

Characterization and preservation of silt-laden soils in the humid depressions of Hatainville's dune massif (Manche, France)

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Abstract

Hatainville's dunes have become a symbolic example on the western coast of Cotentin on how to preserve a remarkable natural heritage be it from the point of view of geomorphology, landscape or flora. The study of the silt-laden soils in the humid depressions of the dune massif appears to be essential in order to understand the process of floristic growth and the presence of hygrophile vegetable communities.

Keywords: Silt-laden soil; Humid depressions; Dune massif; Hatainville; Preservation.

Introduction

The dunes on the Cotentin western coast are a remarkable natural heritage whether from the point of view of geomorphology and landscape or at the biological level of fauna and flora (Provost, 1975; Livory and Stallegger, 2001). Since 1976, many dune sites in south Normandy have been purchased by the 'Conservatoire du Littoral' in order to preserve natural environments. Hatainville's dunes have become a symbolic example of the work done by the 'Conservatoire du Littoral' of south Normandy. A preservation plan is being elaborated, promoting experimental action in the site in order to preserve a living and diversified dune massif. Because of their extensive resources, the preservation of the humid depressions in Hatainville's dune massif is considered a priority aim in the general preservation project as defined in conformity with the document set up and signed in 2001 for Natura 2000 sites (Mouchel, 2001; Galloo, 2002). If that wealth is partly related to the topo-geomorphological conditions of the site, it is actually revealed through the nature and properties of the soils, resulting in ecological and floristic diversity. The study of the soils thus appears as essential to understand the process of floristic growth and the presence of rare or more common plants. That is why, for two years now, we have been focusing on the research of the relationship between soil and vegetation in the humid depressions, so as to give the administrations in charge of Hatainville's site food for thought in terms of management recommendations aiming at the preservation of the dune geosystem.

Characterization of silt-laden soils

If the relationship between the texture of the soils with the sand basis is generally observed, the significant presence of silt in many pedological profiles is truly typical of soils in humid depressions (Le Gouée *et al.*, 2005). Those silt-laden soils thus appear as a particularly interesting natural heritage as they are closely linked with the presence of hygrophile vegetable communities among which, for example, *Apium repens*, a species mentioned in Annex II of the 'Directive Habitat'. A close analysis both on the site and in laboratories has made it possible to describe the silt soils very accurately, to define the origine of these soils, to confirm the importance of their hydric properties for hygrophile communities, and to work out a precise map of the humid depressions characterized by that type of soil on the site.

The appearance of silt-laden soils is quite recent; indeed it occurred in the 50's when the deflation process of the sands was stopped as the vegetables gradually stabilized the dune massif. The thinness of the pedological cover and the process of carbonation are evidences of the juvenile character of the soils. The origin of the silt is both biogenic and detrital. As local phreatic waters are renewed over winter months, intra-dune depressions are recurrently filled up. The appearance of shallow pools gives life to aquatic ecosystems where diatoms and characeae can develop (Round, 1992). These decamicrometric weeds form a deposit in the depressions once the waters have completely levelled away. The repetition of this phenomenon accounts for such particles covering the sands. Besides, the examination of the silt soils under the microscope shows that the biogenic elements are caught in a biodeutral matrix made of quartz grains and gastropod fragmites that have been brought into the depressions by the wind. Eolian particles settle down depending on how sheltered the depressions are and how much of a trap the pools can be.

When subsoil waters level away, the hydric needs of hygrophile vegetable communities then become dependent on the quantity of useful available water, on how it can get depleted and renewed. Laboratory analysis first shows large quantities of useful available water, about 100mm. This results from an important organic fraction, with a significant capacity of water retention. Besides, the analysis of the curves of characteristic moistures reveals a very gradual depletion of useful available water during drying sequences. Hygrophile vegetables benefit from a hydric environment that is favourable to their development in spite of lasting drying conditions. Last, the renewal of useful available water is efficiently ensured by a very good surface absorptivity when rainfall is low and the presence of significant capillary rises when phreatic water is just below the topographic surface (Hillel, 1974).

The surveying of the humid depressions characterized by silt-soil shows they are generally situated half-way between the higher beach and, further inland, the paleoclipf. The confrontation of GPS surveys with centimetric precision in x, y and z with the piezometric values show that the location of silt soils corresponds to the areas where the depressions are most likely to fill up with water as lastingly as possible.

Conclusion

Actions for the protection of diversity and ecological resources are associated with the tradition of extensive pasture which contributes to the preservation of Hatainville's dune massif. Yet, the watering places which the humid depressions can be are not numerous enough. The high density of cattle around the pools leads to an intensive trampling of the soil which seriously endangers its edaphic and ecological balance. The preservation of silt-laden soils as natural heritage thus goes together with the creation of artificial pools accessible to cattle.

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