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Policy Article

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Boosting livelihood security of Kumaoni hilly farmers through agroforestry fodder trees

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Abstract

Retaining trees in and around agricultural land for fodder is primeval practice in most of the hilly area of Kumaon region. This region of Uttarakhand containing six districts is known for its floral diversity and magnificent landscapes. 66% of rural inhabitants are marginal farmers having agriculture combined animal husbandry as main occupation. There is prevalence of small agricultural land holding on undulating terrain with marginal productivity creating huge scope for hilly farmers to create sustainable livelihood from animal farming. This region faces 41.13% fodder deficit with highest in district of Pithoragrah. Ample supply of nutritive fodder is salient for enhancement of livestock productivity in the region. Most of the leaf fodder from trees is more nutritive, palatable and available in lean period. Common native tree species like *Grewia optiva, Celtis australis, Morus alba* have huge potential in the region. Fodder production through agroforestry can mitigate fodder deficiency and boost rural economy.

Key words: *Kumaon region, agroforestry, fodder trees, animal husbandry*

Introduction

The state of Uttarakhand is divided into two regions, first is Garhwal region and second being Kumaon region. The Kumaon region, which is part of the Central Himalaya, has a climatic gradient ranging from subtropical to temperate to alpine areas. This region has a diverse floral and faunal species composition due to its unique climatic and physiographic conditions. Agriculture integerated with animal husbandry practices is main occupation among the rural Kumaoni inhabitants. Prevalence of undulating terrain, small land holdings, lower inputs, farm mechanization, infrastructure accompained by frequent natural calamities in this zone, agriculture is not very profitable. However, livestock rearing can boost livelihood prospects, enhance income sources and uplift socio-economic status of the people in this region, which is heavily reliant on the availability of nutritive fodder. Despite the fact that animal husbandry is an important occupation in the region, its full potential has not yet realised due to fodder crunches. Agroforestry practices with native fodder trees can be instrumental to reduce fodder deficits and create a year-round supply of fodder for this region. Trees such as *Grewia optiva*, *Ficus aureculata, Quercus semecarpifolia*, and others can provide nutritive green fodder even during the harsh winter months when other fodder is scarce. Apart from increasing animal productivity in this zone, increasing agroforestry tree cover helps to mitigate climate change, erosion in sloping agricultural fields, women's drudgery, and many other issues.

Farming Community of Kumaon Region

The Kumaon region, which stretches from 28^0 44 to 33^0 49'N latitude to 78^0 45' to 81^0 1' E longitude encompasses the most of the Central Himalayan region, covering 21,033 km^2 area. The region is known for its majestic diversity of flora and fauna containing six districts namely Nainital, Almora, Udham Singh Nagar, Pithoragarh, Champawat and Bageshwer. This region can be divided into one plain area called Terai region and three hilly areas i.e Sub-Himalaya (the Siwaliks or foot hills), lower Himalaya and the higher Himalaya. More than 50 % of Kumaoni hilly farmers are marginal farmers having small land holding (0.19 ha/capita) on undulating landscapes. Farming is subsistence having

lower output and is dependent on the monsoon rainfall. In this region, agriculture and animal husbandry are highly interwoven with each other providing major share of income to Kumaoni farmers. The presence of less arable land (12.6 percent) combined with changing climatic scenarios can lead to livelihood insecurity in which livestock farming holds great promise. The livestock composition mostly consists of cow, buffalo, goats, sheep and oxen. Sedentary and migratory livestock rearing are the most common types of livestock rearing prevalent in this region Dairy farming alone accounts for 69% of household economy. Animal husbandry is extremely beneficial because it provides manure to agricultural fields as well as meat, milk, and wool, which boosts the rural economy.One of the major challenges in this zone is ensuring an adequate supply of fodder for the ever-increasing livestock population. The main reason for lower livestock productivity is a lack of fodder, particularly during the lean winter season, as well as due to financial constraints. In the Kumaon region, livestock farming is heavily reliant on natural resource bases such as nearby grasslands and forests, all of which are suffering from grazing degradation.

