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Research Paper

Impact of over-grazing on vegetation and physico-chemical characters of soil steppiques in western Algerian

Borsali Amine Habib [1, 2] *, Gros Raphaël [2], Hasnaoui Okkacha [1]

[1] University "Dr. Moulay Tahar", 20,000 Saida and University " Aboubeker Belkaid ", 13000 Tlemcen, Algeria
[2] Institut Mediterranean Biodiversity and Ecology, UMR CNRS 7263, Aix-Marseille University, 13397 Marseille Cedex 20, France
*Corresponding author E-mail: rhizobiologie@yahoo.fr

Abstract

The ground at a fundamental regulatory environmental function of water flows or on biological activity. Under anthropogenic influence and change of use changes, mineralogical, physico-chemical and biological soil constituents are processed on the basis of own sensitivity an each type of pedogenesis, altering sometimes sustainably agronomic and environmental functions and in particular the resource in water [1].
The present study shows the current state endured the steppe area in the municipality of Maamora Wilaya of Saïda. The diagnosis made sheds light on a situation that leaves to be desired and was under the influence of spectrum degradation whose origin is anthropogenic. Indeed, ploughing extends and the courses are systematically cleared, thus promoting the extension of the phenomenon of desertification. The operating system Nomad trained overloading of pastures and their degradation. Before this alarming situation and the fragility of the steppe ecosystem supports a new vision is needed and will have to rely on a rigorous planning and management thus projecting from a sustainability perspective.
Our work has focused on the assessment of the (pastoral) anthropogenic impact at various levels of pressure on vegetation and some physico-chemical characteristics of soils.
The results showed that a very high anthropozoogenic pressure could be irreversible for the edaphic characteristics of soils and vegetal groups had no time to recover following pressures exerted on them and the particular climatic conditions including lack of water that prevails in these semi-arid.

Keywords: *Constraints, Maamoura, Overgrazing, Placing Defends, Steppe.*

1. Introduction

The abandonment of rural, which began towards the end of the 18 th century is now continued with the implementation of the agricultural policy, has deeply modified landscapes in the Mediterranean circum in general and in North Africa in particular. In the region of Saida traditional agro-sylvo-pastoral activities are changing. It can be seen that plant structures (pre-forets, shrub land, forests and steppes) regress under climato-anthropogenic impact. This double action leads to changes in physiognomic and landscaped at the origin of revisions of the natural resources. Indeed, in the Mediterranean basin, weather models predict an increase in summer droughts and increased temperatures [2].
This trend would be accompanied by a greater frequency of extreme events of torrential rain, heat wave, drought [3] mainly inland as steppiques areas. Also overgrazing reduced plant cover and put bare surfaces that become highly hydrophobic.
In the upper part of the soil, a collapse of the structure led has a fall correlated levels of carbon and water of more than half of their value. The structural scabs will develop causing a runoff increased [1]. The lasting effect of this change in leads use has effects irreversible of edaphic characteristics.
Our study area is located in the commune of Maamora wilaya of Saïda. It is distinguished by the presence of a course quite rich but doomed to degradation by the heavy load of cattle. Today this area meets the problems that saw the Algerian steppe namely free access to the courses, the semi-sedentarisation that causes a more intense exploitation of the steppe, pastoral practices not conforming to the reality on the ground.

The study area is a representative example of the arid areas threatened by the scourge of desertification. The phenomena of silting, degradation of steppe environments and reduction of plant species in pastoral vocation are the main illustration of the ecological disturbances.
This work aims to show the human impact on the biodiversity of the different compartments (edaphic and floristic).In this context, it has conducted several analyses of soil and directed floristic surveys that reflect the consequences of the action of human and its troupaux on the dynamic process of vegetation and soils. Therefore have divided our study into two separate stations, the first area having benefit for an upgrade in defends therefore prohibited access to the herds and the second station where animals moves freely and regularly.
In each station were initiated on the ground several observations joint vegetation and soil, based on two basic principles which have been respected throughout all of the prospecting where at each survey of vegetation is always associated with a soil profile and the choice of the location of the statement stems from an agreement of ecological homogeneity, physiognomic and floristic.
This study takes into account on the one hand, the analysis of the main edaphic factors (physical and chemical characteristics of the soil) that determine the distribution of plant communities and inventory of flora on the other hand and the consequences of overgrazing on edaphic factors and vegetation. We also tested the hypothesis that the physico-chemical characters could be impacted by a decrease in plant species richness and could vary under the influence of overgrazing.

