A NOTE ABOUT THE REGRESSIVE DYNAMICS OF THE VEGETATION IN SEMI-ARID AND ARID REGIONS: CASE OF THE MAGHNIA PLAIN (ORANIE-ALGERIA)

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Abstract*. The arid and semi-arid regions of the extreme west of Algeria, as in the study area, represent in the current state, a transitional environment between the steppes and matorrals. Our objective being the floristic and ecological characterization of the vegetation of the study area and thus to seize the dynamic aspects and the evolution of the groupings. The method of Transects is used to know easily and quickly the effect of the modifications of the environment (exposure, slope, ground...) on the distribution of the vegetation in other words to determine to understand the dynamics. The results obtained are likely to provide us with valuable information as well on the evolution as on the situation of the degraded zones. Indeed, steppe and presteppe vegetation occupy important surfaces, but also in a more limited way almost everywhere in the region. The pre-steppe vegetation with xeric determinism has remained essentially confined to the altitudes, with an extremely low development and where the grassy and therophytic cover clearly dominates. Despite the intensity of anthropogenic degradation, the irreversibility stage is not yet achieved; since the advent of a rainy period leads to a more or less rapid recovery of the vegetation.*

Keywords*: Regressive dynamics, Transect, Phyto-ecology, Arid/semi-arid, Maghnia (Oranie - Algeria).*

INTRODUCTION

It is well-known that in the Mediterranean arid and semi-arid zones of North Africa, repeated droughts have contributed, to some extent, especially during the last two decades, to worsening the situation of the water balance and edaphic aridity and consequently the organization of vegetation structures.

However, according to LE HOUEROU (1993), the impact of these droughts was minor or insignificant when the human and animal impact was minimal or absent.

This indicates that anthropic action is the origin of desertification in arid and semi-arid areas, such as the Mediterranean regions with arid and semi-arid climates, which are subject to a harmful and continuous ecological disequilibrium, caused by excessive exploitation of their natural resources, as confirmed by these authors: AIMÉ (1991), BENABADJI (1991), QUEZEL *et al.* (1992-1994) , BARBERO AND QUEZEL.(1995), AIDOUD (1997), TATONI *et al.* (1999),TATONI (2000) ,QUEZEL (1998-2000),TATONI (2000) BOUAZZA *et al.* (2001), BENABADJI *et al.* (2001) , AMARA (2003), ACHHAL *et al.* (2004), AMARA (2008), MESLI-BESTAOUI , (2009), AMARA (2014), AMARA *et al.* (2016) , AMARA *et al.* (2017).

The pre-forest and steppe areas are the scene of a negative and continued ecological instability resulting from the very high charge they receive in one hand, and their low production, on the other hand. (BOUAZZA and BENABADJI, 1998).

The region of Maghnia, an integral part of the extreme west of Algeria, has been chosen as a study model to analyze the phenomenon of desertification, because it is threatened like the steppe areas, by this scourge that constitutes a major risk.

This threat is only really apparent at the level of the ecological station where the effects of anthropozoic disturbances on the environment are more significant.

It is at this level of perception that this comparative study was carried out between the two selected stations Fillaoucene and Hammam boughrara.

Study area

The test territory is located in the North-West of the wilaya of Tlemcen as well as on a national scale (Figure 1).

The study area extends from 1°44' West longitude to 1°30' East longitude. In latitude it extends from 34°66' to 34°84' North latitude.

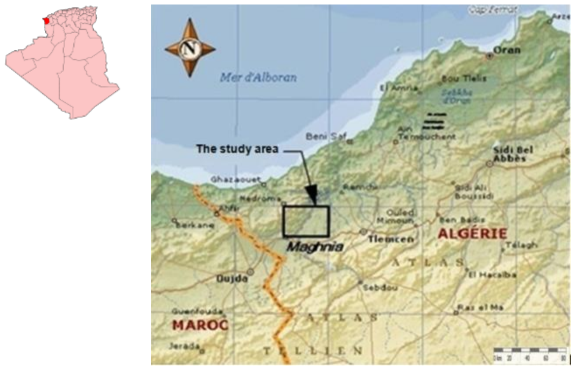

Fig.1. Location of the study area

Bio climate

During both periods, the study area is characterized by a stability of the semi-arid bioclimatic stage, despite the decrease of the Q2 rate.