Livestock status

In comparison to nation, state of Uttarakhand is home to 1.05% cattle, 0.91 % of buffalo, 0.57% sheep and 0.19 % of goat. State accounts for 96.64 lakh livestock population including poultry of which 44.7 % share is of cattle, 25.1% is of buffalo, 6.1% is of sheep and 23.71% is of goat. According to 20th livestock census (2019), there is increase of 19.3% indigenous cattle and 18.4% buffalo population in the state. In Kumaon region, number of livestock/person is highest (1/person) in districts of Pithoragarh, Bageshwar and chamoli. This suggests that animal husbandry practises are more prevalent in higher elevation areas of the Kumaon region. For remaining districts, number per capita is 0.8 in Almora, 0.4 in Nainital and 0.2 in Udham singh nagar .

Fodder scenario of Kumaon region

Kumaon region is diverse agroecological zone having variety of fodder tree and grass species. Natural resource base of region mostly consist of grasslands, forests, fodder trees on agriculture lands and cultivated grasses. Fodder is obtained directly via grazing and indirectly via stall feeding. Districts such as Almora, Bageshwar, Champawat, and Pithoragarh have a moderate forest cover, whereas Nainital has a forest cover that exceeds 60% of its geographical area. The maximum amount of grassland coverage in the region is seen in rural districts like Bageshwar, Champawat, Almora, and Pithoragarh. The majority of the fodder is procured by Kumaoni residents from adjacent grasslands and forests. Temperate/alpine grasslands (bugiyals) and oak leaves plays major role for high elevation dairy community. Regardless of all natural resources, the Kumaon region faces a 47.75 metric tonnes (41.13 percent) of fodder deficiency every year. District Pithoragarh faces highest deficiency (12.88 Lakh metric tonnes) whereas terai district Udham singh nagar faces lowest about 2.43 Lakh metric tonnes. Main reasons behind fodder deficit in the region are:

1. Lack of proper management of communal grazing lands by the villagers.
2. Excessive grazing pressure causes deterioration of forests and grasslands, resulting in lower fodder biomass.
3. Fodder generation technologies such as grass cultivation, agroforestry, and so on are not widely used.

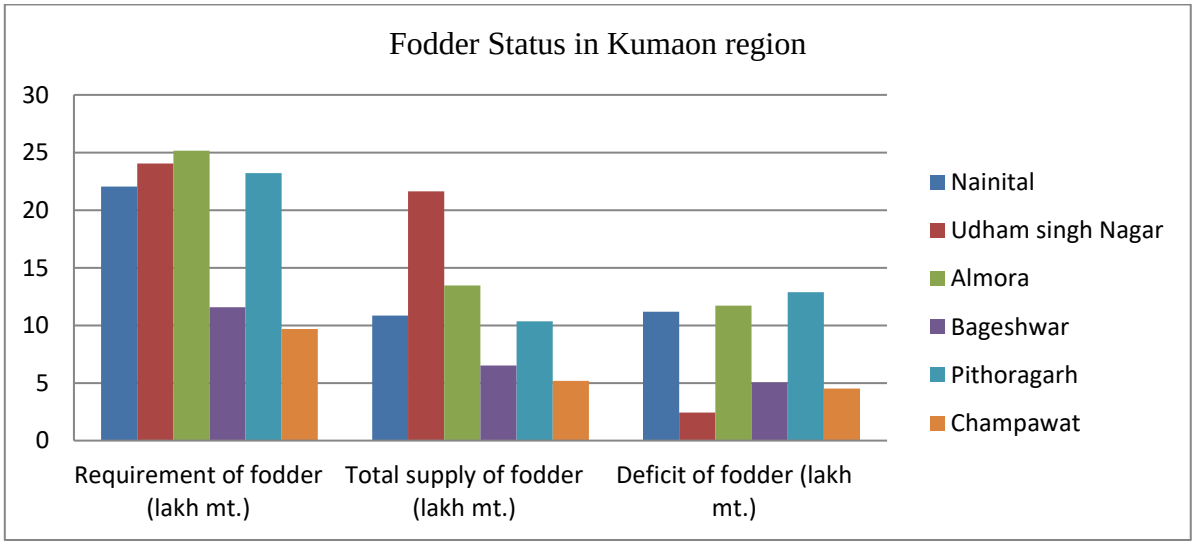

Fig.1 Fodder status in Kumaon region (State statistical report, 2015)

