Strengthening Livelihood of Rural Farmer Populations through Improved Grasslands

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The 23rd International Grassland Congress (Sustainable use of Grassland Resources for Forage Production, Biodiversity and Environmental Protection) took place in New Delhi, India from November 20 through November 24, 2015.

Proceedings Editors: M. M. Roy, D. R. Malaviya, V. K. Yadav, Tejveer Singh, R. P. Sah, D. Vijay, and A. Radhakrishna

Published by Range Management Society of India

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ABSTRACT

This paper reviews the current background of the grassland resource with a purpose of livestock perspective to improve the livelihood of rural farmers. The use of grasslands for livestock rearing by rural farmers has been a long tradition. In climate and vegetation contrast, these grasslands are much more diverse. They are likely to play an economical role in increasing the milk production in many Asian countries. With an increase of human population, the traditional feeding, breeding and surviving habitats for livestock have been acutely restricted in many countries. Therefore, a continued effort is needed to maintain production for sustainable management of grassland resource for rural farmers. Pastoralism in wildlife protected area must be gradually proscribed and encouraged to form community grasslands. In addition, issues such as development of water resources, extension and education must be considered as higher attentions than basic grassland principles.

Key words: Animal production, Grasslands, Livelihood, Rural farmers

Introduction

Grasslands contribute to the livelihood of over 800 million people including poor small holders in different parts of the world (White *et al*., 2000). According to the American Heritage dictionary of the English Language (1978), livelihood and living usually specify the occupation, work or other means by which one earns his or her income whereas, the livelihood in the context of grasslands refers broadly the higher livestock production, provision of food and power to cultivate crops (Hervieu, 2002). Grazing livestock is the main source of livelihood of most of the rural farmers in Asia where the agricultural population is 87% of the rural population although the income may be different with the involvement of other activities. According to Wiggins and Keats (2014), in most countries of Asia, typical rural wages remain low, at levels that would barely allow households that depend on laboring for incomes to escape ($2 a day) poverty. These changes in rural wages are associated inversely with changes in rural working population.

Farm families, either cultivating food crops or engaged in plantation crops, keep one or several species of animals which are integral parts of their farm/farming system. Cattle and buffaloes are raised mainly for milk and draught whereas goats, swine and chickens are reared for meat production. Ruminant livestock feed is mainly derived from natural grasslands, roadsides, marginal lands, fallow paddy fields, fodder crops, fodder legumes, crop residues and agricultural by-products. However the quantity as well as quality of forage obtained from communal grasslands, roadsides and marginal lands are very low. Therefore, strengthening livelihood of rural farmer population through improved grasslands is very important in Asia in near future.

Existing forage resources

Natural grasslands/forests

In India grasslands are spread over an area about 12.04M ha (Misri, 2006) whereas natural grasslands in Sri Lanka is nearly 12,000 km^2 (Pemadasa, 1990). Using grasslands for livestock through traditional means goes back several centuries. The cohesiveness of traditional societies and social groups in livestock rearing led to holistic approaches that resulted in appropriate, or environmentally sound sustainable technologies. Nevertheless, as in many other countries, grasslands have deteriorated due to mismanagement under the existing socio-economic position in Asia. However, grasslands remain very important for livestock production and environmental stability. There is continued need to maintain a broad spectrum of production and conservation interests in order to ensure the effective and suitable management of the grassland resource (Premaratne *et al*., 2003). Grasslands in India have been classified into five types (Table 1).

Stocking rates in semi-arid areas of India are 1-51 adult cattle units (ACU)/ha against the carrying capacity of 1ACU/ha whereas, stocking rates in arid areas are 1-4 ACU/ha (Shankar and Gupta, 1992) against the carrying capacity of 0.2-0.5ACU/ha (Raheja, 1966). This deterioration of Indian pastures, grasslands and other grazing lands may be due to the large bovine population, free grazing practices, lack of management and natural constraints like high temperature, variable rain fall, and steepness of slopes and scarcity of soil moisture in some areas (Misri, 2006).

Sri Lankan grasslands play an economically vital role because they have a potential as feeding grounds for livestock. However, their exploitation has been rather unsystematic due to increasing biotic interference by haphazard clearing for short-term cultivation, illegal burning and extensive

Table 1. Grasslands of India.

