

## CHAPTER IV

### FORMS AND FUNCTIONS OF AGROFORESTRY SYSTEMS IN THE STUDY AREA

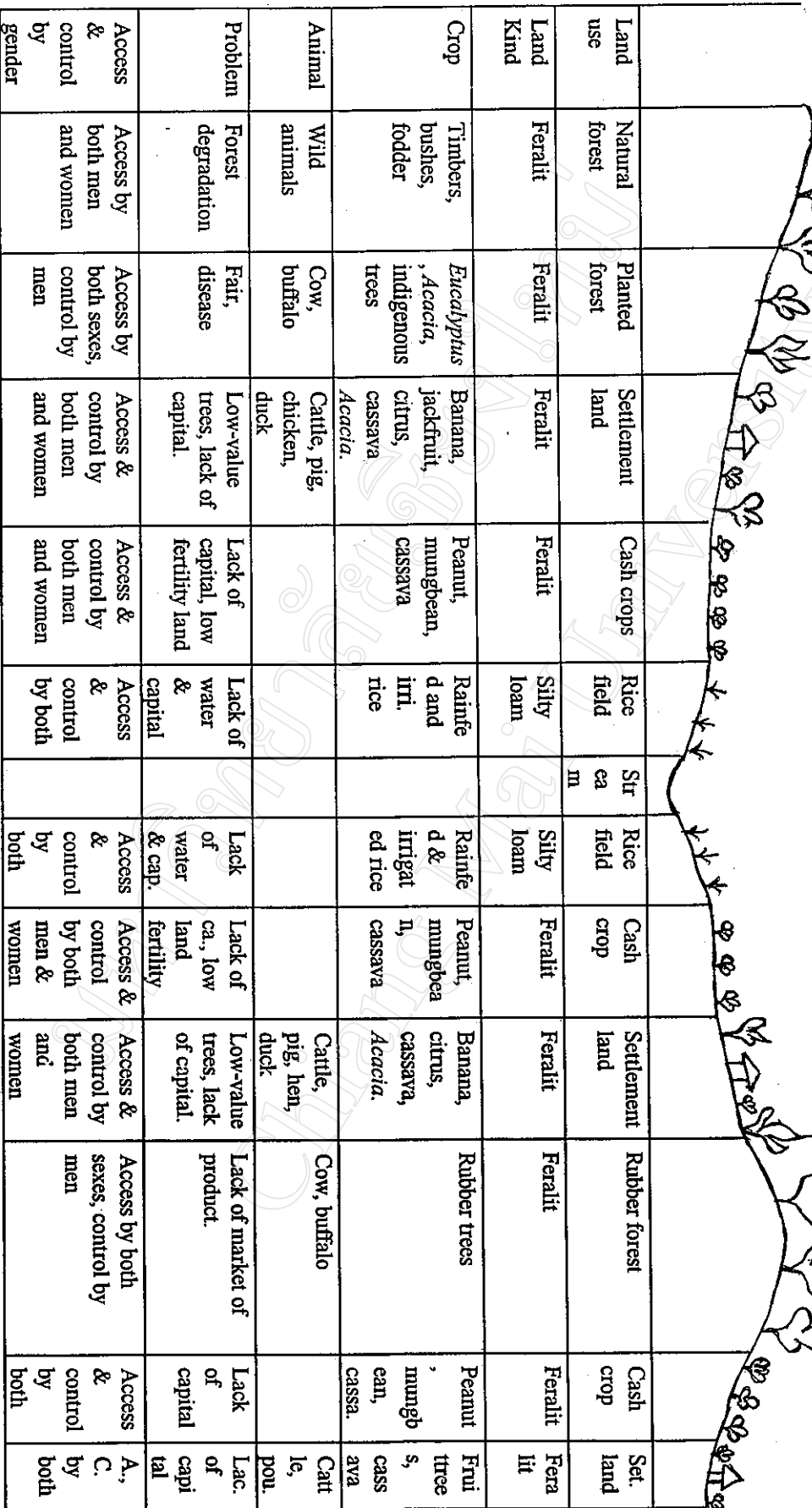
In order to understand what women or men often do in the production systems of Binh Dien commune of Huong Tra district, Thua Thien Hue province Vietnam, firstly we have to understand agroforestry systems of the region. Like many other upland areas in the mountainous and hilly regions of the north central coast of Vietnam, Binh Dien commune also has different forms of agroforestry systems. The transect in Figure 4.1 shows distinct forms of agroforestry system in the survey region. Each form of the system has its own function and there is an interrelationship among them (Figure 4.2). All forms of the system play important roles in maintaining the overall systems.

