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Global concern about climate change motivates for increasing interests in revising the management plan of natural ecosystems to include carbon sequestration services. Such revision must be informed of knowledge of carbon storage capacity of these ecosystems and the underlying factors. Here, the aim is twofold: to quantify the carbon stock that could be expected from the diversity of trees (~500 species) in the Kruger National Park (KNP; ~2 million ha) if all individual trees recorded in 110 plots of 50 m × 50 m grow to their maximal potential; and to test the predictive power of several potential correlates of the physiology of carbon storage. The results indicated the KNP is a potential reservoir of ~2×10^8 tonnes of carbon with a total mean density (above + below-ground carbon) of ~105 tonnes ha^{-1}, a carbon density comparable with that of many other natural systems. Carbon storage in the KNP did not correlate with phylogeny and species abundance, but did so with phenology and wood density. However, only 4% of the variation in carbon storage was explained, indicating that key determinants of carbon storage are missing in this analysis. Although this study suffered a number of limitations that are presented, the expectation from this study is that it would raise increased interests into the potential of carbon stocked in the KNP in South Africa as one of the key diverse services this park provides beyond biodiversity conservation.
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