ON THE GRASSES AND GRASSLANDS OF KUTCH

K. C. KANODIA AND P. C. NANDA

Central Arid Zone Research Institute, Jodhpur

INTRODUCTION

Cultivators of Kutch district in Gujarat State depend more on their animals than on agriculture due to the highly erratic rainfall in the area. The animal population of the region is solely maintained on the natural grasslands. Grasslands are, therefore, the mainstay of the peasantry. But these grasslands have been over-exploited and are in the last stage of degradation especially with respect to their fodder potentials. In order to sustain and strengthen the economy of peasantry concentrated efforts are essential to scientifically improve and upgrade these areas by encouraging suitable and desirable fodder grasses. In this paper, which is the outcome of the extensive explorations and survey in Kutch district of Gujarat State in the years 1960-62, an attempt has been made to throw light on the fodder grasses of the region with their phenoology, fodder potential, economic importance, growth characteristics, habitat preference and distribution of individual species.

ENVIRONMENT

(a) Location Major portion of the district, under study, falls in the arid region of the Indian sub-continent. It lies between 22°47' to 24° N. and 68°21' to 71°10' E. It measures across 256 km. from east to west and 112 km from north to south, covering a total area of 28672 sq. km. The mainland exclusive of the Rann of Kutch embraces only 19497 sq. km. The area is surrounded by the Arabian sea in the west, by Great Rann of Kutch in the south and by the Little Rann in the east. Thus the area is more or less encircled by either sea or swampy marshes and saline belts.

(b) Landforms The tract is characterised by three major landforms of which only two figure on the mainland, where vegetation grows. The ranns, which form the third landform occupy a salt encrusted waste-land and do not support any vegetation. The two landforms of which the grasses and grasslands have been accordingly dealt with are:
(i) Plains formed by old and young alluviums including coastal sands and sandy habitats with deep soils.

(ii) Rugged hilly projections and gravel formations representing various geolithological series with shallow soils.

The latter landform occupies the major portion of the mainland.

(c) Soils Each landform is characterised by specific soil environment. The soil in the former landform is deep, sandy to sandy loam in texture with variable soil characteristics depending on the site location. It is generally saline also. It is low in nitrogen, medium to high in available potash, low to medium in available phosphate, low in organic carbon, pH ranging from 7.0–8.5 and with water holding capacity of 23.8–43.0 per cent. It contains high percentage of soluble salts and calcium carbonate.

On the other hand the soil from the latter landform is shallow with plenty of disintegrated rock and exposed rocky boulders. It is generally immature, structureless and very coarse in texture; yellow brown to dark yellow brown in colour; low to medium in available phosphates, pH ranging from 7.6–8.5 and with water holding capacity varying between 22.4 to 32.1. The total soluble salts are low, ranging between 0.04–0.08 and very low in organic matter.

(d) Climate The climate of Kutch has been classified as Ed (arid with little or no water surplus, Subrahmanyan, 1956). A brief erratic monsoon, very hot summers and extremely cold and dry winters characterise the climate of the region. Generally the monsoon commences from 1st June. The total number of rainy days vary from 20–30 per annum. The winter depressions, which pass over north India, affect only the temperature, winds and clouds but provide hardly any precipitation. Any rainfall during October to May is entirely abnormal and has, therefore, insignificant influence on the vegetation.

The hottest and driest months are April and May. The area is subjected to frequent violent dust storms during May–June. The average annual rainfall (34.04 cm), which is very erratic throughout the area varies from 27.25 cm. in Khadir taluka to 40.50 cm in Mandvi. It has been recorded from 0.80 cm. in Khadir taluka in the year 1911 to as high as 123.50 cm in Khadva Taluka in 1913. Generally July is the rainiest month when nearly 50% of the annual rainfall occurs. June to September are the cloudy months and the area receives about 80–90 per cent of the total annual rainfall. From September onwards the number of sunny days gradually increase until the next monsoon.
The region experiences severe winter which extends from November to February and the temperature goes as low as 1°C during January. The relative humidity during this period is generally very low. The area is subjected to south-westernly winds during the period from May to August and northerly winds during September to January. The velocity of wind varies from 5.5 km to 18.7 km per hour in June and July.

GRASSES AND GRASSLANDS

Each landform is characterised by a specific set of grasses, some of which occupy sizeable area in association with other species to form dominant communities. Depending on the extent of exploitation through cutting only, cutting and aftermath grazing, grazing all the year round, progressive stages in each community could be observed. However, each community can be improved by proper management and encouragement to the best fodder grasses for optimum forage production.

