4. MATERIAL AND METHODS

The site of this study was Milnag forest. In the present study of forest ground vegetation, after preliminary observations it was found that the methods applicable in the grassland and meadow (Gupta 1979) studies were useful and the same were followed. For the extensive study of productivity and nutrient structure open slopes, natural forest openings and the footpaths were selected whereas for the structure and phytosociology of the ground vegetation the whole forest was considered. Field observations were carried out on monthly basis during the snow free period from March to November.

For the phytosociological studies like density and frequency, shape and size of the sample plot has been held important. For minimizing the variation amongst the sample plots, long and narrow plots are suitable, however, the size of the plot depends largely on the vegetation type. For herbaceous vegetation, the most common unit of sampling is 1 m² (Oдум 1960, Iwaki et al. 1964, Uliss 1966). The species area curve method (Goodall 1952, Josting 1956, Gupta 1979) was employed for the determination of size of the quadrat size of 1 m² was found suitable for the herbaceous species
whereas the shrubs could be well studied within $5 \text{ m}^2$ quadrats. The area for study of herbs and shrubs, $1 \text{ m}^2$ and $5 \text{ m}^2$ respectively, was laid with the help of four wooden pegs and long ropes. 40 to 60 quadrats were laid on each date of sampling. Separate quadrats were laid for herbs and shrubs. In each quadrat, the species were recorded for density, frequency and basal area which was obtained by actual count method (Misra 1968).

Curtis and McIntosh (1951) were followed in obtaining the importance Value index from the relative values of density, frequency and dominance of each species. Observations for the perennating organs were made in the field itself and life form and biological spectrum was obtained following Haunkiser (1934). Phenological pattern of all the species was obtained on the basis of observations made on each date of sampling. The three main phenophases studied were the beginning of vegetation growth, flowering, and senescence.

**BIOMASS AND PRODUCTIVITY.** For the biomass study, sampling pattern and methods depend on the type of vegetation to be studied. Various methods have been identified and used for the said studies. Size of the sampling plot is of great importance and is dependent on the type of vegetation to be studied. Various sizes of the sampling plots have been used for the biomass studies. The most common unit for sampling herbaceous communities is $1 \text{ m}^2$ (Odum 1960, Iwaki et al. 1964).
Quadrat sizes of 0.4 m² and 0.5 m² have also been used for the same studies (Pearsall and Newbould 1957, Gollay 1965, Billing and Bliss 1959, Weigert and Evans 1964, Chowdhary 1967, Gupta 1979).

In the present studies 25 cm² quadrats were selected for the biomass studies (Pearsall and Newbould 1957, Gollay 1965, Gupta 1979). The quadrats were laid randomly and the soil monoliths (30 cm deep beyond which generally the roots do not penetrate) were taken out. Four to six plots were laid at each spot randomly in the whole area of study.

The soil monoliths were soaked in water before the final washing. Clear and soil free underground parts were taken, after washing them continuously under the tap, for the estimation of below ground biomass. The washed plant material was carried to laboratory in polythene bags (Edwards 1965) for further sorting, which was done two to three days after collection.

The plant material was separated into two groups: dominants (species which were represented in greater numbers) and other species (species which were rare, species which could not be identified and saplings which were too young to be identified). Dominants were sorted out specieswise for further treatment, whereas the other species were kept as such. Mosses were separated and dried as a group but later on their values were added up with that of 'other species'. Plant material of dominants as well as that of 'other species'
was separated into different components, i.e., above ground live, above ground dead and underground parts. Above ground live included all the plant parts which stood above the ground and were live. Similarly, above ground dead included plant parts which stood attached to plant above the soil but were dead. Underground included all the parts which were below the soil including roots, rhizomes, etc. Litter was collected by the handpicking method from the 25 cm² quadrats. It was taken as a whole without any specieswise separation. All plant parts were oven dried at 80°C continuously for 24 hrs. till these gave a constant weight. The final dry weights were recorded for determining the production of biomass. Net production of all the components was determined following Wielgolaski (1972), Billore et al. (1975), Singh et al. (1975), and Gupta (1979). Turnover rates were evaluated after Dahlin & Kucera (1965). Annual increment of the plant matters were obtained by adding up all positive increments during the period of study.

**NUTRIENT STRUCTURE.** The dried plant material of different compartments was used for mineral analysis after obtaining biomass values. Plant material of dominants and other species was mixed together for mineral analysis but in different compartments of the vegetation i.e., aboveground live, above ground dead, underground and litter. These materials were analysed for major nutrients (nitrogen, phosphorus, potassium) only. The dried plant material was ground to powder in glass pestle and mortar and passed through 30 mesh screen before further analysis.
For the chemical analysis, 1 gm of powdered plant material was taken from each compartment and was subjected to digestion in triacid mixture of nitric, perchloric and sulphuric acid (Jackson 1967, Piper 1950, Allen 1974), in a ratio of 10 : 4 : 1. This digestion was done in 100 ml. Kjeldahl flask at a moderate heat. The digested material, after the appearance of white fumes, was cooled and filtered and filtrate was diluted to 100 cc in distilled water. Aliquots of this digestion were taken for the individual analysis.

Phosphorous was determined colourimetrically, using spectrocoel colourimeter, at 660 mu by the sulphomolybdate blue colour method (Jackson 1967). Potassium was determined by using digital flame photometer after making the requisite dilutions.

For the analysis of nitrogen, separate digestion was done in sulphuric acid only, using a catalyst mixture of copper sulphate + potassium sulphate + salicylic acid + selenium powder (Black 1965). The digested material was filtered and filtrate was diluted to 100 cc in volume with distilled water. Aliquots, from this digestion, were taken for determination of nitrogen by Microkjeldahl method (Misra 1968).