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# Quantifying the level of degradation in two adjacent rangeland areas in Ha'il district

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**Abstract**
International Journal of Applied Research Across Saudi Arabia, rangelands considered International Journal of Applied Research potential food source suppling huge numbers of livestock particularly in the northern regions of the country. However, very little is known or documented on the situation of remaining zones of rangelands that can be found across the northern part of Saudi Arabia. This study was conducted to estimate the level of degradation on vegetation cover in two adjacent areas in Ha'il District of Saudi Arabia, in the way to design a future plan for improvement and management. Different measurements were used to quantify the vegetation type including frequency, cover, composition and density during the spring season of 2016. The study area was classified into two types 1) Fenced (or protected) rangeland where there is no kind of grazing or animal activities and, 2) Open rangeland where grazing is allowed. Forty (40) of plants species were recorded in fenced area whereas this number was reduced to only 15 species in open area. Results obtained from this study showed that the presence of overgrazing was the major reason for species declining in open area due mainly to the huge numbers of grazing animals during the optimum grazing period. Results also indicated that overgrazing had great impact on the presence of less palatable plant species. Along with the replacement of original plants, a considerable variation on species density was observed due to excessive grazing. Results obtained from this study showed continues selective grazing and hence disturbance in rangeland.

**Keywords:** Rangeland, Degradation, Plant frequency, Plant compositions, Plant cover, Plant density

## Introduction
Change in vegetation composition has been attributed to the intensity of grazing, type of grazers and, plant host species [16, 15, 5]. As well, grazing is known to reduce vegetation cover, decreasing the species diversity and, increasing the presence of unpalatable species [10, 7, 20, 8, 11, 14]. Al-Rowaily, (2003) [1] stated the economic and social importance of rangelands in Saudi Arabia in supporting livestock forage and creating opportunities for outdoor enjoyable activities. Beside, rangelands contributed to the species conservation as they play an important ecological role in biodiversity. In the absence of land use policy, overgrazing may decrease biodiversity and sustainability of these rangelands [6, 4, 2]. Fencing rangeland as a successful tool for restoration and excluding grazing animals has been mentioned by many respective authors around the world [13, 19, 12].

## Materials and Methods
### Study area
The current study was conducted in Ha'il District, Saudi Arabia (Figure.1). Ha'il district lies in the north central part of Saudi Arabia between 25° 29′N and 38° 42′E and it covers an area of 118,322 km². The study was conducted during the spring season of 2016 within 2 large scales of rangeland areas. The study area was divided into two major zones: 1) fenced (or protected) and this area was protected by the Rangeland Authority in Ha'il and was used for the purpose of the study as a control area and, 2) open area which has a considerable grazing activities. Both areas were adjacent and have been chosen intentionally in order to avoid the effect of its physio-graphic characteristics on vegetation. The open area suffers from periodical grazing events by camels, goats and sheep whereas in the protected area there is not any kind of grazing activities over the year due to the high protection by the respective authority.

**Sampling procedures**

**Vegetation cover and composition**

Sampling for herbaceous cover was based on locating 10 transects of 50m length along each type of rangeland. For each transect 1×1m quadrate was aligned across the line to determine the species density and frequency. However, a quadrate of 10×10m was used to determine the density of trees and shrubs using direct count.

To determine the percentage of plant cover, 1×1m quadrate been allocated along each transect over 10 m intervals. The cover percentage was recorded and the total estimation were summed and then divided by the number of quadrates in order to calculate the average cover for one square meter.

**Species Frequency**

Frequencies of plant species have been calculated by counting the number of species, which occur in the sampling quadrate. The following equation has been applied to calculate the frequency:

Frequency % = Number of quadrats with plants species occurred / Total number of quadrats × 100

**Species density**

Trees and shrubs density was determined by direct counting in each 10×10m quadrate. The quadrate was placed twice across the line transect over the study area. The species encountered were summed and divided by their number in all quadrates to calculate the average.

**Results**

The current study investigated the level of degradation in two rangeland areas in Ha'il district, Saudi Arabia during the spring season of 2016, the season that represents the peak of flourishing vegetation in such dry lands. The results showed clearly that, the average cover percentage was higher in the protected area compared to the open grazed land (Table.1). As shown in table.1, the plant composition was also higher in fenced rangeland.

