

**INSTITUTIONAL OPTIONS AND
PASTORAL COMMUNITIES IN MOROCCO**

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Introduction

Great changes have been affecting the Moroccan pastoral zones stretching from the High Atlas mountains up to the high plateaus of the Oriental (North East), through the Middle Atlas. Those vast grazing lands, mostly marked by an arid and semi arid climate, constitute a heterogeneous set from the naturalistic point of view and in terms of their socioeconomic role. Overall, they have experienced more or less severe degradation. Their average productivity does not exceed 75 Forage Units (FU) per hectare. This low performance is certainly due to recurrent drought as well as to the loss of some of the best rangeland to the extension of marginal agriculture, urbanization and infrastructure works, but it is also due to overexploitation. Encouraged both by a high demand on mutton from the cities and by different forms of subvention from the government, stockbreeders have been growing excessive numbers of small ruminants. The fact that these flocks perform poorly does not dissuade them. To the contrary, it seems to induce them to ever maximize the size of their flocks, to the extent permitted by their financial capacities, of course. The gratuity of grazing on pastoral land, however impoverished the latter may be, is perceived as an easy way to reduce costs.

During the last three decades, the government has made a considerable effort to improve the situation of rangelands. Until the mid-eighties, however, this effort was essentially exploratory and technical in character. Small “Perimeters of Pastoral Improvement” were established here and there. The impact of these experiments was very limited.

Decision-makers as well as all research and development parties concerned progressively came to the realization of the fact that at the heart of the pastoral problem lied the

institutional issue. In the past, in effect, the situation of rangelands was relatively better not only because population pressure and demand for meat were lower, but also because the management of rangelands was more strictly controlled by traditional institutions (*jmaa-s*) that still enjoyed effective power. Size of stocks and access to pastures with clearly defined boundaries were rigorously regulated. Transhumance was a routine practice which favored complementarity between grazing areas sometimes separated by very long distances (for example between the plateaus of the Oriental and the territory of the Rhamna tribe, or between the High Atlas mountains and the Missouri region). This practice used to contribute to the overall preservation of all the rangelands involved in it.

The disempowerment of traditional institutions has led to the quasi-generalization of a chaotic management of rangelands. Transhumance has practically disappeared. Settling within rangelands has become the rule. Cultivating parts of the rangelands is expanding. Privatization of these or other parts of the rangelands is progressing. And, last but not least, what remains from the original rangelands is exposed to fierce overexploitation.

Conscious of this adverse course of events, the government, with the help of international organizations such as the IFAD, has launched ambitious programs for the improvement of major rangeland zones: the Oriental, the Central zone including the Middle and High Atlas and the Tafilalet-Dades area. These new programs differ from the previous ones in their scope: they aim at covering entire agro-ecological zones; in their methods: they purport to be holistic and integrated and to address the full range of issues constituting the rangeland problem, from the demographic to the technical through the socioeconomic and with a special focus on the institutional; finally, in their concern with gaining from their very inception the adhesion and participation of the population of stockbreeders.

Broadly speaking and from the perspective adopted here, two main choices have been made: the introduction of the cooperative system in the Oriental and the rehabilitation of the traditional tribal system in the other areas, knowing that even in the former much attention was paid to making the territory of the newly created cooperatives coincide with the borders of ancient tribal groups—knowing also that whether in the Oriental or elsewhere the department of Water and Forests kept claiming authority on the lands that were under its supervision.

The purpose of this study is to evaluate the impact of institutional options on the management of rangelands. Three zones were retained for the investigation:

- The high plateaus of the Oriental, where cooperatives were created
- The Middle Atlas , where the traditional tribal mode of management of rangelands was reported to face severe difficulties
- The Central High Atlas, where the *jmaa* system seemed to be still in good shape

In each of these zones (except the third), the investigators were keen to find at least two sites, one in a relatively more favorable situation and one in a relatively less favorable situation, so as to be able to control for significant variables initially not taken into account.

Two approaches were successively used: rapid rural appraisals and an econometric analysis.

Part I of this report summarizes the findings of the rapid rural appraisals. Part II presents the econometric analysis.

PART I. RAPID RURAL APPRAISALS

The objective of rapid rural appraisals was to associate stockbreeders to the evaluation of the impact of institutional options on the management of rangelands and to the identification of possible solutions to the problems encountered. Four situations were hypothesized:

Situation 1 : the institution in charge of rangelands management is vested with considerable powers and can ensure rational management of pastoral resources and, thus, protect rangelands from degradation. It is the ideal situation which has the least chances to prevail in reality. Should this be the case, this model would deserve to be replicated under similar conditions.

Situation 2 : the rangelands management institution is vested with considerable power but the rangelands are seriously deteriorated and it is rather the rehabilitation of the rangelands that needs to be considered. The solutions in this case would be more technical than institutional.

Situation 3: the rangelands management institution does not have any real power and the rangelands are extremely deteriorated. This scenario is the worst of all. However, it is not too frequent in reality.

Situation 4: the rangelands management institution is weak in terms of power but the rangelands are in a good condition. In this situation, the problem lies in the institutional mode of management and the solution in an institutional alternative that could lead to the first scenario. This situation is encountered in pastoral improvement areas where the focus was technical and where social and organizational aspects of management were not taken enough into account.

To test these hypotheses, preliminary informal interviews were conducted in the Oriental and in the Middle Atlas with stockbreeders, individually and in groups, along transects determined in concertation with the provincial and local agricultural services. In the High Atlas, this phase and the subsequent ones were restricted to only one community, because of the difficult access to other communities, both in the geographical and in the linguistic sense. In each of the two first zones, informal surveying led to the selection of two sites where later local participatory workshops were held and where the household surveys needed for the econometric analysis would also be conducted. Finally, this part of the investigation culminated with a national workshop organized in Oujda in late February 2001.

Below are summaries of the local workshops. Recommendations of the national workshop have been integrated into the general conclusion of this part of the report.

The Oriental

The Northern Oriental

In this part of the Oriental, the local workshop involved in majority members of the cooperative "Jamal." The cooperative was established in 1991. At the beginning its membership amounted to 230 adherents distributed through four douars (Ouled Amer with 70 houses and approximately 1000 animal heads; Ouled Daoud with 40 houses and approximately 400 animal heads; Ouled Ben Addou with 60 houses and approximately 4000 animal heads; and the Mrabtin with 30 houses and approximately 1500 animal heads).

