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DESCRIPTIVE AND DIAGNOSTIC STUDIES OF SHEEP AND GOAT PRODUCTION IN THE FARMING SYSTEMS OF UPLAND BALUCHISTAN

by

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Descriptive and Diagnostic Studies of Sheep and Goat Production in the Farming Systems of Upland Baluchistan, Pakistan

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ABSTRACT

Descriptive and diagnostic studies of sheep and goat production in upland Baluchistan, Pakistan were undertaken. These studies consisted of secondary data collection as well as formal and informal surveys describing the farming systems. Major constraints and priority problems are identified. Suggestions are made for major research and extension opportunities that could substantially increase sheep and goat productivity.

The sheep and goat industry of Baluchistan operates within a harsh climatic environment and is characterized by small flocks obtaining most of their feed from relatively unproductive rangeland. At present, most flocks are poorly-managed secondary enterprises and are used as a store of wealth rather than a commercial business. Although not necessarily commercial in nature, sheep and goat production is important to the economy of Baluchistan.

Major constraints to improved sheep and goat productivity are: (1) poor nutrition because of the low productivity of rangelands and the non-availability of low-cost supplemental feeds; (2) disease and parasite problems because of limited veterinary coverage; (3) poor flock management; (4) poor credit, marketing and transportation infrastructure; (5) no range management or control on the common tribal rangelands and (6) poor genetic potential of animals.

Suggestions for research and extension interventions include: (1) the introduction of perennial legumes, cool season grasses, and shrub reserves to improve feed supplies and to rehabilitate the rangeland; (2) grazing control studies on the number and kinds of animals and appropriate seasons of use; (3) dryland fodder production combining new forage species, fertilizer, and water harvesting; (4) increasing the nutritive value of crop residues and the use of non-conventional feeds; (5) providing farmers with the knowledge to vaccinate and dip their own animals; (6) flock management, credit and infrastructural improvement, and (7) increasing the genetic potential of the animals.

Sheep and goat production could become more important to the economy by alleviating the major production and marketing constraints and by the adoption of an industry strategy by the Government of Baluchistan. Comparative economic advantage and marketing research is required to outline a Baluchistan sheep and goat export trade strategy with not only the other provinces of Pakistan and but also with other countries. A more commercialized industry would be better able to exploit research and extension interventions.

INTRODUCTION

In order to identify appropriate research problems related to sheep and goat production in upland Baluchistan, descriptive and diagnostic studies with a farming systems perspective were conducted at the Arid Zone Research Institute (AZRI), Quetta, Baluchistan in partnership with the Management of Research and Agricultural Technology Project, Arid Zone Research Component (MART/AZR). The research program at AZRI is multidisciplinary and includes on-station and off-station agronomy, range and livestock research. Farming systems research in the AZRI/MART program follows the operational stages of description and diagnostics, research design, on-farm testing and evaluation, and dissemination and monitoring. It acknowledges linkages and interactions within the relevant sub-systems of the farming system (Nagy and Sanders, 1988).

The present AZRI/MART research focus in Baluchistan is on high elevation (greater than 1000m), rainfed agriculture. The high elevation (upland) area of Baluchistan is found within the Khuzdar, Kachhi, Quetta, Pishin, Loralai and Zhob districts of the Province.

The specific objectives of the descriptive and diagnostic work in the AZRI/MART research program are: (1) To describe the production and marketing constraints and priority problems of sheep and goat farmers and herders, and (2) To develop hypotheses about major research and extension opportunities that may exist for the upland Baluchistan range-livestock industry, based on the descriptive and diagnostic information.

This paper presents the findings of the descriptive and diagnostic work and outlines major research and extension opportunities for sheep and goat production in upland Baluchistan. While the descriptive and diagnostic work focuses on upland Baluchistan, the constraints and ensuing research and extension opportunities discussed in the paper have general relevance for much of the extensive uplands of west Asia in which small ruminants are raised. The paper concludes with a delineation of a sheep and goat production strategy for Baluchistan.

METHODS AND PROCEDURES

The descriptive and diagnostic work involved four distinct phases: (1) gathering of secondary data and information, (2) conducting of an informal survey, (3) conducting of a formal survey, and (4) development of hypotheses concerning major research and extension opportunities. Secondary (existing) information was gathered to help establish the current knowledge and importance of sheep and goat farming systems in upland Baluchistan and to identify the past and present range-livestock research and extension efforts.

Informal surveys of farmers in February, 1987 were undertaken in villages in the Kalat District at Zarchi (1800m) and in the Loralai District at Tomagh (1700m, Fig.1) and represent locations with different ethnic groups, Baluch and Pathan, respectively. Rainfall and air temperature regimes make these areas distinctly different; nevertheless, they are representative of the crops and range vegetation of larger areas of upland Baluchistan. The informal survey consisted of an interdisciplinary team made up of economists, range-livestock specialists and agronomists interviewing individuals and groups of farmers over several days. A check list of guideline questions was used instead of a formal written questionnaire. The informal survey provided a method of obtaining cost effective information quickly at the farm level, information that macro-secondary data is unable to provide. The aim of the informal interview approach was to obtain some knowledge of sheep and goat farming systems and to focus on the major production and marketing constraints faced by the farmers. The interview procedure and guideline questions are described in Nagy et al., 1987. Part of the informal survey process also included key informant interviews with progressive farmers, the Baluchistan Livestock Department and livestock specialists.

