Introduction

The objective of this study was to evaluate the hydrological characteristics of a degraded area located in the northeastern Italian Alps. The area was selected because of its high potential for soil restoration and the availability of accurate data on soil properties and climatic conditions. In order to evaluate the quality of the pedotransfer functions, a significance test was done using the root mean square error (RMSE) based on measured and estimated water content.

Materials and Methods

The hydro-climatic characteristics of the area were evaluated using climate data from the weather station of S. Lazzaro Alberoni (Piacenza). A Walter and Lieth (1960) climate diagram was drawn up. Using this diagram, the average temperature and precipitation were estimated for the study area.

Two different sets of pedotransfer functions were derived to establish a suitable dataset: class and continuous pedotransfer functions. Class pedotransfer functions are based on two different models:

- van Genuchten (1975) model
- Brooks-Corey (1964) model

The van Genuchten model is given by:

\[ \theta = \frac{\theta_c - \theta_r}{1 + (\lambda h)^n} \]

where \( \theta \) is the soil water content, \( \theta_c \) is the saturated soil water content, \( \theta_r \) is the residual soil water content, \( \lambda \) is the characteristic length, and \( n \) is the shape parameter.

The Brooks-Corey model is given by:

\[ \theta = \theta_s \left( \frac{h}{h_s} \right)^{m} \]

where \( \theta_s \) is the saturated soil water content, \( h_s \) is the capillary pressure, and \( m \) is the shape parameter.

For both models, the parameters were determined using measured soil properties (percent of clay and silt, organic matter content, bulk density).

Results and Discussion

The climate diagram for Piacenza (Fig. 5) highlights a period of edaphic dry spell (May to September) which would justify the high evapotranspiration rate of the area. This is also confirmed by the low water content observed during the summer months.

The water balance of landfill soil indicates the presence of a long dry spell, which would affect the availability of water for plant growth. The analysis of the water balance showed that the period of hydric stress is much longer for the landfill soil compared to undisturbed soil with similar texture, bulk density, and organic matter content.

Conclusion

The study demonstrated the importance of considering the water balance in the restoration of degraded areas. The development of appropriate pedotransfer functions is crucial for predicting the hydrological characteristics of the soil. Further research is needed to improve the accuracy of the models and to develop more effective restoration strategies.