The adhesion to the cooperative was conditioned by the possession of a certain number of actions the value of which was 25 DH the action, amount that was raised to 100 DH later. In order to maximize their benefits from the cooperative, some early members had mobilized their family, including sons living abroad, for adhesion. This caused sharp inequality within

the cooperative. A cleansing operation became inevitable, which effectively occurred in 1997.. Effective membership was reduced to 90. Migrants, but also very small stockbreeders, were forced to leave the cooperative.

The agricultural area supervised by the cooperative consists of 70.000 ha of rangelands and 250 ha of irrigated land. According to stockbreeders, nearly 35% of the rangelands were brought to dry agriculture. barley covers 20.000 ha, soft wheat 2000 ha, hard wheat 1000 ha and oats 1000 ha. As for irrigated agriculture, it concerns essentially alfalfa (70%), oat, wheat and market gardening.

The sheep stock of the cooperative amounts to 6900 heads while its cattle stock counts about 250 heads. The latter is directly managed by the cooperative, which makes important profits out of the sales of milk and calves.

The cooperative pastoral space is divided into five large parcels: Fritess, Nkhila, Sadra, Fouchil and Chaabat Kadour. Fouchil was put in reserve in 1996 with the plantation of a third of its surface with Artiplex. Chaabat Kaddour was put in reserve in April 1997 with the plantation of 500 ha in December 1998. Access to the parcels put in reserve is prohibited till the period of rest decided by the cooperative ends. When these parcels are opened, the access to them is subject to a pastoral pre-payment consisting of 2 Dirhams per head of sheep for a period of 40 days per year. Users of the parcels put in reserve receive a compensation of 40 kg of barley per ha.

In case of violation of a reserve, the guardian is supposed to submit a plaint to the president of the cooperative. The latter draws up a minutes to the local authorities, thus, the matter is laid before the technical services (CT, DPA, ODCO, Chambre, Province). A Commission of Pastoral Police composed of the CT Director, the DPA, representatives of the authorities, the

Commune and the police conducts an inquiry after notification. If the violator cedes before notification, the amend is 20 DH per head. If he waits until notification, the amend will be double this amount.

Water is of crucial importance in the area. Because of recurrent drought, demand for water is in continuous increase. However, the limited number of waterholes added to their bad condition is not encouraging at all. The cooperative supervises five waterholes and two mini-dams (Sehb Ihoujaj and Siguet Lguer). The waterholes are: Nkhila, Fritess, Laaraoudi, Nkhila Laqdim and Natma. They supply five underground tanks of a capacity of 100 m³ each. These tanks are linked to seven reservoirs serving as a watering place against a charge of 0.10 DH/head/day.

The settlement of the stockholders in relation with waterholes depends on the means of transportation that are available to them. Stockholders without means of transportation are compelled to stay near the waterholes while big and medium stockholders owning lorries can afford to move throughout a large area. They always manage to be able to exploit the less deteriorated rangelands.

According to stockholders, the functioning of waterholes is practically the same that prevailed before the implementation of the Project for the Development of Rangelands and Animal Husbandry in the Oriental. The Commune partially contributes to fuel and lubricants expenses, while the users take care of the rest and of other expenses. Although there is an Association of Water Users theoretically in charge of the maintenance of hydraulic infrastructure and equipment, in reality this association has still to undertake its mission.

The more important constraints evoked by stockholders are as follows:

- Inequality between the members of the same cooperative. Small stockholders suspect big ones of paying lower charges for the access to reserves and of getting higher compensations for the latter. They suspect them also of using the cooperative equipment, mainly lorries, for personal purposes
- The inability of the cooperative, so far, to undertake the guardianship of reserves
- The frequency of conflicts, both within the cooperative (for the reasons above) and with neighboring cooperatives because, according to stockbreeders, reserves have often been placed in border areas.

The Southern Oriental

This is the home of the Beni Guil tribe. This tribe is more exactly a confederation of five tribes: the Beni Amir, the Ouled Hajji, the Ouled Youb, the Ouled Faress and the Ouled Brahim. In the beginning, these tribes were divided into two large groups, each one of them occupying a north-south stretch corresponding to large pastoral lands. Now, the divide is rather latitudinal, and we have the Northern Beni Guil and the Southern Beni Guil, corresponding, grossly, to the Tandrara commune and the Bouarfa commune, respectively.

Each of the five tribes had historically control over seasonal pastures called *woulf-s*. Thus, there were summer *woulf-s* to which were attached waterholes and cultivation lands. There were also spring and winter *woulf-s*, devoted to transhumance. This system functioned in accordance with intra-tribal but also inter-tribal agreements.

This system has undergone a profound transformation, due to the progress of land cultivation and to the settlement of families. Nomads or semi-nomads have become a combination of farmers and shepherds. This transformation was greatly facilitated by the drilling of

waterholes by the government. The availability of modern means of transportation (lorries especially) is another factor that helped destabilize the traditional order.

In the absence of irrigation, cereal cultivation is the only agricultural practice in the region. It essentially concerns the cultivation of barley and wheat. The average hectarage per household is 44 around Tandrara and Maatarka and 25 around Bouarfa. Farmers need the approbation of the Jmaa and local authorities, before they can possess cultivation land..

Sheep stocks are rather important in the Beni Guil. A stock of 100 heads is considered small. A medium stock would count 100 to 200 heads. A few outliers own over 20 000 heads. Stocks of near 1 000 heads are not unfrequent.. Stock feeding is mainly based on rangeland grazing, with complementation with barley and extract as needed, or affordable.

In the past, the localization of waterholes (*Ougla*) and buried tanks (*Jboub*) forced the concentration of camping during the summer. Now, there are more waterholes, but they do not suffice to satisfy demand. The commune of Tandrara-Maatarka, in particular, suffers from chronic deficit in water. Sometimes, one has to go round seven waterholes to fill one tank.