The informal survey was followed closely by a formal survey in June and July, 1987, and was part of a general crops/livestock survey. A written questionnaire was prepared based on the information gained from the informal survey (Nagy and Farid Sabir, 1987). The objective was to obtain data and information on livestock numbers, rangeland ownership and control, and supplementary feeding. Formal surveys were conducted at five locations: at the informal survey sites of Zarchi and Tomagh, in Khuzdar District around the city of Khuzdar (1150 m), in Kalat District in the Kovak Valley (2000 m) and in Quetta District in the Dasht Valley (1600 m) (Fig 1). Forty households were interviewed at each location. Several villages within each location were selected at random where two to five farmers,

also selected at random, were interviewed. The AZRI/MART range-livestock section also conducted formal surveys on the incidence of internal and external parasites in sheep (Khan et al., 1988b).

OVERVIEW OF UPLAND BALUCHISTAN SHEEP AND GOAT PRODUCTION

Climate

The higher altitude areas of northern and eastern (upland) Baluchistan (1,000m to over 3,000m) are climatically classified as semi-arid continental Mediterranean, and the lower regions as hot sub-tropical desert (Rees et al., 1988). Rainfall (Fig.1) is uncertain and low (50-400mm) and occurs in both winter and summer, with the former predominant in the north-west which is less affected by summer monsoons. Winters are cold at higher altitudes with night air temperatures frequently below freezing from mid-November to the end of February.

Farmers' perceptions supported by meteorological data suggest that sufficient rainfall for grain production (greater than 200 mm) occurs in upland Baluchistan only five to seven years in ten - in the remaining three to five years in ten, many farmers do not plant (Rees et al, 1988).

Land Utilization and Feed Resources

While the land area of Baluchistan is very large (34.7 million ha), only 4% is cultivable (1.47 million ha) (GOB). Ninety-three percent of Baluchistan is classified as rangeland of which 20.9 million hectares (60%) are used for grazing. About 11.7 of the 20.9 million ha of rangeland are classified as poor grazing providing only 30-50 kg/ha of dry matter (DM), while there are only 2.9 million ha classified as excellent to very good grazing providing 250-280 DM/kg/ha (FAO, 1983). The vegetation of the northern area is a grassland type on the lower range and mixed shrub-grassland on the higher range with Chrysopogon being the major species. In the south, the vegetation can be classified as an Artemisia-shrub steppe (see Hasnain, 1985 for a full description of native vegetation). There is evidence of severe overgrazing and deforestation because of the pressure from both the increase in sheep and goat numbers (Table 2) and from the increase in fuel wood consumption. This overgrazing has left shrubs and unpalatable grasses as the predominant rangeland vegetation.

Of the cultivated land, only about 0.6 million ha are planted to crops and orchards (GOB). Hectarage sown to fodder and crop production is small in relation to the number of sheep and goats - there are 50 sheep and goats per hectare of fodder and crop land (from Tables 1 and 2). Also, yields are very poor on rainfed land which accounts

for about 60% of the total grain and fodder hectarage in Baluchistan. For example, upland rainfed wheat and barley yields are poor even in the best rainfall years ranging from 400 to 900 kg/ha grain and 800 to 1800 kg/ha straw (Rees et al., 1988).

An FAO estimate that 90 to 95% of all feed for Baluchistan's 18.4 million sheep and goats comes from rangeland is plausible given the relative size of fodder and crop hectarage (FAO, 1983). Estimates of 85% of ruminant feed from rangelands by Rees et al., 1988 for the Kalat and Khuzdar areas corroborate the FAO results. Also the formal survey results indicated that only 20% of farmers supplemented range fodder and crop stubble with small amounts of other feeds and that supplementing feed for draft animals took precedence. Lucerne and barley grain were the most common animal feeds with wheat straw, sorghum grain and straw, and cut green fodder also being used. Cut green fodder (wheat or barley growth cut predominantly in November-December before winter dormancy) provides 200 to 300 kg/ha dry matter (DM) in a good rainfall year. Over 90% of the supplementary feed is given in the autumn and winter periods. Animals that were pregnant or sick, or were to be sacrificed for religious purposes, received the most supplements.

Opportunities for appreciably extending the irrigated area in Baluchistan are limited, especially in the upland area. Tube wells presently provide most of the irrigation water but farmers indicate that the ground water level has been decreasing substantially each year, adding to the pumping costs of irrigation. At present, fruit and vegetable production are more profitable than fodder and grain production. Wheat is the staple food and is grown for food security. Farmers indicate that they grow little barley because wheat is their staple and because the barley market is small and uncertain (Nagy et al., 1989).