There are eight grass species which are common to both the landforms. Of these eight species only two species viz. Eleusine compressa and Aristida adscensionis formed sizeable communities and are important for grazing. Eleusine compressa forms a dominant community at Sim of Sadi in Banni area; mixed with Aristida species at Habey forest area in Bhuj taluka; San Rakhal in Bachau taluka; and Mav Rakhal in Lakhpat taluka. The characteristic features of these common eight grasses are listed below. The salient features of the characteristic species of the two landforms have been discussed under each landform separately.

1. Aristida adscensionis L. Medium-sized, annual to biennial, xerophytic, drought evading grass; common on gravels and sandy places; good fodder grass and palatable to animals in green stage but disagreeable at maturity due to its sharp callus.

Loc : Sadi in Banni area; Kargaria Reserve forests, Bhuj; Habey forests, Bhuj; Sherdi Rakhal, Nakhtrana taluka; Kothara varadia area in Abadasa taluka; on Voyar–Brinda Road; Mave Rakhal, Lakhpat taluka; Bachau taluka; Nakhtrana taluka.

2. A. hystric L. Short, annual, xerophytic, drought evading grass; common on gravels and sandy plains; palatable to animals when young, unpalatable at maturity.

Loc : Sherdi Rakhal, Nakhtrana taluka; Kanthkot area, Rapar taluka.
3. *Chloris montana* Roxb. Short, annual, psamophytic grass; forming small patches in saline depressions; palatable to animals in all stages; insignificant as a fodder grass.

Loc: Grazinglands Bhuj; Kothara varadia area; Abadasa taluka and Mave Rakhal in Lakhpat taluka.

4. *Dactyloctenium aegyptium* (L.) P. Beauv. Small, annual, drought evading grass; common on heavily grazed areas and footpaths; palatable to animals; insignificant as a fodder species.

Loc: Kargaria and Habey Reserve Forests, Bhuj; Kothara Varadia area, Abadasa taluka, Mave Rakhal, Lakhpat taluka; San Rakhal, Bachau taluka and Kanthkot area in Rapar taluka.

5. *Eragrostis ciliaris* (L.) R. Br. Small, annual, drought evading, ephemeral grass; common in compounds and along footpaths; palatable to animals; insignificant as a fodder species.

Loc: Nakhtana; 16th mile on Bhuj-Kharda Road; Kothara Varadia area, Abadasa taluka and Kanthkot area in Rapar taluka.

6. *Eragrostis tremula* Hochst. Tall, annual, drought evading ephemeral grass; common in gravel and sandy plains, palatable to animals but insignificant as a fodder species.

Loc: Nakhtana; Habey and Kargaria Reserve Forests, Bhuj.

7. *Eragrostis eisosa* (Retz.) Trin. Short, annual, drought evading, tufted grass, frequent in sandy places and along footpaths; palatable to animals, insignificant as a fodder grass.

Loc: 16th mile on Bhuj-Khavda Road and Kargaria Reserve Forest, Bhuj.

8. *Eleusine compressa* (Forsk.) Asch. et Schw. Short, perennial, stoloniferous, drought evading grass, forming sizeable colonies in open gravels and sandy habitats; palatable and also a good sand binder. Being a hardy plant, provides good grazing grounds where it forms sizeable stands. Seeds are eaten by Francolins and Sand grous (Faruqui et al., 1960).

Loc: On way to Old Port, Jakhau, Bhuj taluka; Bhindara Jhil, Banni area; Sim of Sadi, Banni area; Habey Forest area, Bhuj; Saiyad Par Rakhal, Anjar taluka; Mave Rakhal, Lakhpat taluka and San Rakhal, Bachu taluka.
ON THE GRASSES AND GRASSLANDS OF KUTCH

Grasses from all the flat areas in between the hillocks, coastal sand dunes and the deep sand plain soils with high soluble salt contents. In the lower horizons of the soil profile, the soil is generally normal due to the presence of gypsum.

There are in all 39 grasses that occupy this land system. Out of which 23 species are exclusively found in this land system. Some of these typical species only occur in sizable colonies, forming characteristic grass communities. These are *Dichondra echioides*, *Eragrostis hyparosella*, *Cynodon dactylon*, *Sporobolus heterolepis*, *Eragrostis hyparosella*. Other species occur in their communities providing good forage and soil cover. All the lesser communities can be transformed into these communities by proper management and cultural practices. The highest expression of this association was observed in a Goaner area, while going about 10 years back. The grass was being cut from this area only after seeding. *Dichondra echioides* and *Cynodon dactylon* communities covering an area of about 3 sq. km., was observed at Lumb area in Banav district. *Sporobolus heterolepis* formed colonies in association with sedges on the borders of the saline marshes, in higher ground in Banav area, on the border of Banni of Kutch. The typical grasses of this land system are alphabetically listed below with their characteristics.

