

IMPACT OF SMALL RUMINANTS ON THE ENVIRONMENT IN THE SOUTHERN SHORE OF THE MEDITERRANEAN

AHMED EL AICH (*)

Small ruminants are an integral part of the farming system which impact the environment of the farm, both the socio-economical and the ecological environments. Impacts of the production systems on the environment might be positive or negative depending on the objective pursued. Therefore, the direction of the impact should be carefully defined. For instance, increased cultivation in arid zones in general and in rangelands in particular has a positive impact on small ruminant production systems since cropping provides crop-residues that compensate for loss of natural grazing and improve the feeding status of animals. However, increased cultivation reduced the native vegetation cover on rangeland which enhance their degradation (negative impact). The objective of this paper is to address: (1) the relationship of small ruminants with the socio-economical environment of the farm, (2) the impact of the small ruminants on the natural resources and (3) the use of small ruminants in the management of the natural resources management.

SMALL RUMINANTS AND THE SOCIO-ECONOMICAL ENVIRONMENT

Small ruminants, in addition to their important role as source of protein throughout the world, they are in many cases the only alternative for populations living in marginal areas which prevent these areas from human desertification. Around 20% of the world population base their economics on rangelands resources (The Improvement of Tropical and Subtropical Rangelands, 1990).

ABSTRACT

This paper aimed to address the relationship of small ruminants with the environment from different perspectives (socio-economic, ecological) as well as the use of small ruminants in the management of natural resources. Small ruminants, in addition to their important role as source of protein throughout the world, they are in many cases the only alternative for populations living in marginal areas. The degradation of natural resources due to overgrazing, increased cultivation, the ambiguity of land status resulted in soil erosion and decrease in vegetation cover as well as deforestation. There is no doubt that small ruminants properly managed can be used in the prospective of natural resources conservation and rehabilitation.

RÉSUMÉ

Le présent papier se propose d'analyser l'impact des petits ruminants sur l'environnement avec ses différents aspects (socio-économique et écologique). Les petits ruminants jouent un rôle déterminant dans la conservation des zones marginales du moment qu'ils assurent la valorisation des ressources de ces milieux. La dégradation des ressources naturelles suite aux phénomènes de sur pâturage et mise en culture ainsi que le défrichement conduit à la dénudation du couvert végétal et initie le processus de désertification. Le statut collectif des terres qui supportent ses ressources naturelles accentue le processus de dégradation. Une gestion rationnelle de l'utilisation des ressources naturelles par les petits ruminants assurera la durabilité de ces ressources.

Traditionally accepted roles of small ruminants include food for home consumption, fertilizer, energy from dung and artisanal products. Goats and sheep, raised together or with cattle serve as capital and source of emergency cash for the farm as well as mean to cope with risk. Livestock represents an integral part of farm capital. Animal species can be sold for different purposes. Sales of goats, usually serve to cover family weekly requirement and provisions (groceries,...) and provide some cash to spend on some activities of the farm. Trades on the other species (sheep and cattle) are intended to finance unusual expenses. The diversity of

kinds of animals in flocks makes better use of the farm and its environment resources and insures farm stability when facing stressful situations. In pastoral and agro-pastoral systems, the farmer/pastoralist depend on large numbers of females to recover from droughts. Maintenance of large numbers of animals, especially females, is a strategy to manage environmental and financial risk. Goats are usually sold in stressful situation to buy foodstuff for the other species. For livestock owners, there is much higher risk of losing a lamb in drought year than losing a kid. In addition strategy also include the subdivision of small ruminants herds. In drought year, the herds consist primarily of females averaging 3-5 years in age, with very few year-old females. This is because the livestock owners are forced to sell almost all of the young male and female to purchase cereal grains. Small ruminants breeding, especially goats, does not require high capital. A particular expectation from initiating this small farming business is that enough capital will emerge to switch to more profitable production.

