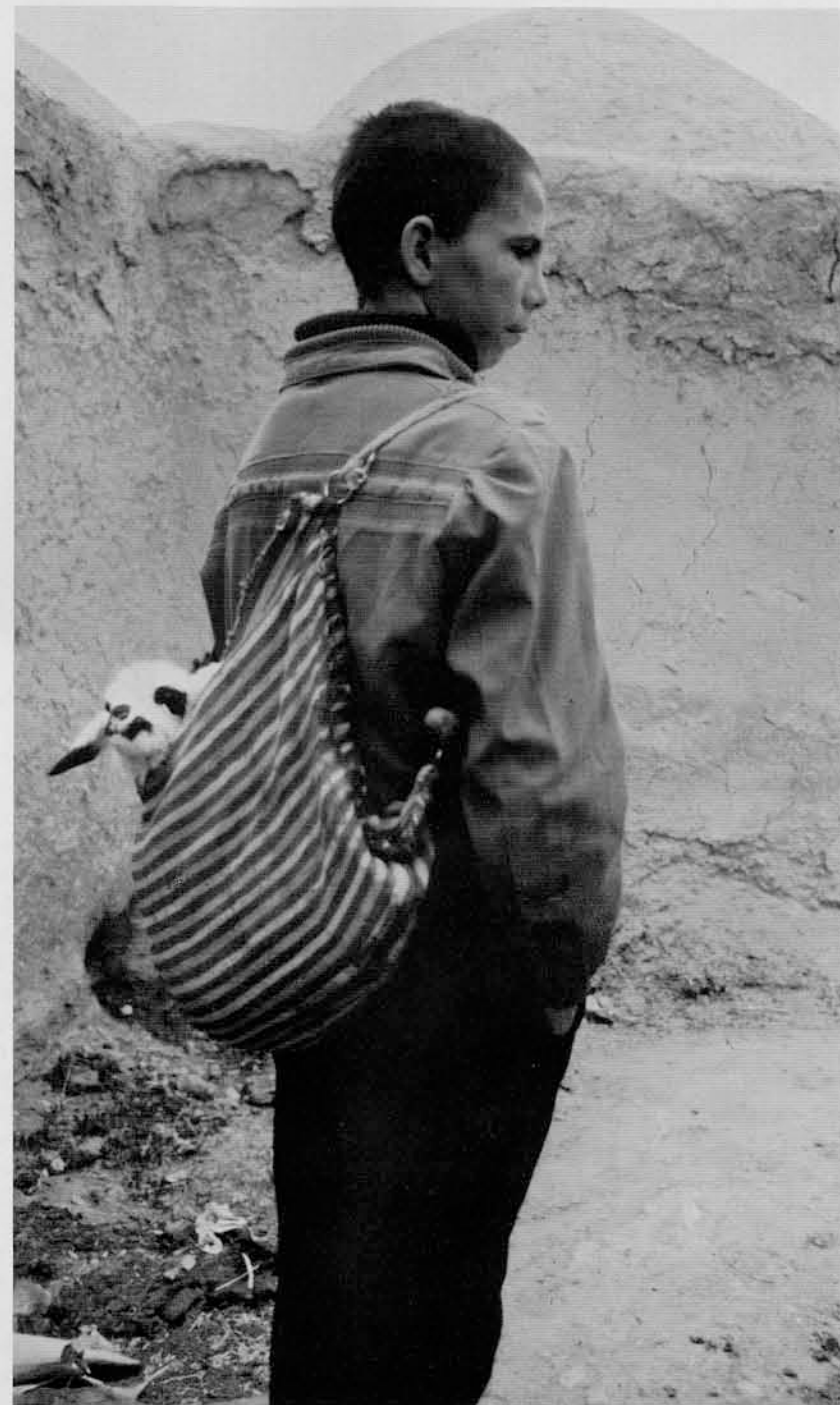


TRADITIONAL PASTORALISM

An Evolutionary Perspective

ENDRE NYERGES



Archaeological evidence indicates that the earliest domestication of sheep and goats occurred in the Middle East about 10,000 years ago. Originally a part of a mixed farming economy, sheep and goat herding came to predominate over vast regions of African and Asian grazing lands. When pastoralism developed as a specialization in its own right we do not know, due to the difficulty of archaeologically identifying transient pastoral camps, but there are indications in the texts that it was practiced in third millennium B.C. Mesopotamia.

