Plant Archives Vol. 16 No. 2, 2016 pp. 907-917 ***ISSN 0972-5210***

THE SYNERGISTIC ACTION OF ARIDITY AND HUMAN IMPACTS ON PLANT BIODIVERSITY IN THE ALGERIAN EXTREME NORTHWEST (TELLIAN PLAIN OF MAGHNIA)

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Abstract

The question of the biodiversity of natural ecosystems of our country, like the tellian plain, arises with more and more importance by the continued deterioration of the biological capital. The aim was to analyze in the first place, the data of the physical environment (Bio-climate and human environment) and afterwards the index of evolution of plant biodiversity resulting of the action of the factors of this environment. Our own perception of vegetation is based on the phyto-ecological approach by comparison at the scale of the ecological station. The plant biodiversity was valued by the analysis of the floristic richness, the biological, systematic and chorological characteristics,

To cite only the essential, the calculation of the perturbation index showed the wealth in Therophytes and chamaephytes, reflecting the large imbalance of plant diversity in the study area and as a result the release of process of therophytisation , the Final stage of degradation.

Finally, despite the strong resilience of the mediterranean arid ecosystems, it seems to exist a threshold at not to exceed insofar as the continued degradation leads without a doubt at aridification of environment and consequently a reduction of the biodiversity.

Key words : Plant biodiversity, phytoecology, aridity, anthropistation, Algerian Northwest (Tellian Plain of Maghnia).

Introduction

The degradation of plant biodiversity of natural ecosystems in Algeria, arises with increasing severity. The massive rural exodus, urbanization, overexploitation of natural resources and the high population growth exacerbated by repeated droughts, particularly over the last two decades have led to the deterioration of the biological capital, by the disappearance of the most important species on the one hand, and the infiltration of other species less appreciated and/ or more xerophilic on the other hand.

The Mediterranean plant biodiversity is the product, for many, a traditional and harmonious use of the environment by man (Quezel *et al.*, 1999).

Pre-steppe and forest areas are the scene of a fatal and continuous ecological imbalance resulting from the very high burden they undergo one hand, and low production on the other hand (Bouazza and Benabadji, 1998).

Indeed understanding structuring plant diversity of Mediterranean forests mechanisms is a complex problem due to the heterogeneity of ecological situations encountered, multiple biogeographic influences and various anthropogenic pressures on these communities (Quezel, 1976 and Barbéro *et al.*, 1990).

Numerous studies such as those of Alcaraz (1982), Benabdelli (1983), Dahmani (1989, 1997), Aimé (1991), Bouazza (1995), Benabadji (1995), Bouazza and Benabadji (1998), Benabadji *et al.* (2001), Bouazza *et al*. (2001), Hasnaoui (2008) and Mesli-Bestaoui (2009), Amara (2003, 2008, 2014), Amara and Bouazza (2013) confirm that the plant biodiversity in Oran is in fact the result of human disturbance and/ or climate.

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Analysis of the floristic richness of the various groups, their biological and chorological characteristics would highlight their floristic originality, their conservation status and, therefore, their heritage value (Dahmani, 1997).

The number of species in a forest stand gives an indication of the richness and biodiversity of this community (Sonké, 1994).

Nationally, flora was estimated at about 3139 species in 1962 by Quezel and Santa, of which 700 species are endemic to Algeria. It has no less than 60 genera and 130 species, subspecies and varieties of food. Some are grown and more than 626 others are varietal.

Currently in the light of new data, 13 new species, almost all rare to extremely rare, non-endemic, add to 3139 listed in the flora of Algeria (Quezel and Santa, 1962-1963) to reach a total of 3152 species 3744 taxa (MATE, 2014).

On the other hand, has a larger scale, the level of the study area (plain of Maghnia), comparing our surveys (Amara, 2014) with those made by Monjauze in 1956 reveals the absence of eight species: *Rhus pentaphylla*, *Ficus carica*, *Lavatera maritima*, *Osyris alba*, *Tunica angustifolia*, *Phagnalon saxatile*, *Ebenus pinnata*, *Hyparrhenia hirta*. This is the danger of over-exploitation of ground cover by too large flocks, often resulting in excessive depletion, sometimes irreparable (Frontier and Pichod-Viale, 1993).

Given this phylogenetic erosion phenomenon in an environment known to adversely continuous ecological imbalance, what is the magnitude and consequences of climatic and anthropogenic factors on plant diversity in the study area ?

Are we in the presence of a continued deterioration in the near future triggering the desertification process ?

To answer this we intend to study first the factors such as bio-climate and the human environment, and secondly, describe the clues of evolution of plant biodiversity of the study area, analyzing its rich flora, biological, systematic and chronological characteristics.

Sites and Methods

Presentation of the study area

The study area is located in the extreme western North Algeria (fig. 1).

The coastal mountain range of Traras and mounts of Tlemcen are respectively the northern and southern boundary of the study area. It is bounded on the west by the Moroccan border and to the east by the Wadi Isser Valley.

It includes the following cities:

Maghnia, Hammam Boughrara, Ain Fattah, Fillaoucene, Ain kebira, Ouled riah, Zenata and Remchi.

Methodology

Our own perception of vegetation is based on phyto-ecological approach compared to the scale of the ecological station.

In general, it is the comparative study of living side by side groups that tracks the dynamics of vegetation (Baguette and Wesselingh, 2002).

Sampling and selection of stations

The choice of two representative stations (Fillaoucene and Hammam Boughrara) is based on the subjective sampling method taking account of the floristic homogeneity and environmental homogeneity of the station.

This subjective mode is to choose at each sample station seemed the most representative and sufficiently homogeneous (Gounot, 1969 and Long, 1974), incorporating all structural situations and vegetation facies encountered.

Our objective floristic and ecological characterization of the vegetation of the region; capture the dynamic aspects of plant communities encountered.

For this we have come to use the phytosociological method (Braun-Blanquet, 1951), also called zuricho-mentpeleriane (floristic) and phyto-ecological surveys.

To determine the minimum area, it has been necessary to use the minimal area method described by Guinochet (1955) and Gounot (1969).

From the species area curve, we determined a neighboring average minimum area of 128m² for Fillaoucene station and 32 m² for the station Hammam Boughrara during the spring season.