IMPACT OF SMALL RUMINANTS ON NATURAL RESOURCES

The degradation of natural resources resulted in soil

(*) Département des Productions Animales Institut Agronomique et Vétérinaire Hassan II B.P. 6202, Raba

erosion and decrease in vegetation cover as well as deforestation. Soil erosion is the most widespread cause of deforestation. Loss of soil due to erosion averaged some 50 tones of soil per hectare per year. This loss is at least five times the natural rate of soil formation (FAO 1992). Summary of the soil degradation by type and cause is provided in **table 1**. We will be limiting our discussion, in the scope of this paper, to the degradation of plant material (rangelands resources and forests). In most instances, forest and rangelands natural resources degradation is a product of human activity. In arid zones, phenomena such as overgrazing, the extensive cutting of fuelwood and the cultivation of fragile lands resulted in loss of plant cover and change in vegetation composition. Loss of the traditional practices in managing natural resources contribute to increase their degradation.

Degradation of rangelands resources

Rangelands constitute around 47% of the earth surface and about 80% of which is at least moderately degraded (The Improvement of Tropical and Subtropical Rangelands, 1990). More than half of this area lies in the tropical and subtropical areas and include the Southern Mediterranean rangelands. The principal rangelands crops are forage and browse for domestic and wild animals.

Although documentation is lacking on the degradation of southern Mediterranean rangelands, even the untrained eye can see the evidence of degradation of most of the marginal lands. In deed, grazing lands can no longer meet the animal requirements because of the reduction in the vegetative cover as result of overstocking, uncontrolled or concentrated grazing, increased cultivation, shortage or lack of water, ambiguity of land status and the loss of traditional pastoral practices.

The high grazing pressure

The inappropriate use of rangeland resources is due to overgrazing and the incorrect use with respect to the

grazing season. Decisions of grazing never take into consideration range readiness or plants reproduction. Grazing on most common use rangelands starts right after physical barriers are gone, i.e. frost, cold snow,.. As results plants are grazed when they are not ready for defoliation which affect dramatically their vigor. Therefore, rangelands botanical composition is changing in favor of annual grasslands are good example of this kind of degradation. Continued high animal density accelerates the removal of palatable species and the lack of competition permit the growth of species that are less palatable or less capable to support livestock. Decrease in palatable species allow woody shrubs to increase in density as result of overstocking. Even these woody species are usually cut for fuel and shelter. The cut of woody species reduces their contribution to livestock diet and increase in the mean time the proportion of bare soil while exposing soil to wind and water erosion.

Overgrazing of rangelands caused their shift from predominately high quality perennial plants such as perennial grasses and legumes to low grazing value species such as annuals. As result, there has been a reduction in late dry season carrying capacity. The inappropriate use of vegetation reduces the opportunity of natural re-seeding.

Traditional land tenure ensures communal ownership of the grazing resources within each tribal area. The ownership of the livestock, however, is individual. This opposition between the collective ownership of the grazing resources and the individual ownership of the livestock results in the absence of the maintenance of the grazing areas and favor the uncontrolled competition for the limited grazing resources.

Increasing grazing pressure make the proportion of bare soil more and more important and reduce in the mean time the amount of litter directly linked to soil fertility. Increased demand for grazing in common access land lead to progressive erosion and decreased soil fertility, lower water table and loss of biodiversity. Higher

Table 1 Soil degradation (in million hectare) by type and cause (classified as moderately to excessively affected).

Regions	Water erosion	Wind erosion	Chemical degradation	Physical degradation	Total (million ha)
Africa	170	98	36	17	321
Asia	315	90	41	6	452
South America	77	16	44	1	138
North and Central America	90	37	7	5	139
Europe	93	39	18	8	158
Australiasia	3	—	1	2	6
Total	748	280	147	39	1.214
Major causes	in %	in %	in %	in %	
Deforestation	43	8	26	2	384
Overgrazing	29	60	6	16	398
Management of arable land	24	16	58	80	339
Others	4	16	10	2	93
Total	100	100	100	100	100

Source: World Agriculture Toward 2010, FAO 1992.

grazing intensities result also in soil compacting which is responsible for higher runoff and less infiltration.