Whether rapid or gradual, the process of introducing domesticated animals to rangelands constituted an invasion with major consequences for the ecosystem, including vegetation changes and perhaps deterioration. However, where regular grazing was eventually instituted around villages or along established nomadic migration routes, adaptive and coadaptive responses on the part of surviving species of the ecosystem may have emerged in time, and continued developing to the present in those areas where traditional pastoral systems are still maintained today.

Although traditional pastoralism is diminishing in some regions today, due to desertification, political action, and agricultural expansion, it persists as the only feasible means of exploiting most Middle Eastern rangelands. When we consider the very long survival of this system and the size of human and animal populations supported, we see that strategies of exploiting the available resources, including both herd management and animal foraging patterns, approach a long-term optimum in relation to the environmental conditions.

THE IMPACT OF GRAZING

It is likely that, as pastoralism developed regular patterns, those plant species most favored by the flocks and herds were either eliminated and replaced by species more

capable of resisting sustained grazing, or they adapted to withstand the different and heavier grazing pressures of domesticated herbivores. At the same time, these animals themselves adapted to the changes in the plant life thus induced, and the pastoralists developed new herding and husbandry strategies both to minimize deterioration of grazing and to develop optimum herd size and productivity consistent with the coadaptation of their animals with the plant life.

Pastoralism thus has caused new adapta-

lated by shepherds and owners. Particularly under conditions in which herd sizes approach the carrying capacity of the environment, competition between different species of herd animals results in the differentiation of feeding patterns. Age and sex differences between animals result in further differences in foraging patterns that broaden the pastoral niche. All these variations may be exploited in herding strategies.

The success of pastoralism depends largely upon the evolved capacity of the

1
A shepherd carries home a lamb born while the flock was on the move.

2
A flock marches out from a summer station for afternoon grazing. They move quickly until they pass beyond the overgrazed areas close in. Goats tend to lead and sheep to follow.



tions in virtually all rangeland species and, except where recent disruption has occurred, these adaptations are reflected in the present ecology of rangelands.

For example, a plant community subjected to heavy grazing pressure over a long period gradually changes toward a "grazing climax": this can be characterized as "anti-pastoral." This process includes changes in plant distribution and the production of toxins, uncommon amino acids, and other substances that reduce the digestibility of the plants. Plant species already dominant in the environment evolve toxicity specifically in response to grazing pressures, and existing toxic species are favored and tend to increase.

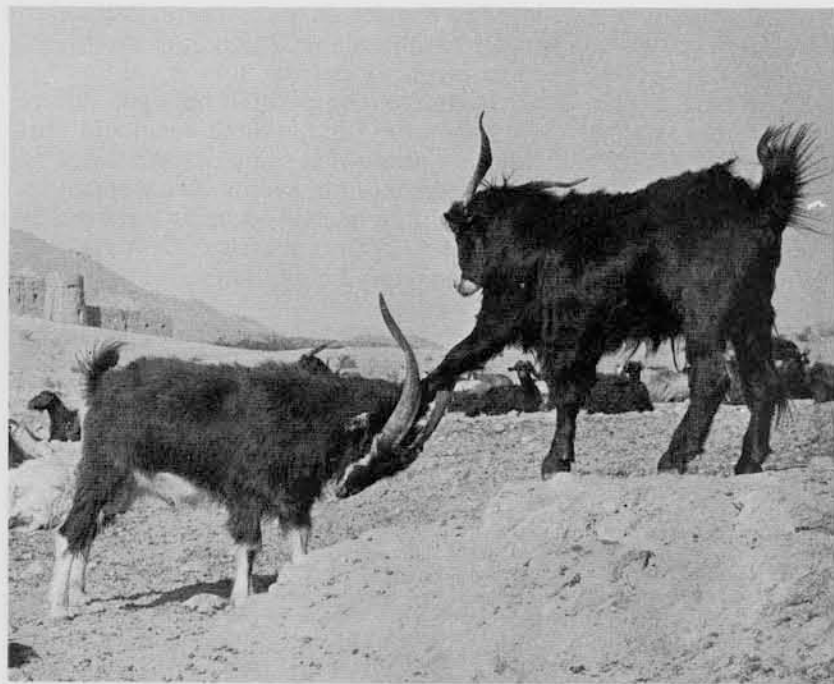
A particularly critical factor, of course, is the availability of permanent water sources. This affects settlement location and more temporary seasonal herding locations as well. Grazing pressure is heavier near these water sources, and vegetation is affected accordingly. Pastoral ecology, therefore, becomes a study of the spatial distribution of populations and their resources.