Physiography of selected stations

Fillaoucene station

Located at an altitude of 231 m with exposure to the North East in general and a recovery of 10 to 60% . It occupies a 500m² surface. This triggered the salt down the slope, hence the existence of a salinity gradient well marked by the degree of colonization of halophytes as: *Salsola vermiculata*, *Atriplex halimus*, *Lygeum spartum*, associated locally with other steppe species such as *Artemisia herba-alba*, *Noaea mucronata*.

Hammam Boughrara station

With different exhibitions and an area of 500m² this station is 400m above sea level, with a recovery rate of 60%.

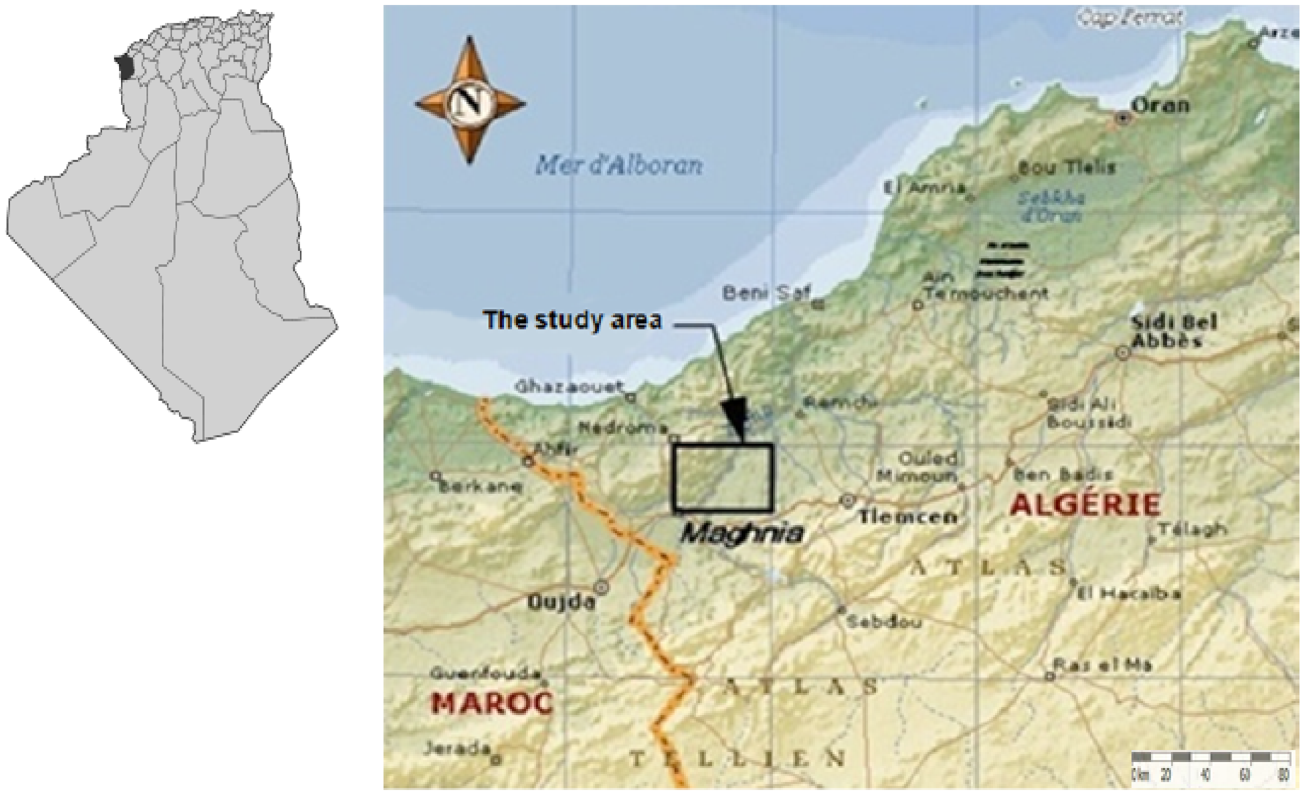

Fig. 1 : Location of the study area.

On phyto-physiognomic level is characterized by the integration of pre-forest tree species (*Olea europaea*, *Tetraclinis articulata*) and steppe species (*Artemisia herba-alba*, *Noaea mucronata*) but with low dominance.

The presence of certain anthropogenic species such as *Asphodelus microcarpus*, *Urginea maritima Calycotome intermedia subsp. villosa,* indicate the passage of flocks and thus the beginning of the erosion of the medium.

Results and Discussion

Bioclimate

The study factor "drought" is of great importance especially for the vegetation which during the dry season undergoes profound disturbances such acceleration of potential evapotranspiration leading to drying (Aafi, 2007).

The quantification of climate drought was clarified by establishing ombrothermic diagrams Bagnouls and Gaussen (1953-1957), showing, for each month the rainfall curve and the average temperatures doubled.

The study area belongs to semi-continental Mediterranean climate (Amara and Bouazza, 2013) characterized by two distinct seasons. The first summer, dry and hot that can reach 7 months (April-October), the second wettest (fig. 2).

The gradual evolution of drought requires the vegetation high evapotranspiration; allowing it to develop adaptation systems (reduction of leaf area, development of thorns ...) thus changing the landscape imposing a xerophilous vegetation (Meziane, 2004).

The Emberger pluviothermic quotient Q_2 for the period (1980-2013) (fig. 3) places the region among the arid bioclimatic stage in temperate winter (Q_2 = 28.38 m °C = 3.41) maghnia and the floor semiarid temperate winter (Q_2 = 42.21, m °C = 5.47) Zenata. For semi-arid regions, annual rainfall is between 300 mm and 600 mm and for the arid regions, they are between 100 and 300mm. Also, qualified for desert regions, rainfall is less than 100 mm (Quezel, 1965).

The annual rainfall in the study area do not exceed 340.57 mm (Amara, 2014).

The length of the dry season is generally correlative of its intensity; but there are important differences that the annual dry season is continuous or not; that is to say according to the annual rainfall regime is unimodal, multimodal bimodal (Le Houérou, 1989, 1995).

The rainfall pattern in this arid region is characterized by a spring maximum (Amara and Bouazza, 2013).

