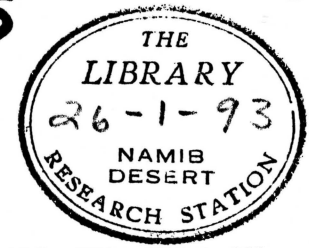


DAN 10205



THE VISUAL EFFECTS OF OFF-ROAD VEHICLES ON
THE GRAVEL PLAINS OF THE CENTRAL NAMIB

10205

A Seminar Presented By J L Daneel

at

the Desert Ecological Research Unit, Gobabeb

September 1992

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INTRODUCTION

A workshop was held at the Desert Ecological Research Unit of Namibia at Gobabeb on the weekend of the 12-13th September 1992. Participating in the proceedings were representatives of Eronqo Mining and Exploration Co, Anglo American Corporation of South Africa, Goldfields Namibia, Anglovaal Namibia, Consolidated Diamond Mining, the Geological Survey of Namibia, The Ministry of Wildlife, Conservation and Tourism, Charly's Desert Tours, the University of Natal, Pietermaritzburg and the Desert Ecological Research Unit.

The main objective in holding this workshop was to provide an informal atmosphere in which the following could be achieved:

- a. The presentation of results from a recent study of the visual effects of off-road vehicles on the Gravel Plains of the Central Namib Desert, and a chance to visit study sites set up during the project and
- b. the interaction of representatives of the Ministry of Wildlife, Conservation and Tourism, the mining and tourism industries and researchers and staff of the Desert Ecological Research Unit, in an attempt to cement an improved understanding of each other's activities and priorities in this region, and to discuss methods of preventing or at least reducing the impact on the desert surfaces that arises as a result of driving off-road in the Namib Naukluft Park.

GEOGRAPHY OF THE CENTRAL NAMIB DESERT

Presented by M K Seely (DERUN)

An introduction to the geography of the Central Namib Desert was presented making particular reference to those factors which may influence the degree to which a variety of surfaces are affected by off-road vehicles, and the recovery rates of vehicle tracks. The rainfall experienced within this region was described as being episodic and potentially erosive. Two surfaces of the Central Namib were identified; the gypsum plains bordering the coastline and the calcrete plains situated further inland. The gypsum plains were identified as the more vulnerable surface on which vehicle tracks remain visible for a greater length of time. The lack of seasonal variation and the unpredictability in the weather pattern with the subsequent response of the environment was highlighted, suggesting the need for a fairly flexible set of recommendations for off-road driving in the Central Namib.

Results of an experiment carried out on the effect of vehicles on various dune substrates were discussed (Seely & Hamilton III). The cornering tracks were defined as being the most visible in the long term, with most of these tracks still visible 18 years after the experiment commenced. Varying effects of off-road vehicles were described, highlighting the possible need to consider different recommendations which may be applicable to different substrates.

Vehicle tracks made in the region of Gorob Mine as long as forty years ago illustrated the long term effects of off-road driving on one of the less sensitive surfaces of the Central Namib Desert. The gypsum plains further towards the coast were identified as being particularly sensitive to off-road driving with a single pass track remaining visible for the same length of time, if not longer.

PROSPECTING IN THE NAMIB NAUKLUFT PARK

Presented by P Walker (Erongo Mining and Exploration Co.)

Prospecting rights were applied for and received in late 1985. In August 1989 field work commenced and the reconnaissance programme was completed in July 1991. The prospecting grant, originally covering an area of 380 000 Ha within the Namib Naukluft Park, was at this time reduced to 25% of its original size. At the onset of field work, various recommendations were made by Smuts, Anglo's Group Ecologist, in order to prevent undue damage to the environment (Smuts 1989). One of the recommendations made by Smuts in this document, that of setting up "fly" camps rather than a single base camp, was overruled by Park Management who suggested a single camp would be more effective in containing impact on the environment.

A two day environmental awareness course aimed at base level workers was held at Gobabeb during this period. This is reported to have met with some degree of success. Erongo's policy of "quick to be in - quick to be out" for sensitive areas was applied when sampling in the desert grant. Problems in restricting vehicle use arose in getting workers to walk rather than drive, especially while carrying heavy sample loads.

