PLANT DIVERSITY AND NTFP MANAGEMENT IN THE COMMUNITY FORESTS OF *WAR* AREA, MEGHALAYA

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THESIS
SUBMITTED IN
FULFILMENT OF THE DEGREE OF
DOCTOR OF PHILOSOPHY IN ENVIRONMENTAL SCIENCE

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ABSTRACT

The present study on the, plant diversity and NTFP management in the community forests of *War* area, Meghalaya, is aimed at the analyzing the floristic richness and community structure and evaluating the effect of biotic disturbance on phyto diversity and certain ecological processes of the protected natural forests, agroforests and homegardens of Meghalaya. The study also inventorised the Non- Timber Forests Products (NTFPs) collected from the forests, agroforests and homegardens of the area with due emphasis on the value of these forest products in subsistence and cash income of the people maintaining these ecosystems.

The study was conducted in the southern part of Meghalaya commonly known as the *War* area, lying between 25º6'25"-25º18'29" N latitude and 91º57'38"-92º1'26" E longitude. It covers an area of about 1,350 sq. km. The maximum temperature (24ºC) was recorded in the months of May. The maximum rainfall was recorded in the month of July (3,208 mm) and minimum (3 mm) rainfall was recorded in the month of January. The relative humidity also showed similar patterns highest value was observed in the month of July (94%) and lowest in the month of January (58%). Cherrapunjee-Mawsynram Plateau one of the wettest places in the world is also located in this region. The altitude varies from 10 m (Shella) to 1,200 m (Pynursla) asl. The soil of the area is fertile and generally rich in humus. The important soil types are red loamy and alluvial soil. The slope of the area is towards the south and the angle of the slope varies between 10^0-40^0. The area has a large numbers of rivers and rivulets, which drain into the plains of Bangladesh. At times, narrow and deep river valleys separate one range from the other. The population density is sparse. Horticulture, forestry and fisheries are the principal occupation of the people. Agriculture is limited to some small valleys where mainly tuber crops are grown. Areca nut, orange, betel leaf, jack fruit, bay leaf, honey and broom grass are the important produce of the region. The area is inhabited by *War* Khasi people,

a tribal community having long tradition of forest conservation. People gather a variety of edibles from forests and water bodies which include fish, frog, crustaceans, mollusks, bushmeats, tubers and wild vegetables. Their staple diet is rice, fish and meat. The area is criss-crossed with a network of rivers and streams. People of this area are skilled in land based livelihood activities viz., agriculture, horticulture, forestry and fisheries. They collect process and market large variety of non-timber forest products and medicinal and aromatic plants such as *Cinnamomum tamala*, *Piper peepuloides*, *Phrynium capitatum*, bamboo, honey, mushrooms, nuts, tubers, edible worms, insects and leafy vegetables from the forests.

For plant diversity studies, extensive survey was carried out in the three primary forests viz., Raid shabong Law adong Pynursla, Law adong Saitbakon and Law adong Pongtung and three agroforests viz., Betel leaf agroforest of Nongkwai village, Betel nut agroforest of Mawriang village and Betel nut agroforest of Sohlong village in the southern part of Meghalaya (*War* area). The study was conducted during the months of January, 2004 to October, 2006. The study on homegardens and Non-Timber Forest Products was conducted in five villages namely Nongkwai, Mawriang, Umkrem, Nolikata and Ranikor village.

A total of 458 plants and 260 plants species were recorded in the primary forests and agroforests respectively. The total numbers of families recorded were 113 and 83 from the primary and agroforests stands. The total numbers of genera were 291 recorded from the primary forests and 199 genera from the agroforests. Stratification of the two forest types showed four distinct layers in the primary forests and five distinct layers were observed in the agroforests of *War* area, Meghalaya. A total of 147 tree species were recorded in the primary forests, while in the agroforests 125 tree species were identified. 57 tree species were common to both primary forests and agroforests. In general, the number of stems/ha was more in the primary forests as compared to the agroforests,