Grasslands	Area, km^2	Elevation, m	Location	Forage species
Sehima-Dichanthium grasslands	1,740,000	300-1200	Central Indian Plateau, Chota Nagpur Plateau and Aravallis	24 species of perennial grasses, 89 species of annual grasses, 129 species of dicots including 56 legumes
Dichanthium Cenchrus-Lasiurus grasslands	436,000	150-300	Northern parts of Gujarat, Rajasthan, Aravalli ranges, South western Uttar Pradesh, Delhi and Punjab	11 perennial grasses, 43 annual grass species, 45 dicots with 19 legumes
Phragmites-Saccharam-Imperata grasslands	2,800,000	300-500	Gangetic plains, the Brahmaputra Valley and the plains of Punjab	10 perennial grasses, 26 annual grass species, 56 dicots with 16 legumes
Themeda-Arunidinella grasslands	230,400	350-1200	States of Manipur, Assam, West Bengal, Uttar Pradesh, Himachal Pradesh, Jammu and Kashmir	37 perennial grasses, 32 annual grass species, 34 dicots with 9 legumes
Temperate-Alpine grasslands		>2100	Jammu and Kashmir, Himachal Pradesh, Uttar Pradesh, West Bengal and the north-eastern states	47 perennial grasses, 5 annual grass species, 68 dicots with 6 legumes

Source: Dabadghao and Shankaranarayan (1973), cited by Misri (2006).

Table 2. Grassland types of Sri Lanka for livestock farming

Grassland Type	Rain Fall (annual), Elevation	Distributed location	Dominant forage species found	Potential for livestock rearing	Important remarks
Dry Patana	1750-2250 mm, 500-2000 m	Uva Basin	Arundinella spp, Pollinia spp Ischaemum spp, *Themeda tremula*, Andropogan spp.	Moderate	The burning of grass just before the rain results in the soil being exposed and consequently getting eroded. This probably accounts for the absence of any trees.
Wet Patana	2500-400 mm >2000m	Horton Plains Elk Plain Moon Plain Bopaththalawa	*Chrysopogan zeylanicum*	Poor	Grasses are tufted, coarse and wiry, scattered trees are prominent
Lowland Savanna	1450-1750 mm 300-400 m	Bibile Monaragala	Panicum spp *Themeda tremula*, Desmodium spp *Temeda triandra*	High	The grass cover is much taller. Fire-tolerant species are rather sporadic.
Upland Savanna	1500-2000 mm 400-500 m	Wellawaya Pethyagoda	Panicum spp *Themeda tremula,* Desmodium spp *Heteropogan triticeus* *Mimosa pudica*	Moderate	The grass cover is much taller. Soil is eroded and denuded as a result of frequent destructions of vegetation
Villu	1500-2000 mm 0-200 m	Polonnaruwa Manampitiya Thamankaduwa Maduru oya	*Cynodon dactylon* *Stenotaphrum secundatum* *Bothriocloa glabra*	High	Wet grasslands found in the flood plains of the rivers in the dry zone. Grasses are more succulent. Soil is rich in nutrients
Damana	1250-1750 mm 0-100 m	Damana Ampara Inginiyagala	*Imperata cylindrica*	High	Origin seems to be the results of forest clearing followed by repeated fire.
Talawa	2000-2500 mm 0-200 m	Kalutara Galle Matara	*Cynodon dactylon*	High	Arise as results of forest felling and *chena* cultivation in wet zone

Source: Pemadasa (1983) and Premaratne *et al*. (2003)

removal of herbage for fodder and over grazing (Premaratne and Premalal, 2006). These activities have caused considerable floristic and habitat change and severe erosion of many types of grassland with near complete destruction of some areas (Pemadasa, 1981).

It is of common knowledge that the economic viability of grasslands as grazing grounds depends partly on their productivity and quality of constituent forage species. In addition, annual rainfall and its seasonal variation, soil fertility, species composition,

stocking rate and anthropogenic and other biotic factors also play an important role (Murphy, 1975). Amarasinghe and Pemadasa (1983) estimated the annual productivity of some regions of dry Patana grasslands in Sri Lanka to be around 68,000 to 111,000 kg/ha. Grassland types of Sri Lanka for livestock farming are given in Table. 2.