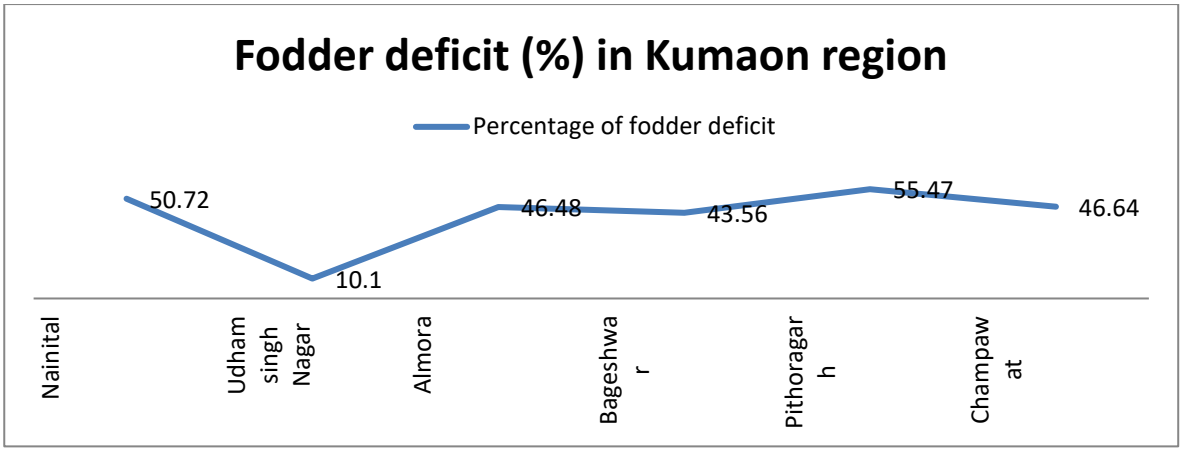

Fig 2 Percentage of fodder deficit in Kumaon region (State statistical report, 2015)

Agroforestry Fodder Trees

Practice of agroforestry which is ecologically desirable and socially acceptable is important land use system that is important for sustainable development of the region. Many tangible and intangible benefits are extracted by rural inhabitants like fodder, fuelwood, fibre, fruits, medicine on daily basis from agroforestry trees. Agroforestry fodder trees act as important source of green fodder in the Kumaon region. Fodder tree leaves provide 37.69% of green fodder to the state. Tree fodder generally consists of higher crude protein content and many are more palatable then grasses. Such fodder is generally more mineral enriched due to deep root system of trees. Such fodder is essentially a boon for the Kumaon region, as an abundance of nutritive tree fodder has the potential to boost rural economies by saving farmers money on nutritive feeds and increasing livestock production. Native/indigenous fodder species must be given more importance due to its resilience to harsh climate. There are about 84 fodder trees and 40 species of shrubs observed in the region as potential source of feed to animals. Species like *Quercus semecarpifolia* and *Quercus leucotrichophora* are important fodder trees of temperate area of Kumaon region. Important fodder species like *Grewia optiva, Celtis australis, Ficus roxburghi, Morus alba, Bauhania variegeta* are commonly grown around agricultural fields and utilized extensively in the mid hills of region. Species like *Grewia optiva* is very useful as species remain green even in lean winter period with high (19.69 %) crude protein content. Increase in the native and exotic fodder tree cover is one of the potential solutions to increase fodder supply in the region. This can be done in many ways:

1.Establishment of fodder banks around village common lands, van panchayat area etc.
2. Planting of fodder trees on the bunds of agricultural fields.
3. Distribution of quality planting material/genotypes by government/KVK'S/research centres producing higher fodder biomass.