**Discussion**

**Frequency**

The study area was dominated by different species in both types of rangelands; this may be due to the grazing intensity. The results showed that, *Notoceras bicorne* recorded the highest frequency in the protected area where *Leysera leyseroides* scored the highest in the open grazed area (Figure.2).

The overgrazing and overstocking for long periods may change the dominant species such as *Plantago cylindrical* which is considered to be preferred by animals. Another fact that this species was disappeared from open grazed area and that, could, explain its palatability by different animals.

Also, the results showed that, *Notoceras bicorne* and *Leysera leyseroides* found in both areas during the study period (Figure.2), this could be attributed to the fact that, the frequency has almost remained the same in open or protected areas. This result may show that both species are tolerant and not palatable by animals.

Beside competitions and utilization, [17] stated that physical factors determine the kind of vegetation available, the manner and degree of possible use. Physical factors such as climate, soil and topography are also affected by type of vegetation as mentioned by the previous author.

**Plant composition**

According to Yates *et al*., (2000) [18], grazing by domestic livestock has been considered as a the main degrading factor because it changes vegetation structure and composition as a result of which some species increase in abundance and others decrease. Current results of plant composition over Ha'il's rangeland areas were demonstrated in (Table.1). The notable decrease of the plant composition in open grazing area may be due to both variable soil properties and high grazing intensity. Moreover, such disturbance may cause the unpalatable plants to invade these areas. Therefore, reduction in more palatable species in the area such *as Plantago sp.* could be occurred.

**Species density**

The results of relative density of the most dominant species were illustrated in Table.3. *Notoceras bicorne* showed highest density in the protected area where *Leysera leyseroides* was dense in the grazed one (Table.3). As noticed, these types of species are not preferred by most grazing animals, therefore, they considered invader plants in both areas. However, individuals within *Plantago spp*. started to be less dense and even disappear completely in the grazed area explaining that it is palatable species. This phenomenon is well known and documented by some researchers such as Gamoun, (2014) [9].

**Implications**

The current study concluded that, the vegetation cover was generally lower in the grazed area compared to the protected one. Also, a considerable variation in species composition was recorded due to the intense grazing. In addition, a change in the vegetation type such as the replacement of palatable grasses by less palatable plant species was also recorded. Moreover, dominance of less preferred species such as *Leysera leyseroides* and *Notoceras bicorne* indicated that notable intense selective grazing and hence disturbance of rangelands is taking place in the study area. Current results indicated clearly that, the concentration of high numbers of animals and the ongoing rate of grazing in the study area lead to rangeland degradation Therefore, protection and management plans should be applied strictly for such degraded area in order to prevent the loss of its native plant biodiversity.

**Acknowledgment**

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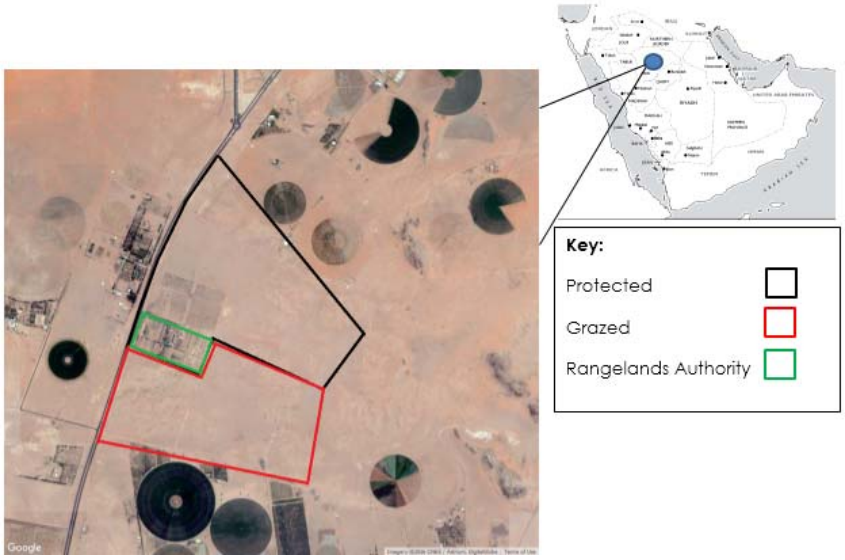