The idea of creating pastoral cooperatives in the Beni Guil was launched even before the Project for the Development of Rangelands and Animal Husbandry in the Oriental. Two stockbreeding cooperatives were created in the early eighties by good willing personalities who wanted to help the economy of the region. The experience was short lived though, because of intra and inter-tribal conflicts.

The Project for the Development of Rangelands and Animal Husbandry in the Oriental launched this idea again, focusing on the grafting of the cooperative formula on a traditional social structure. The concept was well appreciated by stockbreeders in general. The project

managed to attract 5961 adherents to 17 cooperatives bases on tribal subdivisions (fractions) of the Beni Guil confederation. Eight cooperatives were established at the level of the commune of Bouarfa and nine others in the commune of Tandrara-Maatarka. A “stabilization” program aiming at discarding non-owners reduced this number to 3591.

The first reserve (100.000 ha) was introduced in the commune of Tandrara-Maatarka in 1992. Its exploitation was allowed two years later. Access to it was completely denied to members of the cooperatives of the other commune (Bouarfa). This signed the end of intra-tribal cooperation as to rangeland use. The territorialization of rangelands was, thus, confirmed, and in effect some readjustments of borders were made but at the same time they erected these borders as barriers between tribes, or, more accurately, between the subdivisions of the same tribe. Very few pastures remain open to common exploitation. When this happens, “outsiders” must pay a fee to the cooperative “owning” the pasture. If the pasture is a reserve, the fee will return to the “outsider’s” cooperative. These arrangements do not suffice to avoid conflicts, when for example an “outsider” refuses to leave after 45 days, which is the amount of time allowed for using a reserve.

The majority of the attendants to the workshop held near Tandrara in the summer of 2000 seemed to regret that ancestral intra-tribal cooperation be sacrificed so crudely to the spirit of so called rational, modern management. A few, however, insisted that the implementation of the rules should be even more strict. But all agreed that the localization of reserves should at any rate have avoided places potentially controversial (borders, *woulf-s* of cultivation, etc.).

For the rest, but may be precisely because their attention is focused upon “external” affairs, the cooperators of the Tandrara commune seem overall satisfied with the functioning of their cooperatives. Their major “internal” problem is the lack of water.

The Middle Atlas

In the Middle Atlas, the problematic of rangeland management is somewhat different from that prevailing in the Oriental. Despite the fact that the region experienced a project for the development of livestock breeding on grazing lands, the option of rangeland management by cooperatives was not raised as a solution. The tribe fraction was maintained as the supreme authority for rangeland management, through the *naib* (representative). However, it is worth mentioning the difference in plant cover which was noted between the various communes of the region. This difference is striking at the level of the Timahdit and Aïn Leuh communes. The choice of these two communes was determined by the importance of rangelands, the similarity of environmental conditions and the differences in resource management patterns.

Timahdit

The commune of Timahdit falls under the administrative authority of the Province of Ifrane. It is located to the Center-East of the Middle Atlas and stretches over a surface area of 617 km². To the south-east, the Mid Atlas folds, and to the East the depressions of Bekrit lay on the Bouanguer syncline. Last, to the East, the Guigou limestone plateau comes next to the Valley of Lahrouch.

The commune is part of the semi arid stage characterized by cold winters. The average annual rainfalls remain very low and stand at about 386 mm. The climate is marked by cold winters and hot summers with a dry season during the period from May to the beginning of October. During the cold season, precipitations occur generally in the form of snow. The coldest period ranges from December to March, and the coldest month is January, registering a minimum temperature of 2.5 °C, the hottest month being August with a temperature of 31°C.

The Aït Arfa of Guigou make up a tribe of four fractions: Aït M'Hamed, Aït Ben Hcine, Aït Hcine ou Hand and Aït Ben Yacoub. In ethnic terms, this tribe is part of the Beni M'Guild confederation of the North and holds as territory the commune of Timahdit. According to the last population census, this commune population numbers 6,790 inhabitants. The distribution of this population shows the significance of the number of inhabitants at the level of the Aït ben Yakoub fraction. It is worth noting that 60% of the population are economically active. The major occupations of the population are agriculture and stockbreeding.

The growth rate during the 1982-1994 period stood at 3.7% and appears to be high in comparison with the national average.. This growth can be accounted for, inter alia, by the presence of foreign populations in the tribe who chiefly work as shepherds.

With its four fractions, the tribe of Timahdit occupies a total surface area of 60,700 ha. This area is dominated by rangelands which represent 74% of the total, including 24% of forests. It is a basically pastoral zone. Nonetheless, the usable agricultural area (UAA) is not insignificant (26%). It is worth noting that the UAA falls within the legal regime of *Melk* (private property), while the rangelands are fully collective lands. The farmers owning less than 5 ha represent about 29% of the total number of farmers.

Irrigation involves about 9800 ha, i.e. 61% of the total agricultural area. This significant figure is related to the availability of water resources. Agricultural production activities are dominated by cereal crops which account for 43% of the agricultural area, followed by fallow and oats. The large agricultural holdings which characterize the commune of Timahdit enable stockbreeders to practice fallow in order to cover herds feeding needs.

The distribution of crop lands among the fractions of the commune shows the definite dominance of the Aït Ben Yacoub (center of Timahdit) with 55% of bour lands and 21% of irrigated lands.

Landless farmers are concentrated in the fraction of Aït M'Hamed with a rate exceeding 36% (monography of the rural commune of Timahdit, 1990).

The tribe of the Aït Arfa of Guigou totals 130 000 heads of sheep, 12 000 heads of goats, 5 000 heads of equidae, 1 800 heads of camels.

Sheep represent thus 87% of the commune total livestock. The sheep herd structure is dominated by the presence of animals aged above 12 months and a significant number of rams. It is worth mentioning also that the distribution of animal numbers among fractions is unequal. Owing to their location at the center of Timahdit, the Aït Ben Yacoub possess only 18% of sheep of the whole Aït Arfa of Guigou. On the other hand, the numbers of sheep have gone through a significant increase during the last thirty years.

This increase is related to the importance of the sylvo-pastoral range, to the extension of stockbreeding associations and to the massive incoming of "foreign" shepherds who mainly originate from Beni Warayen in the region of Taza. At the level of this commune, foreigners who settled at the beginning of the century as shepherds are owners nowadays of substantial sheep herds. This brings us to raising the issue of stock breeding contracts. The analysis of the issue shows the significance of tenure in all the fractions and especially in the Aït M'Hamed fraction.

