

Effects of Socioeconomic Factors on Rangeland Institutional Options on the Semi-arid Regions in Jordan

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ABSTRACT

There are four rangeland management options practiced in the low rainfall areas in Jordan, namely; tribal management of open access, cooperative management, state-managed reserves and private rangeland. The discrete choice of the Probit model was used to explain the socioeconomic characteristics of herders and their role in the herder choices to adopt different management options. Shepherders are using different combinations of rangeland management options depending on the influence of several factors such as the existence of institutions, the herder's formal education and his household size. Herding practices, such as hiring a shepherd, are positively correlated with choosing the tribal and cooperative management option. Results show that increasing the flock size owned by shepherders will increase the probability of utilizing the tribal management option and will make it less probable to utilize state-managed reserves. Results also show that herders integrating crop and livestock are less likely to choose state-managed shrubs. Rangeland cooperative option can reduce the probability of utilizing tribal rangelands. Real involvement of rural communities in the collective action of rangeland management is an attractive idea to improve rangeland in Jordan. Enhancing the establishment of rangeland users' associations or cooperatives using conditional lease of rangeland utilization will protect rangelands and make the ultimate benefit of it in a sustainable manner.

Keywords: Grazing, Reserves, Cooperative Management, Probit Model.

INTRODUCTION

Common rangeland resources are the livelihood base of pastoralists and, in particular, of poor rural households in the developing countries. There is a growing evidence that natural resources in the marginal land are becoming increasingly scarce (Otsuka, 2001; Hamadeh, 2001), rural societies are responding in their turn by adopting new livelihood coping mechanisms,

including those based on collective managements and social networks (Kadigi et al., 2007). Many researchers argue that rangeland development projects failed because of the top-down approaches from remote centralized administrations while excluding the pastoral institutions from the management of their resources (Ngaido and Kirk, 2000). Furthermore, many technical interventions have failed in managing rangelands due to ignoring the role of communities and local institutions in managing common rangeland (Ngaido, 1998; Abu-Zanat and Amri, 2005). The government institutions also failed in promoting sustainable resource management practices due to their method of top-down implementation of rangeland development projects. This provides an

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additional argument in favor of the greater participation of local communities in managing common property resources. Therefore, empowerment of rangeland users is one of the major tools of rangeland devolution policies (Riedel et al., 2007). The new paradigm shift in managing common resources aims to achieve a positive impact on the development of certain outcomes such as economic growth, equity, poverty alleviation and sustainability. Many countries are reforming their land and resource management policies and devolving more decision-making power to local communities and organizations (Meinzen-Dick et al., 2004). Recently, rangelands have been subject not just to the open access situation but also to a wide range of tenure arrangements, with different structures for regulating access, use, and management of rangelands. These include customary and tribal institutional arrangements that have functioned for long periods in rural communities. There are three main categories defined of land ownership: (1) state ownership; (2) individual ownership; and (3) common property. Furthermore, a number of different institutional arrangements have been introduced to manage state-owned rangelands including granting use rights to local communities or cooperatives grazing licenses, and leasing arrangements (Ngaido and Mccarthy, 2004).

In Jordan's drier zones, low and variable rainfalls limit the options available to farmers. Small ruminants supported by rain-fed barley production and natural grazing in the extensive rangelands are the principal economic outputs of these zones. Increased demands for livestock products and agricultural policies have encouraged a rapid expansion of small ruminant numbers over the period (1990-2009). One of the major problems faced by herders is finding enough feed to support the small ruminant population and rural families who depend on them. The rangeland can no longer cover

such a large proportion of feed needs for livestock population, so supplemental feeding with barley grain, straw and other crop by-products is essential. Abu-Zanat (1995) estimated that rangelands in Jordan provide only about 20-30% of feed requirements for grazing animals. Attempts to meet the widening "feed gap" have resulted in an expansion of the area planted with barley, the principal livestock feed, which is achieved primarily through cultivating previously uncultivated marginal land and replacing the traditional barley-fallow rotations with continuous barley cropping. Cereal production in these areas is based on minimal inputs; thus, yields are low due to farmers' negative attitude towards risks. Continuous barley cropping is rapidly depleting soil fertility and enhancing wind erosion. Land tenure confusion and the lack of a defined and practical strategy regarding the role of local communities in the use and management of rangeland resources are identified as the main impediments to the existing rangeland reserves. The lack of community involvement and the rejection of their traditional claims have created a sentiment of rejection toward state rangeland reserves.

The total area of Jordan is about 8.9 million hectares (MOA, 2003). Law number "20" of 1973 defined rangeland as: "the land receiving less than 200 mm average annual rainfall". It recognized the state as the owner of the rangelands and it gave the authority of managing the land to the Ministry of Agriculture. Rangelands play an important role in providing native feed at a very minimal or no cost; wherein grazing is a way of life and a promising source of income for about 22% of the population in these areas, who are dependent on livestock for their livelihood (Rowe, 1999). Traditional grazing cycles were originally based on a transhumance system that allowed for the natural regeneration of forage. Nowadays, this situation no longer exists, as traditional grazing rights are mostly ignored due to the increasing livestock population over carrying

capacity and the increasing cost of hand-feeding. Rangelands are being severely degraded because of overgrazing, uprooting of range shrubs off-road driving, inappropriate cultivation patterns and urbanization.

Improvement in living standards increased demands for animal products. The price ratio between livestock outputs and feedstuffs is increasing; therefore, sheep owners started to keep more animals on the rangelands. The feed concentrate has generally been distributed to flock owners on an untargeted per head of livestock basis. The annual subsidy of barley during the period (1990-1995) averaged \$15.4 million, which increased to about \$51 million in 2005, and jumped to \$134 millions in 2007. The government paid a subsidy of \$100-130 ton⁻¹, which is the difference between government purchasing price and the farmer's subsidized price (Ministry of Industry and Trade, 2008). The price subsidy increased the total number of sheep from 1.2 million heads in 1988 to about 2.5 million heads in 1995. The feedstuff subsidy removal during the period (1997-2000) which was accompanied by a severe drought in (1998-2000) accelerated the decrease of the flock size which reached the minimum of (1.6 million heads) in 2000. After the re-introduction of feed subsidy, the flock size started to increase from 1.66 million heads in 2001 to 2.41 million heads in 2007. This caused an increase in grazing pressure on the rangeland and allowed sheep owners to increase their flocks without increasing their fodder production (DOS, 2009). Therefore, the policy of subsidizing prices for imported livestock feed has encouraged livestock herders to keep large numbers of animals that exceed the carrying capacity of the rangeland (Ben Salem and Smith, 2008).