With an increase of human population, the traditional feeding, breeding and surviving habitats for livestock have been acutely restricted in Sri Lanka due to large scale developmental activities pertaining to human life. Nowadays, farmers have developed a complex culture, including a wide variety of on and off-farm activities in order to deal with an unfavorable economic and socio environment (Zemmelink *et al*., 1999).

Home Gardens/Pasture under coconut

A distinct feature in local dairy farms is that animals are grazed (free or tethered) on vacant areas such as government lands, fallow fields, coconut lands or stall fed with cut grass usually comprising of weed cut from the roadsides (Zemmelink *et al*., 1999; Ranawana, 2008) as majority of farmers do not have land of their own for dairy cattle farming. Therefore, the main sources of roughage for dairy cattle in south Asia including Sri Lanka are the weeds and grasses that grow on road sides and vacant areas.

It is very common to use mixed farming systems in both developed and developing countries to increase agricultural output and/or the sustainability of farming. Integration of livestock into a cropping system is important to increase subsistence security by diversifying the food generating activities of the farm family as well as to transfer nutrients and energy between animal and crops via manure and forage from cropped areas and via use of draught power.

Cattle and buffalo grazing on natural pasture under coconut are a common scenario in south Asia especially in Sri Lanka. Coconut-livestock farming system provides a steady income through out the year with less risk than intercrops. The micro climate under coconut will help to rear superior cross bred animals and thereby increase the milk production of animals. Livestock graze on weeds also reduce the cost of weeding. In mixed farming systems, animals and poultry provide milk, meat and eggs and thereby self sufficiency in food supply for the farm family and recycle the nutrient within the system reducing pollution and improving the soil fertility and increasing land productivity. Animals can perform numerous functions in small holder systems. Keeping livestock to secure subsistence is particularly important when cropping risks are high. Livestock serve as a buffer when crop yields do not meet family needs and can act as a savings account, with offspring as interest. Diversification in livestock keeping extends the risk reduction strategies of farmers beyond multiple cropping and thus increases the economic stability of the farming system. Spreading risk by practicing both crop and livestock production may lead to lower productivity within each sector than in specialized farms, but total production per unit area may be increased, as both crop and livestock yield can be gained from the same area of land.

Ruminant production in home gardens or pasture under coconut is based on the semi-intensive management system with tethered grazing of natural feed resources under coconut and other perennials. Yields of grass from homesteads and highland gardens are low because these areas are intensively cropped with trees and other perennial crops. This farming system causes regular supply of organic matter to the soil as daily excretion of

feces and urine (weight to weight basis) in large ruminants (cattle and buffalo) and small ruminants (sheep and goat). Daily excretion of feces and urine amount to 9.5% and 3.5% of body weight of animals.

Fluctuations in fertilizer prices and uncontrollable soil erosion have depleted the fertility of coconut lands. Hence, use of locally available conventional sources of manure is a vital agronomic practice in these lands. Animal manure could increase the soil fertility as well as the physical characteristics of soils without changing the soil acidity or the nutrient availability. It is a cheaper source of nutrients compared to inorganic fertilizer. According to previous work, tethering of a buffalo weighing 350 kg to a coconut palm for 10 days or a cow (neat cattle) weighing 250kg for 14 days would provide the nutrients requirement of the palm for 1 year.

Fodder trees/fodder legumes

Forage tree legumes (*Gliricidia sepium, Erithrina, Leucaena leucocephala, Caliandra callothirus*, *Acasia* species) are being cultivated as a source of mulch, nitrogenous fertilizer, shade, fuel wood, agro-forestry, supportive crop for intercrops like pepper and, as an animal feed in many homesteads. Rapid growth rate, the ability to grow as a live fence and use of sticks to generate bio fuel are added advantages of these tree fodder legumes. Use of this organic manure will help to cut down the cost of fertilizer as well as to increase the soil physical properties of soil compared to inorganic fertilizer. However, the access to feed is largely dependent on availability of household labor and this, in turn depends on the size and demographic structure of the households, and on alternative employment opportunities (Zemmelink et al., 1999). In general, male farmers are responsible for harvesting of fodder from trees in Asian region.