On the other hand, this variation results in a shift of the bioclimatic stage from semi-arid to arid in Maghnia (Table1).

In Orania, BARBÉRO AND QUÉZEL (1995) confirm this trend of aridification but with a different process depending on whether one is in the coastal region or in the continental steppe.

Indeed, over a 30 to 40 year interval, the coastline suffers a water deficit that can reach 200mm, while in the continental steppes, temperatures have generally increased by 1 to 2°C across "m".

This type of climate change probably also causes a change in plant formation by the proliferation of arid-active species in favor of other arido-passive species.

Table 1

Emberger Q2 values and the bioclimatic levels

Stations	Période	m °C	Q2	Q3	Bioclimatic levels and thermic variants
MAGHNIA	1980-2013	3,41	28 ,38	28,48	Arid to temperate winter
	1913-1938	3,3	48,82	48,77	Semi-arid to temperate winter
ZENATA	1980-2013	5,47	42,21	42,34	Semi-arid to temperate winter
	1913-1938	6,7	64,04	64,26	Semi-arid to temperate winter

MATERIALS AND METHODS

The Sampling

At the landscape scale, two major physiognomic units are well distinguished in space according to their floristic composition (steppe vegetation and pre-forest matorral groups at higher altitudes).

A second vision on a larger scale (ecological station) within these selected groups, guided the choice of the location of transects.

We adopted this linear sampling method very appropriate for our work allows on the one hand, to relate the vegetation and the environment, using gradient of ecological variability, such as microtopography, substrate, salinity, and on the other hand to study the horizontal and vertical structure of the vegetation (BOUAZZA *et al.*,1994).

In our study area to relate the vegetation and the environment according to the gradients of ecological variability (topography, type of soil) we had recourse to a systematic sampling by transects.

RESULTS AND DISCUSSIONS

Transect n°1 (Fillaoucene station) (Figure 2)

This transect extends over a distance of 120 meters, with a NW-NE orientation and a slope of 32%. The drop is 54 meters over the total length. the micro-relief is characterized by the appearance of the mother rock, deposits of pebbles and conglomerates with a deep gully at the 72nd meter where we find in the latter that the *Noaea mucronata*.

The cohabitation of *Salsola vermiculata* and *Atriplex halimus*, at the bottom of this transect witnesses of the salinity of the substratum.

In 36 plots aligned along this transect we have inventoried 26 species with heterogeneous frequencies of appearance (Table 2).

The most dominant species are *Artemisia herba-alba* with 21 presence (58%), and to a lesser degree *Vella annua, Asteriscus maritimus, Fagonia cretica*.

Micropus bombycinus is also more or less frequent; it shows an advanced degradation and a thin film of sand on the surface of the soil (BENABADJI , 1991).

The presence of nitratophilous species along the transect is not negligible.

On the whole they are represented by 24 individuals divided between *Bromus rubens* (13 presence) and *Plantago albicans* with 11 presence.

On average, the species/plot ratio of 0.72 indicates the low specific richness of the transect (Figure 3).

It is clearly shown in (Figure 2) that the number of species is largely variable from one plot to another.

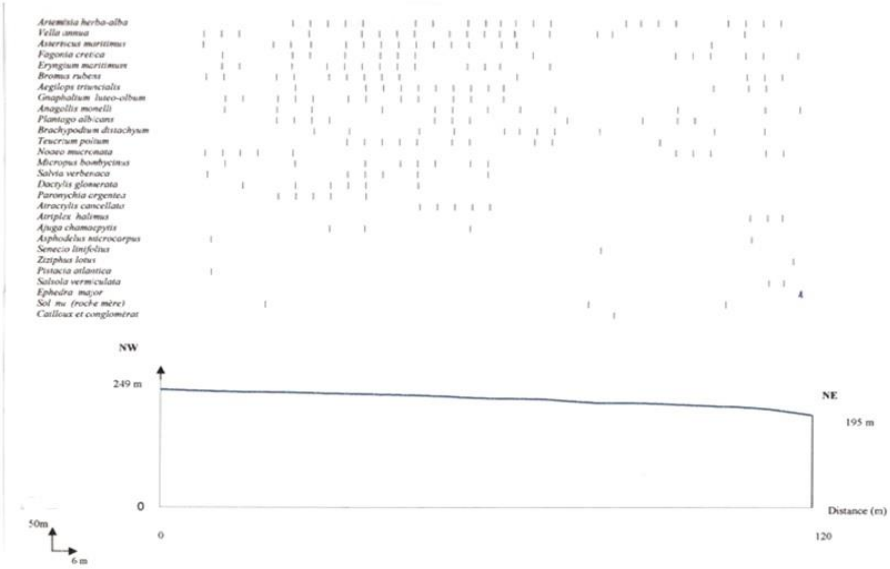

Fig. 2. Phyto-ecological transect (station N°1: Fillaoucene)

