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The Phytomass Variability in Algerian Steppic Zones

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ABSTRACT

The Algerian steppe environment is characterized by a specific soil ecosystems that can give a certain allocation of vegetative cover. The study of the total phytomass in these regions may be related to the physicochemical characteristics of soils The analyzes showed that Soils have predominantly sandy texture which can reach 75% of coarse sand, low organic matter content and the presence of nutrients nitrogen, phosphorus and potassium weak.The existing vegetation cover is characterized by the presence of three main plants species: *Alfa (Stipa tenacissima) white sagebrush (Artemisia herba alba) and salsolacées (Fructicossa and Salsola)*.
The evaluation of the phytomass in relation to the physico-chemical characteristics of the soil, revealed that there's a proportional interaction between the presence of the carbon and nitrogen and the distribution of the total phytomasswhich can reach maximum values in soils rich in C and N and minimum values where rates in C and N are low, these results are confirmed by the application of the CPA and coefficients of determination that can reach values of R^2 equal to 82 and 86%.
KEYWORDS: -Soil, -phytomass, -vegetal, -steppe, -CPA, -Algeria.

INTRODUCTION

The physiognomic aspect of the plant taxon of Algerian steppe reflects the interaction of edaphic, climatic and anthropic factors**[1]**. This vegetation is currently subjected to stressful conditions (anthropic pressure and prolonged drought and cyclical) **[2]**. To adapt to these hard conditions, steppic plant species must develop a root system able to draw effectively water and soil nutrients**[3,4]**. in Algeria steppic environment, the various plant covers shows an advanced state of degradation, this finding is not only linked to climatic conditions but also to changes in edaphic properties **[5]**. Consequently, the study of soil characteristics with the variation both qualitative and quantitative of steppic vegetation will provide answers to this regressive dynamics of vegetation in this environment.

MATERIALS AND METHODS

1.The study area

The study has been carried in the commune of Maamora, part of the west Algerian steppe, with arid climate on rainfall do not exceed the 250 mm / year variable in time and spatial,the minimum temperature varies from 8 to 10 ° C, and the maximum temperature can reach 37 ° C**,** The soils belong to the order of aridisols, they are skeletal, low in organic matter and rich in calcareous**[6,7].**

2.Sampling

Soil samples were collected at the horizon surface between the tufts of steppic vegetation. Sampling was carried out at random for each different taxon plant type. The vegetation sampling is to identify different plant species occurring in each measurement and massiquement quantifying the total phytomass of vegetation.

3.Methods used

Soil sampling was conducted during the winter period (February 2016), samples are taken at the surface horizon whose depth does not exceed 30cm, this is a relatively horizon explored by the root system of the steppe vegetation. A number of 20 samples of different taxa were selected for the soil characterization, estimation of edaphic parameters was made by standard methods appropriate for each element.

The granulometry by the international method with the pipete Robinson, total limestone by calcimetry, the acidity by pH metry with a soil / water ratio (1 / 2.5), organic carbon by the method of Anne, the total nitrogen by the method of Kjeldhahl, soluble cations assayed using spectroscopy and assimilable phosphorus by chlorométrie**[8,9].**

Regarding plant biomass, evaluation was carried out by a direct method; Vegetation cut at ground level, is put into paper bags or thin fabric, numbered and weighedThe first step of crop processing is to perform the weighing, it must be done as soon harvesting for the mass fresh before begins the natural desiccant,. then dry the

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samples in the oven either at one temperature of 80 ° C for 24 hours or 120 ° C for 8hoursFor each sample, have its mass before desiccation and its mass after drying, that is to say, two series of values corresponding to the production of dry matter**[10,11].**

RESULTS AND DISCUSSION

1. Results of Soil analyzes

textural point of view, the size analyzes show a coarse fraction where the percentage of sand can reach 75%, silt vary from 15 to 25%, while the clay content does not exceed 10% dominated by non-expandable fractions, Low specific fibrous surface geochemical characteristic of calcareous soils **[12]**,This organization generates particular behavior édaphique, bad structural stability , low water retention, low humidification, qualitative and quantitative variability of the vegetation cover (Figure 1).

