CHAPTER 5

PRINCIPLES OF RANGE MANAGEMENT-III

——— related to site ———

II. Selection of suitable site.

This is the most important of all principles. One should select most favourable among available sites. None of the important climatic, edaphic, biotic and socio-economic factors be limiting or in excess. Potential productivity (if not the present one) should be high. Socio-economic factors such as accessibility throughout the year, availability of market, etc., are generally ignored while evaluating the suitability of a site for commercial Range Management. All efforts be directed towards preferably selecting a site with land capability class from III to VII in decreasing order. The selected site should have minimum number of limitations and these too of less severity. The site should require a few easily manageable precautions if any. Range lands of land capability class III and IV are of very high potential and are popularly called as pastures. Easy and dependable accessibility of the site throughout the year can't be over emphasized. A far fetched inaccessible but otherwise near ideal range area is of practically no use unless communications are developed. This factor is generally ignored. Government and semi-government organizations rather than individuals are more important in providing this missing but vital facility.

The following additional environmental factors are of utmost importance in Pakistan and deserve to be considered very carefully before making a final selection.

1. Amount and distribution of rainfall; intensity, duration and frequency of droughts.
2. Availability of underground water suitable for drinking and growing forage crops or availability of canal irrigation water for the same purpose. (This means that proposed rangeland should be adjacent to the irrigated area).
3. Steepness of slopes and intensity of erosion. It is important at this point to understand the effect of steepness of slopes on range productivity. Sloping rangelands are less productive than flat plains because:

a. Sloping land does not absorb as much water as flat one and thus remains relatively dry.
b. Erosion hazard is high, leading to loss of fertility and reduced depth of soil.
c. With increasing slope, more and more land surface is occupied by rocks and their proportion in the soil increases; thus relatively little quantity of soil is available for plant growth.
d. One has to leave relatively higher proportion of forage un-used in the field (i.e., light range use intensity) for soil conservation purposes.

4. Suitability of range vegetation for the purpose of feeding livestock and its condition for as long grazing period as possible.
5. Rights of the local residents, number's and kinds of livestock owned by them; existing grazing intensity, incidence of nomadic grazing, etc.

In short, marginal rangelands (especially those having little possibilities of site improvement) must be avoided.

IV. Site Development

The entire range area, after necessary demarcation should be divided into 4 or 5 equally productive permanently numbered blocks. In addition, about 5% of total area should be earmarked for irrigated fodder production for supplementary and emergency feeds. Administrative Headquarter including office, animal sheds, open enclosures (pens), feed stores, dispensary, watering point, residences etc. should preferably be centrally located and easily approachable.

Development of communication and storage facilities consists of removal of hurdles, construction of culverts, bridges and building roads which remain open throughout the year. It also includes construction of storage facilities for the animals or animal products. The availability of these facilities and their intelligent use ensures high prices and increased profits. Since profit is the ultimate driving force behind the whole enterprize of Range Management, any operation that would increase the profit would certainly popularize private ranching.

Efforts for maximizing forage production on sustained basis must be undertaken vigorously. One such most important effort under our circumstances is water conservation, water harvesting and spreading. If properly carried out, this effort can alone increase forage production from 4 to 8 time of current production.

Stone collection and constructing ridges along contour lines, occasional deep ploughing to break hard pan, burning or removal of old trees and shrubs of doubtful forage value and replacing them with new and better plants, establishing permanent tree shelterbelts, planting legumes and bushes in small suitable pockets/strips here and there in the range and stock water development are a few more examples of efforts that are expected to cause permanent increase in forage production.

1. Water Spreading

It is a crude form of irrigation. It consists of damming a stream at a suitable location ~~or harvesting run-off water at the foot of a hill~~, diverting flood water to the range through main channel and spreading the water with the help of dykes, ridges and trenches. It is undertaken where:

i. Precipitation is not sufficient for good growth throughout the year.
ii. Area has sufficient and dependable source of flood water.
iii. Area has less than 5% slope.
iv. Suitable location for damming water is available.

A good example of water spreading is at Rakh Miran Range (Dera Ismail Khan).

