

## Adaptive management at the Ramat Hanadiv Nature Park, Israel: Expectations vs. Reality in a dry Mediterranean ecosystem

Liat Hadar & Avi Perevolotsky

### Abstract

Ramat Hanadiv, a privately-owned Mediterranean Nature Park in Northern Israel, is managed according to the 'adaptive management' approach, followed by a long term monitoring program (LTER). Thirty years of applying active management in the park, aimed to conserve its biological assets among other goals, resulted in three main lessons: (1) Scientific knowledge is never sufficient, hence most management decisions are not objective but value-driven; (2) Highest ecological values exist in the most disturbed habitats; and (3) No park is an island! The neighboring community is and should be a central player in most management decisions.

---

### Keywords

LTER, Adaptive management, Mediterranean ecosystem

### Introduction

Ramat Hanadiv is a privately-owned Mediterranean Nature Park and memorial to the late Baron Edmond de Rothschild, operated for the benefit of the public by the Rothschild Foundation. The site covers ~450 ha. of land perched on a plateau at the southern tip of the Carmel mountain range, overlooking the coastal plain and the Mediterranean Sea.

The Nature Park consists of open landscape abundant with indigenous fauna and flora and is perhaps the most investigated and carefully managed open space in Israel. It is managed according to the 'adaptive management approach', followed by a long term monitoring program (LTER). Within this framework, vegetation structure, diversity of selected biological groups, flag species and re-introduced species are monitored routinely as a basis for educated decision-making. Management operations include cattle and goat grazing alongside with plans for the management of rare, out-breaking and invasive species.

Thirty years of applying active management in the park, aimed to conserve its biological assets, revealed the complex interactions between objective scientific data and their interpretations and applied meanings. These ideas will be demonstrated by three case studies:

### Case study 1: Managing the Park's gazelle population

Mountain Gazelles (*Gazella gazella*), an endangered species and a bio-indicator for ecosystem health, are considered charismatic wildlife that can play a role as a 'flag species' for conservation purposes. The park supports a local population of gazelles that is considered an important asset. To draw a management strategy for the population, field surveys for determining basic demographic parameters and population size of the local gazelles are conducted from 1987, and structured as part of the Park's LTER program from 2003. Surveys are conducted 4 times a month, along a 12 km fixed transect, and analyzed using distance sampling methods. The results show a decrease in predicted numbers followed by an increase in recent years (Fig. 1a). However, a closer look at the future generation reveals a decline in fawn numbers (Fig. 1b) and raises questions about other factors that potentially affect population size, such as change in methods and observer along the years and cattle presence (SHAMOON, 2015). Collecting long term demographic data appears to be a big challenge; despite the different methods used (direct, indirect, fecal transects, cameras) and the huge sampling effort invested over almost three decades, the applicable meaning of the data is still not clear. Moreover, the definition of gazelles as a 'flag species' is mainly value-oriented given that their ecological role, visibility and behavior are still not well understood.

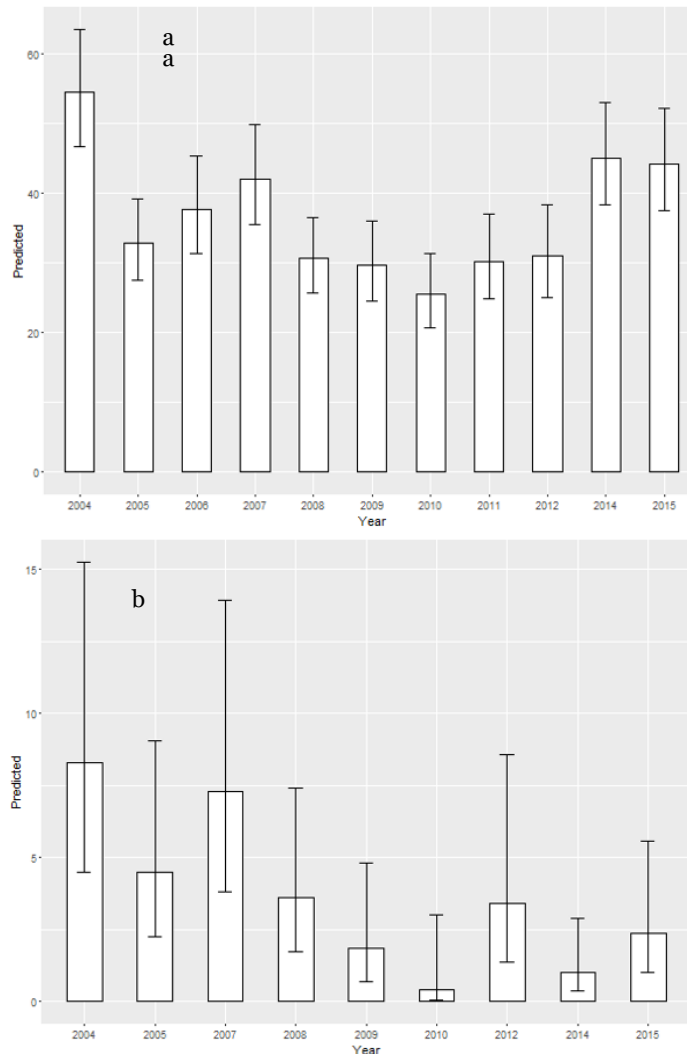


Figure 1: Gazelle population dynamics at Ramat Hanadiv 2004-2015 (predicted highest estimation for January) a). total population; b). fawns (SHAMOON, 2015).

