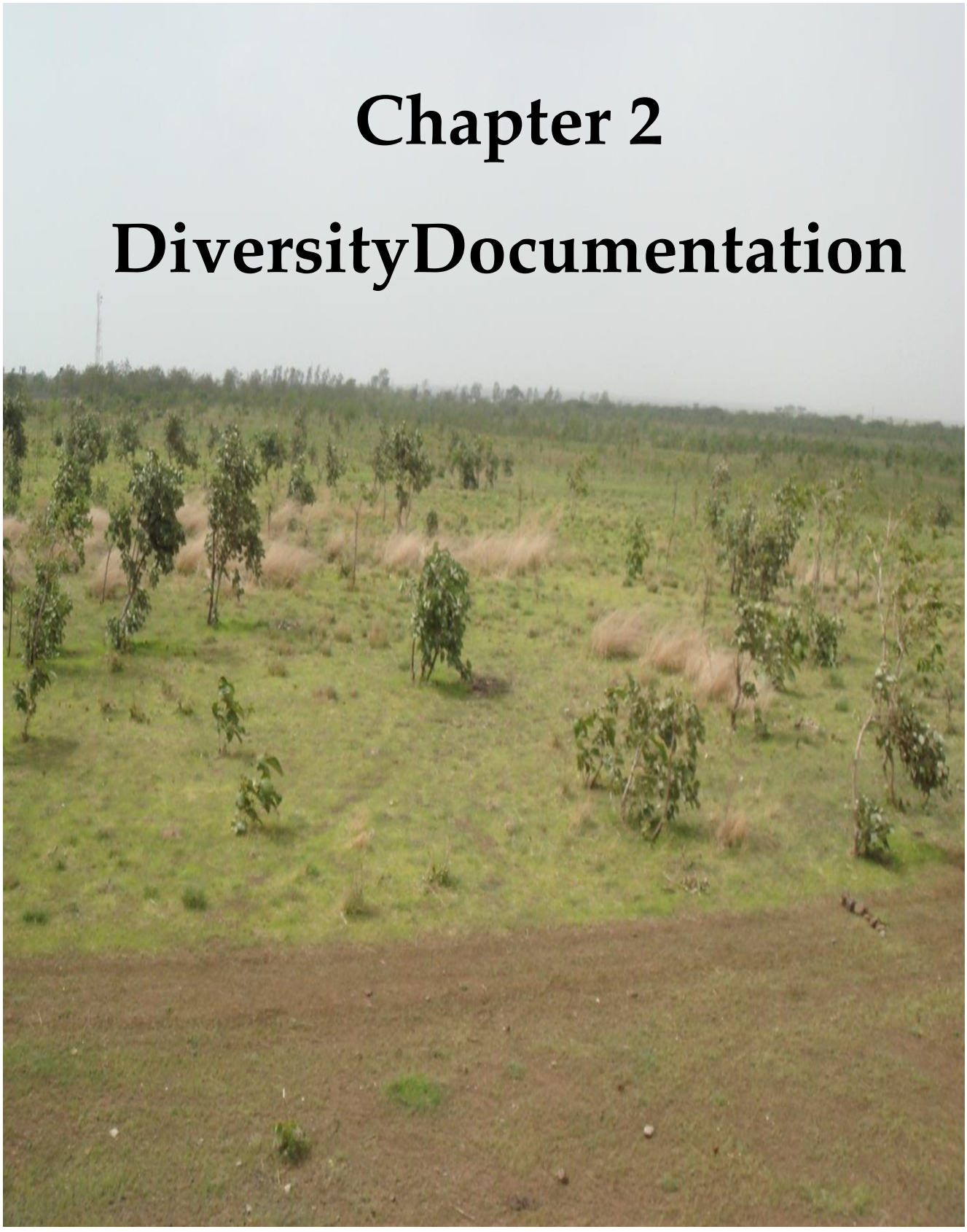
Chapter 2

DiversityDocumentation



Chapter 2

Diversity Documentation

Biodiversity and its natural process in different ecosystems contribute to the correct understanding of the interrelationships between the land, climate, plants and other living things (Fallahchai, 2011). Biodiversity is an essential case for life continuance, economic affairs and ecosystems function and resistance (Singh, 2002). Biodiversity measurement typically focuses on the species level and species diversity is one of the most important scales (Ardakani, 2004). Grasslands have many biodiversity values which includes wildlife habitat, occurrence of rare species, fundamental ecosystem properties of structure, function and composition, and ecosystem services such as watershed protection, grazing, and scenery. In addition, some grassland is seen as having high biodiversity values because of their high species richness.

As we know that the areas of grasslands are expanding and in last few years, North-Eastern part of the Gujarat state is also getting a unique identity as grasslands. The selected study sites are such grasslands, differing in their altitude, habitat, evolution, species composition along with the dependency of tribal for food and forage.

The grasslands of Eastern Gujarat are under constant threat of mass wasting, grazing pressure, unscientific agronomic practices, dominance of unpalatable species and degradation of land which have created an overall adverse impact, disturbance and imbalance in the ecosystem. Grasslands selected for the present study play a vital role for the tribal peoples where the economic structure and social organizations are built around the primary relationship with natural resources. Therefore, the study of such unexploited grassland areas for proper management and conservation is of paramount importance. The documentation of the flora for the many parts of the Gujarat state has been already done (Shah, 1978). Being a new area which is totally

unexplored in this way might not be thoroughly studied. Determining the quantity of natural resources and its planned use for sustainable development is an important aspect for present and future days. If natural ecosystems and their functions are to be kept in equilibrium condition, then there is a need to have correct assessment of natural resource availability. As we know that the species composition of an area changes over time, thus for proper management of grassland, a study on grassland inventory is the first requirement. Hence, an attempt has been made to compare the vegetation parameters by estimating the tree, shrub and herb diversity, composition and species richness of grasses.

Bandheli and Rampur grasslands support a variety of species diversity in their habits with the majority of tree species due to the adjoining region of mixed deciduous forests. The Bandheli grassland is situated at 147-164 m elevation (22^0 50' - 22^0 51' N lat. and 073^0 42' - 073^0 43' E long.) while Rampur grassland is found at 367-399 m elevation (22^0 49' - 22^0 50' N lat. and 074^0 10' - 074^0 11' E long.).

Bandheli and Rampur grasslands are two very important grasslands of Eastern Gujarat. A pure database of the grasses occurring in this region has not been properly studied. This research and documentation compares and contrasts plant species richness, diversity and compositional characters of different species occurring in the selected grasslands. Thus the objective of this study was to generate baseline information on the distribution patterns and composition of the species of grasslands in order to support long term conservation strategies and species level monitoring.

Material and Methods

Total five sites were selected for the studies (Map), which were further, subdivided (Table2.1.)

Table 2.1. Geographical Positions of Selected Sites

Site I – Bandheli		
Site: Bandheli I N: 22^0 51' 10.3", E: 073^0 42' 52.2" Altitude: 155 mt	Site: Bandheli II N: 22^0 51' 26", E: 073^0 43' 25.9" Altitude: 164 mt	Site: Bandheli III N: 22^0 50' 48.3", E: 073^0 42' 50.9" Altitude: 147 mt
Site II – Rampur		
Site: Rampura I N: 22^0 50' 18", E: 074^0 10' 56" Altitude: 389 mt	Site: Rampura II N: 22^{0}50' 05.5", E: 074^0 11' 0.29" Altitude: 394 mt	Site: Rampura III N: 22^0 50' 04.6", E: 074^0 11' 02.5" Altitude: 394 mt
Site III – Rozam		
Site: Rozam I N: 22^0 49' 26", E: 074^0 11' 03" Altitude: 397 mt	Site: Rozam II N: 22^0 49' 21", E: 074^0 11' 05" Altitude: 399 mt	Site: Rozam III N: 22^0 49' 33", E: 074^0 10' 27" Altitude: 397 mt
Site IV – Kalitalai		
Site: Kalitalai I N: 22^0 50' 30", E: 074^0 12' 32" Altitude: 367 mt		

All selected sites of the study area were visited frequently at a regular interval of about 15-20 days during 2007-2010. Field visits were subsequently conducted to collect the species specimen and to confirm the consistency and variation in the species composition of the study area.

At each site the plots were placed randomly. Herbaceous vegetation and grasses was analyzed using 1 m x 1 m randomly placed quadrats at the time of the peak cover. Each tiller of the grass clump was considered as an individual plant. The Quantitative parameters assessed were diversity, frequency, density, abundance, richness, IVI and were determined as per Curtis and McIntosh (1950). Different indices for plant community were also calculated.

The plant specimen collection was authentically done. The collected specimens were photographed in the field using digital camera (Sony super stedy shot DSC-T10) and the important phenological features were noted down. Sample specimens were

collected and brought to the laboratory and processed for the herbarium preparation by standard method (Maden, 2004). Plant specimen were dissected and identified with the help of different floras viz. Flora of Gujarat (Shah, 1978), The Bombay Grasses (Blatter and McCann, 1335) and The Flora of Bombay presidency (Cooke, T., 1967), the herbaria were compared with the specimen at the 'The Blatter Herbarium', St. Xavier's College, Mumbai for authentication.

Results and Discussion

Poaceae and Leguminosae are two largest families of both the regions and it needs special attention for their taxonomic identity and its distributional pattern. In the present study a thorough survey of these grasslands was conducted during the tenure of the project from 2007 to. 2010 and the diversity of the grasses and associated legumes in these areas have been documented. They are presented in Table 2.2- 2. 5. While representative photographs of dominant and rare species of grasses and legumes are given in plates 2.1 – 2.3.

Table 2.2 List of documented species (Family - Poaceae)

Sr. No.	Botanical name	Local Name	Species present at	
			Bandheli	Rampur
1	*Alloteropsis cimicina* (L.) Stapf	-	√	-
2	*Andropogon pumilus* Roxb.	Pochu ghas	-	√ (K)
3	*Apluda mutica* L.	Karedi	√	√ (R,Ro,K)
4	*Aristida adscensionis* L.	Lapadu	√	√ (R,Ro,K)
5	*Aristida funiculata* Trin. and Rupr.	Motu Lapadu	√	√ (R,Ro,K)
6	*Arthraxon lanceolatus* (Roxb.) Hochst.	Tepari	-	√ (Ro)
7	*Bothriochloa pertusa* (L.) A. Camus	Zinzavi	√	-
8	*Brachiaria eruciformis* (J. E. Sm.) Griseb.	Nani Ekol	-	√ (K)
9	*Brachiaria reptans* (L.) Gard. and Hubb.	Moti Ekol	-	√ (K)
10	*Capillipedium huegelii* (Hack.) Stapf	-	√	-
11	*Cenchrus ciliaris* L.	Ghaulu	√	-
12	*Cenchrus setigerus* Vahl	Anjan	-	√ (R)
13	*Chionachne koenigii* (Spr.) Thw.	Nani Kaha	-	√ (Ro)
14	*Chloris barbata* Sw.	Kadi Sukali	√	√ (K)
15	*Chloris virgata* Sw.	-	-	√ (K)
16	*Chrysopogon fulvus* (Spr.) Chiov.	Khad	-	√ (R, Ro, K)
17	*Coix lachryma-jobi* L.	Kaha	-	√ (Ro)
18	*Cymbopogon martinii* (Roxb.) Wats.	Rosha	√	√ (R, Ro, K)
19	*Cynodon dactylon* (L.) Pers.	Dharo	√	√ (R, Ro, K)
20	*Dactyloctenium aegyptium* (L.) P. Beauv.	Chokhaliyu	√	√ (R)
21	*Desmostachya bipinnata* (L.) Stapf	Dabh	√	-
22	*Dichanthium annulatum* (Forssk.) Stapf	Ubho Zinzavo	√	√ (R, Ro, K)
23	*Dichanthium caricosum* (L.) A. Camus	Ado Zinzavo	-	√ (Ro)
24	*Digitaria adscendens* (H. B. and K.) Henr.	Tarodiyu	√	√ (R,K)
25	*Digitaria granularis* (Trin. ex Spr.) Henr.	-	√	-
26	*Dinebra retroflexa* (Vahl) Panz.	Khariyu	-	√ (K)
27	*Echinochloa colonum* (L.) Link	Samo	-	√ (R, Ro, K)
28	*Echinochloa crusgalli* (L.) P. Beauv.	Jhinko samo	-	√ (R, Ro, K)
29	*Eleusine indica* (L.) Gaertn.	Nagli	√	√ (R)
30	*Eragrostiella bifaria* (Vahl) Bor	Bhumsi	√	-
31	*Eragrostis ciliaris* (L.) R. Br.	Murmur	-	√ (R)
32	*Eragrostis tenella* (L.) P. Beauv.	Bhumsi	√	√ (R, Ro, K)
33	*Hackelochloa granularis* (L.) O. Ktze.	Kagari	√	-

Sr. No.	Botanical name	Local Name	Species present at	
			Bandheli	Rampur
34	*Heteropogon contortus* var. *contortus* subvar. *typicus* Blatter and McCann	Moti Sukali	√	√ (R, Ro, K)
35	*Heteropogon contortus* var. *contortus* subvar. *genuinus* Blatter and McCann	Nani Sukali	√	√ (R, Ro, K)
36	*Imperata cylindrica* (L.) P. Beauv.	Vareniyu	√	-
37	*Ischaemum molle* Hk. f.	Todu	-	√ (K)
38	*Ischaemum pilosum* (Klein ex Willd.) Wt.	Kundho	-	√ (K)
39	*Ischaemum rugosum* Salisb.	Valeru	-	√ (K)
40	*Melanocenchris jacquemontii* J. and S.	-	√	√ (R, Ro)
41	*Ophiorus exaltatus* (L.) O. Ktze.	Sutado	-	√ (R, Ro)
42	*Oropetium thomaeum* (L. f.) Trin.	-	√	-
43	*Panicum antidotale* Retz.	Dhun	-	√ (K)
44	*Panicum trypheron* Schult.	-	√	√ (R, K)
45	*Paspalidium flavidum* (Retz.) A. Camus	-	√	√ (R,K)
46	*Perotis indica* (L.) O. Ktze.	-	√	-
47	*Schoenefeldia gracilis* Kunth	-	√	-
48	*Sehima ischaemoides* Forssk.	Safed Sukali	-	√ (Ro)
49	*Sehima nervosum* (Rottl.) Stapf	Shaniyar	-	√ (R, Ro)
50	*Sehima sulcatum* (Hack.) A Camus	Seran	-	√ (R, Ro)
51	*Setaria glauca* (L.) P. Beauv.	Zipti	√	√ (R)
52	*Setaria tomentosa* (Roxb.) Kunth	Kutariyu	-	√ (R)
53	*Setaria verticillata* (L.) P. Beauv.	Lati	-	√ (R)
54	*Sorghum halepense* (L.) Pers.	Baru	-	√ (Ro, K)
55	*Sporobolus diander* (Retz.) P. Beauv.	Rimbhanu	√	-
56	*Thelepogon elegans* Roth ex R. and S.	Sikol	-	√ (K)
57	*Themeda cymbarica* (Roxb.) Hack.	Gandheli	√	√ (Ro)
58	*Themeda triandra* Forsk.	Bhathedu	√	√ (R,Ro,K)

R- Rampur, Ro-Rozam, K-Kalitalai

Table 2.3 List of associated herbaceous legumes (Family - Leguminosae)

Sr. No.	Botanical name	Local Name	Species present at	
			Bandheli	Rampur
1	*Aeschynomene indica* L. (Desmodium species)	-	√	√ (Ro)
2	*Alysicarpus monilifer* (L.) DC.	Moti lipodi	√	√ (R,Ro,K)
3	*Alysicarpus procumbens* (Roxb.) Schindl.	-	√	-
4	*Alysicarpus vaginalis* (L.) DC.	Lipodi	√	√ (R,Ro,K)
5	*Atylosia scarabaeoides* (L.) Bth.	Ajimo	√	√ (R)
6	*Cassia absus* L.	Saved	√	-
7	*Cassia mimosoides* L.	Nani Saved	-	√ (Ro)
8	*Cassia occidentalis* L.	Kasundari	√	√ (R, Ro)
9	*Cassia tora* L.	Puvad	√	√ (R,Ro,K)
10	*Clitoria ternatea* L.	Koyal	√	√ (R, K)
11	*Crotalaria calycina* Schrank.	Ghughari	-	√ (R)
12	*Crotalaria juncea* L.	Shann	-	√ (R,Ro,K)
13	*Crotalaria leptostachya* Bth.	Ghugharo	-	√ (R,Ro)
14	*Crotalaria mysorensis* Roth	-	-	√ (R)
15	*Crotalaria notonii* W. and A. Prodr.	-	√	-
16	*Crotalaria orixensis* Willd.	Tripani Ghughari	-	√ (R, Ro)
17	*Crotalaria spectabilis* Roth.	Ghugharo	√	-
18	*Indigofera cordifolia* Heyne ex Roth.	Lipodi	√	√ (R, Ro)
19	*Indigofera echinata* Willd.	Nani Lipodi	√	√ (R, Ro)
20	*Indigofera enneaphylla* L.	Bhoi gadi	-	√ (R)
21	*Indigofera glandulosa* Roxb. ex Willd.	Zinzaru	-	√ (K)
22	*Indigofera hirsuta* sensu Baker	-	√	-
23	*Indigofera linifolia* Retz.	Lipodi	√	√ (R,Ro,K)
24	*Indigofera tinctoria* L.	Gadi	√	-
25	*Rhynchosia minima* (L.) DC.	Dhankani	-	√ (R,K)
26	*Sesbania aculeata* (Willd.) Pers.	Moti Ikad	-	√ (Ro)
27	*Sesbania sesban* (L.) Merr.	Nani Ikad	-	√ (Ro)
28	*Tephrosia purpurea* Pers.	Sarpankho	√	-
29	*Tephrosia villosa* (L.) Pers.	-	√	-
30	*Zornia gibbosa* Span.	Lepadavi	√	√ (R, Ro)

e 2.4 List of Rare Grasses and Legumes

Sr. No.	Botanical name	Local Name	Species present at Bandheli	Rampur
	Grasses			
1	*Cenchrus biflorus* Roxb.	Anjan	√	-
2	*Echinochloa stagnina* (Retz.) P. Beauv.	Banti	Garbada (Baria Forest Division)	
3	*Eragrostis cilianensis* (All.) Link	Bhumsi	-	√ (R)
4	*Eragrostis japonica* (Thunb.) Trin.	Munj	√	-
5	*Eragrostis nutans* (Retz.) Nees and Steud.	Chiktu	√	-
6	*Eragrostis tremula* Hochst.	Bhumsi	√	-
7	*Eragrostis unioloides* (Retz.) Nees	Bhumsi	-	√ (R)
8	*Eragrostis viscosa* (Retz.) Trin.	Bhumsi	√	-
9	*Isachne globosa* (Thumb.) O. Ktze.		Kantu (Baria Forest	
10	*Ischaemum indicum* (Houtt.) Merr.	Bala	Division)	
11	*Iseilema laxum* Hack.	Moti Mahil	Kharoda (Baria Forest Division)	
12	*Oplismenus burmannii* (Retz.) P. Beauv.	-	-	
13	*Pennisetum setosum* (Sw.) L. C. Rich.	Ghoda ghas	-	√ (K)
14	*Rottboellia exaltata* L. f.	-	-	√ (K)
15	*Sporobolus fertilis* (Steaud.) Clayton	Murmur	√	-
16	*Sporobolus halvolus* (Trin.) Thw.	-	√	-
17	*Sporobolus marginatus* Hochst. ex A. Rich.	-	-	√ (R)
18	*Themeda laxa* (Anderss.) A. Camus	Fumta Bhathedu	-	√ (Ro)
	Legumes			
19	*Alysicarpus belgaumensis* Wt.	-	√	-
20	*Alysicarpus rugosus* (Willd.) DC.	-	-	√ (K)
21	*Alysicarpus tetragonolobus* Edgew.	Samervo	-	√ (Ro,K)
22	*Atylosia platycarpa* Bth.	-	√	-
23	*Crotalaria albida* Heyne ex. Roth	-	-	√ (R)
24	*Crotalaria burhia* Buch.-Ham. ex. Bth.	-	-	√ (R)
25	*Crotalaria filipes* Bth.	Zini Ghughari	Kantu (Baria Forest Division)	

Sr. No.	Botanical name	Local Name	Species present at	
			Bandheli	Rampur
26	*Crotalaria linifolia* L. f.	Adabau Shann	-	√ (R)
27	*Crotalaria nana* Burm. f.	-	-	√ (Ro)
28	*Desmodium gangeticum* (L.) DC.	-	-	√ (K)
29	*Goniogyna hirta* (Willd.) Ali	Piludi	-	√ (R)
30	*Indigofera spicata Forsk.*	-	-	√ (R)
31	*Tephrosia strigosa* (Dalz.) Sant. and Mahesh.	-	-	√ (Ro)
32	*Vigna radiata* (L.) Wilczek	Jangali Mung	-	√ (Ro)

Table 2.5 List of other associated species

Sr. No.	Botanical name	Local Name	Family	Species present at	
				Bandheli	Rampur
	Trees				
1	*Acacia auriculiformis* A. Cunn. ex Benth.	Bangali Bawal	Mimosaceae	√	√
2	*Acacia catechu* Willd.	Khair	Mimosaceae	√	√
3	*Acacia chundra* (Roxb. ex Rottl.) Willd.	Safed Khair	Mimosaceae	√	√
4	*Acacia nilotica* (L.) Del.	Bawal	Mimosaceae	√	√
5	*Acacia tortilis* (Forssk.) Hayne	Israeli Bawal	Mimosaceae	√	√
6	*Adina cordifolia* (Roxb.) Bth. and Hk. f. ex Brand.	Haldu	Rubiaceae	√	√
7	*Aegle marmelos* (L.) Corr.	Bili	Rutaceae	√	√
8	*Alangium salvifolium* (L. f.) Wang.	Ankal	Alangiaceae	√	√
9	*Albizia lebbeck* (L.) Bth.	Kado Siras	Mimosaceae	√	√
10	*Albizia procera* (Roxb.) Bth.	Safed Siras	Mimosaceae	√	√
11	*Annona squamosa* L.	Sitafal	Annonaceae	√	√
12	*Anogeissus latifolia* (Roxb.) Wall. ex Bedd.	Dhavado	Combretaceae	√	√
13	*Bauhinia racemosa* Lam.	Asitro	Caesalapiniaceae	√	√
14	*Bombax ceiba* L.	Simado	Bombacaceae	√	√
15	*Boswellia serrata* Roxb.	Salai	Burseraceae	-	√
16	*Bridelia retusa* (L.) Spr.	Dantio	Euphorbiaceae	-	√
17	*Butea monosperma* (Lam.) Taub.	Khakharo	Papilionaceae	√	√
18	*Cassia fistula* L.	Garamado	Caesalapiniaceae	√	√
19	*Cassine glauca* (Rottb.) O. Ktze.	Bhutadi	Celastraceae	√	√
20	*Cordia dichotoma* Forst.	Gundo	Ehretiaceae	√	√
21	*Dalbergia lanceolaria* L. f.	Dharan	Papilionaceae	-	√

Sr. No.	Botanical name	Local Name	Family	Species present at	
				Bandheli	Rampur
22	*Dalbergia latifolia* Roxb.	Sisam	Papilionaceae	√	√
23	*Dalbergia paniculata* Roxb.	Pataradi	Papilionaceae	√	√
24	*Dalbergia sissoo* Roxb.	Sisam	Papilionaceae	√	√
25	*Diospyros melanoxylon* Roxb.	Timru	Ebenaceae	√	√
26	*Emblica officinalis* Geartn.	Amada	Euphorbiaceae	√	√
27	*Ficus benghalensis* L.	Vad	Moraceae	√	√
28	*Ficus religiosa* L.	Pipado	Moraceae	√	√
29	*Gmelina arborea* L.	Sevan	Verbenaceae	√	√
30	*Lannea coromandelica* (Houtt.) Herrill	Moyano	Anacardiaceae	√	√
31	*Leucaena leucocephala* (Lam.) de Wit	Su-bawal	Mimosaceae	-	√
32	*Madhuca indica* J. f. Gmel.	Mahudo	Sapotaceae	√	√
33	*Mangifera indica* L.	Ambo	Anacardiaceae	√	√
34	*Meyna laxiflora* Robyns	Fendi	Rubiaceae	-	√
35	*Miliusa tomentosa* (Roxb.) Sincl.	Umbh	Annonaceae	√	√
36	*Mitragyna parvifolia* (Roxb.) Korth.	Kalam	Rubiaceae	√	√
37	*Morinda tomentosa* Heyne ex Roth	Aledi	Rubiaceae	√	√
38	*Moringa oliefera* Lam.	Mitho Saragavo	Moringaceae	√	-
39	*Ougeinia oojeinensis* (Roxb.) Hochr.	Tanachh	Papilionaceae	√	√
40	*Prosopis juliflora* (Sw.) DC.	Gando Bawal	Papilionaceae	√	√
41	*Pterocarpus marsupium* Roxb.	Biyo	Papilionaceae	√	-
42	*Schleichera oleosa* (Lour.) Oken	Kusum	Sapindaceae	√	√
43	*Soymida febrifuga* (Roxb.) A. Juss.	Royan	Meliaceae	√	√
44	*Sterculia urens* Roxb.	Kadayo	Sterculiaceae	√	-
45	*Syzygium cumini* (L.) Skeels	Jambu	Myrtaceae	√	√
46	*Tamarindus indica* L.	Khati Ambali	Caesalapiniaceae	√	√
47	*Tectona grandis* L. f.	Saag	Verbenaceae	√	√
48	*Terminalia bellirica* (Gaertn.) Roxb.	Baheda	Combretaceae	√	-
49	*Wrightia tinctoria* (Roxb.) R.Br.	Moti Dudhkadi	Apocynaceae	-	√
50	*Xeromphis spinosa* (Thunb.) Keay	Mindhad	Rubiaceae	-	√
51	*Zizyphus mauritiana* Lam.	Bor	Rhamnaceae	√	√
52	*Zizyphus xylopyra* (Retz.) Willd.	Ghatbor	Rhamnaceae	√	√
	Shrubs				
1	*Caesalpinia crista* L.	Kanchaka	Caesalpiniaceae	√	√
2	*Calotropis gigantea* (L.) R. Br.	Ankado	Asclepiadaceae	√	√
3	*Calotropis procera* (Ait.) R. Br.	Ankado	Asclepiadaceae	√	√
4	*Capparis sepiaria* L.	Kanthar	Capparaceae	-	√

Sr. No.	Botanical name	Local Name	Family	Species present at	
				Bandheli	Rampur
5	*Carissa congesta* Wt.	Karamdi	Rutaceae	√	-
6	*Cassia auriculata* L.	Awad	Caesalpiniaceae	-	√
7	*Clerodendrum multiflorum* (Burm. F.) O. Ktze.	Kadavi Mahendi	Verbenaceae	-	√
8	*Euphorbia nivulia* Buch.-Ham.	Thor	Euphorbiaceae	√	√
9	*Ficus hispida* L. f.	Dhedumro	Moraceae	√	√
10	*Ipomoea fistulosa* Mart. ex Choisy	Naffatiyo	Convolvulaceae	√	√
11	*Jatropha curcas* L.	Ratanjyot	Euphorbiaceae	√	√
12	*Jatropha gossypifolia* L.	-	Euphorbiaceae	√	√
13	*Lantana camara* L.	-	Verbenaceae	√	√
14	*Nyctanthes arbortristis* L.	Parijatak	Nyctaginaceae	√	-
15	*Vitex negundo* L.	Nagod	Verbenaceae	√	√
16	*Ziziphus nummularia* (Burm. f.) W. and A.	Chanibor	Rhamnaceae	√	√
	Herbs				
1	*Abelmoschus manihot* (L.) Medic	Jangali Bhindi	Malvaceae	√	√
2	*Abutilon indicum* (L.) Sw.	Khapat	Malvaceae	-	√
3	*Acalypha ciliata* Forsk.	Dadari	Euphorbiaceae	√	√
4	*Acalypha indica* L.	Dadari	Euphorbiaceae	√	√
5	*Acanthospermum hispidum* DC.	-	Acanthaceae	√	√
6	*Achyranthes aspera* L.	-	Amaranthaceae	√	√
7	*Agave americana* L.	-	Agavaceae	√	√
8	*Ageratum conyzoides* L.	-	Asteraceae	√	√
9	*Amaranthus spinosus* L.	-	Amaranthaceae	√	√
10	*Amaranthus viridis* L.	-	Amaranthaceae	√	√
11	*Amorphophallus commutatus* (Roxb.) Bl.	Jungali Suran	Araceae	-	√
12	*Andrographis echioides* (L.) Nees	Kariyatu	Acanthaceae	√	√
13	*Anisomeles indica* (L.) O. Ktze.	-	Lamiaceae	√	-
14	*Blepharis maderaspatensis* (L.) B.Heyne ex Roth		Acanthaceae	√	√
15	*Blepharis repens* (Vahl) Roth.		Acanthaceae	√	√
16	*Boerhavia diffusa* L.		Nyctaginaceae	√	√
17	*Borreria articularis* (L. f.) F. N. Will.		Rubiaceae	√	√
18	*Borreria stricta* (L. f.) K. Schum.		Rubiaceae	√	√
19	*Celosia argentea* L.		Amaranthaceae	-	√
20	*Chlorophytum borivilianum* Sant. and Fernand.		Liliaceae	√	-
21	*Cleome viscosa* L.		Capparaceae	√	√
22	*Commelina benghalensis* L.		Commelinaceae	√	√
23	*Corchorus aestuans* L.		Tiliaceae	-	√

Sr. No.	Botanical name	Local Name	Family	Species present at	
				Bandheli	Rampur
24	*Corchorus capsularis* L.		Tiliaceae	√	√
25	*Cyperus rotundus* L.		Cyperaceae	√	√
26	*Datura innoxia* Mill.		Solanaceae	√	√
27	*Echinops echinatus* Roxb.		Asteraceae	√	√
28	*Eclipta alba* (L.) Hassk.		Asteraceae	-	√
29	*Elytraria acaulis* (L. f.) Lindau		Asteraceae	√	-
30	*Enicostema hyssopifolium* (Willd.) Verdoon		Gentianaceae	√	√
31	*Eriocaulon spp.*		Eriocaulaceae	-	√
32	*Euphorbia hirta* L.		Euphorbiaceae	√	√
33	*Euphorbia hypersifolia*		Euphorbiaceae	√	√
34	*Evolvulus alsinoides* (L.) L.		Convolvulaceae	√	√
35	*Heylandia latebrosa* (L.) DC.		Leguminosae	√	-
36	*Ionedum spp.*			-	√
37	*Leucas aspera*		Lamiaceae	√	-
38	*Leucas biflora* R. Br.		Lamiaceae	√	-
39	*Leucas cephalotes* (Roxb. and Roth.) Spr.		Lamiaceae	√	√
40	*Ocimum canum* Sims		Lamiaceae	√	-
41	*Oldenlandia corymbosa* L.		Rubiaceae	√	√
42	*Oxalis corniculata* L.		Oxalidaceae	√	√
43	*Phyllanthus niruri* L.		Euphorbiaceae	√	√
44	*Psoralea corylifolia* L.		Papilionaceae	-	√
45	*Rungia repens* (L.) Nees		Acanthaceae	√	√
46	*Sida acuta* Burm. f.		Malvaceae	√	√
47	*Sida alba*		Malvaceae	√	-
48	*Sida cordifolia* L.		Malvaceae	√	√
49	*Sida spinosa* L.		Malvaceae	√	√
50	*Solanum xanthocarpum* Schard. and Wendl.		Solanaceae	√	√
51	*Striga angustifolia* (D. Don) Saldanha		Scrophulariaceae	-	√
52	*Tribulus terrestris* L.		Zygophyllaceae	√	-
53	*Trichodesma indicum* (L.) R. Br.	Undha fali	Boraginaceae	√	√
54	*Tridax procumbens* L.		Asteraceae	√	√
55	*Triumfetta rhomboidea* Jacq.		Tiliaceae	-	√
56	*Typha sp.*		Typhaceae	-	√
57	*Urginea indica*	Dungado	Liliaceae	√	-
58	*Vanda tessellata* (Roxb.) Hk. F.		Orchidaceae	-	√
59	*Vernonia cinerea* (L.) Less.		Asteraceae	√	√

Andropogon pumilus

Apluda mutica

Aristida adscensionis

Cenchrus ciliaris

Chrysopogon fulvus

Coix lachryma-jobi

Echinochloa colonum

Eragrostis tremula

Eragrostis unioloides

Ischaemum indicum

Ischaemum pilosum

Melanocenchris jacquamontii

Pterotis indicum

Sehima nervosum

Plate 2.1 **Representative photographs of grasses**

Aeschynomene indica

Alysicarpus monilifer

Crotalaria calycina

Crotalaria filipes

Crotalaria nana

Indigofera echinata

Indigofera enneaphylla

Indigofera glandulosa

Indigofera hirsuta

Indigofera linifolia

Indigofera tinctoria

Tephrosia villosa

Plate 2.2 Representative photographs of Legumes

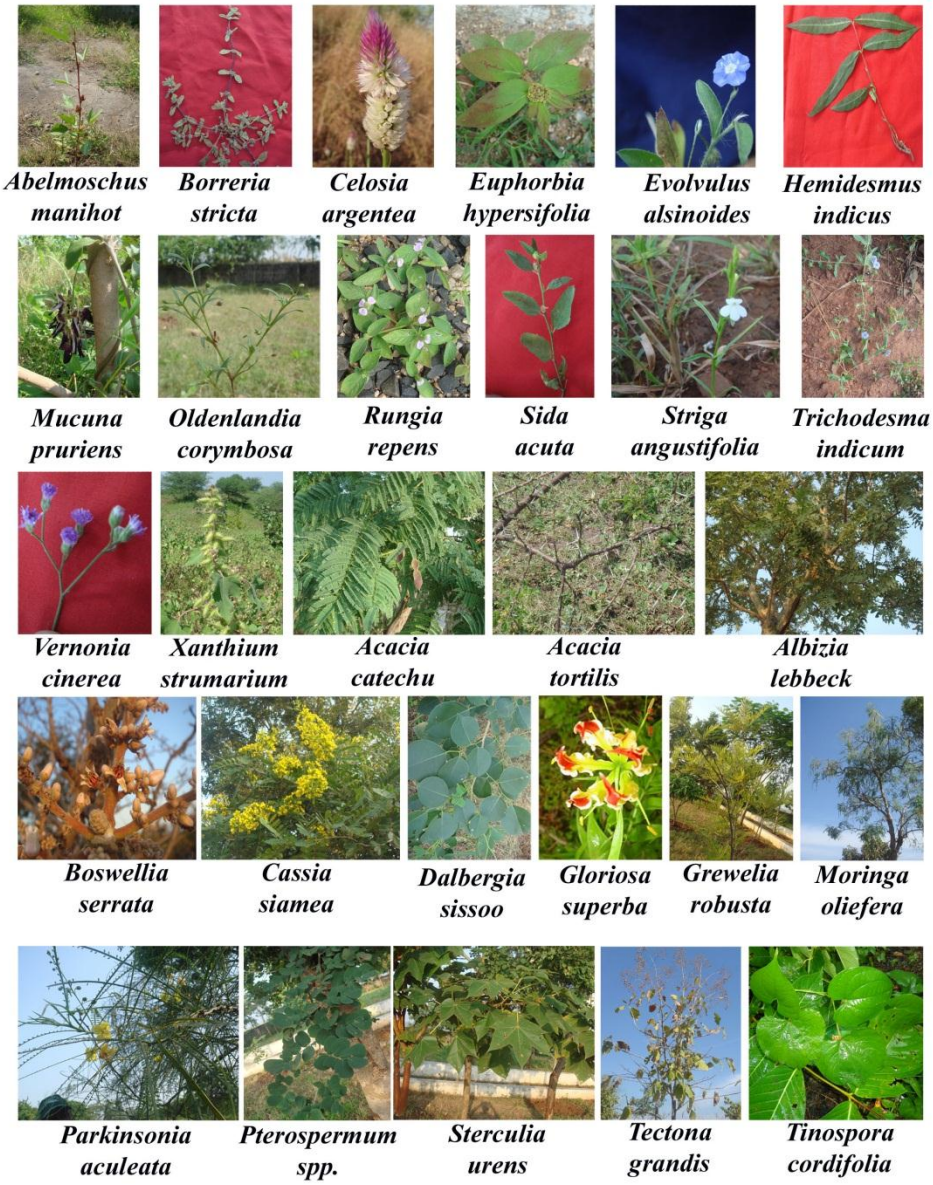


Plate 2.3 Representative photographs of Other plants

Sr. No.	Botanical Name	Local Name	Family	Specoes present at	
				Bandheli	Rampur
60	*Vicoa auriculata*	Sarpankho	Asteraceae	√	-
Climbers					
1	*Abrus precatorius* L.	Chanothi	Papilionaceae	-	√
2	*Cuscuta reflexa* Roxb.	Amarvel	Cuscutaceae	√	√
3	*Dioscorea oppositifolia* L.	Chairo	Dioscoreaceae	-	√
4	*Mucuna pruriens* Baker	Kuvech	Papilionaceae	-	√
5	*Teramnus labialis* (L. f.) Spr.	-	Papilionaceae	-	√
6	*Tinospora cordifolia* (Willd) Miers	Gado	Menispermaceae	√	√
7	*Gloriosa superba* L.	Kankasani	Liliaceae	√	-
8	*Cryptolepis buchananii* Roem. and Schult.	-	Asclepiadaceae	√	-
9	*Hemidesmus indicus* (L.) R. Br.	-	Asclepiadaceae	√	-

The climate is characterized by hot summer and general dryness, except in the monsoon season and annual rainfall in the area is ranging from 400–800 mm/annum as it is very irregular and erratic. The mean maximum temperature varies from 45°C to 46°C (April - May) and the mean minimum from 6°C to 8°C (November - December). Depending upon the environmental fluctuations; the monsoon strikes from the middle of June/July to the end of September which sometimes extends up to October. The present study area i.e. Bandheli and Rampur grasslands shows high biodiversity which was brought mainly due to specific habitat structure of the area, physical environments, different and unpredictable climatic conditions, competition between species and favorable nutrients for growth.

Table 2.6 Family-wise contribution to genera and species

Sr. No.	Bandheli			Rampur		
	Family	Genus	Species	Family	Genus	Species
1	Leguminosae	22	42	Leguminosae	31	59
2	Poaceae	28	39	Poaceae	34	52
3	Euphorbiaceae	5	9	Euphorbiaceae	6	10
4	Asteraceae	6	6	Rubiaceae	7	8
5	Rubiaceae	5	6	Acanthaceae	4	5

Sr. No.	Bandheli			Rampur		
	Family	**Genus**	**Species**	**Family**	**Genus**	**Species**
6	Acanthaceae	4	5	Asteraceae	5	5
7	Lamiaceae	3	5	Malvaceae	3	5
8	Malvaceae	2	5	Verbenaceae	5	5
9	Asclepiadaceae	3	4	Amaranthaceae	3	4
10	Verbenaceae	4	4	Moraceae	1	3
11	Amaranthaceae	2	3	Rhamnaceae	1	3
12	Liliaceae	3	3	Tiliaceae	2	3
13	Moraceae	1	3	Anacardiaceae	2	2
14	Rhamnaceae	1	3	Annonaceae	2	2
15	Anacardiaceae	2	2	Asclepiadaceae	1	2
16	Annonaceae	2	2	Capparaceae	2	2
17	Combretaceae	2	2	Convolvulaceae	2	2
18	Convolvulaceae	2	2	Solanaceae	2	2
19	Nyctaginaceae	2	2	Agavaceae	1	1
20	Rutaceae	2	2	Alangiaceae	1	1
21	Solanaceae	2	2	Apocynaceae	1	1
22	Agavaceae	1	1	Araceae	1	1
23	Alangiaceae	1	1	Bombacaceae	1	1
24	Bombacaceae	1	1	Boraginaceae	1	1
25	Boraginaceae	1	1	Burseraceae	1	1
26	Capparaceae	1	1	Celastraceae	1	1
27	Celastraceae	1	1	Combretaceae	1	1
28	Commelinaceae	1	1	Commelinaceae	1	1
29	Cuscutaceae	1	1	Cuscutaceae	1	1
30	Cyperaceae	1	1	Cyperaceae	1	1
31	Ebenaceae	1	1	Dioscoreaceae	1	1
32	Ehretiaceae	1	1	Ebenaceae	1	1
33	Gentianaceae	1	1	Ehretiaceae	1	1
34	Meliaceae	1	1	Eriocaulaceae	1	1
35	Menispermaceae	1	1	Gentianaceae	1	1
36	Moringaceae	1	1	Lamiaceae	1	1
37	Myrtaceae	1	1	Meliaceae	1	1
38	Oxalidaceae	1	1	Menispermaceae	1	1
39	Sapindaceae	1	1	Myrtaceae	1	1
40	Sapotaceae	1	1	Nyctaginaceae	1	1
41	Sterculiaceae	1	1	Orchidaceae	1	1

Sr. No.	Bandheli			Rampur		
	Family	Genus	Species	Family	Genus	Species
42	Tiliaceae	1	1	Oxalidaceae	1	1
43	Zygophyllaceae	1	1	Rutaceae	1	1
44				Sapindaceae	1	1
45				Sapotaceae	1	1
46				Scrophulariaceae	1	1
47				Typhaceae	1	1
Total		125	173		142	204

In Bandheli grassland, a total of 173 species were encountered that belong to 43 different families and 125 genera (Table 2.7). Leguminosae was the most dominant family (with 42 species) followed by Poaceae (with 32 species), Euphorbiaceae (with 9 species), Asteraceae and Rubiaceae (with 6 species). Likewise, at Rampur grassland, a total of 204 species were encountered that 47 belong to families and 142 genera (Table 2.7). Here also Leguminosae was the most dominant family (with 59 species) followed by Poaceae (with 52 species), Euphorbiaceae (with 10 species), Rubiaceae (with 8 species), Acanthaceae (with 5 species). The proportions of family to genera, family to species and genera to species were higher in Rampur grassland than the Bandheli grassland (Table 2.7).

Table 2.7 Ratio of species, genus and family

Grassland	Genus : Species	Family : Species	Family : Genus
Bandheli	125:173	43:173	43:125
Rampur	142:204	47:204	47:142

Phytosociological Studies

Studies were conducted to get a comprehensive picture of ecological status of different grass and legume species in the study area. At each site the plots were placed randomly. Herbaceous vegetation and grasses was analyzed using 1 m x 1 m randomly placed quadrats at the time of the peak cover. Each tiller of the grass

clump was considered as an individual plant. The important quantitative analysis such as density, frequency, and abundance of grasses and herbaceous legumes were determined as per Curtis and McIntosh (1950). Table 2.8 shows the values for quantitative characters of grasses and legumes only as these species are important for our study.

Table 2.8 Quantitative characters of Grasses and Legumes

Sr.		D		F (%)		A		Rd		Rf		Rdo		IVI	
No.	Botanical Name	B	R	B	R	B	R	B	R	B	R	B	R	B	R
1	*Alloteropsis cimicina*	3.05		25		12.50		5.30		1.95		0.82		8.07	
2	*Andropogon pumilus*		1.87		7		28.00		2.56		0.37		0.29		3.22
3	*Apluda mutica*	1.55	1.67	50	33	3.10	5.00	2.70	2.28	3.89	1.87	2.61	1.53	9.20	5.68
4	*Aristida adscensionis*	5.05	0.87	50	33	10.10	2.60	8.78	1.19	3.89	1.87	0.08	0.05	**12.75**	3.11
5	*Aristida funiculata*	1.45	1.20	35	20	4.14	6.00	2.52	1.64	2.72	1.12	0.04	0.02	5.29	2.78
	Arthraxon lanceolatus		0.53		7		8.00		0.73		0.37		0.08		1.19
6	*Bothriochloa pertusa*	3.55		25		14.20		6.17		1.95		0.29		8.41	
7	*Brachiaria eruciformis*		0.60		7		9.00		0.82		0.37		0.02		1.22
8	*Brachiaria reptans*		0.67		20		3.33		0.91		1.12		0.06		2.09
9	*Capillipedium huegelii*	0.40		10		4.00		0.70		0.78		0.58		2.06	
10	*Cenchrus ciliaris*	1.60		10		16.00		2.78		0.78		0.94		4.50	
11	*Cenchrus setigerus*		0.87		7		13.00		1.19		0.37		0.31		1.87
12	*Chionachne koenigii*		0.53		13		4.00		0.73		0.75		1.23		2.71
13	*Chloris barbata*	0.45	1.00	5	33	9.00	3.00	0.78	1.37	0.39	1.87	0.51	0.29	1.68	3.53
14	*Chloris virgate*		1.07		27		4.00		1.46		1.50		0.19		3.15
15	*Chrysopogon fulvus*		3.20		73		4.36		4.38		4.12		0.57		9.07
16	*Coix lachryma-jobi*		0.53		7		8.00		0.73		0.37		1.89		3.00
17	*Cymbopogon martinii*	4.95	4.73	65	87	7.62	5.46	8.61	6.48	5.06	4.87	1.78	0.96	**15.45**	**12.32**
18	*Cynodon dactylon*	2.20		70		3.14		3.83		5.45		0.38		9.66	
19	*Dactyaloctanium aegyptium*	0.75	1.00	25	20	3.00	5.00	1.30	1.37	1.95	1.12	0.21	0.28	3.46	2.78
20	*Desmostachya bipinnata*	1.15		30		3.83		2.00		2.33		0.45		4.79	
21	*Dichanthium annulatum*	0.75	2.07	35	87	2.14	2.38	1.30	2.83	2.72	4.87	0.64	0.84	4.67	8.54
22	*Dichanthium caricosum*		0.20		7		3.00		0.27		0.37		0.73		1.38
23	*Digitaria adscendens*	2.05	1.47	45	33	4.56	4.40	3.57	2.01	3.50	1.87	0.31	0.40	7.38	4.28
24	*Digitaria granularis*	1.20		25		4.80		2.09		1.95		0.21		4.24	
25	*Dinebra retroflexa*		0.53		13		4.00		0.73		0.75		0.09		1.57
26	*Echinochloa colonum*		1.67		73		2.27		2.28		4.12		0.22		6.62
27	*Echinochloa crusgalli*		0.67		47		1.43		0.91		2.62		0.22		3.76
28	*Eleusine indica*	0.30	0.73	15	3	2.00	5.50	0.52	1.00	1.17	0.75	0.27	0.13	1.96	1.89
29	*Eragrostiella bifaria*	1.00		25		4.00		1.74		1.95		0.38		4.07	

Sr. No.	Botanical Name	D		F (%)		A		Rd		Rf		Rdo		IVI	
		B	R	B	R	B	R	B	R	B	R	B	R	B	R
30	*Eragrostis ciliaris*		0.33		7		5.00		0.46		0.37		0.07		0.90
31	*Eragrostis unioloides*		0.53		7		8.00		0.73		0.37		0.08		1.18
32	*Eragrostis tremula*	0.40		10		4.00		0.70		0.78		0.18		1.65	
33	*Hackelochloa granularis*	1.25		40		3.13		2.17		3.11		0.13		5.42	
34	*Heteropogon contortus*	1.00	5.67	25	73	4.00	7.73	1.74	7.76	1.95	4.12	2.01	1.07	5.69	**12.95**
35	*Imperata cylindrica*	1.15		10		11.50		2.00		0.78		4.90		7.68	
36	*Ischaemum molle*		0.53		13		4.00		0.73		0.75		0.91		2.39
37	*Ischaemum pilosum*		1.00		7		15.00		1.37		0.37		0.76		3.87
38	*Ischaemum rugosum*		0.93		13		7.00		1.28		0.75		0.95		2.97
39	*Melanocenchris jacquemontii*	1.40	0.87	5	13	28.00	6.50	2.43	1.19	0.39	0.75	0.29	0.19	3.11	2.13
40	*Ophiorus exaltatus*		3.33		27		12.50		4.57		1.50		1.07		7.13
41	*Oropetium thomaeum*	0.75		5		15.00		1.30		0.39		0.08		1.77	
42	*Panicum antidotale*		0.27		7		4.00		0.37		0.37		0.22		0.96
43	*Panicum trypheron*	0.25	0.67	5	27	5.00	2.50	0.43	0.91	0.39	1.50	0.30	0.17	1.12	2.58
44	*Paspalidium flavidum*	0.50	0.80	20	27	2.50	3.00	0.87	1.10	1.56	1.50	0.40	0.15	2.83	2.74
45	*Pterotis indica*	0.70		10		7.00		1.22		0.78		0.41		2.41	
46	*Schoenefeldia gracilis*	0.80		15		5.33		1.39		1.17		0.59		3.15	
47	*Sehima ischaemoides*		0.40		13		3.00		0.55		0.75		0.22		1.52
48	*Sehima nervosum*		1.40		20		7.00		1.92		1.12		0.83		3.87
49	*Sehima sulcatum*		0.67		20		3.33		0.91		1.12		0.93		2.97
50	*Setaria glauca*	0.50	0.60	10	20	5.00	3.00	0.87	0.82	0.78	1.12	0.45	0.20	2.10	2.15
51	*Setaria tomentosa*		0.47		20		2.33		0.64		1.12		0.24		2.00
52	*Setaria verticillata*		0.33		7		5.00		0.46		0.37		0.23		1.06
53	*Sorghum halepense*		1.00		20		5.00		1.37		1.12		7.67		**10.16**
54	*Thelepogon elegans*		0.40		7		6.00		0.55		0.37		0.83		1.76
55	*Themeda cymbarica*	0.55	0.53	20	13	2.75	4.00	0.96	0.73	1.56	0.75	1.28	0.60	3.79	2.08
56	*Themeda laxa*		0.80		13		6.00		1.10		0.75		0.73		2.57
57	*Themeda triandra*	1.15	1.93	35	53	3.29	3.63	2.00	2.65	2.72	3.00	1.74	0.88	6.46	6.52
58	*Aeschynomene indica*	0.75	0.60	20	20	3.75	3.00	1.30	0.82	1.56	1.12	0.37	0.11	3.23	2.06
59	*Alysicarpus monilifer*	1.25	2.33	50	73	2.50	3.18	2.17	3.20	3.89	4.12	0.31	0.14	6.38	7.45
60	*Alysicarpus procumbens*	1.75		65		2.69		3.04		5.06		0.26		8.36	
61	*Alysicarpus vaginalis*	1.20	2.20	60	80	2.00	2.75	2.09	3.01	4.67	4.49	0.30	0.11	7.06	7.62
62	*Atylosia scarabaeoides*	1.00	1.00	35	53	2.86	1.88	1.74	1.37	2.72	3.00	0.38	0.19	4.85	4.56
63	*Cassia absus*	1.10		10		11.00		1.91		0.78		4.39		7.08	
64	*Cassia mimosoides*	-	1.00		33		3.00		1.37		1.87		0.66		3.90
65	*Cassia occidentalis*	0.15	0.33	10	20	1.50	1.67	0.26	0.46	0.78	1.12	12.49	7.86	**13.53**	9.44
66	*Cassia tora*	0.45	0.67	20	33	2.25	2.00	0.78	0.91	1.56	1.87	11.25	6.58	**13.59**	9.37
67	*Clitoria ternatea*	0.15		5		3.00		0.26		0.39		0.59		1.24	
68	*Crotalaria calycina*		0.67		13		5.00		0.91		0.75		1.02		2.68
69	*Crotalaria juncea*		0.93		20		4.67		1.28		1.12		1.67		4.08