Soil pH remains substantially constant and varies between 8.3 and 8 (Figure 2)., the stability of the acidity is due not only to the edaphic aridity and low decarbonization of the soil profile, but also to the rich soil of alkaline earth cations particularly calcium and magnesium ions, which gives a high buffering power impeding pH variation of these soils **[13]**.

The average rate of total limestone ($CaCO_3$) is 5 to 17% (Figure 3). These contents are consistent with the quality pedogenitique calcimorphe of arid regions, indeed all forms of the limestone precipitation may occur in the soils of this region (from diffuse form until calcareous slab)**[14].**

Available phosphorus (P_2O_5) varies between 4 to 10 mg / kg (Figure 4), these contents remain below values that improve the fertility phosphoric, this can be explained by the ion precipitation mechanism phosphate by the excess of limestone, forming the insoluble tricalcium apatite $Ca_3(PO4)_2$.

Analysis of the ionic complex of the soil solution demonstrates the degree of saturation of the solution by alkaline earth metal cation derived from a partial solubilization of the parent rock, the average soluble chemicals in the soil (Ca, Na and mg, K) varies between 1 and 5 mmol / l (Figure 5), which remain in ionic equilibrium (reversibility of reaction between the mineral matrix and its solution **[15]**.

Biochemical parameters particularly nitrogen and organic carbon generally have low levels (Figure 6), with the exception of flood zones and closed depressions where they accumulate some organic alluvium, but without necessarily a strong maturation of this organic fraction due to adverse soil and climatic conditions. The low values for both are primarily related to reductions organic inputs of steppe vegetation by permanent regression (overgrazing and desertification).

All these edaphic parameters evidenced by themselves the unfavorable conditions of the biotope at which biological life faced.

