# Spatial distribution of soil phosphorus and implications for catchment-scale predictions of losses in South Spain

Isabel Díaz[1], Fabrizio Ungaro[2], Vidal Barrón[3], María del Carmen del Campillo[3], Antonio Delgado[1]

*[1] Universidad de Sevilla, Sevilla, Spain; [2] Universidad de Córdoba, Córdoba, Spain; [3] CNR IRPI, Firenze, Italy*
***adelgado@us.es***

Accurate definition of critical sources areas for P loss in catchments involve not only the knowledge of the soil P status but also the conectivity of soil with transport pathways. Nowadays, all these data can be monitored realized by using kriging method in combination with GIS contour.
Two small catchments in South Spain were studied in order to study soil P level and release potential by means of single extractions (Olsen P and water extractable P at a soil:water ratio of 1:10). These observations were intensively done in each catchment by sampling on a regular square grid (grid spacing 100 m). Dominant soil type in one of the catchments were Typic Haploxerert (Vertisol catchment, 60 ha surface), and in the other were Calcic Haploxeralfs (25 ha surface) according to the Soil Taxonomy. Fertilizer (usual 30 kg P $ha^{-1}$ applied each two years) and crop management was similar in both catchment and absolutely homogeneous within each catchment. Topographic Index (TI) were calculated on the basis of slope and upslope contribution area estimated from the digital elevation model (DEM) of each catchment. High TI values indicates areas of low slope and/or large upslope contributing areas (hillslope concavity, guillies), meanwhile low TI values area associated with steep sloping areas and/or small upslope contributing areas (e.g. topographic ridges, plateau). Thus, a high P loss potential throgh runoff and erosion can be expected at low TI values.
Most of the catchment points sampled presented Olsen P levels above critical values for fertilizer response of crops (8-10 mg Olsen P $kg^{-1}$), ranging from 10 to 70 mg $kg^{-1}$ in the Vertisol catchment and from 5 to 80 mg $kg^{-1}$ in the Alfisol Catchment. Water extractable P was significantly correlated with Olsen P ($r = 0.90$ and 0.92, $P < 0.001$, in Alfisol and Vertisol catchment, respectively). Correlations performed using the values estimated on a 10 x 10 m grid revealed that Olsen P increased with increasing elevation ($r = 0.71$, $P < 0.05$) and decreased with increasing slope and TI ($r = -0.19$, and $r = -0.12$, respectively, $P < 0.05$) in the Vertisol catchment. On the contrary, in the Alfisols catchment, Olsen P decreased with increasing elevation ($r = -0.48$, $P < 0.05$) and increasing slope ($r = -0.3$, $P < 0.05$), meanwhile increased with increasing TI ($r = 0.05$, $P < 0.05$). In the Vertisols catchment, higher Olsen P were associated to low TI values, meanwhile the opposite was observed in the Alfisols catchment.
Spatial distribution of Olsen P values in the Vertisol catchment can be ascribed to the soil type dominant in the upper part of the catchment, where Haploxeralfs-Palexeralfs are dominant. Different P dynamics between soils in the upper part of this catchment and Vertisols dominant in the rest of the catchment (Haploxeralfs-Palexeralfs have a lower P buffer capacity) explain the increased Olsen P at increased height in the catchment. In the Alfisol catchment, the observed relationships between soil P indexes and position must be the consequence of P enrichement of soils in the botton of the catchment due to erosion. It can be concluded that the definition and management of critical source areas (hot areas for P loss) in catchment should consider not only geographycal and hydrological information and the estimation of P level, but also soil properties affecting P dynamics in order to reduce the density of observations required to define the critical source areas.