In this situation, this spring maximum (meaning Alcaraz, 1969 and Bouazza, 1991) used by plants during

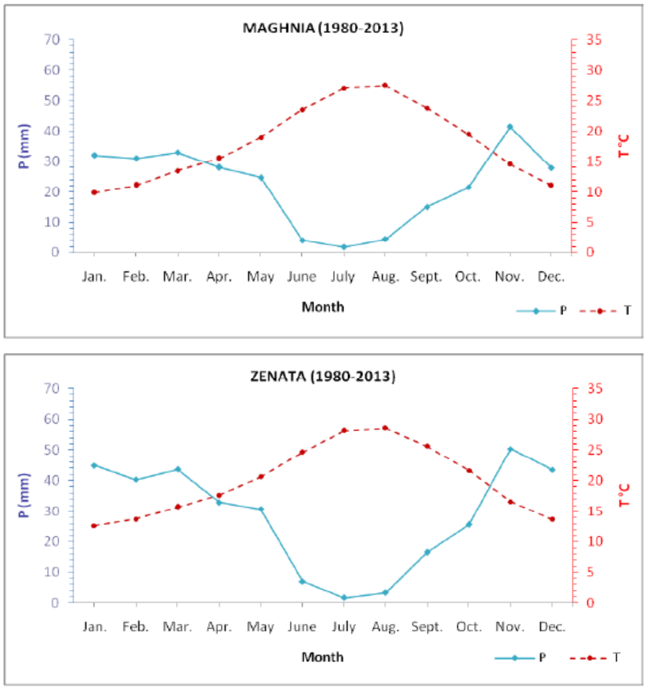

Fig. 2 : Ombrothermic diagrams for the study area (Amara, 2014).

water stress season thus constitutes a reserve of temporary water; July marks the depletion of the stock.

Extreme temperatures and calorie deficits are the main causes of the limits of plant ranges (Mullenbach, 2001).

Extreme values are strong limiting factors whose effectiveness depends on certain levels and their frequency of occurrence (Aimé and Remaoune, 1988).

In our case, the thermal maxima means the hottest month (M °C) range from 33.06°C (Zenata) and 35°, 25°C (Maghnia), which contributes to the enhancement of evapotranspiration and therefore the arid environment.

The arid enclave around Maghnia is thus characterized by a thermal micro-continental climate, cold in winter and very hot in summer (Aimé and Remaoune, 1988).

Faced with this worsening climate we are witnessing a proliferation of spiny species, toxic and other low pastoral value species. The fragility of this environment by human pressure is most evident during the period of scarcity where the herd finds that the species are not considered palatable.

But according to Le Houérou (1993), the impact of the drought was weak or negligible where human impact and animal was low or zero; reflecting that man and its activities are often the cause of the gradual extinction of the most demanding ecosystems, especially in arid and semi-arid extreme western Algerian.

Human impact

In addition to the high variability of weather conditions and the succession of droughts adds anthropogenic phenomenon that finds expression in the ever increasing pressure of human population and animal load.

The majority of the population throughout the province of Tlemcen is concentrated in public works of places where the density may exceed 70 Habt./km².

On animal load, the number of global herds, experienced an increase of 95509 heads with a growth rate equal to 0.9% (1992/2012) (Amara, 2014).

But the dynamic trajectories of ecosystems are mainly conditioned by the intensity and type of pasture, action goats are generally more harmful than sheep or cattle.

In the province of Tlemcen (extreme north western Algeria), the rate of increase in sheep is 1%, 0.64 for cattle and -0.29 for goats. Indeed, for 20 companies, Sheep farming remains predominant is privileged (86-90%) compared to goat breeding (5-8%) and beef (4-6%) (Amara, 2014).

In general, the burden of livestock is 3.78 heads/ha is 583000 heads against a course surface 154271 ha (table 1).

In the communes of Remchi, Zenata, Bouhlou and the load is more than 05 times that of the average load of livestock of the province, because of the term small size or ability, reflecting a pronounced overgrazing. In addition to the number of livestock, with the amount of course remains a key element in determining the degree of pasture.

Fillaoucene of Public and Ain Fattah made except by the absence of rangeland that will reverberate against other agricultural and forest land.

In the forest, grazing has the effect of eliminating grazing by the younger generations, the lower branches and releases and even in the year of scarcity all the foliage and tree branches then cut by shepherds to ensure the survival of herds. Overgrazing usually results often called regressive succession to the impacted vegetation. Indeed, pastoralism and forestry are generally perceived as inconsistent practices in Mediterranean environments (Quezel and Médail, 2003).

Phytodiversity

Biological type

The biological type of plant is the result, on the vegetative part of all biological processes, including those that are modified by the environment during the life of the plant and are not hereditary (Polunin, 1967). This same author adds that life forms could inform us on the influence of environment and/ or on local conditions.

Aubréville (1963) reports that biological spectra are characteristic notions of vegetation, in direct correlation with the medium.

Bruts biological spectra

The proportion of the various biological types translated very often the degree of evolution of a group within a range of vegetation. According to the environmental conditions, a biological type often takes precedence over other (Floret *et al*., 1982).

It determines the percentage of the number of species for each biological type [Therophytes (Th), chamaephytes (Ch), hemicryptophytes (He), phanerophytes (Ph), Geophytes (Ge)] on the total number of species.

Overall the division of life forms in the two formations studied follows the following pattern: Th> Ch> He> Ph> Ge.

Quezel (2000) points out that one reason that could explain this wealth in the Mediterranean region, is undoubtedly its high therophytes.

Table 2 and fig. 4 show the similarity of the distribution of the main biological types but with different proportions. For comparison the high rate of Therophytes, chamaephytes and hemicryptophytes in Fillaoucene station pre-steppic formation lessens at the station Hammam Boughrara more forestry formation (scrub) the benefit of phanerophytes with 12 species (14%) and Geophytes with 7 species (8%).

Floret and Pontanier (1982) explain that the more a system is influenced by man (overgrazing, culture), more therophytes take more importance.

In our case, in each type of higher education the proportion is represented by therophytes, 38% to Hammam Boughrara and 46% to Fillaoucene (table 2), which shows the strong influence of human action on the environment.

Despite the importance of Therophytes (table 2), the chamaephytes with 31 species (22%) and hemicryptophytes with 30 species (21%) keep a particularly important place in the two studied formations.

This dominance of dryland chamaephytes shows their strong adaptation to climate constraints (Aridity and low temperatures).

