International Journal of Ecology and Environmental Sciences
www.ecologyjournal.in
Online ISSN: 2664-7133, Print ISSN: 2664-7125
Received: 02-03-2021, Accepted: 03-04-2021, Published: 01-05-2021
Volume 3, Issue 2, 2021, Page No. 94-98

The grasslands of Bhavnagar: A review

Krishna Gadhvi* Dhruv Pandya, Himanshu Pandya, Archana Mankad
Department of Botany, Bioinformatics and Climate Change Impact Management, School of Science, Gujarat University, Ahmedabad, Gujarat, India

Abstract
Grassland is an area with natural vegetation of mainly Gramineae family and is 80% covered by the grasses. Bhavnagar is located in the Saurashtra region of Gujarat state of India. It is situated on the west coast of the Gulf of Khambhat. It is a peninsular region. The climate of Bhavnagar is hot and semi-arid. The vegetation found is a thorn-shrub type with a high proportion of graminoids and commonly referred to as shrub savanna. This Grassland area is locally called *Vidis.* This review is focused on the status and productivity of grassland and its contribution to the livelihood of the area and the approach of the forest department to conserve them.

Keywords: grasslands, Bhavnagar, grassland status, management practice, conservation

Introduction

Grasslands are the areas that are mostly dominated by the vegetation of grasses (Sanderson *et al.*, 2009) [8]. Grasslands are one of the major ecosystems occupying almost one-third of the earth's terrestrial surface (Suttie *et al.*, 2005) [10]. The development of grasses first appeared in the Eocene period approximately 55 million years ago. Grasses are monocots having blade like leaves and roots are fibrous. The part of the plant occurring above the ground is known as stem which bears nodes and internodes. Grasses possess flowers without petals and consists three different types of inflorescences they are raceme, spike, and panicle. Inflorescence of the grass plays a major role in the identification of the species (Woodward, 2008) [11]. Bhavnagar is a city in the Bhavnagar district of the Saurashtra region of the Gujarat State of India. It coordinates 21.76ºN72.15ºE. It is on the west of the Gulf of Khambhat and is on the eastern coast of Saurashtra. It is also known as Kathiawar. It has an average elevation of 24m. It occupies an area of 53.3sq.km. Bhavnagar has a hot semi-arid climate with an average rainfall of 580mm. The mean annual temperature of the area is a minimum of 26 ºC-27 ºC and maximum is 11 ºC-40 ºC sometimes in extreme conditions it goes up to 5 ºC-46 ºC. The fluctuation of humidity is between 65-70 percent. Three distinct seasons are experienced in this area, *viz*., winter (November-February), Summer (March-June), and monsoon (July-October). The vegetation of this area is shrub-type vegetation with a high proportion of graminoids and is commonly called shrub savanna. These grazing lands are locally called *Vidi* (Mehta, 2015). The grassland type of semi-arid region like Rajasthan, Gujarat, Western Uttar Pradesh, Delhi, and Punjab is *Dichanthium-Cenchrus- Lasiurs* type according to Dabadghao *et al.*, 1973. Bhavnagar forest division consists grasslands in a total of 2626.14 hectares area and has a total of 32 *vidis* in six ranges of Bhavnagar Forest Division. As per the study by the forest division total of twenty-one perennial and three annual grass species are found in the grasslands of Bhavnagar (Mehta S.K., Kumar S., 2018.). Grasslands are mostly situated on undulating lands, hills, and plain lands of bhal tract in Bhavnagar. *Vidis* with high productivity are called reserve vidi and *vidis* with low productivity are classified under non-reserve vidi. Reserve *vidis* are harvested for grass collection and the *ganjies*(grass bales) of grasses are stored in central godowns(place to store grass) and are utilized and supplied to public at concessional rates in the time of natural calamities, and some non-reserve *vidis* are leased to various institution like *panjarapol*, *panchayats*, *gaushala* etc., on basis of guidelines of state government. Bhavnagar District has highest reserved *vidis* in entire saurashtra region.