The presence of foreigners and the practice of partnership contracts with those foreigners are contested by the population because they considerably contribute to forest and rangelands degradation.

Feeding practices are essentially based on the use of rangelands. Unfortunately, recent drought years have been fatal to these lands. Herds have survived mainly thanks to fodder reserves (alfalfa) and extra foods (barley, bran, etc...). Health coverage is limited to internal pest control and veterinary services are only resorted to in serious situations.

In normal years, rangelands account for 46% of livestock feed allowances, while concentrates represent a mere 23%. If we exclude forests, there is a clear dependency on rangeland and forest contributions and, hence, the fragility of this feeding system, taking into account the climatic conditions and the conflicts between users.

The feed contribution of rangelands and forests has dramatically deteriorated. Stockbreeders encountered in the douar of Aït Fatkhaoui, fraction of Aït Hcine ou Hand, reported that ewes, for lack of grass on rangelands, seek to graze roots off by digging with their hoofs. With 31,000 ha of rangelands and 14,100 ha of forest, all the fractions at the commune of Timahdit do not manage to meet the herds needs. The load of some ranges may reach 400 ewes per hectare. Stockbreeders are realizing more and more that only the limitation in animal load, land resting and the rehabilitation of vegetation could fix the present condition of rangelands.

This raises the issue of management. Although the *naïb* is supposed to represent the population, in fact he speaks for the administration. Stockbreeders feel they are completely excluded from the management of their own resources. Besides, they stress the following constraints:

- Collective rangelands boundaries are not clearly defined: for example, there is a conflict over the issue between Aït Hcine ou Hand and Aït Ben Yacoub. The Boutagrouine rangeland is also subject to a dispute opposing the Aït Arfa and the Aït Ouahi.

- The dispersion of collective shelters constructed under a governmental project makes it difficult to organize collective grazing activities.
- The construction by stockbreeders of permanent camps contributes to the reduction and even the disappearance of herds movements.
- Foreigners overload pastures. In the Aït Bouataya sub-fraction, for example, they have brought in over 3 000 sheep.
- Water management all over the commune poses a serious problem as to the sustainability of water points in rangelands and the availability of drinking water for douars.

Ain Leuh

The Ain Leuh commune belongs administratively to the Province of Ifrane. Geographically speaking, the first part of the commune consists of plains and hillrocks located in the area which belongs to the central plateau: the Azaghar. The second part consists of the Mid Atlas Mountain's Piedmonts. The third part is the mountainous area, where the altitude ranges between 1500 and 2000m.

Rainfall is variable depending on the territories' different zones. The annual rainfall average is of 700mm. The falls in the Northeast part of the Commune are in the form of snow, which starts since October in the high altitudes.

Unlike the Commune of Timahdit, which consists of only one tribe, Ain Leuh Commune consists of five tribes: Ait Mouli, Ait M'Hamed ou Lahsen, Ait Ouahi, Ait Merouel and Ait Lyass. These tribes frame the Ait Abdi federation which is part of the Beni M'Guild confederation. In 1993, this commune was divided into three Municipalities, Ain Leuh, Oued Ifrane and Sidi L'Makhfi. Thus, Ain Leuh was limited to one tribe: Ait Mouli, which

comprises many fractions; Ait Azzouz, Ait Moussa, Ihadrane and Ain Leuh center. The total population of these four fractions is 10.501 people, 848 of whom are deemed to be farmers. The average density is estimated to be 19 rural people per km. Approximately 60% of the population are below 25 and only 30% of them are active.

The total area of the Commune is 49.541 ha, of which

- Agricultural area occupies 6.367 ha
- Collective rangelands occupy 8.103 ha
- Forests occupy 9.713 ha
- Uncultivated lands occupy 25.358 ha

The cultivated lands are ruled by the Melk status while the rangelands are collective and the forest is a property of the State. Stockbreeders have a territory which includes Melk cultivated lands, collective pasturelands and grazing rights in the forests belonging to the State.

The fallow is a common practice, and occupies an important place in the rotation. It represents 41% of the UAA. Fodder crops occupy an insignificant area (2,5% of UAA). As for cereals, they occupy 54% of the UAA and what remains is reserved for orcharding.

Sheep population has gone up from 28.700 head in 1970 to 76.000 head in 1999, i.e. an increase of 164%. The increase of animal population is due to:

- The extension of barley and fodder crops in the Azghar.
- The integration of exploitations in the market of stock breeding products;
- The extension of association contracts with foreigners;
- The incoming of “invaders” who squat the rangelands (“Ait Boumika”)

Unlike the rangelands of Timahdit, those of Ain Leuh are only moderately deteriorated. The Ait Mouli tribe owns 9 rangelands: Afounrir, the most important in terms of area, Narten Lakbira, Narten Sghira, Mistrane, Tafrouet Bouikhitane, Ain Kahla, Areg, Mermel Sekoura and Tabourite.

In the past, the use of ranges was ruled by a calendar respected by all fractions. The Jmaa was entrusted with the management of all the pasture lands of Ait Mouli tribe. It attended to the identification of parcels to be used in the Agdals, to determining rest periods, to the organization of transhumance and to the settlement of intra and inter-tribal conflicts. Because of the deterioration of social structures in the region, this institution has disappeared and has been reduced to a committee, which consists of the *naïb*-s of the tribe fractions. Hence, the role of the *naïb* has been limited to prolonging state action. He does not intervene in conflict resolution but he is rather an informer of the Caid.

Foreign shepherds who settled a long time ago cause a serious problem in the region. Some tribes had recourse to judicial processes to expel them from the rangelands. According to the latest judgment pronounced by the Court of Justice in Rabat, approximately 50 stockholders owning 5000 heads of sheep were recently expelled from the rangelands.

In spite of the relatively good shape of the rangelands of Ain Leuh, stockbreeders of the area stress the following issues:

- Afforestation undertaken by the Water and Forest Administration has reduced the movements of animals.
- The fact that the population is not included in the choice of the lands to be replanted or to be left fallow has engendered a climate of controversy between the population and

the Water and Forest Administration. The population still considers the forest their own property.