The dominance of dryland phanerophytes is related to well-fed water systems and relatively less salty. (Valley bottoms and depressions). The chamaephytes are better adapted to drought than phanerophytes.

As for Geophytes, based lily, overall are the least represented in both studied formations.

The photophile and drought-resistant nature of chamaephytes inhibited their development in forest areas by competition. As soon as there is opening of this environment the proportion of this biological type tends to increase.

To appreciate the vegetation degradation state in the study area, we calculated the disturbance index (DI) (Loisel and Gamila, 1993) expressed by the following relationship:

(Number of chamaephytes + Number of therophytes) / Total number of species

The Fillaoucene station (pre-steppic formation) has a higher rate (68.69%) compared to the hammam Boughrara scrub (58.62%).

These figures show that wealth and Therophytes chamaephytes at a plant community probably reflects a high degree of disturbance, which also reflects a more open environment.

The origin of the extension of therophytes is largely due to:

- Either adapting to the stress of the winter cold (Raunkiaer, 1934 and Ozenda, 1963) where the summer drought (Daget, 1980 and Negro, 1966).

- Either to environmental disturbances by grazing, crops, ... (Grime, 1977).

The interventions of the man and his animals have visible effects on the physiognomy of vegetation. The sheep and goats differently appreciate the species classified by major morphological types (woody erect, herbaceous perennials, annuals, etc.). Sheep prefer annuals and almost regardless of the life stage where they are while the goats instead consume only low annual (Le Floc'h, 2001).

The reduction of the vegetative cover from overgrazing is accompanied by the change in the floristic composition, this change is evidenced by the expansion of non-palatable species (toxic and/ or difficult) *Asphodelus microcarpus*, *Ferula communis*, *Asphodelus microcarpus*, *Urginea maritima Calycotome villosa subsp. Intermedia*, *Scolymus grandiflorus*, *Thapsia garganica*, *Centaurea solstitialis* or adapted to pastoral systems (co-evolution) (*Plantago albicans*) to other species with great pastoral value (more palatable) *Thymus ciliatus* and others.

Real biological spectra

In the second biological spectrum, also known as real biological spectrum (Carles, 1948), determining the degree of overlap (or abundance in number of individuals) of each biological type regardless of species. It is a biological and structural concept (Aubreville, 1963).

The arrangement between the dominant phytogeographical elements in the studied flora and others, is even more pronounced when their participation is expressed by their abundance-dominance, ie their recovery. This quantitative parameter to better measure the importance of the taxa in the occupation of space and thus locate those rare or endangered (Dahmani, 1997).

Unlike biological raw spectra, where we observe a fairly homogenous shape of the curves for most of the studied formations, actual biological spectra have very different proportions depending on the maturity of the structures studied (Dahmani, 1997).

The distinction of the various Mediterranean ecosystems is based on the overall architecture: the physiognomy determined by the dominant plant. These remain the best bio-indicators because they represent species that actively structure the system (Aidoud, 1997).

In Fillaoucene (pre-steppic station) formation the real biological spectrum is comparable to that of crude biological spectrum (figs. 4 and 5).

Therophytes the chamaephytes with an overlap of 31% for each and hemicryptophytes 26%, which means the wide dominance of the herbaceous layer.

In sylvatic formation hemicryptophytes are less dominant: Ph> Th> Ch> Ge> He that is comparable, according to Dahmani in 1997, the northern woodlands.

Both formations are characterized by a considerable invasion of therophytes with 31% in the Fillaoucene station and 26% in the Hammam Boughrara station (table 3).

The opening of the vegetation is more pronounced in the first station than Hammam Boughrara, following the conditions of unfavorable environments.

The change in therophytes rate is related to the degree of openness of the vegetation and interspecific competition (Dahmani, 1997).

The actual biological spectrum thus reflects the degree of species recovery which leads to know the degree of the opening of the plant formations ie the degree of therophytisation and disruption.

The very high proportion of therophytes is explained by soil conditions (light soil, well ventilated) and especially microclimate: winter and spring period relatively humid alternating with periods of drought (Amara, 2003).

In addition to human impacts, the therophytisation finds its origin in the phenomenon of desiccation. Barbéro *et al*. (1990) presented the "thérophytie" as a drought resistance of form as well as high temperature in arid environments.

Aidoud (1983), points out that in the Algerian high plateaux, rising therophytes is related to increasing aridity gradient.

In the plain of maghnia the importance of characterisric therophytes of Thero-Brachypodietea such as *Asteriscus maritimus*, *Pallenis spinosa, Micropus bombycinus*, *Aegilops triuncialis* indicates the extent of antropozoogene share (Amara and Bouazza, 2013).

Therophytisation, the final stage of degradation, is therefore the result of the synergistic action of aridity and human impacts.

Frequency

In addition to the actual biological spectrum, the frequency of species, especially indicator defines the physiognomic type of a plant formation on one hand, and provides guidance on the nature of the dominant factor in this second ecosystem.

This index is expressed as a percentage.

$F\% = 100xn / N$

Durietz (1920) lists the frequency in five (05) classes:

Class I: very rare species; 0 <F <20%, **Class II:** rare species; 20 <F <40%, **Class III:** frequent species. 40 <E <60%. **Class IV:** abundant species; 60 <E <80%, **Class V:** very constant species; 80 <F <100%.

The scrub Hammam Boughrara formation is clearly dominated by the phanerophytes with an overlap of 31% reflecting the woodsy atmosphere (table 3).

However in Fillaoucene station pre-steppic formation, the relative importance of therophytes (31%) due to the dominance of low phanerophytes (8%), which determine the available light for low stratum, seems to be more related to the degree of the opening of the vegetation (table 3).

But despite this weak recovery phanerophytes, some dryland active species (Ph) as *Ziziphus lotus* and *Calycotome villosa* Subsp. *intermedia*, have frequencies ranging from 20% to 60% indicating the arid atmosphere and semiarid prevailing in the study area.

The dominance of Geophytes over other life forms is also negligible (6%) in this pre-steppic formation (table 3, fig. 5), but their tendency towards monotony because of the high frequency of undesirable species by livestock (*Asphodelus microcarpus* (II) and *Asparagus stipularis* (IV) indicates the intensity of grazing.