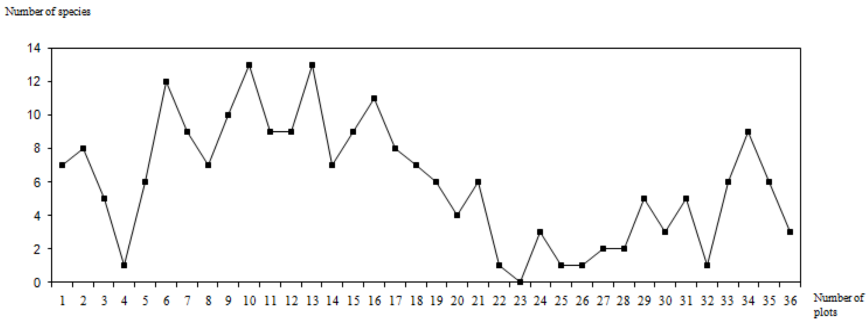

Fig.3.The specific richness of transect (Fillaoucene)

The first 48 meters (going from NW to NE), i.e. the first 16 plots, are characterized by a fairly high species richness, except at the 12th meter where the outcrop of the bedrock appears; *Noaea mucronata* appears.

From the 17th plot, the more the number of plots increases, the more the number of species decreases.

This floristic impoverishment is accompanied by an uneven microtopography (bedrock, bare soil, pebbles and conglomerates and a deep gully) which is the result of intense erosion.

To these conditions settle only the most adapted species such as: *Plantago albicans* and *Artemisia herba-alba, Senecio linifolius*.

At the level of the 34th plot of this transect we record a rise again in the number of species due to the colonization of halophytes such as: *Salsola vermiculata, Atriplex halimus* , with other steppe species such as *Artemisia herba-alba* , *Noea mucronata* and *Ziziphus lotus* .

From the point of view of biological types, the distribution remains homogeneous between the champhytes and the hemicryptophytes (seven species for each)
While the therophytes are in number of eight with high frequencies as *Vella annua* (17 presence) that is 47% and *Aegilops triuncialis* (13 presence) that is 36%, implies an accentuated degradation.
The organization of *Artemisia herba-alba* and *Noea mucronata* along this transect is very significant. Indeed it seems that the competition settles between them, except for the last 34 and 35 plots where they are found together.

Table 2

The frequencies of apparition of the species with their biological types in the transect N°1.

Taxons	Biological Types	Number of presence / plot	%
Artemisia herba-alba Asso.	Ch	21	58
Vella annua L.	Th	17	47
Asteriscus maritimus (L.) Less.	Ch	15	42
Fagonia cretica L.	Ch	14	39
Aegilops triuncialis L.	Th	13	36
Bromus rubens L.	Th	13	36
Eryngium maritimum L.	He	13	36
Anagallis monelli L.	He	12	33
Gnaphalium lute-album L .	Th	12	33
Brachypodium distachymum (L.) P.B.	Th	11	31
Plantago albicans L.	He	11	31
Noaea mucronata (Forsk.) Asch. Et Schw.	Ch	10	28
Teucrium polium L.	Ch	10	28
Micropus bombycinus Lag.	Th	8	22
Dactylis glomerata L.	He	6	17
Salvia verbenaca (L.) Briq.	Ch	6	17
Atractylis cancellata L.	Th	5	14
Paronychia argentea (Pourr.) Lamk.	He	5	14
Ajuga chamaepytis Scherb.	Ch	3	8
Atriplex halimus L.	Ch	3	8
Asphodelus microcarpus Salzm.etViv.	Ge	2	6
Pistacia atlantica Desf.	Ph	1	3
Salsola vermiculata L.	He	1	3
Senecio linifolius L.	He	1	3
Ziziphus lotus (L.) Desf.	Ph	1	3
Ephedra major Host.	Ph	1	3