- Ain Leuh possesses a considerable natural riches (water, forest and rangelands) that generates significant returns (wood, industry and tourism). Nevertheless, the population states that these returns are spent out of the Commune.

The Central High Atlas

The Ait Boulli tribe is located in the central High Atlas. It is an administrative part of the commune of Tabant, Azilal province

The characteristic traditional economy of the Ait Boulli is based on pastoral stockbreeding. Agriculture is subject to limited areas, uneven lands and severe climatic conditions. Nevertheless, some factors such as demographic growth, monetaring of exchanges and the modification of the cultivation system, have affected the pastoral system's equilibrium. Yet, these changes have not affected the rangelands management mode even though the traditional tribal model has taken a new form changing from the jmaa to the model of the naïb

The douars of Aït Boulli are of small size and gather in, average, 6 to 10 compounds. The region is mountainous with an altitude ranging between 1800 and 3000 m passing from the valley to the mountain. The average rainfall is of 800 mm with a snow period between December and March. The access to Ait Boulli valley is difficult because of the bad quality of the roads and tracks linking the douars to each other.

Agricultural areas of the valley are very small. The irrigated sector constitutes the core of the agricultural system. Terraces sometimes rise very high on the slopes. Terracing need d a lot of work and demands permanent maintenance.

The average area of terraces ranges between 10 m² and 1000 m² and some terraces can be the property of many owners. The parcels area is evaluated using seed units.

Production of the valley is based on cereals. Barley and maize are the major products of the entire valley with hard wheat in the secondary place. Potatoes recently introduced are in progress and have become the main crop in some douars located in the large part of the valley. Moreover, alfalfa has started forging its place in the production system, mainly with the introduction of an ameliorated bovine race.

Techniques remain in general very traditional and tools rudimental. Plowing is effectuated with plows. The parcels are divided into parallel strips, which mark the boards for irrigation ridges ranging from 20 to 30 cm. Broadcasting after plowing is the way the sowing is made, the varieties used are local. The use of insecticide in weeding is not absent but it is rather limited.

Thanks to a well-managed irrigation system and to an intensive usage of dunging, three crops succeed to each other every two years on about 90% of cultivated area.. Every exploitation cultivates some terraces in farming; these

Winter crops mainly comprise barely, which importance varies according to years but it represents in general less than half of the cultivated fields. The plowing and sowing of barley takes place in November, the harvest in May. However, a late barely might be sowed on January according to the region's farmers.

Wheat is almost insignificant in this valley. To explain this, some farmers call upon climatic reasons (adaptation problems); however, the majority of them explain the absence of wheat by the lack of space. The cultivation of winter potatoes and onions has also been developing for some years.

Maize is the major summer cultivation. It occupies almost the $\frac{3}{4}$ of the region's fields and follows immediately barley on the parcels. It is harvested in mid-September and spread on the terraces to be dried. Spring and summer crops are added to each other, in a lesser proportion: summer potatoes (March to September), summer carrots and turnips.

The typical rotation is as follows:

Year 1: barley - maize

Year 2: potatoes-maize (or onion-maize)

Year 3: barley - maize (or barley-summer legumes)

The returns are rather considerable in these fertile lands: a field of one abra of barley (approximately 13 kg and 250 m²) supplies a harvest of 18 to 20 abra in irrigated land and 5 to 6 abra in bour.

Barley and maize remain the two traditional cereals destined to familial consumption, but they have been occupying a weaker position in contrast with potatoes' progress.

Trees are rather numerous but less varied in the valley. The maintenance of orchards is limited to irrigation. Cultivation techniques are limited to a very superficial plowing in November and the adjustment of the water tanks around the trees.

Stockbreeding occupies a privileged position in the economy of the valley. The natural milieu of Ait Boulli provides a number of pastures with variable fodder value, which allows a complex pastoral life: mountainous pastures, forest, zones of slopes, straws of irrigated terraces and crop products and sub-products. Cultivation and stockbreeding are closely linked.

The importance of livestock varies according to the importance of the pastures' area. The Ait Boulli¹ have a vast and important pastoral area where the prevailing vegetation provides complementary feed, which accounts for the movement of herds according to a precise itinerary during the whole period of transhumance.

The introduction of alfalfa permitted the development of bovine breeding in the region. As a cattle breeder declared, the number of heads moved from 0 to 25% of livestock. The new importance of cattle in the area is accounted for also by water abundance, change of alimentary habits and economic value of the products used in bovine breeding.

The bovine herd is composed of ameliorated races such as black-magpie. In Ait Moulli, the predominance of ovine and caprine over bovine is accounted for by the abundance of mountain pastures, which suits smaller ruminants, mainly goats.

Concerning sheep, one cannot talk about a pure race Timahdite, but only about a phenotype population resembling the race of Timahdite. However, it is worth noting that the sheep of the region are appreciated for the quality of their wool, their meat, their resistance to cold and their ability to travel through long distances. According to stockbreeders, the number of sheep has regressed by about 30% since the beginning of the eighties. The decline is not essentially linked to 1983 droughts but to the region cropping mutation, namely the introduction of fruit trees and potatoes.

Goats are widespread in the region and constitute an important financial resource. The most frequent race in these mountainous regions is a race of small shape meat. It is a local race with white (Taghat Tamlilt), brown (taghat Tazougart) and black varieties (Taghat Taedelit)². Black goats are appreciated by farmers for they resist cold, which is a

very important characteristic to adapt to the climactic conditions of this zone. The goat is rustic, less demanding, easy to adapt to pastures conditions. In some douars, the number of goats is almost equivalent to that of sheep.

The rhythm of pastoral life is regulated by seasonal movement. The climbing to spring pastures starts on March, and at the beginning of fall, animals return to the valley.

The movements on rangelands are known and discussed by all the members of the community in the presence of the naib. Depending on the state of rangelands, the tribe members meticulously define herds' itineraries. If a farmer does not respect the pastures' calendar, the jmaa is immediately informed and the naib organizes a meeting to decide on the sanctions against the person at fault. In general, the farmer at fault must sacrifice a sheep and prepare food for all the men of the community. In case of abstention, harsher decisions are taken such as stopping to provide him with irrigating water and the case may be carried out in justice. All rangelands are collective and distributed all along the mountains surrounding the valley. Every course is endowed with an encampment of herds, families and animals called *azib*.