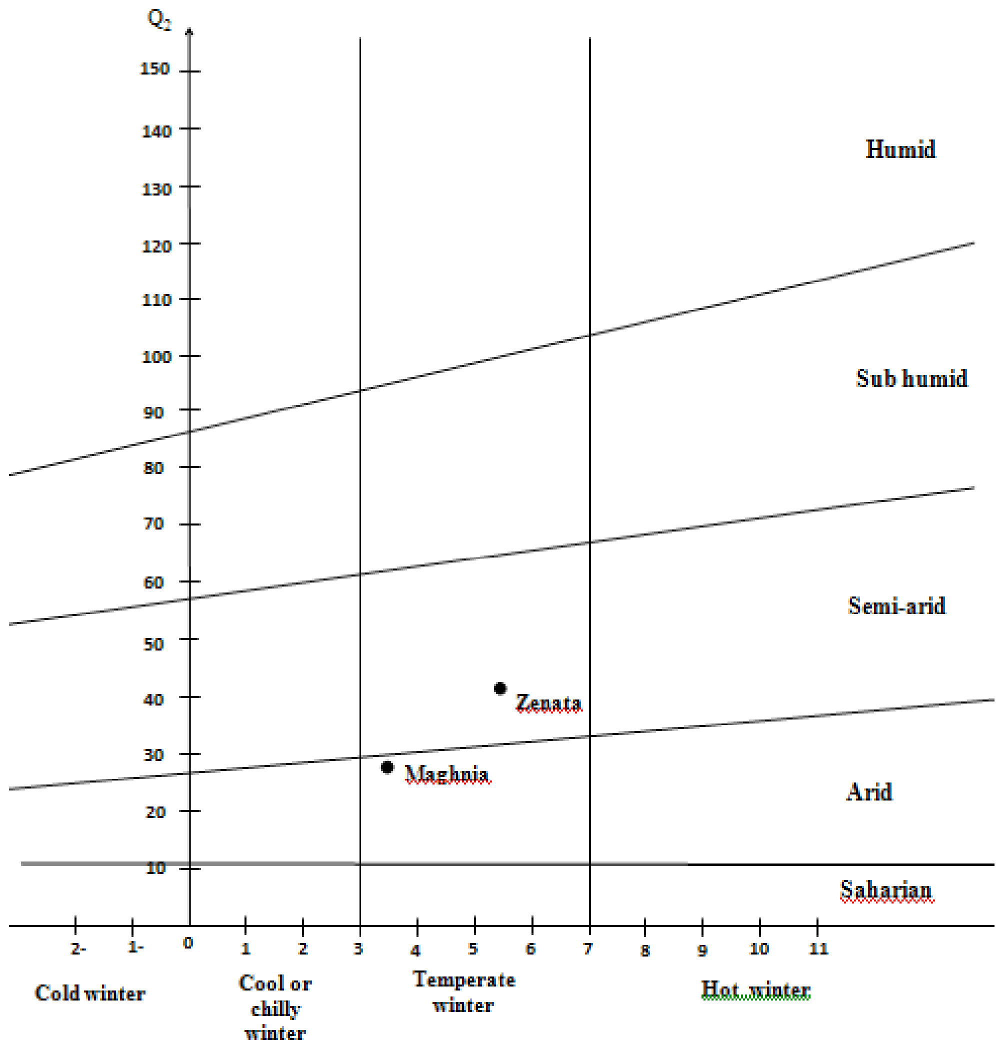

Fig. 3 : Emberger pluviothermic quotient (Q_2) for the study area (Amara, 2014).

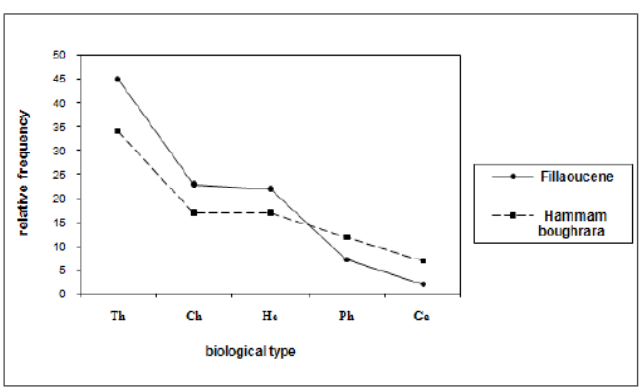

Fig. 4 : Raw biological spectra in the study area.

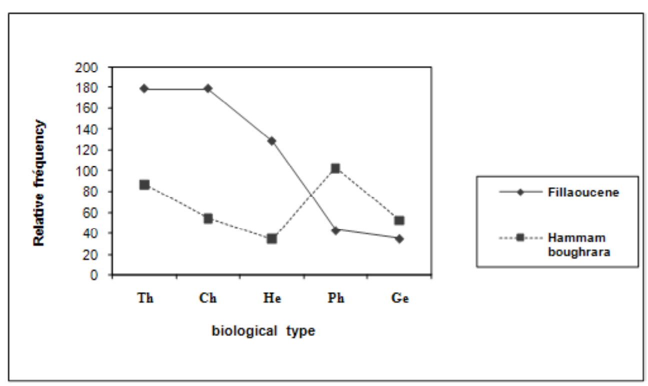

Fig. 5 : Real biological spectra in the study area.

The calculation of the rate is more significant when the actual spectrum of a biological life form is insignificant.

Systematic composition

The determination of taxa was made from flora of Algeria and Santa Quezel (1962-1963).

Table 4 gives information on the consistency of the flora of the study area and showed that angiosperms gymnosperms and Clamydospermes are represented by 140 species: Eudicotes with 117 species (84%) and 20 monocots species (14%). Other vascular plants (gymnosperms and Clamydospermes) are represented by 3 species, 3 genera (2%) only (*Pinus halepensis, Tetraclinis articulata, Ephedra major*).

Table 1 : Pastoral charge by Commune in the study area for the company 2011/2012 (Leadership of Agricultural Services modified).

Communes	Total (livestock)		Range lands and pastures including the uncleared land and brushwood
	2011/2012	Charge (head/ha)	
a./ fettah	9870	/	0
a./ kebira	1930	1.14	1686
b./ bahdel	1945	0.83	2331
Bouhlou	8236	18.98	434
Fillaoucene	8960	/	0
h./ boughrara	9260	1.68	5509
Maghnia	17950	6.89	2606
o./ riah	6580	9.52	691
Remchi	6510	25.94	251
Zenata	4260	20.88	204
Total w. tlemcen	**583000**	**3.78**	**154271**

Table 2 : Species distribution according to biological types in the study area.

