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Evaluation of soil carbon stocks in different native and cultivated areas in Southern Peru

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Carbon accumulation and sequestration in the Peruvian's soils (from lowlands to highlands) - as in most Andean Latin countries included in Biome B - are scarcely documented. The altitude and orography of this mountain chain produces changes in the temperature, rainfall and humidity patterns, which have direct effect on soil development. Rainforests are found at the windward east hillside while the leeward west hillside is a desert. With the aim to determine soil carbon stocks according to soil classes, altitude, temperature gradient, climatic parameters, crop classes and native vegetation, as related to global warming, soils from main cropping systems in 5 contrasting Peruvian agroecologies within a 1,000 km transect, were sampled. These soils were sampled, in triplicates, from the arid Pacific coast, passing through the Andean high plateau, and down to the Amazonian rainforest. Five layers samples from 0 to 30 cm depths were taken and processed for total carbon analysis in duplicates. Carbon contents (CC, in g kg^{-1}) and Carbon stocks (CS, Mg ha^{-1}) were estimated in each layer and throughout the entire profile. Using a linear additive model for a nested sampling scheme, CC and CS were compared, among cropping systems within agroecologies and among agroecologies, using MANOVA and orthogonal contrasts. Overall, the soils in the Amazonian site (134 Mg ha^{-1}) presented higher ($P>0.05$) CC than all the other agroecosystems. It also presented, together with dry valleys, the highest ($P>0.05$) CS (83 Mg ha^{-1}). It is noteworthy that well managed coffee plantations in the Amazon and alfalfa under irrigation in the dry valleys can present as much CS as primary rainforests. The dry lowlands showed the lowest values (CC: 51 g kg^{-1}; CS: 40 Mg ha^{-1}). This can be due to typical problems found in dry soils such as compactness, fire, wrong tillage practices, and the lack of water. Our results also showed that soil organic carbon increased with elevation in the arid environments, and when CS was analyzed as a function of altitude for different agroecologies, within the same texture class, a linear relationship ($r \sim 0.8$) was obtained, which confirms some observations found in the literature. In the high plateau low CC (68 g kg^{-1}) and CS (47 Mg ha^{-1}) were estimated. The texture in these soils were different from the others agroecologies and thus non-comparable.