Ch :Chamephytes ; Ph : Phanerophytes ; Ge :Geophyte ; He :Hemicryptophytes ; Th : Therophytes

Transect N°2 (Hammam Boughrara station) (Figure 4)
This transect was carried out over a distance of 60 m following a NE-NW orientation.
It is characterized by a difference in level of 55 m and a slope of 28%. It is quite comparable to the first transect, but with a higher altitude.
In total, 22 species were inventoried and distributed on 17 plots along the transect. The frequency of species varies according to their adaptive strategies to the environmental conditions.
The examination of (Table 3) shows us that the most frequent species are:
Fagonia cretica with 15 presence or 88%, *Asphodelus microcarpus* and *Vella annua* with 11 presence for each or (65%) *Plantago albicans*10 presence, *Anagallis monelli, Asparagus stipularis* with 9 presence.
Fagonia cretica colonizes mainly rocky areas and dry pastures (QUEZEL AND SANTA 1962-1963), this is our case.

The vegetation of this transect is characterized by the apparition of anthropozooic plants such as Asphodelus microcarpus and Calycotome villosa Subsp. intermedia indicating the frequent passage of the herd. The dominance of *Plantago albicans*, a species well adapted to pastures also confirms it clearly.
Urginea maritima occupies the bottom of this transect taking advantage of the phenomenon of hydric compensation.
We also notice that the dominant species in transect 1 as, *Micropus bombycinus, Ajuga chamaepytis*, present rather weak frequencies. *Vella annua* is still important in both transects.
The presence of *Lygeum spartum* and *Artemisia herba-alba* remains negligible,
BOUAZZA (1991) reports that the stands of *Lygeum spartum* and *Artemisia herba-alba* occupy only the steep slopes of the ravines where the runoff and erosion are intense and frequent.
The distribution of species is homogeneous along the transect (Figure 5).
The calculation of the species/plot ratio of 1.29 indicates a fairly dense vegetation.
The cover rate is significantly higher than the first transect of the fillaoucene station.

Table 3

The frequencies of apparition of the species with their biological types in the transect N°2.

Taxons	**Biological Types**	**Number of presence / plot**	**%**
Fagonia cretica L.	Ch	15	88
Asphodelus microcarpus Salzm. et Viv.	Ge	11	65
Vella annua L.	Th	11	65
Plantago albicans L.	He	10	59
Anagallis monelli L.	He	9	53
Asparagus stipularis Forsk.	Ge	9	53
Euphorbia nicaeensis All.	Ch	6	35
Withania frutescens Pauquy.	Ph	5	29
Eryngium maritimum L.	He	4	24
Gnaphalium lute-album L .	Th	4	24
Limonium thouini Viv.	Th	4	24
Ajuga chamaepytis Scherb.	Ch	3	18
Artemisia herba-alba Asso.	Ch	3	18
Calycotome villosa subsp. *Intermedia* *(* Salzm.)Maire	Ph	2	12
Olea europaea L.	Ph	2	12
Anthyllis tetraphylla L.	Th	1	6
Lavandula multifida L.	Ch	1	6
Lygeum spartum L.	He	1	6
Micropus bombycinus Lag.	Th	1	6
Tetraclinis articulata (Vahl.) Masters.	Ph	1	6
Urginea maritima (L.) Baker	Ge	1	6
Zizphus lotus (L.) Desf.	Ph	1	6

Ch :Chamephytes ; Ph : Phanerophytes ; Ge :Geophyte ; He :Hemicryptophytes ; Th : Therophytes