Ecological Status of The Grasslands

As per the report of Bhavnagar forest division (Mehta S.K. and Kumar S., 2018) [7], the total grassland area of Bhavnagar District is 2626.14 hectares from which 55.3% area is covered by dense grass cover and 22.5% area is allocated under sparse grass cover. There are a total of 32 *vidis* in six different forest ranges of Bhavnagar District. All the *vidis* are situated either on hilly slopes, undulating lands, or plain lands and are distributed in different ranges covering 30.18 to 727.67 hectare area. There are six different ranges under the Bhavnagar forest division Bhavnagar, Mahuva, Sihor, Palitana, Vallabhipur and Kesar among this *vidis* Mahuva range has the highest number of *vidis* and in Kesar range there is no grassland. The area is semi-arid and has 32 varieties of grasses (Jadav, 2010). There are a total of twenty one perennial and three annual species as per the recent study by the forest department. Dominant species in all the *vidis are Sehima sulcatum, Themeda quadrivalvis, Apluda mutica, Cynodon dactylon, Heteropogon contortous, Bothriochloa inschaemum, Sorghum halepense, Aristida adscensionis, Desmostachya bipinnata, Cymbopogon martini*. *Vidis* on the hilly slopes have dominance of *Bothriochloa inschaemum*, *Sehima sulcatum* and *Themeda quadrivalvis* whereas in flat land of alluvial soil *Bothriochloa inschaemum* grows predominantly. Entire Bhavnagar forest division consists 60% palatable grass and 40% non-palatable grass species.

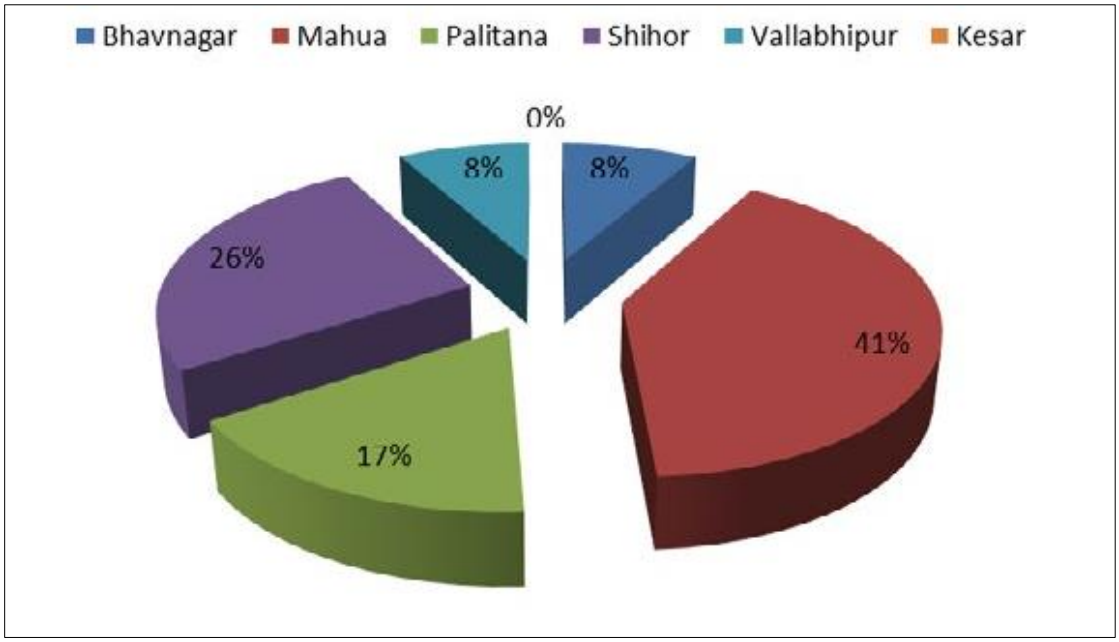
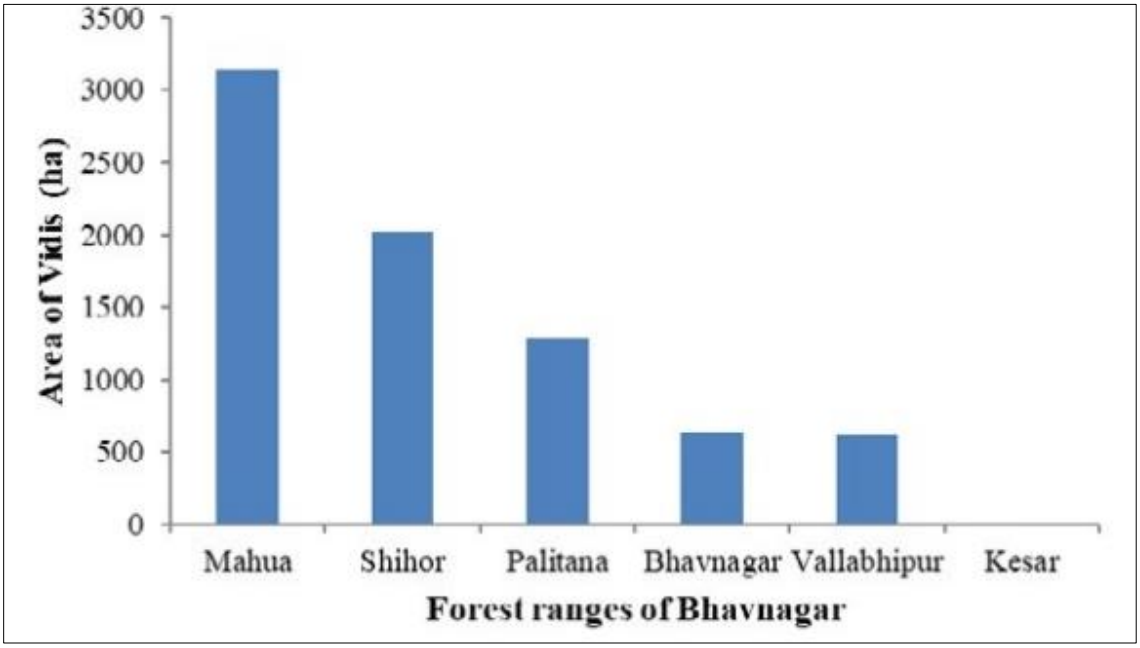