**Fig 1:** The study area in Ha'il, north central of Saudi Arabia.

**Table 1:** Average percentage of plant composition, cover, bare soil, and litter

| Rangeland | Plant Composition (%) | Cover (%) | Bare Soil (%) | Litter (%) |
|---|---|---|---|---|
| Protected | 75.1 | 32.3 | 8 | 0.38 |
| Grazed | 55.2 | 23.4 | 19 | 2.5 |

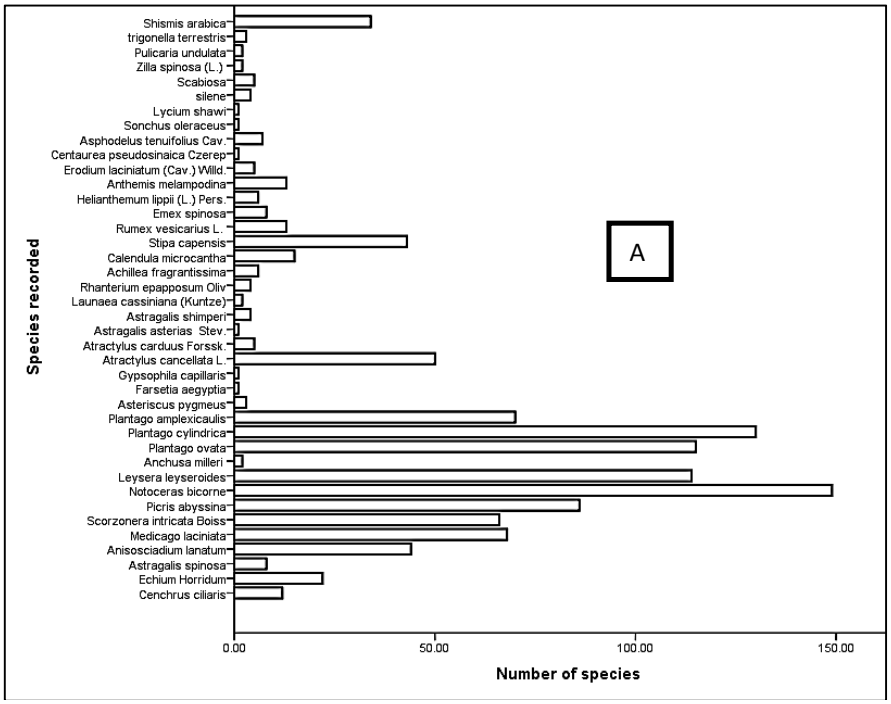
**Table 2:** Check-list of plant species identified over the study area

| No | Protected Rangeland | Grazed Rangeland |
|---|---|---|
| 1 | *Achillea fragrantissima* | *Atractylis cancellata* |
| 2 | *Anchusa milleri* | *Anisosciadium lanatum* |
| 3 | *Anchusa sp.* | *Astragalus spinosus* |
| 4 | *Anthemis melampodina* | *Cynodon dactylon* |
| 5 | *Asphodelus tenuifolius Cav.* | *Erodium laciniatum* (Cav.) Willd. |
| 6 | *Asteriscus pygmaeus* | *Hamada elegans* |
| 7 | *Asteriscus sp.* | *Heliotropium lippii* (L.) Pers. |
| 8 | *Astragalus asterias* Stev. | *Leysera leyseroides* |
| 9 | *Astragalus schimperi* | *Notoceras bicorne* |
| 10 | *Atractylis carduus Forssk.* | *Picris abyssinia* |
| 11 | *Atractylis cancellata* L. | *Plantago amplexicaulis* |
| 12 | *Calendula microcantha* | *Pulicaria undulata* |
| 13 | *Centaurea pseudosinaica* Czerep | *Rhanterium epapposum* |
| 14 | *Emex spinosa* | *Shsismis arabica* |
| 15 | *Erodium laciniatum (Cav.) Willd.* | *Zilla spinosa* |
| 16 | *Farsetia aegyptia* | |
| 17 | *Gypsophila capillaris* | |
| 18 | *Helianthemum lippii* (L.) Pers. | |
| 19 | *Launaea cassiniana* (Kuntze) | |
| 20 | *Leysera leyseroides* | |
| 21 | *Leysera sp.* | |
| 22 | *Lycium shawi* | |
| 23 | *Notoceras bicorne* | |
| 24 | *Notoceras* sp. | |
| 25 | *Plantago amplexicaulis* | |
| 26 | *Plantago amplexicaulis* | |
| 27 | *Plantago cylindrica* | |
| 28 | *Plantago* sp. | |
| 29 | *Plantago ovata* | |
| 30 | *Plantago* sp. | |
| 31 | *Pulicaria undulata* | |
| 32 | *Rhanterium epapposum* Oliv | |
| 33 | *Rumex vesicarius* L. | |
| 34 | *Scabiosa olivieri* | |
| 35 | *Shismis arabica* | |
| 36 | *Silene* sp. | |
| 37 | *Sonchus oleraceus* | |

