The Role of Geomorphology in Catchment Management

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Catchments (watersheds) are integrated through water movements. Sediments and pollutants are also transported in the water, affecting the pedology, geomorphology and various ecological components of catchments. The insertion of pollutants is caused by land-use practices. Land uses are influenced by the pedo-geomorphology of the catchments (uplands, valley sides, flood plains and terraces, spurs and hollows, convexities and concavities; upper, middle and lower catchment; catenary relationships). Therefore catchment management must deal with interrelationships amongst human activities and various geomorphic elements. Several case study examples from southwestern Australia demonstrate the importance of geomorphology in catchment management. They include: rates of hillslope erosion and translocation of P in micro-catchments within a drainage basin context; stream salinisation; geomorphic elements influencing the spread of weeds and the erosion of access tracks; and some relationships between valley-side land uses and stream characteristics. The incorporation of these and other issues in a management strategy are then illustrated. Complex skills are involved in producing and implementing a management strategy, including but extending well beyond the geomorphologist.

Key words: catchment management, geomorphology, land use, erosion, salinity
Conservation of landforms and landform-ecosystem: a main role of geomorphology in the 21st century
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A large-scale modification of landforms characterizes the 20th century. Especially in Japan, destruction of hill slopes, cutting of meander channel and concreting the river banks and coasts have drastically changed the natural landforms of this archipelago. Geomorphology has mainly played a role of pushing these public and development works although it has tried to minimize their impacts in several cases. However, an importance of the landform conservation to sustain the biodiversity has not well been recognized among geomorphologists. We have to emphasize that the conservation of landform-ecosystem is the main role of geomorphology in the 21st century, since the biodiversity cannot be sustained without a conservation of each habitat of wildlife which is closely linked to each specific landform from a riffle-and-pool structure to a large valley system playing as a corridor.

key words: landform-modification, biodiversity, habitat conservation
Applied Geomorphology and Environmental Management: A Case Study in the Araguari Watershed, Brazil.

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The Araguari River watershed is located southeastern Brazil, in an area known as the “Triangulo Mineiro”. It has been occupied since the XIX\textsuperscript{th} century but, in the last 30 years, agricultural growth and high intensity use of land resources have accelerated land degradation. The main symptoms of this degradation are the increase of erosional features (sheet erosion, rills and gullies), lowering of the water table, drainage of wetlands and loss of native savanna vegetation (cerrado). The analysis of relief patterns in the watershed allows a diagnosis of its characteristics, an identification of ongoing processes and the prevention of future problems. These objectives were attained using morphologic and morphometric maps over the entire watershed. We further investigated some specific sites to understand the relationship between environmental factors such as sheet erosion and different types of land uses, increase of gullies and rills in agricultural and pasture areas, soil compaction, landscape degradation and others. The integrated analysis of terrain characteristics with social and environmental factors will allow a complete evaluation of problems and their possible solutions, which we will use to propose alternative uses in degraded areas.

Key words: geomorphological maps, sheet erosion, gullies, land use, soil degradation.
Morphological Impacts of Sequences of Floods in Ephemera Channels in SE Spain: Results of Monitoring and Modelling

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Nine sites on ephemeral stream in SE Spain have been monitored for over four years. Several flow events of varying magnitude have occurred. Frequency of flow has varied between the sites which are in different positions within basins and on different lithologies. Morphology of the channels has been monitored by detailed surveying from which DEMs have been created and differences in DEMs and changes in volume have been calculated. The effects of the flows are varied both with magnitude and site. Within a site the morphological impacts show some systematic relations to magnitude of flow but the effects are also very dependent on prior morphological state. Variations between sites are mainly related to the hydrodynamics and the sediment supply conditions. A simulation model of channel changes incorporating effects of vegetation and conditions between floods has been constructed and results from this are compared with those monitored. The implications of the results for the impact of hydrological changes due to climate and/or land use changes are discussed.

Key words: channel change, erosion, deposition, floods, DEM
Hillslope Runoff and Erosion Following Reforestation in the Copper Basin, Tennessee, USA

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The 130 km² Copper Basin was extremely altered by over a century of mining, logging, acidification, grazing, and fire. It was the focus of reforestation programs in the 1900s, and is now largely tree-covered. We investigated the effects of >50 years of reforestation using space-for-time substitution and conducting rainfall simulation experiments in "forest" patches of various ages, unvegetated sites, and forested reference sites outside the basin. We monitored rainfall runoff and sediment detachment rates during 30-min. experiments on wet soils, and determined SOM content for each site. The results, from 54 experiments, show that soil erosion by sediment detachment decreases within a decade following reforestation, but that changes in rainfall-runoff relationships lag many decades behind the replacement of tree cover. Soils in new "forests" have significantly less organic matter and higher runoff rates than forests >50 years old. The long-term persistence of low infiltration rates suggests that, at sites where A and B horizons have been lost, restoration of the hydrologic function of a landscape by reforestation may require decades to centuries.