2. Water and Soil Conservation

It consists of checking or minimizing run off water and soil erosion on sloping areas by stablishing vegetation and by various simple field and engineering operations. Important engineering and simple field operations include diversion walls, dykes, gully plugging, check damming, levelling, contour ridging, contour trenching, contour cultivation, etc. The degree of erosion (light, moderate or severe) determines the relative importance of engineering approach or cultural cum biological approach. In case of severe erosion, engineering operations assume more importance but in case of light erosion simple field operations and establishment of vegetation become more important.

3. Stock Water Development

It consists of construction of suitable structures for providing drinking water at appropriate intervals. The size and number per unit area of watering points depends on

a. kind of livestock
b. kind of vegetation
c. climate and
d. topography etc.

One may collect rainwater (small lakes, and tobas), use stream/canal water (ponds, etc) or tap underground water (hand pumps or animal, diesel, electric or wind-powered tube-wells). Discovering and linking new watersheds for feeding tobas in the deserts in addition to improving existing tobas by deepening, brick lining and roofing etc. is a very important development operation in the deserts where under-ground water is either too deep or brackish. What is needed in such cases is firstly to discover a new watershed and secondly to dig shallow water ways for guiding and collecting runoff water from a valley and then directing this water across a sand dune or mound through an open channel or burried concrete pipe (as the case may be) to the toba in question. This is particularly required where existing toba is seasonal and dries out during summer. The seasonality of a toba may be due to either excessive water percolation/evaporation or reduced run off water from the existing watershed(s) (inter-dunal valley(s)) or both with respect to water consumption by men and livestock. The answer to this problem is, therefore, two pronged i.e. improve the tobas capacity and increase water yield by linking new watershed(s). Judicious water development results in uniform and efficient use of low grade forage.

4. Controlled Burning

It consists of burning undesirable woody vegetation, brush wood and litter. The fire is kept under complete control and all appropriate precautions are observed. Burning may be done for

a. making more space available for grass growth,
b. making it easy for the range animals to walk any where in the range, even under trees or shrubs,
c. promoting succulent regrowth of shrubs and grasses and
d. liberating nutrients which were tied up in woody tissues and litter and making them available for new growth.

Controlled burning may have to be done in Pothowar range area (Attock, Rawalpindi, Jhelum) where a scrub forest is to be developed as a rangeland.

5. Levelling of uneven areas and Terracing (constructing levelfields just like steps of a stair on sloping lands):

These operations are expensive and are generally associated with farmland. These should, therefore, not be carried out in range areas except in crude form or on small scale. These operations lead to increased forage production by ensuring even distribution and retention of water and nutrients. The precision of levelling and the quality of terraced fields in range areas is always inferior to that in farm areas. This difference is largely due to cost/benefit ratio.

6. Establishing Tree Shleterbelts

Single lines of trees or strips of 2 to 3 lines of trees cum shrubs are planted at right angle to general direction of prevailing winds. The density of these belts should be uniform both vertically as well as horizontally and the porosity should be around 50 percent. The effectiveness of a shelterbelt extends

to a distance equal to about 20 times the average height of trees in a shelterbelt; hence the spacing between any two shelterbtlets.

7. Providing Transport

It is required for moving men, animals and materials on regular basis or on emergencies. It may include either procuring ones own ever available vehicle with independent control or making fool-proof arrangements for obtaining a private vehicle on rent as and when required especially during emergencies or making arrangements with public transport system or all. In the present day world, availability of one or two pick ups should serve the purpose very well.

V. Site Management

It covers soil Management Water Management and Atmospheric Manipulations.

A. Regarding Soil Management.

1. Soil cultivation and ploughing on extensive areas is not a regular feature of Range Management. It is, however, regularly required on small areas reserved for irrigated forage production in the range. Soil harrowing on the other hand is more of a regular feature over extensive areas of the range. Harrowing may be done for varying purpose such as breaking crust to discourage evaporation of moisture from the soil and to encourage water absorption in the soil, to uproot and weaken turf grasses and other creepers, to mix seed in the top soil and to mix litter and manure etc. in the soil. Cultivation and ploughing loosen the soil and retard water evaporation, promote water absorption and root growth, break and bury litter in soil and promote its decomposition, uproot the stubbles of undesirable plants. Frequent cultivation and ploughing in range areas may give rise to certain problems such as hazard of soil erosion by wind and water might be increased. Uneven, pitted, trenched, ridged and stony soils may not permit cultivation or ploughing at all. Occasional cultivation or ploughing on extensive scale on range areas has its own merits and is common in some cases. It is in sharp contrast to the fact that cultivation and ploughing is vital and basic operation of farming.

