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Phosphorus monthly losses at the outlet of an agroforestry catchment under Atlantic climate (NW Spain)

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Phosphorus levels in runoff waters help to estimate the possible contamination associated with them and to know the existence of eutrophication conditions. The amounts of P transported from catchments depended on the hydrology, on soil P contents, and on the amount of P added as fertilizer and manure. The aim of this study was to monthly losses of total P (TP), sedimentary P (TSP), and dissolved P (TDP) at the outlet of an agroforestry catchment under Atlantic climate. This research was conducted at Valiñas River catchment in Coruña (NW Spain), a periurban area of 36.3 km^2. Land use is as follows: 35% arable land, 20% grassland or pastures and 45% forest. This study reported data from January 1999 to September 2006. The total sample number was 872, varying from 53 in 1999 and 193 in 2003. Sampling time variability was related to rainfall distribution. The different P forms, TP and TDP, were analyzed using inductively coupled plasma-mass spectroscopy (ICP-MS). The TSP was calculated from the difference between TP and TDP. To calculate the mass balance of these P forms, discharge data at the catchment outlet were estimated. Suspended solids were assessed by filtration. Relations between the three P forms and suspended solids were determined using Pearson's correlation coefficient. The concentrations of the three studied P forms varied widely during the whole study period. Total P yearly losses ranged from 0.350 kg ha^{-1} $month^{-1}$ in 2004 to 1.199 kg ha^{-1} $month^{-1}$ in 2000. From January to September 2006 they were 0.259 kg ha^{-1} $month^{-1}$. TSP losses varied between 0.201 kg ha^{-1} $month^{-1}$ in 2004 and 0.7315 kg ha^{-1} $month^{-1}$ in 1999. Finally, TDP losses oscillated between 0.140 kg ha^{-1} $month^{-1}$ in 2005 and 0.508 kg ha^{-1} $month^{-1}$ in 2000. The main causes for these variations were rainfall and flow regimes, soil management, and wastewater discharges. Considering the different seasons, flow regime was low from July to September during the studied years, whereas the highest flows were registered in the period from January to March or from October to December, depending on the year. This fact is coincident with the highest rainfall records. Consequently, TP losses were higher during January to March and October to December than during the rest of the year. The period from July to September presented the lowest losses. TSP levels were always greater than those of TDP except in the period from July to September. Significant correlations between suspended solids and TP and TSP were observed throughout the whole study period. This fact indicates the erosive origin of the P exported to this catchment. A significant correlation between TDP and suspended solids was observed only in 2000, 2001, 2003 and 2005. These correlations would indicate that TDP concentrations in this catchment have different origins, not only erosion but wastewater discharges and manure applications. Rainfall was significantly correlated to TP and TSP along the studied period, whereas rainfall and TDP were significantly correlated only in some years, as the relation between flow and the different phosphorus forms. These results may indicate the influence on the season on the phosphorus concentrations although, due to the characteristics of the studied catchment, several origins are possible. For instance, runoff and erosion would increase TSP losses and manure application may increase TDP.