Other recommendations made for the reduction of vehicle impact included the use of light vehicles fitted with wide tyres at a low tyre pressure. Driving on existing, multiple tracks and avoiding high ground by following less sensitive stream beds was suggested. Fast driving with undue acceleration and cornering was recommended against. Drivers were encouraged to carefully plan new tracks and to leave existing roads at a sharp angle, covering up tracks at point of entry or exit with a brush in order to discourage others from following the same track. The basic recommendation was to restrict off-road driving at all times, walking rather than driving where possible.

VEHICLE TRACKS IN THE CENTRAL NAMIB DESERT
Presented by A Lensson
(Ministry of Wildlife Conservation and Tourism)

Two of the major problems associated in the past with vehicle disturbance in the Namib Naukluft Park were identified as a lack of awareness on the part of the Nature Conservation staff as to the implications of driving off-road and activities of the Military in certain areas of the Park.

Lack of recuperation of vehicle tracks was attributed to the very low rainfall experienced in the Namib Desert with the suggestion that rapid recovery would result with the onset of a heavy rainfall event. Heavy rainfall would result in erosion of the surface, covering the vehicle tracks, and would induce vegetation regrowth attracting animals which would trample remaining tracks. It was implied that patience was required in observing the natural rates of vehicle track recovery.

In discussing the major culprits involved in vehicular disturbance in the Namib Naukluft Park, the largest disturbance was described as being the result of Military activity within the boundary of the Park. Second to this were the activities associated with prospecting for minerals conducted by large prospecting companies. Less impact was attributed to government departments (road building etc), private researchers not associated with the DERU, small-time prospectors, 4x4 rally drivers, film crews and tourists.

The private vehicle owners who live in the vicinity of the Namib Naukluft Park and who are probably fully aware of the effects of off-road driving, were identified as being a particular problem associated with vehicle damage within the Park.

A need for further research into rehabilitation of vehicle tracks was identified. The importance of educating the public as to the

consequences of off-road driving as well as publicizing any research conducted into this field were discussed. The importance of circulating any recommendations designed to prevent or reduce vehicle track damage to those parties which might be involved was stressed.

THE VISUAL IMPACT OF OFF-ROAD DRIVING
ON THE GRAVEL PLAINS
OF THE CENTRAL NAMIB DESERT

Presented by J L Daneel

A masters project conducted through the University of Natal on the visual impact of off-road vehicles in the Central Namib Desert was sponsored by Erongo Mining and Exploration Company. The project was initiated by Erongo out of concern for the possible impact on the environment that may occur as a result of their prospecting activities.

The project proposed by Erongo in consultation with Dr Seely of the Desert Ecological Research Unit and Dr Smuts of Anglo American Corporation of South Africa, involved an initial two year study on the immediate effects of off-road driving with the establishment of long term monitoring sites, and a monitoring programme to determine recovery rates of vehicle tracks.

The objectives laid out by the company included an investigation of the immediate physical impact of off-road vehicles, determination of a set of recommendations aimed at reducing future impact, and investigation into the rehabilitation of vehicle tracks. An additional objective was that of public awareness.

The study area was defined as Erongo Mining and Exploration Company's original prospecting grant in the Namib Naukluft Park, an area of 380 000 Ha bordering on the western boundary of the Park in the region of Walvis Bay and Swakopmund. Being of fairly variable topography, soil and vegetation types, this study area was simplified into smaller, more homogeneous units during the initial reconnaissance stage. These units included the well developed gypsum plains with lichen fields, the gravel plains with no lichens, the calcrete plains, alluvial surfaces and mountains and

inselbergs and their lower slopes.

Density of existing tracks was determined by recording the number of tracks intercepted per kilometer transect. High density areas were identified as being those regions of the western part of the study area. Track density generally decreased with increasing distance from the coast.