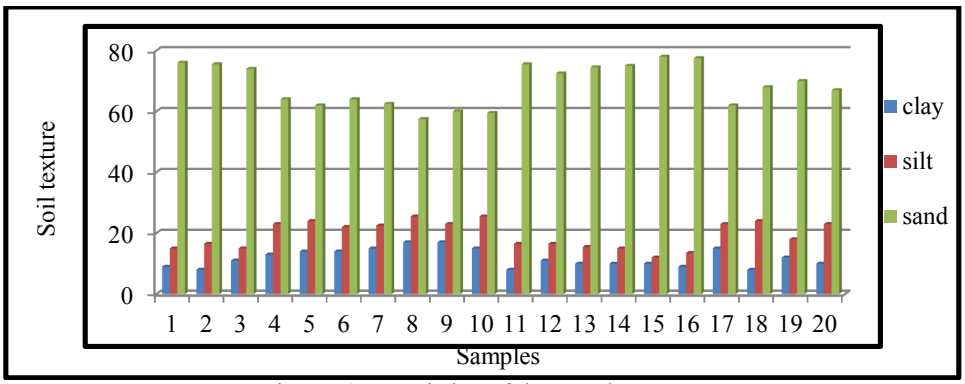

Figure n°1 : Variation of the sample texture

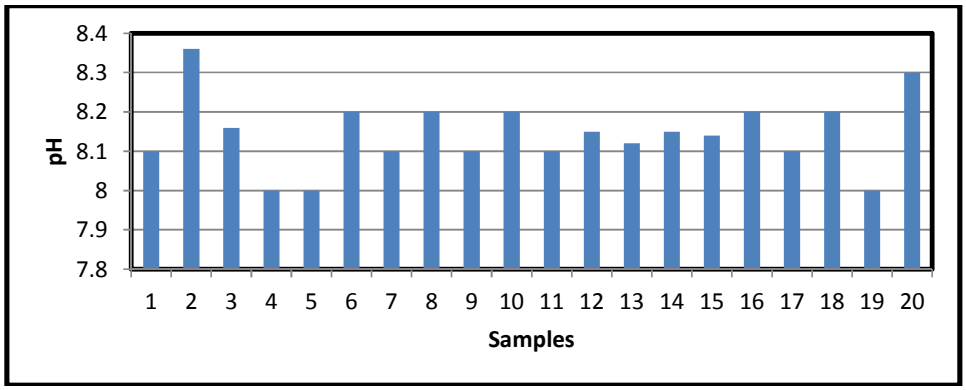

Figure n°2: pH variation of the samples

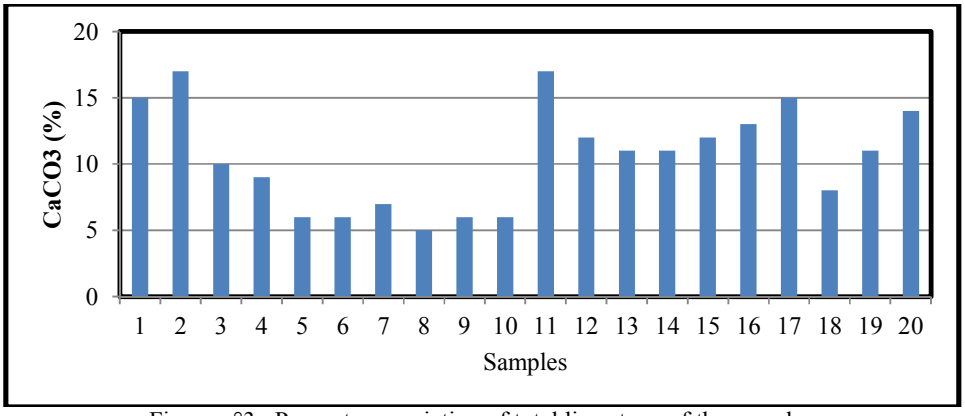

Figure n°3 : Percentage variation of total limestone of the samples

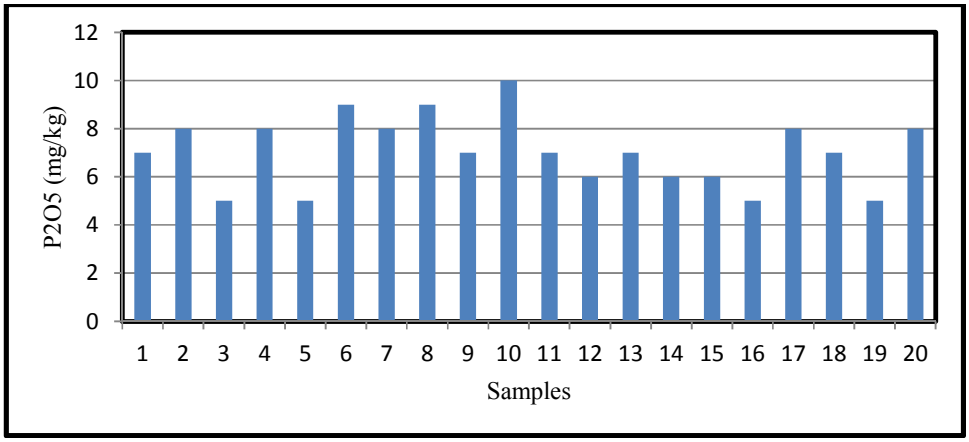

Figure n°4 : Variation of assimilable phosphorus of the samples

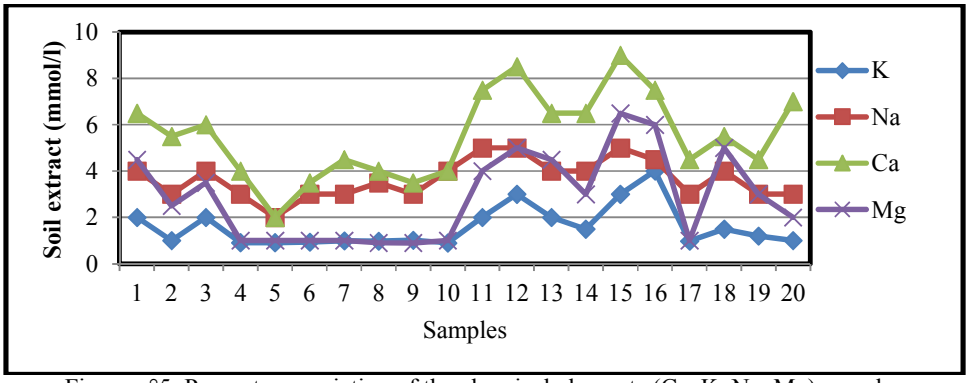

Figure n°5: Percentage variation of the chemical elements (Ca, K, Na, Mg) samples

