



# Comparative study of vegetation structure and regeneration between 2 monitoring surveys in Dubai Desert Conservation Reserve.

Tamer Khafaga, Dubai Desert Conservation Reserve

**Introduction:** Following the baseline survey on the vegetation of Dubai Desert Conservation Reserve which assessed and quantified the vegetation cover and plant communities and provided data that served as the preliminary basis for comparison. These study policies are to implement a continuous, practical and efficient vegetation monitoring program and to apply analytical tools for the data interpretation which mainly emphasize the assessment of density, cover and diversity of the flora. In addition, results and findings are also mapped to provide visual illustration of patterns of vegetation and defining lineage between different floral communities, using multivariate analysis and GIS techniques.

**The aim:** To implement a continuous practical and efficient vegetation monitoring program and to apply analytical tools for easy data interpretation. This information and data is indispensable for managing the DDCR in a sustainable manner.

**Study Region:** Dubai Desert Conservation Reserve (DDCR) is a designated area set aside for conserving the natural environment of the desert ecosystem in Dubai. It encompasses about 225km<sup>2</sup> of sand dunes desert ecosystem interspersed with gravel plains and spans about 5% of the total area of Dubai Emirate. Indigenous wildlife was re-introduced as free ranging animals including Arabian Oryx, Arabian Gazelle and Sand Gazelle.



Location and Topography of the Dubai Desert Conservation Reserve



Vegetation Sampling Points

### Methodology:

- Using plot sampling technique to randomly select points with consideration to the two main habitats (Sand Dunes and Gravel Plains).
- A circular plot was used for sampling an area of 50m diameter.
- The parameters measured in each plot include (Density, Relative Density, Frequency, Relative Frequency, Abundance, Relative Abundance, Cover and Relative Coer.
- Significant Important Value Index calculated by summing all the relative values.
- Diversity indices (Simpson, Shannon-Weiner and Brillouin) used to quantitatively assess the diversity of the plant communities and comparing different habitats.
- Using complementarity which covers the distinctness in species composition over a broad spectrum of environmental scales.

### Result and Findings:

The different habitats of the study area showed a double increase in the total number of the species recorded between this survey 2009 and the previous survey of 2004. A number of annual species have been recorded which indicates the positive rehabilitation of the habitats during the last years.

A total of 45 species were recorded during the survey. 17 species were common in all habitats types and 12 were unique to only one habitat type. Gravel plains harbored 33 different species (15 species in 2004 survey) while the sand dunes contained 30 species (17 species in 2004 survey). 25 species were common to both the habitats.

The dominant species in all habitats are; (*Heliotropium kotschy*; *Leptadenia pyrotechnica*; *Rhanterium epapposum*; *Heliotropium dimyngum*; *Moltkiopsis ciliata*; *Haloxylon salicornicum*; *Fagonia indica*, *Cyperus conglomeratus* and *Eremobium aegyptiacum*)

the indices of Simpson, Shannon-Weiner and Brillouin were used to estimate the floral diversity and compare it with the previous data to check for the habitat diversity improvements; these results show the diversity estimates at point estimates.

Table 1: Diversity Estimates for Plant Community in AMR

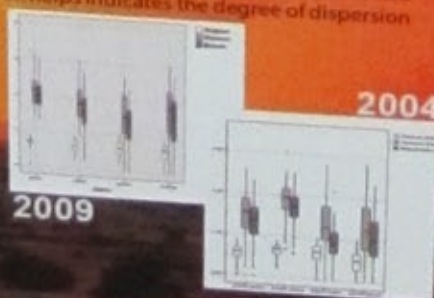
Index	AMRGP05	AMRGP09	AMRSD05	AMRSD09
Simpson	0.737	0.971	0.748	0.97
Shannon-Weiner	2.35	5.4	2.52	5.26
Brillouin	2.34	5.37	2.5	5.2

Table 2: Diversity Estimates for Plant Community in DDCR

Index	DDCRGP05	DDCRGP09	DDCRSD05	DDCRSD09
Simpson	0.831	0.953	0.547	0.985
Shannon-Weiner	3.04	4.75	2.89	6.67
Brillouin	2.91	4.68	2.84	6.62

The indices showing that there are changes in all habitats between the two surveys, all three indices have increased compared to the 2004 survey. It did not dramatically increase within the Simpson index because it is Type II index where it is most sensitive to the more abundant species; while it is nearly doubled or even tripled in Shannon-Weiner and Brillouin indices which are both considered to be Type I indices most sensitive to rare species in the habitat. This is clear by seeing the species list and the number of new species recorded in this survey, most of which are annuals with low recorded number.