Evolution of Rangeland Management System

In the past fifty years, rangelands were divided into tribal environs. Each tribe used to know its range areas and others' areas and respect these rights. Tribes used to

move their flocks knowing that their right in their steppe range is saved and not violated by other flocks, except if with their permission. Grazing was mainly organized by traditional tribal rules, as most tribes considered themselves the owners of the land and that they have usually grazed the same land for many years. In those times, outsiders were excluded from using the rangeland and grazing rights were clear.

The main livestock production system in the last 50 years was known to be the system of nomadic grazing, where flocks used to move most of the year according to the availability of forage and water. This system was good enough to allow giving rest to the rangelands for about six months each year for vegetation to recover. The availability of water was the main factor in deciding to stay or to leave a range site. This nomadic grazing system began to diminish as nomads settled in the steppes and started to cultivate newly acquired lands (Tadros, 1988; FAO, 1995). The settled people then cultivate previously uncultivated, low-potential rangeland using rain-fed or irrigated methods. A combination of unfavourable environmental factors and inappropriate farming methods often leads to rangeland degradation and declining productivity (Millington, 1999; Koch et al., 2008). The young males gradually joined the labor force and migrated to large cities; which had a great impact on the societies resulting in a decline of the number of young people who were ready to take shepherding and herding as a job. Hiring shepherds increased the pressure on vegetation as flocks started to move long distances and stay for a longer time on the rangeland. Many socioeconomic changes occurred at that time in the nomadic societies. Settling, selling the individual property of allocated rangeland from state, increasing the nonagricultural income, using vehicles to reach any rangeland in few hours instead of moving flocks to that rangeland, livestock water subsidy and the

prevalence of education in these societies led to a dynamic transformation in livestock production system (Edwards et al., 1999). The transhumant communities have settled under control of the central government; and they have acquired trucks to transport animals. In addition, herding was largely performed by hired shepherds and herd sizes were increasing because of feed subsidy. The increasing provision of state services and infrastructure has enticed the majority of dwellers to settle in villages where they are better placed to receive these benefits. The provision of a water supply to most villages, in combination with the availability of cheap, subsidized feeds, has encouraged the development of sedentarized forms of livestock production (Rowe, 1999). The government policies have made it easier to cultivate marginal lands in low rainfall areas for barley production, whether for sale or, more commonly, for *in-situ* livestock feed. This has also enabled flocks to access areas of rangelands for extended periods of the year. Damage to vegetation from overgrazing, vehicular compaction, trampling, and fuel wood collection is widely reported (Oram, 1998). The small ruminant production systems vary from one location to another according to the availability of grazing material and forage biomass. The main production systems prevailing in the low rainfall areas are:

(1) Nomadic system. This prevails in the eastern and southern regions, which are arid to semi-arid. It is the most extensive system as the herds move from one place to another, on foot or by truck, looking for grazing or water. The flock depends on natural herbage as their main source of feed, in addition to the hand feeding in winter for a period, which varies with availability of herbage.

(2) Semi-nomadic system. Flocks depend partially on natural grazing and on crop residue and agricultural by-products. They move to land adjacent to the field crops, and return to spend the winter around the houses

where they survive on the hand feeding given to them. The hand feeding period extends from 4-6 months.

(3) Settled system. Flocks are kept in fattening units. They graze in the morning and return to their units in the afternoon. They feed on crop by-products and the adjacent natural grazing. Supplementary hand feeds are provided to them as required.

(4) Intensive system. Sheep are kept in permanent farms with modern facilities and equipment. They are provided with balanced feeds and health care.

By nationalizing rangelands, undermining tribal authority, and enforced settlement of nomadic people, without substituting alternative effective systems of management and establishing clear property rights, some governments have opened the door to the abusive uses of the resource described above. The land belongs to everyone and to no one!. The local communities still claim their rights over parts of the rangelands that are considered environs or facing areas (rangeland), while many individuals do claim ownership of the lands they developed on their tribal lands. Such rangeland rights negatively affect and control the efficiency of the use of or the proper management of rangeland resources (USAID and GTZ, 1994). Recently, the government attempts to overcome land tenure problems by conducting a cadastral survey and by allocating land to individuals (or groups). However, it would be extremely difficult to make any agreements among all claimants. Government policies in this regard have been widely criticized for their continued reference to 'Tragedy of the Commons' based solutions of fencing and private rangeland ownership. Such initiatives for rangeland privatization are now globally identified as a cause of worsening rangeland degradation and deepening social and economic inequalities. Thus, it will be more effective to seek piecemeal agreements for sustainable land use improvement with those *de facto* landowners

who are known to be interested, cooperative and locally accepted, moving after that toward expanding, this based on the success achieved (Dutton and Shahbaz, 1999).

The United Nations Compensation Commission (UNCC) agreed with Jordan that both wildlife and grazing land had been severely damaged. This Commission granted Jordan \$160 million for implementing a cooperative rangeland management program over a period of 20 years. Furthermore, the UNCC has developed a draft "cooperative rangeland management program" that is considered to be suitable for Jordan's restoration program. The objective of the program is to ensure effective management of Jordan's livestock grazing activities, in order to improve the productivity of rangelands and wildlife habitats. Cooperative management is based on the promise that resource users and resource managers can find a common solution that produces gains for both of them in the long term (Engicon and GFA, 2008).

The factors and farmers' characteristics that influence the adoption of technology and new farming systems have been studied by different authors, these characteristics were grouped by Feder et al. (1985) into four categories: farm characteristics, household characteristics, technology characteristics and institutional factors. Tripathi and Psychas (1992) presented, in specific, the major socioeconomic factors that determine whether individual farmers and communities choose to adopt a new farming practice or not. These include; land tenure, labor requirements, management complexity and profitability. Therefore, it is necessary to examine the factors influencing the adoption of different grazing management options by herders and then to decide what is the appropriate institutional arrangement that should be followed to achieve the proper use of land.

Objectives

The purpose of this study is to participate in the understanding and assessment of the different institutional options for managing and improving rangelands. The specific objective of this study is to examine the socioeconomic factors that explain alternative rangeland use options by herders in the semi-arid regions and its implication on the institutional options for rangeland management. All in light of recent social and economic developments within livestock herders' society.

Methodology

Rapid Rural Appraisal (RRA) in six communities was conducted to characterize the pastoral systems and range management options. Six communities were chosen to represent the different management options. These are Sabha and Boweidha Gharbeih communities in the north, Jabal Bani-Hammedah and Mleih communities in the middle, in addition to Ader and Rawdat Rashed communities in the south. Selecting the communities was based on certain criteria such as agro-ecological zones, contrasting experiences of natural resource degradation and population density of human and livestock. A standard questionnaire that consists of a series of clearly stated questions, that are interestingly formulated and formatted in a structured manner, has been developed and pre-tested to meet the local conditions of rural communities. The data were randomly collected from each community by means of personal interview. All herders had equal chances to be part of the sample and were able to be selected once only. The total number of collected and questionnaires were 300 reflecting different management options as shown in Table (1). The socio-economic characterization of households was used to evaluate the effects of these characteristics on the adoption of specific management options by herders.

