**DroughtCat service**

**Goal**

Offer model predictions regarding the current-day and recent trends in water status of forest soils and main tree species over Catalonia (NE Spain). Uses a soil water balance model on forest plots of the Spanish National Forest Inventory (De Cáceres *et al.* 2015). Intended to complement monitoring programs of observed drought-related forest decay in the same area (DEBOSCAT) (Chaparro *et al.* 2016).

**Tracked soil water balance variables**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable name** | **Definition** | **Units** | **Display** |
| PET | Penman’s potential evapotranspiration | mm/day | Yes |
| Precipitation | Precipitation | mm/day | No |
| NetPrec | NetPrecipitation | mm/day | No |
| Runoff | Surface (overland) runoff | mm/day | No |
| DeepDrainage | Deep drainage to groundwater | mm/day | No |
| LAI | Leaf area index (including all woody species) | m2/m2 | Yes |
| Eplant | Plant transpiration | mm/day | Yes |
| Esoil | Soil evaporation | mm/day | No |
| Theta | Average soil moisture relative to field capacity. | [0-1] | Yes |

**Tracked plant drought stress variables**

|  |  |  |
| --- | --- | --- |
| **Variable** | **Definition** | **Units** |
| PinusHalepensis | Drought stress for *Pinus halepensis* | [0,1] |
| PinusNigra | Drought stress for *Pinus nigra* | [0,1] |
| PinusSylvestris | Drought stress for *Pinus sylvestris* | [0,1] |
| PinusUncinata | Drought stress for *Pinus uncinata* | [0,1] |
| PinusPinea | Drought stress for *Pinus pinea* | [0,1] |
| PinusPinaster | Drought stress for *Pinus pinaster* | [0,1] |
| QuercusIlex | Drought stress for *Quercus ilex* | [0,1] |
| QuercusSuber | Drought stress for *Quercus suber* | [0,1] |
| QuercusHumilis | Drought stress for *Quercus humilis* | [0,1] |
| QuercusFaginea | Drought stress for *Quercus faginea* | [0,1] |
| FagusSylvatica | Drought stress for *Fagus sylvatica* | [0,1] |

**Displayed trends**

|  |  |  |
| --- | --- | --- |
| **Temporal resolution** | **How far into past?** | **Update** |
| Daily | Last 365 days | Daily |
| Monthly | Last 36 months | Every first day of month |
| Yearly | Since service started | Every first day of year |

**Scripts**

*Preliminaries\_0\_InitSpatialForesPoints.R* – Initializes forest plot data (trees, shrubs, soil properties) from Forest inventory (IFN3) data and soil layers.

*Preliminaries\_1\_InitRootSystems.R* – Initializes root system distribution and soil depth using estimates derived from optimization under the eco-hydrological equilibrium hypothesis (Cabon et al. in prep.).

*Preliminaries\_2\_InitInputObjects.R* – Creates input for soil water balance model for each plots. Soil and plant state variables are stored in “/Rdata/Plots”.

*Preliminaries\_3\_InitPlotYearTrends.R* – Initializes one-year plot trends (missing values for all days). One-year trends are stored in “/Rdata/PlotYearTrends”.

*Day\_0\_MeteorologyInterpolation.R* – Interpolates daily weather over forest plot locations from weather station data.

*Day\_1\_SWB.R* – Calls soil water balance function in medfate to update soil and plant water status. Soil and plant state variables are stored in “/Rdata/Plots”. Results of daily soil water balance are stored in “/Rdata/DailySWB”.

*Day\_2\_DaySWBMaps.R* – Extracts soil water balance status from daily results and shapes it in form of spatial points data frame. Results are stored in “/Rdata/SpatialPointSWBMaps”.

*Day\_3\_UpdatePlotYearTrends.R* – Extracts soil water balance status from daily results to update plot-wise tables that store daily trends for one year. One-year trends are stored in “/Rdata/PlotYearTrends”.

*Day\_4\_DayDroughtStressMaps.R* – Extracts species drought stress from daily results and shapes it in form of spatial points data frame. Results are stored in “/Rdata/SpatialPointDroughtStressMaps”.

*Day\_Master.R* – Calls the routine to download AEMET daily weather and, after that, calls Day\_0 to Day\_3 functions to perform simulations and process results for the current day.

*RecoverDays\_Master.R* – Used to simulate daily water balance and/or process results when, for any reason, Day\_Master.R has not been successfully completed in programmed tasks. Also used to reshape past outputs to current display formats.

**References**

1.De Cáceres, M., Martínez-Vilalta, J., Coll, L., Llorens, P., Casals, P., Poyatos, R., *et al.* (2015). Coupling a water balance model with forest inventory data to predict drought stress: the role of forest structural changes vs. climate changes. *Agric. For. Meteorol.*, 213, 77–90

2.Chaparro, D., Vayreda, J., Vall-llossera, M., Banque, M., Piles, M., Camps, A., *et al.* (2016). The Role of Climatic Anomalies and Soil Moisture in the Decline of Drought-Prone Forests. *IEEE J. Sel. Top. Appl. Earth Obs. Remote Sens.*, 10, 503–514