Tropical forests constitute the one of the most diverse plant communities on earth. These forests are disappearing at alarming state due to deforestation for extraction of wood, timber, medicines and other forest products. A forest ecosystem is one major ecological unit that exists as "home" for a community of either native or introduced classified organisms. The structural components of forest ecosystem are flora, fauna, microbes, soil and its environment. The Ecological investigation of Dry Tropical Forests of Aravalli hills at Udaipur and Bhilwara, Western India with special references to Tree diversity, Biomass and Nutrient dynamics.

In the present study ecological investigation of Dry Tropical Forests of Aravalli hills at Udaipur and Bhilwara, Western India with special references to Tree diversity, Biomass and Nutrient dynamics was carried out two study area (1) Tropical Dry Deciduous Mixed Forest (TDMF) and (2) Teak Dominant Forest (TDF) were studied out in relation to tree diversity, biomass and nutrient dynamics.

The tree species biodiversity data collected from both study area TDF and TDMF were studied for species distribution, stand density and basal area. The species diversity was calculated using the Shannon-Weiner diversity index; the concentration of dominance using Simpson dominance index; the Equability or Evenness index and the Species richness index were computed using the Margaleef’s index, the Species Heterogeneity index and the $\beta$- diversity index. The quantitative analysis of frequency, density, abundance, dominance and their relative values of density, frequency and basal area were calculated and summed up to get Importance Value Index (IVI).

The present findings revealed higher Tree diversity and stem density in TDMF than TDF. A total of 38 species, 33 genera belonging to 23 families and 728 individuals of trees were recorded in TDMF whereas 34 species, 31 genera belonging to 20 families and 458 individuals of trees were recorded in TDF. The TDMF is dominated by *Tectona grandis* and *Annona squamosa* and while TDF is dominated by *Tectona grandis* and *Acacia leucophloea*. The highest IVI for tree species was recorded for *Tectona grandis* in both TDMF and TDF.
For tree species diversity indices, the Simpson’s dominance index, the Equitability or Evenness index and the Species Heterogeneity index values were higher in TDMF whereas the Shannon-Wiener diversity index ($H'$), the Margalef’s species richness index and the $\beta$- diversity index values were higher in TDF. The higher values of the Margalef’s index and the Shannon-Weiner index represented higher biodiversity and higher value of the Simpson index indicated low diversity.

The TDF study area showed higher biomass than TDMF which may be due to stem density and age of forest. In both the study area higher biomass was observed in tree layer followed by shrub and herb layer. The biomass was divided in two parts above-ground and below-ground biomass. The above-ground biomass in tree layer was greater in bole wood followed by branch, bole bark, foliage and reproductive parts whereas in the below-ground biomass, stump root had higher biomass followed by lateral root and fine root.

In the shrub layer, the biomass values were in order stem < foliage < root. The regression coefficient was calculated for all above-ground and below-ground components of trees using different parts of the tree as variables (bole wood, bole bark, branch, foliage, reproductive parts, stump root, lateral root and fine root). The allometric equations were developed for estimation of shrub biomass (stem, foliage and root) on the basis of the basal diameter. The regression coefficient values of trees and shrubs for above and below ground components were significant at $p < 0.05$.

The higher forest floor biomass was observed in TDF than TDMF because of climatic conditions, age of forest, leaf size and species diversity. The variation of forest floor biomass in different seasons showed the following trend: winter > monsoon > summer. The total annual litter fall of TDF was found to be higher than TDMF.

The NPP (Net Primary Productivity) was higher in TDF than TDMF. The highest NPP was observed in above-ground components of the tree layer in the order: bole wood > branch > bole bark > foliage > reproductive part. The maximum NPP among the below-ground component was reported in stump root followed by lateral root and fine root. The NPP of herb layer was higher than shrub layer because NPP is directly proportional to biomass of herbs.
The Biomass Accumulation Ratio (BAR) was found higher in TDMF than TDF and it has been used to characterize the production efficiency study area. The highest BAR was detected in above-ground components in the order - bole wood > branch > bole bark > foliage > reproductive parts. In the below-ground components, highest BAR was observed in stump root > lateral root > fine root.

The pattern of plant nutrient concentration in different life forms was in the order: herbs > shrubs > trees. In the present study, the nutrient concentration was the highest in the reproductive parts followed by foliage, branch, bole bark and bole wood in above-ground components. In the below-ground components the order was: fine root > lateral root > stump root. In the shrub layer the maximum nutrient concentration was observed in foliage followed by stem and root. The greatest nutrient concentration was recorded in the above-ground parts followed by below-ground parts in the herb layer. The different nutrient concentrations were found in the order: N > Ca > K > Mg > P > Na in tree layer, shrub layer and herb layer in TDMF and TDF. The soil nutrient concentration was higher in 0-10 cm depth in both study area TDF and TDMF. The level of nutrients in a given soil is the net outcome of input to and output from the system. The soil organic matter and that deposited above it, with numerous constituents is acted upon by a variety of micro-organisms, transferring the nutrients contained in it to the soil.

