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Floristic composition and community types of Gedo Dry Evergreen Montane Forest, West Shewa, Ethiopia

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ABSTRACT

This study was conducted on Gedo Dry Evergreen Montane Forest in West Shewa Zone of Oromia National Regional State, 182–196 km west of Finfinne (Addis Ababa). The objective of the study was to determine floristic composition and community types of Gedo Forest. Systematic sampling method was used to collect vegetation data from 72 (20 m × 20 m) and subplots of 1 m × 1 m at the four corners and the center of the large quadrat for herbaceous plants. Vegetation classification was performed using PC-ORD software package. Hence four plant community types (clusters) were identified from the hierarchal cluster analysis using PC-ORD version 5 computer programme namely *Chionanthus mildbraedii-Olea capensis* subsp. *Macrocarpa*, *Brucea antidysenterica-Allophylus abyssinicus*, *Maesa lanceolata-Vernonia auriculifera-Olea europaea* subsp. *cuspidata*, *Gnidia glauca-Echinops macrochaetus-Olinia rochetiana* community types. Sorensen's similarity coefficient was used to detect similarities and dissimilarities among communities. Shannon-Wiener diversity index was applied to quantify species diversity and richness. A total of two hundred thirty five species of plants (herbs, shrubs, lianas and trees) were recorded. One hundred and forty of the species collected from sample plots were used for floristic analysis. The rest, 95, were collected out of sample plots but from the forest and used to describe the complete floristic list. Asteraceae is the most dominant family with 36 species in 24 genera followed by Fabaceae with 16 species in 14 genera and Lamiaceae with 16 species and 13 genera. Out of the plants identified in this study, 25 were endemic species which have been included in the preliminary list assessed for IUCN Red Data List. The forest was compared with five dry evergreen forests of Ethiopia which is vital for general conservation and management of the forests and particular to endemic species for the country's priority sites.

1. Introduction

Ethiopia is an important regional center for biological diversity due to its wide ranges of altitude, its great geographical diversity with high and rugged mountains, flat-topped plateaus and deep gorges, incised river valleys and rolling plains [7,27]. These helped the emergence of wide ranges of habitats that are suitable for the evolution and survival of various plant and animal species. As a result, the country is regarded as one of the most important countries in Africa with respect to endemism of plant and animal species in tropical Africa [5,10]. The Ethiopian flora is very heterogeneous and has many endemic species. The country possesses about 6000 species of higher plants, of which about 10% are endemic [14].

A substantial proportion of the Ethiopian highlands were once believed to have been covered by forests having wide coverage than at present, but have gradually been cleared [12]. Tamrat Bekele [23] remarked that the occurrence of isolated mature trees in farmlands and the patches of forests that are seen around church-yards and religious burial grounds indicate the presence of vast expanse of forests earlier. At the moment, most of the remaining forests of the country are confined to south and south-western parts of the country; however, nowadays the remnant forests in these areas are threatened by human activities [24].

Historical document indicated that Ethiopia had experienced substantial deforestation, soil degradation and an increase in the area of bare land over the years. The need for fuel wood, arable land and grazing areas have been indicated as the main causes of forest degradation; frequently leading to loss of forest cover and biodiversity, erosion, desertification and reduced water resources [8]. Deliberate fire and non-integrated investment activities are also reasons for the reduction of forests in Ethiopia. The high level of dependency of the local community on agriculture (>80%) and high rate of population growth [5,11,21,22] have also accelerated the problems. Gedo Forest is a dry evergreen montane forest that is found in the high lands of Shewa. It is one of National Forest

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Priority Areas with an area of about 10,000 ha [5]. The objectives of the study are to assess floristic compositions, analyze species diversity, identify community types and make phytogeographical comparisons of Gedo Forest with other related forests in Ethiopia.

2. Materials and methods

2.1. Description of the study area

2.1.1. Geographical location

Gedo Forest is located in Cheliya District, West Shewa Zone of Oromia National Regional State (Fig. 1). The northwestern part of the District is covered with hilly slopes and mountainous escarpments rising to an elevation of about 3060 m a.s.l. at Tullu Jarso Mountain [6]. The study area District lies approximately between latitudes 9°02′ and 9°01′N and longitudes 37°25′ and 37°16′E.

2.2. Methods

2.2.1. Sampling design

Vegetation data were collected from sample plots placed in transect lines, which are systematically laid. A total of 72 plots were laid along transect lines following the Braun-Blanquet approach of phytosociology as modified by van der Maarel [25]. Quaqrats of 20 m × 20 m (400 m^2) were laid at every 200 m along 12 transect lines, which are laid 300 m apart. Transects are used because they are considerable importance in the description of vegetative change along an environmental gradient, or in relation to some marked feature of topography. For the collection of herbaceous species, subplots of 1 m × 1 m at the four corners and the center of the large quadrat were laid.

2.2.2. Floristic data collection

All plant species including herbs, shrubs, lianas and trees in each quadrat were recorded. Additional plant species occurring outside quadrats, but inside the forest were also recorded only as 'present', but they were not used in the subsequent data analysis. The vernacular (local) names were used when available. In the study area, physiographic variables such as altitude, longitude, latitude and aspect were measured for each quadrat using altimeter, GPS, and compass respectively. The plant species collected were brought to the National Herbarium (ETH) of Addis Ababa University for identification.