## Case study 2: Aleppo pine (*Pinus halepensis*) colonization in the park

The expansion of *P. halepensis* from plantations into natural sites is becoming a frequent occurrence across the Mediterranean zone of Israel and a source of debate among natural conservationists, foresters and landscape managers. This issue is strongly associated with ideology and management decisions, contradictory opinions and perceptions and a handful of emotions.

In Ramat Hanadiv, the continuous colonization of pines in the natural garrigue was recognized by the park managers in 2007 and assumed to be dynamic and management related. Its implications were projected to influence the park at the ecological, functional and landscape aspects. Intensive research was initiated to serve as a basis for objective decision making. The research goals were to assess and map colonization extent and population dynamics, with relation to three human related factors: afforestation, cattle grazing and fire.

Research findings were that density of colonizing pines was mainly determined by the proximity to planted pines and enhanced by cattle grazing (OSEM et al. 2010). The results confirmed that pine colonization is significant, dynamic and strongly related to human impacts. However, it originated different perceptions of the process and, accordingly, different management strategies. The 'invasion scenario' views pine colonization as an undesired human-dependent process and proposes to control it. Consequently, it focuses on the spatial dynamics and the 'invasion front'. The 'succession scenario' represents a more pragmatic perspective that views *P. halepensis* as a native component of the pristine ecosystem and its colonization as part of natural succession. Hence, pine removal will only be performed in patches where colonization does not coincide with the park's goals. A set of criteria was designed to support management decisions, including view-sheds of scenic observation points, fuel-break zones, patches of special natural and anthropogenic interest, wildlife activity and nesting sites, rare plant populations, research plots and hiking trails. A 'no intervention zone', as well as a 'pine free zone', was defined. Throughout the process, decision making was found to be complex as implications of intensive pine removal alongside difficulties in determining the desired landscape pattern and its relation to biodiversity and ecosystem functioning arose. The process highlights the role of research accompanying adaptive management and how management choices reflect fundamental perceptions and values.

### Case study 3: Cattle grazing: ‘friend or foe’ of biodiversity?

The dominant vegetation formation in Ramat Hanadiv is a Mediterranean garrigue of heterogeneous density and structure (LEVIN et al. 2013). The inter-shrub patches are populated by a diverse community of herbaceous vegetation, extremely rich in species (an average of 12 species/0.25 m<sup>2</sup> quadrat) and diverse in life-forms. Although Ramat Hanadiv covers only 0.016% of Israel's area, it conserves 636 species constituting ~23% of Israel's flora. Of these, 42 are defined as rare species, 35 are endemic, and 6 qualify as IUCN ‘red’ species. Several crop wild relatives grow in the park, including wild emmer wheat, *Triticum dicoccoides*.

Ramat Hanadiv's flora is monitored routinely as part of the LTER monitoring program in order to define the management that best conserves the local vegetation richness. Herbaceous vegetation data were analyzed at the community, functional groups and species level. Special attention was paid to the relationships between cattle grazing - a large scale, fire prevention management held in the growing season (November-June), and community diversity and composition. Throughout 14 years of monitoring, vegetation richness and diversity did not change significantly between sites, even when extreme management tools (heavy grazing, clearing) have been applied (Fig. 2). Moreover, highest richness values were found in the most disturbed, including heavily grazed, habitats (HADAR et al. 2013). In terms of the temporal dynamics, herbaceous community showed high variation in species composition between years, and extremely high decadal turnover rates (BAR-MASSADA & HADAR 2017). These results raise questions regarding the extent to which overall species diversity can serve as a practical management goal in species rich Mediterranean habitats, and to the meaning of conservation in the context of a constantly changing species composition. Ramat Hanadiv's ‘species list’ can be conserved only at the scale of the whole park, over long time and granted that spatial heterogeneity is preserved.

