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Fodder for Livestock of Bhiloda Tehsil's Aravalli Forest area : Gujarat State

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Abstract

India boasts one of the largest livestock populations globally and a high in dairy sector; however, it continues to struggle with fulfilling the nutritional requirements of its animals due to insufficient and substandard fodder. Forage crops are essential not only for enhancing livestock productivity but also for promoting soil health and biodiversity. The Bhiloda Tehsil, situated in the ecologically rich Aravalli Forest region of Gujarat, plays a vital role in supporting local livestock through its diverse natural vegetation and forage resources. This area is home to a diverse species of indigenous grasses, shrubs, and herbaceous plants that are important for livestock nutrition. Nevertheless, challenges such as climate change, overgrazing, and deforestation effects to the availability and sustainability of these vital resources. This study focused on evaluate the current state of forage and fodder availability in the Bhiloda Range, reported the diversity of species present, analyze seasonal fluctuations, and identify nutrient deficiencies. The results will support to sustainable fodder management strategies and support both livestock development and forest conservation within the Aravalli ecosystem.

Key words : Livestock, Aravalli Range, Fodder Survey, Seasonal varieties of Fodder.

Livestock farming in India plays a crucial role in providing food items such as milk, meat, and eggs for human consumption, contributing significantly to the country's economy and employment sector. Livestock production is a vital activity in rural areas, offering livelihoods and income to farmers and marginalized communities. The livestock sector in India is the second-largest in the world, with a substantial share of the country's GDP and agricultural GDP. The sector faces challenges such as low productivity due to inadequate nutrition and socio-economic issues, necessitating structured breeding programs and investments for improvement. Furthermore, the livestock sector's growth

underscores the importance of long-term policies and investments to meet the rising consumer demand for meat, improve nutritional status, generate income opportunities, and address environmental concerns. The impact of the Indian climate on livestock fodder crops is significant due to the vulnerability of agriculture to climate change in the region rising temperatures and changing precipitation patterns in India, exacerbated by global warming, pose challenges to crop yields, including fodder crops crucial for livestock[7,9]. The projected increase in peak temperatures could make agricultural activities nearly impossible in certain regions, affecting fodder availability for livestock[5]. Additionally, the changing climate in India threatens land irrigated by groundwater, further impacting fodder crop production for livestock[5]. Climate change-induced alterations in temperature and precipitation levels can jeopardize food security by affecting crop yields, including those essential for livestock feed, emphasizing the need for adaptive strategies and sustainable agricultural practices to mitigate these adverse effects[10]. The availability of feed, both in terms of quantity and quality, is a crucial constraint in enhancing livestock productivity[1].

Area : Aravalli Region in Gujarat :

The Aravalli Range in Gujarat, an important part of the extensive Aravalli Mountain Range in India, plays a significant role in the ecology and agriculture of the region, particularly byproviding fodder for livestock. Stretching across Gujarat, Rajasthan, Haryana, and Delhi, the Aravalli range is leading in the northern and eastern regions of Gujarat, encompassing areas like Sabarkantha, Aravalli, and parts of Banaskantha districts.

The natural vegetation in this hilly area sustains a rich array of plant species suitable for grazing by various livestock such as cattle and goats. The monsoon period witnesses a rise in vegetation growth across the Aravalli Range, benefiting the natural fodder reserves. Grass varieties like *Cenchrus ciliaris* (Buffel grass), *Themeda triandra* (Kangaroo grass), and leguminous species flourish in forest clusters and open grasslands, offering important sustenance for livestock, particularly in dry seasons when resources become insufficient.

The **Bhiloda Range** in the Aravalli Hills of Gujarat plays a vital role in providing forage and fodder crops essential for supporting the livelihoods of local communities and wildlife. This study's main purpose is the distribution of natural vegetation, the impact of grazing, and the potential for sustainable fodder production to inform conservation and management practices that coordinate ecological well-being with the needs of both people and livestock.

Climatic Condition :

The region show a semi-arid to sub-humid climate characterized by distinct dry and wet seasons. Summers are characterized by hot and dry conditions, while winters are relatively cool and mild. Adequate monsoon rainfall during the wet season is useful for fostering vegetation growth. The hilly and rugged topography of the Bhiloda Range, featuring numerous ridges, valleys, and highland, significantly influences the distribution and abundance of vegetation and forage species.

