Chapter 3
Study sites

Location
The study was conducted in three traditional agroforestry systems in the foothills of Arunachal Pradesh and adjacent villages of Assam. The sites are located between 27°07' N latitude and 93°45' E longitude at an altitudinal range of 100-135 m asl. Politically, Assam with a total geographical area of 78,523 km$^2$ is distinctly divided into 25 districts with a human population of 2.3x10$^6$ (according to 2001 census), and Arunachal Pradesh, "the land of the rising sun" (83,743 km$^2$ with 16 districts) with thin population (10, 91,117) is the biggest area wise among the northeastern states of India. Arunachal Pradesh has been recognized as one of the 25 mega biodiversity "hotspots" in the world is situated in the extreme northeastern region of India (Myers et al., 2000). The state is having different linguistic, social, economic and cultural backgrounds live together in the same geographical region and therefore can rightly be called as "the land steeped in tradition and mosaic of colourful tribes".

After a preliminary reconnaissance, three villages (Table 3.1) practicing traditional agroforestry system viz. Doimukh and Nirjuli in the Papum Pare district of Arunachal Pradesh and Harmutty (about 4 km away from these sites in Arunachal Pradesh) of North Lakhimpur dist. of Assam were selected for the detailed study (Map 1). The average area of the agroforestry farms varied between 200-400 m$^2$ in Nirjuli and Doimukh and 320-490 m$^2$ in Harmutty.

The "Nyishi" community, one of the major tribes of Arunachal Pradesh with a Tibeto-Mongoloid stock inhabits Nirjuli and Doimukh. While the "Kalitas" inhabited in the small pockets of Harmutty have Caucasoid feature and are of Aryan origin. Such cultural differences have distinct characters in terms of management of traditional agricultural systems, including the traditional agroforestry.

Ethnic communities and their livelihoods
Arunachal Pradesh is the homeland of 25 major tribes and 110 sub-tribes with diverse dialects. There is no land use policy and hence the land ownership and the right of
Map 1. Location map of the study area.
individuals to use it are governed by local traditions or customs (Ronya, 1994). ‘Nyishi’ community is one of the major tribes with a Tibeto-Mongoloid stock inhabits Nirjuli and Doimukh of the hilly Papum Pare district. Traditionally, people practice shifting cultivation (locally called ‘jhum kheti’) and also a few farms under traditional agroforestry. The Nyishis believe in the existence of the Sun and the Moon (‘DONYI-POLO’ in Nyishi dialect). With this traditional belief, they perform festivals that are mainly agricultural-based. The major festivals include ‘NYOKUM-YULLU’ (festival for good harvest and social well-being) and ‘SIROM-MOLO-SICHUM’ celebrated during December is mainly related with future prosperity. The rice-pearl beer (locally called ‘APONG’) prepared from paddy and *Eleusine coracana* grain is a common drink for the community.

‘Kalita’ group dominates Harmutty village of Assam. The village is within 5-10 km radius from Nirjuli and Doimukh villages of Arunachal Pradesh. Here again, agriculture is the major occupation. Unlike the tribes of Arunachal Pradesh, the Kalitas are very religious and profess ‘VAISHNAVISM’ where they offer prayer in the local ‘NAMGHARS’. The main festivals celebrated by these people are ‘RONGALI BIHU’ mainly celebrated for a good agricultural harvest, ‘MAGH BIHU’ for all-out feasting and rejoicing and ‘BOHAGH BIHU’ in spring season is predominantly meant for agricultural Assamese society. During these festivals, the women-folk prepare various edible items which are mainly the plant products like rice cakes, vaporised sticky rice, etc. and feed to relatives, guests with milk, curd and bananas.

Climate

The sites are located in a tropical humid environment and experience 4 distinct seasons, namely, autumn (mid-October-December), winter (January-February), spring (March-April) and rainy (May-mid-October). The mean annual maximum and minimum temperature varies between 37° C and 12° C respectively. More than 80% of rainfall occurring during monsoon (June-September) registering about 60-80% relative humidity. However, the fact that occasional rainfall also occurs during winter season cannot be completely ruled out. A climatogram of the study area is given in Figure 3.2.
Figure 3.2 Climatogram of the study area (●Rainfall  ●Temperature  ○Humidity).

Geology

All the traditional agroforestry systems are part of a tropical forest and are located along the flood plains of mighty river Dikrong basin. Soils at the sites were sandy loam to loamy sand. Geologically, the parent rock exposed around Nirjuli and Doimukh area are consists of alluvium (newer and older terrace deposits respectively), represented by valley field deposits, mainly the sediments. In Harmutty area, the alluvium belonged to Pleistocene and recent times (Kumar, 1997).

Table 3.1. Location and history of study sites in different traditional agroforestry systems.

