Restoration monitoring in Mediterranean rangelands: management practices influencing landscape functions

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Soil degradation and desertification pose significant threats to Mediterranean ecosystems. The marginal maquis shrublands of Messara in Crete, Greece, exemplify poor land management under Mediterranean conditions, where overgrazing influences vegetation composition and density, leading to extensive soil erosion and desertification (Daliakopoulos et al., 2017). As ecosystem restoration becomes a global priority, the complete removal of livestock and revegetation efforts have become common throughout the Mediterranean. However, few of these restoration projects have been evaluated post-intervention (Nadal-Romero et al., 2016). Landscape Function Analysis (LFA) is a widely preferred method for assessing the impact of land use across various climates and ecosystems, including semi-arid rangelands (Maestre & Puche, 2009) and semi-arid woodlands (Eldridge & Delgado-Baquerizo, 2018). Biodiversity is one of the crucial indicators of the success of a restoration project (Ruiz⎵Jaen & Mitchell Aide, 2005), as is carbon sequestration (Wimmler et al., 2021). In this study, we utilize LFA to evaluate the current condition of 8 sites within the Messara Valley, directly comparing these findings with data collected a decade ago from the same locations. These locations have been categorized based on the management practices implemented and their slope. Additionally, we utilize Shannon's Diversity Index to evaluate biodiversity and estimate biomass production through allometric equations. Preliminary results indicate that grassing and slope are the most significant factors influencing the condition of the fields. Fields with a high slope and light grassing perform comparably to those with a slight or no slope but high grassing. However, a holistic approach to cultivating and managing grassing consistently yields the highest scores.

Bibliography
Ruiz⎵Jaen, M. C., & Mitchell Aide, T. (2005). Restoration Success: How Is It Being Measured? Restoration Ecology, 13(3), 569–577. https://doi.org/10.1111/j.1526-100X.2005.00072.x
Wimmler, M.-C., Bathmann, J., Peters, R., Jiang, J., Walther, M., Lovelock, C. E., & Berger, U. (2021). Plant–soil feedbacks in mangrove ecosystems: establishing links between empirical and modelling studies. Trees, 35(5), 1423–1438. https://doi.org/10.1007/s00468-021-02182-z

Daliakopoulos, I. N., Panagea, I. S., Tsanis, I. K., Grillakis, M. G., Koutroulis, A. G., Hessel, R., Mayor, A. G., & Ritsema, C. J. (2017). Yield Response of Mediterranean Rangelands under a Changing Climate. Land Degradation and Development, 28(7), 1962–1972. https://doi.org/10.1002/ldr.2717

Eldridge, D. J., & Delgado-Baquerizo, M. (2018). Grazing reduces the capacity of Landscape Function Analysis to predict regional-scale nutrient availability or decomposition, but not total nutrient pools. Ecological Indicators, 90, 494–501. https://doi.org/10.1016/j.ecolind.2018.03.034

Maestre, F. T., & Puche, M. D. (2009). Indices based on surface indicators predict soil functioning in Mediterranean semi-arid steppes. Applied Soil Ecology, 41(3), 342–350. https://doi.org/10.1016/j.apsoil.2008.12.007

Nadal-Romero, E., Cammeraat, E., Pérez-Cardiel, E., & Lasanta, T. (2016). Effects of secondary succession and afforestation practices on soil properties after cropland abandonment in humid Mediterranean mountain areas. Agriculture, Ecosystems and Environment, 228, 91–100. https://doi.org/10.1016/j.agee.2016.05.003