BRIEFING / 3.4

June 2013

GLOWA

Grazing cessation – more supporting evidence for a rangeland management strategy in the face of climate change

Key findings

- Increased grazing stocking rates currently exceed the carrying capacity of dry rangelands.
- Without long-term sustainable management strategies, large areas may lose their economic and floristic value.
- Our results show that climate change will increase the prominence of plant species more commonly found in drier regions of the Middle East.
- Drier regions, and species from drier regions, are affected more by heavy grazing, and would therefore be affected dramatically by a drying environment under current grazing rates.
- Grazing cessation for a short period, or a longer term reduction in grazing pressure, will result in a higher plant-density on the rangelands, thereby maintaining fodder and soil quality further into the future.

Overview and Objectives

For over 10,000 years, the rangelands of the Middle East have been heavily influenced by grazing, which currently acts as the only source of income for many people living in this region. These rangelands provide fodder for animals and are an important source of plants with edible, medicinal and fuelling properties. Additionally, they constitute an important genetic resource for ancestors of domesticated crops like wheat and barley, and harbor a large fraction of the rich local floral that makes the Eastern Mediterranean region a designated global hotspot of biodiversity (Bangerter 2009).

Following human population growth, the stocks of grazing animals have increased steadily over the last 50 years, and currently exceed the carrying capacity for these rangelands. Consequently, reduced plant diversity and biomass productivity, and increased susceptibility of soils to water and wind erosion have been observed (Le Houerou 2002).

Climate models for the Middle East predict reduced precipitation, higher temperatures, and an increased variability of climatic conditions. This will have a dramatic impact on the vegetation of the rangelands in the future, which may be aggravated by overgrazing (Smiatek et al. 2011).

The changing climate combined with the consequences of overgrazing make the development of sustainable long-term management strategies a very

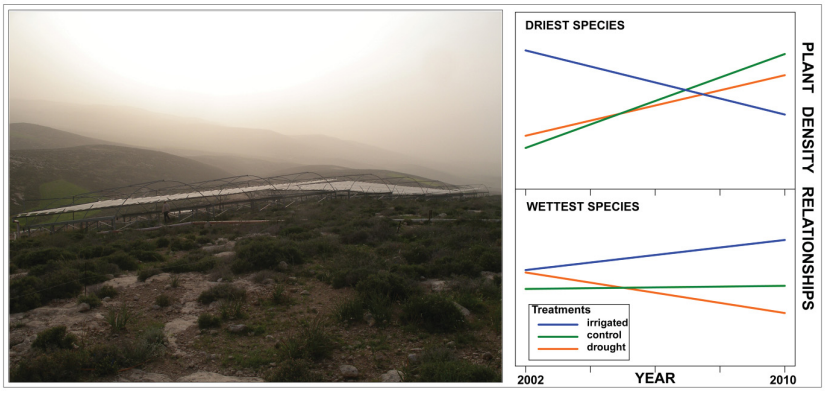

Figure 1: Israel rainfall manipulations: Plants from drier regions (see: driest species) increased under imposed drought conditions, and plants from wetter regions (see: wettest species) increased under irrigated conditions.

Teams of researchers from Germany, Israel, Jordan and the Palestinian Authority work on how best the hazards posed by global change to the future of the Jordan River basin can be faced and overcome.

www.glowa-jordan-river.de

The GLOWA Jordan River project is part of a larger research initiative launched by the German Federal Ministry of Education and Research under the title "Global Change and the Hydrological Cycle".

SPONSORED BY THE
Federal Ministry of Education and Research

http://nbn-resolving.de/urn:nbn:de:bsz:21-opus-69736

pressing issue. Without such strategies, large areas of present day rangelands may lose their economic and floristic value.

Research Methods

Two experiments were set-up across climatic gradients (ranging from Arid to Mesic Mediterranean) to monitor how rangeland plants would respond to a combination of climate change and grazing cessation.

In Israel, climate change scenarios were tested for nine years in different climatic regions. In some regions, rainfall reaching the ground was reduced using shelters (simulated drought), and increased using sprinklers (irrigation).

In Jordan, the effect of grazing cessation (method: fencing grazers out) was tested for four years along a climatic gradient.

Many of the same species are present in both countries, so it was possible to test if a grazing resting period may be a suitable management strategy to reduce degradation and initiate restoration of the rangelands under a future drier climate.

(1) Effects of climate change

When comparing the numbers of plant individuals (densities) growing in the different rainfall treatments, we discovered that species more commonly found in the driest regions performed relatively better under drought conditions, and that plants from wetter regions performed better in the irrigated treatment (Figure 1).

(2) Effects of grazing in different climates

The investigated rangelands recovered rapidly after grazing cessation. This increase in species richness, productivity and plant density was more pronounced in the drier sites. Supporting this, on the north facing (wetter) valley sides the response to grazing cessation was less than on the southern (drier) exposures (Figure 2).

(3) Effects of grazing on plants from different regions

Plants from drier regions of the Jordan River Valley recovered more so after grazing cessation than the plants from wetter regions.

Conclusions

These studies suggest that as the climate gets drier in the Middle East, the plants from the drier regions will become more prominent. More so, if grazing continues at current stocking rates, the combination of a drying climate and grazing pressure could reduce the floristic and economic value of rangelands considerably. However, cessation of grazing for a short period (e.g. 2 to 3 years), or an extended period of partially reduced grazing, could be sufficient to increase plant densities. This could be an effective and sustainable management strategy to protect the productivity of the rangelands for future generations, consequently reducing water and nutrient run-off and providing further fodder for continued grazing.

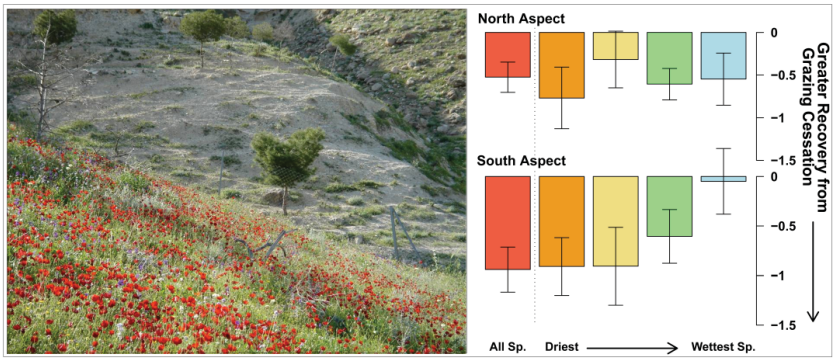

Figure 2: Jordan grazing manipulations: Plants in drier climates (see: all species on south aspect slopes), and from drier regions (see: driest species), are impacted more so by grazing, and visibly show greater recovery from grazing cessation.

References

Bangerter S. (2009) "Grazing cessation - Restoring rangelands in the face of climate change" GLOWA JR briefings #15

Le Houerou, H. N. (2002). "Man-made deserts: Desertization processes and threats" Arid Land Research And Management. 16(1): 1-36.

Smiatek, G., Kunstmann, H. and Heckl, A. (2011) "High resolution climate change simulations for the Jordan River area" Journal. Geophysical. Research 116, D16111.

GLOWA JR Briefings present relevant scientific results of the GLOWA Jordan River project concerning the effects of climate and global change in the Jordan River basin.

Written by Mark Bilton and Katja Tielbörger
University of Tübingen, Department of Plant Ecology, Germany
mark.bilton@uni-tuebingen.de

Contact: Prof. Dr. Katja Tielbörger
University of Tübingen, Germany
coordination@glowa.uni-tuebingen.de
Tel. +49 7071 29 74246