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Role of geomorphology in identifying soil types in an arid region in southeastern Iran

Azam Jafarisirizi (1), Peter Finke (2), Shamsollah Ayoubi (1), and Hossein Khademi (1)

(1) Isfahan University of technology, college of Agriculture, Soil Science, Isfahan, Islamic Republic Of Iran (a.jafari@ag.iut.ac.ir), (2) Department of Geology and Soil Science, University of Ghent, B9000, Ghent, Belgium

Soils cannot be separated from the landscapes in which they form. As landscapes evolve, soils develop through the interaction of pedogenic and geomorphic processes. Relationships between landscape position and soil type can be understood using methods developed by soil scientists and geomorphologists. By understanding both the forms and the processes of landforms, predictions can be made regarding the type of soil based on landscape position. This study analyzes the relation between soil and geomorphology in an arid environment of southeastern of Iran using geomorphology levels as predictors in soil class and diagnostic horizons prediction. A four-level geomorphic hierarchy (landscape, landform, lithology and geomorphic surface) was used to breakdown the complexity of different landscapes of the study area. Furthermore, to predict soil-classes from profile observations, multiple auxiliary predictors such as terrain parameters and remote sensing indices were used in the Zarand region. Logistic regression models were applied to find the relationships between soils and predictors. Among the predictors, the geomorphology map was identified as an important tool for digital soil mapping as it helps increase the prediction accuracy. Also, among levels of geomorphology map, the fourth level (geomorphic surface) was much more powerful to predict the soil type as compared to the other levels (landscape, landform and lithology). The prediction maps of gypsic and salic diagnostic horizons showed high probabilities at playa and gypsiferous hills, respectively. Calcic horizon was mostly predicted in alluvial fan and bajada landforms. The prediction showed high mean probability values for Torripsamments in sand dunes, Haplogypsid in gypsiferous hills, and also Haplocalcids in alluvial fans. Prediction of soils with better reliability was achieved for those highly influenced by topographic and geomorphic characteristics in the study area (e.g. Haplosalids, Haplogypsid and Torripsamments) and soils with very low reliability and accuracy of prediction are those hardly influenced by the topographic and geomorphic characteristics (e.g. Haplocambids and Calcigypsid).