In definitive, the stocking decisions may result from an incorrect perception of changes in animal density on net return and risk. It is not intuitively obvious that reduction in animal numbers will not necessarily reduce total revenue. It is not easy to place a cost or value on use of animals to store wealth.

Small ruminants represent for the producers not only livelihood, but a means of accumulating capital, insurance and prestige as well. Therefore, prosperous families are reluctant to reduce their stock. Offered prices to pastoralists are usually too low to encourage them to sell during times of abundance which keep the large numbers of animals on rangelands.

The cropping of rangelands

In addition to degradation due to overgrazing, rangelands are subject to cultivation. Among the reasons that enhance cultivation the demand for cereals usually favored by political priorities to ensure self-sufficiency. Cultivation rate on rangelands has been accelerated by the use of tractors. Additionally, the favorable ratio (cost of cereal to meat price) tend to enhance the cultivation. Two examples of these practices are the Algerian and Syrian steppe.

Cultivation is usually practiced on the best parts of the rangelands which reduce grazing areas to poor conditions lands. As result, the size of rangelands is decreasing and the production systems are becoming more agro-pastoral. Cultivation on rangelands damage native vegetation that has been cut and make soil more vulnerable to wind erosion especially after the cropping abandon as result of the low and decreasing yields of cereals. Once these cultivated marginal areas are abundant, their grazing values are almost null and it may take decades to the native vegetation to come back. Agricultural expansion in drylands increased the pressure on rangelands since it forces pastoralists to overgraze the remaining land.

The use of rangelands for agriculture purpose transformed the production system and reduce the size of the grazing lands. These two factors change the animal species distribution and increase the grazing intensity which lead with time to lower carrying capacity.

The scarcity in water

Lack of water for small ruminants in some arid rangelands limits their use to definite periods of the year and increase pressure on others where water is available. To face this problem of shortage of water, small ruminants producers developed different strategies. In some instances, small ruminants producers water their animals every other day to cope with the shortage of water (El Aich et al 1990). Others small ruminants producers carry water to rangelands where water is not available. In

deed, the widespread availability of trucks facilitate the transport of animals and water to use rangelands previously used infrequently. A third group of producers prefer to buy water. For example, in the Middle Atlas of Morocco, trucks are getting specialized in the trade of water to sheep producers using rangelands where there is shortage of water during summer.

Water may be also a determinant factor in the nomads decisions to move among grazing areas. In the Southern part of Morocco, nomads based their late spring and early summer movements on the availability of water. Lack of water in some grazing areas of the desertic ecosystems contribute to rangelands preservation since the duration of the grazing periods is defined according to the demands of water by animals. Unfortunately, in some desertic rangelands, solving the problem of the unavailability lead to the deterioration of rangelands. The establishment of water points in some areas without any grazing control damaged the rangelands resources in countries such as Syria.

The ambiguity of the land status

In developing countries, there is a little incentive to control the number of animals because of the collective-use status of rangelands. In addition to the overstocking, the ambiguity of the land status favor the increase in cultivation. Increased in cultivation aimed cropping to meet family and livestock needs, but also it is also one way to show ownership on common use lands. It is very common that the farmer plow more lands than his needs.

Loss of traditional pastoral practices

Pastoral production systems were based on herd movements over large scale. Movements can be either on seasonal for transhumant pastoralism or perpetual for nomadic pastoralism. In addition to movements, pastoral societies practiced highly regulated land use systems for conservation of standing forage such as "Agdal" in the Middle Atlas of Morocco or the "herima" system of Messina. The ecological integrity of the pastoral systems was destroyed with the imposition of the European law. Therefore, the indigenous highly regulated land use was converted to open access systems.

