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## ORIGINAL ARTICLE

# Vegetation and condition of arid rangeland ecosystem in Central Saudi Arabia

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**Abstract** Saudi Arabia rangeland ecosystems have undergone intense processes of degradation for many decades because of extreme climate and human activities such as overgrazing and socio-economic changes. In this study, Hail and Qassim Regions of Saudi Arabia covering an area about 79610.73 km<sup>2</sup> were selected to study the rangeland vegetation and condition. *Haloxylon salicornicum* was the most dominant species, covering more than 56% of the total area. The second prominent community was *Acacia-Lycium shawii*, which covers about 21% of total area. It was found that about 65% of vegetation in the surveyed area is in good or very good condition compared with about 31% in poor or deteriorated condition. Effective measures such as determination of carrying capacities and development of grazing systems have to be implemented to ensure resources sustainably.

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## 1. Introduction

Saudi Arabia occupies about 80 percent of the Peninsula (Abd El Rahman, 1986). In general, most of the country can be classified as an arid land ecosystem characterized by unpredictable and low-erratic precipitation and high temperatures (Shmida,

1985). High rainfall variability is the norm between and within years. Mean annual temperature of Saudi Arabia is about 20 °C (De Pauw, 2002). Rangelands of Saudi Arabia occur mainly in arid and hyper-arid regions that cover about 75% of the country (Al-Rowaily, 1999). These rangelands differ functionally because of differences in the spatial and temporal distribution of vegetation structure, soil and climate of each region. (Chaudhary and Le Houérou, 2006). Livestock grazing (mainly sheep, camels, and goats) is the prevalent form of land use in rangelands (Al-Rowaily, 1999, 2003). Despite the relatively low productivity, rangeland ecosystems benefits derived from them are becoming increasingly recognized. These include watershed management (Al-Saud, 2009), wildlife conservation (Abuzinada, 2003) and eco-tourism (Seddon, 2000).

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In the interior of Saudi Arabia, there were relatively very rich stands of communities of *Haloxylon salicornicum* and *Rhanterium epapposum*. The same areas now support dense stands of unpalatable shrubs or herbs such *Rhazya stricta*, *Pulicaria undulata* and *Astragalus spinosus* (Chaudhary and Le Houérou, 2006). Acacia woodlands cover extensive patches of wadi runnels and localized plain areas. The major species are the *Acacia tortilis*, *Acacia ehrenbergiana* and *Leptadenia pyrotechnica*. Woodland understory host several species of low shrubs, grasses, and annual and perennial herbs. This vegetation complex forms the major rangelands resources for livestock (Chaudhary and Le Houérou, 2006; Ghazanfar and Fisher, 2013).

Relatively low productivity per unit area with a high proportion of bare ground is a characteristic of these fragile rangelands. For example, Bayoumi (1986) estimated that 260 ha of rangelands are required per annum to support one camel. Earlier, Kingery (1971) had estimated that over two thirds of rangelands of Saudi Arabia had been destroyed by overgrazing and tree and shrub cutting for. By 1985, it was estimated that 75% of the whole country was seriously degraded due to destruction of the natural vegetation (Anon, 1985). Rapid social and economic changes during the past few decades, led to heavy and prolonged pressure on rangeland ecosystems. Overgrazing, fuelwood cutting and cultivation pressure brought intense processes of environmental degradation to nearly all of the rangelands in Saudi Arabia (Heady, 1963; Batanouny, 1991; Al-Rowaily, 2003; Chaudhary, 2010; Dregne, 2002; El-Keblawy et al., 2009). Increased human activity tends to over-stress land and vegetation which has increased steadily across the entire Arabian Peninsula leading to resources degradation, salinization, and erosion (Kingery, 1971; Khan, 1982; Hellden, 1991; Oatham et al., 1995; Ghazanfar, 2003; Kharbotly et al., 2003; Geist and Lambin,

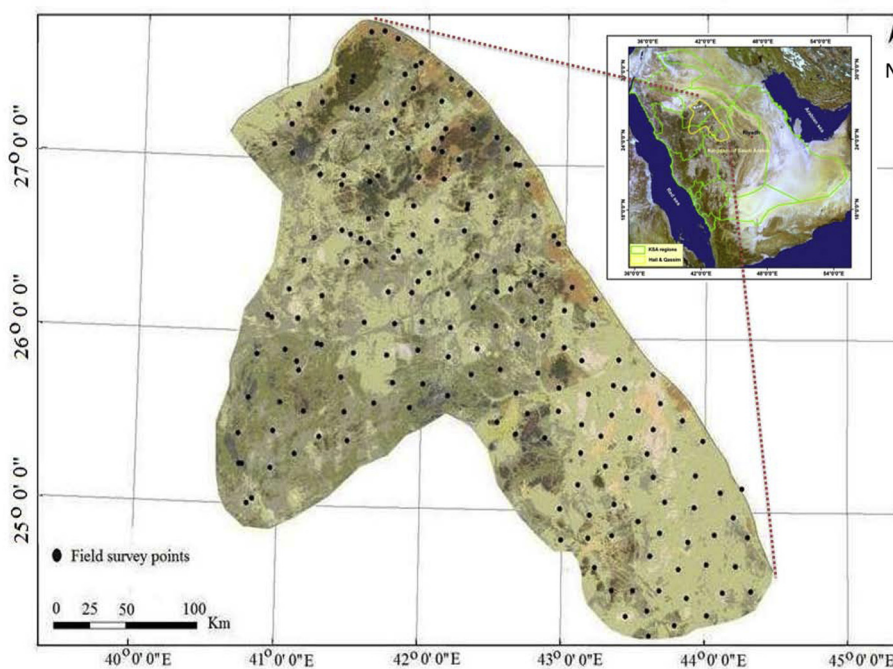
2004). The result has been a drastic reduction of species diversity, density, composition and reduction of plant cover (Barth, 1999; Al-Rowaily, 1999). Several works describing the natural vegetation of Saudi Arabia are published (e.g. Miller and Cope, 1996; Kürschner, 1998; El-Ghanim et al., 2010; Watts and Al-Nafie, 2013). However, most of these studies were more generalized and lack details. The current study aimed to describe vegetation and assess the current condition of rangelands at Hail-Qassim region in Central Saudi Arabia.

## 2. Materials and methods

Natural vegetation in Hail and Qassim regions of Saudi Arabia was studied covering a total area of about 79610.73 km<sup>2</sup>. The area is located between 44° 30'–48° E and 24° 15'–28° 45' N (Fig. 1). The two regions are characterized by several landscape units, such as isolated mountains (e.g. Aja, Salma,

**Table 1** Area of vegetation communities in Hail and Qassim Regions of Saudi Arabia and % from total surveyed area.

Vegetation Communities	Area (km <sup>2</sup> )	% of total area
<i>Haloxylon salicornicum</i>	47453.00	59.6
<i>Acacia-Lycium shawii</i>	17156.48	21.6
<i>Haloxylon salicornicum-Lycium shawii</i>	7973.98	10
<i>Suaeda vermiculata</i>	2561.75	3.2
<i>Haloxylon salicornicum-Panicum turgidum</i>	2445.57	3.1
<i>Rhanterium epapposum</i>	1147.94	1.4
<i>Haloxylon salicornicum-Zilla spinosa</i>	872.01	1.1



**Figure 1** Study area with field distribution of vegetation stands.

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