Table 1: Management options practiced in the communities and the number of collected questionnaires

Management options	Community	Location	Rainfall (mm)	Questionnaires collected
Private (P)	Boweidha Gharbeih	N	250	25
Tribal+ State (S)	Sabha	N	150	35
Tribal (T)	Mleih	M	250	39
Tribal+ Cooperative (C)	Jabal Bani-Hammedah	M	150	78
Tribal+ State (S)	Rawdat Rashed	S	200	35
Tribal+ State+ Cooperative	Ader	S	200	88

In order to measure the factors explaining the adoption of management options used by herders, the data were analyzed using the limited dependent variable regression. Management options are treated in our study as a binary variable, either practiced or non-practiced. The functional forms most frequently used in this case are linear probability, probit and logit models (Amemiya, 1985). The use of discrete choice model in explaining socioeconomic characteristics is not recent. When we are faced with a situation where the variable of interest, that we choose to explain, takes values of 0 or 1, this is called a discrete variable. We seek to write a model where a set of explanatory variables determine this outcome. Ordinary Least Square method (OLS) is not appropriate for this because in OLS, the variable that we seek to explain must have real values and can run from $-\infty$ to ∞ . Therefore, if OLS is inappropriately applied in this situation, the estimates from this 'linear probability model' are inconsistent. An alternative method is suggested by Chester Bliss in 1930 is the probit analysis. The term "probit" stands for probability unit. Following Pindy and Rubinfeld (1981), Polson and Spencer (1991) and Maddala (1992) the Probit model which follows the standard normal distribution comes as shown in equation (1):

$$Y_i = F(W_i) = \int_{-\infty}^{W_i} \frac{1}{\sqrt{2\pi}} e^{-s^2/2} ds \quad (1)$$

For $-\infty < W_i < \infty; X_i \beta$

Where Y_i expresses the probability that the i th farmer may practice a specific rangeland management option, 0 otherwise. s is a random variable that is normally distributed with zero mean and unit variance. Therefore, the general form can be represented as: Y_i is defined as a sequence of dependent binary random variable taking the values of 1 or 0, X_i is a K -vector of known explanatory variables, β_i is a K -vector of unknown parameters, whereas F is a certain known function. The linear probability model has a defect in that F of this model is not a properly distributed function, as it is not constrained to lie between 0 and 1. However, the probit model, like many other models using the normal distribution, may be justified by appealing to a central limit theorem. A major justification for the logit model is that the logistic distribution function is similar to a normal distribution function but has a much simpler form. With regard to the probit and logit models, Amemiya (1981) concluded the difficulty to distinguish between them statistically unless one has an extremely large number of observations. It was shown that the choice between them is largely one of convenience and program availability (Hanushek and Jackson, 1977; Amemiya, 1981; Perry et al., 1986; Gujarati, 1995; Shidded and El Mourid, 2005).

The change in the probability that a farmer may practice a specific rangeland management option given the change in any one of the explanatory variables

known as the marginal effect can be computed as shown in equation (2):

$$\frac{\delta y_i}{\delta x_i} = \left(\frac{\delta F_i}{\delta w_i} \right) \left(\frac{\delta w_i}{\delta x_i} \right) = F(w_i) \beta \dots(2)$$

Where $F(w_i)$ is the standard normal density function of the probit model. Probit model has been used to assess the practiced rangeland management options adopted by herders based on their characteristics and circumstances. However, probit model has been widely applied in adoption studies (Bagi, 1983; David and Otsuka, 1990; Griffin et al., 1995; Owens et al., 1997; and Morris and Doss, 1999). If the coefficient of a particular variable is positive, it means that higher values of that variable result in a higher probability to adopt a specific management option, while a lower value of a particular variable implies a lower probability of adoption (Sarap and Vashist, 1994). For this purpose, three management options compared with the private rangeland option were analyzed using the limited dependent variable regressions. An alternative approach of probit model is the following regression model as described by Maddala (1992) in equation (3):

$$y_i^* = b_0 + \sum_{j=1}^k b_j x_{ij} + u_i \quad (3)$$

$$y_i = \begin{cases} 1 & \text{if } y_i^* > 0 \\ 0 & \text{otherwise} \end{cases}$$

where (y_i^*) is not observed, and it is commonly called a "latent" variable, x 's are the socio-economic factors that explain the adoption of a certain management practice and u_i is the error term. However, the latent variable can only be observed as a dichotomous variable as (y_i) is a variable measuring adoption/non-adoption of a specific management option. Maximization of the likelihood

function for equation (1) is accomplished by nonlinear estimation methods (Pindyck and Rubinfeld, 1981; Maddala, 1992; Griffiths et al., 1993). However, there is a problem with the use of the conventional R^2 measure when the explained variable has only two values. In OLS regressions, it is common to provide a measure of how well the model fits the data, such as R^2 . Unfortunately, no direct equivalent to R^2 exists for probit models. A wide range of pseudo- R^2 measures has been proposed. However, these measures have formulae that differ from one another and will take different values for the same model. For example, Veall and Zimmermann (1996) described a model in which McFadden's pseudo- R^2 was 0.25, while the McKelvey-Zavoina pseudo- R^2 was 0.5. Therefore, they suggested to use another measure of R^2 which is that of McFadden who defines it as shown in equation (4):

$$\text{McFadden's } R^2 = 1 - \frac{\log L_{UR}}{\log L_R} \quad (4)$$

Where L_{UR} is the maximum of the likelihood function when maximized with respect to all the parameters, and L_R is the maximum likelihood function when maximized with the restrictions $b_i = 0$ for $i = 1, 2, \dots, k$. However, more details related to pseudo R^2 can be found in Veall and Zimmermann (1996) and Hoetker (2007). Furthermore, as described by Maddala (1992) and Griffiths et al. (1993), a proportion of correct predictions is used as a measure for the goodness or fitness of the estimated models as shown in equation (5). The probit model was estimated by a maximum likelihood method using STATA 7.0© (StataCorp, 2001).

$$\text{count } R^2 = \frac{\text{number of correct predictions}}{\text{total number of observations}} \quad (5)$$

Results and Discussion

Identification of Rangeland Management Options

Results of RRA in Northern, Middle and Southern parts of Jordan show that there are four different management options practiced in different combinations. These are traditional tribal system (T); which is known also as "Open Access", cooperative management (C) a form of collective action, state-managed reserves (S) and private rangeland (P). Shepherders can use different combinations of rangeland management options. The household composition includes; average household size, gender, level of education, and source of income, which were all thought to be significant factors in the adoption of specific rangeland management options. Results from the survey indicate that the majority of households (66%) were seasonally mobile, while about a third spent most of the year based at rangeland herding camps or divided their time between camps and a village base. The majority of the livestock-herding households being studied (60%) were in receipt of supplementary non-livestock incomes, principally pensions, agricultural incomes, remittance incomes and land or property rents, many of which were bound into livestock-production-related cash transactions. Hired shepherding is a commonplace as (40%) of shepherders hire shepherds to graze animals. This enables some younger men to engage in alternative employment or economic activities made possible by their earlier education and the growing opportunities for their getting state employment in the service and military sectors.

