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Runoff and Sediment Transport from a Mountain Road

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Introduction: Road drainage from unpaved roads generates large quantities of sediment during storms and may alter stream hydrographs due to rapid delivery of intercepted subsurface water and direct runoff from the compacted road surface. Additionally, both mass and surface erosion are common sediment sources from road cut- and fillslopes in steep terrain. Thus, although such corridors occupy only a small percentage of the catchment, they may exert a dominant anthropogenic influence on storm runoff and erosion. The objectives of this investigation are to assess the influence of upslope landform shape on the road runoff and erosion processes, as well as to assess the contribution of storm drainage and sediment from the road to streams.

Methods and Materials: This study was conducted on an unpaved, midslope road in the Fudoji catchment, Shiga Prefecture, Japan. The area is underlain by granite, the upper layer of which is highly weathered. Soils vary in depth from 0.6 to 1.2 m. Storm runoff was monitored from January to mid-August (including Baiu storms) in 2005; sediment data are only reported for the first 6 months of the year due to construction. Three road sections (16.1 to 18.4 m in length) were isolated to assess both sediment and runoff fluxes during storms. A ditch was installed below each section; runoff and sediment were routed into 45° V-notch weirs located to the side of road. Sediment was collected from the drop-box weirs, dried and weighed for periods ranging from 2-4 weeks.

Results and Discussion: During the first 7.5 months of 2005, we monitored runoff from the three road segments during storms. For most storms, the greatest amount of runoff occurred from the road section located below the concave hillslope (Fig.1); such concave slopes are known to accumulate subsurface water. During wet conditions, progressively more runoff was generated for similar levels of rainfall inputs late in storm events and runoff continued after rainfall ceased (convave slope) (Fig. 2). Thus, subsurface flow appears to be intercepted at cutslopes once soils are wet, especially from concave slopes. Sediment transport from the convex, planar, and concave road sections averaged 2.6, 6.9, and 11.6 t $ha^{-1}yr^{-1}$.

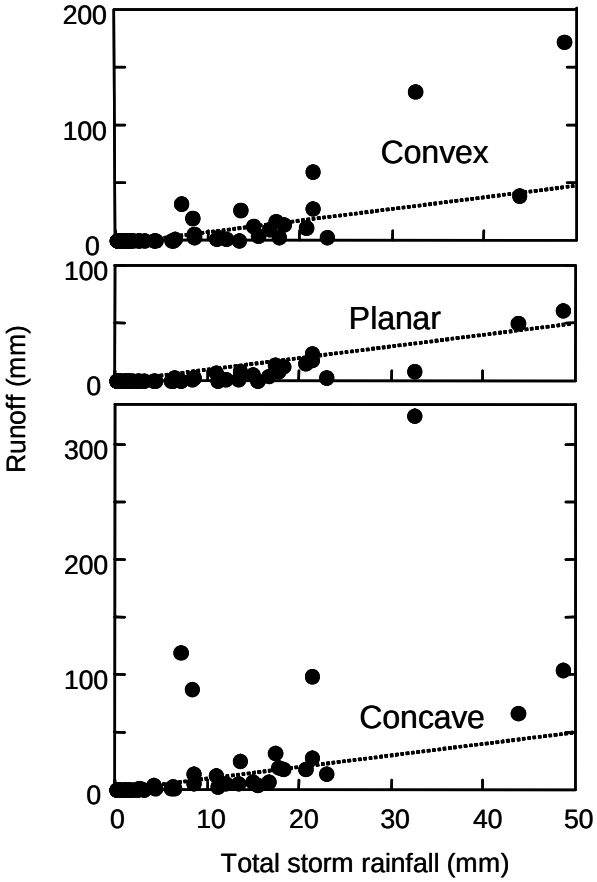

Fig. 1. Total runoff from the three road sections (convex, planar, and concave) monitored during a series of storms in 2005.

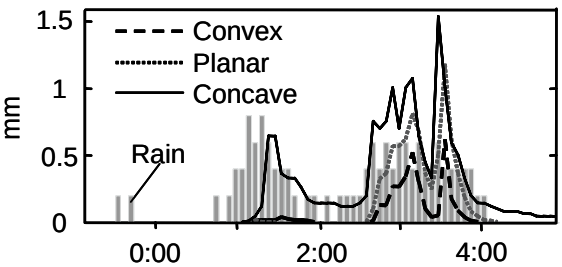

Fig. 2. Road runoff from three segments, each affected by different upslope landforms during a storm on 21 June 2005.