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The 22nd International Grassland Congress (Revitalising Grasslands to Sustain Our Communities) took place in Sydney, Australia from September 15 through September 19, 2013.

Proceedings Editors: David L. Michalk, Geoffrey D. Millar, Warwick B. Badgery, and Kim M.

Broadfoot

Publisher: New South Wales Department of Primary Industry, Kite St., Orange New South Wales, Australia

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How agro-pastoralists adapt to climate change in the Algerian steppe?

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Keywords: Algeria, steppe grasslands, climatic changes, agro-pastoralists, North Africa.

Introduction

The Algerian steppe grasslands cover about 30 million ha located between the 100 and 400 mm isohyets. It feeds about 15 to 23 million sheep and goats, depending on the year (MARA 1974). To assist agro-pastoralists plan for future we wanted to know:

- What perceptions do different pastoralists and agro-pastoralists have of climate change?
- Have these land users changed the way they are managing their livestock and crop production enterprises? and,
- How do changes adopted differ pastoralists and agro-pastoralists?

Methods

Location of the study

A survey was conducted in June, July and August, 2011 with 600 pastoralists and agro-pastoralists (farmers) living in remote rural areas (*i.e.* outside urban) of 12 municipalities covering the steppe in the North of the Wilaya (or Province) of Laghouat (Fig. 1). The survey was conducted at weekly markets with people who come to sell their sheep and who kindly agreed to be interviewed and provide details of their agricultural resources, main enterprises and management practices.

Analysis of the survey

We used principal component analysis (PCA) to identify the factors that account for most of the variance in the survey data. The three criteria most likely to influence perception on climate change were: herd size (number of sheep), area of arable land and ploughing practice, and pasture area available. Four classes of farms emerged: C1; C2; C3; and C4 (Table 1; Fig. 2).

Results

Perception of climate change

About 55% of agro-pastoralists had heard of climate change and had some understanding of the issue. Among those who have heard of climate change, 70% had heard about it via radio. All interviewees who have heard of climate changes, described the cause as a lack of rain, but all thought that temperatures will also rise significantly, and vegetation cover will decrease and sandstorms will occur with greater frequency resulting in greater sand accumul-



Figure 1. Location of the study area.

Table 1. Characteristics of the average farm.

	Number of agro-pastoralists per class	Average size of ewe by agro-pastoralist (ha)	Average acreage per agro-pastoralist (ha)	Average pasture area used by agro-pastoralist (ha)
Classe 1	416	16	44	67
Classe 2	138	33	91	176
Classe 3	34	32	109	562
Classe 4	12	38	55	2000
Total	600	22	58	159

ation in dunes. An overwhelming majority (88%) said that climate change in their region has resulted in a lack of water sources, especially in wadis.

There was wide divergence in answers to the question of when the effects of climate changes started: 29% thought that climate changes began in the 1960s and 1970s; 49% in the 1980s and 1990s; and 20% in the start of the 21st century. In fact, in Algeria, severe droughts began to affect the steppe grassland system in the early 1970s. These responses were replicated in the three consecutive surveys.

Changes in land management and livestock

The survey detected a shift in the ploughing practiced by agropastoralists with 45% of all classes indicating that there was more land cultivated now than in the 1960s. This is consistent with Bédrani's (1995) report that increased tillage is associated with increasing the productivity of pasture area than for producing more grain. About 30% of respondents reported less land cultivation than in the 1960s.

Livestock number have declined with 52% of those interviewed reporting that they have fewer sheep than in the

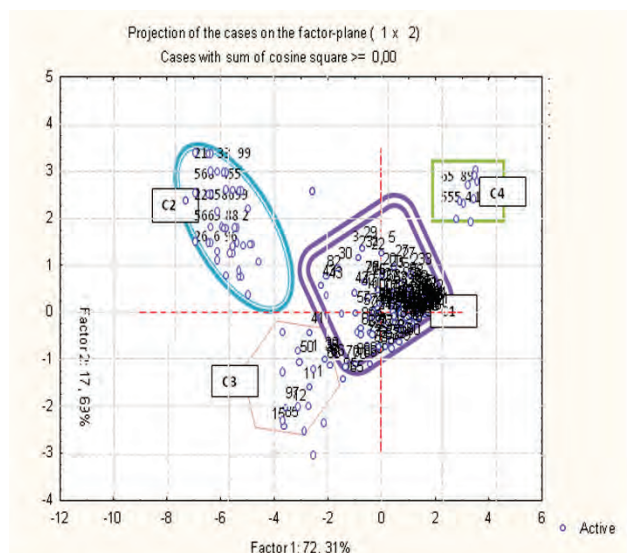


Figure 2. Choosing a classification of farms.

1960s, whereas 28% indicated that they have increased their sheep herd size. This is dependent on enterprise size with 67% of Class 4 (largest agro-pastoralists) saying they have increased their sheep herd size since the 1960s. However, there was general consensus that sheep numbers have declined from the sixties.

One approach to mitigate the negative effects of climate change is for farmers to practice herding sheep belonging to third parties in return for cash or in kind payments. Almost a third of respondents reported participating in this practice, predominantly small farmers who accounted for 76% of this category.

Another way for farmers to fight against the effects of drought is to practice fattening lambs with purchased feed. This new activity is practiced by only 16% of respondents, and again 77% are small farmers (Classes 1 and 2). The low proportion of agro-pastoralists farmers practicing fattening lambs is due to the large capital outlay required for this activity (purchase lambs lean and concentrates for food) when practiced on a medium to large scale.

Developing and expanding irrigation has emerged as another means to counter the effects of recurrent drought. More than 35% of respondents indicated that they use irrigation with the proportion is roughly the same for all classes. Although droughts frequency has intensified since the 1970s, irrigation developed is a more recent practice

with 79% of those who do use irrigation received subsidy as part of Government policy initiative that began in 2000. However, most of the irrigation is used for vegetable crops (e.g. potatoes) with only 12% of respondents using irrigation to grow fodder for their livestock.

Finally, herd management has changed because of climate change. For traditional management, livestock feed is supplied primarily from grazing whereas under current management 40% of farmers either purchase or produce themselves livestock feed needs. This rises to 61% purchasing most of their feed supplies in bad years. This reliance on grown or purchased feed has led to major changes in transhumance compared to the 1960s. In the 1960s, 65% of agro-pastoralists practiced transhumance, but in 2011 less than 22% moved livestock between summer and winter grasslands, particularly small and medium herd owners.

Conclusion

Climate change and its consequences are known to be a major issue by the majority of agro-pastoralists interviewed. According to our survey, they are well aware of the potential future increases temperatures, drought and wind erosion. Because climate change evident through increased frequency and severity of drought has diminish the quality and availability of pasture which, in turn, has reduced household profitability. The significant reduction in the number of sheep per household and the increase in feeding costs are the prime causes for reduced income from farming. The combination of these factors has pushed agro-pastoralists to change their management of their crop and pasture lands. All agro-pastoralists have tried to counter the negative effects of climate change by increasing land tillage, using irrigation if available and by intensification of livestock production systems by practicing pen fattening of lambs. Small and medium agro-pastoralists become sheep managers with payment for others. Transhumance, once practiced by almost all agro-pastoralists, is now a management system mainly used by larger ranchers because of its high cost.

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