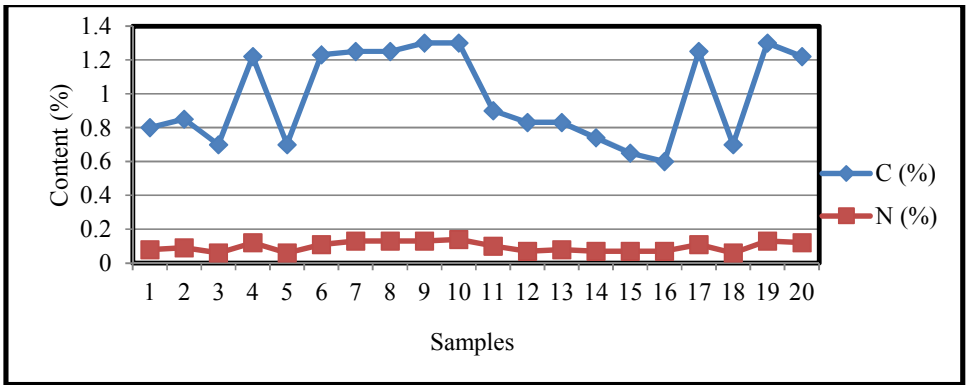

Figure n°6 : Percentage Variation carbon and nitrogen of the samples

2. The phytomass evolution

The analysis of the plant species spectrum in the study area is given in **Figure n°7.**

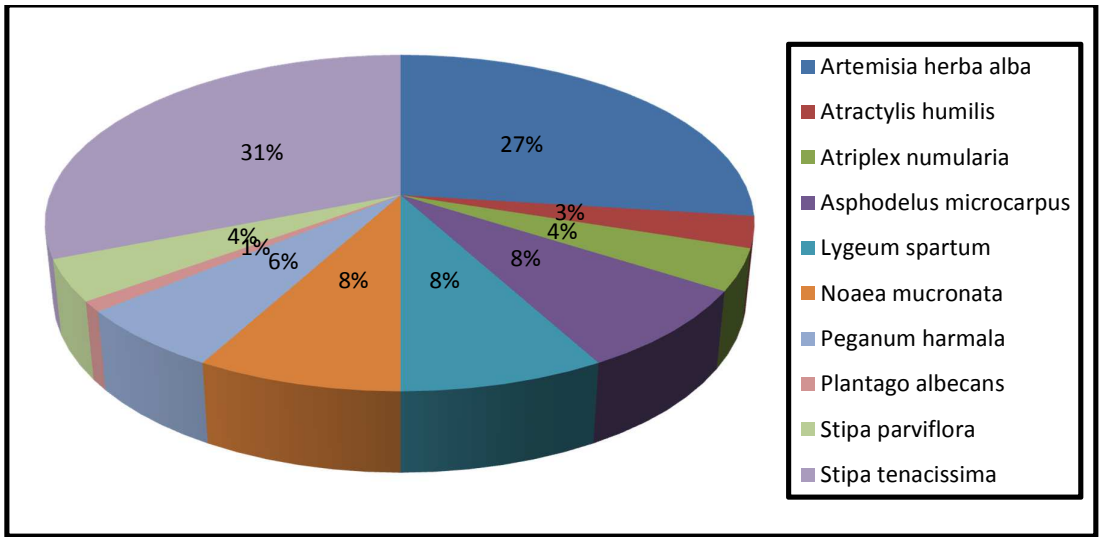

Figure n°7: Distribution of plant species in the study area

This spectrum shows a dominance of Stipa species *tenacissima* and *Lygeum spartum* two endemic species that live in their ecological sites, However, the presence of species: *Peganum harmela, Noaea mucronata* and *Atractylis humilis* reflects the trend of this area degradation, same remark was given by **[16,17,18].**

The quantitative estimation of the total phytomass for all samples is given in **Table n°1.**

Tablen°1: Evaluation of the total phytomass.

