

# Adaptation strategies of small ruminants production systems to environmental constraints of semi-arid areas of Lebanon

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**Abstract:** In Lebanon, the sheep and goat production sector has been undergoing drastic changes in response to serious constraints, mainly feed availability and seasonality of rainfall. This study focuses on the changes in the major small ruminant production systems (semi-nomadic, transhumant, sedentary and semi-sedentary) in marginal semi-arid lands of Lebanon, and the interaction between these systems and the environment, over a period of five years. All systems studied revealed major adaptation strategies to environmental constraints. Comparative feed charts indicated that herders decreased their overall herd size, reduced the movement of flocks and cut down on the use of concentrates. Herders maintained the same sheep to goat ratios to promote a more effective utilization of pastures. Producers also modified their livelihood strategies by diversifying their sources of income and increasingly relying on off farm activities.

**Keywords:** adaptation strategies, small ruminants, environmental constraints, semi-arid

## Introduction

In a previous study, Hamadeh et al. (1996) had identified 4 small ruminants production systems in Lebanon drawing on diversified resources: 1) semi-nomadic system with migratory flocks moving seasonally with a heavy use of native pastures, 2) semi-sedentary system depending on mountain pastures in spring and summer, 3) settled system making moderate use of rangelands, and 4) semi-sedentary system making use of crop residues in summer. A follow up study in 1997 indicated that the small ruminants production is undergoing drastic changes in response to serious obstacles (Hamadeh et al., 1999). Marginal lands are increasingly being converted to crop production and thus are becoming less available to small ruminant production. The result of such changes is overgrazing on marginal lands which leads to the desertification of such lands (Hamadeh et al., 1993). In response to these growing production constraints, the efforts of securing and stabilizing livelihood are receiving first attention from herders in their every-day activities (Scoones, 1998). The objective of this paper is to study the changes in small ruminants production systems in semi-arid areas of Lebanon and assess their adaptive mechanisms in terms of flock management, feed resources and livelihood strategies.

## Materials and methods

The study area, Aarsal, is a large highland village spread over a wide marginal area with an average rainfall depth of 300 mm per year. The total village land area is 42,000 ha, and the combined small ruminant flocks of Aarsali farmers comprise 60,000 heads. A pre-tested questionnaire was used to collect information regarding number and composition of sheep and goats flocks, grazing sites, pasture rent, feed quantity, and feed diversification. The questionnaire was filled for 4 representative farmers from the 4 different systems in Aarsal as defined in 1997 (Hamadeh et al., 1998). The impacts of the 4 small ruminant systems were compared in terms of feed resource diversification and flock movements for 1997 and 2002. A survey covering 15 herders was conducted to identify the livelihood adaptation strategies of Aarsali farmers. The diversification of the sources of income was determined. Collected data were also analyzed to show the diversification of feed resources and herd size fluctuation.

## Results and discussion

### Changes in Small Ruminants Production Systems

The study revealed that herders in System 3 (settled, making moderate use of rangelands) sold their flocks; while herders from systems 1, 2 and 4 as defined in 1997 have reduced their flock size by an average of 52 heads in an attempt to adapt to less available grazing sites and cut down on use of concentrates. Herders that cannot afford supplementing feed to their animals are known to sell their entire herds or even to reduce their numbers to avoid losses of animals through death and to secure food for the household (Davis, 1993). Furthermore, flock movement was confined to proximate open-access pastures around the village. The same sheep to goat ratios were maintained between 1997 and 2002 in order to cope with the pasture availability and terrain and promote a more effective utilization of plants (Abou Zanat, 1995).

### Livelihood Strategies

The livelihood analysis in 2002 showed that herders were increasingly diversifying their income from livestock with other agricultural (33%) and off-farm activities (60%) to satisfy household subsistence requirements, with only 7% depending exclusively on livestock. Diversification provides important means by which smallholders self-insure against risk and seize income-earning opportunities (Hussein and Nelson, 1998).

Eighty-seven percent of pastoralists interviewed had income from agriculture, mainly rainfed trees production, which may be explained by the expansion of cropland at the expenses of pastures. Livestock sales were driven largely by liquidity constraints and the seasonal needs to purchase food, or pay for school fees or emergency health expenses (Ellis, 1998).

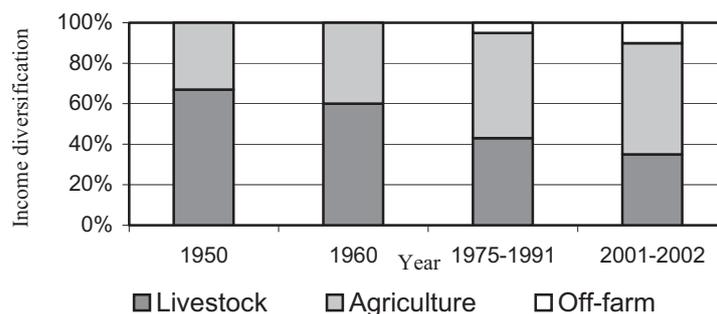


Figure 1. Income Diversification Trends (unpublished)

Figure 1 illustrates income diversification trends from 1950 to 2002. The figure shows a continuous reduction in the income generated from livestock production, an increase of about 40% in income from agriculture since the nineties and a shift to new income generating activities including off-farm work as of 1975 accounting for around 10% of total income generating activities in 2002.

## Conclusion

The study revealed important changes in small ruminants production systems of Aarsal, a shift from 4 small ruminants production systems in 1997 to 3 systems in 2002 was detected. Herders are adopting strategies to cope with the environmental constraints such as reducing their overall flock size and reducing the movement of flocks to grazing sites inside Aarsali lands. The number of animals per system has decreased and feed supplements are being reduced. Herders are also diversifying their income generating activities to be self-insured against risks and environmental constraints.

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