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Fencing Mediterranean Shrubland, a Decade Later

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Abstract

Soil degradation and desertification are considered major threats to Mediterranean ecosystems (Daliakopoulos et al., 2017). Marginal maquis shrublands of Messara in Crete, Greece, are a typical example of poor land management under Mediterranean conditions, with overgrazing (Papanastasis et al., 2017) shaping vegetation composition and density (Jucker Riva et al., 2017), and leading to widespread soil erosion and desertification (Kosmas et al., 2015). With ecosystem restoration becoming a global priority (Robinson et al., 2012), total removal of livestock and revegetation actions have been widespread throughout the Mediterranean (Korkanç, 2014). However, few of these restoration projects have been analysed after the intervention (Nadal-Romero et al., 2016). Land function analysis (LFA) (Tongway et al., 2004) is the weapon of choice for assessing the impact of land use in a wide range of climates and ecosystems including semi-arid rangelands (Maestre & Puche, 2009), and semi-arid woodlands (Eldridge & Delgado-Baquerizo, 2018). Here we use LFA to assess the restoration of a former grazing site in the present (2024), hereafter called “fenced” (0.45 ha), where livestock had to be excluded to comply with a CAP afforestation action taking place in adjacent land. A neighbouring site (0.71 ha), which was assessed using LFA during FP7 Project “CASCADE” in 2014 and where land management continues “as usual”, serves as the control plot. Preliminary results indicate that, while soil stability index of the control remained unchanged at 54.3% (±2.7%) for 2014 and 52.9% (±2.9%), by 2024, that of the fenced plot increased to 67.4% (±3.2%). More importantly, while the landscape organization index (percentage of patches) in the control declined from 68% (±5.2%) to 36% (±10.72%), that of the fenced plot increased to 90% (±1.49%). At the same time, while the average interpatch length of the control plot increased from 0.75 m (±0.09 m) in 2014 to 1.4 m (±0.34 m) in 2024, that of the fenced plot decreased to 0.62 m (±0.80 m). On the other hand, there are no differences between the sites’ infiltration index (mean value 31.3%), and nutrient cycling depicts differences between the older (2014) measurements of the degraded site (23.8%±2.3%) and the fenced one (34.8%± 5.5%), but not between the aforementioned and the more recent measurements of the degraded (27.9%±3.9%). According to our results, fencing (a) promoted the recovery of the site, (b) enhanced resources conservation towards improved ecosystem functioning, and (c) reduced overland flow connectivity towards improved resources stability. This study will serve as a proof of concept to assess ecosystem restoration in other plots under a diversity of land uses including afforestation and terracing.

Keywords: Landscape Function Analysis, LFA, Overgrazing, soil stability, Livestock exclusion

References

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 Jucker Riva, M., Daliakopoulos, I. N., Eckert, S., Hodel, E., & Liniger, H. (2017). Assessment of land degradation in Mediterranean forests and grazing lands using a landscape unit approach and the normalized difference vegetation index. Applied Geography, 86, 8–21. https://doi.org/10.1016/j.apgeog.2017.06.017 Korkanç, S. Y. (2014). Effects of afforestation on soil organic carbon and other soil properties. CATENA, 123, 62–69. https://doi.org/10.1016/j.catena.2014.07.009 Kosmas, C., Detsis, V., Karamesouti, M., Kounalaki, K., Vassiliou, P., & Salvati, L. (2015). Exploring long-term impact of grazing management on land degradation in the socio-ecological system of Asteroussia Mountains, Greece. Land, 4(3), 541–559. https://doi.org/10.3390/land4030541 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 Papanastasis, V. P., Bautista, S., Chouvardas, D., Mantzanas, K., Papadimitriou, M., Mayor, A. G., Koukioumi, P., Papaioannou, A., & Vallejo, R. V. (2017). Comparative Assessment of Goods and Services Provided by Grazing Regulation and Reforestation in Degraded Mediterranean Rangelands. Land Degradation and Development, 28(4), 1178–1187. https://doi.org/10.1002/ldr.2368 Robinson, D. A., Hockley, N., Dominati, E., Lebron, I., Scow, K. M., Reynolds, B., Emmett, B. A., Keith, A. M., de Jonge, L. W., Schjønning, P., Moldrup, P., Jones, S. B., & Tuller, M. (2012). Natural Capital, Ecosystem Services, and Soil Change: Why Soil Science Must Embrace an Ecosystems Approach. Vadose Zone Journal, 11(1). https://doi.org/10.2136/vzj2011.0051 Tongway, David., Hindley, Norman., & CSIRO (Australia). Division of Sustainable Ecosystems. (2004). Landscape function analysis manual : procedures for monitoring and assessing landscapes with special reference to minesites and rangelands. CSIRO Sustainable Ecosystems.

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