PROSPECTS OF INCREASING ANIMAL PRODUCTS IN HAZARA PRE-INVESTMENT FORESTRY PROJECT

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Abstract. *At present there are 371 thousand animal units in Hazara Pre-investment Forestry Project area, which require 948 thousand tonnes of air dry forage annually against the present production of only 547 thousand tonnes from cropland, rangeland and forests combined. The production of Shaftal can be increased by 90 thousand tonnes if the local variety is replaced with improved variety and fertilized. Planting of summer legumes in 10 per cent of the cultivated land and alfalfa under apple trees can increase the forage production by 772 and 40 thousand tonnes respectively. Replacement of undesirable forage species on field boundaries and range fertilization can further increase forage production by 27 and 128 thousand tonnes respectively. In this way the annual forage production can be increased to 1604 thousand tonnes and the animal units to 628 thousand. At the present level of efficiency of conversion of feed to animal products, they can be increased 2.9 times by increasing their feed production through better management.*

Introduction. A total area of 202,768 hactares has been earmarked in Abbottabad and Mansehra districts of Hazara Civil Division for development and improvement of Socio-economic conditions of the people. This paper deals with the present production of animals in the area and prospects of increasing the animal products by increasing the quantity and quality of feed available to them.

Project Area. The project area is situated between Lat 33 °, 55′ and 34° 44′N and Long 72° 55′ and 73° 25′ E due north of Islamabad. The mean annual rainfall in the area varies from about 750 to about 1500 mm, about half in summer (June to September and about a quarter in spring (February to April). November is the driest month of the year, when the average rainfall varies from about 19 to 53 mm. January is the coldest month and June the hottest. The range of mean minimum temperature during the year is from −2 to 23°C and of mean maximum from 12° to 36°C. The average relative humidity varies from about 37 at 0800 and 25 at 1700 in June to about 81 at 0800 and 69 at 1700 in August. (Khattak, 1980).

A major part of the project area is mountainous. The mountain ranges generally run north-south. The elevation varies from 519 to 2588 metres. Topography largely determines land use. All the level and gently sloping lands are under agriculture. Steep and rocky areas are under forests and rangelands. Cul-

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tivation is encroaching even on hill slopes. Granitic rocks of various types and ages cover more than half of the total area. Sedimentary and metamorphic rocks occur over the rest of the area. The soils are well drained loams, depth varies from less than 15 cm to more than 50 cm (Khattak, 1980).

Present Position. *(i) Stocking pressure.* The total number of livestock in the project area is given as under:

Kind of live stock	Number (thousand)	Animal equivalent	Animal units (thousand)
Cattle	89	1.0	89
Buffaloes	74	1.5	111
Goats	72	0.3	22
Sheep	58	0.2	12
Others	137	1.0	137
TOTAL:	430		371

Because of light weight animals the daily dry-matter requirements of Hazara cows, sheep and goats were estimated to be not more than 75 per cent of the standard animals (Khan, 1971). The standard animals require 9 kg of air dry forage per animal unit per day. So the amount of air dry forage required per animal unit per day in the project area will be 7 kg. At this rate the total amount of air dry forage required annually is 947,905 metric tonnes.

The air dry forage produced by 110,281 hectares of cropland at the rate of 3,511 kg of air dry forage per hectaer (Khan, 1971) is 387,197 tonnes. 56,798 hectares of rangelands at an average of 2,250 kg of air dry forage per hectare (Khan, 1971) produce 127,796 tonnes. While 35,689 hectares of forestland at an average rate of 897 kg of air dry forage per hectare (Khan, 1971) produce 32,013 tonnes annually. All this adds to 547,000 tonnes per year. This leaves a a deficit of 400,905 tonnes of air dry forage every year. So the stocking pressure in the area is 1.7 times the combined capacity of all croplands, rangelands and forestlands of the project area.