<table>
<thead>
<tr>
<th>Site</th>
<th>Ethnic groups</th>
<th>Altitude (m asl)</th>
<th>Longitude</th>
<th>Latitude</th>
<th>Geology</th>
<th>History of land use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harmutty</td>
<td>Kalitas</td>
<td>100</td>
<td>93°51' 23.80&quot;E</td>
<td>27°07'20.97&quot;N</td>
<td>Pleistocene</td>
<td>Agriculture</td>
</tr>
<tr>
<td>Nirjuli</td>
<td>Nyishis</td>
<td>120</td>
<td>93°44' 36&quot;E</td>
<td>27°08'30&quot;N</td>
<td>New terrace</td>
<td>Forest</td>
</tr>
<tr>
<td>Doimukh</td>
<td>Nyishis</td>
<td>135</td>
<td>93°45' 25.61&quot;E</td>
<td>27°09'44.84&quot;N</td>
<td>Older terrace</td>
<td>Jhuming</td>
</tr>
</tbody>
</table>
Brief history of traditional agroforestry

Agroforestry practice in tropics and sub-tropics is probably as old as agriculture itself, and it is considered as a way of life of traditional farmers, although research on it started only about 25 years ago. Agroforestry systems, a distinction is made between

Figure 3.3. Agroforestry pathway for shifting cultivation. Different agroforestry options open up for different stages in the main historical sequence of agricultural development. The R index shown on the left gives an approximate indication of the land use intensities corresponding to the stages shown on the right. \( R = \frac{C}{C+F} \times 100 \), where: \( C \) = cropping period and \( F \) = Fallow period. The R index is also equivalent to the percentage of land in cultivation. (Raintree and Warner 1986)

the age-old traditional agroforestry systems and agroforestry technologies that have been developed through formal scientific research. The possible evolution of traditional agroforestry, from a simple rotational sequence of temporal agroforestry to the intensive and complex multistory system, was described by Kang and Wilson (1987). A similar description of intensification of shifting cultivation is also given by Raintree and Warner (1986, Figure 3.3).
Most traditional agroforestry species and techniques have not yet been subjected to institutional scientific experiments. Nevertheless, they have been well tested by the local farmers of this region over the years. The traditional farmers have rich Traditional Ecological Knowledge (TEK) of the components in their agroforestry and also its interactions with local environment. The traditional agroforestry system can therefore act as a substitute to shifting cultivation in addition to promoting the preservation of high agrobiodiversity at intra-and inter-specific levels through mixed cropping systems.

Traditional agroforestry in and around Arunachal Pradesh have been evolved with time in response to population pressure and depletion/degradation of non-renewable resources. After the personnel interview with the villagers it can be illustrated that the agroforestry systems of Harumuty site was created from the paddy field that means the farmers of the site prepared their houses in the agricultural field and later they started agroforestry practice. In Nirjuli site it was originated from the forest land and the place was occupied for settled cultivation and started agroforestry, whereas the same tribe was doing shifting agriculture in the hilly land of Doimukh site, but due to the shortage of land they started settled cultivation i.e., agroforestry from last few years. The levels of productivity that can be achieved reflect the potential and the degree of the management of the resource base.

Various types of agroforestry
The people of the northeast India practice different agroforestry systems, which are generally dominated or predominated by specific plants. The agroforestry system of Harumuty site is generally arecanut based (Plate 3.1) whereas the arecanut plant is predominant in Nirjuli and Doimukh site. In Nirjuli site bamboo based systems were more, whereas some other plants like pineapple, arecanut, banana and timber plants were also predominate in agroforestry sites. Still we can say that Kalita community prefers arecanut plant and Nyishi prefer bamboo and timber plant in their agroforestry systems.
Plate 1. Traditional agroforestry systems of different ethnic groups.

*Agri-horti-silvi-pisci culture of Harmuty site*

*Agri-horti-silvi culture of Nirjuli site*

*Horti-silvi culture of Doimukh site*
Importance of selected study sites

The Nyishis and Kalitas were selected for the proposed study due to their cultural heritage. The Kalitas of Assam is one of the major tribes, which carries a lot of traditional knowledge of the Assamese and they are distinguished for their agricultural practice. The agroforestry/homegarden of Assam are well known all over the India and Kalita community is having immense contribution in this cultivation. They maintain a sustainable and economically sound agriculture system. Their system is also characterized by predominance of market-oriented cultivation methods (e.g. arecanut, banana, betel leaves etc.). On the other hand, the Nyishi is the most dominant tribe and can be considered as one of the traditionally rich tribe in the capital of Arunachal Pradesh. Though the village adjacent to the capital complex is involved in other source of income besides doing agroforestry, but still the remote villages are practicing shifting cultivation and agroforestry in a traditional way. So the traditional agroforestry systems of two villages one near the capital (Nirjuli village) and other far from the capital complex (Doimukh site) were selected for this study. The increasing attention is pragmatic in traditional ecological knowledge and practices embedded in the land use by the people live in the mountains of Arunachal Pradesh, where the soil is geologically young, highly leached and prone to frequent landslides and erosion in the hills and floods in the foot hills (Kumar, 1997). The jhum practice is more diverse in this region than any other part of the world, due to the diverse socio-cultural, socio-economic and socio-religious practices of over 100 tribes in the northeastern region (Ramakrishnan, 1993). The people of Doimukh village had been doing jhum, but now they divert themselves towards agroforestry. All these three sites have different altitudes, site characteristics, vegetational characteristics, etc. Though the sites selected for the present study carries remarkable identity for their agricultural pattern but no works yet done in this field.