2. Material and methods

2.1. Presentation of the study area

The municipality of Maamora is located to the South of the wilaya of Saïda. It extends over an area of 127,000 hectares and administratively to the District of El-Hassasna, which is one of the most important dairates of the wilaya depends both on the more agricultural than forest [4].
From a climate point of view, this area is characterized by the aridity of the climate, the scarcity of precipitation and their irregularities as well as the adverse effects of the sirocco. Average temperatures range from 7 ° C in winter and 27 ° C in summer. As for precipitation, the area receives an average rainfall of 300 mm / year, which justifies the aridity of the climate.The wind is an important and harmful factor in this area by its erosive action and movement of sand (quite marked phenomenon of desertification). It acts directly on the ground and on plants, especially in times of sirocco (hot wind from the South) [5].

2.2. Choice of stations

Different purposes two stations have been chosen; a first station 1 which received a bet in defends more aged (03), and a second station 2 that has not benefited from protection.
To enforce only the anthropic pressure on the variability of the stands studied, we chose very homogeneous plots on the environmental plan:

- A study reduced, located in alfatiere sheets of Maamora area;
- A range of altitude mean for all of the sites which is 1132 m to qualify for the homogeneous climate conditions;
- A single type of bedrock and soil;
- Of sites having the same exposure;
- Representative average slopes of this type of relief situations.

2.3. Geo location of stations:

On each of the two stations, 5 sites of sampling and observations have been raised to GPS Garmin72. We chose 05 sites of sampling of 400 m^2 each with 05 repetitions for each of the two stations. What makes 50 sites for the two stations. We give here only the coordinates of each station:
Station N° 01 : Y/ 34 ° 42 ‘ 44,1’’N. X / 0 ° 34’ 06, 02 ‘’W
The average height for all the sites is 1132 m
Station N° 2 : Y/ 34 ° 40 ‘ 22,4’’ N. X/ 0 ° 36’ 21,1 ‘’W
The average height for all the sites is 1121 m.

2.4. Study of vegetation

The vegetation study was conducted based on the stigmatic method of [6]. 15 surveys were completed in selected facies and observation site. The choice of survey is based on a sampling that takes into account the structure of vegetation where the criterion of floristico-ecological homogeneity was privileged.

