



INVESTIGATION ON STUDY OF DENSITY, FREQUENCY AND ABUNDANCE OF GRASSES AND THEIR ROLE IN CARRYING CAPACITY OF GRASSLANDS FOR HERBIVORES IN TADOBA ANDHARI TIGER RESERVE MAHARASHTRA STATE

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ABSTRACT:

Grasses are naturally distributed in the grasslands of Tadoba Andhari Tiger Reserve , grasses variability with the change in soil texture and soil ecology , soil physical properties , landscape topography and water conducting capacity of soil. The important grasses reported from Tadoba Andhari Tiger Reserve are *Setaria pumilla* , *Setaria italica* , *Sorghum halpensis* , *Panicum scorbiculatum* , *Oryza rufipogon* , *Elusine indica* , *Panicum milliaceum* , *Paspalum canare* , *Panicum notatum* , *Paspalum Paspalodes* , *Panicum sumatrense* , *Saccharum spontanium* , *Sorghum contraversum* , *Sorghum deccanense* , *Urochloa panicoides*. *Themeda quadrivalvis* , *Heteropogon contortus* , *Dicanthium annulatum* , *Dimeria ornithopoda* , *Chrysopogon aciculatus* etc . Grasses identification , ecological study of grasses , density , frequency and abundance by ecological quadrat method calculated and studied . Grasses distribution and association play vital role in grasslands utility index study and to know the carrying capacity. These ecological parameters of grasses are useful for wildlife habitat management. Conservation of grasses by seeds collection and enrichment useful to maintain composition of grasslands in Protected Areas.

Keywords:- Density , Frequency and Abundance Grasses , TATR.

INTRODUCTION:

Grasses are one of the largest and most valuable groups of flowering plants, consisting of 610 genera and 10,000 species (Cope, 1982). Clayton and Renvoize (1986) put the total number of grasses in the world about 10,000 species, 651 genera were recognized and assigned numbers indicating their phylogenetic status based upon various evidences. It ranks third in number of genera after the Compositae and Orchidaceae and fifth in number of species after the Compositae, Orchidaceae, Leguminosae and Rubiaceae (Good, 1953). Grasses are widespread than any other family of flowering plants. The great adaptability of different species has enabled them to thrive under the most varied conditions. They form the climax vegetation of the semiarid prairies of the American continent, the steppes of

Asia and the savannas of Africa. Grasses exceed all other in the importance of its products. It provides food in the form of cereals for man and forage for most animals. Many species of native and introduced grasses are utilized in improved pastures (Salter, 1952).

A grass is taxonomically defined as any species within the large family (Gramineae or Poaceae) of monocotyledonous plants having narrow leaves, hollow stems, and clusters of very small, usually wind-pollinated flowers. Grasses include many varieties of plants grown for food, fodder, and ground cover (Grass 2014). Grasses are often confused with sedges (Cyperaceae family) The grass family is the fifth largest plant family on earth with over 700 genera and 9700 species. About ten percent of the grass species worldwide can be found in southern and tropical Africa; the

major genera of which are *Eragrostis*, *Pentascistis*, *Panicum*, *Sporobolus*, *Aristida*, *Digitaria*, *Stipagrotis*, *Setaria*, *Brachiaria*, and *Hyparrhenia* (Van Oudtshoorn 2009).

Evaluating a Grassland There are four main measures to evaluate a grassland: grazing value, ecological indicator status, succession stage, and perennially. Several factors that can help conservation managers determine whether their area is providing valuable grazing material. By identifying grass species in the area, grazing value can be determined. Grazing value is defined as the quality and quantity of material from an individual available for grazing (Van Oudtshoorn 2009).

Grasses inhabit the earth in greater abundance than any other comparable group of plants. Some are adapted to warm, humid and tropical climate while others are established in the polar regions, where the growing season is two months or less and direct sunlight is absent for many months of the year. Some are important elements of marsh and swamp vegetation, and other inhabit desert regions where the annual precipitation is 5 inches or less. Even before the time of recorded history, the grains of grasses provided a staple food supply for the human race (Gould, 1968). The members of this group are present in all the conceivable habitats, suitable for growth of plant communities (Mitra and Mukherjee, 2005). Grasses are used as forage for domesticated, wild animals and soil conservation (Gould, 1968).

