

## Vegetation structure and species diversity of Wadi Turbah Zahran, Albaha area, southwestern Saudi Arabia



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### ABSTRACT

The aim of this work was to study the vegetation structure of Wadi Turbah Zahran, Albaha area, Saudi Arabia and some biodiversity indices. Paleontological Statistics (PAST) Software Package was used for data analysis. A total of 266 species (201 genera, 71 families) were identified and most of the species were herbs (87%). Therophytes (32.7%) and Chamaephytes (30.45%) were the most prominent groups. Asteraceae family was represented by the highest number of species (15.4%) followed by Poaceae (9.4%). Thirty-one families (43.7%) were represented by a single genus and species. Thirty-four species (12.8%) were common to all sites. The genus *Solanum* was the most speciose followed by *Rumex*. Most of the calculated indices showed variations among the sites. Shannon (3.71–4.06), Menhenick (2.271–4.746) and Chao-1 (106–319.6) diversity indices markedly varied among the sites while Simpson values (0.96–0.97) were almost the same. Berger–Parker values revealed the dominance of *Hyparrhenia hirta* in four sites. Beta diversity values indicated high diversity between site 1 and 4 and less diversity between site 1 and 6.

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### Introduction

The Kingdom of Saudi Arabia is the largest arid land in the Arabian Peninsula, with an area of about 2,250,000 km<sup>2</sup>. It is approximately located between latitude 15°45'N and 34°35'N and between longitudes 34°40'E and 55°45'E (Al-Shareef, 2002; Miller and Cope, 1996). The country is characterized by its variation in environmental factors such as topography, geomorphology, climate and soil. These variations are reflected in the country distinctive ecological habitats, vegetational zones and consequently rich flora. It is endowed with a wide range of ecosystems and species diversity, especially in the southwestern region (Fadl et al., 2015). The Kingdom of Saudi Arabia lacks rivers and lakes, but Wadis (valleys) are frequently found throughout the country which demonstrate physiographic irregularities that lead to parallel variations in plant species distribution (Kassas and Girgis, 1964). Generally, vegetation of Wadis is annually varied due to many factors such as moisture levels, geographical position, physiographic features, and human impacts (Siddiqui and Al-Harbi, 1995). Flora of Saudi Arabia is very rich and is a mixture of Asia,

Africa and Mediterranean Irano-Turanian plant species. The greatest species diversity in Saudi Arabia occurs in the western mountainous area of the Kingdom (Collenette, 1998). Several studies have been published on the flora and the ecology of the country Migahid (1978, 1988, 1989, 1990), Collenette (1999), Chaudhary (1999, 2000, 2001); including Wadis (El-Ghanim et al., 2010; Alatar et al., 2012; Osman et al., 2014).

Albaha, south-western, Saudi Arabia is rich of Wadis, mountains and wild life area. Its flora is a mixture of the tropical African, Sudanian plant geographical region (Paleotropical origin) with very few of Saharo-Sindian or Saharo Arabian region (Holarctic origin) and Mediterranean regions (Al-Khulaidi, 2013).

This work aimed at studying the vegetation structure, floristic composition and species diversity of Wadi Turbah Zahran, Albaha area, Saudi Arabia.

### Materials and methods

#### Study area

Wadi Turbah Zahran lies approximately 42 km northwestern of Albaha city and covered about 120 km<sup>2</sup>. It locates between latitudes 20°10' and 20°15'N, longitudes 41°15' and 41°20'E and at the altitude ranges from 1790 to 1900 m.a.s.l. (Fig. 1). The area lies