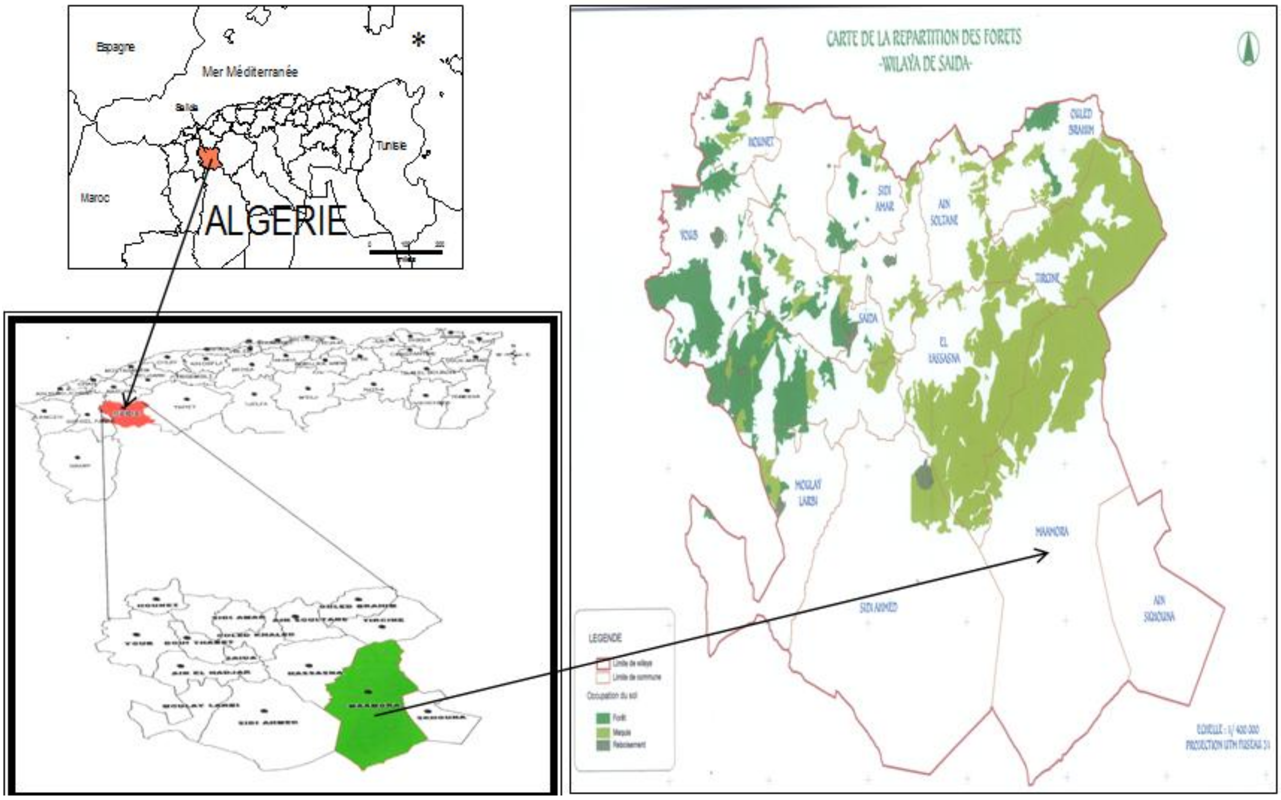

Fig. 1: Location of the Study Area Map

2.5. Physico-chemical analyses of soil

Soil sampling: on each parcel of study, five soil samples were taken randomly, after eliminating the litter at a depth between 0 and 5 cm corresponding to the organo-mineral surface horizon. Five soil samples were then mixed to obtain a composite sample (1 kg). Composite samples were sieved to 2 mm, air-dried before performing the following physicochemical analyses:

2.5.1. Particle size analysis

Particle size distribution (%) of 3 fractions (sands 2000 µm to 50 µm, coarse silts from 50 µm to 2 µm, clays < 2 µm) of fine soil was determined by sedimentation under the pipette Robinson [7] and sieving method.

2.5.2. Holding capacity

The water retention capacity was determined by the Bouyoucos method. The sample is dampened for 12 hours by capillary rise in a sintered glass filter of Buchner. Then the filter is placed on a flask vacuum connected to a trunk water to eliminate the water in the pores of less than 8 µm in diameter. The difference between the wet weight and dry weight (after drying at 105 ° C) allows to know the capacity of water in (%) retention of dry weight [8].

2.5.3. The pH and electrical conductivity

Soil pH was measured in a suspension of soil: distilled water (1: 2.5). The measurement was made after 2 h of stabilization at room temperature using a pH meter Métrom (Herisau, Switzerland). Overall salinity samples was expressed in the form of the sum of the ions of aqueous extracts

2.5.4. Measurement of the levels of calcium carbonate

Calcium carbonate levels were determined by Bernard calcimetre [9]. In a flask for Bernard calcimetre was introduced in the finger 5ml of HCL ½ with a straight pipette, then were weighed 10 g of finely ground soil that have been inserted into the vial, then on moistened the Earth with water demineralised without excess. After closure of the flask connecting it to the calcimetre, it is sure that the liquid level reaches up to the zero mark.

2.5.5. Levels of total organic carbon, total nitrogen and organic matter

Concentrations of total carbon (TC) and total nitrogen (NT) were measured using an elemental analyser CN FlashEA 1112 (Thermofisher). Organic carbon (OC) is obtained by subtraction of the concentrations of inorganic carbon ($CaCO_3$) at concentrations in CT. C/N ratio has been calculated. Organic matter content was measured by loss of mass of a dry sample during calcination at 550 ° C for 16 hours.