The basic productivity of a pastoral system depends on the behavior of the animals as they are deployed and manipu-

domesticated animals to forage successfully on the available vegetation. Since this vegetation is generally sparse, nutritionally poor, and partly toxic, the animals' foraging capacity must include adaptations to maximize nutrient intake and minimize (or avoid) toxins. Possible adaptations include detoxification of plant secondary compounds in the gut, and avoidance of more toxic plants—the latter apparently learned by individual animals in infancy, and specific to local vegetation. In general, foraging by domesticated animals, and the control of foraging by humans, are designed to achieve optimum consumption; but these strategies must be understood in the context of both plant and animal adaptations.

HERD MANAGEMENT

There are two general aspects of herd management, the owner's function of husbandry and the shepherd's function of herding (one person may be both owner and shepherd, or course). Husbandry involves decisions about herd size, species composition, sex ratios, age structure, and migration patterns. In a market economy the owner attempts to develop the market value of his herd, emphasizing the growth



3 Goats play more than sheep. Traditional management strategies take such factors into account.

4 The shepherd keeps an eye on the flock as it grazes dispersed on the open range.



the owner, day-to-day management is the shepherd's function. In ecological terms, this primarily concerns the organization of animal foraging in relation to local habitat variations and the dispersal of grazing pressure. Differences in grazing pressure in pastures accessible from any one watering point are maintained by herding strategies which take advantage of variability in the diet and mobility of the animals, due to species, age and gender differences. These short-term strategies of exploiting the variations of both animal grazing behavior and local vegetation are linked to longer-term conservationist strategies to ensure future forage quality—dispersal of animals limits the pressure of grazing on any one pasture at any one time.

While the functions of owner and shepherd are complementary, their roles are not necessarily of equal importance. In a highly fluctuating environment, the owner's functions of planning migrations and increasing herd size in good years are particularly critical. In more stable environments, by contrast, the herd sizes will be more stable through time, and the shorter-term strategies of the shepherd will be more important.

SANJARI: THE STUDY AREA

In order to explore further the relationships among herding strategies, animal diets and animal foraging behavior, and between foraging patterns and the structure and composition of range vegetation, I have been conducting field studies at several types of pastoral settlement in Turan. My main study site was Sanjari, a small summer milking station.

Sanjari is located beside a mountain spring at an altitude of 1300 meters. It faces out onto plains which slope down to meet the salt desert 20 kilometers away to the southwest. From April to October it is the base for three families and about eleven hundred sheep and goats. Most of these animals are owned by a resident of Tauran (20 kilometers to the north), whose family spend their summers at the station, herding animals and processing milk products; they are assisted by two hired shepherds and their families. Aside from the maintenance of a small garden, activity at the summer station is devoted exclusively to pastoralism—flocks are tended, lactating females are milked, milk is processed into clarified butter and other products, and firewood is cut for milk processing. During the rest of the year Sanjari serves as an occasional watering point only, and the animals are kept at a



5 A group of shepherds camped during spring when the flocks are taken away from the summer and winter stations to make the most of the new vegetation.

covered winter pen (*aghol*) several kilometers away. There they are tended only by shepherds and the rest of the population returns to Tauran for the winter.

In the summer of 1976 there were 1100 animals at Sanjari in a goat to sheep ratio of four to one. The animals were divided into three herds as follows:

- 1) goat herd—300 milch goats and over 200 gelded male and non-lactating female goats, accompanied by approximately 20 rams.
- 2) sheep herd—220 ewes and lambs, including at least 60 milch females and accompanied by approximately 30 buck-goats. (Note that until autumn the rams are run with the goats, and the buck-goats are run with the sheep).
- 3) kid herd—more than 300 goats under a year of age.

While in the field, I spent a total of 210 hours with the animals, observing and recording the distance and direction of movement of the three herds, the diet and foraging behavior of selected individual animals, and the shepherds' activities in relation to their animals.

The daily grazing cycle in summer at Sanjari is distinctly patterned both in time and space. All herds are out grazing away from camp continuously except for two periods a day: they return to the spring-side in midmorning and again at mid-afternoon for watering, milking, rest and rumination. The herds leave the station along well-worn radial paths and are absent from noon to midafternoon and

then from evening to midmorning, camping away from the spring overnight and grazing when moonlight permits.