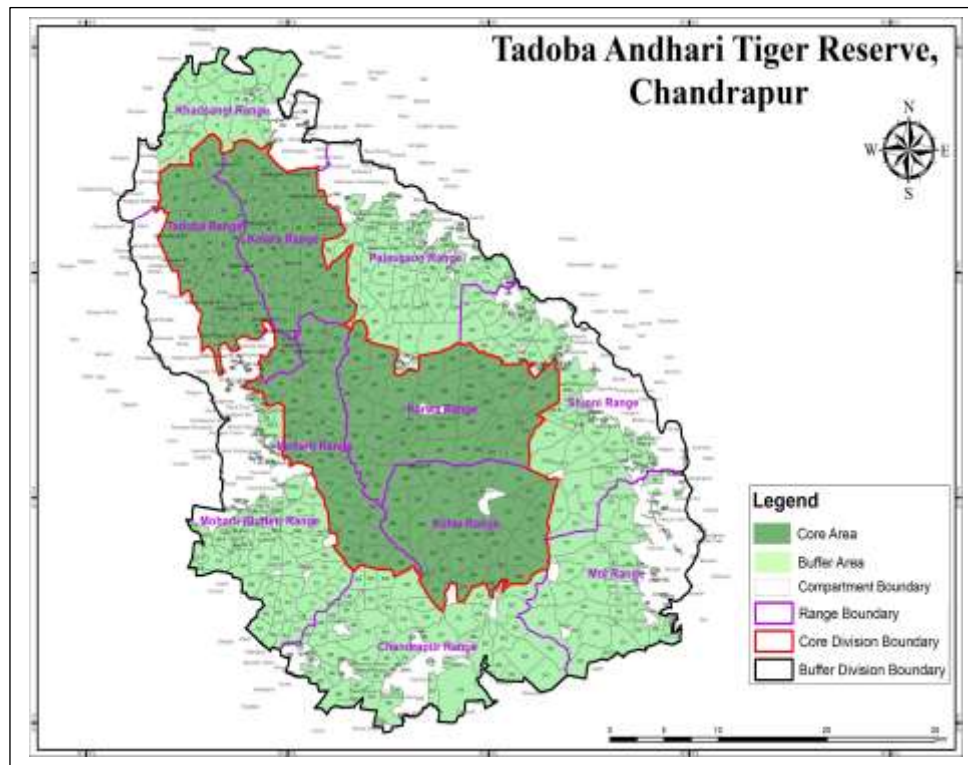
Tadoba Andhari Tiger Reserve Forest Diversity :

"Tadoba" is taken from the name of the god "Tadoba" or "Taru", worshipped by the tribes who live in the dense forests of the Tadoba and Andhari region, while "Andhari" refers to the Andhari river that meanders through the forest.

Tadoba Andhari Reserve is the largest national park in Maharashtra. The total area of the reserve is 625.4 square kilometres (241.5 sq mi). This includes Tadoba National Park, with an area of 116.55 square kilometres (45.00 sq mi) and Andhari Wildlife Sanctuary with an area of 508.85 square kilometres (196.47 sq mi). The reserve also includes 32.51 square kilometres (12.55 sq mi) of protected forest and 14.93 square kilometres (5.76 sq mi) of uncategorised land. Tadoba National Park and Andhari wildlife sanctuary together form the Tadoba-Andhari Tiger Reserve. The total area of the Tadoba-Andhari tiger reserve is about 1,727 km².

Tadoba National Park was established in the year of 1955. Total area of the park is 116.55 Km². The Andhari Wildlife Sanctuary was formed in the year 1986. Total area of the Andhari Wildlife Sanctuary is 508.85 Km².

Total core area of the tiger reserve is 625.40 Km². Total buffer area of the tiger reserve is 1101.60 Km². The reserve also includes 32.51 Km² of protected forest and 14.93 Km² of other areas.



The monsoon season begins in June; the area receives heavy rainfall during this season (approx.1275 mm) and humidity around 66-70%.

Tadoba Andhari Tiger Reserve is a predominantly Southern tropical dry deciduous forest with dense woodlands comprising about eighty seven per cent of the protected area. Teak is the predominant tree species. Other species include *ain*, *bija*, *dhauda*, *salai*, *semal* and *tendu*. *Beheda*, *hirda*, *mahua* *palas* (flame-of-the-forest, *Butea monosperma*) and *Lannea coromandelica* (wodier tree). *Axlewood* (*Anogeissus latifolia*, a fire-resistant species), *black plum* and *arjun* are some of the other tropical trees that grow in this reserve.

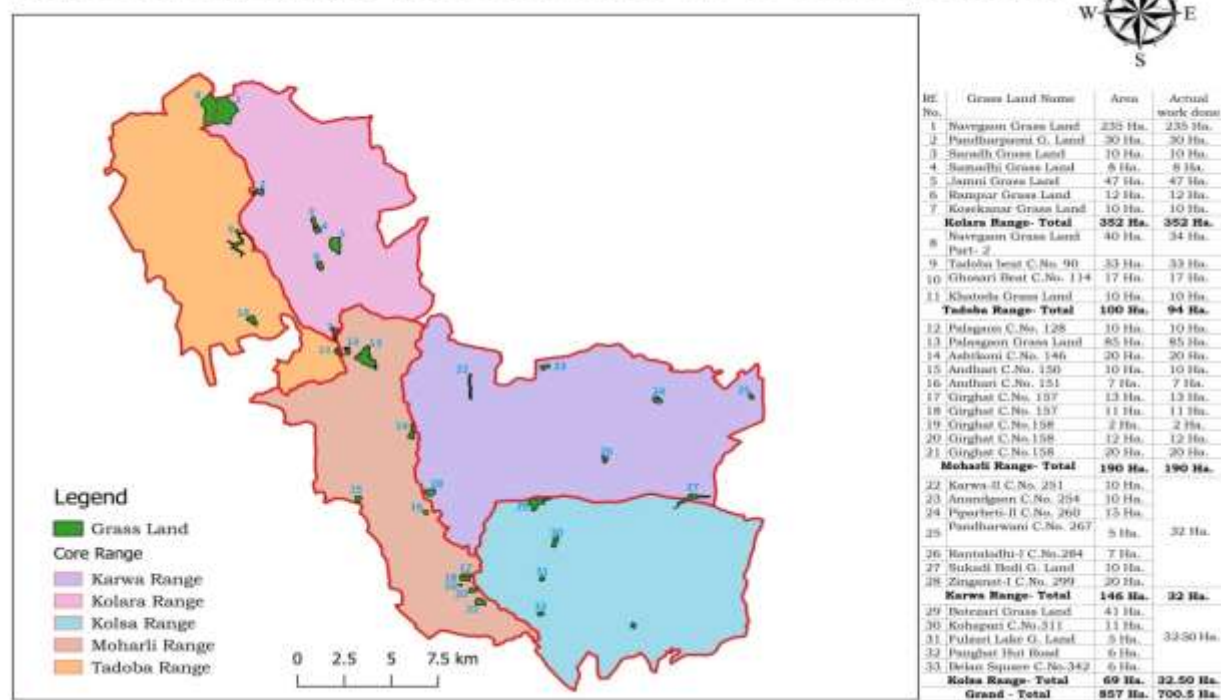
Poaceae is the one of the largest family among the monocotyledons in the world. The grass vegetation broadly divided into two types depending upon their life-span, Ephemeral vegetation consisting mainly of the grasses that

complete the life cycle during rainy season or after rainy season. Grasses autumn or long lived vegetation with species that grow with the rains but complete their life-cycle after rains. The species like *Arthraxon lancifolius* ,*Arundenella pumila*, *Sporobolus coromondelianus* , *Digitaria ternata*, are the chief components of farmers category. On the contrary the species like *Heteropogon contortus* , *Andropogon pumulus* , *Chrysopogon fulvus*, *Dicanthium caricosum* , *Setaria forbesiana* , *Pennisitum hohenackeri* which form the autumn vegetation are either perennial vegetation forming large tufts.

Tadoba-Andhari National Park/Coordinates
20.2484° N, 79.3607° E

Sr. No.	Name of grassland	Area in Hectares
Kolara Range grasslands		
1	Navegaon part 1 (Rehabilitated Site)	235 Hectare
2	Kosekanar	10 Hectare
3	Pandharpauni	30 Hectare
4	Jamni (Rehabilitated Site)	47 Hectare
5	Samadhi	08 Hectare
6	Rampur	12 Hactre
7	Saradh	10 Hectare
Tadoba Range Grasslands		
1	Navegaon part II	40 Hectare
2	Tadoba beat Comp. No. 90	33 Hectare
3	Khatoda	10 Hectare
Moharli Range Grasslands		
1	Palasgaon (Rehabilitated Site)	95 Hectare
2	Girghat	58 Hectare
3	Astkoni Com. No. 146	20 Hectare
Karwa Range		
1	Sukdobodi	10 Hectare
	Rantalodi	39. 41Hectare
Kolsa Range Grasslands		
1	Botezari	41 Hectare
2	Kohapari	11 Hectare
	Doni	65 Hectare
	Kolsa (Rehabilitated village)	150 Hectare

Map Showing Campa Work Year 2020- 21 in TATR Core area



OBJECTIVES :

- Identification and Enumeration of grasses .
- To identify the grasses in the field by observations and morphological study.
- To determine density, frequency and abundance grasses plants and its ecological significance in forest ecosystem.
- Ecological and morphological study of grasses
- Study role of grasses in wildlife habitat management.

METHODOLOGY

- To select the sites /area for the study of wild grasses plants present in forest and grasslands ecosystem.
- To arrange the regular field visits in three different seasons of the year, rainy season, Winter season and summer season.
- To observe the open grassland with special reference to phyto-sociology and ecological point of view.
- Grasses distribution and their ecological and environmental study.
- Ecological significance of grasses with reference to study community characters density , frequency and abundance by ecological quadrat method in forest ecosystem.
- Random sampling of grasses by Quadrat method

Recognising the morphology of plant species

By using regional, local and national floras, the data from the herbarium specimens, the accounts on morphological details, diagnostic characters and range of variation studied. The grasses plants are observed at different stages vegetative and reproductive stages of the plants. The roots are observed from morphological point of view, to study the role of grasses in forest

ecology and to modify the texture of soil. Observation of morphological characters under dissecting microscopes and magnifying lens. Study of root, stem , leaf and flowers morphology of the plants in specific season. Identification of grasses plants by using regional floras or national floras. Their identity requires a skill in systematic botany.

Study area : Core area grasslands of Tadoba Andhari Tiger Reserve .

1. Palasgaon grassland
2. Navegaon grassland
3. Jamni grassland
4. Pandhar pauni grassland
5. Botezari grassland.
6. Rantalodi rehabilitated village.

OBSERVATIONS:

Association between different grass taxa and wild leguminous plants

The grasslands of Tadoba Andhari Tiger Reserve are of three types smaller , intermediate and taller, most of the grasslands dominated by *Vetiveria zizanioides* , *Bothriochloa bladhi* , *Iselima laxum* . The grasses growing in sandy soil are *Themeda quadrivalvis* , *Chrysopogon aciculatus*, *Heteropogon contortus*. The grasslands are heterogeneous with good generic and species diversity with association of wild leguminous plants and some weeds species like *Hyptis suaveolens* , *Sida acuta* , *Sida cordifolia* , *Cassia tora* , *Alternanthera sessalis*, *Celosia argentea*

1.Telia Dam Grassland :

Cynodon Dactylon , *Panicum notatum* , *Vetiveria zizanioides*

2. Road side grasslands:

Chrysopogon aciculatus , *Themeda quadrivalvis* , *Heteropogon contortus*, *Dicanthium annulatum* , *Sporobolus* , *Eragrostis viscosa*

3. Near Khatoda gate grassland:

Iselima laxum , *Cynodon dactylon* , *Ischemum indicum* , *Bothriochloa bladhi*.

4. Palasgaon grassland

Heterogeneous grassland, intermediate type of grassland

Setaria pumilla, *Ischemum indicum*, *Ischemum rugosum*, *Panicum scorbiculatum*, *Paspalum flavedium*, *Cynodon dactylon*

5. Gaothan grassland : (Restored Grassland)

Themeda quadrivalvis, *Heteropogon contortus*, *Setaria pumilla*, *Elusine indica*

6. Hilltop grassland:

Chrysopogon aciculatus, *Themeda quadrivalvis*, *Heteropogon contortus*, *Dimeria ornithopoda*

7. Samadhi grassland:

Cynodon dactylon, *Vetiveria zizanioides*, *Ischemum indicum*

8. Jamni grassland:

Dicanthium annulatum, *Cynodon dactylon*, *Ischemum indicum*, *Elusine indica*

9. Gaothan grassland area :

Dicanthium annulatum, *Dicanthium caricosum*, *Elusine indica*, *Sporobolus indica*, *Eragrostis viscosa*, *Themeda quadrivalvis*, *Heteropogon contortus*, *Ischemum indicum*.

10. Pandharpauni grassland :

Dicanthium annulatum, *Chloris gayana*, *Chloris dolichostachya*, *Eragrostis viscosa*, *Sporobolus indica*, *Aristida hystrax*.

11. Pandharpauni grassland back side of lake :

Aristida hystrax, *Vetiveria zizanioides*, *Iselima laxum*, *Sporobolus paniculata*

12. Navegaon grassland :

Taller and intermediate type of grassland: *Iselima laxum*, *Cynodon dactylon*, *Panicum notatum*, *Panicum scorbiculatum*, *Eulalia trispicata*

13. Roadside grasses :

Themeda quadrivalvis, *Heteropogon contortus*, *Dicanthium annulatum*, *Sporobolus indica*, *Eragrostis viscosa*, *Elusine indica*, *Dactyloctenium aegyptium*.

14. Gaothan grassland (Restored Grassland)

Themeda quadrivalvis, *Heteropogon contortus*, *Saccharum spontaneum*, *Sacciolepis indica*

Wild leguminous plants association with grasses

Rhynchosia minima, *Rhynchosia maxima*, *Phaseolus radiata*, *Atylosia scorbioides*, *Vigna radiata* all these leguminous plants shows association with grasses in Navegaon grassland

15. Kolsa grassland :

Grassland dominated by *Ischemum indicum*, *Cynodon dactylon*, *Iselima laxum*

Roadside grasses association :

Themeda quadrivalvis, *Heteropogon contortus*, *Apluda mutica*, *Dicanthium annulatum*.

16. Gaothan grassland :

Setaria verticellata, *Setaria intermedia*, *Elusine indica*, *Chloris virgate*, *Digitaria stricta*.

17. Kolsa lake back water grassland :

Grassland perennial with dominance of *Cynodon dactylon*, *Vetiveria zizanioides* and Cyperaceae (Sedges)

18. Tadoba Lake grassland :

Amphiterrestrial, perennial grassland with composition of *Cynodon dactylon*, *Vetiveria zizanioides* and out side lake area *Chrysopogon*, *Themeda*, *Heteropogon*.

19. Rampur grassland :

Perennial grassland with composition of grasses like *Bothriochloa pertusa*, *Ischemum indicum*, *Vetiveria zizanioides*, *Dicanthium annulatum*, *Panicum notatum*.

20. Karwa Range Grasslands :

Taller type of grasslands dominated by *Aristida hystrax*, *Chrysopogon aciculatus*

In water body areas : *Vetiveria zizanioides* as a dominant grass.

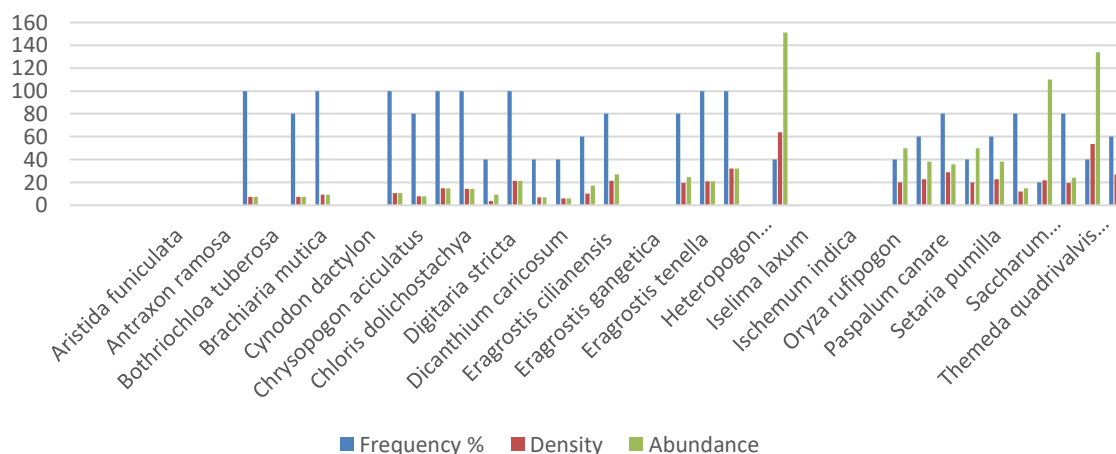
Wild relatives of grasses in grasslands of Tadoba Andhari Tiger Reserve :

Finger Millet (*Eleusine coracana* (L.) Gaertn.), Proso millet (*Panicum milaceum* (L.) and Little Millet (*Panicum Sumatrense* Roth. ex Roem et Schult.), Kodo Millet (*Paspalum scrobiculatum* L.) Kodo millet is locally called kodo kutki. Foxtail Millet (*Setaria italica* (L.) P.

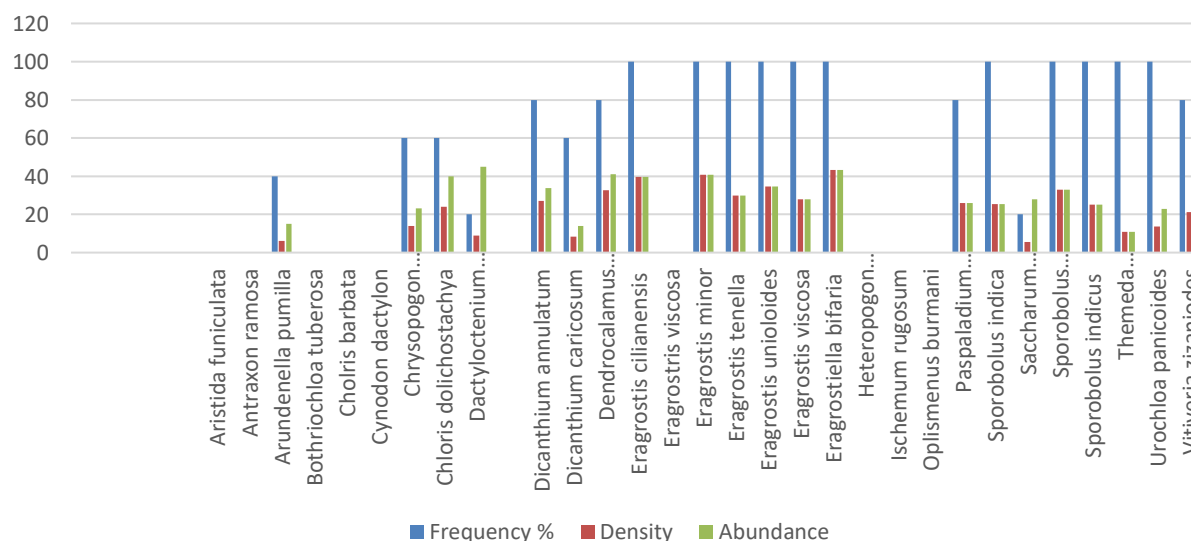
beauv) , Sugarcane (*Saccharum officinarum* L.), *Eleusine indica* (L) Gaertn. , *Oryza rufipogon* Griff. , *Panicum antidotale* Retz. , *Panicum maximum* Jacq. , *Saccharum*

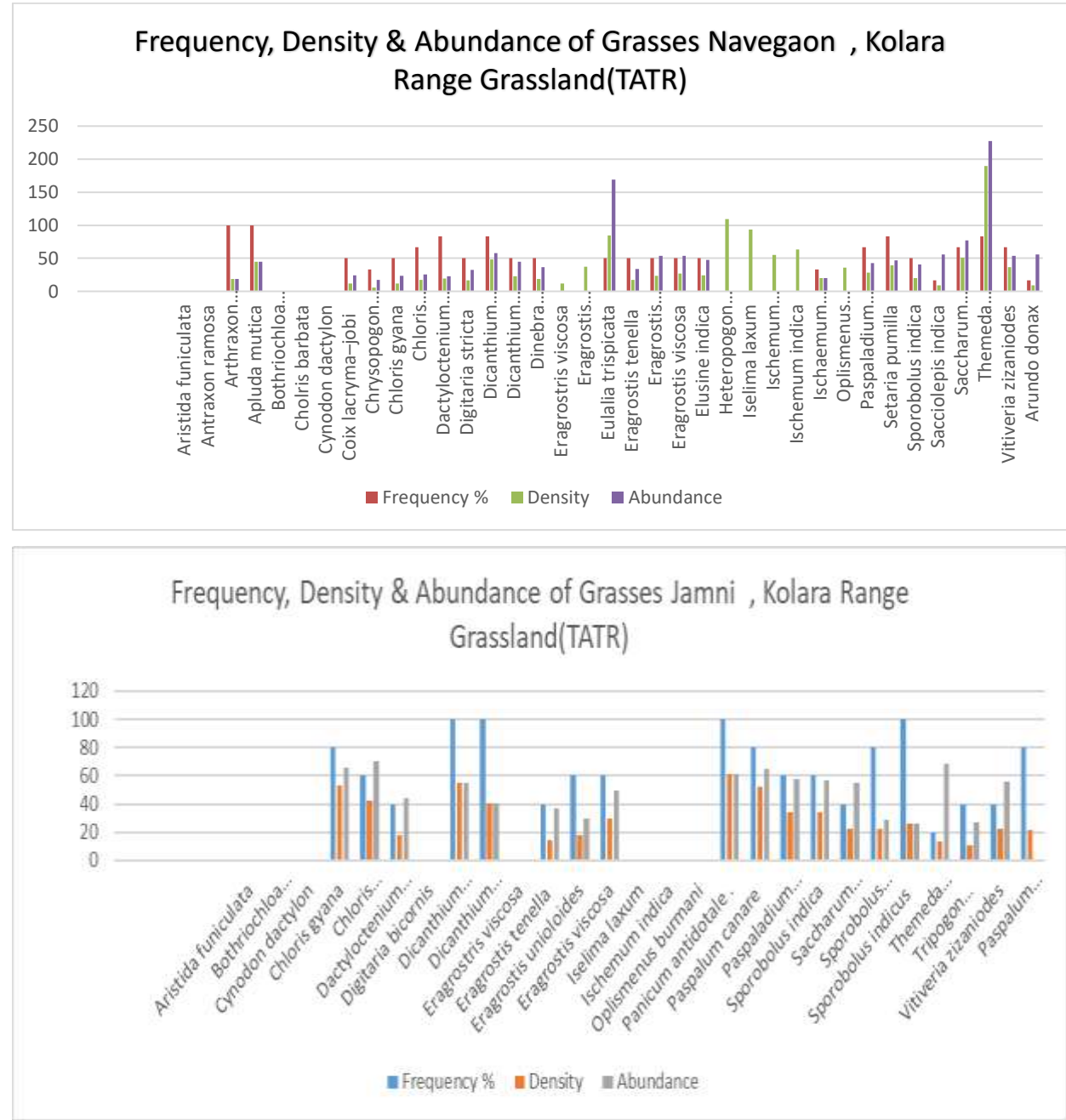
spontaneum L., *Setaria pumila* (Poir.) , *Setaria verticillata* (L.) P. , *Setaria italica* (L.) , *Sorghum halepense* (L.) .

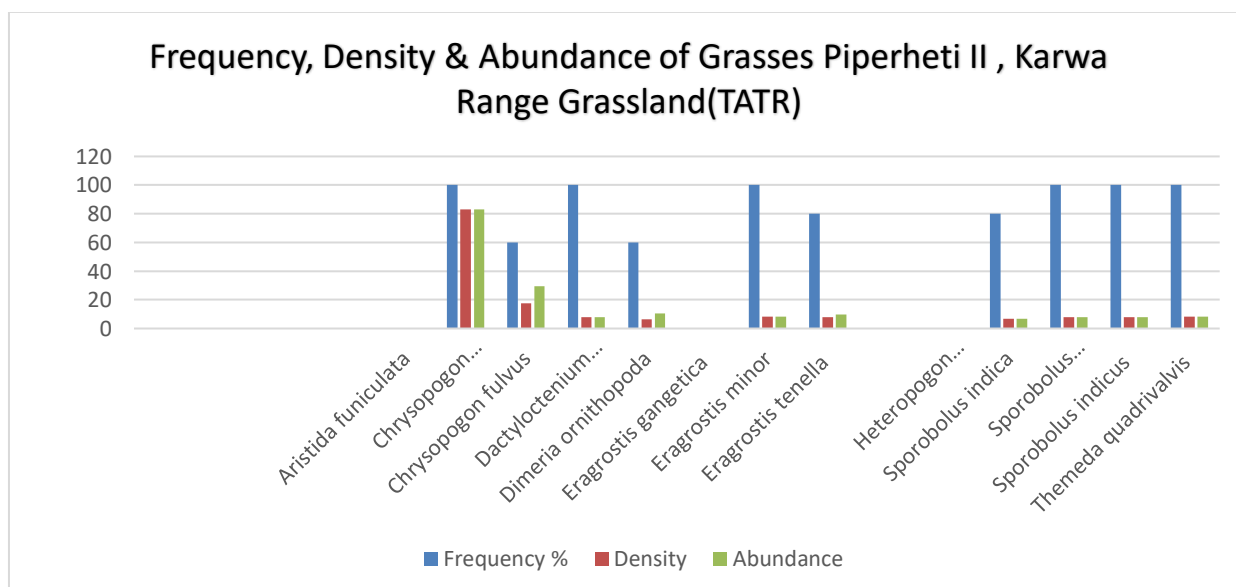
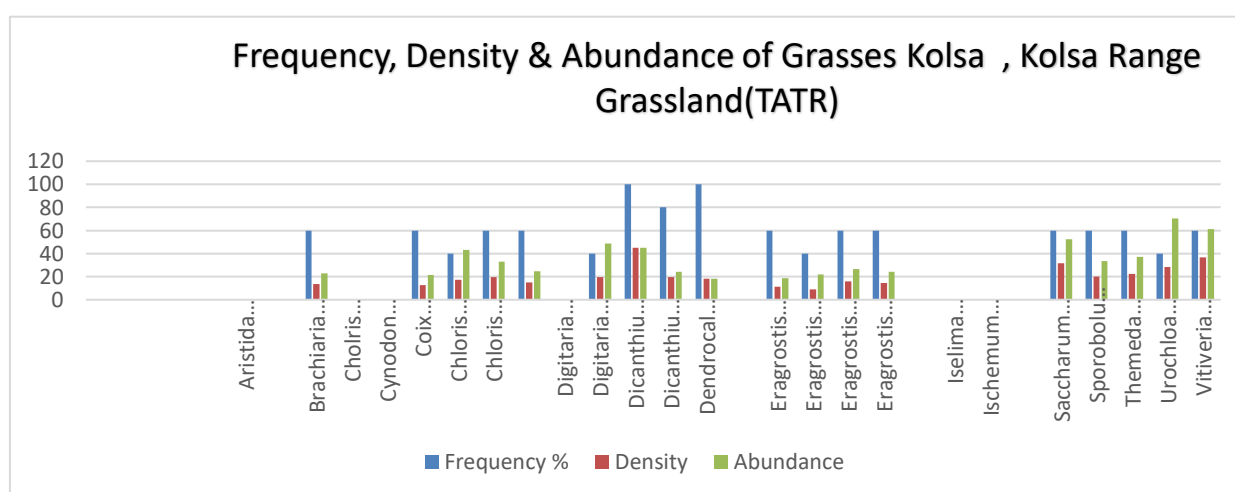
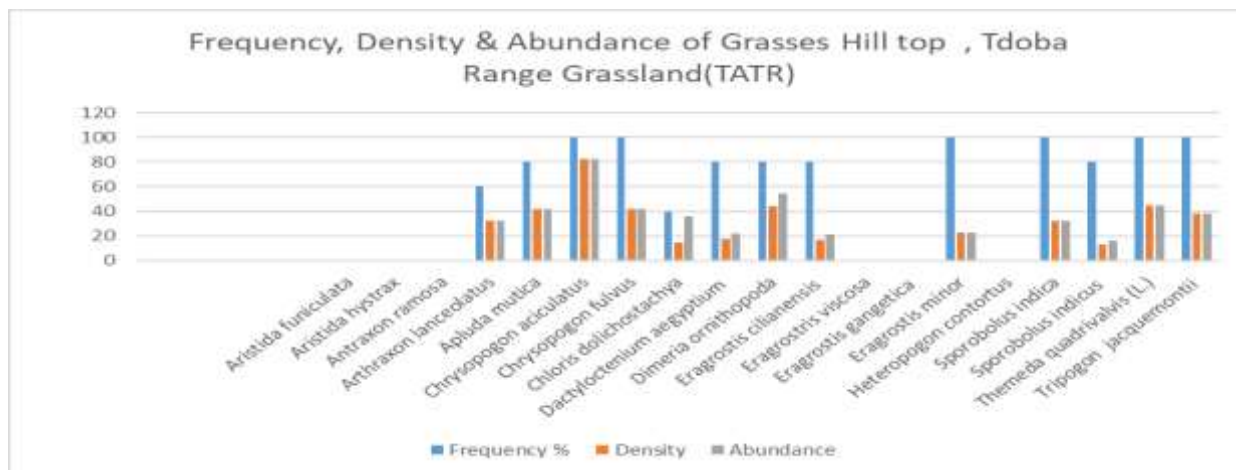
Frequency, Density & Abundance of Grasses Palasgaon , Mohrli Range Grassland(TATR)



Frequency, Density & Abundance of Grasses Pandharpauni , Kolar Range Grassland(TATR)







Density = total no. of individuals of grass species / total number of quadrat studied

Abundance = Total no. of individuals of grass species/ No. of quadrats in which species occurred

Frequency = $\frac{\text{Total no. of quadrats in which species occurred}}{\text{total number of quadrat studied}} \times 100$

RESULTS AND DISCUSSION :

Frequency of grasses :

- A) 1-20% : *Ischaemum rugosum* , *Oplismenus burmanii* , *Oplismenus compositus* , *Antraxon lamcifolia* , *Dimeria ornithopoda* , *Perotis indica* , *Sacciolepis indica* , *Melanocenchrus jacequmontii*
- B) 21 -40 % : *Ischaemum indicum* , *Iselima prostrata* , *Dicanthium annulatum* , *Dicanthium caricosum* , *Themeda triandra* , *Themeda laxa* , *Chloris dolichostachya* , *Eulalia trispicata*
- C) 41 -60% : *Themeda quadrivalvis* , *Iselima laxum* , *Cynodon dactylon* , *Setarisa pumilla* , *Chloris gyana* , *Chloris barbata*
- D) 61 – 80 % : *Aristida funiculata* , *Chrysopogon aciculatus* , *Dactyloctenium aegyptium* , *Eragrostis gangetica* , *Eragrostis minor* , *Eragrostis tenella* , *Heteropogon contortus* , *Sporobolus indica* , *Sporobolus coromandelianus* , *Sporobolus indicus* , *Vitiveria zizaniodes*.

Density of grasses :

High density of grasses : *Vetiveria zizanioides* , *Ischaemum indicum* , *Cynodon dactylon* , *Aristida hystrix* , *Chrysopogon aciculatus* , *Heteropogon contortus* , *Themeda quadrivalvis* , *Aristida funiculata* , *Chrysopogon aciculatus* , *Dactyloctenium aegyptium* , *Eragrostis gangetica* , *Eragrostis minor* , *Eragrostis tenella* , *Heteropogon contortus* , *Sporobolus indica* , *Sporobolus coromandelianus* , *Sporobolus indicus* , *Vitiveria zizaniodes*.

Low density grasses : *Ischaemum rugosum* , *Oplismenus burmanii* , *Oplismenus compositus* , *Antraxon lamcifolia* , *Dimeria ornithopoda* , *Perotis indica* , *Sacciolepis indica* , *Melanocenchrus jacequmontii*

Moderate density of grasses : *Ischaemum indicum* , *Iselima prostrata* , *Dicanthium annulatum* , *Dicanthium caricosum* , *Themeda*

triandra , *Themeda laxa* , *Chloris dolichostachya* , *Eulalia trispicata*

Abundant grasses of Tadoba Andhari Tiger Reserve : *Aristida funiculata* , *Chrysopogon aciculatus* , *Dicanthium annulatum* , *Cynodon dactylon* , *Panicum notatum* , *Panicum exacum* , *Setaria pumilla* , *Eragrostis gangetica* , *Eragrostis minor* , *Eragrostis tenella* , *Heteropogon contortus* , *Sporobolus indica* , *Sporobolus coromandelianus* , *Sporobolus indicus* , *Vitiveria zizaniodes*.

Role of fodder grasses density, frequency and abundance in wildlife habitat management:

- 1. Role of perennial grasses :** Perennial grasses are indicator of soil texture , colour , moisture , water holding capacity in soil and fertility of soil. Perennial grasses increases productivity of grassland , increases carrying capacity of grassland with reference soft feeder herbivores , useful for grazing habitat of herbivores , soil binding and control soil erosion. *Dicanthium annulatum* , *Vetiveria zizaniodes* , *Saccharum spontaneum* , *Cynodon dactylon* , *Imperata cylindrica* , *Aristida hystrix* , *Heteropogon contortus* , *Eulalia trispicata* , *Paspaladium favadium* , *Coix aquatica* , *Chloris gyana* , *Chloris dolichostachya* , *Elusine indica* , *Arundo donax* , *Dendrocalamus strictus* etc can be used to stabilize the degraded ecosystem. They have deep root system and capacity to grow in a variety of climates. These species helps soil structure by improving aeration, increasing water filtration and lowering soil erosion. Additionally, perennial grasses contribute to the enhancement of organic matter in the soil through biomass that decomposes over time, enriching the health of soil. The fibrous roots in association with

mycorrhizae improve the soil texture by exuding polysaccharides that stimulate microorganisms, which in turn exude the gum that aggregates soil particles. Thus, forming the water-stable soil aggregates, that leads to water infiltration and retention.

2. Soft palatable grasses species like *Iselima laxum*, *Dicanthium annulatum*, *Panicum notatum*, *Cynodon dactylon*, *Panicum exacum*, *Paspalum scorbiculatum*, *Iselima prostratum*, *Chloris barbata*, *Chloris virgata* etc used by soft fedder herbivore like Spotted deers, Barking deer, Sambhar deer, Chinkara, Chousinga etc. The course palatable grasses like *Themeda quadrivalvis*, *Heteropogon contortus*, *Saccharum spontanium*, *Chloris dolichostachya*, used by the couse feeder herbivores like Indian Gaur, Blue Bull etc. Tuberous and rhizomatous grasses used by wild boars. All taller grasses like *Vetiveria zizanioides*, *Sachharum spontanium*, *Sorghum halpense*, *Bothriochloa bladhi*, *Bothriochloa tuberosa*, *Arundo donax*, *Heteropogon contortus*, *Themeda quadrivalvis* play vital role for wild life habitat like breeding, nesting, hiding, resting in all seasons in Tiger Reserve area. The grasses like *Cynodon dactylon*, *Oplismenus compositus*, *Oplismenus burmanii*, *Iselima laxum* used by all wild animals for resting habitat.

CONSERVATION MEASURES :SOURCES

The adequacy of the conservation technologies in use is key to meeting the objectives of long-term conservation of genetic diversity:

- Preparation of inclusion plot of palatable grasses to conserve nutritional of grasses useful for wildlife habitat.

- The adequate long-term conservation of germplasm, preservation of essential forage biodiversity.

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