Types of Soil :

Mostly lateritic, red, and sandy soils found in the Bhiloda range, a common feature of semi-arid environments. Variability in nutrient content and water-holding capabilities of the soil directly impacts the assortment of vegetation species that succeed in the area.

Vegetation :

The primary vegetation cover in the Bhiloda Range consists of dry deciduous forests complemented by a combination of grasslands, shrubs, and scattered trees.

Livestock and Grazing Practices :

The Bhiloda Range is home to a diverse array of livestock, encompassing cows, buffaloes, sheep, and goats. Grazing serves as a fundamental source of sustenance for these livestock, with local communities dependent on forest resources to provide feed for them. Historically, livestock have been allowed to graze in the forests, grasslands, and inactive lands with little supervision, impacting the abundance and long-term viability of forage resources.

The research work started with a selection of forest villages by random sampling from BHILODA (One Range in Aravalli Forest from Gujarat). In Bhiloda range selected 25% forest villages from 52 forest villagefor study and each village selected 10% Households for data collection. Researchers[8] employed pre-tested questionnaires; while[11] utilized personal interviews to gather information regarding feeds and fodder. This research relies on primary data obtained about fodder and feeding practices to evaluate the availability of fodder in the study region. Questionnaires were filled up by communication with local people in each village. The collection of data was noted in local language.

✓ *Forest department permission :*

For visiting in a forest, we need permission from forest department of Bhiloda range.

✓ *Interviews with local farmers :*

For data collection of conduct interviews with local farmers or livestock owners about the availability and usage of fodder.

✓ *Secondary Data :*

Collect data from forest department records, agricultural studies, and previous reports on forage crops in Aravalli Forest of Gujarat.

✓ **Analysis :**

Statistical or qualitative analysis of fodder availability across seasons, land use, and environmental factors.

Data collection :

Field surveys:

The forest village's selection also divided into 3 parts:

1. *Dense Forest :*

This type of forest life is characterized by an abundance of plant types, with closely spaced trees and a dense layer of underbrush. The canopy is dense, with thick leaves making it difficult for sunlight to penetrate the ground.

2. *Open Forest :*

An open forest features trees that are more widely spaced, allowing increased sunlight to penetrate the ground. The canopy is less continuous, and the forest has a greater variety of grasses, shrubs, or herbaceous plants on the forest floor relative to a dense forest.

3. *Degraded Forest :*

A degraded forest has experienced some level of harm, typically due to human activities like logging, agriculture, or pollution. The trees may be fewer in number and smaller in size, and the ecosystem is less varied and more susceptible to additional damage. Degraded forests may have lost significant biodiversity and may struggle to support the same diversity of wildlife or plants as they did previously.

Study of Forest village divided in to 3 Seasons: (14 Villages)

1. **Monsoon (4 villages)**
2. **Summer (5 villages)**
3. **Winter (5 villages)**

Table-1. Village selection according to Forest Type and Season

Bhiloda	Dense (03)	Open (07)	Degraded (04)	25%	Season
Vagheshweri	✓			4	Monsoon
Budharasan		✓			
Sunsar		✓			
Jumsar		✓			
Silasan	✓			5	Winter
Kundol (pal)		✓			
Mau (navalpur)		✓			
Munai			✓		
Chorimala			✓		
Bedasan	✓			5	Summer
Patiyakuva		✓			
Vejpur		✓			
Bolundra			✓		
Malasa			✓		
Villages	3	7	4	14	Total

Monsoon (Kharif) Fodder :

The Monsoon is an important period for fodder production in many regions, especially in tropical and subtropical climates. These plants are crucial for providing nutritious and sustainable feed for livestock during the monsoon. They are typically planted at the beginning of the monsoon season and harvested before or during the rainy season, making them well-adapted to the abundant moisture and humidity during this period. The variety of plants listed below offers different forms of nutrition to livestock, from protein-rich legumes to high-fiber grasses.