The spring and settlement constitute a central point of obvious importance to the pastoral system at Sanjari. Because of the extreme localization of water and labor resources at a specific point in the rangeland, grazing is necessarily restricted to the area that can be reached while returning to the station twice daily. Under the additional restrictions of a mountainous local topography, the result is a semi-circular area approximately three kilometers in radius.

The implications of this limitation on foraging area are significant because the carrying capacity of the Sanjari range is set by the amount and quality of vegetation near water. Herding and foraging strategies must make the most of the vegetation within this area. In addition, stress from grazing and fuel cutting is placed on the range vegetation in a particular pattern: areas closer to the center are more heavily used while areas at greater distance are relatively unused and undisturbed.

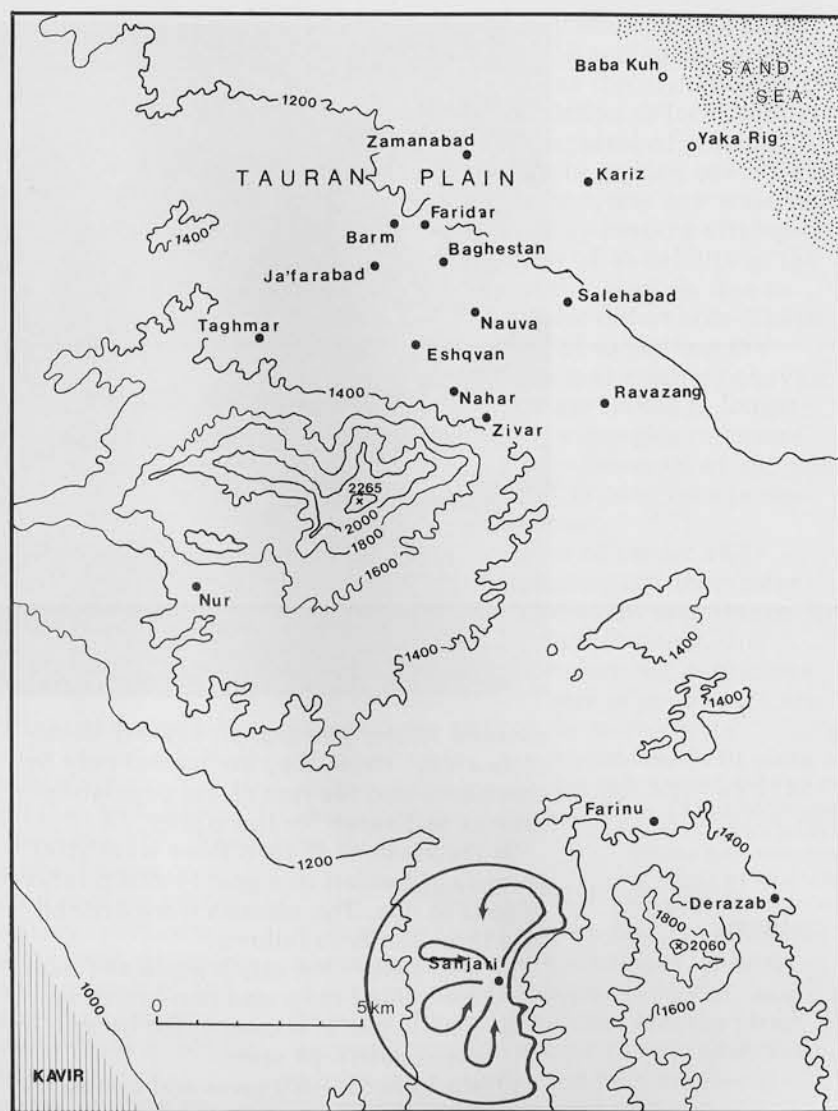
Both sheep and goats forage heavily on shrubs (46% of goat diet, 38% of sheep diet), but strong differences occur in which species they select. While foraging, they both move rapidly through plains areas, stopping to feed for only a few seconds at a time. However, when crossing dry streambeds goats may stop and gather around certain species of large shrubs found only in such places. These shrubs account for 22% of goat diet but only 4%

of sheep diet. While sheep largely ignore vegetation in streambeds, they prefer other plains shrubs which are ignored by goats. Both sheep and goats also rely heavily on ground forage—annuals, seeds and leaf litter.