The cattle forage on the open ranges and in forests all the time during summer and most of the time in winter. Only about ¼th of the total forage required annually by one cow, (639 kg out of 2,555 kg), is stall fed. The cattle is a grazier and prefers grass over forbs, and shrubs. It, therefore, obtains most of its requirement (about 2/3rd) from the open rangelands in preference to forestland. On an average, therefore, one cow requires about 1,703 kg from 0.757 hectares of open rangeland, 213 kg from 0.237 has of forestland, 239 kg from 0.104 ha of

reserve range (locally known as 'Katal' which means the area of rangeland which is closed from grazing from the start of Monsoon till the end of the growing season i.e., October and is then harvested, stored and fed to the livestock during winter) and 400 kg from 0.178 ha of cropland.

The buffaloe is kept inside the house and is never grazed on the open range or forestland. Its forage requirement is met mostly from the cropland (90%) and a little (10%) from the reserve rangeland. One buffaloe will need 3,832 kg of forage annually, out of it 3,449 kg will be met from 0.982 hectares of cropland and 383 kg from 0.17 ha of reserve range.

The goat is a browser. It prefers forestlands (65%) in comparison to rengeland (35%). One goat will require 766 kg of air dry forage annually. Out of this it obtains 268 kg from 0.119 ha of rangeland and 498 kg from 0.555 ha of forestland. The goat is stall-fed only during snowy days and will obtain only negligible amount of forage from cropland or reserve range.

The sheep prefers forbs to grasses and shrubs. It will obtain 50% of its annual requirement of 511 kg of air dry forage from rangeland and 40% from forestland. It also is confined to stall-feeding longer than the goat and about 8% of its total annual requirement of air dry forage comes from cropland and 2% from reserve range. Thus one sheep will require 256 kg of air dry forage from 0.114 ha of open rangeland, 204 kg from 0.228 ha of forestland, 41 kg from 0.012 ha of cropland and 10 kg from .004 ha of reserve rangeland.

Others include mainly horses, donkeys and mules. They are down to earth graziers and will prefer open rangeland (60%) to forestland (almost Nil). However they are also commonly more stall-fed than all other animals except buffaloe. Their stall-fed forage comes 30% from croplands and 10% from reserve ranges. The annual requirement of air-dry forage of one other animal is 2555 kg. Out of this 1533 kg comes from 0.681 ha of open rangeland, 766 kg from 0.218 ha of cropland and 256 kg from 0.114 ha of reserve rangeland.

The following table shows the requirement of rangeland, forestland and cropland for the total number of each category of the livestock.

Table

Area requirement by the livestock in hectares

	Open rangeland	Reserve range	Total range	Cropland	Forestland
Cattle	67,373	9,256	76,629	10,146	21,093
Buffaloe	—	12,580	12,580	72,668	—
Goat	8,568	—	8,568	—	39,960
Sheep	6,612	232	6,844	696	13,224
Others	93,297	15,618	108,915	29,866	—
TOTAL:	175,850	37,686	312,536	113,376	74,277

It is evident that while requirement of the cropland area is close to being satisfied, the requirement of rangeland is 213,536 ha as against available area of only 56,798 ha. Similarly the requirement of forestland is 74,277 as against available area of 35,689 ha. Under present conditions, therefore, the stocking intensity is about 4 times the carrying capacity of rangeland and about double the carrying capacity of the forestland.

(ii) Feed. The feed of animals comes from two different sources which will be dealt with separately.

a. *Cropland.* The only important fodder crop grown in this area is shaftal *Trifolium resupinatum.* It is usually rotated with rice and occupies the lowlying bottomlands in the valley along the water streams and is usually irrigated. About 1% of the total cultivated area is grown to shaftal during winter. The average production of local variety of shaftal is about 16 tonnes per hectare. The total production of forage at this rate will be equal to about 17,700 tonnes of forage. This is an extremely important feed as it is available in green form when most of the range forage has dried. It is also high in proteins and is usually used mixed with roughage type of forage like hay and aftermath of cultivated crops.

Maize, wheat, rice and pulses are grown primarily for seed but their stalk is also a good source of feed for the livestock. Usually two crops are grown every year one after the other. The normal crop rotations practiced in the area are shaftal-rice, wheat-rice, wheat-maize and wheat-pulses. Each crop on an average produces about 1765 kg/ha of staw or aftermath. Rice rotated with shaftal will thus produce about 1950 toones of forage. While in the non-shaftal production of aftermath will be about 385,399 tonnes from two crops annually.

