

S1 Optimal time window for image analysis

In order to determine the periods when low light levels significantly affect the GCC observation, the mean diurnal GCC cycles during different months were calculated for the reference plate placed within the tree crown (Fig. S1). These cycles show that from March to October the mean 30-min GCC values remained stable from 9.00 to 17.00 (local winter time, UTC+2). During the other months, the stable period was markedly shorter. In winter, solar radiation is low throughout the day (Fig. S2), which was observed as a decreased GCC level even at noon; in addition, the variance of GCC increased notably. Similarly, the nocturnal data show a large variance throughout the year, although at these latitudes, i.e. north of the Arctic circle, it never gets completely dark during the summer months.

To further illustrate the annual cycle of the reference plate GCC, Fig. S3 shows the mean daytime GCC over a 17-month period, with the daytime period here limited to 11.00–15.00. The reduction in the mean GCC occurred from November to February, during which period the variance was also increased. This degradation of the signal in insufficient light conditions must be taken into account, if GCC data are to be used for studying the effect of snow cover, and further investigated if other measures of greenness are used. However, as the present study aims to observe the phenological development of ecosystems, we limited the study period to 10 February – 31 October. During this period, the reference GCC values were stable varying between 0.332 and 0.339 (with an average of 0.336). The maximum standard deviation for the period was 0.0036.

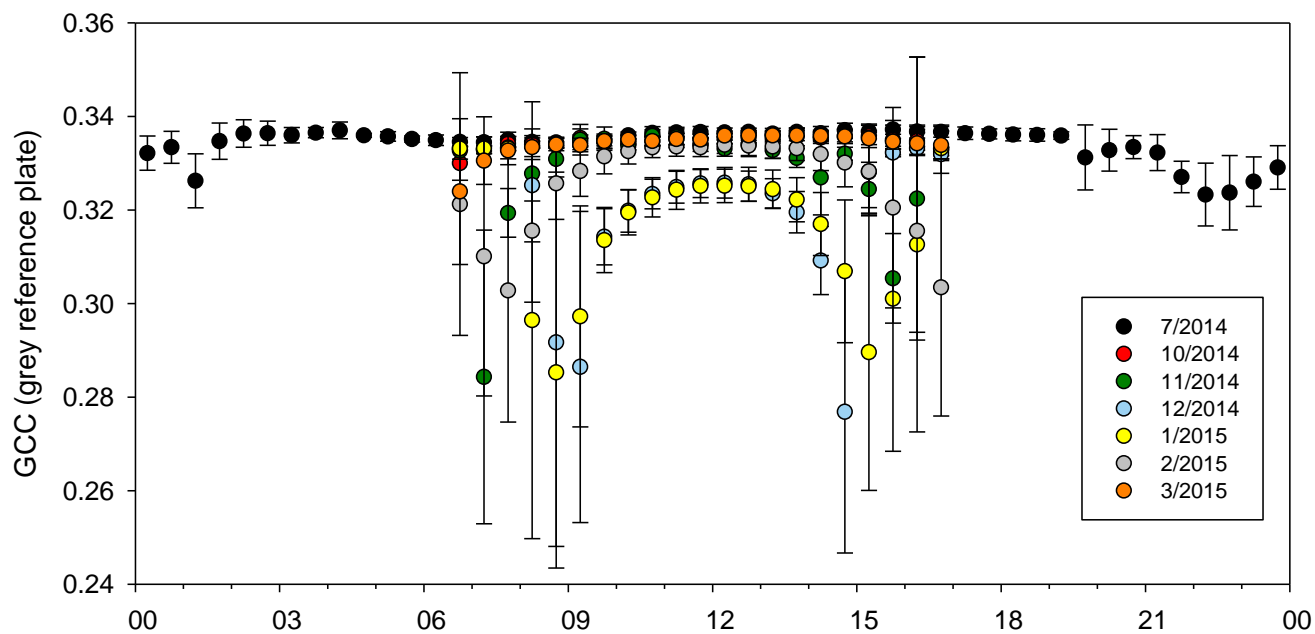


Figure S1. Mean diurnal cycle of GCC (+/- standard deviation shown by error bars) of the tree crown reference plate during selected months.

