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Soil Erosion and Sediment Losses from the Ridge Watersheds in the Guánica Bay, Puerto Rico

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Puerto Rico faces considerable challenges regarding sustainable land use and effects of land use on adjacent coastal ecosystems and the services they provide. One primary concern is increased sediment loading to reservoirs and ultimately to Guánica Bay and reef areas outside the Bay. Studies by scientists in Puerto Rico have suggested that nutrient and sediment contaminants have increased 5 to 10 fold since pre-colonial levels and an additional 2 to 3 fold in the last 40-50 years (Sturm et al., 2012). Sediment deposition has significantly reduced the storage capacity of several reservoirs, and the associated contaminants and nutrients within the terrestrial soil particles of sediment can stress corals and negatively impact reef health. Sedimentation can also reduce photosynthetic activity of aquatic plants and algae, and increase water-treatment costs for domestic and industrial uses (Estades Hernández, 1997). Therefore, it is important to understand soil erosion and sediment transport processes. In this study, we analyze sediment losses from ridge watersheds of the Guánica Bay and try to understand the main factors causing soil erosion and sediment in those ridge watersheds. Our specific objectives were: 1) to quantify sediment contributions to Guánica Bay and identify sediment sources; 2) seek factors that impact the sediment loss and explore alternative strategies to reduce soil erosion and sediment loading to the reservoirs, Guánica Bay and the coastal zone. It was found that sediment loss in those ridge watersheds was mainly caused by interaction of heavy rainfall (especially the hurricanes) and steep mountainous slopes. Coffee planting increased the risk of soil erosion, which the loss of protective canopy for sun-grown coffee exacerbated. In addition, rainy seasons (February to May and August to November) contributed more than 80% of annual sediment loss. Exploration of different land use scenarios found that coffee land use yielded more sediment per hectare than forest and grass. Finally, conversion from sun-grown to shade-grown coffee can also reduce soil erosion.