THE IMPACT OF OFF-ROAD VEHICLE TRAFFIC ON THE GRAVEL PLAINS OF THE CENTRAL NAMIB DESERT, NAMIBIA

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ABSTRACT

Off-road driving, a popular activity in many arid regions, has been identified as a problem in the Namib Desert, Namibia. The Gravel Plains of the Central Namib Desert are especially vulnerable to vehicle impact with tracks in some areas still visible 40-50 years after impact. A study was undertaken on the Gravel Plains in the Namib Naukluft Park to assess the extent of this damage and to investigate possible means of preventing or at least reducing further impact. The objectives of the study were as follows:

(i) to assess the extent of existing damage,

(ii) to determine the short-term visual and physical impact of off-road vehicles on the soils and vegetation of the Gravel Plains with the objective of providing recommendations for the prevention or reduction of further impact,

(iii) to investigate the rehabilitation of vehicle tracks, and

(iv) to establish permanent monitoring sites for the investigation of the long-term effects and recovery rates of vehicle tracks.

The highest vehicle track density was determined for the coastal regions of the study area. These surfaces were characterised by a well-developed gypsum crust situated close to the soil surface and by lichens which grow free on the surface or attached to rocks and pebbles. Track density decreased inland as more calcareous surfaces were encountered.

Vehicle treatments were applied to experimental plots located throughout the study area and the relative impact was assessed based on visual and physical comparisons. Treatments involved variations of tyre width, tyre pressure, vehicle load, number of passes, speed and drive (2x4/4x4). Visual comparisons were made between treatments from aerial and ground photographs.

Microtopographical measurements - surface area and depth of track - were used to determine the physical effects of the vehicle treatments at the soil surface while penetrometer resistance, gave an indication of the sub-surface effects of vehicle damage.

Cornering resulted in the highest visual impact, followed by the multiple-pass track and that made by narrow lug tyres. Vehicle tracks made at high speed were less visible than those made at a lower speed and tended to recover visually at a much faster rate. The multiple-pass track resulted in the smoothest, deepest rut, while the speed track was generally shallow with a rough surface.

Soil strength determinations based on penetrometer resistance revealed that multiple-pass and narrow tyre tracks resulted in sub-surface soil disturbance to depths significantly greater than that resulting from the other treatments. The cornering and speed treatments resulted in the highest impact within the surface layers of soil. Generally disturbance of soil structure did not extend to depths greater than 80 mm, being, for the most part, confined to the upper 0-50 mm zone.

Vehicle disturbance was found to have a highly significant effect on lichens with cover being reduced by as much as 80% following impact. It is suggested that this contributes significantly to the high visual impact of vehicle tracks on these surfaces. The least sensitive surfaces were the calcrete plains further from the coast, where the lowest track density was observed.

The rehabilitation of vehicle tracks using handheld rakes was investigated with the intention of determining the optimal dimensions of an instrument for successful surface rehabilitation. It is suggested that further research be conducted into the design of a related instrument which can be attached behind the rear wheels of a vehicle for immediate rehabilitation.

The suggestions for the reduction or prevention of vehicle impact, derived mainly from the conclusions of this study, involve education, careful planning and a certain degree of discipline in the field. Awareness of field staff to the problems associated with off-road driving was stressed.