1. *Achnatherum hymenodes* (L.) Trin. Short, perennial, trailing, pioneer, halophytic grass; very common in marsh, saline habitats, palatable to animals; magnificent as a fodder species.

2. *Bouteloua gracilis* (L.) A. Camus. Tall, perennial, bunch grass; common in grazed areas and flat plains, palatable in all stages and a good fodder grass.

Loc : Banni Grasslands; Old port, Jakhau, Banni taluka; Gandhidham.

Loc : 16th mile on Banni-Khavda Road.
3. **Brachiaria ramosa (L.) Stapf.** Medium-sized, trailing, annual, hygrophyllous, weak-stemmed grass frequent in low lying areas and moist places; very rare in open plains; palatable only in preceding stage, insignificant for fodder value. Loc: Kanheri area, Rajaratna.

4. **Cassia occidentalis Roxb. Short, annual, xerophytic, pioneer grass; palatable in all stages, insignificant from fodder point of view.**


6. **C. segetum Bailey. Medium-sized, perennial, xerophytic, bunch grass; frequent in sandy plains, but does not contribute to the fodder wealth of Kutch.** Loc: Kanheri area, Rajaratna, Rajaretta.


8. **Gigas alsinoides (L.) Link. Small, annual, drought evading grass; rare on sandy soils, palatable to animals but insignificant as a fodder species.**

9. **Hymenostachys lagenicaulis (L.) Stapf. Tall, perennial, halophytic grass; common in coastal grasslands.**

10. **Digitaria oncella (Forsk.) Stapf. Tall, perennial, halophytic grass; common in coastal grasslands.**
stages; very important fodder grass for Banni area, where it forms pure colonies.

Loc : Old port Jakhau; Nadi Bag, Bhuj; Khavada-Kala Dungar; Bhindara Jhil, Banni; Sim of Sadi in Banni area; Near Kothara village, Abadasa taluka.

11. *Echinochloa colonum* (L.) P. Beauv. Small, annual, hygrophilous grass; frequent in moist depressions and ditches; palatable grass but insignificant as a fodder species. Seeds are eaten by Black Francolins (Faruqi *et al* 1960).

Loc : Jorodi Badi, Jakhau; Nakhrana; Bhuj; Depressions on 16th mile from Bhuj on Khavada Road.

12. *E. crusgalli* (L.) P. Beauv. Medium-sized, annual, hygrophilous grass; frequent in moist places; palatable to animals but adds little to its fodder wealth; seeds are eaten by Francolins (Faruqi *et al*, 1960).

Loc : Depressions on 16th mile on Bhuj-Khavda Road.


Loc : Anjar; Bhindara; Chitrod; Habey reserve Forests, Bhuj.

14. *Imperata cylindrica* (L.) P. Beauv. Both tall and dwarf froms, perennial, hygrophilous, bunch grass; not very common in the area; palatable only at young stage; afterward it becomes very fibrous.

Loc : Vajor Dam area and other moist localities.

15. *Panicum antidotale* Retz. Tall, perennial, savannah, bunch grass; common in depressions and among bushes; palatable fodder species and also as good soil binder.

Loc : Along Bhuj-Khavda Roadside, Bhuj taluka.

16. *Paspalidium flavidum* (Retz.) A. Camus. Medium-sized, annual, hygrophilous grass; common in ditches and depression; palatable to animals but insignificant as a fodder grass; seeds taken by Gray Francolins (Faruqi *et al*, 1960).

Loc : Nakhrana; Bhindara Jhil, Banni grassland area.

17. *Saccharum spontaneum* L. Tall, perennial, hygrophilous, savannah grass; frequent near river banks and coastal regions and serves as a good sand stabilizer; non-palatable and hence of no fodder value.

Loc : Lakhpat and Mandvi areas.
18. *Sorghum halepense* (L.) Pers. Tall, perennial, savannah grass forming big clumps; very rare; palatable in all stages but adds very little to the fodder wealth of the region. Seeds eaten by the poor, wherever in plenty during famines.

**Loc:** Dhinodhar; On way to Bhindera village from Kothara, Abadasa taluka.

19. *Sporobolus comendalianus* (Retz.) Kunth. Short-sized, halophytic, annual, pioneer grass; frequent in saline areas; palatable but insignificant as a fodder species.