2.5.6. Determination of nitric and ammoniacal nitrogen

Quantities of ammonium ions (µg de N-NH_4^+.g-1 dry soil) and nitrate (µg de NNO_3^-.g-1 of dry soil N) were determined by spectrocolorimetry according to [10,11] from the extraction of soil solution (1:10 M KCl). 5g (dried equivalent) soil fresh have been in suspension in 50 mL of a molar solution of KCl. After a 1 hour shaking, the suspension was filtered on paper Whatman n ° 5. Then, the content of ammonium (µg de N-NH_4^+.g-1dry soil) contained in the filtered solution was dosed by Colorimetry. The intensity of the emerald green color formed after addition of salicylate is measured with the spectrophotometer to the wavelength of 667nm. The absorbance of the yellow coloration of nitrate salicylic acid is read with the spectrophotometer at 410 nm.

3. Results

3.1. Physico-chemical analyses of soil

Retained stations are characterized by a monotony of the field with lean and impermeable soils which the topographic configuration promotes the flow of leachate from the rain to Wadi Berbour. Soil analysis reveals the following soil types:

Table 1: Texture Study Stations

Station 01	Texture and color	Station 02	Texture and color
Site 01	Silty-Sandy Brown	Site 01	Silty-Sandy Brown
Site 02	Silty-Sandy Brown	Site 02	Sandy Brown
Site 03	Silty-clayey-Sandy Brown	Site 03	Sandy Brown
Site 04	Silty-Sandy Brown	Site 04	Sandy Brown
Site 05	Silty-Sandy Brown	Site 05	Silty-Sandy Brown

The texture triangle place our stations in the Sandy to silty-Sandy area. These are light soils and permeable indeed quantitative analyses have highlighted the following points:
Station 1 : level soils are red brown color by Mediterranean, silty texture, their thicknesses exceed rarely 20 cm.
Station 02 is characterized by color hydromorphic Brown with a heavy textured soils. They are also shallow (less than 20 cm). There is an outcrop of limestone bedrock by location and sandy deposits in other places with appearance of stones and gravel surfaces which do not offer great agronomic interest. Level this station the amount of clay is reduced; It is between 5% and 10.3% while it oscillates between 10.3% and 20.6% for the staion 1.
As silt, measurements ranged between 15% and 29.34% for station 02 and 28.1% and 42.8% for the station 01.The presence of sand is mixed; It wobbles between 60% and 71.25% for the two stations.

Table 2: Physicochemical Analyses of Soil

Soil sampling sites	pH Water	Elect cond	Holding capacity	$CaCO_3$ (%)	NH_4^+–N (mg/g)	NO_3^-–N (mg/g)	NT (%)	OC (%)	C/N ratio	O M %
Site 1 (St 01)	7. 30	0.69	35.78	18.34	6.12	2.60	0,65	0.50	0.76	0.98
Site 2(St 01)	7.65	0.27	34.89	15.06	7.23	1.98	0.14	1.67	11.92	1.21
Site 3(St 01)	7.41	0.30	35.67	14.50	6.78	1.67	0.89	0.67	0.75	1.43
Site 4(St 01)	8.00	0.52	36.89	15.83	8.90	2.30	0.70	0.90	1.28	1.77
Site 5(St 01)	7.56	0.45	36.67	16.43	9.70	1.98	0.85	1.09	1.28	1.94
Site 1(St 02)	6.80	0.69	22.89	16.87	35.56	1.77	1.34	2.50	1.86	0.08
Site 2(St 02)	6.60	0.87	20.78	14.56	24.50	2.20	1.19	2.67	2.24	0.67
Site 3 (St 02)	6.90	0.85	19.90	13.43	32.67	1.89	1.29	2.87	2.22	0.79
Site 4(St 02)	7.02	0.84	18.90	15.87	26.78	2.00	1.22	2.90	2.37	0.47
Site 5 (St 02)	6.70	0.89	20.67	16.90	30.56	1.98	1.27	2.89	2.27	0.82

- Elect cond : Electrical conductivity

The results in table 1 shows a significant decrease in pH, retention capacity, and organic matter, however we note a total increase of the values of the ammonium ions, organic carbon and nitrogen of station 1 to station 2. For the other value (conductivity, CaCO3 (%) and the nitrate ion are partiquement similar on both sites.)