Seven experimental plots laid out in a grid fashion were located within these homogeneous units. The treatments applied to the experimental plots included a standard vehicle treatment (Mazda B2600 4x4, RVT 180n tyres, tyre pressure of 1.6 KPa, unloaded, 2 wheel drive, single pass at a low speed), a high tyre pressure treatment (standard vehicle with tyres inflated to 2.3 KPa), a narrow tyre treatment (standard vehicle with lug tyres), a 4-wheel drive treatment (standard vehicle engaged in 4x4 high ratio), a loaded vehicle treatment (standard vehicle with a load of approximately 500kg), a multiple pass treatment (standard vehicle 5x over the same track), a speed treatment (standard vehicle at 45 km/hr), a cornering treatment and finally a wet soil treatment (ground watered with the equivalent of 10mm rainfall before impacting with a standard vehicle).

Comparisons between treatments in terms of visual impact, microtopography and soil strength, were made for all of the plots. Visual impact was assessed by means of aerial and ground photographs, surface area and average depth of the tracks were determined using a descending point apparatus (DPA) and soil strength was assessed by means of a modified dynamic cone penetrometer (DCP). The effect of vehicle tracks on lichen cover was determined for one of the plots situated within the lichen fields.

General conclusions from the treatment comparisons were that the cornering track caused the most disturbance from all aspects. The

multiple pass track resulted in the second highest level of disturbance, followed by the narrow tyre track. There was no difference detected between the high tyre pressure, the standard vehicle, the loaded vehicle and the 4 wheel drive treatments for all of the parameters measured. The speed track resulted in the least amount of disturbance, mainly from a visual point of view.

Study sites were compared using the same parameters as for the treatment comparisons. The results were as follows: The well developed gypsum plains with lichen cover were the most sensitive to off-road vehicle impact. Tracks made on the alluvial soil had a high visual impact, although because of the nature of the soil a fast recovery of these tracks is anticipated. Tracks on the gravel plains without lichens and the lower slopes of the inselbergs and marble ridges had a lower visual as well as structural impact. The least sensitive surface was that of the calcrete plains situated furthest from the coast.

On the tracks made on the gravel plains further inland from the well developed gypsum plains, the soil strength within the top few centimeters was actually reduced with impact. This was attributed to a fragile porous structure present a couple of centimeters below the surface of the undisturbed soil and observed in thin sections made of this soil. This fragile structure appears easily crushed with even a slight application of force to the surface. It was suggested that the loosened, more powdery soil is likely to be more susceptible to wind erosion. An exception to this was observed for the tracks made on wet soil. Surface soil strength was dramatically increased after wetting and disturbance by a standard vehicle. A saline crust was observed to form on the surface of the soil during desiccation, cementing the vehicle track in a stable rut. This appears to have important implications for driving under these conditions, which should be avoided until the soil is completely dry.

On the plots situated on the well developed gypsum crusts, soil strength was increased with impact in all of the treatments excepting the cornering track. This soil lacks the fragile structure observed in the plots mentioned previously and is underlain at a depth of a few centimeters by a resistant gypsum crust. Soil strength was not dramatically altered with impact on the experimental plot situated on the calcrete plains.

Rehabilitation of vehicle tracks was investigated. Experiments using homemade rakes of varying width and distance between prongs were conducted on a gypsum/lichen surface and a sandy surface without lichens. The most success was achieved using a rake wider than the width of the track with prongs 2cm apart. The suggestion was made that further investigation be conducted into developing a rake of similar dimensions that can be attached behind the rear wheels of a vehicle in order to achieve immediate visual rehabilitation.

Experimental sites were permanently marked for the purpose of future monitoring. Geographical location was determined using a Global Positioning System (GPS), plots were marked on 1:50 000 topographic maps, a detailed description of the location of the plots was made and aerial and ground photographs taken of the areas. Physical marking of the plots was discussed.

Recommendations for a follow-up survey included conducting visual comparisons after a two year interval and soil strength and microtopography comparisons after a five year interval. It was argued that little is known of the recovery rates of vehicle tracks, and a more efficient programme for monitoring could only really be determined after an initial monitoring period.