#### 4.1 Agroforestry systems of the survey area

##### 4.1.1 Cropping systems

Cropping systems in the region are very diverse. The food crops are lowland rice, mungbean, peanut, cassava, and sweet potato with some others such as taro, edible yam, etc. (Figure 4.3 and 4.4). Cassava is one of the principle crops with an average yield about 5 ta (1 ta = 0.1 ton) per sao (1sao = 500 m<sup>2</sup> = 0.05 ha). Although cassava is a low-value crop, it is still popular because it does not require high fertility soil, and its product can be used not only for pig raising but also for food, especially in poor households. The sweet potato cultivation area is small but it plays an important role in food subsistence because it can be used not only for food but also for vegetable. Rice paddy occupies a small portion of land. The areas cultivated for rice include bot rainfed land and irrigated land which is watered by small dikes.

Figure 4.1 The transect of Binh Dien commune



Land use	Natural forest	Planted forest	Settlement land	Cash crops	Rice field	Str ea m	Rice field	Cash crop	Settlement land	Rubber forest	Cash crop	Set. land
Land Kind	Feralit	Feralit	Feralit	Feralit	Silty loam		Silty loam	Feralit	Feralit	Feralit	Feralit	Feralit
Crop	Timbers, bushes, fodder	<i>Eucalyptus</i> , <i>Acacia</i> , indigenous trees	Banana, jackfruit, citrus, cassava <i>Acacia</i> .	Peanut, mungbean, CASSAVA	Rainfed and irri. rice		Rainfed & irrigated rice	Peanut, mungbean, cassava	Banana, citrus, cassava, <i>Acacia</i> .	Rubber trees	Peanut, mungbean, cassava.	Fruit trees, cassava
Animal	Wild animals	Cow, buffalo	Cattle, pig, chicken, duck						Cattle, pig, hen, duck	Cow, buffalo		Cattle, pig, pou.
Problem	Forest degradation	Fair, disease	Low-value trees, lack of capital.	Lack of capital, low fertility land	Lack of water & capital		Lack of water & cap.	Lack of ca. low land fertility	Low-value trees, lack of capital.	Lack of market of product.	Lack of capital	Lac. of capital
Access & control by gender	Access by both men and women	Access by both sexes, control by men	Access & control by both men and women	Access & control by both men and women	Access & control by both		Access & control by both	Access & control by both men & women	Access & control by both men and women	Access by both sexes, control by men	Access & control by both	A., C. by both

Source: PRA, 1998.