2. **Adding organic manures, fertilizers etc.** not only increase total forage production but also improve the quality and nutrition of forage, prolong growing and grazing season and gradually change the composition of the range. Adding organic manures, fertilizers and chemical ammendments in cultivated pockets of the range area earmarked for irrigated fodder production can be adopted as a standard practice. The doses of these inputs are generally 20 to 40% of those in the irrigated tracts. In addition, fertilizers may also be added in selected relatively high potential range areas or may be applied locally around forage shrubs.

In general, manures and fertilizers should be added to the range areas in 2-3 light doses rather than one heavy dose. This precaution is suggested because of commonly low nutrient holding capacity of range soils. Complete and slow release fertilizers should be preferred. Best times of application is the start of growing seasons/beginning of rainy season. Pothowar range area(Districts of Islamabad, Rawalpindi, Attock, Jhelum and Chakwal) is a good example of the area where fertilization of rangelands should be carried out extensively.

3. Mixing of sand in clayey soils of interdunal valley (dahrs) of Cholistan and of other deserts in order

to open up the soils for increasing water absorption and promoting seed germination and root penetration is an important soil management practice. An easy way of achieving this goal is to plough the land as soon as possible after the rains. The furrows should run at right angle to the prevailing wind direction. The furrows should be deep and need not be very close to each other. The wind in the following season will blow away sand from the dunes across the valley. The sand particles will get trapped in the furrows and will get mixed with the clay. If this process is repeated twice or thrice, satisfactory results can be achieved in relatively short period.

4. Stones occupy land surface and reduce soil surface available for plant growth. Stones may also create problem for the animals during walking. Animals feet may get injured in some cases. All these problems can be overcome and a few additional good results achieved if these stones are collected and systematically placed along contour lines for making broken and staggered stone walls/ridges at appropriate distances apart. These stone walls/ridges interrupt runoff water, reduce soil erosion and increase water absorption and forage production.

B. Regarding Water Management:

1. Regular repairs and strengthening field boundaries of range field in relatively high rainfall areas is a must for retaining maximum rain water in the field. Similarly routine repairs of water spreading dykes, water channels, water ways, ridges, ditches, pits, outlets, check dams and diversion walls etc. is also a must for soil and water conservation. The overall result of all above operations will be tremendous increase in forage production. Digging of new trenches and pits should be a regular feature of water management in the range areas.

2. In desert ranges with scanty and unpredictable rains, only partial area (may be 10 to 25 or 33%) can be made productive by harvesting water from the adjoining areas and directing to natural depressions or man made troughs of varying sizes. These troughs should be about 0.40 to 0.60 m deep, 3 m wide and 9-12 m long and should be so located and shallow water channels from the surrounding relatively high areas so designed that maximum runoff water quickly reaches the troughs. These troughs should be heavily manured with organic matter for increasing the water holding capacity of the soil and should be heavily mulched for keeping the soil cool during summer (and warm during winter) and reducing moisture evaporation from soil surface. Forage shrubs should preferably be planted in these troughs while maintaining the completeness of the mulch.

3. Soil compaction or soil loosening plays a major role in water management in rangelands. Heavy soils tend to get compacted easily as a result of heavy grazing especially when it is allowed on wet soil. Light soils on the other hand tend to loosen by sheep hooves as a result of grazing. Compact soils are not desirable because water and air cannot enter easily; roots cannot penetrate in soil. Soil compaction thus leads to sheet erosion, rill erosion and finally gully erosion. Soil compaction on small areas with short lengths may, however, be good and desirable when we want to collect and harvest maximum run off water for productivising a nearby patch. One may be required to adopt certain methods for achieving soil compaction on small areas for the above

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Note: **Cultivation** refers to cutting, and disturbing top soil layer. **Ploughing** refers to cutting, inverting and pulverizing top soil layer with the help of mould board ploughs. **Harrowing** refers to disturbing soil surface. **Discing** refers to cutting and pulverizing top thin layer of soil with the help of sharp concave metal discs.

referred purpose. Loose soil in sandy areas has its own disadvantages. Unstable soil either leads to uprooting of newly planted vegetation or leads to its burrial. Medium to heavy grazing may accelerate soil loosening. There are many such situations where various methods are required to be adopted for stabilizing the moving sands.