Road side grass

Use of road side grass to feed ruminants is a very common practice in developing countries in Asia. In general, animals are allowed to graze along the road sides but cut and feed system is more common in hilly areas. Guinea grass (*Panicum maximum*) is a native grass of Africa which was introduced to Sri Lanka in the 1960s (Santhirasegaram *et al*., 1969) and it is well adapted under a wide range of soil types. Presently Guinea species are found in all over Sri Lanka and it has been difficult to control its spreading nature. It has become a freely avialble fodder grass for livestock farmers all over Sri Lanka.

Marginal lands/ fallow paddy fields

Most of the rural farmers use the weed cover or the forage growing in marginal tea or rubber lands around the world. It is common to see animals grazing in paddy fields when the land is not being cropped with rice. However, grazing is not possible if the field is used to grow vegetables, though harvesting of grass and weeds is still possible. Rice fields are an important source of green feed in the form of grass and ratoon from the main field after harvest, and grass growing on the field bunds through out the growing period, except when bunds are being re-plastered. As the fields are regularly fertilized, this feed is also of relatively high quality. Grass from paddy fields is mainly used by the owner of the field however owners of rice fields encourage others to harvest grass in bunds for easy maintenance of bunds.

Development programs in grassland development

Community grasslands

According to the experience of other countries, development and demonstration of

a sustainable grassland management and livestock improvement strategy is not merely a technical matter. Further it has very little to do with basic principles such as, stocking rates, grazing patterns and systems. Grassland development should base within the local community structure where they could address their own problems in an organized manner. Establishment of farmer co-operative societies could get the cooperation from farmers and implement the decisions collectively in an organized manner. It has been revealed that most of the farmer communities had a very clear picture of a prosperous future, but very few of them had the capacity to get their own, or had thought of soliciting the right support to get there (Reynolds *et al*., 1999). Despite the constraints, every grassland-resourced country should develop the resource in a sustainable manner to reduce poverty and meet food needs. Grassland management policies coupled with other functional policies such as economic, socio-economic, land use and wild life management could improve the sustainability of communal grasslands and thereby could strengthen the rural farmer populations.

Fodder legumes

Inherent low productivity of grasslands is a common problem due to seasonal variation of rainfall, poor nutritional status of soils, weed invasion, and low quality of existing forage. Use of fodder legumes such as *Gliricidia sepium, Erithrina, Leucaena leucocephala, Caliandra callothirus*, *Acasia* species to improve the existing grazing grounds is another option to overcome this problem. Tree legume fodder speices are rich in crude protein, high in dry matter yield and a good source of minerals for grazing animals. In addition, these plants could fix nitrogen and survive during the dry period. Most of these tree fodders are also cultivted in homesteads and widely used by the livestock farmers in tropics. Propogation of these legumes are possible with the use of availble seeds or stem cuttings.

Fodder banks/blocks

It is important to advise farmers to cultivate their own fodder blocks in the household using waste water from the kitchen or dairy washings. A number of high yielding, high qualty forage species have been developed in India and other tropical countries. Use of these forage species together with organic manure availble in the farm could increase the availability of forage for livestock.

Pasture under coconut/trees

Use of improved varieties of forage such as Brachiaria milliformis, Brachiaria brizantha or CO-3 to replace the existing weed population in the homestead is another option to strengthen the rural farmer population. A number of high yielding forage varieties which could tolerate shade are availble.

Conclusions

It can be concluded that livestock production in grasslands, community lands or homesteads on a low input, low output system of rearing can increase the animal production as well as the crop production in a given land area and, lead to an increase of income of the rural farmer populations. Low nutritional inputs into the system through livestock increase the yield of herbage and other crops and, maintain the soil fertility levels economically. In addition, issues such as development of water resources, extension and education must be considered as higher attentions than basic grassland principles. Further, the grasslands divers their volume from livestock, wildlife and other domestic uses, of which generates marketed and non-

marketed outputs. Policymakers should pay much attention to extract these uses and outputs, integrating the fundamental, social and socio-economic issues into the design and implementation of development interventions through multidisciplinary manner.

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