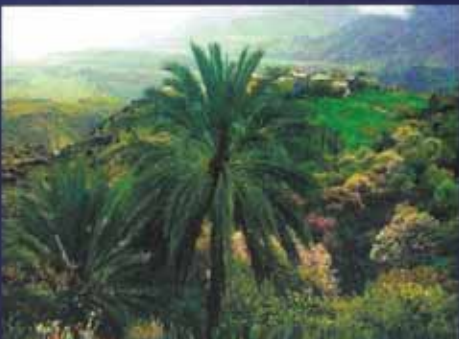


The Flora of the Sultanate of Oman



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# Effects of Altitude and Grazing on Al Jebel Al Akhdar

*Sideroxylon mascatense*  
on Al Jebel Al Akhdar



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## Effects of Altitude and Grazing Intensity on Species Composition, Plant Diversity and Vegetation Structure on Al Jebel Al Akhdar

The mountains of northern Oman host about 60% of the country's 1,200 species of vascular plants, of which 18 taxa are endemic. As compared to the foothills and central plains, the species diversity and the levels of endemism in this area are particularly high. A particularly interesting zone botanically within the area is the limestone massif of Al Jebel Al Akhdar (the Green Mountain), which forms the highest part of the Hajar range.

The rangelands of Al Jebel Al Akhdar (1,580–2,000 metres) are characterised by semi-evergreen woodlands dominated by *Sideroxylon mascatense* growing in scattered mixed stands with *Dodonaea*, *Euryops arabicus*,

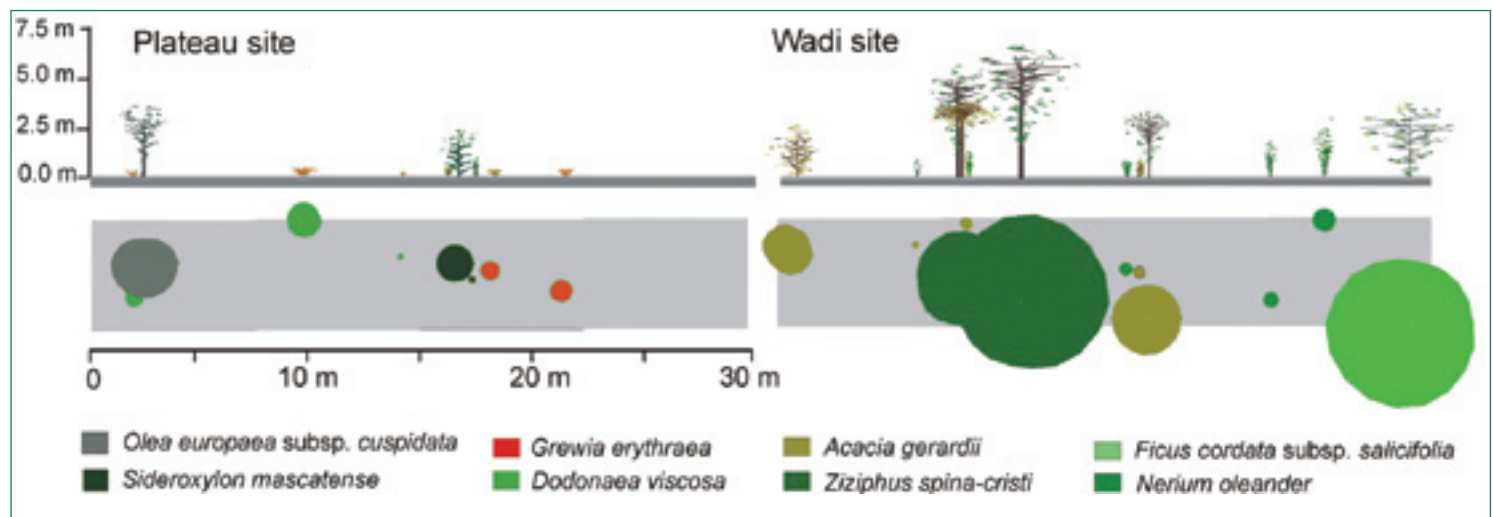
*Olea europaea* subsp. *cuspidata* and *Sageretia thea*. From heights of 2,000 metres to the summit, the vegetation is characterised by *Juniperus excelsa* subsp. *polycarpus*, *Ephedra pachyclada* subsp. *pachyclada* and *Teucrium mascatense*. It has been suggested that the occurrence of *Juniperus* spp. and other plant associations in the Al Hajar range may be due to plant migrations from southeastern Iran across the Arabian Gulf.

About 400 species of vascular plants are found in the *Olea europaea* and the *Juniperus excelsa* Takhtajan woodlands above altitudes of 1,500

*Moringa peregrina* is used traditionally in folk medicine and sold in local markets in Nizwa and Bahla, and the fruits of *S. mascatense* and *Z. spina-christi* are still collected by people and sold locally.

## vegetation changes along environmental gradients – a case study

The aim of this case study was to describe the species composition, diversity and stand structure of open woodlands on Al Jebel Al Akhdar along



*Stand structure of rangeland vegetation on a typical wadi (right) and a typical plateau site (left) on Al Jebel Al Akhdar.*

metres; however, the condition of the juniper trees is generally poor and regeneration is minimal, possibly reflecting the effects of increased grazing pressure by goat herds and feral donkeys.