Tribal Managed Rangeland.

Fifty years ago, the role of tribal authorities was vital in regulating access to and use of rangeland resources. The pastoral communities continue to claim common tribal rights and enjoy free access and use of natural resources, where tribe members have the same rights of

access and use regardless of the number of livestock owned. State claims over rangelands changed the traditional *hema* system, leading to a breakdown of resource allocation mechanisms and so that transformed secured-access rights to the rangeland into secured-tenure rights. Therefore, state appropriation did not prevent local communities from having access to their traditional rangeland, but favored a situation of "open-access" to rangeland resources and referred the expansion of barley cultivation. Pastoral communities cultivate barley in rangeland areas for the purpose of producing feed and proving their claim of ownership of the rangeland. After titling, they will convert the land to real estate for the purpose of speculation.

Neighboring tribes are using social networks to demand reciprocal access for grazing from one another. They grant access to each other as a means of confirming their claims and strengthening their traditional social relations with other communities (Ngaido et al., 1996). These arrangements among tribes maintained and sustained nomadic and transhumant systems. They serve as risk-sharing devices to overcome environmental variability and enhance access and use of resources in other areas. Therefore, tribal rangeland is becoming a common rangeland in fodder utilization, but still, with a tribal claim for ownership. The number of households with large flocks practicing transhumance is now low. A more common situation regarding livestock rearing is for families to keep a few sheep and goats at home, feed them grain, and then take them graze on harvested fields.

In Rawdat Rashed community, the rangeland areas represent about 90% of the total areas in this community. Local communities consider rangeland a tribal land. Every tribe is responsible for managing their rangeland area but they do not prevent members from other tribes to graze in their claimed tribal rangeland. In Mleih, 30%

of the area is considered a tribal rangeland while the rest is planted with salt shrubs. Results show that 34% of herders practiced the tribal rangeland management option. The average age of farmers was 55 years, while average family size was 9.2. (The national average household size in Jordan is 5.2 people). The average farmer's experience in herding is 28 years. The percentage of illiteracy was 38%, only 15% of farmers reached the secondary education level and above. The average household income from herding practices is about US\$ 3000, which is two folds of non-agricultural sources. The average cultivated area is 0.8 ha, whereas the average flock size is found to be 169 heads. The average daily flock movement is about 11 km. About 56% of sheepherders hired migrant shepherds to graze their animals. Smaller herds produce principally for the household consumption, while larger herds reflect a more commercial orientation. It must be acknowledged that the largest herds are generally confined to desert areas and are too large to exploit post-harvest residues seasonally in agricultural areas.

State-Managed Grazing Reserves

The government has for many years recognized the importance of rangelands and the need for their development. The first range reserves were established in the early 1940s to protect, improve, and manage rangelands through research and development activities. Currently, there are 27 governmental range reserves covering a total area of about 0.8 million hectares. These reserves are planted, managed and protected by the Forest Directorate. The range management specialists determine that the grazing capacity will allow neighboring pastoral groups to use the reserves for certain periods of time and with a specific number of animals for grazing; they do usually charge them fees on head-basis. Government's introduction of palatable

shrubs in rangelands had the purpose of reducing land degradation, soil erosion and enhancing feed availability. The Ministry of Agriculture's development efforts were not successful in managing rangeland resources because of hundreds of trespasses occurring annually on state-managed reserves, and since there were disputes over rangeland utilization. The governmental institutions responsible for the control and management of these reserves were excluding local communities from the process of implementation, management and utilization of land at the period of feed shortages and droughts; hence, this led to a serious problem of trespassing.

The Lajun reserve was established in 1981 on 1100 hectares on what was considered a private land of the community and had been planted with pasture shrubs such as *Salsola* and *Atriplex* and perennial grasses and other shrubs. Fences and guards are used to protect rangeland reserves. The rangeland is open twice a year in April for 2-4 weeks and later in autumn for 2-4 weeks. Livestock herders pay 0.7-cent head⁻¹day⁻¹ for the sheep and 7 cents head⁻¹day⁻¹ for the goat.

Sabha community is another example, where the rangeland area forms 5% of the total area of Sabha community. About 1300 hectares of treasury land were appropriated as a state rangeland grazing reserve. The remaining area of the community land is cultivated with cereals and planted with fruits and vegetables. Rangeland plant species, which were dominant in the previous two decades, especially *Artemisia*, *Atriplex*, *Hordium glausum*, *Stipa capensis*, disappeared due to rangeland degradation, which, in turn, was caused by overgrazing, cutting of woody vegetation and the increase of livestock population.

Results show that 34% of herders rely on state managed reserves as their source of livestock feed. 57% of them are relying also on a cooperative rangeland. Whereas 18% of these herders depend mainly on the

tribal rangeland management option. The average age of farmers is 56 years, while the average family size is 8.3, and average farmers' experience in herding is 26 years. The percentage of illiteracy was 29%. The average household income from herding practices is about US\$ 2400. The average area cultivated with filed crops is 0.9 ha, whereas the average flock size reached 111 heads. The average daily flock movement is about 6 km. 42% of shepherders hired migrant shepherds to graze their animals. In addition, 18% rely on their sons and family members for grazing livestock, and finally, only 24% practice a cooperative shared flock management.

Cooperative Managed Grazing Reserve

The participation of pastoral groups in rangeland development has been active since 1956. The Ministry of Agriculture and Jordan Cooperative Corporation have established a large number of range reserves in order to improve human relationships and the natural resources, range users are consulted from the very beginning of the establishment. Out of the 238 agricultural cooperatives under this umbrella, Jordan Cooperative Corporation, 20 are range cooperatives who manage grazing reserves where rangeland management and improvement, especially planting fodder shrubs and protecting the natural vegetation cover, are adopted. Many cooperatives were very active in the beginning and provided credits for large number of farmers. The political interference and dominancy of some cooperative members were the main factors leading to dysfunctional cooperatives.