except *Areca catechu* which was cultivated and managed for its economic importance. Basal cover was higher in the primary forests as compared to the agroforests and all the tree species showed contagious horizontal distribution pattern in both forest types. The dominance distribution curve showed high equitability and low dominance in both the primary forests and agroforests. This shows that under similar agroclimatic conditions and similar management regime the dominant and co-dominant species may vary. In totality the Shannon and Wiener diversity index was higher in the primary forests as compared to the agroforests. A total of 87 and 30 shrubs species were recorded in the primary forests and agroforests respectively. Shrub density was significantly higher in primary forests the reason being in the agroforests periodic weeding was done and many undesirable were removed. The spatial distribution pattern and dominance distribution pattern of shrub species was similar to that of tree species. However, Shannon and Wiener diversity index for shrub species was higher in the primary forests than the agroforests, while Pielou's evenness index for shrub was more or less similar in both the primary forests and agroforests. The number of herbs species recorded was 114 species and 54 species from the primary forests and agroforests respectively. Unlike tree and shrubs the numbers of herbaceous species were more in the agroforests as compared to the primary forests. The distribution pattern of herb species showed a pattern of distribution similar to that of tree and shrub species. Shannon diversity index for herb species was higher in primary forests and Pielou evenness index was higher in agroforests. However, the dominance index showed reverse trend in the case of Shannon diversity index as well as Pielou evenness index. A total of 52 species of climbers including 9 liana species were identified in the primary forests. Whereas, in the agroforests, there were 18 species of climbers and no liana species was recorded in the agroforests because most of them were removed during cultivation. There were 60 species and 35 species of epiphytes in the primary forests and agroforests respectively.

A total of 216 plant species were recorded in the 150 homegardens studied. The number of families recorded was 78. The Simpson's index of dominance decreased with increase in diversity. The gross production of homegardens of the five villages of *War* area was Rs.19,69,671 of which Rs.6,88,442 (34.95%) was used for self consumption, and Rs.12, 81,229 (65.04%) was for sale. The average annual gross income from homegardens was Rs.3,514.58 per household and Rs.73,748.39 per hectare. The overall contribution of monetary income from homegardens to average household income was 7.02% which was comparable to the income of rural people of South Africa, Sri Lanka and South West and North-East Bangladesh.

The *War* community of Meghalaya collects many angiospermic plants, fungi and animal species from the forests for food, cash, medicine and fuel (charcoal and fuelwood). A total of 231 NTFPs (156 plants, 5 fungi and 65 animals) were recorded from the study area. Majority of NTFPs were collected for self consumption with only 50 (21%) of plant origin and 12 (18%) of animal origin were marketed. The distribution, habitat, production, density, marketing, policy and economic impact of three important marketable forest products viz., Bayleaf (*Cinnamomum tamala*), Wild Pepper (*Piper peepuloides*) and Packing Leaf (*Phrynium capitatum)* of *War* area was studied in detail. These plants, even though they grow wild in the forests but due to their high demand and availability of markets, people in these areas have domesticated them in their agroforests and homegardens along with other economically important plants. It has been found out that the annual gross income of the people in the respective studied villages was Rs.10,485/household from bayleaf, Rs.30,000/household from wild pepper and Rs.8,820/household from packing leaf. In term of percentage, Wild pepper contributed the highest percentage with 41.82% followed by bayleaf with 15% and packing leaf only 13.56 % of the total gross income of the people.

The study demonstrated that both in the natural and agroforests, plant species diversity is very high, with a variety of tree, shrub, herb, climber, liana and epiphyte species which form a tightly packed system. As a result of selective cultivation the agroforests showed lesser density of trees and shrubs. The basal cover also was less in the agroforest; however, the diversity was more or less the same. The over all pattern of forest community revealed that both the forest types have a highly heterogeneous distribution of plant species and can be considered as highly diverse forests. Homegardens contributed significantly to food supply as evident from high diversity of cultivated edible species. The benefits emanating from homegardens are important to the people because of low investment and easy accessibility. It provide *ex situ* as well as *in situ* conservation of plant genetic resources. The findings also revealed that forest resources contribute to the livelihood in many ways ranging from being a substantial source of food, materials, medicines and cash income. This study clearly showed that *War* community of Meghalaya are dependent on the forest for their food, medicine, shelter, fuel, bushmeat and above all the cash income. People also domesticate a large number of wild plant species which have high market demand. The domestication and cultivation of NTFPs was done so that people can produce them in larger quantity and also to protect these species from over exploitation from their natural habitat.

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