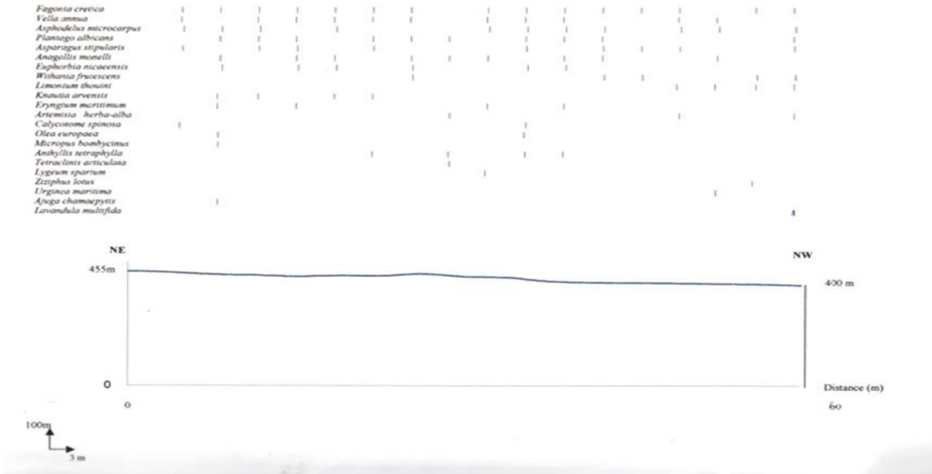

Fig. 4. Phyto-ecological transect (station N°2 : Hammam boughrara)

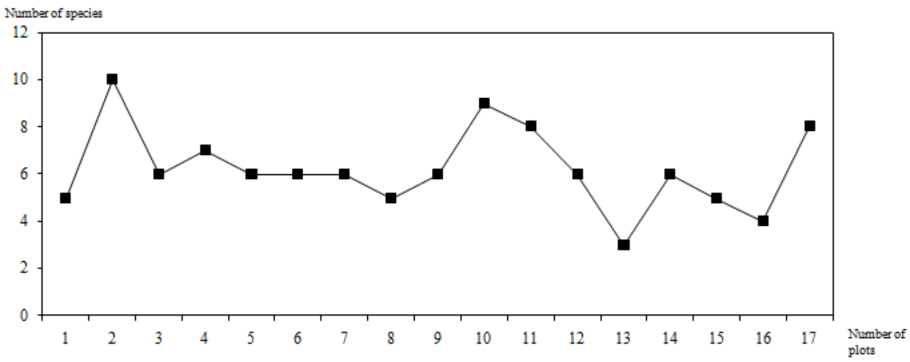

Fig. 5.The specific richness of transect : Hammam boughrara)

According to the conditions of environment, a biological type often takes the step completely on the others. (FLORET *et al.*, 1982) showing certainly the dynamics sense.
The links of contiguity between plant communities according to ACHOUR KADI-HANIFI *et al.*, 1997 allow to advance hypotheses of evolution of the groupings in spite of the static character of the approach, from where the not of synchronic study of the dynamics.
As a comparison (Figure 6) the high rate of Theophytes, Chamephytes and Hemicryptophytes in the station of fillaoucene to pre-steppe formation decreases at the level of the station of hammam boughrara to more forest formation (matorral), to the benefit of Phanerophytes with 5 species and Geophytes with 3 species which confirms the results of AMARA (2016) about the distribution of the biological spectrum in the tellian plain of Maghnia.

The richness of therophytes and champhytes at the level of a plant formation probably reflects a high degree of disturbance that easily triggers the beginning of regressive dynamics.

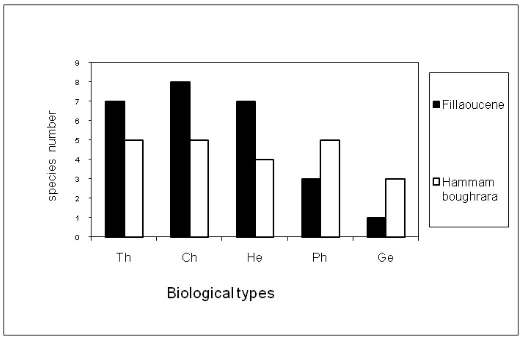

Fig. 6. Biological spectrum of the transects for the two stations

CONCLUSIONS

The results obtained using the transect method, which is faster than the phytosociological method, remain similar to those obtained by AMARA M. AND BOUAZZA (2016) since The passage from the station of Hammam boughrara to the station of Fillaoucene in the plane of maghnia is attested by the triggering of regressive phenomena, such as the expansionist evolution of thorny species (*Aspargus albus*, *Calycotome villosa* ...) and / or toxic (*Asphodelus microcarpus*) to the benefit of palatable species (*Lavandula multifida*).

The consequences of this regressive dynamic are:

- An important change of the floristic composition which varies in the direction of aridity (steppisation),
- A modification of the structure of the vegetation,
- A reduction of the vegetation cover.

The extreme degradation of resources and environments, which is sometimes too quickly called "desertification", can under certain conditions be repaired; this is partly the object of restoration ecology. (LE FLOC'H, 2001)

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