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Effects of shrub revegetation with Atriplex halimus L. and Retama sphaerocarpa L. in gypsiferous soils. Influence in soil properties

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The low crop yield obtained in semi-arid climates has led to the decline of agriculture and the abandonment of large areas resulting in a high risk of land degradation due to the lack of vegetation. Revegetation with shrubs is considered a way to prevent land degradation and enhance soil conditions, particularly in problematic soils. The study area is located in Colmenar de Oreja (Madrid, Spain, UTM 30T X=455236, Y=4436368). This is a semi-arid region, close to aridity in certain years, with a mean annual rainfall of 390 mm and annual evapotranspiration (Thornthwaite) of 769 mm. The soil is developed over gypsum marls with a xeric moisture regime. These soils are frequent in semiarid and arid countries in the world because leaching is prevented due to low rainfall. They usually show shallow depth, high penetration resistance and compaction, particularly when the soil is dry. Moreover they exhibit low fertility and small water retention capacity. All these circumstances hinder the development of roots and therefore the spontaneous recovery of vegetation after abandonment.

Two different species of shrubs -Atriplex halimus L. and Retama sphaerocarpa L.- were planted in USLE plots (80 m2) in 2003 in a sloping area (average 10%). Changes in the physical and chemical properties of soils beneath these different treatments were studied since then, and they were compared with spontaneous vegetation. We considered soil indicators such as bulk density, intrapedal porosity, soil organic matter content, aggregate stability and soil penetration resistance.

Two years after planting, vegetation coverage in the low part of the plots covered 70% of soil, rising 80% after the third year. The litter generated by shrubs did not change soil organic matter content at the site where it occurred, but rather a few feet below, where it was deposited by water erosion. Five years later, the lower section of the plots exhibited an increase in soil organic matter (from 2.3 to 3.2%), a decrease in bulk density (from 1.24 to 1.20 g cm-3), and a higher number of drop impacts necessary to destroy soil aggregates (from 18 to 33 drop impacts). There were changes in soil penetration resistance amongst the treatments, although not so clear in soil surface. Differences were found at 20 cm depth in Atriplex halimus L. treatment, arguably due to a deeper root system of this shrub compared with Retama sphaerocarpa L.