



Hemiboreal forests under the 2018 Europe heat wave

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Hemiboreal zone covers a substantial amount of forests in Estonia, Southern Finland and parts of Sweden, being the transitional part between boreal and temperate zones. The European heat wave of summer 2018 resulted in the prolonged high air temperature period (from May till the end of July) coupled with low precipitation causing a significant drought. Utilizing the eddy-covariance technique we studied the effect of these extreme climatic conditions on the carbon exchange of four forest ecosystems typical for the hemiboreal zone in Estonia:

1. Soontaga Forest Station (coniferous site) is a dry 200-year-old Scots pine (*Pinus sylvestris*) forest with Norway spruce (*Picea abies*) forming the second layer.
2. SMEAR Estonia (mixed site) main tower footprint covers a mixture of forested (102-year-old pines, 79-year-old spruces and 68-year-old birch (*Betula pendula* and *Betula pubescens*) trees) and clear-cut areas located on a drained peatland soil.
3. Agali (deciduous site) is a 40-year-old *Filipendula* type grey alder (*Alnus incana*) stand on former agricultural land (*Gleysol*) typically characterized by periods of flooding in spring (after the snow melting) and in autumn (in case of high precipitation).
4. Tenso site is a young clear-cut site with the plantation of 3-year-old Silver birch seedlings and dominating *Poaceae* species.

All the sites are equipped with similar eddy-covariance systems (LI-7200 + Metek uSonic Class A (Gill HS-50 at the clear-cut site)) and the data processing followed the same protocols. For the purposes of the present research only the data from 2 consecutive years (“cold and wet” 2017 and “hot and dry” 2018) were studied.

The change in average soil water content (SWC) during the growing seasons of 2017/2018 differed for all the 4 sites: coniferous site experienced only slight decrease ($10.19 \pm 3.05\%$ in 2017; $9.25 \pm 3.08\%$ in 2018); deciduous site SWC decreased for almost by one third (from $47.51 \pm 13.69\%$ in 2017 to $34.46 \pm 23.06\%$ in 2018); mixed site SWC reduction was almost by double ($49.5 \pm 25.1\%$ in 2017; $27.03 \pm 26.7\%$ in 2018). The greatest difference was found for the clear-cut site (from $12.91 \pm 4.32\%$ in 2017 to $3.96 \pm 4.29\%$ in 2018).

The differences in NEE, GPP and Reco, as well as Michaelis-Menten light response curve parameters (GPPmax and ecosystem light use efficiency) of the 2017-2018 years, are the focus of the present study.