Regeneration dynamics of woody species in a Mediterranean landscape under different disturbance-based management treatments

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Background:

Mediterranean ecosystems are often managed using disturbances such as grazing and shrub clearing. However, many woody species regenerate following disturbance, thus interference management requires periodic maintenance, which necessitates knowledge about regeneration rates. We quantified the response of woody vegetation to five disturbance treatments across 10 years in a LTER field experiment in Ramat Hanadiv Nature Park, Northern Israel.

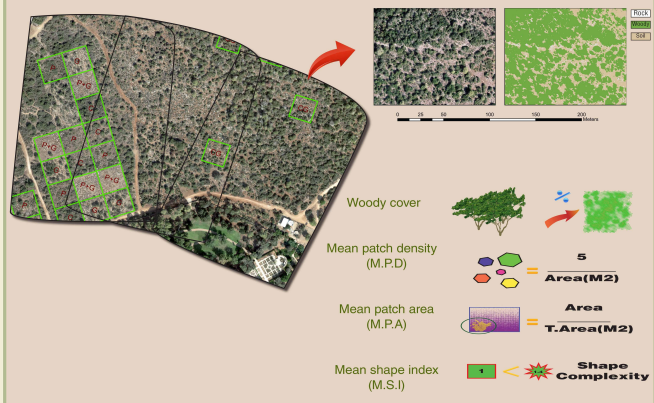
Research objectives:

To reconstruct woody regeneration dynamics across space and time following different disturbance management activities in the LTER in Ramat Hanadiv.

Methods:

Ramat hanadiv LTER field experiment comprises the following treatments:

- Control (C)= clearing and grazing were prevented by fences.
- Cattle grazing (CG)= 150 cow grazing days/ha/year, mainly in spring.
- Goat grazing (G)= goat grazing in varied periods of time.
- Shrub clearing (P)= one time clearing in 2004, and a second one in 2010.
- Shrub clearing+grazing (P+G)= clearing in 2004, and goat grazing ever since.



To quantify spatiotemporal patterns of woody cover regeneration, we classified current and historical aerial imagery of the study sites. We used 10 aerial photographs from 2003 to 2015 (excluding 2012), which we classified using a maximum likelihood algorithm. We classified each image to three classes, woody vegetation, soil, and rocks. We evaluated classification accuracy using total accuracy and Cohen's kappa, and found that all classifications were highly accurate (both measures above 0.8).

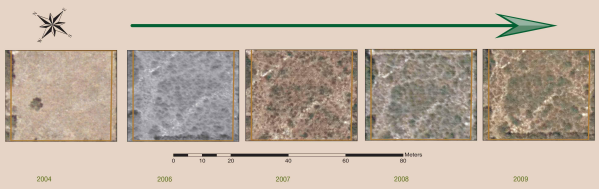


figure 1. Spatial dynamics of woody vegetation in treatment Shrub clearing(P) from 2004-2009,Ramat HaNadiv nature park.

vector art was adapted from : www.vecteezy.com

Results:

Woody cover and its dynamics varied across treatments. Shrub clearing showed the fastest regeneration trend (figure 2). Goat grazing reduced woody cover (figure 3). Shrub clearing+goat grazing led to the greatest change from the control, and inhibited the regeneration of woody vegetation (figure 4).
M.P.A ,M.S.I and M.P.D exhibited similar results, and were therefore ommited.

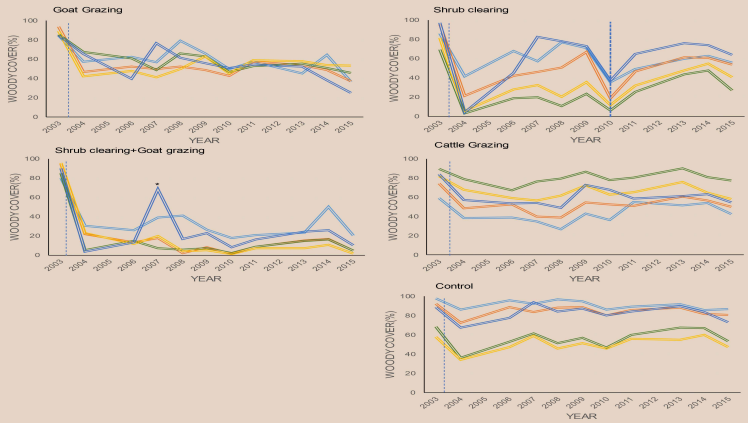


Figure 2. Woody cover dynamics under different disturbances. The thin dashed line marks the year 2003, before treatments were started. The thick dashed line in the Shrub clearing treatment marks the second application of clearing in 2010. Each color depicts a different treatment replicate.

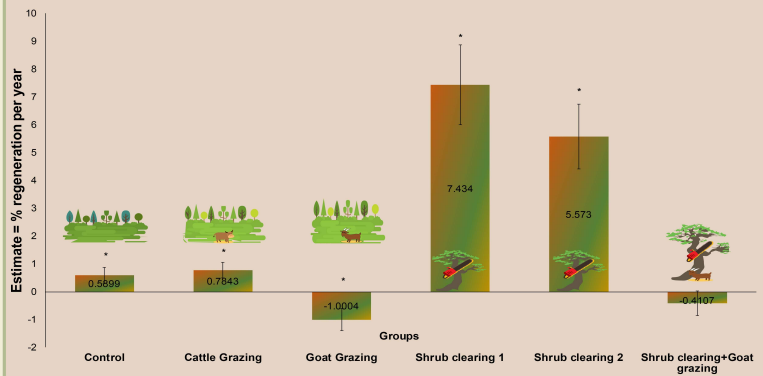


Figure 3. Average annual woody regeneration rates across different treatments, based on the slope coefficient of a linear mixed effects model. Asterisks denote significant treatment effects ($p<0.05$). The Shrub clearing treatment was split into two separate periods due to re-application of clearing in 2010 (N=25 in each group).

Figure 4. Mean annual differences in woody cover in each treatment compared to the undisturbed control. Asterisks mark significant changes

Take home message:

- ✓ Shrub clearing + goat grazing led to a steady state and halted regeneration of woody vegetation.
- ✓ Shrub clearing allows return to the original woody cover in ~10 years.
- ✓ Cattle grazing only partially slowed woody regeneration.
- ✓ Long term effect of goat grazing on slowing regeneration.

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