Thus a total of about 387,000 tonnes of forage is being produced in the cultivated lands. In addition to this usually inferior type of grasses are inhabiting the field boundaries (occupying about 5%of the cultivated land) which are cut and fed to the livestock.

b. *Rangelands.* Climax vegetation of this zone is Chir pine *(Pinus roxburghii)* forests and is situated above Phulai/Kao zone and below temperate humid zone or Kail zone. One degradation from forests, the zone supports a spectra of range types, often highly productive.

In the project area socio-economic pressures have resulted in large scale convertion of chir forests into either agriculture field or productive rangelands. However, large areas are still under productive forests.

Chir pine makes almost pure association with very limited shrub by and herbaceous undergrowth. The removal of chir and needle cover, however, develops into beautiful productive rangeland. The average production of chir forest (more than 50% canopy cover) is about 897 kg per hectare and other types (less than 50% canopy cover) is 2250 kg per hectare.

About 10% of the rangeland area is protected from grazing from the onslaught of Monsoon upto September-October. This is cut and reserved for winter feeding. Such reserves usually have a higher forage production of about 3375 kg/ha amounting to almost 19,000 tonnes of forage. The remaining rangelands on an average produce about 2250 kg/ha (as detailed above). This gives about 113,000 tonnes of forage. The rangelands in the project area thus contribute about 132,000 tonnes of forage. The total forage available to the livestock per year from cultivated land and rangeland thus comes to about 519,000 tonnes.

Stage of harvesting. Both cultivated fodder and range forage in the protected reserves is cut at a very late stage when lot nutrients have already leached. The best stage of maturity for harvesting fodder and forage is the boot stage when the inflorescence is ready in the sheath but has not come out. At this stage the essential nutrients especially digestible protein, phosphorus and vitamin A are at their maximum and fibre is at its minimum. The people harvest fodder/forage at a stage when fibre is highest and also total quantity is highest. The reason behind this is that they have been underfeeding their animals for a long time They know that the animals' intake is proportional to the palatability and nutritive value of the feed, so they will consume less of fibrous material as compared with the quantity of nutritious feed. In this way the animals will be able to overwinter on a lesser quantity of feed. While if they are fed more nutritive feed, they will consume all the feed reserved for winter in a short period and will start starving thereafter. (In fact they are starving all the time). This local system in the project area is quite comparable to the Australian system of drought feeding. During periods of drought, the sheep in Australia are penned down and not allowed to move at all to minimise dissipation of energy in work. In this way they need only energy at very close to their BMR (Basic Metabolic Rate). These sheep are fed the qunatity of feed normally required daily only once a week. In this way the sheep become very weak but they are saved from dying. The local system of feeding of fibrous material to the livestock also aims at passing alive animals through winter.

Storage. The hay and aftermath of crops is stored in the open usually on trunks and branches of the trees. This is open to vagaries of the weather. During rain the nutrients are leached out and the feed starts rusting. No silos or other types of open store-houses are available in the locality. (In a country where we are short of wheat storage facilities, it is unthinkable to have modern store-houses for the animal feed).

Limiting Factors of Management. Nutritious green forage is available in spring months (March, April and May) and summer monsoonic months (July, August and September). The periodicity is correlated with rainfall pattern. The project area is primarily summer range. The lack of winter browse, however, can be well compensated by establishing winter green perennial pastures.

The customary, yearlong grazing is particularly harmful during wet periods of summer monsoons. In addition to compaction, the hills relief is prone

to mechanical tearing up of turf and soil and thus causes accelerated soil erosion. The grazing during such periods should be discouraged. Alterenate arrangements, however be made for stall feeding.

Erodibiity. The area is characterised by heavy density of population, abandoned cultivated fields with often defective terracing and cropping patterns, yearlong grazing especially around inhabitations and agricultural fields and high intensity summer monsoonic rainfall storms. These factors, if not properly controlled, are capable of causing serious erosion hazards. Prospects of Increasing Animal Products. The animals products can be increased by increasing feed in the project area by improved pratices as discussed below:

A. **Cultivated land.** Following are the main areas where the fodder/forage for livestock has prospect of being enhanced.