The Lajun range grazing reserve is located in the Karak Governorate near Ader community with an area of 1100 hectares owned by the Ministry of Agriculture. The villagers of Ader established the reserve in 1976. The cooperative has 350 members who are all livestock owners. It operates in a system of shares whereby each

member buys 150 shares. From the total area, 800 hectares are planted with *Atriplex*. The Ministry of Agriculture plant annually around 50-100 hectares with *Atriplex*. Around 40% of the cooperative members participate in the planting activities. The cooperative excludes all non-members from the use of the reserve. However, the major shortcoming of this cooperative was the absence of a specific mechanism to prevent outside herds from coming in and exploiting the grazing. The limited access for community members who are not cooperative members resulted in many conflicts regarding the use and management of resources. It is necessary to improve these types of cooperatives by promoting a broad base of cooperative involvement of local communities in supporting activities related to livestock such as marketing and diary processing, feed supplements, mineral blocks and industrial by-products.

The rangeland in Ader is managed by rangeland cooperative. More than 70% of the Ader community land is used as rangeland reserve. The cooperative managers of rangelands at this community plant salt shrub species and protect them from grazing for three years, and thereafter, open them for grazing under the control of the cooperative. Major species grown were *Salsola and Atriplex*. The cooperative reserve of Ader is managed by its members who protect it by preventing plowing and overgrazing, and organize grazing time, while it charges its members fees of \$US 0.014 heads⁻¹ day⁻¹ for using the reserve. This cooperative was able to manage its resources without the interference of government officials, it usually allows others to utilize the reserve, and as a result, it had better rangelands. The form of organization has shown to be appropriate for managing and improving rangeland resources, but the cooperative need a legal framework to make it the sole decision maker for the access and use of the cooperative. Yet, the lack of such an authority would prompt

cooperative members to misuse their pastures in reaction to the illegal permits given by government's officials in their cooperative pastures.

In Jabal Bani Hamedah community, 12500 hectares of the land are used as rangeland managed by the Royal Scientific Society (RSS). Additional 2500 hectares are managed by a cooperative. Main species are; *Atriplex* spp. Agricultural land suitable for cultivation is planted with cereal crops and used for grazing before being harvested by sheepherders. RSS and the cooperative are managing the reserve by preventing trespassing of neighboring sheepherders, and they organize grazing time for cooperative members. The lack of tenure security prevented many cooperatives and associations from effectively managing their grazing resources; whereas granting access to outsiders of this community by government officials contributed to the destruction of the rangeland. Many community members expressed the need for greater tenure security for successful management of rangelands.

Results show that 56% of herders practiced a cooperative rangeland management option. The average age of farmer was 55 years; average family size was 8.2 persons. The average farmer's experience in herding is 29 years. The percentage of illiteracy was 34%. The average household income from herding practices reached about US\$ 2500, which is two folds higher than that from non-agricultural sources of income. The average cultivated area is 1.2 hectares, whereas the average flock size is 125 heads. The average daily flock movement is about 4 km. About 38% of sheepherders hired shepherds to graze animals, 20% rely on their sons and family members for grazing livestock, only 14% practice a cooperative shared flock management

This discussion with farmers shows that rangeland management, such as state-managed type and tribal system, does not include a real involvement of

stakeholders and rural communities and so they failed to conserve rangelands. It is necessary to adopt a new method of management through rangeland privatization with long-term conditional leases. Therefore, users' associations or cooperatives in which groups of organized people, sheepherder cooperatives, or communal cooperatives can manage, protect and benefit from specific rangeland areas without claiming ownership and can properly use them to sustain productivity of such lands. However, if the cooperative fails to properly manage the reserve, it will be back to state-management.

A story of success of the cooperative management was seen at Ader community where cooperative members protect their reserves from violations and rehabilitate their rangeland without charge, while the state-managed reserves are fenced and maintained yearly with guards all the time, which means a higher cost for just reaching the level of cooperative rangeland conditions or even close to that.

The conflict of interest among community members resulted in the dominance of some members who tried through tribal influence to control the cooperatives. Future range cooperatives should have one task, which is the management of all affairs related to livestock production (grazing regulation, supply of feedstuff, animal health, marketing of animals and their products, and lobbying to share in decision making). The lack of equity among members has also been a problem. Members owning large flocks and those originating from large and strong tribes dominated the cooperatives through "Pseudo Elections" to win a position in cooperative administrations. All tribes in the targeted ecosystems should be equally represented in the cooperatives to avoid dominance of members, and shares (number of animals per household) need to be equally distributed among members.

The collective rangeland management of local inhabitants could be a key factor to prevent rangeland degradation. Rangeland cooperatives proved that they have a sustainable use of resources compared to open access and state-managed reserves. Participation and utilization of the indigenous knowledge of inhabitants that coincides with a sustainable use of scarce resources should be encouraged when planning of and implementing the institutional reform of rangeland utilization. Hence, it is suggested that the fencing and other transaction costs of state-managed reserves could be saved and directed towards building a new institutional form of rangeland management based on the understanding of the livelihood of local community.

Private Rangelands

The absence of clear property rights is a major disincentive to private investment in sustainable land management such as shrub plantations, range reseeding or phosphate application, fencing, soil conservation, terracing and adopting water harvesting techniques. This type of rangeland is mainly found in higher rainfall zones. Individuals have their own pastures whose owners and those who use them are known to other community members. The results of agricultural census conducted by the Department of Statistics in 2007 show that out of 2,615,076 million dunums privately owned, there are 10,850 dunums which are considered a private permanent rangeland and planted with forage shrubs (DOS, 2008). Furthermore, about 2,500 dunums are temporary private rangeland planted with forage shrubs, 432,036 dunums are lifted fallow for crop rotations and grazed by small ruminants and 304,592 dunums are potentially productive agricultural land are not used for cultivation. Many individuals who own private rangelands and potential productive land are not shepherders. Therefore, utilization of these resources is

governed by community rules and they are used solely by community members. Grazing in private rangelands and fallow land is mainly organized by traditional tribal rules, as most tribes allow shepherds from their tribe to utilize biomass. Lands are usually grazed by the same shepherds for many years as members of other communities are excluded. Thus, grazing rights are clear. However, in spite of that, a high number of disputes and trespasses from other communities also characterize this type of management.