3.2. Description of vegetation

Table 3: Inventory of Plant Species of Station 1

Species	Site1	Site2	Site3	Site4	Site5
Stipa tenacissima	3	4	3	3	3
Artemisia herba alba	2	1	2	2	1
Helianthemum pilosum	2	1	1	2	2
Senecio vulgaris	1	1	2	1	1
Muscari comosum	1	2	1	1	1
Astragalus incanus	1	1	2	1	1
Ferula communis	+	+	+	1	+
Eruca vesicaria	+	1	+	+	+
Scorzonera humilis	+	+	+	+	+
Stipa parviflora	1	1	1	++	1
Avena alba	1	+	+	1	1
Litter	Presents	Presents	Presents	Presents	Presents

Table 4: Inventory of Plant Species of Station 2

Species	Site1	Site2	Site3	Site4	Site5
Stipa tenacissima	+	1	+	+	1
Artemisia herba alba	+	+	1	+	+
Senecio vulgaris	+	+	+	+	1
Noaea mucronata	+	+	+	1	+
Helianthemum virgatum	+	+	+	+	+
Eruca vesicaria	+	+	+	+	+
Avena alba	+	+	+	+	+
Lygeum spartum	2	1	1	2	+
Atractylis serratuloides	1	++	1	1	2
Peganum harmala	2	1	1	2	2
Litter	Abscente	Presents	Abscente	Abscente	Abscente

We note on table 3 that the dominant species is the Alfa with good growth and an important richness. However observed on table 4 relics of the very degraded alfa persist, with a very low recovery rate and the surrounding species are limited generically. According to the sites, there is a depletion of the floristic richness.

4. Discussion

The growth of plants in areas steppiques depend on climate that prevails in this area and some physico-chemical and biological properties of soil. The antropozoogene action can produce significant changes in these properties which in turn deeply affect the ecology of plants. Physico-chimical characters that were measured in this study allow to account for any malfunctions, representative of training alfatieres of the semi-arid floor soils of Western Algeria.

According to the analysis garnulometriques our soils are sandy to silty - sandy, indeed, steppe soil that grows the alfa are shallow and with a large proprtions of sand usually. Different facies occupying the steppe areas vary from one area to another on the basis of the planimetry, climate and environmental conditions [12]. And after the results of table 1, the overgrazing to an effect on the texture of the soil making it more sandy, indeed the animals destroying vegetation and website clumps of Alfa and sagebrush leaves bare soil and the action of the wind will cause fine particles which are the silts and clays worm to other areas and consequently the concentration of particles of sand is most important in sites that undergo the action from overgrazing.

When vegetation cover has disappeared or if it is too much pressure as in the case of overgrazing, soil directly receives rainfall which the percolates and it results in leached soils. Most often, leached soil is acidified [13].

The over-grazing also decreases the retention capacity of soils because when vegetation is removed, the soil is exposed to the impact of the rains and the activities of animals that compact and level the soil settle. The settlement makes the soil less conducive to the proliferation of roots and reduces its ability to hold water the plants need to survive. Exposure and drying of the soil resulting may also result in the formation of scabs. Water has, thus, more difficult to penetrate the soil which can cause surface runoff leading to a phenomenon of erosion. [1] has shown that in arid and semi-arid regions than soils that have been trampled and whose structure has been destroyed by overgrazing may cause a compaction and crusting of surface with loss of the retention capacity of these soils. Also have may explain this decrease in the retention capacity of the 2 station who suffers the effect of overgrazing that destroying vegetation induced erosion of the largest fines [14] and contributes as a decrease of the retention capacity of the soil water [15]. The removal of vegetation by overgrazing may have accelerated the drying of the soil by increasing evaporation and evapotranspiration.

