



Trait-based ecology approach in Successional Agroforestry Systems

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Despite progress in understanding the benefits of enhancing agrobiodiversity, we lack practical guidelines to diversify cropping systems to balance productive and regulating functions of agroecosystems. In order to assess the effects of crop functional diversity on key agroecosystem functions we adopted a trait-based approach to establish permanent experimental field plots of successional agroforestry systems. This is a high-diversity agroecological cropping system mixing trees with annual and perennial crops managed to accelerate fallow processes along forest succession. The experiment represents a gradient of biogeochemical trait diversity, while maintaining crop species richness constant across all treatments. It has been established in late 2016 in humid subtropical Southern Brazil. We hypothesized that crop functional trait diversity drives multiple agroecosystem functions. We quantified traits of crop and weed vegetation (maximum plant height, leaf area, leaf nitrogen concentration, specific leaf area, stem specific density, clonality and N₂ fixing status). We used Structural Equation Modeling (SEM) to test how well our hypothetical causal model explained how crop functional diversity affects (1) leaf area index (LAI), (2) weed suppression, (3) functional diversity of the weed community, and (4) crop productivity during the first year of growth. Our results support the hypothesis that high functional diversity (FD) drives several ecosystem processes and contributes significantly to the delivery of ecosystem services. We found that with greater crop FD more niches were occupied by crop plants, thereby increasing total photosynthetic light interception in the agroecosystem. Greater light interception by crops suppressed weeds, which in turn increased crop productivity. Although further investigations are necessary in order to assess longer term effects on agroecosystem multifunctionality, our early results help to improve our understanding of how biodiversity underpins agroecosystem processes and the benefits that people derive from them.