Bweidhah Gharbieh community, which is located at the northern part of Jordan, was previously considered an open access rangeland. After land titling, rangelands became private and utilization was restricted to community members, so shepherders from neighboring communities could not graze in it. Moreover, it was noticed during the field visit that the large increase in herd's numbers, overgrazing, plowing and drought conditions led to the degradation of these rangelands. The reduction in the profitability of sheep rearing is causing farmers to sell off sheep. The only alternative agricultural strategy for such households is to cultivate more rainfed crops in private rangelands. However, a major proportion of the harvest from rain-fed fields is geared toward livestock rearing. The inter-annual variability of rainfall for rain-fed cultivation means that wheat and barley cultivation for grain is a risky enterprise, with crops often failing and with standing crops is being used only for grazing.

Results show that only 6% of herders practiced herding in a private rangeland, 94% of them practice a tribal rangeland in addition to private rangeland. The average age of farmers was 61 years; average family size was 5.2 persons. The average farmers' experience in herding is 34 years. The percentage of illiteracy was 17%. The average household income from herding practices reached about US\$ 2200, which is two folds

higher than the non-agricultural sources of income. The average cultivated area is about one hectare, whereas the average flock size is 134 heads. The average daily flock movement is about 6 km. 60% of farmers hired shepherds to graze animals, 18% rely on their sons and family members for grazing livestock, only 12% practice a cooperative shared flock management.

Socioeconomic Factors and Management Options

To examine the factors that can explain the adoption of a specific rangeland management option, a probit analysis was performed for tribal, cooperative and state-managed shrubs options compared with private rangeland option. Rangeland management strategies followed by stockowners are influenced by several socioeconomic factors such as income, education, crop-livestock integration. The explanatory variables, which are taken in the analysis as independent variables, are shown in Table (2). Rangeland and flock management options were represented as dummy variables with a value of (0) if these options are not utilized or adopted by stockowner and a value of (one) if stockowners adopt these options. The impacts of these variables are formulated in such a way that they can downward or upward the estimated probability to adopt rangeland management option. Table (2) shows also the descriptive statistics of the selected variables. The mean of the dummy variables of rangeland and flock management options represented the percentage of herders who adopt such management options. For example, 30% of herders practiced the tribal rangeland management option, whereas 56% of herders practiced the cooperative rangeland management option. Furthermore, 20% of herders had an access to governmental shrubs, while only 6% of herders used their own private rangelands. It can be noticed from the pervious figures that herders can adopt more than one option.

The socioeconomic factors included in the analysis to capture the effect of household composition and

characteristics on different rangeland management options are; herder's age, formal education of the household head, household size, ratio of male to female in the household. As the age increases, the farmers seem to be less interested in collective action work, as they are more confident in their endogenous knowledge of farming practice. The size of the household is expected to be positively related to tribal management, while negatively correlated with cooperative management. This is because of the fact that larger households would most demand greater food needs and have enough labor forces to move with livestock greater distance in open access rangeland. As the ratio of males increases in the household, it is expected to adopt tribal management option where the flock can be managed by the farmer's son. Herder's experience in livestock production and herding practice might influence the herder's decision of grazing practices. A more experienced producer may be more confident about the collective action and cooperative work than a less experienced one, simply because of the knowledge he acquired over the years. The more educated producers can be more aware of rangeland degradation problem, alternative sources of feed and new livestock technologies such as feeding block, and urea treatment of straw, since their capacity to digest information from specific sources may be larger. Therefore, the more educated herders are expected to accept the cooperative principle of sharing benefits. There is an empirical evidence suggesting a strong positive relationship between the level of educational achievement and the likelihood that the herders will adopt new and perhaps challenging land management practices. Higher levels of professional knowledge and skills have been found correlated to a greater 'capacity' to adopt and practice sustainable management practices.

The magnitude of livestock income could play a role in choosing management options. High income from livestock is expected to be negatively correlated with state-managed shrubs. High non-agricultural income can influence directly

the chance of using tribal management options. Relying on non-agricultural income requires one to choose a sedentary production system and not nomadic system. A higher household income (regardless of how it is earned) is expected to reduce the financial burden of adopting sustainable management practices. Off-farm employment may well be the result of poor farm profits and reflect severe financial constraints. Herders with a large flock size are expected to rely on open access rangeland and adopt tribal rangeland since using open resources allows herders to expand herds without bearing the full costs of that. Individual herders maximize their stock and gain all the marginal benefits (extra stock) while, at the same time, sharing the negative impacts (rangeland degradation and reduced grazing) or marginal cost that may arise with other herders (Serunkuuma and Olson, 2001). Livestock mostly grazed on natural vegetation growing in the rangeland. However, during times of drought, supplementary feeding is undertaken with fodder bought from the livestock feed. Therefore, availability/access to income is important for herders to feed their livestock. It is expected that herders using different combinations of grazing management will have lower feeding cost compared to others. Furthermore, as the total planted area with cereal increases, it is expected that the herder will rely on tribal rangeland as a primary source of feed. Herders who graze stock by themselves or by one of their family members are expected to practice state-managed shrubs and cooperative rangeland. Herders who hired shepherd for livestock grazing are expected to choose tribal grazing practices. Since hired shepherd can move with the flock to farther distances away from his resident place.

Table (3) shows the results of the maximum likelihood estimates of the Probit analysis of tribal rangeland management option and marginal change (derivatives), the change in probabilities with respect to the change in the regressors are also presented. The model has a percentage of 87.4% of correct prediction of

the probability that the herder is adopting a certain practice. This level of correct prediction is consistent with other studies in this field such as Cary and Wilkinson (1997), Enete et al. (2003). McFadden's R-squares for the model are 0.57. This level of explanatory power is consistent with other such cross-section studies using censored data to explain socioeconomic factors on the adoption studies (Goodwin and Schroeder, 1994; Nkonya et al., 1997; Magnusson and Cranfield, 2005; Brewin et al., 2009). However, most pseudo-R² measures have no intuitive interpretation for values other than 0 or 1. For example, a McFadden's pseudo-R² of 0.57 indicates a 57 percent increase in the log-likelihood function—a figure without obvious meaning (Veall and Zimmermann, 1996; Hoetker, 2007).

The results show that the herders integrating crop and livestock have a lower probability to choose this option. This could be explained by the fact that those herders are more reliant on their own feed resources. As the cultivated areas increase by one dunum, the probability of adopting this option is increased by 4.6% as shown in the column of marginal effect (dF/dx). Household size had a positive effect on practicing a certain option, and the null hypotheses that the coefficient estimates were equal to zero was rejected at a significance level of less than 5%. Increasing the household size is usually reflected by an increase on the abundant labor forces that can go for farther distances from the resident place to graze livestock. The herders who sent the flock to a farther distance are more likely to adopt tribal rangeland management compared with herders who graze their livestock near the community. Most of the herders choosing this option combine tribal and state-managed options. Since during spring, herders rely more on tribal rangeland and the flock consumes the forage in the common rangeland before they start pressurizing to utilize the state-managed shrubs during the critical period when sheep are in late pregnancy in October. Furthermore, the herders who hired shepherds for

their flock are more likely to adopt tribal grazing; where the shepherd can go for long distances with sheep, and even may spend 4-5 days in the tribal rangeland with flock before coming back home. Furthermore, results indicate that as the flock size increases this will increase the probability to practice tribal range management. Whereas the hand feeding

cost increases, probability to adopt this option decreases. Herders who practice shared grazing with other herders are less likely to adopt this option. In fact, most of the herders who practice shared and cooperative flock management have a small flock size compared with shelf and hired shepherded flock management.

