

Estimating loss of carbon stocks in postfire chaparral shrublands in southern California

Presenter's Name: Mark De Guzman

Presenter's Company/Employer: UC Davis

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Abstract:

Carbon sequestration is one of the many ecosystem services provided by chaparral shrublands in Southern California, however chaparral's effectiveness in providing this service is dependent on its resilience to mitigate disturbance. Estimates of carbon stocks pre- and post-fire in chaparral where fire occurrence is within the historical range is directly quantifiable (e.g., aboveground, belowground, litter, soil carbon), but quantification of stocks in areas with short fire return intervals and tailored to the different functional life histories of chaparral species (seeders versus resprouters) has yet to be determined. We estimated carbon stocks through compiling biomass estimates from the literature to build regeneration models for the seeder and resprouter life history types. We then integrated our models with Landsat-derived Enhanced Vegetation Index (EVI) and historical fire perimeter data to estimate changes in carbon stocks in chaparral pre- and post-fire. Carbon stocks were disproportionately affected in areas with the shortest fire return interval which was mainly driven by changes in the vegetation composition. The greatest losses occurred in type-converted landscapes that are heavily dominated by resprouter life history types, which store a higher proportion of biomass belowground compared to seeders. Our methods could be applied to environmental damage assessments to estimate the amount of carbon permanently lost due to fire and changes in fire regime.