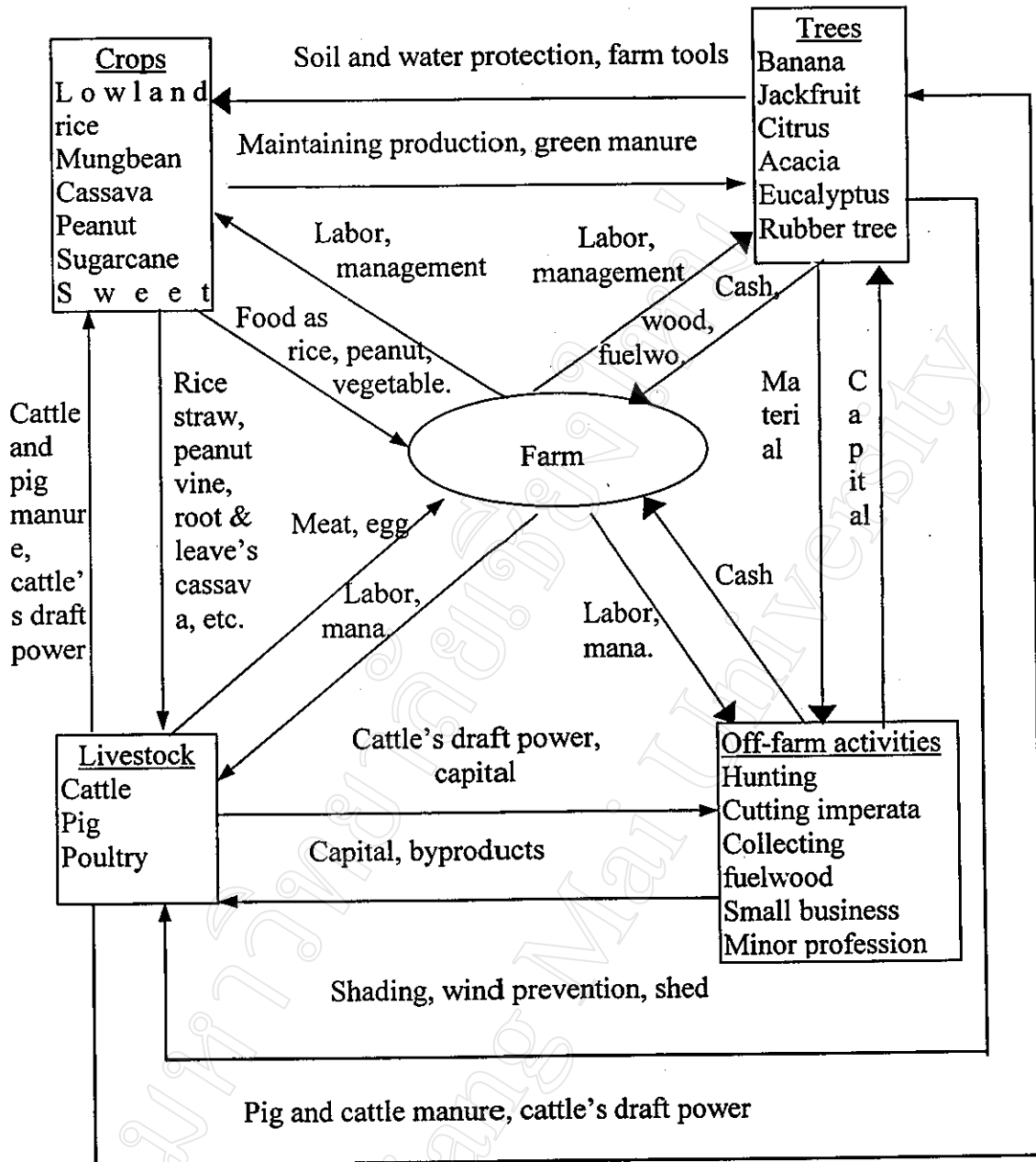
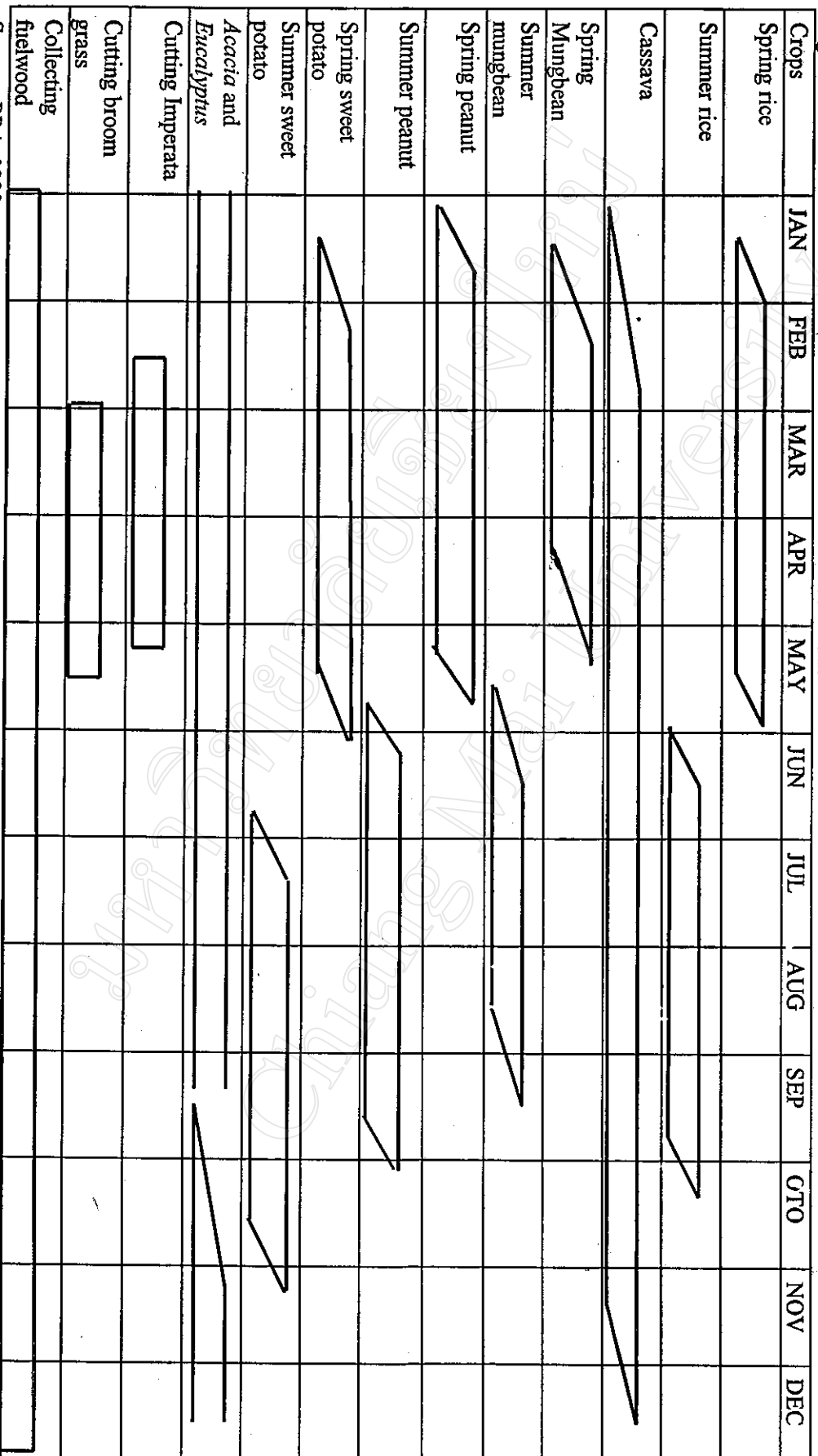
