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‘The application of a novel IoT driven biosensing platform, the TreeTalker®, for coppice forest monitoring in central Italy’.

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Coppicing forest management systems represent the oldest systematic silvicultural practice across the European continent. This simplistic yet sustainable system is well defined by several silvicultural applications which are in general designed to provide a woody crop within a relatively short rotational period. Additionally, the treatment and maintenance of such forests continue to provide a variety of functions and thus ecosystem services. Although the extension of coppice forests is estimated at approximately 20 million hectares across Europe, they are often poorly utilised, undermanaged or altogether abandoned. In systems where management activity is enduring, threats from climate induced mortality remain prevalent. This coupled with poor management, which often promotes over stocking on one hand and unregulated coppice sprout management inducing stool exhaustion on the other, threaten this historical management approach. Consequently, novel monitoring efforts for these forest types and systems merits attention. This study aims to investigate the application of a novel biosensing platform, the TreeTalker, toward the continuous monitoring of individual sprouts on coppice stools and selected standards across three plots in a historically coppiced forest located in central Italy. The TreeTalker is an IoT driven device integrated platform aiming to monitor well established tree ecophysiological processes such as sap flow, stem radial growth and light canopy interactions in quasi real time via LoRa architecture and an inhouse multi sensor infrastructure. We present the results of a two year consecutive monitoring campaign using these devices. Evidently, we observed that competition among sprouts on the same stool is clearly detectable via the TreeTalkers sensors, particularly the radial dendrometer expressing different results both across the seasons monitored and among individuals. Strong signals in reduced stem radial growth across the very dry 2022 season were also observed. The results suggest that the TreeTalker provides high fidelity data on the ecophysiological behaviour of trees throughout the vegetative season. Data from these devices offers an exciting new frontier in forest monitoring. For coppice forests specifically, silvicultural activities such as timing of thinning intervention and sprout selection for standard recruitment can be guided by retrieved information in addition to real time monitoring of stem health. Scaling via more TreeTalker device installation and subsequent spatial and temporal requirements requires further investigation.