Fodder, mainly wheat and rice straw, is transported to upland Baluchistan from the irrigated areas of the Indus Valley in both Baluchistan and Sind. At present, fodder is used mainly in the larger centers to feed draft animals.

The Economic Importance of Sheep and Goats

The livestock sector of Baluchistan contributed an estimated 25% in 1982-83 of the Gross Agricultural Product of Baluchistan (FAO, 1983). Sheep and goats are the major class of livestock in Baluchistan and represent 56 and 37% respectively, of all livestock numbers (excluding poultry). Of the 11.1 million sheep and 7.3 million goats in Baluchistan 65% and 60% respectively, are raised in upland Baluchistan. Both sheep and goat numbers have increased substantially since 1955 exhibiting annual growth rates of

7.2% and 7.6% respectively (Table 2). Estimates of mutton demand for Pakistan to the year 2000 however, exceed the present potential (FAO, 1987). Baluchistan exports mutton to other provinces, with most exports going to the Karachi market (data unavailable). At present there are about 4.3 sheep and goats per person in Baluchistan but only 0.35 sheep and goats per person in the remaining three Pakistani provinces.

Informal survey and key informant interviews established that sheep and goat flocks are important as food, income and collateral for farmers. The percentage of income (cash and credit) from sheep and goats as a percentage of agricultural income ranges from 70-80% in Zarchi to 40-50% in Tomagh (Table 3). Off-farm income is also becoming more important for farm families and there is a trend towards increasing migration to larger centers. Income from off-farm sources as a percentage of total income is estimated at between 10-15% in good rainfall years and between 35-65% in poor rainfall years (Rees et al., 1988).

Sheep and goats are used as a store of wealth. Consumption and marketing are on an as needed basis for food and cash. Lambing and marketing are not scheduled to meet any peak price periods such as religious events. Livestock is used as collateral to obtain credit from money lenders in the larger villages and towns. When cash is required, usually in poor agricultural years or for special social occasions, money is borrowed to be paid back in kind (sheep or goats) in better agricultural years. If calculated, the interest on the borrowed money in return for live animals would be excessive and greater than the interest charged at banks. However, farmers indicate that they have a general mistrust of banks as bank regulations dictate foreclosure when a farmer cannot pay back the loan, whereas money lenders can afford to be more lenient. Banks also do not allow small ruminants as collateral.

Production System Characteristics

Sheep and goat production systems can be classified as transhumant (65% and 52% of all sheep and goats), nomadic (30% of all sheep and all goats), and household (5% and 18% of all sheep and goats) (FAO, 1983). Transhumant flocks are owned mainly by farmers who cultivate crops and the flocks are grazed around cropped areas and on the open range. Most of the rangelands are tribally owned but are grazed in common by farmers of the same tribe. In winter, both the transhumant farm family and their livestock move out of the upland areas down to the warmer Indus Valley plain. There, animal feed is more abundant and many farmers find employment and live in homes on established tribal lands. There are also household (sedentary) flocks that are over-wintered in upland Baluchistan. Nomadic flocks (owned by

Powindas, from both Pakistan and Afghanistan) also are moved throughout Baluchistan on established routes. They are wintered in the Indus Valley areas and pasturage is found for them at higher altitudes in the summer. A 1982 estimate of Afghan Powinda sheep and goat numbers was 415,000 and 493,000 respectively, and Afghanistan refugee flocks were estimated to be 267,000 sheep and 254,000 goats (FAO, 1983).

The formal survey done as part of the present study indicated that 51% of the farmers keep livestock on the upland Baluchistan range all year and do not migrate in winter. Ninety-three percent of migratory farmers indicated lack of winter fodder and cold as principal reasons for winter migration.

Sheep are mainly of the fat-tailed type and a number of breeds exist. The Bibrik and Harnai sheep breeds are predominantly found in the northern Districts of Baluchistan while the Baluchi and Rakhshani breeds are found in the southern Districts. Northern goat breeds include the Kajli (Pahari) in the Loralai District, and the Khurassani in the Loralai, Zhob and Chagi Districts. The Lehri goat is found on the plains in the Sibi and Kachhi Districts (see Hasnain, 1985 for breed characteristics).

Of the 160 farmers surveyed in Khuzdar, Kovak, Zarchi and Dasht (Tomagh excluded because of enumerator problems), 108 said that they owned sheep and 114 said that they owned goats. Table 4 gives information classified by the number of breeding ewes and does. The overall sheep flock size is 29.5 with an average 16.8 breeding ewes and a crude birth rate 61% (a small percentage of ewes had not lambed at the time the survey was conducted). The crude birth rate falls as flocks become larger. The birth rate for the 1 to 10 ewe category seems high. However, the 1986-87 year was a good rainfall year with better than normal range conditions and crop residues which could have increased the birth rate. The overall goat herd size is 22.2 with an average 12.2 breeding does. Crude birth rates could not be calculated for goats because the kidding period is not as well defined as for sheep. The proportion of breeding females, males over one year, and young under one year for both sheep and goats is similar to that found in the 1976 Pakistan livestock census for Baluchistan (Hasnain, 1985).