**DISCUSSION: GENERAL RECOMMENDATIONS FOR THE
PREVENTION OR REDUCTION OF VEHICLE DAMAGE
DURING OFF-ROAD DRIVING IN THE NAMIB NAUKLUFT PARK**

A discussion on recommendations designed to prevent or at least reduce the impact due to off-road vehicles driven within the Namib Naukluft Park was held. The following recommendations resulted:

1. Off-road driving be kept to a minimum at all times
2. Existing tracks (other than single pass) be used wherever possible
3. Driving should, where ever possible, be restricted to the least sensitive surfaces, for example rocky outcrops, river beds and washes.
4. High lying areas should be avoided as these are visible from a greater distance than low lying areas
5. Driving directly up slopes should be avoided, taking time to drive around an obstacle rather than over it
6. All driving should be avoided when the soil is wet, allowing a period of a week for soil to dry after heavy rains
7. The use of wide tyres deflated to as low as the conditions permit, is recommended
8. Cornering be conducted at low speed
9. Rapid acceleration and braking be avoided
10. Vehicle be engaged in 4 wheel drive high ratio where ever possible
11. Fresh tracks be raked over at points intercepting roads open to the public
12. Light vehicles be used where possible

Two study sites in the vicinity of Gobabeb were visited during the morning of the following day. The first site visited was located approximately 25km from the coast off the main Walvis Bay - Windhoek road. The surface on which the site was situated consisted of a well developed gypsum crust thinly mantled by a soil layer. The surface was well vegetated by lichens of numerous species.

Quadrates cleared of lichen cover for the monitoring of recolonisation were investigated. Visual comparisons were made between the various vehicle treatments. Rehabilitated plots were observed.

The second plot visited was located in the region of Karp Rock inselberg, approximately 10km north of Vogelvederberg. This plot was representative of the region characterized by gravel plains with some gypsum present but without lichen cover. Differences between the soil strength of the wet soil treatment and the undisturbed soil were illustrated. Comparisons were again made between the tracks noting the high visual impact of the multiple track and the faintness of the speed track compared to the other treatments. Rehabilitated sections of track were investigated. Large mammal preference for walking along the vehicle tracks was observed.

MATTERS ARISING FROM THE WORKSHOP

Resulting from discussion which arose during the workshop, the following suggestions relating to the completion of the project on off-road vehicle impact, and to the ongoing monitoring of study sites were made:

1. It was recommended that plots be visited at least every year to monitor damage to the experimental tracks and the effect of rainfall events
2. Visual monitoring to take place in two years time, monitoring of microtopography and soil strength in 4-5 years time
3. Plots be physically marked with white pebbles positioned at the corners of each plot
4. Rehabilitated areas be extended along the whole length of the tracks
5. Follow up project on the rehabilitation of vehicle tracks be conducted in future, possibly through an engineering faculty. Funding for this project will be asked from companies who are likely to be active within this region in future.
6. An informative pamphlet on the effects of off-road vehicles on the desert surface be produced for distribution to mining companies, 4x4 hire companies, tour companies and the public in general. This pamphlet could be funded jointly by the Wildlife Society of Namibia, the Geological Society and the Desert Ecological Research Foundation of Namibia and Charly's Desert Tours.
7. A short newspaper article concerning the workshop to be submitted to local newspapers.
8. A final document on the study conducted on the visual impact of off-road driving on the Gravel Plains of the Central Namib to be submitted on completion to the Desert Ecological Research Unit, Erongo Mining and Exploration Company, the Geological Survey of Namibia, the Ministry of Wildlife Conservation and Tourism head office in Windhoek, MWCT Park

headquarters in the Namib Naukluft Park, the University of Natal Pietermaritzburg and to Anglo American Corporation of South Africa head office.

9. Publications submitted to appropriate journals

ACKNOWLEDGEMENTS

Acknowledgement is due to the Erongo Mining and Exploration Company for generously providing support for the research project on the effects of off-road vehicles on the Gravel Plains of the Central Namib Desert, to the Desert Ecological Research Unit under directorship of Dr M K Seely, for providing supervision and facilities during the course of the project and to the Ministry of Wildlife, Conservation and Tourism for their interest and cooperation. The research project is conducted through the University of Natal, Pietermaritzburg, and the presence of Prof J de Villiers, Prof N M Tainton as well as that of Dr G L Smuts of the Anglo American Corporation of South Africa at this seminar is greatly appreciated.

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