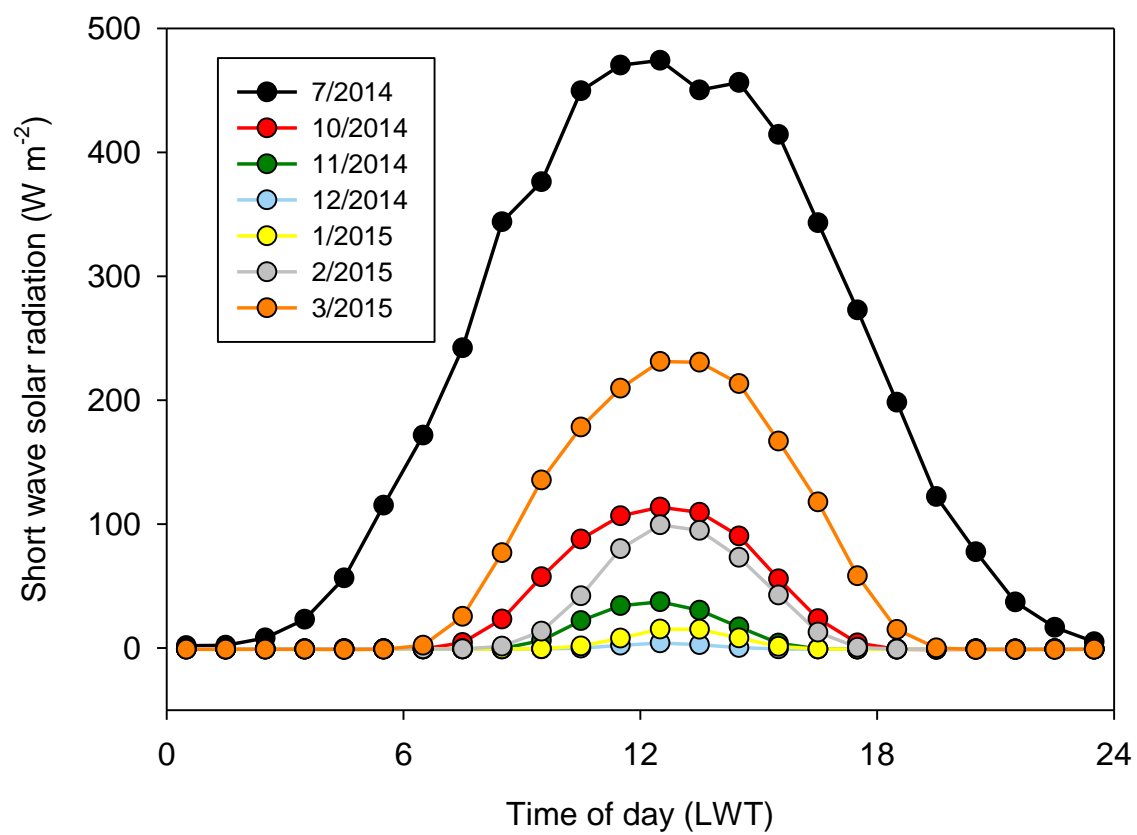


Figure S2. Mean diurnal cycle of shortwave radiation during selected months.