Table 4 also indicates that a high percentage of the flocks are mixed (both sheep and goats) with a 1.80 overall sheep/goat ratio for such flocks. Mixed flocks with 20 or less ewes have lower sheep/goat ratios than larger sheep flocks. Mixed flocks with 10 or less does have a higher sheep/goat ratio than larger goat herds. Flock and herd ownership size is small, and the majority of farmers own flocks and herds having between 1 and 10 breeding females with very few flocks of over 20 breeding females.

Research and Extension

Past research efforts on range-livestock management have been minimal considering the prominence of the Baluchistan sheep and goat industry. Moreover, very few researchers are currently working on range-livestock problems. The Baluchistan Livestock Department is principally involved with veterinary service programs but coverage is small as is the coverage of the livestock extension program. Some Livestock Department research on lamb and kid fattening has been on-going since 1980. Breed improvement and cross-breeding programs have been established at Maslakh using Karakul sheep. Cross-breeding programs with Angora goats have also recently begun (Coop, 1987). AZRI/MART has started a basic program that highlights work on stocking rates, kind of livestock grazed, season of grazing, and on range rehabilitation and ecological baseline studies.

MAJOR CONSTRAINTS AND RESEARCH OPPORTUNITIES

The overall problem in increasing sheep and goat productivity in Baluchistan is the harsh climatic environment with low and erratic intra- and inter-year rainfall and with cold winter and hot summer air temperatures. Within this setting exist the major constraints faced by sheep and goat farmers in Baluchistan. Some of these constraints with hypotheses for research and extension opportunities are listed below:

1. Nutritional deficit.

Low rangeland productivity, especially in the winter months, and lack of readily available and cost effective supplementary feeds have given rise to an overall nutritional deficit. It is estimated that there is a nutritional deficit of 7% total digestible nutrients (TDN), 16% digestible protein (DP) and 11% DM overall for sheep and goats in Baluchistan (FAO, 1983). The nutritional deficit in winter months seems to be correlated with animal deaths in this period. The low conception, lambing and weaning percentages also reflect the low nutritional status of the animals.

During the informal survey range specialists indicated that few if any cool-season grasses now occur in the upland Baluchistan range. Without cool-season grasses, forage for animals in the late gestation and early lactation periods can be limited.

Research on improving rangeland productivity does now include adaption studies of: (1) shrubs and perennial legumes in grass rangelands, (2) grasses and perennial

legumes in shrub rangelands, (3) cool-season grasses, and (4) forage shrub reserves using species such as Atriplex canescens (fourwing saltbush). Results of research at AZRI indicate that fourwing saltbush can be established and is adapted to Baluchistan range conditions and that animals can maintain their body weights on a full diet of this plant (Atiq-ur-Rehman et al., 1988; Aro et al., 1988).

Rangeland productivity may also be improved as a result of grazing control studies on the appropriate: (1) animal/rangeland ratio, (2) proportion of sheep, goats and camels to be grazed together, and (3) seasons of use (e.g. deferred spring grazing). These improvements are required so that when it is possible to control use of the common rangelands, recommended practices can be extended to the farmers.

Opportunities for increasing fodder production in dryland agriculture may exist. Further researcher as well as farmer-managed trials are required to ascertain the forage potential of combining new forage species, such as barley or the promising V. villosa ssp. dasycarpa, with water harvesting and fertilizer application (ICARDA, 1988). The possibility of growing summer crops more widely, such as sorghum for fodder, should also be researched.

Increasing the nutritive value of crop residues, and the use of range cubes, molasses blocks, mineral supplementation and other non-conventional feeds are also alternatives that need further research (Mallorie and Ali, 1987; Stubbs, 1987; Coop, 1987).

Research trials are also needed to ascertain which periods in the ruminant growth cycle (pre-flushing, flushing, gestation, or lactation) and which feed source, give the best economic returns from feed supplementation.

2. Animal disease and health problems

A high incidence of mortality and morbidity losses exists from disease and parasitism. Many lambs die of enterotoxaemia, bacterial and viral diseases; anthrax and contagious pleuropneumonia have also been serious problems (Hasnain, 1985). Disease problems mainly coincide with the winter period of the year when feed is less readily available.

The AZRI range livestock group also conducted a formal parasite survey on sheep in the Kovak valley (Khan et al., 1988a). The incidence of endo-parasitism was as follows: Nematodirus spp. 86%, Haemonchus contortus 63%, Strongyloides papillosus 49%, trichostronglylus spp. 42%, Marshallagia marshalli 41%, and Fasciola hepatica 33%. The ecto-parasitism incidence of tick infestation (Ixodes

ricinus) was 35% and sheep scab (Psoroptes ovis) was 23 %. The survey also indicated that 100% of the animals sampled had one or more of the above parasites.