N° Rel	Tot.Phyt (kg/ha)
01	435.71
02	707.14
03	373.80
04	1038.09
05	364.28
06	1073.80
07	1266.66
08	1076.19
09	1642.85
10	1438.09
11	904.76
12	619.04
13	600.00
14	380.95
15	326.19
16	285.71
17	1364.28
18	352.38
19	1942.85
20	1016.66

The evaluation of the total phytomass of stations studied reveals a great difference. The maximum value is in R19 stations with a value of 1942.85 kg / ha. Where the recovery vegetation rate is very importantThe lower phytomass is that of R16 stations with a value of 285.71kg / ha,

It is the station where the global recovery is weakestSame values found by **[19,20,21].**

3.Interaction between phytomass and soil parameters

At the study area the phytomass either aboveground or underground remains relatively low and is only an indicator of soil conditions, climate and the strong pressures that constantly exert it. What seems worrying is the very weak development of the underground part, it is fairly balanced with aerial phytomass. such an ecosystem the root system should experience important development**[22,23]**. Soil analysis has brought some answers to this finding, physical and chemical characteristics of the soil does not allow a proper development of the plant, combined with a very paltry rainfall and very low winter and spring temperatures **[24,25].**

Interaction between the total phytomass and carbon content gave us a good correlation with a coefficient of determination $R^2 = 0.86$, the second interaction is confirmed with the nitrogencontent with a $R^2 = 0.82$, which verifies the importance of these two nutrients in the distribution of the total phytomass (**figuren°8,9).**