Table 2: The descriptive statistics of management options and explanatory variables used in probit analysis

Variables	Description	Unit	Mean	S.D	Min	Max
Ut_Tribalrange	Utilization of tribal rangeland	(0, 1)	0.34	0.474	0	1
Ut-Govshrub	Utilization of state-managed reserves	(0, 1)	0.53	0.50	0	1
Ut_Cooper	Utilization of cooperatives rangeland	(0, 1)	0.56	0.50	0	1
Ln_age *	Ln Farmers' age	years	54.6	11.2	23	80
HH_size	Household size	person	8.7	4.1	1	40
Malefemale	Ratio of male to female in household	Scale	3.7	2.2	0	10
Educ +	Farmers' Education	Scale	1.0	0.97	0	3
Exper	Farmers' Experience in herding	Years	27.5	11.9	2	50
Ln_income*	Ln Farmer's agricultural income	JD	2456	1884	63	9475
Ln_offincome*	Ln Farmer's non-agricultural income	JD	1302	1517	0	7200
Ln_cultiva*	Ln Field crop cultivated areas	dunum	8.8	14.0	0	160
Ln_livestock*	Ln Flock size (\approx adult sheep)	head	116.8	111.1	9	748
Ln_handfC*	Ln Hand feeding costs	JD	3511	3364	0	18750
Movedistkm	Flock moving distance	Km	7.3	16.9	0	170
Shephrdmgt	Herd managed by hired shepherd	(0, 1)	0.39	0.49	0	1
Sonmgt	Herd managed by owners' sons	(0, 1)	0.19	0.39	0	1
Sharemgt	Sharing of herd management	(0, 1)	0.14	0.35	0	1
Unharvegrain	Grazing standing filed crops	dunum	7.6	10.6	0	80
Greenarea	Grazing green forage	dunum	1.6	5.0	0	40
Stubble	Grazing in crop residues	dunum	1.2	10.5	0	160
Ln Marketfeed*	Ln of Purchased feed from market	JD	3803	3611	50	25826
Ex_rangecoop	Existence of rangeland cooperatives	(0, 1)	0.27	0.44	0	1

* Converted to a real number for presentation purpose, Ln = natural logarithm, (0,1) a dummy variable has a value of 1= yes, 0=otherwise

+ Farmer's Education (0, illiterate, 1, primary, 2 elementary , 3 secondary education and above)

Table 3: Results of applying Probit model on the adoption of tribal management options

Variables	Coefficient	Std. Error	t-statistics	Probability	dF/dx
Ln_age	0.580	0.532	1.090	0.276	0.210
HH_size	0.014 **	0.007	1.960	0.048	0.005
Malefemale	-0.037	0.072	-0.520	0.606	-0.013
Educ	0.145	0.104	1.400	0.162	0.053
Exper	-0.004	0.010	-0.360	0.722	-0.001
Ln_income	-0.030 *	0.016	-1.840	0.066	-0.011
Ln_offincome	0.030 *	0.016	1.830	0.067	0.011
Ln_cultiva	0.126 *	0.074	1.700	0.089	0.046
Ln_livestock	0.291 **	0.105	2.620	0.021	0.105
Ln_handfC	-0.304 **	0.139	-2.200	0.028	-0.111
Movedistkm	0.012 **	0.005	2.250	0.025	0.004
Shephrdmgt	0.196 ***	0.024	8.020	0.000	0.071
Sonmgt	-0.020	0.246	-0.080	0.934	-0.007
Sharemgt	-0.634 *	0.326	-1.950	0.052	-0.201
Unharvegrain	-0.001	0.009	-0.140	0.889	0.000
Greenarea	0.143 ***	0.030	4.740	0.000	0.052
Stubble	0.006	0.009	0.630	0.526	0.002
Ln Marketfeed	0.006	0.307	0.020	0.983	0.002
Ex_rangecoop	0.325	0.200	1.630	0.103	0.121
Constant	-3.085	2.394	-1.290	0.198	

Log likelihood intercept only = -186.9 Log likelihood full model = -79.23 Chi X² test = 190.6
 Percent of correct prediction = 87.4% McFaddenR² = 0.576

*, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

The results of the probit analysis of utilizing the rangeland cooperatives are shown in Table (4). The model has satisfactory indicators; since the percent of correct prediction of the probability of being a user of rangeland cooperative is 87.4%. The McFaddenR² of 0.576 is approaching 85% of R² in ordinary least square regression as plotted in Veall and Zimmermann (1996). In the model, the null hypothesis H₀ was stated as: that all parameters that are equal to zero are rejected, indicating that the variables in the

Probit regression model have significant influence on the adoption of cooperative management. Membership in rangeland cooperative is the main factor that explains the adoption of cooperative rangeland in which the exploitation of the cooperative rangeland is usually strict to members of the cooperative. Utilizing the cooperative rangeland reduces the probability of utilizing other tribal rangeland. Herders' age is negatively correlated with the adoption of this kind of management. Older herders seem to be less interested in

cooperative management. More experienced herders in livestock production are more confident about the collective action and cooperative work than the less experienced herders are. This is simply because of their knowledge they acquired over the years. Furthermore, the herders who hired shepherds for their flock are more likely to adopt cooperative grazing; where the shepherd can go for long distances with sheep to reach the cooperative rangeland and can stay with the flock many days in the cooperative rangeland without a need to have a permission every time to enter the cooperative rangeland. Off-farm and household income had a negative effect on the cooperative management. This might be a result of increasing off-farm income so that the herders become in a well off-position to purchase grain and feed from the market.

Table (5) shows the results of the maximum likelihood estimates of Probit analysis for state-managed shrubs and marginal change in the probabilities. The model has a satisfactory prediction power, and has 85% percent of correct prediction. Older sheepherders are more probable to utilize the reserve, because either they have a small flock size or they are more confident in their endogenous knowledge of farming practice. The size of the household is negatively correlated to state-managed shrubs, as the household size

increases herders become more relying on tribal management as a result of abundant labor forces at the household.