Table-2. Available Fodder in Monsoon Season

Monsoon (Kharif) Fodder			
Sr. No.	Local Name	Scientific Name	Family
1	Bajra	*Pennisetum glaucam* L.	Poaceae
2	Sorghum	*Sorghum bicolor* L.	Poaceae
3	Maize	*Zea mays* L.	Poaceae
4	Bajra-Napier Hybrid	*Pennisetum purpureum* + *Pennisetum glaucam*	Poaceae
5	Marvel Grass	*Dichanthium annulatum* (Forssk.) Stapf.	Poaceae
6	Cenchrus Grass	*Cenchrus ciliaris* L.	Poaceae
7	Guiena Grass	*Megathyrsus maximus* (Jacq.) B.K. Simon & S.W.L. Jacobs	Poaceae
8	Groundnut	*Arachis hypogaea* L.	Fabaceae
9	Cow Pea	*Vigna unguiculata* L.	Fabaceae
10	Cluster Beans	*Cyamopsis tetragonoloba* L.	Fabaceae
11	Green gram	*Vigna radiata* L.	Fabaceae
12	Johnson Grass	*Sorghum halepense* (L.) Pers.	Poaceae
13	Soybean	*Glycine max* L.	Fabaceae
14	Kodo millet	*Paspalum scorbiculatun* L.	Poaceae
15	Pigeon Pea	*Cajanus cajan* L.	Fabaceae
16	Black Gram	*Vigna mungo* L.	Fabaceae
17	Barley	*Hordeum vulgare* L.	Poaceae
18	Pioneer Grass	*Pennisetum purpureum* Schun.	Poaceae
19	Bullet Grass	*Panicum repens* L.	Poaceae
20	Bhindi Grass	*Aristida themeda*	Poaceae
21	Karn grass	*Apluda mutica* L.	Poaceae
22	Rice	*Oryza sativa* L.	Poaceae
23	Chick Pea	*Cicer arietinum* L.	Fabaceae

Winter (Rabi) Fodder :

Winter (Rabi) fodder crops play a significant role in providing nutritious feed for livestock during the cooler months, when pastures are less abundant. These crops are typically sown at the onset of the winter season and harvested before the summer, aligning with the cooler weather, which suits their growth requirements. A variety of crops are used during the Rabi season, ranging from grasses to legumes, each providing essential nutrients to meet the dietary needs of livestock.

Table-3. Available Fodder in Winter Season

Winter (Rabi) Fodder			
Sr. No.	Local Name	Scientific Name	Family
1	Lucerne	*Medicago sativa* L.	Fabaceae
2	Berseem	*Trifolium alexandrium* L.	Fabaceae
3	Oats	*Avena sativa* L.	Poaceae
4	Maize	*Zea mays* L.	Poaceae
5	Sorghum	*Sorghum bicolor* L.	Poaceae
6	Barley	*Hordeum vulgare* L.	Poaceae
7	Groundnut row (after harvest)	*Arachis hypogaea* L.	Fabaceae
8	Green gram	*Vigna radiata* L.	Fabaceae
9	Wheat	*Triticum aestivum* L.	Poaceae
10	Soybean	*Glycine max* L.	Fabaceae
11	Chocory	*Cichorium intybus* L.	Asteraceae
12	Bajra-Napier Hybrid	*Pennisetum purpureum* + *Pennisetum glaucam* (L.) R.Br.	Poaceae
13	Pioneer Grass	*Pennisetum purpureum* Schumach	Poaceae
14	Bullet Grass	*Panicum repens* L.	Poaceae
15	Karn grass	*Apluda mutica* L.	Poaceae

Summer Fodder :

These plants are all important summer fodder species, providing essential nutrition and fiber to livestock, particularly during hot weather. Many of them also have additional benefits for the soil or can be used in different forms, such as silage or hay, for feeding animals throughout the year.

Table-4. Available Fodder in Summer Season

Summer Fodder			
Sr. No.	Local Name	Scientific Name	Family
1	Sorghum	*Sorghum bicolor* (L.) Moench	Poaceae
2	Maize	*Zea mays* L.	Poaceae
3	Bajra	*Pennisetum glaucam* (L.) R.Br.	Poaceae
4	Cow Pea	*Vigna unguiculata* (L.) Walp.	Fabaceae
5	Groundnut	*Arachis hypogaea* L.	Fabaceae
6	Wheat (after harvest)	*Triticum aestivum* L.	Poaceae
7	Wheat (straw)	*Triticum aestivum* L.	Poaceae

8	Green gram (after harvest)	*Vigna radiata* L.	Fabaceae
9	Black Gram	*Vigna mungo* L.	Fabaceae
10	Pioneer Grass	*Pennisetum purpureum* Schum	Poaceae
11	Bullet Grass	*Panicum repens*	Poaceae
12	Bajra-Napier Hybrid	*Pennisetum purpureum* Schum + *Pennisetum glaucam* (L.) R.Br.	Poaceae

Green Fodder (Fresh Fodder) :

This type consists of fresh, edible plants, grasses, and legumes that are cultivated and directly fed from forest to livestock. It is particularly nutritious when consumed shortly after harvesting.