Importance of agroforestry fodder trees in Kumaon region

1. Establishment of fodder trees can enhance tree cover of the region.
2. Carbon sequestration by agroforestry fodder trees can aid in climate change mitigation.
3. Agroforestry fodder trees lease up grazing pressure on natural forests and ameliorate already done deterioration.
4. Deep rooted fodder trees on agricultural field bunds in hilly area reduce soil erosion and retain soil moisture.
5. Collection of fodder from fodder trees nearby agricutlural fields and households in hilly terrain reduces women drudgery.

Common agroforestry fodder trees of Kumaon region

1. Beul (*Grewia optiva*) – This tree is evergreen found from 500 to 1500 m.s.l and can be grown in any soil. Fodder derived from tree is highly nutritious, palatable and best type. This tree is also used for fuelwood and fibre derived from branches is used to make ropes. Leaves contain 19.69% crude protein, 3.20 % calcium and 0.23% phosphorus. This tree gives green fodder in lean winter season when no other fodder is available. Every year about 35-150 kilogram fodder can be derived from tree. They have highest protein content when they are young and during winter and then lose their nutritive value during the rainy season
2. Kwairal (*Bauhinia variegeta*) – This is semi-evergreen to deciduous tree found from 500-1300 m.s.l. It belongs to legume family so leaves fodder is considered high quality. Leaves

are also used to paper plates called "Dona". Flower buds are consumed as vegetable and used in pickle. Leaves are used as green fodder in winter season. Leaves contain 13.89% of crude protein, 2.11 % calcium and 0.22% phosphorus. Every year about 25-100 kilogram fodder can be derived from tree.

3. Khidak (*Celtis australis*) – This is a deciduous tree found from 1000-2000 m.sl. This tree is frost and snow hardy. The tree is mainly grown for fodder. It is lopped during lean periods (October to mid January) and provides ample supply of highly palatable, nutritious, and tannin-free fodder during peak periods.
4. Shehtut (*Morus alba*) – This is a deciduous tree, grown from tropical to temperate climate. Tree is used for wood and rearing silk worms. Mulberry leaves are highly palatable and digestible (70-90 %) to herbivorous animals. Mineral content is high and no toxic compounds have been identified. About 20-60 kilogram of fodder is obtained from tree per year. Tender twigs are also relished by animals. Leaves contain 15.27% crude protein, 2.42% calcium and 0.24% phosphorus.
5. Timla (*Ficus aureculata*)- This is a evergreen tree mostly found above 800 m.s.l. Tree leaves are important traditional fodder sources in many parts of the Himalaya, particularly during the dry winter season. Leaves fodder are highly palatable and relished by animals. Leaves contain 12.26 % of crude protein, 2.19 % of calcium and 0.22 % of phosphorus. Leaves are also used as plates in celebrations and fruits are edible, used to make vegetable.
6. Chiura (*Diploknema butyracea*) - It is a deciduous multipurpose tree mostly found from 300-1500 m.s.l. Leaves in form of green fodder is available in dry months of year and considered good for lactating animals. Leaves are also considered sacred and used to offer food to deities. Seeds are used to extract fatty acid called " cheura ghee" used as vegetable oil as well to light lamps.

Conclusion

Majority of hilly farmers of Kumaon region are poverty –stricken fetching most of the income share from unproductive agricultural lands. Rearing of high yielding animals and selling of their products can enhance living standards of hilly inhabitants. However, deficiency of fodder is a major crunch that inhibits to reach full potential of animal husbandry. Establishment of fodder trees around agricultural lands, fodder banks in community lands can increase green fodder cover and solve fodder issues. Sustainable practice of agroforestry have huge potential to preserve natural resources and boost rural economy of Kumaon region.