The wadi vegetation is of an azonal type, dependent on the prevailing water regime, and is highly influenced by man and livestock. The wadi fans consist mainly of gravel and sandy soil. Occasional rainfalls in winter can lead to flash floods that rush through the barren wadis. *Acacia gerrardii*, *Ziziphus spina-christi* and *Ficus cordata* subsp. *salicifolia* are the major tree species present. Typical of the narrow wadi outlets of Al Jebel Al Akhdar range are shrubs such as *Dyerophytum indicum*, *Nerium oleander* and *Pteropyrum scoparium*.

The stand structure present on the different topographic forms (slopes, ridges, dry wadis and water runnels) is highly variable. Wadi fans and plateau locations reveal the greatest variation in stand structure (see diagram above).

Several species are of economic and medicinal value. The oil extracted from the seeds of

altitudinal and grazing gradients (Brinkmann et al. 2007). The study was carried out on the common pastures of three villages, which are located within 10 kilometres of Sayh Qatanah, the central settlement of Al Jebel Al Akhdar mountains. The species' compositions and several environmental variables such as browsing rate and distance to the settlement were investigated. Statistical analyses (cluster analysis and detrended correspondence analysis) revealed five different vegetation types along the environmental gradients, which were defined on the basis of the dominant species: The *Sideroxylon mascatense*–*Dodonaea viscosa* group on grazed and the *Olea europaea*–*Fingerhuthia africana* group on ungrazed plateau sites at 2,000 metres, the *Ziziphus spina-christi*–*Nerium oleander* group on wadi sites, the *Moringa peregrina*–*Pteropyrum scoparium* group at 1,200 metres, and the *Acacia gerrardii*–*Leucas inflata* group at 1,700 metres. The richness of plant species followed a unimodal distribution along the altitudinal gradient with the highest number at an altitude between 1,400 and 1,600 metres. The more balanced climate and the higher diversity of the topography in this zone probably accounted for the higher plant species numbers.



Grazing intensity decreased with increased distance from human settlements and with proximity to the steep, inaccessible slopes at the peripheries. Altogether 27% of the species showed a high degree of browsing damage. The highest browsing intensity was found on the Sayq plateau, reflected by the puny development of the ground layer and a severely impoverished species composition. A sharp decline in the populations of most palatable annual plant species, especially those of grasses, and the establishment of invasive species, such as *Dodonaea viscosa* and *Euryops arabicus*, was observed.

found at the coolest site above 1,700 metres, while others only occurred at the warmer locations. A multilayered vegetation structure dominated with a canopy, an understory and a ground layer. Greatest species richness was recorded in the lowest stratum. Multicropping in small-scale agriculture creates favourable microclimates and often provides habitats for wild plants and animals. Remote Omani oases are not only a recently discovered important refuge for ancient wheat landraces (Al-Maskri et al. 2003, Zhang et al. 2006, Al Khanjari et al. 2007a,b) but also for indigenous wild plant

*Left: Olea europaea subsp. cuspidata on Al Jebel Al Akhdar.*



## the biodiversity of oasis farmland

A surprisingly diverse mosaic of crops was found by studying two oasis settlements at Al Jebel Al Akhdar (Balad Sait and Al 'Ayn, Al 'Aqr and Ash Sharayjah). The genetic resources were assessed using a GIS-based field survey and farmer interviews (Gebauer et al. 2007). With a total of 92 different plant species, the number of crops was very high in comparison to other small-scale cropping systems under arid or semi-arid conditions. Fruits were the dominant use category with the highest number of species, followed by vegetables, cereals and medicinal plants. Some species, such as temperate fruits, were exclusively

species, such as *Epipactis veratrifolia*. This orchid can be found in moist places in cliffs and along irrigation canals at an altitude of 450 to 2,000 metres, but it is threatened by habitat degradation and infrastructure development in Oman.

*Right: Feral donkeys grazing in uncontrolled herds on common pastures at Al Jebel Al Akhdar.*

## Al Jebel Al Akhdar – a local centre of plant endemism and biodiversity

About 400 species of vascular plants are found in the *Olea europaea subsp. cuspidata* and the *Juniperus excelsa* woodland above 1,500 metres. Al Jebel Al Akhdar provides habitats for 62 species

on the Oman Plant Red Data Book, representing 5.2% of the total flora and 15% of the flora of this mountain range. According to the most recent analysis of the endemic and threatened flora of the country, a total of 46 range-restricted species occur in this mountain range (3.8% of the total flora). Of the threatened non-endemic species, 15 occur in Al Jebel Al Akhdar (1.3% of the total flora) (Patzelt 2007), but remote parts of the northern mountains are yet to be investigated fully and future work will reveal more distribution data of threatened species and allow more precise estimates of population size for conservation action.

grazing pressure. Future scientific work should attempt to better quantify the degradation stage and the regeneration ability of these unique ecosystems for the development of sustainable management strategies.

### Acknowledgements

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The traditional land-use management practices, which have been employed by the population, played a pivotal role in protection against overexploitation on Al Jebel Al Akhdar range. Many traditional land uses have either modified or completely abandoned in recent times and the most serious change has been caused by the dramatic increase in livestock numbers, which has resulted in the overgrazing of many plants and vegetation types. However, this degradation has not been well assessed in terms of area affected and environmental impact due to the absence of national survey and monitoring capacity in Oman. Large numbers of feral donkeys have seriously added to the overgrazing problem, and these herds urgently need to be controlled to reduce

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*Fruits of Ziziphus spina-christi and Morus nigra sold in a local market in northern Oman.*