Stations	Fillaoucene		Hammam boughrara		Study area	
Biological types	Number	%	Number	%	Number	%
Th	45	46	34	38	58	42
Ch	23	23	17	20	31	22
He	22	22	17	20	30	21
Ph	7	7	12	14	14	10
Ge	2	2	7	8	7	5
Total	99	100	87	100	140	100

The generic diversity among angiosperms is quite high compared to the gymnosperms and Clamydosperms, they have a total of 102 kinds.

Dicotyledonous also has the largest generic diversity with 82 kinds in total (80%), and to lesser degree monocots with 17 genera (17%).

At the study area 37 families in total were identified (fig. 6). For the vast majority; they are found in the two stations. However, families this great species diversity are in order: The Asteraceae, Poaceae, the Cistaceae the Fabaceae, the Lamiaceae, Liliaceae, the Pink Family and Brassicaceae.

If overgrazing continues the best forage species disappear (usually Poaceae and Fabaceae) (Chaieb *et al.,* 1991) and there remains only the less palatable species, or spiny, or strong odor and taste, or even toxic.

Phytogeography

One of the problems we found in this work is that of nomenclature phytochoriques elements varies from one author to another.

In our case we followed that of Le Houerou (1995), who made a floristic and phytogeographical analysis of the steppes of the arid zone of northern Africa.

The integration of the study area in the arid area from the point of view climate and flora, justifies our choice.

Analysis in fig. 7 shows that among the 140 plant species inventoried in the two study sites 97% are original or affinity Mediterranean, of which 46% are strictly Mediterranean (*Ajuga chamaepytis Bromus rubens, Erica multiflora Olea europaea Urginea maritima...*) 50% of Mediterranean-steppe (*Artemisia herba-alba, Asparagus stipularis, Asphodelus microcarpus, Atriplex halimus, Noaea mucronata, Pistacia atlantica, Salsola vermiculata ...*) and 1% of Saharo-Arabian. The species of Mediterranean origin is not in all 3%; [2% for the Euro-Siberian species (*Dactylis glomerata, Helianthemum intermedium, Sonchus tenerrimus*) and 1% for multiregional or cosmopolitan species (*Plantago lagopus, Gnaphalium luteo album*)].

Endemic is Maghrebian or Iberians are far from being dominant.

Among 140 inventoried species we have 7 Endemic Maghrebian species (5%) (*Centaurea macroccana, Centaurea involucrata, Chrysanthemum grandiflorum, Silene glaberrima Thymus ciliatus, Helianthemum helianthemoides, Solenanthus lanatus*).

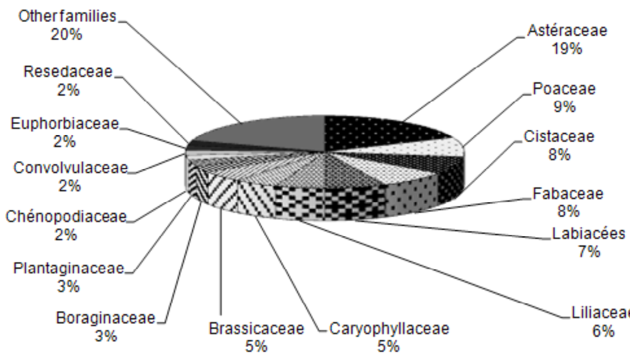

Fig. 6 : Rate of distribution of families in the study area.

Table 3 : The recovery of the vegetation according to biological types.

Stations	Fillaoucene		Hammam boughrara	
Biological types	P	R (%)	P	R (%)
Th	179	31	87	26
Ch	179	32	54	17
He	129	23	34	10
Ph	43	8	103	31
Ge	35	6	52	16

P : Présence, **R** : Recovery in %

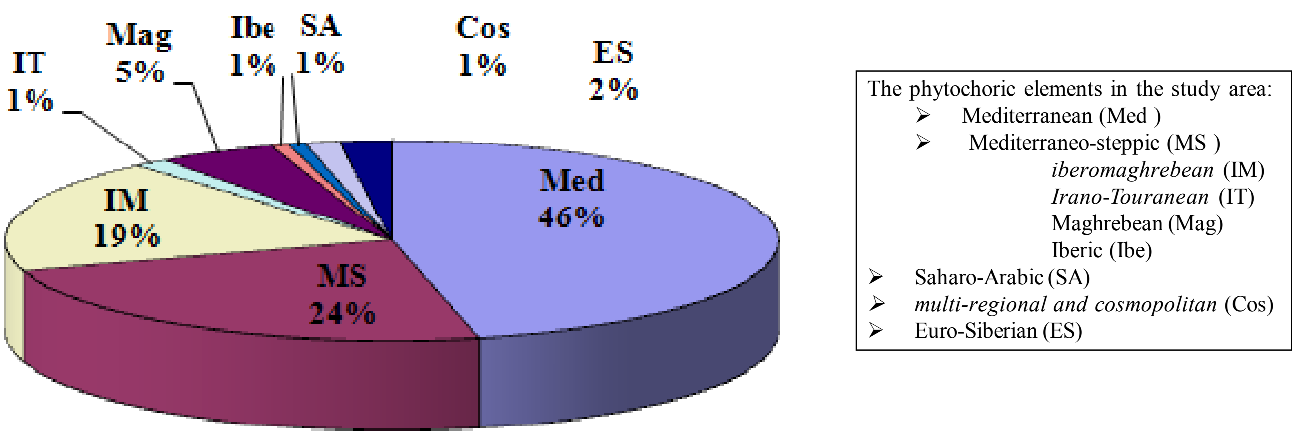

Fig. 7 : Distribution of phytochoric elements in the study area.

For the Iberian endemic species we record only *Santolina pectina* var. *squarrasa* at the Hammam Boughrara station.

Quezel (1999) states that the low rate of endemic elements throughout the region is linked to the disappearance of many species due to significant degradation of the environment. The element Iranian-Turanian plays a significant role with 2 species only (1%). Quezel (1983) reports that this flora is currently poorly represented in North Africa (forty taxa with rare endemic species).

Continuous grazing, probably increases the risk of local extinction of rare species by grazing the young shoots, eliminating the regeneration process.