Under the demographic pressure and the politic changes, these systems are becoming more sedentary. With the new administrative delimitation, livestock are usually constrained in their movements. In addition, sedentarisation is associated with more demand for cultivation lands. Pastoral, transhumant farmer are becoming more and more sedentary. Small holders are progressively acquiring cattle. Shift towards a mainly sedentary is on the way enhanced by the pressure on land.

As population become more and more sedentary, the amount of agro-pastoralism increases. The environment

is probably too variable to support an agro-pastoral system. All these factors related to the transformation of the pastoral systems make the systems heavily dependent on external feed resources and agricultural by-products. These changes induce also changes in livestock composition; less goats and more sheep and cattle.

Traditional rangelands grazing systems are abundant also because of the lack in qualified labor; herders are becoming rare. In traditional systems, people to people and family linkages are needed to ensure a source of labor, credit.

In most instances, the degradation is result of breakdowns in the traditional resources management systems that for centuries had maintained an equilibrium between natural resources utilization and human activity.

Degradation of forest resources

Forests occupy some 26 percent of the land area of the globe (FAO 1992). Forests provide habitat for large proportion of plants and animal species, conservation of mountain watersheds, conservation of biodiversity as well as fodder for livestock. Forest ecosystems are subject to change due to natural causes and human interventions. In tropical and temperate regions, the human intervention is the major determinant of the course of change.

The pressure on forests land and its loss to agriculture is mainly tropical problem. Indeed, yearly deforestation rates average about 15.4 million hectares (FAO 1992). In addition to the use of forests for agricultural purposes, they are usually overused by grazing herds of neighboring populations. Small ruminants and particularly goats are pointed out to be responsible for deforestation. As consequence, domestic animals, especially goats, are considered as enemies of the forest in the Mediterranean countries and were subject to some anti-goats legislation that varied among countries from simple fines to complete eradication of goats from forest (El Aich et al 1995).

Since small ruminants are able to survive on forest foliage and other shrubs in the absence of other feed resources, they are raised in mountainous areas and arid to saharian regions. El Aich (1995) found out that in the Southern shore of the Mediterranean that small ruminant abundance is connected with increasing aridity. Indeed, in mountainous zones, goats are raised in the neighborhood of the forests to valorize "cheap" woody resources. Comparative studies of the goats farming systems in the Mediterranean (El Aich et al., 1995) showed that forest foliage to contribute up to 90% of goats diet during winter. Forest foliage (green oak leaves) is usually cut during winter by herders and provide to goats when no other range resources is available.

In the High Atlas of Morocco, during the same period,



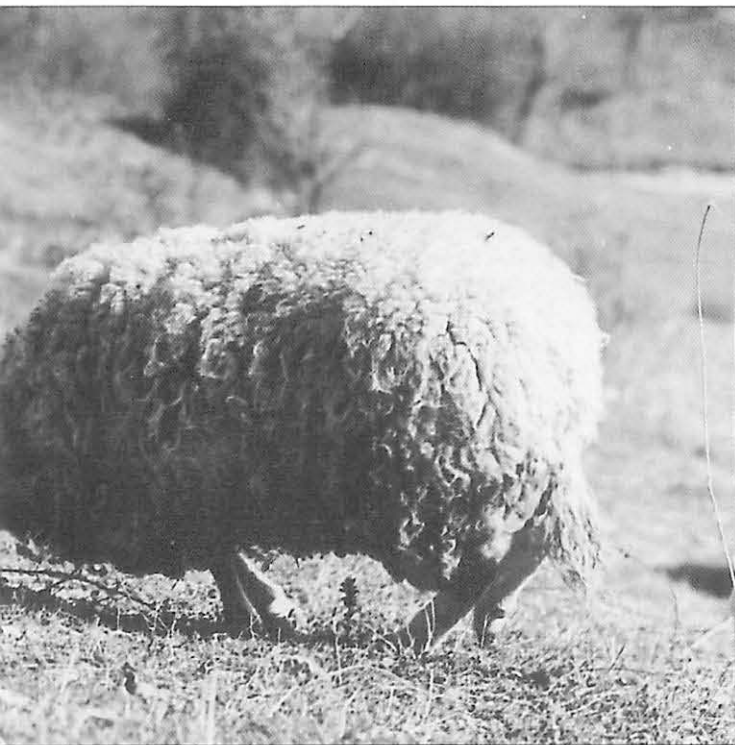
the animal species associated to goats are either fed with stored farm resources (cattle) or moved to better grazing areas in less harsh environments (El Aich, 1995).