**Loc:** Sim of Sadi in Banni grassland area.

20. *S. helvolus* (Trin.) Dur. et Schinz. Medium-sized, halophytic, perennial, bunch grass; very common and codominant in saline flat plains; palatable only when young and latter becoming fibrous.

**Loc:** On way to Nadibag, Bhuj; Sim of Sadi in Banni area; Near Rann of Kutch in Banni; Kothara varadia area, Abadasa taluka; San Rakhal in Bachau taluka.

21. *S. mariguatus* (Hochst.) Richb. Medium-sized, halophytic, perennial, bunch grass; very common and codominant in flat plains; palatable when young and contributes much as fodder grass in Banni area.

**Loc:** Old Port Jakhau; Near Kukma Rly. station; Bhuj Nadi Bag, Sim of Sadi in Banni area; Kothara varadia area in Abadasa taluka.

*22. Urochondra setulosa* (Trin.) Hubb. Tall, perennial, halophytic, savannah grass; common in swampy saline habitats; not palatable and can be used for mulching.

**Loc:** Old Port, Jakhau; Mandvi, Banni grasslands; Gandhidham.

*Note:* This species has earlier been recorded from Kathiawar, Sind, Arabia, Socotra and African stases, hence forms a new record for Kutch and extends its distribution from Sindh, Kathiawar southwards to Kutch in Gujarat.

23. * Vetiveria zizanoides* (L.) Nash. Tall, perennial, hygrophilous, savannah, bunch grass; not very common; found only in depressions where water accumulates; unpalatable but highly valuable for its "Khas khas oil" and a prospective species for cottage industry.

**Loc:** Depressions along Adesar to Chitrod Railway line tract.
Grasses of Rugged hilly projections and gravel formations.

This landform is characterized by detached spurs and rugged hills subjected to severe sheet and wind erosion. The areas under this landform have been severely over-grazed and exploited for fuel. The soil is generally sandy, very shallow with protruding pebbles and rocky boulders.

In all, thirty-three grass species occur in this landform. Of these, Cymbopogon flexuosus, Heteropogon contortus and Cyperus jacquemontii are the most important. It provides good fodder and pasture to many livestock. Some of these species occur in the following areas: Cymbopogon flexuosus and Cyperus jacquemontii are found in areas where there is less wind and soil erosion. The other prominent grasses are Cyperus papyrus, Eremias trachyophylla and Eragrostis ciliaris, which are more resistant to these conditions. The area under this landform is observed occupying a specific area at Khambhat, Rajput, taluka.

The Cymbopogon community is further enriched with other species. The area occupied by this community is probably due to the area occupied by the shrubs. The area under this community was observed occupying a specific area at Saputara, Dang, taluka.

Animals generally do not graze on these grasses, but the species that grow in shade and are not easily accessible to livestock. The grasses grow and multiply in this community. The area under this community was observed occupying a specific area on Vahiga-Brinda road.

1. *Cymbopogon flexuosus* L. Tall, annual. Savanna grass, not very common in the region. It grows unhampered and occupies the entire area. The area under this community was observed occupying a specific area at Khambhat, Rajput, taluka.

2. *Arthrida jacquemontii* Trin. et Rupr. Medium-sized annual, xerophytic, pioneer grass, common on open gravel, palatable only at young stage, insignificant as a fodder species.
Loc: 16 km. south of Bhuj; Kanhkot area, Rapar taluka; Mave Rakhal, Lakhpal taluka; Saiyed par Rakhal, Anjar taluka; Habey R.F., Kergaria R.F. and Goshala areas, Bhuj.

3. *A. hystrioides* Edgew. Short-sized, annual, xerophytic, pioneer grass; common on open lands; provides browsing to sheep when young but insignificant as a fodder species.

Loc: Habey Forest area, Bhuj; Sherdi village Rakhal, Nakhtrana taluka.

4. *Chrysopogon aukeri* (Boiss.) Stapf. Short-sized, perennial petrophytic, bunch grass; rare in the region; palatable at all stages of growth, but insignificant as a fodder species.

Loc: Kargaria Reserve Forest, Bhuj and Habey forest area, Bhuj taluka; Dhinodhar.

5. *C. fulvus* (Spreng.) Chiov. Tall, perennial, petrophytic, bunch grass; forming large colonies and a codominant of gravels; palatable in all stages and very good fodder species of the area. Also a good soil binder.

Loc: 8 miles east of Narayangsarowar; Sherdi village Rakhal, Nakhtrana taluka; Saiyed Par Rakhal, Anjar taluka; Habey forest area, Bhuj taluka and Kargaria R. F., Bhuj.