| | | |
|---|---|---|
| 38 | *Stipa capensis* | |
| 39 | *Trigonella terrestris* | |
| 40 | *Zilla spinosa* (L.) | |

**Table 3:** The average relative density of the most dominant species in both protected and grazed areas

| Protected | | Grazed | |
|---|---|---|---|
| **Species** | **Density/m²** | **Species** | **Density/m²** |
| *Notoceras bicorne* | 21 | *Leysera leyseroides* | 18 |
| *Plantago cylindrica* | 19 | *Notoceras bicorne* | 14 |
| *Plantago ovata* | 15 | *Plantago amplexicaulis* | 11 |
| *Leysera leyseroides* | 13 | *Erodium laciniatum (Cav.) Willd* | 9 |



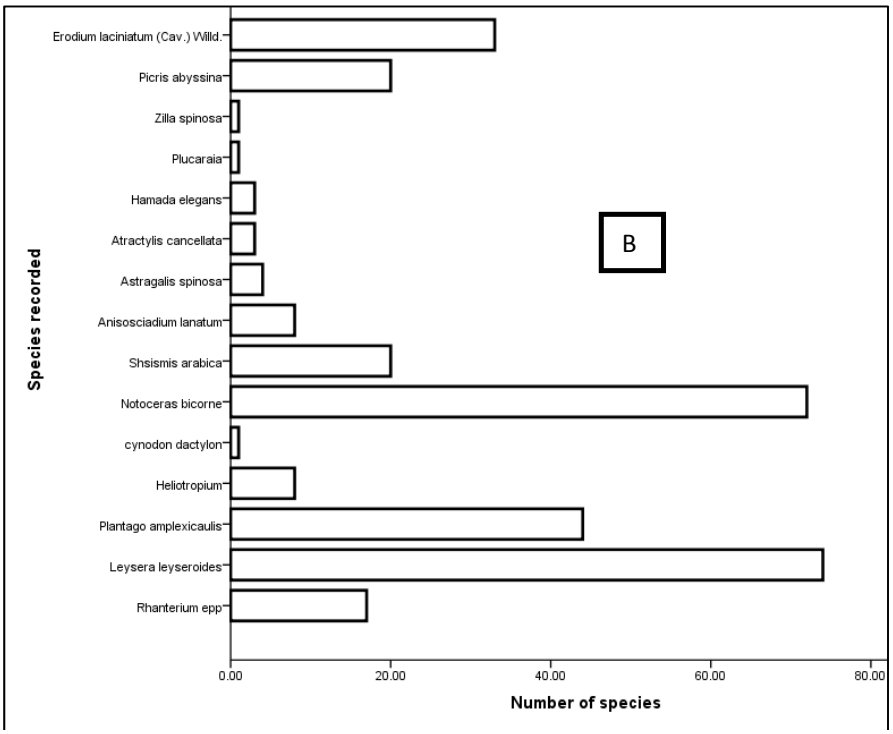




**Fig 2:** Variation in speceis frequency over both (A) protected and, (B) grazed areas

**Fig 3:** Camels graze freely while taking measurements in the open area

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