In general, a greater proportion of nutrients occurred in the surface soil, reflecting the massive input of nutrients to the soil through the litter fall. The mean soil microbial biomass C, N and P at varying depths ranged from 869.4 to 883.3 μg g⁻¹; 88.2 to 97.5 μg g⁻¹ and 39.2 to 53.8 μg g⁻¹ in TDMF at 0-30 cm depth whereas 876.3 to 893.5μg g⁻¹; 78.8 to 93.2 μg g⁻¹ and 34.6 to 49.7 μg g⁻¹ at 0-30 cm depth in TDF. The soil microbial C, N and P value were found to be higher during the rainy season and lower during winter season.

The relative contribution to standing state of nutrients in tree layer, above-ground components was in the order: bole > branch > foliage > reproductive parts whereas the below-ground components was in order: stump root > lateral root > fine root. In the shrub layer, it followed the order as stem > foliage > root. The nutrient storage in tree layer, shrub layer and herb layer was reported as 92.85-95.57%; 2.70-4.19% and 1.73 - 3.26% for TDMF and 92.25 - 95.04%; 3.03 - 4.51% and 1.81 -
3.52% in TDF respectively. The nutrient content in different components differed considerably on account of variation in biomass and nutrient concentration. The standing state of nutrients in different components increased with an increase in their biomass and the role of concentration was minimized. The highest nutrient content values were recorded in TDF followed by TDMF.

Nutrient translocation process during the ageing of tissues is an important system for maintaining tree growth in infertile soil. The maximum nutrient retranslocation (Na, P and Ca) was reported in TDF whereas in TDMF N, K and Mg showed maximum retranslocation. Nutrients such as Phosphorus, Potassium, Magnesium and Sodium are absorbed more strongly by soils and are only present in small quantities in the soil solution. These nutrients move to the root by diffusion. Diffusion is a key process for uptake of the majority of the nutrients (P, K, Mg and Na) to roots. The nutrient uptake level in case of both study areas is different because of difference of nutrient availability in soil, floral diversity and climatic conditions. The retention value (i.e. return of nutrients and net nutrient uptake) influences the nutrient cycling of vegetation. The higher the retention value the greater the nutrient availability to the plant. Nutrients turnover time for standing vegetation reflects the rate of nutrient cycling in an ecosystem. In TDMF the maximum turnover time was recorded for Mg followed by Ca, N, K, Na and P while in TDF the highest turnover time recorded for Mg followed by N, Ca, K, Na and P.

Litter fall comprises of dead plant material including dry foliage, bark, twigs and reproductive parts. This dead organic material and its constituent nutrients are added to the layer of top soil, commonly known as the litter layer or O horizon.

In the present study, the maximum litter fall was observed in TDF followed by TDMF. The litter fall was markedly seasonal. The highest litter fall production was observed during the September to January. The non-leaf litter fall occurred almost throughout the year except in the month of June and July. However, the litter fall was markedly seasonal and more than two third litter fall was recorded in cool and dry period.

Net primary production and litter fall are intimately connected with each other. In every terrestrial ecosystem, the largest fraction of all net primary production is lost to herbivores and litter fall.
The turnover time for P and K was higher for both TDMF and TDF, and it was little longer than other elements. The Potassium (K) is soluble and is more rapidly leached from the organic matter, therefore, recycles faster than structurally bound elements like Ca, N, Mg, S and P which are sequestered and often immobilized by micro-organisms. The slower turnover of P and Na in the litter layer also appears to be due to re-translocation in the plant before senescence, thereby reducing the relative amounts of these nutrients in litter fall.

The nutrients most commonly limiting plant growth are N, P, K, Ca, Mg and Na. NUE depends on the ability to efficiently take up the nutrient from the soil, but also on mobilization, transport, storage, usage within the plant and the environment. The NUE of Mg was observed the highest and P was the lowest among the nutrients in TDMF whereas Na was the highest and N was the lowest among the nutrients in TDF.

In present study, litter weight loss and leaf litter decomposition rate was observed for a period of one year and these values were different for both study areas i.e. TDF and TDMF. The biomass remained after one year was higher in TDF and lower in TDMF. The leaf litter showed a slow loss in the initial period of incubation (January to May), rapid loss during intermediate phase (June to mid August) and again gradual loss during the end of the year (mid August to December).

In the present study TDF showed good productivity and nutrient dynamics followed by TDMF. In TDF the annual increment rate of above-ground biomass, litter fall production, rate of litter decomposition and soil fertility were higher than TDMF. This might be due to soil fertility and floral diversity in TDF. This enabled the rate of nutrient dynamics and mineral element fluxes for TDF to be faster than TDMF. However, much variation was not recorded between two study area which might be due to the fact that TDF was well maintained man made forest plantation ecosystem whereas TDMF was natural forest ecosystem. In the present study both the study sites TDF and TDMF produced good results in terms of Tree diversity, Biomass production, Nutrient dynamics and litter decomposition than other dry tropical forests.