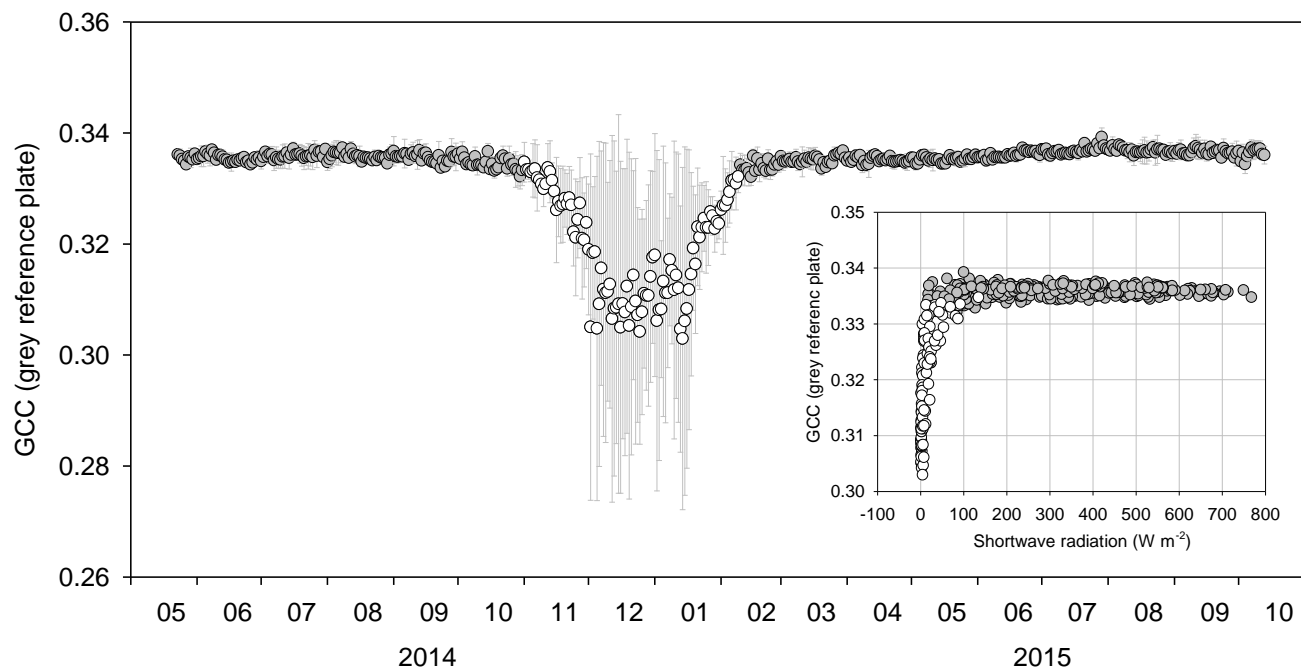


Figure S3. Annual cycle of the mean daytime (11.00–15.00, local winter time) GCC (+/- standard deviation shown by error bars) of the tree crown reference plate. In the inset figure the same GCC values are plotted against shortwave radiation. The white circles indicate the wintertime data that are influenced by an insufficient light level.

S2 Additional figures

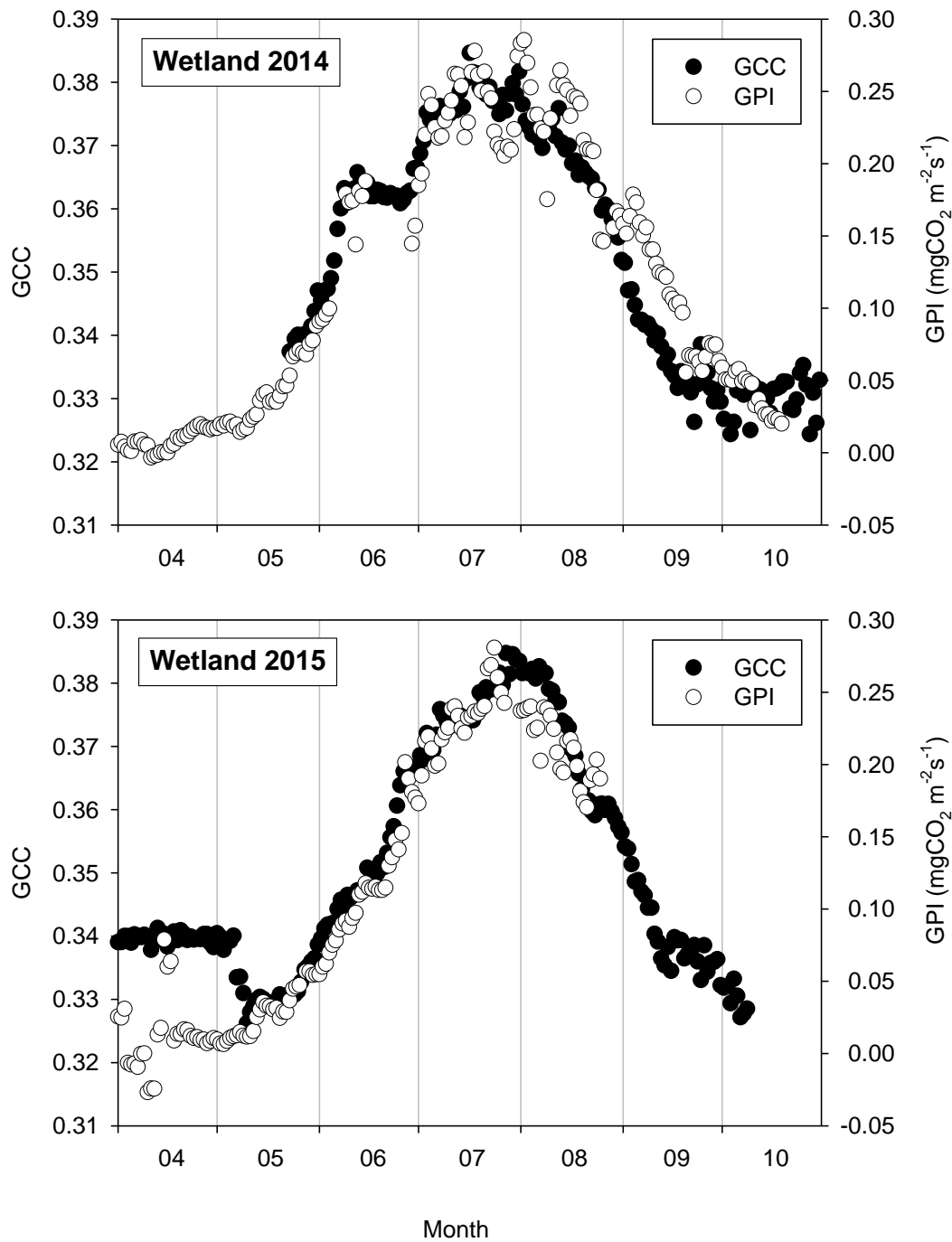


Figure S4. Mean daytime (11.00–15.00) GCC together with the gross photosynthesis index (GPI) at the wetland site in a) 2014 and b) 2015.