Veterinary services are not widely used either because they are too expensive or services are not available. AZRI, Pak-German Self-Help and Baluchistan Livestock Department veterinary camps have shown that farmers do understand and appreciate the value of vaccination and de-worming.

Technological interventions already exist for the alleviation of most animal disease and health problems in Baluchistan through vaccination and dipping. Resource limited government programs have not been able to give full coverage. A better solution to this problem may be to encourage farmers to administer their own vaccination and dipping. The expense is well within their means; however, extension programs on a large scale would be required.

3. Poor flock management

Information from the informal surveys indicated that the performance level of flock management is low (Table 3). The timing of breeding is not controlled and rams and bucks run with the herd throughout the year. The majority of young are born in the spring period (Table 3), but observation indicates that young animals are seen throughout the year with sheep having a more defined spring lambing period than goats. Breeding animals are not carefully selected and the breeding male/female ratio appears to be low. Birth rates are very low and perhaps lower than the farmers' perception. Most females are exposed to males when females are too young, underweight or in poor condition leading to low conception and birth rates.

Many management practices carried out by the farmers seem to be at odds with accepted practices elsewhere. Several of these practices involve ewe/lamb relationships. One such practice is keeping young lambs and kids separated from their mothers during the entire day while the mothers are grazing. The farmers claim that the young develop diarrhea if fed milk all day. Also, they suggest that the young impede the mothers grazing because they cannot keep pace with the flock and that the young would suffer from the long walks on the range. However, livestock specialists indicate that the young are heavily stressed by this separation and are further stressed by the fact that the young are not allowed to suckle from their mothers during the day. Also, the consequent large milk intake at the end of the day by the young flushes the abomason giving rise to diarrhea ending in high mortality and morbidity losses. The pressure of a full udder may also be harmful to the ewe and mastitis is a common problem. This management practice is contrary to a normal lamb/kid feeding pattern adjusted by

the lactating mother. Another practice is the sealing and drying of the umbilical cord of newly born animals with dirt or manure which can cause tetanus and joint ill. Proper lambing techniques and an inexpensive treatment with an iodine solution would be very effective. Improper methods of handling of lambs and kids, especially from birth to three weeks old, is another problem. The young are often picked up by the belly instead of by the front of the chest, causing bruised muscles and cracked rib cages.

Shearing practices also deviate from the norms of improved management. One common practice is leaving the wool/hair on the belly and on the head of the animal at shearing time. Farmers indicate that it helps keep the animals warm. This wool harbors parasites which could be removed if the animal was sheared properly. Leaving this wool on the animal also stops dipping from being effective. The shearing apparatus used locally is somewhat primitive and animals are therefore not sheared clean or close to the skin thus permitting parasites to stay on the animal. This also causes dipping to be less effective. In addition, long wool has also been associated with wool balls in the very young.

The general health management of flocks and herds is also poor. The animals are not thoroughly inspected for disease nor are they properly culled at regular intervals. The lack of trimming of hoofs results in many animals having badly deformed and split hoofs. As a result, foot rot can occur when the sheep and goats migrate to wetter areas in the winter. Foot dip remedies are not used. Udders are also not inspected for mastitis. Ventilation is also a problem when farmers winter animals in caves and closed shelters and pneumonia and tick problems become exacerbated. Many farmers, including trained veterinarians, administer vaccinations incorrectly. Vaccinations are often given in the muscle instead of subcutaneously and the wrong sized needle is often used. Dipping solutions are often not mixed at the proper strength and proper concentration levels are not always maintained when large flocks are being treated, thus making dipping less effective.

Many of these management practices can be improved at little or no cost. Farmer-managed trials which include a control (traditional practice) and the incorporation of improved management practices can be used for both research and demonstration purposes. Extension programs will then be required on a much wider scale.

4. Lack of sufficient infrastructure

Infrastructure common to a healthy livestock industry, such as credit availability, transportation facilities and roads, marketing facilities, abattoir and meat inspection

facilities, and veterinarian health coverage are lacking. Economic studies on the problems and solutions of credit availability for livestock farmers (e.g. use of sheep and goats as collateral), alternative marketing strategies and the rate of return to veterinary and health coverage should be undertaken.

5. Rangeland management and control problems

Rangeland management is not practiced on most grazing lands. Deferred grazing schemes or range improvement through plant introductions are not practiced perhaps because rangelands are held in common by tribal and village groups. Only 9% of the farmers indicated that the part of the rangeland they used was private and could be controlled Nagy and Farid Sabir, 1987). Four percent of the rangeland is state-owned and the remainder tribally owned and used in common by villages of the same tribe. Very little, if any, range management is practiced on the tribal lands. Communal herding is practiced by about 50% of the farmers.