Key words: land degradation, rainfall runoff, soil erosion, reforestation
Hydrogeomorphological assessment of surface and groundwater quality
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Downstream changes in surface water quality in relation to landuses has been studied in a Mediterranean coastal torrent under the influence of summer tourism. The quality of water on several wells has also been analyzed. Surface waters were sampled weekly in six points during an eight month period, while water from ten wells was sampled only once. The results show that surface waters in the upstream areas, although one pollution point exists, natural dilution is effective in the restoration of acceptable water quality. Downstream the concentration of fosfates, clorites and nitrates is, in two of the points, higher than the recommended values. In relation to the wells, there is also a downstream lowering of the water quality in relation to overexploitation.

Key words: surface water, groundwater, tourism impact
Role of Engineering Geomorphological Mapping in Planning and Development: A Case Study

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Recently, the engineering geomorphological maps have been considered as very important tool in planning and development particularly in developing countries. In fact, region expresses the terrain characteristics which is the result of the aggregation of various terrain elements framing the nature of environment. The engineering geomorphological map depicts the morphological and engineering properties of terrain. In this paper, this type of map of the Saintoli Gad Drainage Basin of Garhwal Himalaya has been prepared with the help of physical components namely topography, rock units, soil units, tectonics, mass stress, mass strain, joint spacing and compressive strength as well as erosional details such as rill, gully and river erosion. The weathering information of the area has also been included while preparing the map. These units have helped in obtaining the terrain stability zones of the Saintoli Gad Basin. A detailed use of this map in planning and development has also been discussed in this paper.

Key words: engineering geomorphological mapping, planning and development, terrain engineering properties, terrain resources, terrain stability zones
ICG ABSTRACT - Tokyo Symposium S28 - The role of geomorphology in combating land degradation

Land subsidence and wetland rehabilitation in the Hula Valley, Israel

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The drainage of Lake Hula and its swamps, have created a new landform and hydrological and sedimentological regime in the Hula valley. The drainage of the Hula lake and swamps in the 1950s covered an area of 40 km² and basically improved the drainage conditions of another 20 km² that were periodically affected by flooding. This man-made project was the end of one of the oldest documented lakes and surrounding wetlands in history, with a rich and diverse aquatic biota. The reclaimed swampy land started to settle immediately upon drainage, owing mainly to the compaction of the peat layers. The mean yearly settling rate was 8 cm/yr. The agricultural development of the reclaimed land was unsuccessful, and soils were affected by continuous underground fires. Weathered peat soils, without a vegetal cover, were carried by wind. Another ecological effect was the release of nutrients by the decomposing peat that were carried by the Jordan floods into the eutrophic Lake Kinneret. In order to avoid the natural subsidence, a small shallow lake - 110 ha - and a network of canals was created in the 90s. This new wetland and the adjacent agricultural areas are the goals of a multidisciplinary monitoring program. An ecotourism development project is currently under planning. Almost 50 years after the starting of the drainage project, the present trend is to restore at least a small fragment of the past and extinct landscape and ecosystem.

Key words: wetlands, land subsidence, drainage, rehabilitation, Hula
The oases evolution in the lower areas of the Keriya River, southern Xinjiang, China

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Taking the oases in the lower reaches of the Keriya River as a demonstration case, the author studied the dependence of the oases evolution on the natural-environmental changes and human influences. The present-day oases of the lower reaches of the Keriya River consist of the green belt along the riverbed and the fan-like oases at the end of the river course. Based on the fluvial deposits and older riverbed, the author concludes the River flowed through the Taklamakan Desert and reached the Tarim River of the northern fringe of the Tarim Basin during the end of the last glaciation. Similar environmental conditions appeared 2000 a B.P. and during the little ice ages. Such superlative variations were originated from natural-environmental changes. However, the especially serious deterioration of the pasture oases of the lower reaches of the river during the last hundred years, particularly since 1950s is caused by the intensive exploitation of the water for irrigation in the catchment. The recent intensive logging of the wood resources in the lower reaches has accelerated the degradation of the landscape considerably as well.

Key words: Oases; land degradation; human influence; Taklamakan Desert
Effect of Geomorphology on Coastal Zone Management in the
Yalova-Armutlu Area (NW Turkey)
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The landscape of Turkey’s Marmara coastal zone has been evolving from human
interference since at least 5000-4000 BP. In the coastal zone of Yalova-Armutlu area,
two important landscape-related events have been demonstrated: significant changes
to vegetative cover due to deforestation and to extensive agricultural activities.
General geomorphological attributes of the study area include the following:
1. The study area includes the northwestern part of the Armutlu peninsula, which has
   mountainous scenery, cut by deep valleys.
2. As a result of sea level changes in the upper Pleistocene and Holocene, maritime
terraces have formed between 10-20, 40-50 and 70-80 meters.
3. The earthquake risk, deep slopes, and the existence of non-resisting layers, human
   interference and extensive rainfall increase the landslide risk in the study area.
In the study area, lands of high agricultural productivity should be targeted for
preservation and the coastal zone itself should be preserved, while the buffer is
developed sensibly.

Key words: Geomorphology, coast, management, preservation.