Fig 1



Source: (Mehta S.K. and Kumar S., 2018, Grasslands of Saurashtra. Bhavnagar Forest Department) [7]

Forest Ranges of Bhavnagar

Vidis are classified into two categories on basis of their annual production.

- Reserve *vidi*- Grasslands with Average grass production of more than 250 kg./ha and overall production of more than 1lakh kg. per annum are classified under Reserve *vidis*.
- Non-Reserve *vidi*- Grasslands with average grass production less than 250 kg./ha and overall production less than 1 lakh Kg. per annum are classified under Non- Reserve *vidi*.

In the entire Saurashtra region, Bhavnagar has the highest number of reserved *vidis*. These reserved *vidis* are managed by the Forest department and it keeps surveillance on the production, harvesting, and storage of grass. Grasses are cut, dried, pressed, baled, and stored in godowns (place to store grass). The distribution of stored grass is handled by the revenue department. Some of the non-reserved *vidis* are given on contract based to *panjrapols*, *panchayat*, *gaushala*, etc. This stored grass stock is distributed in a period of scarcity to villagers to feed their livestock (Mehta S.K. and Kumar S., 2018) [7].

Importance of Grassland

Grasslands are important wildlife habitat. These grasslands are habitat to a variety of interesting species like Lesser florican (*Sypheotides indicus*), Harriers (*Cicrus spp*.), Blackbuck

(*Antilope cervicpra*), Chinkara (*Gazella bennetti*), Nilgai (*Boselaphus tragocamelus*), Lion (*Panthera leo persica*), Leopord (*Panthera pardus*), Jungle cat (*Felish chaus*), Indian fox (*Vulpes bengalensis*) and Jackal (*Canis aureus*). This faunal diversity attracts varieties of birds in these grasslands (Ali, 1954; Dharmakumarsinhji, 1978). The Grasslands are important sources of fodder. Increasing human population increase the requirement of food and milk, and milk is one of the major components of the food and essential for livelihood. Record of last decade suggested that livestock population is on the rise in India and they rely on crop residuals as fodder. The sequential change in land use cover is ultimately affecting a decrease in cropping area, and this decrease in fodder makes grasslands extremely important to conserve because they are a buffer against the shortage of green and dry fodder (Earagariyanna *et al*., 2017).

Grassland Management

Grassland management before independence and after independence till 1959 was done by the district administration. Grassland management was transferred to the forest department in 1959-1960. The history of management practice is illustrated as following:

Past Management Practice

There was a '*Ghas Khata'* section in the collectorate to look after the protection and management of grassland before and after independence till 1959. There was no scientific management strategy with the administration during that period. As a result, grassland suffered and lost its original capacity and productivity(Sugoor & Ande, 2001).

Management Practice by Forest Department

Management practice of grassland was handed over to forest department in 1959-60. But during these years there were no major changes in management practice. In the year 1962 forest department classified *vidis* in reserved and non-reserved *vidis*. (Mehta, 2015). *Vidis* classified under reserved vidi have grass production of more than 1lakh kg/annum whereas non-reserved vidi have total grass production of less than 1lakh kg/annum. Bhavnagar forest division has observed an increase in total grass production in the last 30 years. In these three decades, production increase was around 1.80% while in the last decade it increased by 8.70% because of successive management practices by Bhavnagar forest department. Various successful measures were taken to increase grass production in 2015-16 that are following(Mehta S.K. and Kumar S., 2018):

- All the *vidis* were visited at regular intervals and examined by the respective authorities. The potentiality of work was increased by deploying the targeted staff.
- Removal of unwanted growth, pruning of trees, weeding, dry rubble wall fencing, harrowing and ploughing, check dams, trenches, etc. was primarily done for this advanced work.
- Grass species were selected based on the quality and type of soil of *vidi*.
- Nurseries were developed for increasing quantity of grass rhizome and plantation was done by sowing seeds on contour line and in-between vacant space were filled with grass rhizome(thumda).
- Weeding was done at regular intervals either manually or by chemicals.
- Urea was given as a fertilizer to achieve high productivity.
- To reduce the losses during harvesting, it was preponed to dussehra time as per the research guidelines of Junagadh Agricultural University.

