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Sustainability of sheep farming systems: the case of the northern area of Laghouat/Algeria

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Abstract. Algerian steppe rangelands are in crisis. Recurrent droughts and increasing anthropogenic pressure, on space downsizing increasingly, are exacerbating the already downgrading steppe ecosystem. This situation is obviously not without effects. Rangelands are highly degraded giving rise to a recovery rate not exceeding 50% thereby exposing the rest of the rangelands which become vulnerable to desertification. In socioeconomic terms, we are witnessing the gradual but certain disappearance of traditional pastoralism. The aim of this paper is to analyse the strategy adopted by sheep herders to deal with these changes. The results of the typology (ACM) survey carried out in the northern part of the province of Laghouat show that the traditional way of life linked to the transhumance is disappearing. In fact, the remaining farmers (about 10% of respondents) keep on practicing this way of life with more than 100 cattle head. Most farmers with herd size between 20 and 80 head tend to settle down, whereas 90% of them use tents as a permanent shelter. This settlement results in new modes of farming such as the five-fold increase in arable land.

Keywords. Algerian steppe – Agro-pastoralism – Farming system – Transhumance – Settlement.

Durabilité des systèmes d'élevage ovins : lec as de la zone nord de la wilaya de Laghouat /Algérie

Résumé. *Les parcours steppiques Algériens sont en crise. Les sécheresses récurrentes et la pression anthropique croissante sur un espace de plus en plus réduit, accentuent le déséquilibre déjà très avancé de l'écosystème steppique. Cette situation n'est évidemment pas sans effets. Les parcours sont très dégradés donnant lieu à un taux de recouvrement ne dépassant pas les 50% exposant ainsi le reste des parcours, devenus vulnérables à la désertification. Sur le plan socioéconomique, on assiste à la disparition progressive, mais certaine du pastoralisme traditionnel (Le Houérou, 1985 ; Nedjraoui et Bedrani, 2008, Daoudi* et al.*, 2013). Cette étude a pour but de déterminer et d'analyser la stratégie adoptée par les éleveurs ovins, pour faire face à ces bouleversements. Les résultats de la typologie (ACM) de l'enquête réalisée dans la zone Nord de la wilaya de Laghouat, montrent que le mode de vie traditionnel lié à la transhumance est en voie de disparition. En effet, seul 10% des enquêtés continue de le pratiquer avec un cheptel supérieur à 100 têtes. Par contre, la majorité des éleveurs, dont la taille du cheptel varie entre 20 et 80 têtes, ont tendance à se sédentariser. 90% des enquêtés ont substitué les tentes au profit des habitations en dur. Cette sédentarisation a donné lieu à de nouveaux modes d'exploitation comme l'extension des superficies labourées qui a été multipliée par cinq.*

Mots-clés. *Steppe algérienne – Agro-pastoralisme – Système d'élevage – Transhumance – Sédentarisation.*

I – Introduction

A broad consensus has emerged around the advanced state of degradation of the Algerian steppe as well as the causes (natural and anthropogenic) leading to this situation. Recurrent droughts and increasing anthropogenic pressure on little space, downsizing increasingly, are exacerbating the already downgrading steppe ecosystem. In addition, the high degree of mechanization, development land, mass imports of animal feed by government are additional artificial elements favouring large herds. The issue is related to what strategies pastoralists and agro-pastoralists can develop due to the gradual but certain disappearance of traditional pastoralism (Le Houérou, 1985; Nedjraoui et Bedrani, 2008; Daoudi *et al.,* 2013).

II – Materials and methods

The method used to determine and analyse strategies adopted by sheep herders to deal with these changes is mainly based on direct site-investigation. The investigation was carried on a sample of 600 breeders of a population of 6000 in the scattered area in the north of Laghouat Department (Wilaya).

Three variables have been considered: the plowed fields, lands under cultivation and housing system. Using the GPS and the Map Info software, we have mapped each one of these parameters. Statistical analysis of the data collected was performed using the Multiple Correspondence Analysis (MCA) and Hierarchical Ascending Classification (CHA).

III – Results and discussion

1. Characterization of respondents (typology)

This classification allowed us to distinguish two main classes (C1, C2). Class 1 (C1): In this class, we find individuals under C1a who are located in the positive part of axis 2 and C1b and C1c are located in the negative part of the first axis.

Class 2 (C2) is located in the positive side of axis 1. In addition, it consists of two sub-classes with 110 and 120 individuals, respectively.

This class distribution seems heterogeneous. Their characteristics are as follows: Class 1 (C1) - breeders formed by subclasses c1a (breeders) c1b (cow-feeders) c1c (feeders); Class 2 (C2) farmers formed by c2a subclasses (intensive) c2b (extensive). Cf Table 1.

The classes mentioned are drawn by an in-depth diagnosis of individuals' responses illustrated in the questionnaires in Table 1.

Table 1. Summary table of classes

C1 breeders			C2 farmers	
C1a	C1b	C1C	C2a	C2b
80	189	101	110	120

2. Indicators of change

To understand the impact of exploitation modes, we try to interpret the results according to the classification results of the statistical test and the influence of each variable on these classes concerned. To understand changes going on, we will first deal with farming (with its three sub-classes) and then, with crop production (with its two sub-population).

A. Farming

Almost all individuals of this class perceive that climate change impacts the livestock systems known in this region.

The first subclass (C1a) confirms that the practice of transhumance is not the same as in the past. Moreover, there is a downsizing of transhumance in distance and time. This change is due primarily to rangeland degradation transhumance areas and the disappearance of the majority of water points. The number of livestock, owned by contribution, is reduced by 60% of respondents

in this class. For example, the town of Hadj Mechri does give evidence of the evolution of the type of shelter by a synchronic comparison between 1968 and 2008.

