



Digital imagery: a simple approach to study plant responses to drought

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Different tree species show diverse responses to changing environmental conditions. Since these responses give deeper insight in ecosystem functionality suitable observation techniques are needed. Recent studies have demonstrated the successful application of digital camera imagery for phenological monitoring in ecosystem studies. However, the use of daily imagery from standard RGB cameras to observe species-specific responses of vegetation on environmental impacts has not been tested yet. We therefore studied possibilities and limitations of applying camera imagery of a mixed forest in the observation of tree-specific responses to drought stress.

A digital camera was mounted on the uppermost platform of a fluxtower at the CarboEurope site Lägeren (northern Switzerland). Since 2005 the camera provides daily imagery of the forest canopy which is mainly consisting of beech and ash trees. Based on the image color values a vegetation index was computed. Time series of the vegetation index were jointly analyzed with meteorological data and eddy covariance measurements of ecosystem carbon dioxide and water vapour exchange.

Changing environmental conditions caused changes in the images color values, therefore meteorological data and carbon dioxide exchange data were significantly correlated with the index values. A drought period in early summer 2006 influenced index values for beech but not for the highly drought-tolerant ash trees. We conclude that digital imagery provides a cost-effective, nondestructive and objective technique to study species-specific vegetation responses to drought stress and provide useful data that can be integrated in forest ecosystem models.