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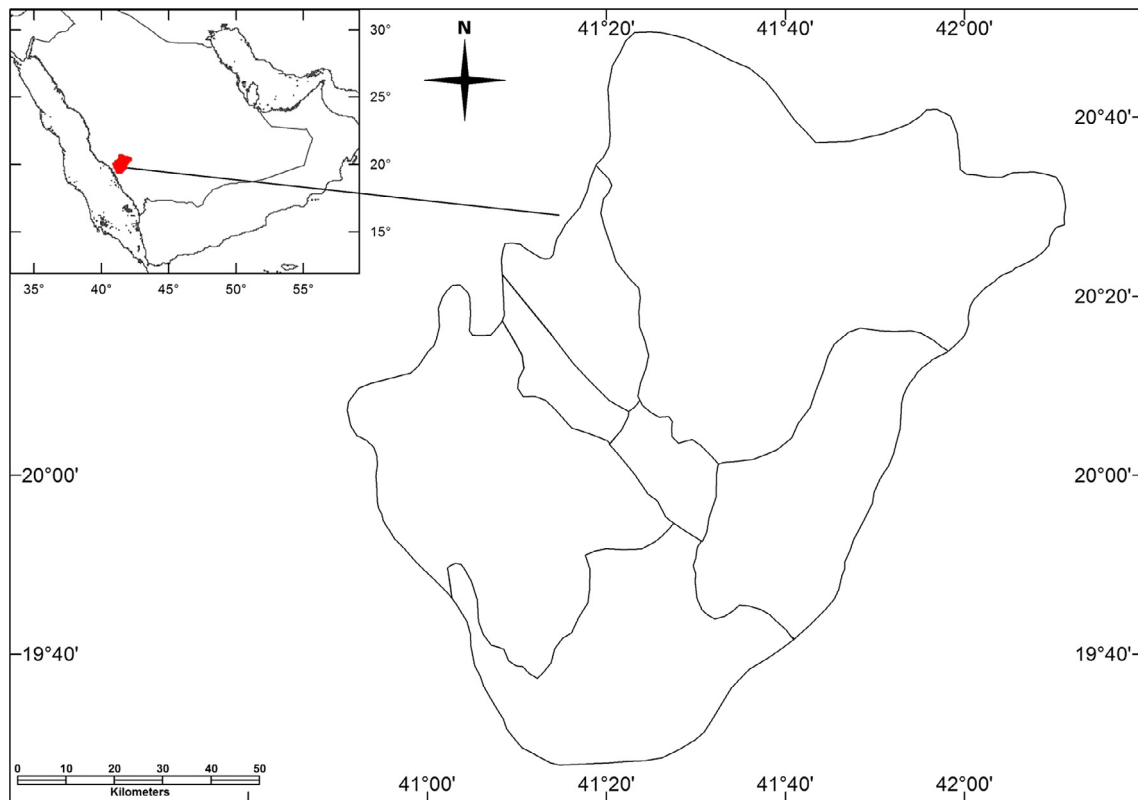
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**Fig. 1.** Location of the study area, Albaha Region, Saudi Arabia.

in the Sarawat mountain chains which is characterized by coarse pink granite, mixed with grey diorite and granodiorite (Ady, 1995). The soil texture is classified into three classes: loam, clay, and silty clay. The loamy soil represents 85.8% of the area, whereas, 8.4% of the area is silty clay and 5.7% of the total area is clay soil (Mahmoud et al., 2014). The climate is dry and semi arid belonging to tropical/subtropical desert (Ayele and Al Shadily, 2000). The mean temperature varies between 16.1 and 29.4 °C, relative humidity is 25–59% and rainfall is between 0.4 and 29.6 mm (Table 1). The area is characterized by huge and steep rocky mountains (Alahmed et al., 2010).

#### Field survey

Extensive and intensive field trips were conducted to the study area during a course of one year from January – December 2015. The area was divided into six sites; each site was divided into three stands with ten quadrates (10 × 20 m). The recorded plant species

were identified and named according to Chaudhary (1989, 1999, 2000, 2001), Chaudhary and Al Jowaid (1999), Collenette (1985, 1999) and Migahid (1978, 1988, 1989, 1990). Nomenclature and citation and Synonyms were updated from electronic sources and authenticated international DATA bases (Germplasm Resources Information Network, GRIN, <http://www.ars-grin.gov/>, The International Plant Names Index, IPNI, <http://www.ipni.org> and The Plant list <http://www.theplantlist.org>). Arabic vernacular names have been recorded from the local community at the study area and from other available sources (Chaudhary, 1989, 1999, 2000, 2001). Voucher specimens were deposited at Department of Biology, Faculty of Science, Albaha University.

#### Data analysis

Habits and life forms of the species were classified following the Raunkiaer (1937) and Naqinezhad and Zarezadeh (2012) systems with some modifications. The dominance of the species was classi-

**Table 1**

Monthly variation in air temperature (°C), relative humidity (%) and precipitation (mm) as recorded at Albaha meteorological station during Jan – Dec 2015.

Month	Temperature (°C)			Relative humidity (%)	Precipitation (mm)
	MX	MN	M		
Jan	22.9	10.4	16.1	59	3.4
Feb	25.6	12.2	18.5	49	0.4
Mar	27.5	14.3	20.5	46	4.8
Apr	29.9	17.4	23.1	48	29.6
May	32.9	20.2	26.1	39	22.8
Jun	35.5	22.9	29.1	25	5.5
Jul	35.6	23.4	29.2	29	11.9
Aug	35.8	23.5	29.4	31	6.6
Sep	33.9	21.7	27.8	27	1.3
Oct	29.7	17.2	23.6	31	4.5
Nov	26.1	13.3	19.3	51	2.3
Dec	23.7	10.4	16.5	55	1.9

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