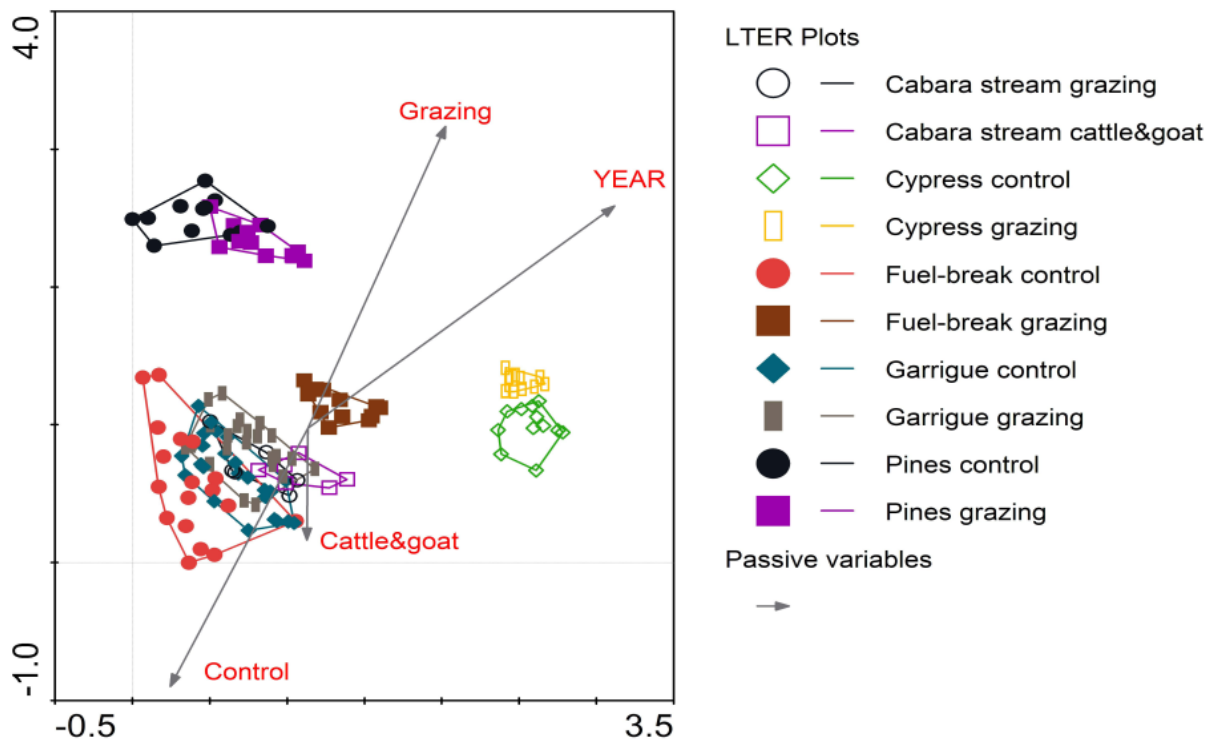


Figure 2: DCA showing site and management effects on plant species composition (HADAR et al., 2013)

### Conclusion

In conclusion, thirty years of adaptive management in Ramat Hanadiv demonstrate the limitations of scientific knowledge and how most management decisions are not objective but value-driven; Furthermore, our experience emphasizes the need to develop scientific concepts that will provide better understanding how different perceptions and values affect interpretation of scientific knowledge and its application in management decisions. The human community is and should be a central player in most management decisions.

## References

- BAR-MASSADA A. & HADAR L., 2017. Grazing and temporal turnover in herbaceous communities in a Mediterranean landscape. *Journal of Vegetation Science* 28(2):270-280.
- HADAR, L., JOBSE, D. & UNGAR, E.D., 2013. Ramat Hanadiv plant community - dynamics in time and space. In: Perevolotsky, A. (ed.), *Conserving and managing Mediterranean Ecosystems: The Ramat Hanadiv case study and beyond*: 277-288. Zikhron Ya'akov.
- LEVIN, N., WATSON, J.E.M. JOSEPH, L.N., GRANTHAM, H.S., HADAR, L., APEL, N., PEREVOLOTSKY, A., DEMALACH, N., POSSINGHAM, H.P. & KARK, S., 2013. A framework for systematic conservation planning and management of Mediterranean landscapes. *Biological Conservation* 158:371-383.
- OSEM, Y., LAVI, A. & ROSENFELD, A., 2010. Colonization of *Pinus halepensis* in Mediterranean habitats: consequences of afforestation, grazing and fire. *Biological invasions* 13(2):485-498.
- SHAMOON, H. 2015. Long term mountain gazelle driven surveys 2003-2015 (Internal report to Ramat Hanadiv).

## Contact

Liat Hadar  
[liat@ramathanadiv.org.il](mailto:liat@ramathanadiv.org.il)  
Ramat Hanadiv  
P.O.B 325  
Zikhron Ya'akov 30900  
Israel

Avi Perevolotsky  
[avi@volcani.agri.gov.il](mailto:avi@volcani.agri.gov.il)  
Volcani Center  
ARO, P.O.B 6  
Bet Dagan 50250  
Israel