The second subclass (C1b) is considered as a transitional subclass between the first and the third: 90% of these individuals have given up transhumance and have become sedentary. They use a private space. They are supported by supplementary feeding compensates. Food shortages, resulting from these courses, provide a small part of food. This sub-population confirms that climate change imposes new conditions. It can be explained by the transition from one way of a semi-extensive livestock to ranching fashion.

The third subclass (C1c) consists of feeders who have a small number of sheep periodically renewed, with small areas for forage. This sub-population suggests that intensive breeding is currently more profitable. This is explained by the high travelling costs and the fact that the breeding system no longer bears the burden of sheep as before: 80% of them have wells for irrigation and watering.

A seasonal shift observed by farmers is confirmed by 90% of this class. It can be summarized as follows:

(i) Frost periods are from January until May and require an additional power supply and more loads.

(ii) Lack of rains: this phenomenon requires that farmers change some of their mowing practices and delay other practices (transhumance, immunization, control, etc.).

(iii) Effects on parturition in sheep.

(iv) Sheep losses (see a circle of correlation): there is a high correlation between the variables and the number of sheep lost: 80% of this class shows that the mortality rate is higher than before, despite the intervention of the State in immunizing against the MLRC, permanent presence of veterinarians, and high rates of climate hazards (flood, hail, wind and sand).

B. Agriculture (crop production)

The second class needs more understanding. It is characterized by producing crops responding to the needs of the sheep. Nearly 60% of respondents are expanding their areas. This has a high correlation with the practice of the technical rotation as it is shown in the circle of correlation (axe2. F2 - Fig. 1). Drilling and storage basins are used, which means the adoption of neo-irrigation (sprinkle, drip). These changes clearly reflect the passage of ancestral subsistence farming to modern agriculture for commercial purposes. Respondents of this class confirm that rain-fed agriculture contribution is limited and precipitation became random, even though traditional wells produce a limited amount of water. The same applied to soils that become poor which require a rest period of at least one season. Nearly 80% of individuals of this class say that climate change has a direct impact on the planting dates. Temperature instability causes harvest delay. This phenomenon might become a major threat to the quality and quantity of agricultural production. Two sub-classes are constructed.

The first subclass **(C2a)** is based on intensive agriculture. It is characterized by the establishment of monoculture (potato, onion) with extensive use of chemical inputs (insecticides, pesticides, fertilizers, soil-enhancing elements) and mechanization. Despite the means and efforts, 70% of respondents reported that the yield is still low and especially in cases where there was a preceding crop. This forces farmers to change the plots every year (extension, location). Soil loss is amplified by the various degradation factors (biotic and abiotic).

The second subclass **(C2b)** is based on extensive agriculture. The production is low: 70% of individuals are on crop. There is a lack of irrigation facilities. Rain is considered as the only means of irrigation. This eliminates the proficiency in production with an unstable output at this time: 30% of this sub-population are specialized farmers in local agriculture (lettuce, spinach, parsley, coriander, mint) in small areas using traditional means of irrigation (irrigation channel). These individuals suggest that the frozen period interrupts their activity. They are sometimes forced to repeat the sowing operation two or three times with an additional quantity of seed.

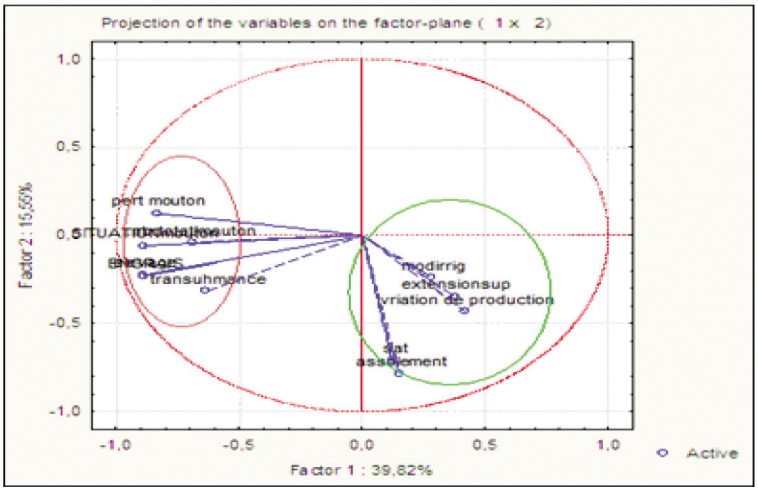

Fig. 1. Diagram components after rotation in space.

In the light of the map in the town of Hadj Mechri land, we can see that the plowed area is a fifth of the total area (12040 ha on 65270 ha) of the town. We can note also that the district of Hadj Mechri is a common steppe but clearings made by the agro-pastoralists have contributed to reduce, in the long run, the expansion of arable land. According to a study by the HCDS conducted in 2008, the town of Hajj Mechri only has an arable surface area of 1200 ha that is reflected in the alarming increase share of plowed land in the study area. To reverse the phenomenon, urgent actions are needed.

Our survey revealed a wide difference in comparison with statistics published by the DSA of Laghouat. In fact, it considers that the total area plowed covers 1100 ha while the results on the ground are about 12,040 ha, i.e a difference of 10,940 ha.

IV – Conclusions

The situation of the steppe, reflected in particular by the low forage supply, forced agro-pastoralists to change the breeding system and adopt a new system. All agro-pastoralists tried to counteract the negative effects of these changes, almost plowing (clearing), so having resort to irrigation in order to produce a feed supplement for the intensification of livestock production (fattening). Transhumance, once systematically practiced by all agro-pastoralists, is maintained actually mainly by ranchers. The decline of traditional tribal social organization resulted in the abandonment of traditional housing systems (tent) in favour of solid construction shelters.

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