GENERAL DISCUSSION
In the north-eastern hill region of India, shortening of the shifting agriculture cycle from a long 20-30 years to 4-5 years, has adversely affected the economic return to the farmer, apart from large-scale environmental degradation. An approach towards plantation/cash crop system and terrace cultivation has been suggested from time to time. In this context, the economic and energy efficiencies of tea, coffee, pineapple with other crops and terrace cultivation of ginger was evaluated. Coffee introduced into the region has not been successful, perhaps related to management practices. This aspect needs further investigation. Ginger cultivation which is economically profitable though is widely practised by tribals in the region needs heavy input of labour and fertilizer and therefore not very efficient from energy viewpoint. There is perhaps, possibility for efficient recycling of resources to reduce the input of inorganic fertilizers. Tea and pineapple along with other crops, both have higher energy efficiency, at the same time providing better returns to the farmer. However, tea cultivation does lesser
damage to the soil because of reduced disturbances. In any case, plantation/cash crops have the intrinsic advantage of reduced losses occurring through hydrology, compared to annual cropping under terraces or under shifting agriculture. Traditionally grown pineapple with other crops was found to be advantageous in that efficient recycling of crop residue along with weed biomass contributed substantially in conserving nutrients within the system. However, the long term sustainability of this cropping pattern is doubtful unless combined with strong agroforestry inputs.

Unlike most of the tribal communities of north-east India, the Apatanis of Arunachal Pradesh have evolved sedentary agriculture chiefly in the form of wet cultivation of rice in their extensive valley lands. Pisciculture along with rice cultivation not only improves the bioproductivity of the agroecosystem, but is also found to be highly efficient both from energy and economic points of view. A unique feature of the Apatani wet rice cultivation, is combining it with *Eleusine coracana* on the bund areas separating rice plots which traditionally in India are otherwise used as foot path for walking from one plot to another. In this way the Apatanis
maximize production per unit land. The rice agroecosystem is mainly labour intensive and depend upon tight recycling of organic wastes from within the village ecosystem. Bamboo gardens maintained around rice plots besides providing fuelwood and timber for village consumption, also provides cash income through export.

A comparative analysis of the village ecosystem study of the Apatanis and the hill Miris indicates that the former are far better organized than the lesser developed hill Miris who depend upon shifting agriculture. The Apatanis are not only self-sufficient in food production and consumption, but also produce surplus rice for export, unlike the hill Miris who are not self-sufficient and have to import rice.

Mithun (Bos frontalis), cattle, swine and poultry form the animal husbandry practices of these tribes. With lesser economic efficiency for shifting agriculture, the hill Miris emphasize upon animal husbandry and this sub-system of the village is more efficiently organized by them compared to the Apatanis. Therefore hill Miris are able to export meat to the neighbouring more affluent Apatanis and purchase excess rice produced by the latter.
Heavy fuel-wood consumption in both the tribes because of energy inefficient cooking stoves results in heavy dependence upon forest resources that are fast dwindling.

Even though Apatani rice cultivation is very sophisticated with high energy efficiency (1:78), provide high economic returns, further intensification through modern inputs in terms of cultivars and through winter cropping which is not done now, perhaps through mixed legumes/tuber crops is a possibility. Similarly the shifting agriculture of the hill Miris under a 7-year cycle could be further improved upon through more agroforestry inputs (Ramakrishnan, 1985c, 1987a). Better management practice for cattle and mithun, so that the waste resources from these two could be effectively utilized for agriculture, would ensure better land use management also. Better organisation of slaughtering regime for animals would ensure better returns to the farmer since some of the animals maintained are often not slaughtered for many years. These efforts combined with better organization of the domestic sub-system with appropriate rural technology inputs (Ramakrishnan, 1984a,b,c, 1985a) would ensure development based on ecological considerations.