Large flock size owned by sheepherders decreases the probability of utilizing the state-managed shrubs. They can provide their sheep with sufficient feed from tribal grazing without relying on state-managed shrub reserves. Sheepherders with small flocks are more dependent on state shrubs compared with large stockowners. Sheep flock managed by shared herding are more reliant on state-managed reserves. Therefore, the sheepherders who hired a shepherd for their flock have a higher probability to adopt tribal grazing and lower probability to utilize state-managed shrubs. The well-educated sheepherders are less likely to utilize the reserves, because either they own small flocks, herding is not their main source of income, or they have a better access to information related to livestock nutrition and non-traditional source of feed nutrition. The results show that the herders integrating crop and livestock have a lower probability to graze in the state-managed reserves and they are more reliant on their own feed resources. Herders who purchased feed from the market are more likely to rely on state-managed shrubs compared with other herders.

Table 4: Results of applying the probit model on the adoption of cooperative management options

Variables	Coefficient	Std. Error	t-statistics	Probability	dF/dx
Ln_age	-1.026 *	0.567	-1.810	0.071	-0.379
HH_size	-0.034	0.025	-1.350	0.176	-0.012
Malefemale	0.059	0.072	0.830	0.406	0.022
Educ	-0.036	0.107	-0.340	0.738	-0.013
Exper	0.026 **	0.010	2.490	0.013	0.010
Ln_income	0.124	0.232	0.530	0.593	0.046
Ln_offincome	- 0.009 ***	0.003	-3.427	0.005	-0.003
Ln_cultiva	-0.047	0.059	-0.800	0.425	-0.017
Ln_livestock	0.349	0.219	1.590	0.111	0.129
Ln_handfC	-0.018	0.272	-0.070	0.946	-0.007

Variables	Coefficient	Std. Error	t-statistics	Probability	dF/dx
Movedistkm	-0.023 **	0.009	-2.510	0.012	-0.008
Shephrdmgt	0.505 *	0.267	1.890	0.058	0.181
Sonmgt	0.211	0.272	0.780	0.438	0.076
Sharemgt	0.319	0.300	1.060	0.288	0.111
Unharvegrain	0.035 **	0.014	2.440	0.015	0.013
Greenarea	-0.031	0.021	-1.530	0.125	-0.012
Stubble	-0.026	0.027	-0.950	0.340	-0.009
Ln Marketfeed	-0.301	0.327	-0.920	0.357	-0.111
Ex_rangecoop	2.129 ***	0.352	6.050	0.000	0.546
Constant	3.235	2.590	1.250	0.212	

Log likelihood intercept only = -200.5 Log likelihood full model = -83.6 Chi X² test = 136
 Percent of correct prediction = 85.7% McFaddenR²= 0.583

*, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 5: Results of applying probit model on the adoption of state-managed shrub options

Variables	Coefficient	Std. Error	t-statistics	Probability	dF/dx
Ln_age	1.213 **	0.533	2.270	0.023	0.484
HH_size	-0.048 **	0.022	-2.230	0.026	-0.019
Malefemale	0.014	0.069	0.200	0.839	0.006
Educ	0.052 *	0.025	2.065	0.061	0.021
Exper	-0.008	0.010	-0.820	0.413	-0.003
Ln_income	-0.140	0.207	-0.680	0.499	-0.056
Ln_offincome	0.029	0.022	1.310	0.191	0.012
Ln_cultiva	-0.241 ***	0.066	-3.670	0.000	0.096
Ln_livestock	-0.330 *	0.196	-1.680	0.093	-0.132
Ln_handfC	-0.244	0.228	-1.070	0.285	-0.097
Movedistkm	0.006	0.006	0.980	0.326	0.002
Shephrdmgt	0.173	0.240	0.720	0.472	0.069
Sonmgt	0.160	0.254	0.630	0.529	0.064
Sharemgt	1.230 ***	0.311	3.950	0.000	0.419
Unharvegrain	0.007	0.009	0.770	0.439	0.003
Greenarea	-0.057 ***	0.018	-3.090	0.002	-0.023
Stubble	-0.064	0.043	-1.470	0.141	-0.025
Ln Marketfeed	0.790 ***	0.261	3.020	0.003	0.315

Variables	Coefficient	Std. Error	t-statistics	Probability	dF/dx
Ex_rangecoop	0.344 *	0.207	1.660	0.096	0.136
Constant	-6.678 ***	2.424	-2.760	0.006	

Log likelihood intercept only = -210.1 Log likelihood full model = -92.3 Chi X² test =195.4
Percent of correct prediction = 84.8% McFaddenR²= 0.560

*, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Conclusions and Recommendations

There are four rangeland management options practiced in the low rainfall areas in Jordan, these are; traditional tribal system, cooperative management, state-managed reserves and private rangeland. Shepherders use different combinations for rangeland management options depending on several factors such as institutional power, household characteristics and herding practices. Membership in rangeland cooperative reduces the probability of utilizing other tribal rangelands as a source of feed. Large flock size owned by shepherders decreases the probability of utilizing the state-managed reserves. Sheep flock managed by shepherds can move long distances and be less reliant on state-managed reserves. The results show that the herders integrating crop and livestock have a lower probability to graze in the state-managed reserves and they are more reliant on their own feed resources.

Policy makers, researchers and different institutions whose concern is rangeland improvement in Jordan need to give enough attention to the access rules of grazing in rangeland. The most successful rules were found under the cooperative management options. This gives the impression that the government should not interfere directly in rangeland management. A conditional lease of rangeland utilization and collective action or participatory approach for rangeland management seems as an attractive idea to improve rangeland in Jordan. Enhancing the establishment of rangeland users associations or cooperatives can manage,

protect, and benefit from specific rangeland areas without claiming ownership. Therefore, incentives in a form of shrubs plantation, feed grain supplement during the establishment phase, and the development of incentive structures will not promote adverse effects on restored ecosystems.

In addition, policies should include; resolving property rights disputes, fostering participation of local communities during the planning and implementation processes, and developing better drought coping strategies. Therefore, conservation and management of rangelands require not only tenure security, but also an understanding of local livestock production and risk management strategies, in addition to understanding the factors that promote collective action, which then can be integrated into national policy formulation. Therefore, there is a need to formulate community-based participatory approach as part of the wider adoption of 'bottom-up' community involvement in rangeland management projects. This shift to 'bottom-up' approaches has been driven by the recognition of the past failings of 'top-down' interventions that have been widely criticized in the development literature. This shift requires careful analysis using a range of socio-economic settings, to analyze the extra benefits provided to local communities and to the rangeland ecosystems upon which pastoralist livelihoods depend.

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