2.2.3. Plant community analysis

Hierarchical cluster analysis (classification) was made using PC-ORD windows version 5 [16,17]. The analysis was based on the abundance of the species (number of individuals). The Relative Euclidean Distance (RED) measures using Ward's method was used. The Euclidean Distance was used because it eliminates the differences in total abundance among sample units; and the Ward's method was used because it minimizes the total within group mean of squares or residual sum of squares [26,17]. The identified groups were tested for the hypothesis of no difference between the groups using the multi-purpose permutation procedure (MRPP). Dufrene and Legendre's [4] method of calculating species indicator values was used to detect the value of different species for indicating environmental conditions.

2.2.4. Plant diversity analysis

Shannon-Wiener [20] index of species diversity was applied to quantify species diversity and richness. This method is one of the most widely used approaches in measuring the diversity of species. The two main techniques of measuring diversity are richness and evenness.

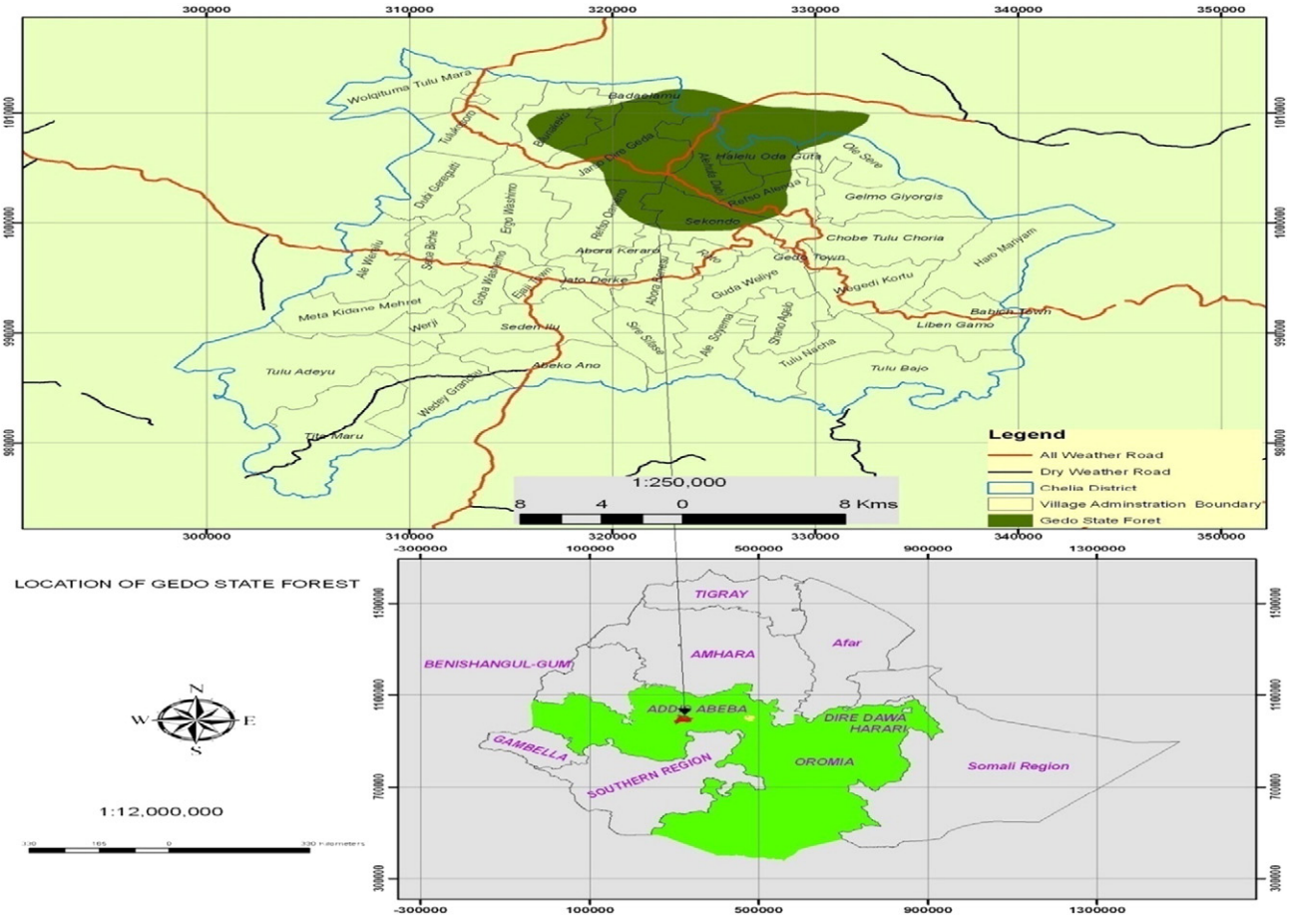

Fig. 1. Map of Ethiopia and the study area.