The elimination or reduction of perennial species (dryland active) by overgrazing, as the essential factor of degradation in North Africa, like the study area, triggers the phenomenon of desertification.

The Saharo Arabian element is represented by a species *Anastatica heirocuntica* L, reflecting the absence of the Saharian influence.

Table 4 : Consistency of the flora of the study area.

	Species		Genres		Families	
	Numbrer	%	Numbrer	%	Numbrer	%
Dicotyledon	117	84	82	80	32	87
Monocotyledon	20	14	17	17	2	5
Other vascular plants	3	2	3	3	3	8
Total	**140**	**100**	**102**	**100**	**37**	**100**

Conclusion

The completion of this study allowed us to draw more comprehensive and accurate conclusions as well as on the evolution of the degree of ecosystem fragility.

Biologically analysis of plant diversity reflects the effect of disturbances anthropozoogéne even climate on the current organization of the vegetation structures.

The distribution of species according to biological types in the study area shows that Therophytes take precedence over others. The calculation of the index perturbation in each station confirms it; This clearly shows the extent of degradation.

In the toxonomic framework high generic diversity among angiosperms is recorded. We have a total of 140 plant species distributed among 37 families.

On the phytogeographic map we find that the majority of species (97%) are generally of Mediterranean origin or affinity.

Endemic elements are poorly represented like the Oranie because of the disappearance of many species due to increasing pressure due to population growth and an abuse of the environment.

Finally, despite the strong resilience of arid Mediterranean ecosystems, there seems to be a threshold not exceeding the extent where the continued degradation leads surely to an aridification of the environment and consequently to a reduction of the biodiversity.

References

Aafi, A. (2007). Étude de la diversité floristique de l'écosystème à chêne-liège de la forêt de la Mamora. Thèse de doctorat d'état (es-Sciences Agronomiques), I.A.V., Hassan II, Maroc. 190 p.

Aidoud, A. (1983). Contribution à l'étude des écosystèmes steppiques du Sud Oranais : Phytomasse, productivité primaire et applications pastorales. Thèse de doctorat, 3ème cycle, U.S.T.H.B., Alger, Algérie. 245 p.

Aidoud, A. (1997). Fonctionnement des écosystèmes méditerranéens. http://museum.agropolis.fr/pages/savoirs/biomes/MESOE_AIDOUD_conf03.pdf

Aimé, S. (1991). Étude écologique de la transition entre les bioclimats subhumides, semi-arides et aride dans l'étage thermo-méditerranéen du tell oranais (Algérie occidentale). Thèse de doctorat. Université Aix-Marseille III, France

Aimé, S. and K. Remaoune (1988). Variabilité climatique et steppisation dans le bassin de la Tafna (Oranie occidentale). *Méditerranée,* **63** : 43-51.

Alcaraz, C. (1969). Étude géobotanique du pin d'Alep dans le tell Oranais. Thèse de doctorat, 3ème cycle, Fac., Sc., Montpellier, France.

Alcaraz, C. (1982). La végétation de l'ouest Algérien. Thèse de doctorat ès-sciences, Perpignan, France.

Amara, M. and M. Bouazza (2013). Contribution à l'étude des groupements à *Pistacia atlantica* Subsp. *atlantica* dans la plaine de Maghnia (Extrême nord-ouest algérien), phytosociologie et dynamique. *European Journal of Sientific Research,* **99** : 22-35.

Amara, M. (2003). Dynamique de la végétation des régions arides et semi-arides : cas de Fillaoucene et Hammam boughrara. Mémoire d'ingéniorat, Univ., Aboubakr belkaid, Tlemcen, Algérie.

Amara, M. (2008). Contribution à l'étude de *Pistacia atlantica* Desf. dans le Nord-Ouest Algérien: Aspects écologiques et cartographie. Thèse de magistère Univ., Tlemcen, Algérie.

Amara, M. (2014). Contribution à l'étude des groupements à *Pistacia atlantica* subsp. *atlantica* dans le Nord-Ouest algérien. Thèse de doctorat en sciences, Univ. Tlemcen, Algérie.

Aubréville, A. (1963). Classification des formes biologiques des plantes vasculaires en milieu tropical. *Adansonia,* **3** : 221-225.

Bagnouls, F. and H. Gaussen (1953). Saison sèche et indice xérothermique. *Bull. Soc. Hist. Nat.,* **88** : 193-239.

Bagnouls, F. and H. Gaussen (1957). Les climats biologiques et leurs classifications. *Ann. Geog.,* **335** :193 – 220.

Baguette, M. and R. A. Wesselingh (2002). Biogéographie. Université catholique de Louvain. Belgique. https://fr.scribd.com/doc/188020604/42843237-Biogeographie

Barbéro, M., G. Bonin, R. Loisel and P. Quezel (1990). Changes and disturbances of forest ecosystems caused by human activities in the western part of the mediterranean basin. *Vegetatio,* **87** : 151-173.

Benabadji, N. (1995). Étude phytoécologique de la steppe à *Artemisia herba-alba* Asso. Et à *Salsola vermiculata* L. au Sud de Sebdou (Oranie, Algérie). Thèse de doctorat Es-Sc., Univ. Tlemcen, Algerie.

Benabadji, N., M. Bouazza and A. Mahboubi (2001). L'impact de l'homme sur la foret dans la région de Tlemcen (Oranie-Algérie). *Rev. Foret Méditerranéenne,* **22** : 269-274.

Benabdelli, K. (1983). Mise au point d'une méthodologie d'appréciation de la pression anthropozogène sur la végétation dans la région du Telagh (Algérie). Thèse de spécialité Ecologie. Fac. Sci. Techn. St Jérome Marseille, France.

Bouazza, M. (1991). Etude phyto-écologique de la steppe à *Stipa tenacissima* L. au sud de Sebdou (Oranie, Algérie) .Thèse de doctorat en sciences, Fac., Sc. Marseille- Saint-Jérôme, France.

Bouazza, M. (1995). Étude phytoécologique des steppes à *Stipa tenacissima* L. et à *Lygeum spartum* L. au Sud de Sebdou (Oranie, Algérie), Thèse de doctorat, Es-Sci. Univ. Tlemcen, Algérie.