The encampment is a rudimental shelter: it is established with stones and a hole is made to play the role of the door and the chimney. Herds gather in this room covered with straw and blackened by the smoke of the house. In general, two to three shepherds gather in one encampment, which enables one of them to go to the village to visit his family and bring food. Salaried shepherds get a remuneration in money and nature; the remuneration is about 750 DH and about 15 abra of barely for an equivalent of 40 heads for a period of six months.

The pastures are chosen to be near waterholes and rivers in order to ensure animals' drinking. Some douars have azibs at different altitudes (2000 to 3000m). These sites' disposition offers possibilities of laying out pasture periods. Taking into consideration agricultural activities in the valley, which have intensified during the late years, the movement calendar and the state of rangelands are represented in the following chart:

Rangelands	Altitudes	Period	State
1. Tizal	1700 - 2000	October - February	Average
2. Taltntayar			
3. Amznar			
1. Imzzour	2400 - 3000	March - September	Good
2. Tinaghmatine			
3. Tamzghelt			
4. Tafenfanet			

The system prevailing in the Aït Boulli is different from the two others, mainly in that the practice of Agdal has survived and seems to be still sustainable. The presence of foreigners is limited in spite of the fact that the pastoral area is large. It is also worth noting that agricultural diversification has changed the roles of stockbreeders and that people now opt for production systems based on the complementarity of cropping and stockbreeding. Moreover, touristic activity in the region provided the community with a new considerable source of revenue.

Conclusion of Part I

Except in the High Atlas, all investigations have shown a lack of control of the communities concerned over the situation of their pastoral lands. Whereas this lack of control is due, in the Middle Atlas, to the decline of the traditional *jmaa*, it is rather to be related, in the Oriental, to an insufficient mastery of the new tool constituted by cooperatives and to the difficulty for this new tool to “emancipate” itself from the continuing attraction of old habits and customs. The frequency of conflicts, the tendency not to respect rules governing the use of reserves reflects this difficulty . Obviously, a “pedagogical” effort towards the populations is still to be made by both the technical and the political services of the State. But besides, a better participation of the populations to the identification and delimitation of reserves, to the formulation and implementation of rules of use of reserves and other ranges and to the management of their own cooperatives should be sought. A special attention should be paid to the determination and management of waterholes. Also a special attention should be paid to the delimitation of membership and to the control of “sharebreeding” contracts. To these basic conditions, the cooperative could impose itself as *the* management alternative for all the rangelands of the country.

PART II. ECONOMETRIC ANALYSIS

The main objective of the econometric analysis was to evaluate the effects of range management options on total feed expenditures. This approach was adopted because the general hypothesis of range management is that the improvement of the range would result on more feed availability and hence on the reduction of feed

expenditures. Though this premise has been used to fund many development projects, there has been no study assessing the effect of range management on feed expenditures. In addition, given that feed supplementation is a generalized practice amongst the sheep rearing communities, the major cost differentials would depend on households' land use systems and grazing access options that they have within their own territory and outside their local grazing resources. In the case of Morocco, the three regions that were studied have different livestock production systems even though they all raise mainly sheep.

The main hypothesis was that range management reduces the dependency of sheep breeders on concentrate feeds and hence enhance their overall welfare. This hypothesis was estimated using Stata software and a panel data of 305 households in three Moroccan regions. Tobit analysis was used to estimate the level of feed expenditure for all the three regions and for each region. However, in the case of Oriental, where all the livestock breeders are using supplementation, ordinary least squares model was used to estimate the determinants of household feed expenditures. In addition, elasticities were estimated to measure the percentage change on feed expenditures following a 1% change of the other variables of sheep, household land holdings and household total income.

These relationships were estimated using the following equation:

$$C_{hi} = b_0 + b_h x_h + b_i x_i + b_r R + u_{hi}$$

C_{hi} is vector for dependant variables (feed expenditure) of household (h) of community (i); x_i and x_h are vectors of household and range management characteristics; R is a vector of community level dummies; U_{hi} unobserved factors

affecting the dependant variable and b_0 , b_h , b_i , and b_r are coefficient vectors to be estimated.

Data

Following the RRA surveys the Oriental, Middle Atlas and High Atlas regions; an in-depth survey questionnaire was conducted amongst 325 households composed of 170 households in the Oriental, 105 households in the Middle Atlas and 50 households in the High Atlas. After eliminating cases with missing or unreliable data, the sample was reduced to 305 households. The unit of observation was the household. Data collection involved the recording of livestock and crop production decisions including feeding and grazing strategies as well as the perceptions of the sheep breeders on the quality of their range resources and the types of problems that they face.

The dependent variable feed expenditures was observed only after the decision to purchase concentrate feeds was made. Though, we observed both households using supplemental feeding as well as those that did not, households not owning sheep were not included in the analysis even though their perceptions regarding the state of the range and degradation would be valuable for policy formulation. Sheep owners that did not purchase feeds were included because they are primary users of tribal collective pastures and farm products. Average feed expenditures was 34,198 Dh for the all sample but there was a lot of variability between and within region. For example, in the oriental, grazers on the tribal pastures only spent 2 times more than those that were also grazing on the cooperatives improved grazing reserves (Table I). In the Middle Atlas, sheep owners using the forests spend more on feeds than those grazing solely on common tribal pastures. In the High Atlas, sheep owners grazing in

the Agdal paid much less than those grazing on common pastures. These regional features were controlled using regional dummy variables for the Oriental and the High Atlas and leaving middle Atlas as control variable.