Socio-economic or political influences might change the structure of Baluchistan society in the coming years and allow more control over rangelands. However, these changes may not come fast enough to alleviate the continung degradation of the range vegetation. Demonstration trials along with the formation of cooperative grazing societies may be feasible once research determines proper stocking rates, kinds of animals, and seasons of use, and plant species for introduction on rangeland. Research is needed to determine how to use the existing political, tribal, and village structures to accomplish rangeland management and control.

6. Poor genetic potential of animals

Breeding animals are selected first for their ability to survive the harsh environment and second for growth rate, wool production and quality, and lambing percentage (Buzdar and Jameson, 1984). Animals that survive the low rainfall years may not have great potential to utilize the better feed available in good rainfall years. There is some evidence to suggest that young animals (over 100 days old) receiving good feed, tend to stop their upward growth and tend to grow big in the belly but this requires further investigation (Stubbs, 1987). If there is a constraint on genetic potential, it would come into effect more when nutrition, animal health, and flock management are improved. Breeding improvement research beyond that already underway by the Provincial Government is needed.

DISCUSSION

Two fundamental questions for the future are whether sheep and goat production in Baluchistan will remain in its present form with small flock holdings being used as a store of wealth with minimal modern input use, or whether sheep and goat production can be guided from its present state into a more productive and dynamic commercial industry using available and future interventions and improved management practices. Baluchistan is being influenced by current social and economic pressures and the next twenty years could see large changes in the social and economic structure of Baluchistan (Del Castillo, 1987). In its present form, much of Baluchistan's sheep and goat production may disappear as off-farm income and permanent migration to larger centers in search of employment becomes more economically attractive. Those flocks that remain for "store of wealth" purposes are unlikely, as they are today, to fully utilize available interventions and improved management practices. Low cost and low risk interventions such as vaccination and dipping and some improved management practices would most likely be the only ones adopted. Those flocks attempting to become more commercial in answer to the possible decrease in sheep and goat production would still be disadvantaged because of nutritional, infrastructural and the other previously described constraints.

An important step in increasing the long-term productivity of the Baluchistan sheep and goat industry is the development of an overall strategy by the Baluchistan Government to guide the industry over the next decades. This strategy would take into consideration: (1) sheep and goat marketing and export trade opportunities, (2) changes in crop land use for more feed production, and (3) the role of research and extension.

Studies are required to examine how best to further exploit the existing sheep and goat export trade with other provinces in Pakistan. Export trade with other countries, in particular with the mutton-deficit Persian Gulf States, requires investigation. Establishing markets for export trade in turn requires a commitment for infrastructural development to facilitate the export trade.

Utilization of the current rangelands will undoubtedly remain the same. They will be used as the primary source of nutrition for sheep and goat flocks in the future. There is, however, the question of the comparative advantage of land use in the current irrigated and rainfed cropped hectarage. Currently, most cropped land is in wheat production with a small number of hectares in fodder and barley production. A commercially based sheep and goat industry, led by export trade demands, may alter the comparative advantage away from wheat in favor of fodder and

barley production on both irrigated and rainfed land in Baluchistan. The increased feed production would be used for lamb and kid fattening thereby decreasing the pressure on the overgrazed rangeland. The increased feed may also be used to supplement breeding flocks on the rangeland. Further research is needed to determine the conditions and extent to which there could be a shift from wheat to more fodder and barley production (Nagy et al., 1989). Research is also needed to determine if excess feed requirements could be imported economically from the nearby irrigated areas of Sind Province.

Research and extension programs need to develop and disseminate interventions aimed at alleviating the constraints to production. Given the present research and extension knowledge and technology availabile, the impact on the industry in the short term could most likely come from increased health coverage and improved management practices. Interventions that would be available in the intermediate term would include supplementary feed improvement from increased fodder and barley production, non-conventional feeds and forage shrub reserves. Long term impacts would come from improved genetics and range rehabilitation and control.

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Table 1. Grain and fodder hectarage in Baluchistan, 1981-82 to 1985-86 Average

Crop	Baluchistan			Upland Baluchistan		
	Irrigated	Rainfed	Total	Irrigated	Rainfed	Total
	Thousand Hectares					
Wheat	165.4	96.9	263.3	43.0	79.3	122.3
Barley	6.6	4.9	11.5	4.8	3.8	8.6
Rapeseed	16.1	5.9	22.0	3.5	3.3	6.8
Fodder	21.5	10.4	31.9	8.0	5.3	13.3
Sorghum	18.0	24.9	42.9	4.9	7.9	12.8
Total	227.6	143.0	370.6	64.2	99.6	163.8

Source: Government of Baluchistan, Agricultural Statistics of Baluchistan, Directorate of Agriculture, Statistics Wing, Quetta, Baluchistan, Pakistan.

Table 2. Sheep and Goat Numbers, Pakistan and Baluchistan Province, Census years.

