

Use of Geostatistics for Understanding the Process of Ecological Restoration in Gypsum Landfills

J. Pastor¹, L. Alcalá del Olmo², J. M. Martín³ and A. J. Hernández⁴.

This study analyses possible restoration measures for the landfills of the gypsum quarry “Los Yesares” (Almería, SE Spain), the largest of its kind in Europe. When dealing with large surface areas such as that of the quarry examined here (some 15 Ha), the mathematical methods generally applied to monitor the ecological succession that occurs when a degraded system starts to recover (biodiversity indices, Theory of Information indices, plant cover) do not provide the desired information. We therefore decided to evaluate the use of geostatistics to examine the spatial distribution of plant populations of a community arising from the seed bank present in the soil covers used to seal gypsum landfills [1].

The study was performed on 135 plots of 25 m² covering a 7 Ha. area. These experimental plots were set up on slopes of different orientation and gradient. A further 62 plots were established in spontaneously colonised old landfills with or without added soil, and in neighbouring areas of the quarry within a “Paraje Natural”. These last plots served as controls.

Each experimental plot ($N = 135$) was subjected to visual monitoring during the year after the new landfills were given a new soil cover. Through analysis of variance of the species present in the different plots

¹Dpto. Biología Ambiental, Centro de Ciencias Medioambientales, C.S.I.C. Madrid. c/ Serrano 115, dpd. 28006 Madrid (Spain) (e-mail: jpastor@ccma.es).

²Dpto. Biología Ambiental, Centro de Ciencias Medioambientales, C.S.I.C. Madrid. c/ Serrano 115, dpd. 28006 Madrid (Spain) (e-mail:).

³Dpto. Biología Ambiental, Centro de Ciencias Medioambientales, C.S.I.C. Madrid. c/ Serrano 115, dpd. 28006 Madrid (Spain) (e-mail:).

⁴Dpto. Interuniversitario de Ecología, Sección Departamental de la Universidad de Alcalá (Spain). Edificio Ciencias, Campus. (e-mail: anaj.hernandez@uah.es).

in spring, we mapped their spatial distribution. Among the frequently used geostatistical methods derived from the theory of regionalized variables, we selected the *kriging* method. The spatial distribution of the two species showing greatest cover over the study period, *Moricandia arvensis* (L.) DC. and *Halogeton sativus* (Loefl. ex L.) Moq., provides interesting information applicable to the evaluation of soil variables related to the ecological preferences of these species and the reasons for their growth in the early succession process. The data collected also prompt hypotheses concerning the possible effects of competition between these pioneer species and the native gypsophyll species of the area [2, 3, 4]. This groundwork will be taken into account when ecologically restoring the new landfills in a more realistic manner.

References

- [1] Pastor, J.; Castelló, R.; Martín, J. M.; Prieto, N. & Hernández, A. J. 2002.- Restoring Landfills in Gypsum Quarry Areas and Conservation of Endemic Flora. Abstracts 3rd European Conference on Restoration Ecology. Budapest-Hungary :142
- [2] Blanca, G. & Valle, F. 1986. Las plantas endémicas de Andalucía Oriental. Monogr. Fl. Veg. Bética, 1:1-53.
- [3] Cueto Romero, M., Fernández Jurado, M. A., López Cerrillo, M.I., Márquez Payés, J. M., Muñoz González, F., Perez García, F.J., Rodríguez Tamayo, M. L., Sánchez Mañas, M., Serrano Muñoz, M. M., Sola Gómez, A. J. & Mota Poveda, J. F. 1999. La restauración de las canteras de yeso ¿Qué flora se debe utilizar?. In: Collado, M., Sánchez-Garrido, J. & Navarro, A. (eds.), Simposio sobre Minería, Industria y Medio Ambiente en la Cuenca Mediterránea, pp. 69-80. Servicio de Publicaciones de la Universidad de Almería, Almería.
- [4] Lázaro, R. 1986. Sobre la flora y vegetación gipsícola almeriense (fanerógamas). Boletín del IEA, 6: 131-50.