Grasslands of Bhavnagar Forest Department [Source:(Mehta S.K. and Kumar S., 2018)] [7]

Sr. No.	District Name	Taluka Name	Range	Name	Area of Vidi (ha)
1	Bhavnagar	Bhavnagar	Bhavnagar	Rojmal	195.22
2	Bhavnagar	Ghogha	Bhavnagar	Chaya	43.06
3	Bhavnagar	Ghogha	Bhavnagar	K. Chapro	141.00
4	Bhavnagar	Ghogha	Bhavnagar	Pawal	263.55
5	Bhavnagar	Mahua	Mahua	Kheda	649.29
6	Bhavnagar	Mahua	Mahua	Gebar	727.67
7	Bhavnagar	Mahua	Mahua	Ranigara	409.50
8	Bhavnagar	Talaja	Mahua	Sakhdasar	107.35
9	Bhavnagar	Talaja	Mahua	Kudla	455.83
10	Bhavnagar	Ghogha	Bhavnagar	Kotiyal	0.00
11	Bhavnagar	Palitana	Palitana	Anida	155.80
12	Bhavnagar	Palitana	Palitana	Rajasthali	562.55
13	Bhavnagar	Palitana	Palitana	Sankarasar	343.26
14	Bhavnagar	Palitana	Palitana	Sarod	224.78
15	Bhavnagar	Shihor	Shihor	Chorwadla	664.74

16	Bhavnagar	Shihor	Shihor	Malwad	246.87
17	Bhavnagar	Shihor	Shihor	Peeparla	687.98
18	Bhavnagar	Shihor	Shihor	Thana	390.52
19	Bhavnagar	Shihor	Shihor	Karamdiya	30.18
20	Botad	Botad	Vallabhipur	Dhankadiya	372.64
21	Botad	Botad	Vallabhipur	Rohishala	41.24
22	Botad	Botad	Vallabhipur	Sherthali	18.09
23	Botad	Gadra	Vallabhipur	Dudhapur	84.41
24	Bhavnagar	Talaja	Vallabhipur	Vavdi	105.98
25	Bhavnagar	Ghogha	Bhavnagar	Thordi	0.00
26	Bhavnagar	Ghogha	Bhavnagar	Batdi	0.00
27	Bhavnagar	Ghogha	Kesar	Karbhala	0.00
28	Bhavnagar	Ghogha	Bhavnagar	Bhandar	0.00
29	Bhavnagar	Palitana	Palitana	Medha	0.00
30	Bhavnagar	Talaja	Mahua	Karwa	0.00
31	Bhavnagar	Talaja	Mahua	Khakhoi	0.00
32	Bhavnagar	Talaja	Mahua	Vavdi	105.98
TOTAL					**2626.14**

Grass Species of Bhavnagar Forest Division(Jadav, 2010)

GRASS SPECIES		
Andropogon pumilius	*Sorghum halepense*	*Ischaemum rugosum*
Apluda mutica	*Sporobolous helovolous*	*Panicum antidotale*
Aristida adscensionis	*Cynodon dactylon*	*Panicum turgidum*
Arundinella setosa	*Dichanthium annulatum*	*Paspalidium flavidum*
Brachiaria eruciformis	*Eragrostis cilianensis*	*Iseilema laxum*
Brachiaria ramosa	*Eremopogon foveolatus*	*Borhriochloa intermedia*
Cenchrus biflorus	*Eulaliopsis binata*	*Borhriochloa pertusa*
Cenchrus ciliaris	*Hackelochloa granularis*	*Chrysopogon fulvus*
Chionachne koenigii	*Themeda cymbaria*	
Coix lacryma-jobi	*Themeda quadrivalvis*	
Cymbopogon martinii	*Urochondra setulosa*	
Heteropogon contortus	*Sehima nerosum/sacculatum*	

Conservation Issues and Strategies

The major management issue faced in non-reserved *vidis* is that most of the *vidis* are given on short term annual lease to *panchayats*, *gaushala*, and *panjrapol* they overexploit the land without any scientific input, and due to that these lands are gradually degrading. The other parameters in conservation are proper scientific fire and grazing management. There is also a lack of proper roads in the *vidis* for the transportation of grass bales to godowns (place to store grass).