Year	Sheep			Goats			Ratio Sheep/Goats	
	Pakistan	Baluch.	% Baluch. of Pakistan	Pakistan	Baluch.	% Baluch. of Pakistan	Pakistan	Baluch.
	Millions							
1955	8.1	1.2	14.8	7.6	0.7	9.2	1.07	1.71
1960	12.4	2.6	21.0	10.0	1.6	16.0	1.24	1.63
1972	13.7	3.9	28.5	15.6	3.2	20.5	0.88	1.22
1976	18.9	5.1	27.0	21.7	4.4	20.3	0.87	1.16
1986[P]	23.3	11.1	47.6	29.9	7.3	24.4	0.78	1.52
% Growth Rate 1955 - 1986[1]								
	3.4	7.2		4.4	7.6			

Source: Government of Pakistan, Agricultural Statistics of Pakistan, Ministry of Food, Agriculture and Co-operatives, Islamabad, Pakistan.

[1]Geometric growth rate.

[P]Preliminary Report, Pakistan Census of Livestock, 1986, Agricultural Census Organization, Statistics Division, Government of Pakistan, Lanore.

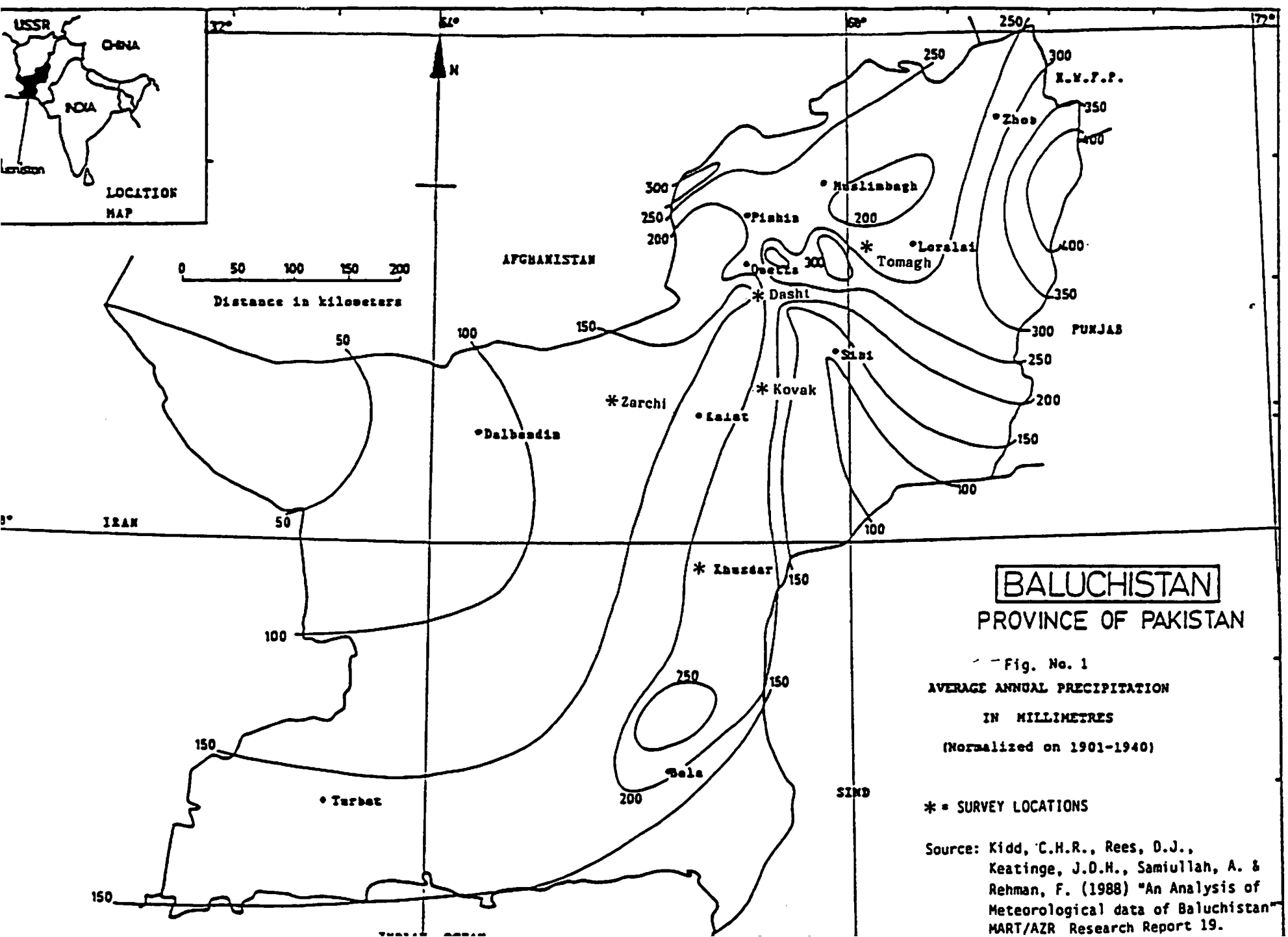
Table 3. Selected informal survey information - farmers' perceptions.