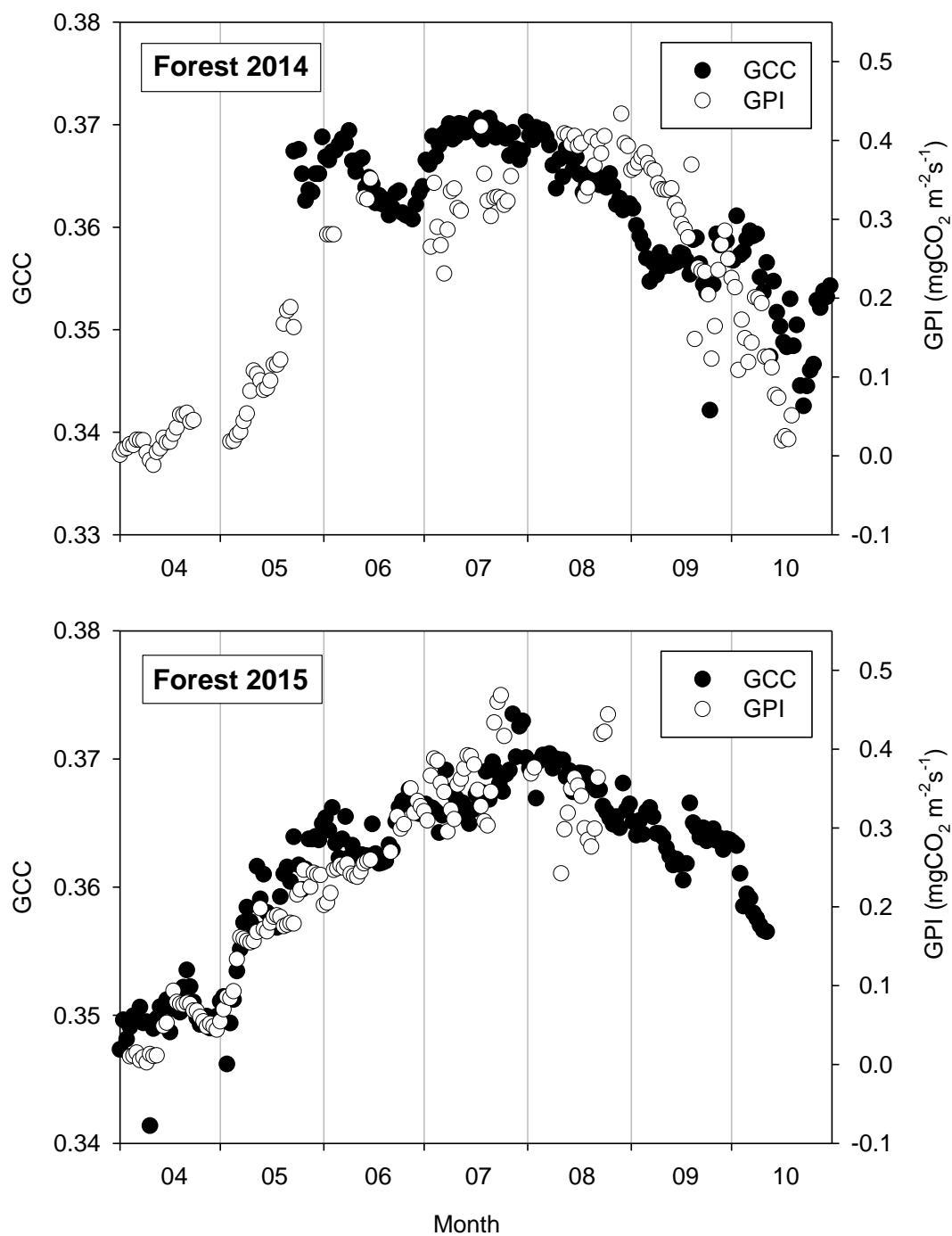


Figure S5. Mean daytime (11.00–15.00, local winter time) GCC (crown camera) together with the gross photosynthesis index (GPI) at the forest site in a) 2014 and b) 2015.