Eventhough goats are well know to better perform on forest foliage than the other animal species because they tolerate higher of secondary compounds in addition, to their ability to climb that let them reach young foliage, they tend to be flexible in their dietary habits and become less browser when forage availability is not limiting. Once forage availability is limiting, goats switch their diet to more brows and may damage even trees bark.

Damage done on forests can not be attributed totally to goats for many reasons. Firsteval, there is an increased demand for firewood for local and urban consumption which put a lot of pressure on forests. Secondly, the land status usually make the tree on enhance the presence of the forest services on lands managed for decade by farmers.

This is the case of the arganeraie in Morocco, where farmers cut trees to the presence of foresters. Thirdly, there are cases in the High Atlas of Morocco, where, forest are properly used, for both grazing and firewood, according to definite schedule which maintain forests in good shape.

An other cause of deforestation is the clearcutting for crop cultivation because agricultural activities expanded on the most productive range lands. As result forest lands were overstocked or simply converted to grazing lands by thinning when the density of forest is high.



USE OF SMALL RUMINANTS IN NATURAL RESOURCES MANAGEMENT

Small ruminants properly managed can be used in the prospective of natural resources conservation and rehabilitation. Any attempt to rationalize the use of natural resources will necessitate the support and the involvement of the pastoralists in order to succeed.

Grazing by small ruminants as biological control of undesirable brows

It is well established that grazing goats utilize large amount of brows in their diets. Therefore, their appropriate use is probably the most effective biological control of undesirable wood range plants while assuring that other preferred are not abusively grazed. In deed, stocking rates and season of use should be adjusted accordingly. Goating was widely used in Texas to control large range shrubs including oaks and mesquite (Valentine 1971).

Grazing by small ruminants as mean to prevent forest fires

In the Mediterranean forests, grazing the herbaceous layer by small ruminants has been effective in preventing fires (Thivaut and Prevost 1986). After shrub removal, grazing by small ruminants enhances the control of shrub regrowth.

Mixed flocks

Goats are usually associated with sheep in mixed flocks

to lead sheep to better grazig areas because of their dietary habits and anatomic ability to find better grazing areas. For this purpose, producers in Morocco include up to 10 goats in the sheep herds for the reasons mentioned above.

Better use of space and natural resources

The idea is to solve the continuous high grazing pressure that damage natural resources. It might be difficult, if not impossible to reduce the stocking rate. However, it is possible to adjust the period of grazing according to the natural resources requirements. Therefore, traditional practices and skills for managing the use of theses resources should be taken into consideration as long as they do not contribute to environmental damage.

More appropriate land status

This is the most difficult issue on which depend the sustainability of rangelands. It will be certainly very easy to manage the use of natural resources if the land status become private.

Integration of livestock in forest management

It is well established, even for the forest services, that any effort for forest development with the elimination of grazing by domestic animals is not possible because the increasing demand for fodder. Forest lands should be integrated with livestock husbandry when proper management is applied according to the bioclimatic and socio-economic conditions. The ideal situation for the achievement of such integration would be to evolve toward a forest with high amounts of herbage biomass of high quality. This would increase the amount of the preferred herbage in the understorey directly used by grazing animals and reduce the pressure on the tree overstorey leading to less damage on forests. ●

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