	Location	
	Zarchi	Tomagh
Enterprise type	Crop/Livestock	Orchard/Crop/Livestock
% sheep/goat income[1]	70-80%	40-50%
Sheep breed	Baluchi	Harnai
Sheep/goat ratio	75/25	60/40
Flock size	60-150	60-100
M/F breeding ratio	1:50	1:40
%birth rate	65-75%	60-70%
Lambing/kidding	Mid-Jan. to March	March
Fem. breeding age	12-18 months	12- 18 months
Castration	Yes	Yes
Shearing sheep[2]	April and Fall	April and Fall
Shearing goats	April	April
Feed shortage months	Dec.-Mar.	Nov.-Mar.
Feed supplementation	No	10% of Farmers
Water shortage	In summer	No
Water Quality	Poor in summer	Good-from streams
Distance to water	3-5 km	3-5 km
Diseases	Lung, Liverfluke	Lung
Disease months	Nov-Feb.	Nov-Jan.
Abortions	Do not know	5-10%
Use of Vet services	No	No
Predators	Wolves	Wolves
Migration	Nov-Mar.(Indus)	June-Aug (Local)
Winter housing	-	Closed shelters

Source: Informal interviews with 4 to 5 groups of farmers at each location.

[1]Percent income (cash and credit) from sheep and goats of total agricultural income - excludes off-farm income.

[2]Fall shearing not always undertaken.



BALUCHISTAN

PROVINCE OF PAKISTAN

Fig. No. 1

AVERAGE ANNUAL PRECIPITATION

IN MILLIMETRES

(Normalized on 1901-1940)

* = SURVEY LOCATIONS

Source: Kidd, C.H.R., Rees, D.J., Keatinge, J.D.H., Samiullah, A. & Rehman, F. (1988) "An Analysis of Meteorological data of Baluchistan" MART/AZR Research Report 19.

Table 4. Sheep and goat numbers, upland Baluchistan formal survey data, June/July, 1987.

	Breeding Females	Young < 1 Year	Males > 1 year	Total	No. of Mixed Flocks[1]	Sheep/Goat[2] Ratio	% Crude[4] Birth Rate
Sheep:							
1-10 ewes: (61 flocks)							
Average No./flock	5.6	3.7	1.9	11.2	41	1.29	74
Std. Dev.	3.0	3.9	2.9				
11-20 ewes: (24 flocks)							
Average No./flock	15.8	8.1	3.4	27.3	19	1.42	56
Std. Dev.	11.5	4.5	3.1				
21-30 ewes: (9 flocks)							
Average No./flock	27.7	19.3	5.3	52.3	8	2.96	69
Std. Dev.	2.9	5.0	5.7				
31-50 ewes: (9 flocks)							
Average No./flock	43.9	22.9	6.8	73.6	8	2.86	48
Std. Dev.	5.9	8.2	6.2				
51-120 ewes: (5 flocks)							
Average No./flock	92.0	48.4	9.6	150.0	3	1.60	54
Std. Dev.	19.2	24.8	6.5				
1-120 ewes: (All 108 flocks)							
Average No./flock	16.8	9.5	3.2	29.5	79[3]	1.80	61
Std. Dev.	20.8	12.4	4.3				
Goats:							
1-10 does: (84 herds)							
Average No./herd	4.2	3.5	1.0	8.7	64	2.52	-4/
Std. Dev.	2.7	4.2	2.0				
11-20 does: (13 herds)							
Average No./herd	15.9	9.8	2.9	28.6	8	1.40	-
Std. Dev.	3.4	4.6	2.8				
21-30 does: (9 herds)							
Average No./herd	27.2	13.2	5.1	45.5	4	2.10	-
Std. Dev.	2.9	20.8	4.6				
31-50 does: (2 herds)							
Average No./herd	40.0	20.5	4.5	65.0	1	1.23	-
Std. Dev.	-	-	-				
51-145 does: (6 herds)							
Average No./herd	83.5	54.3	7.1	144.9	2	0.61	-
Std. Dev.	36.4	52.1	6.5				
1-145 does: (All 114 herds)							
Average No./herd	12.2	8.1	1.9	22.2	79[3]	1.80	-
Std. Dev.	20.46	16.7	3.7				

Source: Formal survey of 40 farmers in each of the locations around Khuzdar, Zarchi, Kovak, and Dasht, Baluchistan, Pakistan.

[1]Flocks with both sheep and goats.

[2]Calculated from flocks that have both sheep and goats.

[3]The average number of breeding females, young less than one year old, and males equal to and older than one year for sheep and goats respectively are 17.5, 10.0, 3.8 and 9.8, 5.8, 1.8 for the 79 mixed flocks.

[4]Number of spring lambs/breeding ewes. Full information on the exact number of ewes that lambed in spring not available. Not calculated for goats because kidding period not as well defined as for sheep.