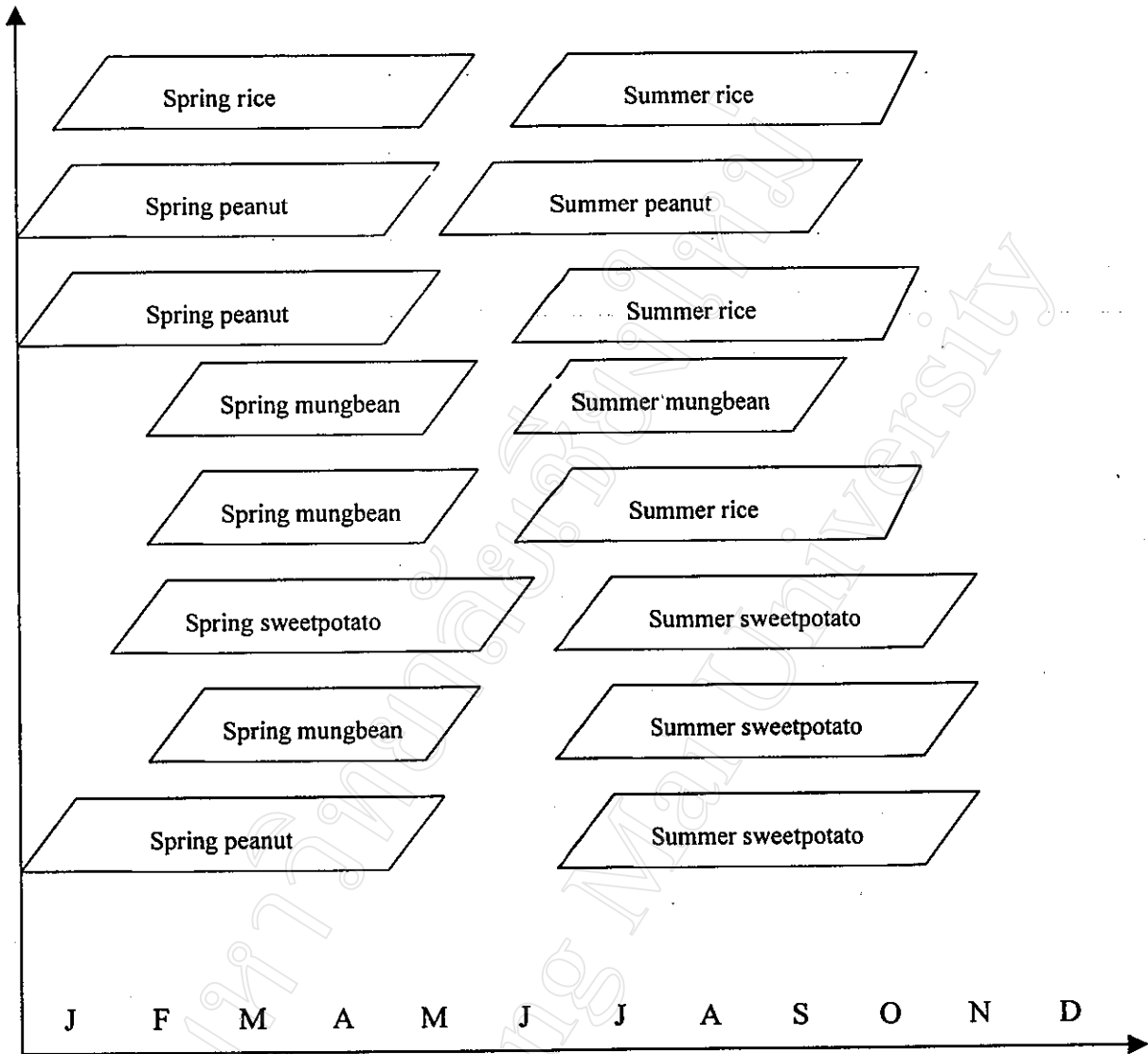