Table I: Description of dependant and explanatory variables

Description	Variable	Obs	Mean	Std. Dev.	Min	Max
Feed expenditures	feedexpend	305	34197.950	55884.590	0	420000
Small ruminants (Sheep & goats)	smallrum	305	218.128	231.891	1	1157
Land holding	hhland	305	13.410	25.010	0	250
Total income	totinc	305	111717.600	141490.000	960	1342000
Proportion of land cultivated with cereals	cropsh	305	0.611	0.356	0	3
Proportion of land cultivated with forage	foragesh	305	0.053	0.100	0	0.67
Grazing tribal and reserves pastures (0,1)	trbange	305	0.026	0.160	0	1
Tribal and forest pastures (0,1)	trbforet	305	0.118	0.323	0	1
Tribal and agdal (0,1)	trbagdal	305	0.141	0.349	0	1
Small livestock owners (0,1)	small	305	0.410	0.493	0	1
Medium livestock owners (0,1)	medium	305	0.498	0.501	0	1
Eastern region (0,1)	oriental	305	0.164	0.371	0	1
High Atlas (0,1)	hatlas	305	0.505	0.501	0	1

Four sets of independent variables including household productive assets (land and livestock), income, land use, dummies for other used grazing resources and regional dummies were used in the analyses (Table III) Land holding was introduced in the

model to account for potential crop production at the farm level. Two land use variables (proportion of areas cultivated with cereals and forages) to see the potential effects of farming on feed expenditure. There was a lot of variability between regions on the size of household holdings. For example, the largest land holdings were found in the Oriental with average household holdings of 21 ha while in the Middle and High Atlas, land holdings were between 0.25 and 4 ha. However, thanks to the relatively more favorable physical conditions and the relative availability of source water in this region, a wide range of crop and trees are grown in the same plot throughout the year. Major crops include cereals (barely, hard wheat, and soft wheat), forages (corn and alfalfa), fruit trees (walnut-tree, and recently introduced apple-trees), potatoes and other vegetables. Average crop yields in this region are among the highest in the country.

The income variable was introduced in the model to evaluate how sheep owners react to increases on household income. Besides High Atlas, livestock was the major source of household income. Livestock income accounted for 80% to 93% of household income in the middle Atlas and Oriental regions. The households from these regions seem to be more dependant on livestock as their main Households in the Eastern region appear to be more dependent on livestock production and hence more vulnerable to rainfall fluctuations.

Two types of livestock management strategies were observed in each region. To highlight the importance of those pastures, dummy variables were constructed for the rangeland reserves in the Eastern region, forest variable for the middle region and Agdal for the high Atlas. The collective rangelands were left as the control variable.

This procedure permits to compare the different management systems with the tribal management systems in each of the region. In the Eastern region 95 % of the farmers grazed only in tribal collective rangelands while 5% grazed in the tribal rangelands as well as in the tribal reserves. The livestock production system in this region, as discussed in previous sections, is extensive. Parts of the tribal rangelands have been improved with exotic shrubs like Attriplex to enhance feed availability. These rangeland reserves are managed by tribal based cooperatives. However, two different reserve management systems were found in the northern and southern parts of this region. In the north, each cooperative has its own reserve and only the members of the cooperative can have access to the reserve while in the south all reserves are considered as collective tribal grazing resources and tribal members can have access to all these reserves. Though these differences in the management of these reserves may have many implications on access and use of these resources, there was very little difference on their effects on feed expenditures.

In the Middle Atlas region 64 % of the sheep owners grazed only in tribal rangelands and 36 % used also forest pastures. In this region, the role of the traditional institutions in the management of the range resources have eroded to the extent to which the Naib plays only an intermediary role between the community and administration. He does not have any authority over the access and use of the resources. This lack of authority may explain why the tribal pastures were degraded. Communities have also access to forests resources that are managed by the Forest Services. In recent years, however, the forests have been also degraded and many sheep owners prefer to stay besides the forest rather than moving back to the lower

areas. Furthermore, water availability has favored the intensification of agriculture and the development of vegetable production and orchards.

In the High atlas region only 14 % of the farmers used only tribal rangeland while 86% used both tribal and Agdal pastures. In this region, the livestock production system is mountainous and the difficult access to the pastures has contributed in maintaining the pastures in fairly good conditions. The community has two tribal collective rangeland resources. All the community members use one of them all year around while Agdal pastures, which are located in high elevations (3000 m high), are used only during spring and summer. Traditional institutions continue to play an important role in the management of tribal pastures and conflicts. The Naib with the help of the Jamaa (community household representatives) sets the rules and decide also on the sanctions for using the pastures. These pastures have been divided between the different tribal fraction and each of these fractions has its own pastures.

Table II : Household characteristics

	Only Tribal pastures			Tribal pastures and reserves	Tribal pastures and forests	Tribal pastures and Agdal
	Oriental	Middle Atlas	High Atlas	Oriental	Middle Atlas	High Atlas
Assets						
Land holding (ha)	21.61	4.02	0.26	20.16	3.40	0.21
Small ruminants (heads)	208.16	252.03	34.57	233.38	278.61	177.12
Land Use						
Cereals (%)	0.57	0.63	0.88	0.74	0.46	0.79
Forage crops (%)	0.02	0.08	0.04	0.05	0.08	0.09
Others (%)	0.41	0.29	0.08	0.21	0.46	0.12
Income (Dh)						
Livestock income	94,285	45,885	5,000	43,412	103,248	33,077
Crop income	10,136	33,789	143,334	1,181	18,694	105,186
Off farm income	6,678	464	8,571	950	1,944	8,035
Total income	114,016	81,317	156,905	46,143	123,887	146,299
Feed expenditures (Dh)	56,455	14,082	314	26,550	29,000	322
Status of livestock ownership						
Small (%)	0.62	0.29	0.86	0.63	0.08	0.02
Middle (%)	0.21	0.71	0.14	0	0.92	0.98
Large (%)	0.17	0	0	0.27	0	
	146	65	7	8	36	43

RESULTS AND DISCUSSION

Table III shows the results of the Tobit and OLS estimates for household expenditures on concentrate feeds. Herd size has the positive sign that was expected but was significant only in the middle Atlas. An increase of the herd size by 1% would result in an increase of 1.8% on feed expenditures. This situation results from the growing specialization of the middle Atlas region as a fattening zone. The variables of classification of livestock owners into small, medium and large, had expected signs and were significant. For all the regions, medium livestock owners spent 66% less on feed expenditures than large sheep owners. In Oriental, medium sheep owners spent 21% less than large sheep owners.