Before winding up this discussion, it will be very useful to analyze and understand the phenomenon of soil compaction. One can easily comprehend this by looking at it from the following two aspects:

a. Factors promoting soil compaction
   i. rain drops.
   ii. trampling by range livestock, particularly when grazing is of heavy intensity and is continuous.
   iii. grazing in wet (drenched) soil.
   iv. grazing in clayey rangelands.
b. Factors promoting soil loosening (opening).
   i. presence of vegetative or litter cover that will absorb the beating force of rain drops and trampling pressure of animals' hooves.
   ii. extensive macropores formed by roots after they are dead and decomposed.
   iii. presence of soil fauna, i.e., insects (beetles, worms) earth worms, centipedes, millipedes and rodents, etc.
   iv. presence of grazing livestock in sandy areas.

One can easily slow down or even reverse the process of soil compaction by following manipulations;

a. Avoid grazing in wet soil.
b. Avoid continuous grazing.
c. Maintain thick vegetation or litter cover.

C. Regarding Atmospheric Manipulations:

Extreme weather is a highly important factor responsible for reduced growth rate of vegetation and livestock if not their mortality. Young plant seedlings and infant animals are more subject to death. Severe reduction of growth rate is, however, common to all. Unfortunately reduced growth rate largely remains unnoticed as compared to mortality. From the point of view of range as a business, reduced growth rate is much more important than mortality losses. Hence there is urgent need for analyzing and identifying harmful components of extreme weather and for adopting suitable measures for minimizing their effects.

1. Soil surface temperature during summer is one typical example of a harmful phenomenon for germinating seed and young seedlings. Partial tree shade, mulching by litter and keeping the soil moist are a few remedial measures.

2. Extreme cold wave (thakka) is very fatal to young infants especially at the time of their birth. Infant mortality can go high in cold range areas unless suitable precautionary measures are not taken in time such as keeping would be mothers in sheltered enclosures under close supervision with special arrangement for providing warm drinking water to such individuals.

3. Hot dry long summer coupled with strong hot winds (loo) are equally uncomfortable and harmful especially to the buffaloes. Planting of tree shelter belts at right angle to loo direction and planting of individual trees

and in small groups scattered here and there in the range for providing easily accessible shade and for raising atmospheric humidity is most useful and effective operation. Provision of plentiful supply of fresh and cool water is also equally important. These above referred two operations can quite effectively counter balance the harmful effects of hot summers.

Grazing and other range management operations such as harrowing, seedling etc. should be scheduled at night or at least to avoid noon hours during summer. The overall idea is that what cannot be cured, must be avoided as for as possible.

TEST QUESTIONS

1. Briefly explain the following.
   Controlled Burning, Terracing, Stock Water Development, Potential Range Site, Water Harvesting, harrowing, Shelterbelt, Staggered Stone Ridges.
2. What factors are considered important for evaluating the productivity of a Range Site?
3. Why is the "Selection of a productive Range Site" of fundamental importance in Range Management?
4. Name important operations pertaining to Range Site Development. Briefly explain any one operation.
5. Explain "Water Spreading" in a Range Site.
6. Enlist important operations related to Range Soil Management.
7. What is the importance of mixing sand in clayey flats in Cholistan?
8. Write a brief note on "Cultivation or Ploughing of Range Soil".
9. What operations contribute to better Water Management in a Range Site ?
10. How can we harvest rain water effectively so that at least a part of the total range area can be made productive ?
11. Write an essay on Range Soil Compaction versus Soil Loosening.
12. What factors lead to soil compaction ?
13. How can one promote soil loosening ?
14. Write a note on "Manipulating Range Atmosphere".