Figure 4.2 Agroforestry systems of the survey area

Figure 4.3 Production seasonal calendar of Binh Dien commune



Source: PRA, 1998.



Source: PRA, 1998.

Figure 4.4 Main cropping pattern in the survey area

Some years ago the local people planted upland rice by shifting-cultivation practices but now they have stopped because the Vietnamese government issued laws to prevent people practicing shifting-cultivation, in order to protect the remaining forests. Most areas which were planted for upland rice have been changed to forest trees. Rice output is used only for household' consumption, with an average grain yield of about 150 kg /sao/crop (1 sao = 500 m<sup>2</sup>). Mungbean and peanut are cash crops which are used not only in the family but are also traded for rice. Mungbean is popularly planted twice a year, and has an average yield of 25 kg per sao per crop; "Lang" and "Moc" are popular local mungbean varieties. Peanut and mungbean are planted not only on farmland and home garden but also under young rubber trees. The average yield of peanut in the region is about 50 kg per sao with "Giay" being the local variety popularly adopted. The area which is used for peanut cultivation is not large compared to the mungbean area, but peanut is recognized as high-value crop by local farmers. However, only high income farmers have a large peanut cultivation area and some households even plant two crops per year.

Industrial crops in the region are sugarcane, black pepper and some newly introduced crops such as cinnamon and rubber trees. Sugarcane with an average yield of 2.5 ton per sao is planted on farmland and home garden to supply material for a sugar factory. Most sugarcane areas were planted under the support of the Indian project. The black pepper area is not large and often belongs to high income households, but it contributes quite highly to the income of local farmers because of an increase in the price of dry black pepper in recent years. Cinnamon is another industrial crop which was introduced by farmers themselves only about 2 years ago, because some farmers saw the profits from this crop production in other regions. Rubber trees also have been newly introduced as an industrial crop which is planted by the funding of the "327" project of the Vietnamese government.

Major fruit trees in the surveyed area are banana, jackfruit, pineapple and some others such as citrus, mango, etc. Although they are not high value fruit trees, but they play an important role in generating income for the household in the region.

Major fruits such as banana, jackfruit and pineapple are used not only as fruit to supplement nutrition but also as vegetable. The cropping system in the commune is mainly a rain-fed and low-input system. The local farmers maintain soil fertility by applying manure and green manure for production of most crops and they rarely use insecticide

#### **4.1.2 Animal production system**

The animal production system is based mainly on the production of pigs, poultry and cows. The average number of pigs per household are 2 heads. Generally, the growth and weight of pigs at slaughtering time are not high, but the local people can make use of left-over food or byproducts of wine making and wild plants in the forests to feed their pigs. Poultry is the most widespread species of all domesticated animals in the region. Almost all households in the survey areas raise poultry. Chicken and duck production is used for meat and eggs, they are usually raised in the backyard of the local farmers' homestead as scavengers. The major poultry raised in the commune is hens, with 7-8 heads per household. