Abstract

Extensive land transformation leads to habitat loss, which directly affects and fragments species habitats. Such land transformations can adversely affect fodder availability for bees and thus colony strength with consequences for rural communities that use bee keeping as a livelihood option. Quantification of the landscape structure is thus critical if the linkages between the landscape and honey bee colony health are to be well understood. In this study, a random forest algorithm was used on dual-polarized multi-season Sentinel-1A (S1) synthetic aperture radar (SAR) and single season Sentinel-2A (S2) optical imagery to map honey bee habitats and their degree of fragmentation in a heterogeneous agro-ecological landscape in eastern Kenya. The dry season S2 optical imagery was fused with the S1 data and class-wise mapping accuracies (with and without radar) were compared. Relevant fragmentation indices representing patch sizes, isolation and configuration were thereafter generated using the fused imagery. The fused imagery recorded an overall accuracy of 86% with a kappa of 0.83 versus the SAR imagery only, which had an overall accuracy of 76% with a kappa of 0.68. However, the S1 imagery had slightly higher user's and producer's accuracies for under-represented but important honey bee habitat classes, that is, natural grasslands and hedges. The variable importance analysis using the fused imagery showed that the short-wave infrared and the red-edge waveband regions were highly relevant for the classification model. Our mapping approach showed that fusing data generated from S1 and S2 with improved spectral resolution, could be effectively used for the spatially explicit mapping of honey bee habitats and their degree of fragmentation in semiarid African agro-ecological landscapes.