Bouazza, M. and N. Benabadji (1998). Composition floristique et pression anthropozo¿que au Sud-Ouest de Tlemcen. *Rev. sci. Techn.,* **10** : 93-97.

Bouazza, M., R. Loisel, N. Benabadji (2001). Bilan de la flore de la région de tlemcen (Oranie-Algérie). *Rev. Foret Méditerranéenne,* **22** :130-136.

Braun-Blanquet, J. (1951). Les groupements végétaux de la France méditerranéenne. C.N.R.S., Paris.

Carles, J. (1948). Le spectre biologique réel. *Bull., Soc., Bot.,* **95** :340-343.

Chaieb, M., C. Floret, E. Le Floc'h and R. Pontanier (1991). Life history strategies and water resource allocation in five pasture species of the Tunisian arid zone. *Arid Soil Research and Rehabilitation*, **6** : 1-10.

Daget, Ph. (1980). Sur les types biologiques en tant que stratégie adaptative. (cas des thérophytes) . In : Barbault R ; Blandin P et Meyer J.A. (eds.), Recherches d'écologie théorique, les stratégies adaptatives, Maloines, Paris : 89 - 114.

Dahmani, M. (1989). Les groupements végétaux des Monts de Tlemcen (ouest algérien) : Syntaxanomie et phytodynamique. *Biocenoses*, **4** : 28 - 69.

Dahmani, M. (1997). Le chêne vert en Algérie : Syntaxanomie, Phytoecologie et dynamique des peuplements. Thèse de doctorat, Es., Sci., U.S.T.H.B. Alger, Algerie.

Durietz, E. (1920). Zune methodogischen Graudlage der moderner pflanzensoziologie. *Uppsala*, 252 p.

Floret, Ch. and R. Pontanier (1982). L'aridité en Tunisie présaharienne : Climat, sol, végétation et aménagement, Mémoire de thèses, Travaux et documents de l'O.R.S.T.O.M., Paris.

Frontier, S. and D. Pichod-Viale (1993). Ecosystèmes : structure, fonctionnement, évolution. Paris, 2[eme] édition Masson.

Gounot, M. (1969). Méthodes d'étude quantitative de la végétation. Paris, éd. Masson.

Grime, J. P. (1977). Evidence for the existence of three primary strategies in plants and its relevance to ecological and evolutionary theory. *The american Naturalist*, **111** : 1169-1194.

Guinochet, M. (1955). Logique et dynamique du peuplement végétal. Phytogéographie – Phytosociologie, Biosystématique , Applications Agronomiques. Paris, Edit., Masson et C[ie].

Hasnaoui, O. (2008). Contribution à l'étude de la chamaeropaie de la region de Tlemcen : Aspects écologiques et cartographie. Thèse de Doctorat, Univ. Abou bekr belkaid, Tlemcen, Algérie.

Le Floc'h, E. (2001). Biodiversité et gestion pastorale en zones arides et semi-arides méditerranéennes de Nord de l'Afrique. *Bocconea*, **13** : 223-237.

Le Houérou, H. N. (1989). Classification écoclimatique des zones aride (S.I.) de l'Afrique du Nord. *Ecologia Mediterranea*, **15** : 95-144.

Le Houérou, H. N. (1993). Changements climatiques et désertisation. *Sécheresse*, **4** : 75-111.

Le Houérou, H. N. (1995). Bioclimatologie et biogéographie des steppes arides du Nord de l'Afrique. *Options méditerranéennes*, série B, N°10, Montpellier, C.I.H.E.A.M.

Long, G. (1974). Diagnostic phyto-ecologique et aménagement du territoire : Principes généraux et méthodes. Paris, Ed. Masson et Cie.

MATE (Ministère de l'Aménagement du Territoire et l'Environnement) (2014). 5eme rapport national sur la mise en oeuvre de la convention sur la diversite biologique au niveau national. MATE/PNUD, Algérie : https://www.cbd.int/doc/world/dz/dz-nr-05-fr.pdf

Mesli-Bestaoui, Kh. (2009). Contribution à une étude écologique et dynamique de la végétation des monts de Tlemcen par une approche cartographique. Thèse de doctorat. Ecol. Vég. Univ. Tlemcen, Algérie.

Meziane, H. (2004). Contribution à l'étude des psammophiles de la région de Tlemcen. Mémoire de Magistère, Ecol., Vég., Univ., Tlemcen, Algérie.

Mullenbach, P. (2001). *Reboisements d'altitude*. Edit. Quae.

Nègre, R. (1966). Les thérophytes. *Mem. Soc. Bot.* Fr. : 92 - 108.

Ozenda, P. (1963). Organisation et reproduction des Angiospermes. In Botanique : anatomie, cycles évolutifs, systématique : 465-722. Paris, Masson et Cie.

Polunin, N. (1967). Elémnents de géographie botanique .Gauthier-Villars ,Paris.

Quezel, P. (1965). *La végétation du Sahara du Tchad la Mauritanie*. Stuttgart, Édit. Fisher Verlag.

Quezel, P. (1976). Les forets du pourtour méditerranéen, In: Note Techn. M.A.B., 2, UNESCO, Forets et maquis méditerranéens: écologie, conservation et aménagements, Paris, 9-33.

Quezel, P. (1983). Flore et végétation actuelles de l'Afrique du nord, leur signification en fonction de l'origine, de l'évolution et des migrations des flores et structures de végétation passées. *Bothalia,* **14** : 411-416.

Quezel, P. (1999). Biodiversité végétale des forets méditerranéennes, son éventuelle d'ici à trente ans. *Foret Méditerranéenne*, **10** : 19-32.

Quezel, P. (2000). Réflexion sur l'évolution de la flore et de la végétation au Maghreb méditerranéen. Paris, Édit., Ibis Press.

Quezel, P. and F. Médail (2003). *Écologie et biogéographie des forêts du bassin méditerranéen*. Paris, Elsevier.

Quezel, P. and S. Santa (1962-1963). Nouvelle flore de l'Algérie et des régions désertiques méridionales. C.N.R.S., Paris.

Quezel, P., F. Médail, R. Loisel and M. Barbéro (1999). Biodiversité et conservation des essences forestières du bassin méditerranéen. *Rev. Unasylva. La Forêt Méditerranéenne,* **50** : 21-8.

RaunKiaer, C. (1934). *The life form of plants and statistical plant geography*. Oxford Univ. Press.