

Aspects of range condition recovery in the southern Jebel al Akhdar , northeastern Libya

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Introduction The extensive grazing of sheep , goats and camel occurs in the southern Jebel al Akhdar rangelands of northeast Libya . Climate is Mediterranean , characterised by winter precipitation between October and April . Annual average rainfall declines rapidly from 250 mm in the northern uplands to less than 30 mm in the south . Vegetation is zoned dwarf shrub steppe . Perennial shrubs include *Artemisia herba-alba* , *Haloxylon scoparium* , *Anabasis articulata* , *Suaeda pruinosa* , *S . vera* and *Salsola tetrandra* (SWECO 1986) . Inappropriate and unsustainable historical and contemporary land use practices have resulted in widespread severely degraded soil and vegetation (SWECO 1986 ; Anon . 2004 ; Russell 2006) . The study objective is to quantify range condition improvement in areas protected from grazing .

Methods and materials This integrated study utilised plant inventory surveys and a suite of permanent monitoring sites located within and outside fenced enclosures at three localities to investigate differences in perennial plant species richness , size and density , foliage biomass , energy and nutrient yield , landscape function , soil surface condition and soil micro-nutrients . Plant inventorying was undertaken during the 2006 spring flowering season and the other data were collected in early summer with a second biomass sampling in early autumn 2007 . Monitoring site layout and data collection protocol is based on the Western Australian Rangeland Monitoring System (Watson , Novelly & Thomas 2007) .

Results and discussion Statistically significant differences between enclosures and open areas were found for all vegetation and soil attributes except soil micro-nutrients and some physical and chemical properties . Levels of erosion are less and species richness and plant biomass are markedly higher within enclosures . For example , within the most productive enclosure (Maduar Zetun , natural regrowth protected for six years) , foliage biomass was approximately 222 kg (DM) per hectare and available gross energy was approximately 2 ,182 MJ per hectare , compared to values of 122 and 1 ,198 respectively , in the adjacent open area . A total of 33 perennial species were recorded in the enclosure compared to 22 in the grazed area . Mean soil surface condition (index value 103) , driven mainly by improved water infiltration and soil stability , had improved 27% during the six years of protection compared to the adjacent area subject to intensive , continuous grazing . This study highlights the interaction between vegetation and soil in land degradation . Protection from high grazing pressure allowed vegetation cover , richness and standing biomass to increase with concomitant reduction in soil erosion . Improved soil surface condition probably facilitated plant recruitment .

Conclusions This quantitative study supports visual observations that improvement has occurred in the protected areas but not in unprotected grazed areas . The study also supports forage biomass energy yield improvement predictions made by SWECO (1986) as part of their range management recommendations to protect areas from grazing . It is estimated that at least 10 years of protection in the higher rainfall areas , and longer in the low rainfall areas , is required for range condition to improve sufficiently before being opened to controlled grazing .

References

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