According our results we note that overgrazing has a visible effect on the chemical soil properties and on the loss of organic matter in station 2 which undergoes the action of animals due to the disappearance of vegetation.Indeed, the substantial contributions of fresh organic matter are due principally to the contribution of litter or the roots of the plants [16]. Under conditions of natural vegetation cover, soil organic matter content tends to be set at a relatively high level. It depends actually on the organic matter from vegetation, characteristics of soil moisture and temperature [17]. The increase in the levels of total nitrogen and organic carbon contents in the stations 2, also suggests contributions of fresh organic materials rich in nitrogen. It is therefore possible that the faeces and urine of animals have enriched soils of organic carbon and total nitrogen 2 station. The high concentrations of ammonium from station 2 to station 1 suggests either a low uptake by vegetation because of its reduction due to overgrazing, or particularly low nitrifying microbial activity. Indeed, [18] report that the nitrate ions are produced from ammonium ions by nitrification.

Identical concentrations of nitrate ions observed in the two stations seem to support the hypothesis of a very low nitrification in these soils steppique due to low microbial activity due to drought and edaphic aridity.

The impact of over-grazing on vegetation is very visible in station 2, indeed, overgrazing is the result of a too high concentration of livestock on a space given translates by the disappearance of edible plant species and the subsequent development of non-edible species. If this too heavy grazing pressure continues, the disappearance of the vegetation cover may cause soil erosion.

Observation on the ground and the interpretation of results reflect the importance of the phenomenon of overgrazing in the study area. They reveal important physiognomic types changes in station 1 compared to those of Station 2. It is the Artemisia herba alba and Stipa tenacissima which esont most exposed to this regressive dynamics, which is losing ground against the species that characterize the rangeland degradation, such as: Atractylis serratuloides, Noaea mucronata and Peganum harmala found in station 2. The analysis of textures shows the importance of sands in station 2.Consequently, the Lygeum spartum by its psammophile character undergoes an evolutionary dynamics and replaces Artemisia herba alba and Stipa tenacissima in degraded and sandy paths. As shown [19] in this work on the El Bayadh region.

From these observations we can see that there is a very major regressive dynamics in different steppe facies. In the courses at alfa, alfa keeps its dominance, but it still exists in a State of decline. Our results are close to the results obtained by [20].

Also on the climate plan, our area has a dry period that extends over many months. This long dry period can damaged seed banks and hindered the healthy development of the plants in the Maamora area.

The impact human and his animals in the studied sites in the region of Maamora is net. Regression of plant formations is unprecedented. Facies observed tell us about the fate of the alfatieres formations. This regression will without any doubt a loss of genetic heritage and soil.

Litter is an important element of the steppe and its deletion from the fact of overgrazing induced by an indirect but crucial, leading to warmer and drier soils and a reduction in the composition of the vegetation. It therefore defines a degradation process likely to lead to desertification [21].

According to our results we note that litter is completely absent in station 2 sites, while it is present in station 1, indeed litter production is directly linked to the presence of vegetation. Litter has an important role in the increase in the temperature of the soil and the amount of water contained in the soil available for the growth of plants, is an important component of all semi-arid ecosystem. These are limited in water and any element that can have an impact on the water contained in the soil will also impact on other ecosystem processes, such as plant growth and competitive interactions. Litter allowing the soil to retain most important water quantities for plant growth, its mass is therefore positively correlated, in semi-arid areas, with the annual net primary production [22]. However, the level of this correlation is variable and depends on the weather in a given year [22] and the characteristics of the plant community.

5. Conclusion

Steppiques regions constitute a buffer between northern Algeria and Western sahara, this box limit negative climatic influences on the coastal Algeria. Steppiques of our study area soils are characterized by the presence of limestone accumulation, a small amount of organic impending, a high concentration of nitrogen and ammonium ions in station 2 probably from the urine of animals that pasture in this station or a consequence of wind and water erosion. The quantities of water are low especially one that can be used by plants and little renouvelablable because of the low rainfall.

The dominant plant species in our stations are dominated by two large types of foramtions; steppe garminieenne made of Stipa tenacissima and Lygeum spatum and chamaephytiques based on Artemisia steppe herba alba whose pastoral values are very valuable.

Our results shows that implementing defends which have benefit certain parcels of the Maamora gave good results for the restoration of the steppe, this technique is not recent, it is practiced for centuries: 'Agdal' in Africa from the North or the "Hema" in the Middle East and Saudi system.

It is to protect a parcel of land against the action of human and animals [23]. This method has been proven because almost always effective, its degree of success and its duration is closely linked to climatic factors.

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