The division of goats into two herds of adults and kids brings out a number of further, but less marked, dietary variations. Adult goats eat less exposed ground forage than do kids and sheep (6% of adult goat diet, 15 and 16% of sheep and kid diet, respectively), but more protected ground forage than do kids (49% of adult goat diet, 32% of kid diet). Being bigger and stronger, adult goats can force their way under shrubs and, with effort, feed on resources inaccessible to kids. Kids also feed on a species of wild almond bush, *Amygdalus*, far more than do adult goats (4% of adult goat diet, 22% of kid diet), although this is the result of shepherds' decisions to herd kids in gorges where this shrub is abundant. These age-specific differences in diet, though relatively small, are the result of differences in foraging behavior and help to reduce competition between animals for vegetation.

The division of animals at Sanjari into herds dominated by adult goats, sheep, and kids, results in groups that behave differently with respect to exploitable resources in other ways as well. Adult goats move faster than kids or ewes with lambs, and make shorter stops to feed. On the other hand, kids move and eat more slowly than either sheep or adult goats. Essentially the adult goat, sheep and kid herds can be described as fast, moderate and slow foragers, respectively.

The primary reasons for separating kids from adult goats presumably are to keep kids from suckling after a certain age and to divide up the herding labor. However, once the herds have been divided, shepherds take advantage of differences in their ecological characteristics. Adult goats march rapidly for the first and last 45 minutes of grazing periods away from camp. During this time (one-third of an afternoon grazing period), they may cover between 36 and 50% of the afternoon's distance but do as little as 5 to 8% of the afternoon's grazing. When grazing begins, adult goats tend to continue to move rapidly and in the overnight grazing period usually reach the outermost limit of the grazing range of Sanjari, approximately 3 kilometers away from camp, exploiting areas not used by other herds. In contrast, kids begin foraging before they have travelled very far from camp, and do not



6 The foraging area at Sanjari is a semicircle of rangeland extending to a maximum of 3 km. from the mountainside spring. Herding and foraging strategies in general optimize the use of the vegetation available in this area. For example, the shepherd of the goat herd tended to rotate the afternoon movements of his flock on a four-day cycle, following the four main routes, as shown here. This strategy of dispersion probably ensures that all accessible areas of the range are equally exploited and that the pressure of grazing on the range is equally dispersed.

7 As the flock returns to the station at the end of each excursion the animals draw closer together, graze less and pick up speed.

8 Animals are often branded for easy recognition in case of disputed ownership.



move very rapidly as they graze—they are in fact often simply grazed around and around in a small valley nearby (where the wild almond is abundant). Thus, though kids and goats eat largely the same diet, they graze in different places in the area. Sheep occupy an intermediate or overlapping position behaviorally and in terms of the way in which they are grazed, but also their competition with goats is reduced by their preference for different plants.

Another way in which shepherds may increase the breadth of land use and minimize foraging pressure is to disperse grazing routes as much as possible. The afternoon grazing routes taken at Sanjari, in late summer, often followed a four-day cycle. Because the area around Sanjari is broken by mountains there are four main



Endre Nyerges is a Ph.D. candidate in anthropology at the University of Pennsylvania. In 1976 and 1978 he made field studies in Turan which have led to the presentation of several papers (including an M.A. thesis) on the ecology and behavior of sheep and goats under traditional pastoral management. He is now seeking to test elsewhere in southwest Asia and Africa the hypotheses developed in his work in Iran.

routes available out of camp, and the cycle seemed to rotate these choices. Plant regeneration, of course, does not occur over a few days in summer, but I suspect that this herding strategy ensures equal distribution of grazing pressure.

Thus, the breadth of resource use by pastoralists and the extent of division of resources among domesticated animals occupying the same limited range is partly the result of dietary differences among animals, but partly also the result of shepherding decisions which take advantage of herd structure and behavioral differences among the animals. Specific local strategies such as these are an important way of increasing the range of vegetation available for forage. This in turn helps to increase carrying capacity and also probably diffuses the destructive impact of foraging pressure.

In my research, I am drawing on ideas from evolutionary ecology to explain the ecology of traditional pastoralists. According to this argument vegetation, domesticated animals, and human societies have co-evolved in Iranian rangeland since the inception of pastoral technology. Browsing by domesticated animals and exploitation strategies by their owners are two kinds of adaptation which have been considered in this paper. Adaptive responses by the vegetation—increased toxicity, decreased palatability, changes in the proportion of plant species—are complementary aspects of this study which are not presented here in detail.

The significance of the ecological history of rangelands for development projects is clear—development strategies that take advantage of past adaptive relations are far less likely to have the disastrous, multiplying consequences of those which suddenly alter the adaptive pressures of a system.