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Conference Abstract

Bab forest phenological assessment by using GCC based on RGB bands of Phenocams imagery

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Abstract

Forest phenology is the crucial indicator of changing climatic conditions. In recent times, phenology cameras are widely being used to observe the growth patterns and seasonal behaviours of vegetation in response to different climatic factors. This study was conducted in the forested LTER site Bab, Slovakia (https://deims.org/79e10639-dd60-4f30-9c43-7b2bae0f359a). The study used the GCC (Green Chromatic coordinate)index based on RGB bands of PhenoCamera imagery from the year 2017 to 2020. Forest vegetation was divided into herb layer and woody layer (trees and shrubs). The main focus of this study was to analyse the differences between growth periods in individual years in context of climatic factors (the Relative humidity (RH), RG (Rain Gain), ground temperature (TG20), soil moisture (SM20), Air temperature (TA), Global radiation (GL) and Photosynthetically active radiation (PAR)). We employed two different methods: a standard GCC index (-1 to 1 values) for the woody layer, and a classification method based on GCC index thresholds for the herbaceous layer (-1 to 0.4 for non-vegetated pixels; 0.4 to 1 for vegetated pixels). The GCC index was susceptible to noise from shadows (especially affecting herbs) and brightness (especially affecting trees and shrubs), necessitating different analytical approaches for the two vegetation layers: a standard GCC index for trees/shrubs and a threshold-based classification method for herbs.

We observed two types of herb vegetation a)spring ephemerals and b)”summer” herbs growing after previous group. The growth time of spring ephemerals was observed from

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the mid of March in all 3 years of 2017, 2019 and 2020 but it was delayed by 2 weeks in the year 2018 (Fig. 1), when the effect of prolonged period with low temperatures was observed by the mid of March. The end of season of spring ephemerals was observed in the mid of May every year, which shown that it was not significantly affected by the climatic factors. In herb layer during summer, start of the season of “summer” herbs was observed from early June in the years of 2017 and 2018, but it started two weeks earlier in 2019. In the year 2020, we observed that the herb layer was badly affected by the forest cutting event, which shown a changed behaviour of herbs layer with the growth of late summer herbs, which caused a delay in the end of the season.

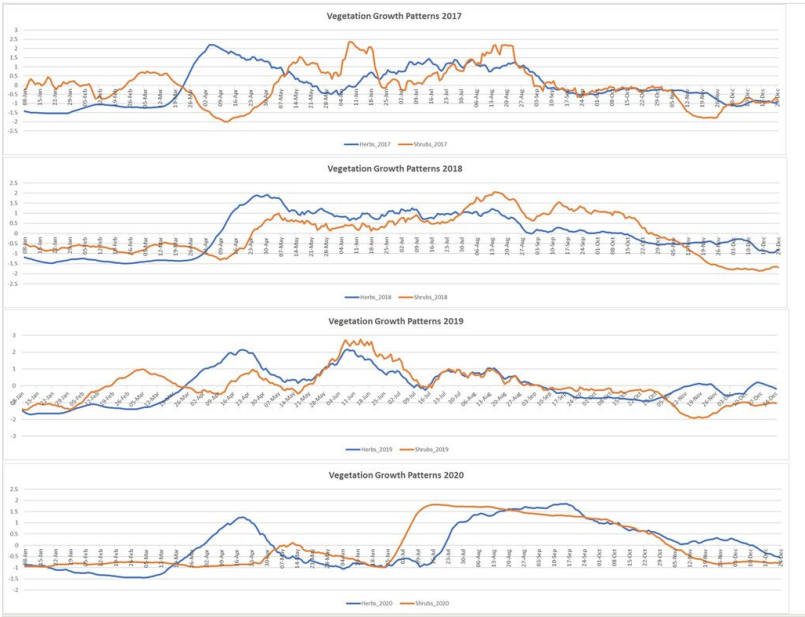

Figure 1. doi

Vegetation growth pattrerns of Bab site from the year 2017 to 2020.

The growth of trees and shrubs started in second half of April, but got delayed by two weeks in 2019. The fluctuations shown decrease of GCC index in summer that could be effect of leaves drying in dry and warm period. During the summer season in high temperature days the low soil moisture influenced the growth patterns by fading the vegetation colour during peak of the summer and in the late summer RG factor along with the high SM20 influence the vegetation growth for both layers. In some years is difficult to detect end of season especially if the summer was dry and warm – leaves are not regenerating after end of dry period. High relative humidity was observed to influence the delayed in start of the seasons, while high temperature factors especially the TG20, TA, PAR and GL influenced the delayed in end of the seasons. In the year 2020, there was a main event of forest cutting observed by the end of June, which badly affected the growth patterns even for the next years.

As compared to the trees and shrub layer, climatic factors are less affecting the growth patterns of herbs layer and there was not a significant delay observed in the start of the seasons, but the end of the seasons showing significant differences with the increase of temperature factors and low soil moisture. GCC performance was negatively affected by shadows and brightness, with shadows impacting the herbaceous layer more significantly and brightness affecting the woody layer. This introduced considerable noise into the data. In conclusion, the research demonstrates the usefulness of PhenoCamera and GCC analysis in observing forest phenology and its response to climatic drivers, while also emphasizing the importance of considering data limitations and employing appropriate analytical methods for different vegetation layers.

Keywords

Phenology, GCC, Forest, LTER site, Climatic factors

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Conflicts of interest

The authors have declared that no competing interests exist.