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RESEARCH ARTICLE

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Nutrient loss to erosion responds to rain characteristics under transformed landscapes in the Río Grande basin, Colombian Andes

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Abstract

The functioning of tropical montane ecosystems are key provider of environmental services. However, climate and land use change interactively affect the ecohydrological and biogeochemical processes that support the provision of such services. We evaluate the effect of land use/land coverand the seasonality and intensity of the rainfall on the ecological functions of erosion control and nutrient regulation in a gradient of human intervention in the Central Andes of Colombia. Our results show that soil erosion (kg/ha/year) was higher in the transitory crop (187.7), followed by the permanent crop (98.2), and much lower in the pasture (8.0) and native forest (7.2). Our results also indicate a differential effect of land use and rainfall seasonality on erosion and nutrient transport, both processes being significantly higher in crops and lower in forest, both for the wet and dry seasons. However, the relationships between erosion and rainfall intensity varied depending on the hydrological season (in the wet seasons, no linear model was significant, while in the dry seasons, linear models for maximum rainfall intensity were significant in both crops and in the oak forest, and linear models with mean intensity were significant for both types of crops). Nitrogen exhibited the highest rates of transport, which can have important implications for water and soil pollution. Nitrogen transport via erosion (g/ha/year) was consistent with erosion results, being higher in the transitory crop (399.9) and permanent crop (265.3) that in the oak forest (6.9) and pasture (6.8). These results indicate that converting forests affects the capacity of ecosystems to provide environmental services, which is further amplified by projections of climate change.

KEYWORDS
climate change, environmental services, oak forest, soil conservation, soil pollution

1 | INTRODUCTION

The soil, a dynamic system in time and space, represents an essential economic resource for society (Paroissien et al., 2015) as it is the main terrestrial reservoir of fundamental nutrients such as nitrogen and phosphorus and fulfils the function of fertility maintenance (Quinton et al., 2010). As a non-renewable resource, it is important to guarantee its sustainability, so that its current and future functionality is maintained (Paroissien et al., 2015). One of the multiple routes of soil degradation is loss through water erosion (Er), which involves the detachment of particles by the impact of raindrops, and their subsequent transport through surface runoff flow (Sr) (Field et al., 2011).

