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# THE INFLUENCE OF PLANT WATER RELATIONS AND VEGETATION COVER ON SLOPE STABILITY

by

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## ABSTRACT

In this project, a barren slope was bioengineered by planting a combination of plant species and monitoring some facets of its stability. This technique was observed to accelerate the establishment of vegetation cover on the barren slope. The combination of plants comprised legume, vetiver grass and three species of shrubs, namely *Justicia betonica*, *Lantana camara* and *Thunbergia erecta* selected based on their extensive root profile and good plant water relation characteristics. The latter include drought resistance characteristics and positive effects of pre-treatment. A survey was also conducted on root and soil water profiles of five type of slopes along the NSE, arbitrarily called type A, B, C, D and E to distinguish the characteristics of stable slope from unstable ones. These characteristics were used as basis to assess the bioengineered slope. Plots with either *L.camara* or *J.betonica* or *T.erecta* along with legume and vetiver did not show any significant difference in terms of the ecophysiological parameters studied. But, when they are present together, biomass and biodiversity increased significantly. Concomitant to these increase, root length density, soil penetrability and shear strength of the bush ecosystem plot were observed to be enhanced. These attributes of the vegetation in the bush ecosystem plot revealed strong positive relationship with slope stability parameters. Hence, it is suggested that these characteristics be used in monitoring and assessment of cut slope.

## ABSTRAK

Di dalam projek ini, satu cerun yang gersang telah di biojuruterakan dengan menanam beberapa gabungan spesies tumbuhan dan mengawasi beberapa aspek kestabilannya. Teknik ini dapat mempercepat proses penumbuhan litupan vegetasi di atas cerun yang gersang ini. Gabungan beberapa spesies tumbuhan adalah terdiri daripada legum, rumput vetiver dan tiga spesies renek, iaitu *Justicia betonica*, *Lantana camara* dan *Thunbergia erecta*, yang telah dipilih berdasarkan profil akar yang meluas dan pertalian air pokok yang baik. Pertalian air pokok dilihat dari aspek rintangan spesies terhadap kemarau dan kesan positif pra-perlakuan. Tinjauan juga telah dijalankan ke atas profil akar dan air tanah di lima jenis cerun di sepanjang NSE, secara rambang dipanggil jenis A, B, C, D dan E untuk membezakan ciri-ciri cerun yang stabil daripada yang bermasalah. Ciri-ciri ini digunakan untuk menilai cerun yang telah di biojuruterakan. Plot yang ditanam samada dengan *L.camara*, *J.betonica* atau *T.erecta* bersama-sama legum dan rumput vetiver tidak menunjukkan perbandingan yang jelas di dalam parameter ekofisiologi yang dikaji. Tetapi, apabila ditanam bersama, biomasa dan biodiversiti jelas meningkat. Seiringan dengan peningkatan ini, kepadatan panjang akar, penetrabiliti tanah dan kekuatan shear di plot "bush" ekosistem dilihat meningkat dengan bererti. Sumbangan vegetasi di plot "bush" ekosistem menunjukkan perhubungan positif yang kuat dengan ciri-ciri parameter kestabilan cerun. Maka dengan ini dicadangkan supaya kriteria tersebut digunakan di dalam pengawasan dan penilaian cerun-cerun yang dipotong.

## ABBREVIATIONS

ABA	Absciscic Acid
ACa & ACi	Carbon Dioxide Response Curve
$A_{\max}$	Light Saturated Assimilation
ATP	Adenosine Triphosphate
cm	Centimetre
DW	Dry weight
FC	Field Capacity
Fig.	Figure
FSKTM	Faculty of Computer Sciences and Information Technology
FW	Fresh weight
$g_m$	Mesophyll Conductance
$km\ m^{-3}$	Kilometre per Cubic Metre
kPa	Kilo Pascal
LAI	Leaf Area Index
$m\ m^{-3}$	Metre per Cubic Metre
MPa	Mega Pascal
NADPH	Nicotinamide Adenine Dinucleotide Phosphate
NSE	North-South Expressway
PAR	Photosynthetically Active Radiation
PPC	Plant Propagation Centre
PPM	Part per Million
QE	Quantum Efficiency
$\Gamma_{CO_2}$	Carbon Compensation Point
$\Gamma_i$	Light Compensation Point
RLD	Root Length Density
RuBP	Ribulose Bisphosphate
R	Legume
RV	Legume and Vetiver
RVL	Legume, vetiver, <i>L.camara</i>
RVJ	Legume, vetiver, <i>J.betonica</i>

RVT	Legume, vetiver, <i>T. erecta</i>
RVLJT	Legumes, vetiver, <i>L.camara</i> , <i>J.betonica</i> and <i>T.erecta</i>
RWC	Relative Water Content
SWC	Soil Water Content
WAC	Water Absorption Capacity
WUE	Water Use Efficiency

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