The Forest department has made many new conservation strategies to overcome this conservation and management issue they are following (Mehta S.K. and Kumar S., 2018) [7]:

- In each non-reserve *vidi* 10% of coupe area (a small area of grassland or a forest within a compartment that is harvested in a single operation) should be reserved for improvement and should be maintained by the department.
- Sowing of seed and grass rhizome should be done intensively with the scientific approach.
- Inferior quality of grass and weeds like *Apluda mutica*, *Cassia tora*, *Sorghum helpense*, *Heteropogon contortous*, etc should be removed either manually or by chemicals.
- Before the beginning of the monsoon invasive species like *Prosopis juliflora* should be removed from roots so that grass vegetation can increase.
- Nurseries within the *vidis* should be developed for the development of grass from rhizome and seeds which are then planted to increase the production of grasslands.
- Plantation of fodder trees on the boundaries of grassland. Development of Rubbel wall, live hedge, boundary pillars, and trenches on the boundaries of grasslands helps in protection. The internal road network is essential for the communication, protection, and transportation of grass.
- Harvesting regulation- Cutting of grass should only start after the seeds of grasses are dried. Some grass species are harvested before flowering for better nutritive value. After the cutting of grass it should be allowed to dry for 2-3 days and then only it should be baled so that risk of combustion can be avoided. Grasses are cut possibly nearer to the ground so that its rhizome is not damaged and can regrow. Grass seeds should be collected before harvesting.
- After the harvesting of grass to avoid ground-level grazing controlled burning should be performed.
- Grazing should be forbidden during the year in reserved *vidis*.
- Fire Management- Fire management is most essential for grassland because dry grasses are flammable. There should be fire lines of 1 meter width on the sides of established pathways within *vidis*. A fireline of 8-15 meters around the grassland should be maintained to prevent fire from any nearby agricultural land or village. Minimum 1meter width clean border path should be made around the collected grass stack to avoid any fire issue. Any inflammatory things should be highly prohibited during this grass collection and in the entire grassland area.
- Stored grasses should be well maintained. Each grass bale should be sprayed with a salt solution during the rainy season to avoid rotting and to increases palatability.
- Storage of this collected grass should be only done for three years as per the grass distribution policy.

Conclusion

Bhavnagar has a very diversified and rich grassland area, these grasslands are well maintained by the Bhavnagar Forest Division. Bhavnagar district has the highest number of reserved *vidis* in the entire Saurashtra region. Well planned management practice resulted in a constant increase in grass production. The non-reserved *vidis* of Bhavnagar should also be taken under strict protection to reduce the overexploitation of the grasslands. Controlled grazing may be permitted in the post-monsoon or winter season to minimize the damage and disturbance to the grassland ecosystem.

References

1. Ali S. The Birds of Gujarat- I and II. Journal of the Bombay Natural History Society,1954:52:374-458 and 735-802.
2. Dabadghao PM, Shankarnarayan KA. others. The grass cover of India. The Grass Cover of India,1973, 713.
3. Dharmakumarsinhji, K. S. Velavadar National Park, Gujarat, India. Tigerpaper,1978:5(1):6-8.
4. Earagariyanna M, Venkayala J, Kammardi S, Sriramaiah M. Fodder Resource Management in India- A Critical Analysis. International Journal of Livestock Research,2017:7(7):1. https://doi.org/10.5455/ijlr.20170513095912
5. Jadav RD. Ecological Status and Importance of Grasslands (Vidis) in Conservation of Avian. Saurashtra University, 2010, 299.
6. Mehta D. The Vidis of Saurashtra. Ecology and Management of Grassland Habitats in India, ENVIS Bulletin Wildlife and Protected Area,2015:17:54-63.
7. Mehta SK, Kumar S. Grasslands of Saurashtra. Bhavnagar Forest Division, Bhavnagar, G. (n.d.). Grasslands of Saurashtra, 2018, 225.
8. Sanderson MA, Wedin D, Tracy B. Grassland: Defi nition, Origins, Extent, and Future, 2009, 57-74.
9. Sugoor RK, Ande DB. Conservation Strategy for Grasslands of Saurashtra and Kachchh Region of Gujarat State. Indian Forester,2001:127(12);1408-1414.
10. Suttie JM, Reynolds SG, Batello C. Grasslands of the World: FAO. Rome, Italy, 2005, 426pages.
11. Woodward SL. Grassland biomes (Vol. 4). Greenwood Publishing Group, 2008, 148.