The income elasticity was consistent with economic theory for the general equation and the regional (Middle and High Atlas) equations. Income elasticities were positive and significant. However, the higher coefficient of the Middle Atlas equation suggests that a 1% increase of income will result into a 3% increase on feed expenditures. The results of the Middle Atlas confirm the relationship between herd size and feed expenditures.

The two land use variables (proportion of household holding cultivated with cereals and forage) had contrary signs. The positive and significant sign of the cereal variable may result from the effect of the drought during the last three years and most of the farmers did not harvest their rainfed crops. The coefficient for the forage crop variable was negative and significant suggesting forage crops are a good substitute for concentrate feeds. Water availability constitutes the main constraint for the

development of forage crops. In the Middle Atlas, where farmers have water springs, some of the farmers are growing forage.

Four types of grazing resources were found in the region: (1) tribal collective, forests, cooperative reserves and mountain pastures (Agdals). The tribal collective and Agdal pastures are managed by traditional institutions and access rules are based tribal affiliation and traditional relationships. The forests are under the management of the Forest Services and herders have to pay a fee to graze in the forests, while improved pasture reserves are managed by cooperatives. Given that all households used collective pastures at certain time of the year and they all have the same access rights to their tribal pastures. Tribal collective pastures were used as the control variable. Consequently, the results of the simulation regarding forests, improved reserves or Agdal could be considered as the effects of these resources on feed expenditures.

The coefficients of the cooperative reserves and Agdal variables had the expected negative sign but only the coefficient associated with cooperative reserves was significant. The significance and sign of the coefficient were consistent in the overall equation as well as in the regional (Oriental) equation with an elasticity of -0.034 and -0.032 respectively. The results suggest that households grazing on these reserves spent 3%³ less than households grazing solely on tribal collective pastures. Regarding forests, the coefficient was significant and was positive. This was contrary to our expectations because the results suggest that sheep owners using the forests are spending 11% more than those that are tribal collective pastures. The results were

³ The percentage change in feed expenditure for explanatory dummy variables relative the control variable was calculated using the following formula $(e^{\text{explanatory dummy variable}} - 1) * 100$ (Ehui et al. 2000)

consistent for the general equation as well as the regional equation (Middle Atlas). Moreover, the results of the regional equation suggest that the households grazing on the forests spend 3 times more than those that are mainly grazing collective pastures. This situation may result from the fact that sheep owners are increasingly staying all year around in the forests and are obliged to rely on supplementation during wintertime. One of the questions that arise is why are some of the herders staying in those areas and not using traditional transhumance routes to seek grazing in other pastures.

The coefficient of the regional variables was positive and significant for the oriental and negative but insignificant for the high Atlas. The results suggest that sheep owners in the Oriental pay 2 times more hand feeds than their counterparts in the Middle Atlas. These regional disparities are very important to take into consideration

In general, none of the variables used to explain herders' decisions to purchase feeds on the regional equation of the High Atlas was significant. The importance of crop and vegetable production provides enough residues to local flocks.

Conclusion of Part II

Concerning the Oriental and despite complaints expressed by members of the cooperatives, it appears that reserves significantly contribute to reducing household feed expenditures. Thus, the cooperative system should be reinforced, so as to allow for an even stricter control of the reserves.

As for the Middle Atlas, a stronger integration between agriculture and livestock should be sought. Encouraging the growing of forage crops could be a way to enhance households' autonomy as to animal feed.

Finally, it seems that the system prevailing in the Central High Atlas enjoys a state of equilibrium, but at a low level of development. Development action should aim at enhancing the general performance of the system.

Table III Tobit and OLS⁴ of household feed expenditures

feedexpend	All regions		Oriental		Middle Atlas		High Atlas
	Coefficients	Elasticities	Coefficients	Elasticities	Coefficients	Elasticities	Coefficients
	10.176		-18.375		33.754		-1.450
smallrum	(17.301)	0.092	(59.977)	-0.070	(18.126)*	1.817	(1.311)
	173.251		106.235		27.552		487.064
hhland	(110.300)	0.123	(158.064)	0.042	(202.959)	0.108	(1054.978)
	0.136		0.149		0.159		0.000
totinc	(0.021)***	0.626	(0.074)**	0.300	(0.030)***	3.129	(0.001)
	17338.810		14293.780		14460.230		135.524
cropsh	(7910.662)**	0.437	(13271.600)	0.150	(13746.600)	1.691	(656.017)
	-113824.700		-44368.540		-161507.500		-1423.326
foragesh	(32478.560)***	-0.249	(35510.800)	-0.020	(42754.240)***	-2.706	(2002.437)
	-31502.020		-33693.400				
trbange	(15811.360)**	-0.034	(15609.440)**	-0.032			
	21908.420				19050.290		
trbforet	(9871.155)**	0.107			(7193.686)***	1.398	
	-17869.500						136.469
trbagdal	(20809.700)	-0.104					(701.690)
	54666.180						
oriental	(8514.026)***	1.139					
	-10582.420						
hatlas	(20237.390)	-0.072					
	-75540.440		-90401.100		-16737.020		
small	(13218.970)***		(41170.770)**		(10167.740)*		
	-52112.370		-64794.970				65.004
medium	(12580.510)***	-1.072	(34717.420)*	-0.230			(695.025)
	31131.920		103621.900		-17908.360		-93.069
_cons	(17845.640)*		(49271.750)**		(11548.550)		(723.474)
	42556.030				28178.690		754.371
_se	(1961.192)				(2657.878)		(123.171)

⁴ Only for Oriental because all the interviewed sheep owners purchased concentrate to supplement their sheep diet.

GENERAL CONCLUSION

The cooperative seems to be the management option of the future. However, it is clear that whatever the institutional choice, the status of rangelands cannot be improved without a significant reduction of the animal load that they have currently to suffer. On the other hand, alternatives to current stockbreeding practices should be actively prospected. A few possible avenues are the following:

- Intensification
- Investment in quality rather than in quantity. For instance, the promotion of the breed *Bni Guil*, already known for its “*bio*” qualities, could prove very profitable
- Re-introduction, especially in the Oriental, of species such as ostrichs and dorcas
- Development of alternative sources of revenue such as medicinal crops and tourism