additional flow:

[kgC m-2 d-1] Conversion from storage to structure

[kgC m-2 d-1] Senescence structure decay

[d-1] Senescence rate

[kgC m-2 d-1] Recycling flow (when stressed)  
 [d-1] Recycling rate

## References

[Johnson](http://library.wur.nl/WebQuery/rduser/ezproxy?url=https://doi.org/10.1111/1365-3040.ep11588103_6_9), I.R. and Thornley, J.H.M. (1983). Vegetative crop growth model incorporating leaf area expansion and senescence, and applied to grass. *Plant, Cell & Environment* 6.9 (1983): 721-729.

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