6. *Cymbopogon juwancus* (Jones) Schult. Tall, perennial, xerophytic, bunch grass; forming large colonies on heavily grazed gravels; less relished by animals due to the presence of oil, hence less significant as a fodder grass but a prospective species of Cottage Industry for its aromatic, medicinal oil.

Loc: Khavda; On way to Kaladungar; Kanhkot area, Rapar taluka; Mave Rakhal, Lakhpal taluka; Saiyed par Rakhal, Anjar taluka; Vajor-Brinda Road, 5 miles from Bhuj; Kargaria R. F. area, Bhuj.

7. *C. martii* (Boxb.) Wats. Tall, perennial, xerophytic, bunch grass; grows in colonies on hillocks; unpalatable to animals due to its aromatic “Motia & Sofia” oils, which can feed a cottage industry.

Loc: Mata Dhola near Bhuj; Saiyed par Rakhal, Anjar taluka; Habey Forest area, Bhuj and Kargaria R. F., Bhuj.

8. *Dactyloltenium sindicum* Boss. Short, perennial grass with runners and rooting at nodes; very common in gravel formations; palatable and good soil-binder, but insignificant as a fodder species; seeds are eaten by Gray and Black Francolinus (*Paraqui et al* 1960).
Loc: Kanthor area, Happy Forest area. Rapid rise on

Khandaga-Kaladungar.

Loc: Kanhorda area. Greenish brown, partly

Khandaga-Kaladungar.

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Khandaga-Kaladungar.
26. *Themeda triandra* Forr., Tall, perennial, savannah grass, forming large colonies; palatable when young; insignificant as a fodder species in Kutch but provides good hay to animals when dry.

Loc: Saiyed Par Rakhal, Anjar Taluka; Sherdi Rakhal, Nakhatrana.

**STATISTICAL SYNOPSIS AND CONCLUSIONS**

Blatter (1908), Blatter & McCann (1935) and Thakar (1926) have together recorded 63 species of grasses. Puri et al. (1959) have just reported 72 species of grasses, followed by Jain and Deshpande (1960), who added 9 grass species as new records for the area. Most of these species were collected and analysed or observed during various field excursions in the area in the period 1960–1962 and the specimens deposited in the Herbarium, Botanical Survey of India, W. Circle, Poona. Of these only 56 species belonging to 42 genera which are of much economic value, have been narrated in the foregoing pages. As is evident from the appended table that out of the total 56 species only 8 species representing 5 genera of the sub-family Pooidae are the species common to both the landforms and the rest are divided conservatively to the two landforms of the region.

In the landform I with sandy habitats, out of the total 23 species belonging to 18 genera, only 14 species of 11 genera, consisting of the two tribes (Andropogoneae and Paniceae) are the members of the sub-family Panicoideae and the remaining 9 species represent 7 genera and 4 tribes (Viz. Aeluropoideae, Chlorideae, Eragrostideae and Sporoboleae) of the sub-family Pooidae. The ratio of genera to species of the family in this landform comes to 1 : 1.28. This ratio of genera to species is also maintained in case of both the sub-families. The ratio of species in Panicoideae to Pooidae is 1.55 : 1.0 and so also is true for their genera. *Sporobolus* (=3 sps.) is the largest genus of Pooidae and *Cenchrus* (=3 sps.) is that of the Panicoideae, concluding that these two are the prominent genera of this landform.

Of the 25 species representing 19 genera belonging to 7 tribes of both the subfamilies from the landform II with gravels and hills, 10 species represent 11 genera and 2 tribes of the subfamily Panicoideae and the remaining 9 species belonging to 8 genera and 5 tribes (Aristideae, Chlorideae, Eragrostideae and Zoysieae) are the representative of the subfamily Pooidae. The ratio of genera to species in this landform results to 1 : 1.32 in the family; 1 : 1.45 in the subfamily Panicoideae and 1 : 1.13 in the case of Pooidae. The ratio
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SUMMARY

With the increase in the area under peanut cultivation, the
importance of selecting and developing new varieties of
peanuts has become more and more evident. In this
connection, the studies on the relationship between
the yield of peanuts and the various factors affecting
the yield have been carried out.

The results obtained indicate that the yield of peanuts
is influenced by a number of factors, including the
soil type, the climate, and the cultural practices.
Furthermore, the yield of peanuts is also affected by
the presence of weeds and pests.

From the above, it is concluded that the yield of peanuts
is influenced by a number of factors, and that
improving the cultural practices and controlling
weeds and pests will lead to an increase in the
yield of peanuts.