**Boxplots** used to identify and visualize heterogeneity, it is non-parametric method, and the space between the different parts of the box helps indicates the degree of dispersion and skewness in the data. The boxplot illustrates that for the Simpson index, which is Type II, there is little differences between the four habitats. While for the Type I indices of Shannon-Weiner and Brillouin the AMR Gravel Plains habitat shows greater vegetation diversity when compared to the other three habitats.

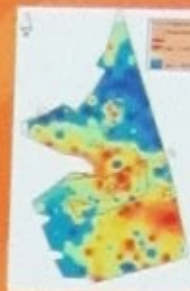


### Predicted Floral Diversity in DDCR

The value of the diversity indices of individual plots over sand dunes and gravel plains were used to interpolate predicted diversity in un-sampled areas and to produce an overall picture of how diversity is changing over the entire Dubai Desert Conservation Reserve; Kriging of the observed biodiversity values is used. The results showed that there is overall recovery in the southern range of the Dubai Desert Conservation Reserve while in the Al-Maha Resort the diversity was reduced compared it to the 2004 survey. There are a lot of diversity hotspots distributed mainly in the south range indicate the recovery of vegetation, while in AMR there are some areas where the diversity affected from the local overgrazing of Oryx and gazelle.



Type I indices most sensitive to rare species in the habitat



Type II indices where it is most sensitive to the more abundant species

### Species Dispersion

Kriging was used as the method to predict the spatial pattern of species involved in the study. The input was the abundance counts of samples over the study region of DDCR. The prediction was applied to selected species of the herbs and shrub vegetation layers.

1- *Cyperus conglomeratus*: This species remain the most wide-spread and abundant species over the study areas, while it is void over the gravel plains in AMR and DDCR, the species is considered as sand dunes specialist and has never been recorded on the gravel plains. The species shows even dispersed distribution over the reserve dunes while in the southern range two new nucleus hotspots have formed.

2- *Leptadenia pyrotechnica*: This species showed a good overall improvement despite the void in dispersing distribution in the area around Al Maha Gate and the area around the Tawi Sohail. The area of high concentration is spread diagonally across the reserve as the effect of the livestock farms was significant in the distribution of the species. There is a great hope that in the coming years there will be a different positive distribution over the DDCR.

**Thiessen Polygons:** In order to clearly display the distribution of the plant communities spatially over the studied area Thiessen polygons were adopted with the aid of the habitat classification of TWINSpan which will enable the spatial display of the final results.

Thiessen polygons clearly showed the habitat classification as follows:

- The area of Nazwa (North) has been classified as a single group of habitat (s) according to its uniqueness in vegetation types and its geological feature of being the only mountain habitat of Al Hajar mountain range within DDCR; while also being the least disturbed habitat being away from the safari companies and other old camel farms activities.

Beneath Nazwa there is distinguish gathered polygons together forming a strip which shows an area previously used by a safari operator for desert driving activities. The area still shows the effect on the type of vegetation by this activity and hence its classification.

- The southern range of the DDCR shows a very diverse habitat classification and the only explanation for this is that it is an indication of habitat recovery and that during this pioneer stage there are more plant communities. This will be the case until a climax stage is reached where there will be more homogeneity of vegetation types and indicator species.

- The area of the Al Maha gravel plains has shown homogeneity in their structure and geographical spread due to the long term conservation of the AMR.

**Discriminant Function Analysis:** Discriminant function analysis is used to determine which variables discriminate between two or more naturally occurring groups. The analysis was done using Abundance of each species; species richness (calculated for each of sampling plot individually);

cover estimate and diversity (expressed as Brillouin, Simpson and Shannon indices). Except for DDCR Gravel Plains the groups centroids show mainly positive results which leads to a conclusion that the habitats are in a steady process of regeneration and restoration. AMR Gravel Plains showed a positive centroid with function 1 (Cover) which give an indication how the cover restored in Al Maha Gravel Plains but the diversity is still low. AMR Sand Dunes and DDCR Sand Dunes showed positive centroid result with function 2 of species richness and Diversity indices which still illustrates the same trend of habitat regeneration. The DDCR Gravel Plains are showing negative centroid with function two and this is obviously due to the negative effect of overgrazing that has been taking place in DDCR Gravel Plains until recently.