Dry Fodder (Hay or Straw):

Dry fodder means plants that have been harvested, dried, and stored for use during periods when green fodder is unavailable, such as during dry seasons. It typically has a less moisture content, and a higher fiber concentration compared to green fodder.

Silage :

Silage is produced through the fermentation of chopped green fodder, commonly maize or sorghum, which is stored in airtight conditions (like silage blocks or plastic bags) to maintain its quality. This anaerobic fermentation process helps retain the nutritional value of the fodder.

Concentrates :

Concentrates are feed materials rich in energy and protein, often used to enhance the primary fodder, particularly for high-yield dairy cattle, poultry and other livestock with high nutritional demands.

By-products (Agro-Industrial By-products):

These are the residuals from agricultural and food processing activities that can be utilized as livestock feed. Although they may not serve as the main feed source, they provide additional nutrients and fiber.

Leguminous Fodder :

Legumes, known for their high protein content, are frequently cultivated specifically for fodder due to their significant nutritional benefits. They also play an important role in nitrogen fixation, thereby improving soil fertility.

Root and Tuber Fodder :

Certain root vegetables and tubers can serve as fodder, offering high energy feed options for livestock.

Tree Fodder :

Some tree species are cultivated for their foliage, which is used as fodder. These trees are mostly beneficial in arid regions where grass availability is limited.

Cereal Fodder :

Cereal crops can be grown for their leaves, stalks, and grains, which are then utilized as fodder for livestock. Different feeding methods like traditional feeding, total mixed feeding, silage free-feeding were reported by researchers[1].

Fodder plays a crucial role in the nutrition of livestock and is available in various forms, each used to meet the specific requirements of the animals, influenced by factors such as seasonality and geographical location. The forage needs vary based on the type of livestock, their age, gender, and whether the cattle are producing milk or are dry. Accurate assessments of feed needs are lacking, thus various methods are utilized to estimate feed requirements[14]. Various feeding techniques, such as traditional feeding, total mixed ration feeding, and silage-free feeding, have been documented by researchers[2]. Livestock is also essential for calculating production of milk, manure, animal power, source of asset, employment, etc.[12,13]. Crop residues (basically straw of rice and wheat) are useful as fodder in dairy activity[4,6] as a supplement to green fodder[3] in the dry and rainy season[15].

Monsoon presents both opportunities for optimal fodder growth and challenges related to excess moisture. Properly managing fodder during this period by selecting suitable varieties, harvesting at the right time, and using preservation techniques like silage can ensure that livestock are well-fed year-round, even when fodder availability decreases during the dry season.

Winter provides good conditions for growing high-quality, nutritious fodder for livestock. Fodder crops like Lucerne, Berseem, and oats thrive in the cooler months, while proper preservation methods like silage and haymaking can ensure year-round feed availability. Managing grazing pastures, providing proper nutrition, and preventing health issues are important to maintaining healthy livestock during the winter season.

Summer poses significant challenges for fodder availability and livestock care. By choosing heat-tolerant fodder varieties, using proper irrigation, preserving excess fodder from earlier seasons, and providing good animal care, farmers can manage the summer months more effectively. Sustainable practices like fodder preservation (silage and hay) and ensuring proper hydration for livestock are important to maintaining livestock productivity during the hot season.

This botanical diversity included both indigenous flora and cultivated fodder crops. In recent times, the availability of forage and fodder in the Bhiloda Range has raised concerns due to challenges such as climate change, overgrazing, and deforestation. It is imperative to ensure the sustainable utilization of these resources to strike a balance between the livestock's needs, wildlife preservation, and forest ecosystem integrity. The research goal pertaining to forage and fodder crop availability in the Bhiloda Range aims to evaluate the present situation, document the species diversity, and check seasonal variations in availability. This assessment will be useful for fodder production, conservation, and sustainable land management which are beneficial for both local communities and the environment.

By understanding the availability of forage and fodder in the Bhiloda Range, the study will contribute to sustainable livestock management and forest conservation in Gujarat's Aravalli region.

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