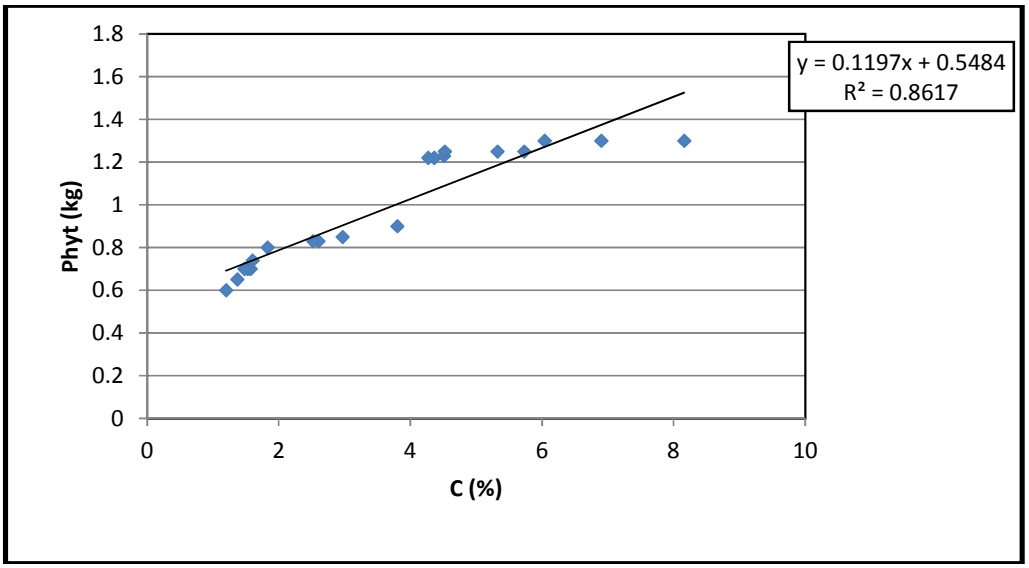

Figure n°8: Interaction between the total phytomass and carbon

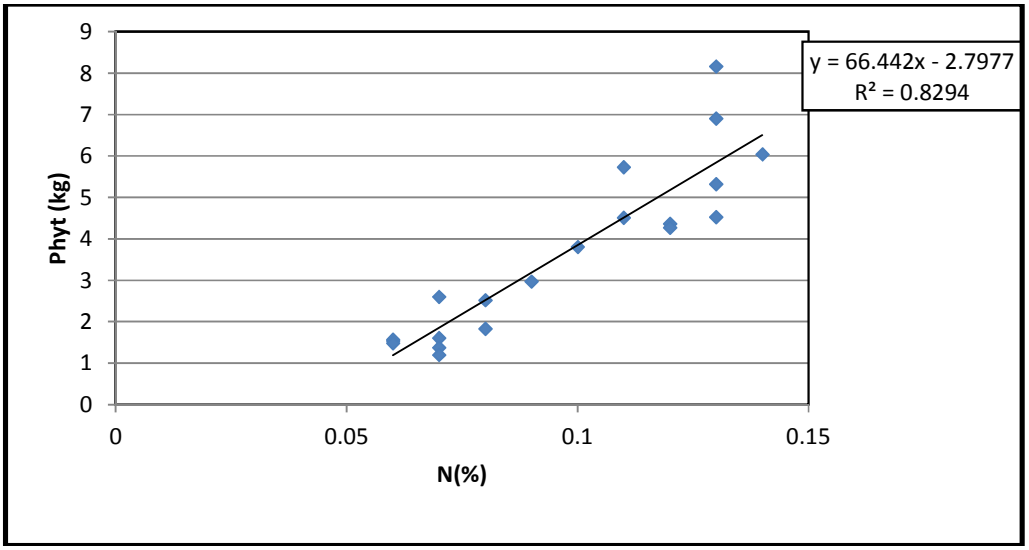

Figure n°9: Interaction between the total phytomass and nitrogen

In general, phytomass is low at all stations, and we can say that this steppic zones explains the significant destruction of vegetation, resulting a greater fragility of the soil to erosion**[26].**

4. Analysis of the phytomass distribution

To analyze the distribution of phytomass at the study area, we used the statistical method of principal component analysis "PCA", which consists in finding homogeneous groups, that contain the factors having an affinity between them **(Figure n°10, 11)**

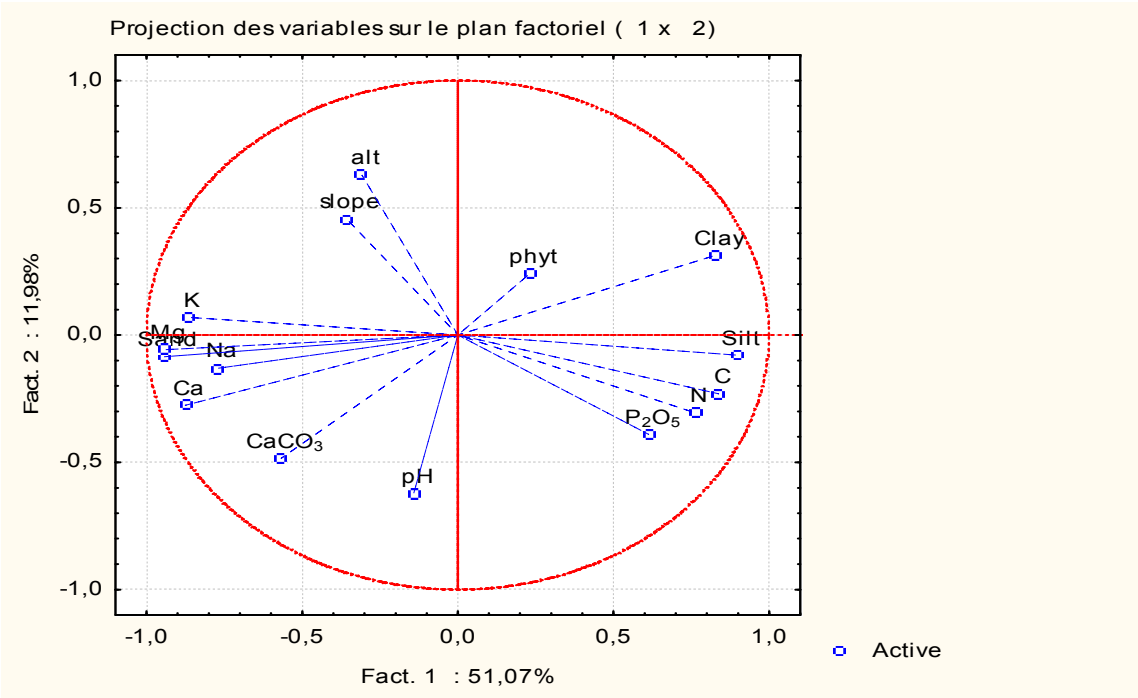

Figure n°10: Distribution of soil characteristics and the total phytomss

The analysis of the "PCA", has shown us that there's a direct interaction between the physico-chemical soil characteristics and the distribution of the total phytomss:

The first axis summarizes 51.07% Information and shows a positive correlation between all parameters of fertilization of the soil, such as silty clay texture, the contents of carbon, phosphorus and nitrogen that promote development a large phytomass that can reach up to 8,16kg / 42m^2(1942,85 kg/ha).