(a) *Area grown to Shaftal.* The local variety of shaftal can be replaced by high yielding variety of *Trifolium resupinatum*. The expected yield from this variety is about 74 tonnes per hectare. This alone will increase present production of livestock on 1103 hactares of land grown to shaftal from 17,700 tonnes to 81,600 tonnes; an increase of 64,000 tonnes.

A general recommended dose of fertilizer for shaftal in the project area will be 50 kg of nitrogen and 50 kg of P_2O_5 per hectare. This is expected to increase the present yield by 33% i.e., from 81,600 tonnes to 108,500 tonnes. Thus the total increase of feed production on land grown to shaftal will be from 17,700 to 108,500 tonnes; an increase of about 90 thousand tonnes.

During summer there is enough range forage, therefore, people do not grow fodder in the cultivated field. There is need of popularising fodder crops like cowpeas, siratro etc., which will increase the total production of livestock feed. The harvested fodder can then be sun-dried or converted into silage and stored for use during winter. The area to be sown with summer fodder need not be the one used for shaftal and may be at higher lands as these summer legumes can be grown without irrigation under natural rainfall of the project area. Suppose 10% of toal cultivated land is sown to summer legumes, at the average production rate of 74 tonnes per hectare an additional amount of 772,000 tonnes of fôrage will be available to the project area.

(b) *Area planted to apple trees.* About 5 per cent cultivated land is grown to apple trees. No crop is usually grown beneath the mature apple trees in the project area. This is because the apple trees are planted very close, their crowns touch each other and there is not sufficient light for the understorey crope to flourish. The frequent soil working in annual crops also bruises the apple trees and makes them susceptible to disease and hence such crops are not suitable to be grown under the apple trees. Range Management Branch of Pakistan Forest Institute, on the basis of 5 years experience at Jaba in the project area, has found that Lucerne *(Medicago sativa)* can come up under the apple trees and can produce about 3-5 tonnes of forage annually. Lucerne is a perennial crop and once

established need not be replaced for the next 10-15 years. It will therefore avoid annual bruising of apple trees also. With the efforts of Watershed Management Project, people in the project area have become apple minded and large tracts of cultivated land are now being converted into apple orchards. Growing lucerne under the apple trees will provide an additional source of income to the farmer and enhance the forage production capacity of the tract as a whole. On an average production of 3 tonnes per hectare, planting of lucerne under apple trees will increase the animal feed by about 40 thousand tonnes.

(c) *Field Boundaries.* The field boundaries occupy about 5% of the cultivated area (estimated by the author). Out of 110,281 hectares of cultivated land, therefore, 5514 hectares constitute field boundaries or wats. All this areas supports herbaceous vegetation of inferior quality (about 50% being unpalatable *Imperata cylindrica* grass). This grass can be replaced by perennial legumes like *Medicago sativa, Lespediza striata, Potarium sanguisorba,* perennial winter grasses like *Festuca arundinacea, Phalaris tuberosa* or by perennial summer grasses like Napier hybrid *(Sorghum atropurpureum), Chrysopogon aucheri, Chrysopogon montanous, Hyparrhenia rufa, Chloris gayana, Dicanthium annualatum, Bothriochloa pertusa, Panicum antidotale* or by fodder trees/shrubs like *Acacia cyanophylla, Acacia ligulata, Amorpha fruticosa, Grewia oppositifolia, Leucaenia leucocephala, Robinia pseudocacea* etc. This will increase the forage production on wats at an average of 5 tonnes/hectare. Total increase of forage production on wats in the project area can thus be about 27,500 tonnes.

B. Rangelands. The range forage productivity can easily be enhanced through fertilization with nitrogen and phosphorus. The experiments carried out at Balakot and Jaba in the project area show that the application of 50 kg/ha of nitrogen and 50 kg of P_2O_5 per hectare doubles the forage production on rangeland therefore the production of forage from rangelands can be increased from 127,800 tonnes to 255,600 tonnes; an increase of 127,800 tonnes.

Conclusion. The total livestock feed production from the project area can be increased from 547 thousand tonnes to 1604 thousand tonnes, which will be enough to carry about 628 thousand animal units round the year. The efficiency of conversion of feed to livestock products increases with the increase in the feed intake. However, even at the present level of efficiency of conversion of feed the animal products can be increased 2.9 times the present production.

References

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