

Bakhtiari and Servak were detected. Then sampling was done by systematic-randomized method. In Bakhtiari formation, soil physical and chemical analysis indicated that  $\text{CaCO}_3$  was increased from surface toward subsurface. Texture class has no difference among depths. But, clay and silt percentages have increasing trend. In other locations, clay and silt were increased and soil texture class was loam. In this area, electrical conductivity declined from subsurface toward surface; water rising and evaporation caused that phenomena. Also, higher clay content in soil surface resulted in maintaining cations

and anions in soil surface. Organic carbon was decreased from surface toward subsurface because of organism activity. In Servak formation,  $\text{CaCO}_3$  was decreased from surface toward subsurface. Soil texture varied from silty clay loam to loam in the lowest depth. Results of soil physical and chemical properties from laboratory and field survey indicated that in Asmari formation, soil acidity in soil surface was in a higher class and was correlated with  $\text{CaCO}_3$  in soil surface.  $\text{CaCO}_3$  induced increase of soil alkalinity.

**Key words:** soil; geological formations; Iran

[T10-27]

## Erosion Types and Sediment Yield Estimation Using MPSIAC Model in GIS Framework in Ardak Watershed, NE, Iran

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Ardak Watershed with an area of about  $497 \text{ km}^2$  is one of the tributaries of Kashaf Rud River Watershed in north east Iran, which consists of two main rivers. This catchment is located in the Kopet-Dagh structural zone and Ardak Watershed is surrounded by Chaman Bid, Mozduran, Shurijeh, Tirgan, and Sarcheshme Formations. The lithofacies and architectural elements show that two main rivers are gravel-bed braided river in their most parts. The major erosion types in this watershed are rock fall, rill, surface erosions, and gully and channel bank erosion. In the study area, the amount of sediment yield estimation in GIS framework using MPSIAC model is about  $130.749 \text{ m}^3 \cdot \text{km}^{-2} \cdot \text{a}^{-1}$  or  $1.77 \text{ t} \cdot \text{h}^{-1}$  and most parts of the basin (more than 90%) has low erosional rate. Mozduran and Tirgan Formations are

more resistant to erosion than other formations with maximum relief and gradient. The major factors for erosion and sediment yield in this catchment area including: annual floods especially in rainfall season, high sensitivity of lithologic units to mechanical erosion, high slopes of hillsides, and rock fall phenomena that they need suitable watershed management. Also, present of several villages in the vicinity of the main channel has increased understanding of suitable methods for flood hazards control. We hope this study can help in better understanding of erosion and sediment yield patterns of watersheds for better water and soil preservation and watershed management.

**Key words:** erosion; sediment yield; MSIAC; watershed; NE Iran

[T10-28]

## Establishment of Field Sites to Study Frost Heaving and Related Landforms in Southern Yakutia, Russia

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Frost heaving processes have been a focus of study since the late 19th century. Factors controlling frost heave development were investigated over several

decades. The mechanisms involved were identified based on numerous field and experimental evidences. However, despite this long history of frost heaving



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245