Sr. No.	Botanical Name	D		F (%)		A		Rd		Rf		Rdo		IVI	
		B	R	B	R	B	R	B	R	B	R	B	R	B	R
70	*Crotalaria leptostachya*		1.00		27		3.75		1.37		1.50		1.21		4.07
71	*Crotalaria mysorensis*		0.67		13		5.00		0.91		0.75		0.74		2.40
72	*Crotalaria notonii*	0.30		5		6.00		0.52		0.39		1.70		2.61	
73	*Crotalaria orixensis*		2.60		67		3.90		3.56		3.75		0.55		7.86
74	*Crotalaria spectabilis*	0.80		25		3.20		1.39		1.95		2.80		6.14	
75	*Desmodium giganticum*		0.13		7		2.00		0.18		0.37		12.85		**13.41**
76	*Indigofera cordifolia*	1.60	1.00	50	40	3.20	2.50	2.78	1.37	3.89	2.25	2.62	1.33	9.30	4.95
77	*Indigofera echinata*	0.75	0.67	35	47	2.14	1.43	1.30	0.91	2.72	2.62	2.18	1.20	6.21	4.74
78	*Indigofera enneaphylla*		0.13		13		1.00		0.18		0.75		0.91		1.85
79	*Indigofera glandulosa*		0.53		7		8.00		0.73		0.37		1.83		2.94
80	*Indigofera hirsuta*	0.45		15		3.00		0.78		1.17		3.70		5.65	
81	*Indigofera linifolia*	0.20	2.13	15	13	1.33	16.00	0.35	2.92	1.17	0.75		2.17		5.84
82	*Indigofera tinctoria*	0.25		5		5.00		0.43		0.39		4.68		6.20	
83	*Rhynchosia minima*		0.47		20		2.33		0.64		1.12		0.90		2.66
84	*Sesbania aculeate*		0.13		7		2.00		0.18		0.37		12.71		**13.26**
85	*Sesbania sesban*		0.40		13		3.00		0.55		0.75		14.51		**15.81**
86	*Tephrosia purpurea*	0.25		20		1.25		0.43		1.56		10.80		**12.79**	
87	*Tephrosia villosa*	0.35		10		3.50		0.61		0.78		13.83		**15.22**	
88	*Zornia gibbosa*	2.90	2.27	75	67	3.87	3.40	5.04	3.11	5.84	3.75	2.34	1.33	**13.22**	8.18

Indices of similarity and dissimilarity were calculated by using formula as per Misra (1989) and Sorensen (1948) as follows:

Index of similarity (S) = 2C/A+B

Where, A = Number of species in the community A (Bandheli)

B = Number of species in the community B (Rampur)

C = Number of common species in both the communities.

Index of dissimilarity = 1 - S

Species richness, diversity and dominance indices

The **species richness** was calculated by using the method 'Margalef's index of richness' (Dmg) (Magurran, 1988).

Dmg = (S-1)/ In N

Where, S = Total number of species.

N = Total number of individuals.

Species diversity and dominance were evaluated by using the following methods. Shannon's diversity index and Simpson's index of dominance were calculated using important value index (IVI) of species.

(a) Shannon–Weaver (1963) index of diversity:

The formula for calculating the Shannon diversity index is

$H' = - \sum pi \ln pi$

Where,

H' = Shannon index of diversity

pi = the proportion of important value of the ith species (*pi* = ni / N, ni is the important value index of ith species and N is the important value index of all the species).

(b) Simpson (1949) index of Dominance:

Simpson's species diversity index was calculated using following formula:

$$D = \frac{\sum n (n - 1)}{N (N - 1)}$$

Where, D = diversity index

N = Total number of organisms of all species found

n = number of individuals of a particular species

As D increases, diversity decreases and Simpson's index was therefore usually expressed as 1 – D or 1/ D. A high D value suggests a stable and ancient site, while a low D value could suggest a polluted site, recent colonization or agricultural management.

Table 2.9 Top six species of studied grasslands

Grassland		Dominant species	IVI	Grassland		Dominant species	IVI
Bandheli	1	*Cymbopogon martinii*	15.45	Rampur	1	*Sesbania sesban*	15.81
	2	*Tephrosia villosa*	15.22		2	*Desmodium giganticum*	13.41
	3	*Cassia tora*	13.59		3	*Sesbania aculeata*	13.26
	4	*Cassia occidentalis*	13.53		4	*Heteropogon contortus*	12.95
	5	*Tephrosia purpurea*	12.79		5	*Cymbopogon martinii*	12.32
	6	*Aristida adscensionis*	12.75		6	*Sorghum halepense*	10.16

Table 2.10 Comparison of different indices

Index	Bandheli grassland	Rampur grassland
Index of similarity	0.64	
Index of dissimilarity	0.36	
Species richness	0.72	0.69
Simpson diversity index	0.52	0.48
Shannon–Weaver index	3.70	3.93

As we mentioned in introduction, both the grasslands shows that grazing affect their diversity, long-term heavy grazing by domestic livestock or native ungulates tends to reduce the number of plant by decreasing the higher-producing desirable plants and increasing low producing, often less desirable plants. This may results in shallow-rooted plants, lower herbage production, reduced water infiltration and increased soil surface temperatures. This results in decreased forage production and subsequent stocking rates. This long-term nonuse results in lower plant vigor and less plant diversity, often creating opportunities for invasive exotic plant species. Less plant diversity resulting from this invasion may reduce forage quality and production also.

Simpson index was higher for Bandheli grassland (0.52) i.e. =/> 0.5 infers clubby occurrence of dominant species while the same index of Rampur grassland is 0.48

(=/< 0.5) which infers somewhat gregarious occurrence of dominant species. Thus, in the Bandheli grassland few species were dominant (Table 2.10) which indicating lower stability of this grassland and the Rampur grassland seems more stable. This analysis of structure, species richness, species composition and species diversity of grasslands will serve as baseline for the area. IVI as a function of relative density, relative frequency and relative abundance was calculated to know dominance and association of species (Table 2.9) which also shows overall importance of each species. In both grasslands among top six species *Cymbopogon martinii* shows high IVI value which clearly says that this unpalatable species has conquered the area and its removal and suppression is essential for successful establishment of palatable species as well as for increasing species diversity specially in Bandheli area. Though at Rampur the dominance of *Heteropogon contortus* is also remarkable and if proper attention not given on the control of *Cymbopogon martinii,* the amount of other palatable species like *Heteropogon contortus* will also reduced.

Past research by Chapin et al., (2000) and Newmark, (2002) showed that the specific type of ecosystems is organized to support high species diversity and species richness in the setting where they evolved and these ecosystems lost their biodiversity in the succeeding years due to miss management. Thus, quantitative data on patterns of distribution and diversity of grasslands is necessary for conservation planning and sustainable utilization, Krishna et al., (2014). Documenting basic patterns of biodiversity is fundamental for prioritizing areas for conservation and management action. A basic pattern that ecologists and systematists attempt to address is the number of species occurring within a given area. To obtain the most accurate and comprehensive estimates, inventory field surveys are needed. Unfortunately, the expense and time required for such studies makes unrealistic to expect that all potential sites for biodiversity conservation can be inventoried in a timely fashion (Villasenor, J. et al., 2007).

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