The second axis summarizes 11.98% of the information reflecting the presence of a second group that represents all the parameters promoting edaphic aridity,such as salinity and lime content, because the salts reduces the mobility of free water in the soil and consequently decrease the total phytomass**(figure n°4)**,**[27,28].**

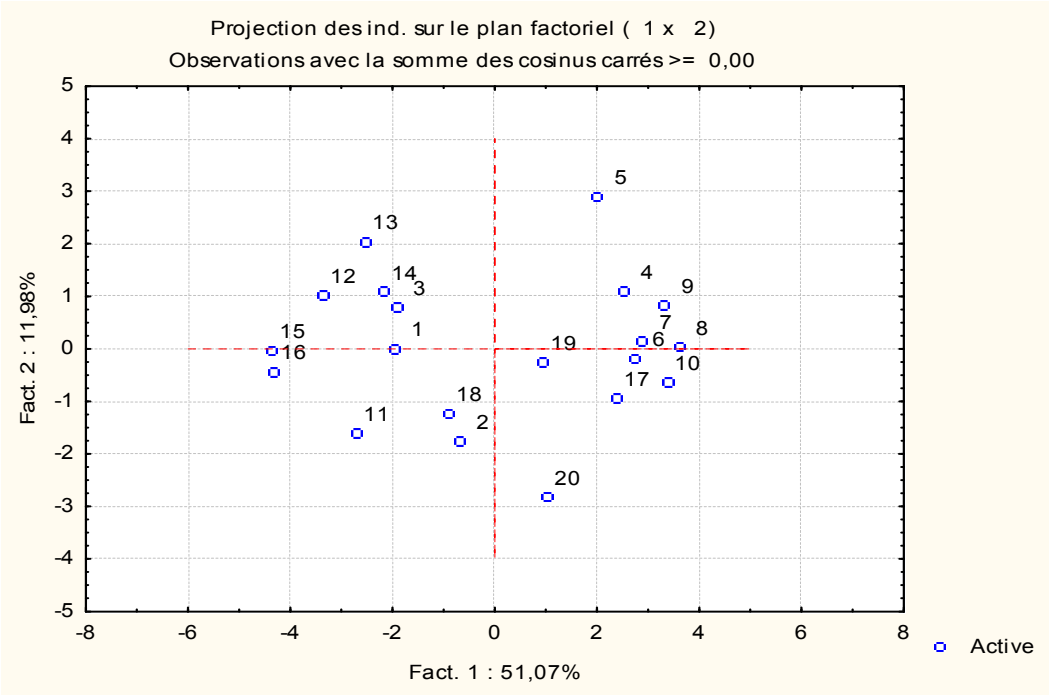

Figure n°11: Distribution of stations in area study

For the distribution of stations, the first group includes 10 stations (4,5,6,7,8,9,10,17,19 and 20) that have a high phytomass diametrically opposed to the group with the other 10 stations with an average and low phytomass, This confirms the distribution of nutrients of the soil in the first group and the presence of edaphic aridity elements in the second group **(figure n°5).[29,30].**

CONCLUSION

In this study in the Mamoura area, we could show that the soils of the steppic zone are low in nutrients which led to the installation of a more or less vegetation cover. Searching for interactions between the total phytomass and edaphic characteristics, applying the principal component analysis "PCA" for 20 samples revealed that this phytomass is significant interaction with the soil nutrient, especially carbon with correlation $R^2 = 0.86$ and the nitrogen with an $R^2 = 0.82$.

In the study area, the phytomass is relatively low and is one indicator of edaphic conditions. In such a steppic ecosystem, the root system must have a greater development. Soil analysis has brought some answers to this finding. Physical and chemical characteristics of the soil does not allow a proper development of the vegetation, combined with very low rainfall and very low winter and spring temperatures, the vegetal does not have the minimum for development according to its physiology.

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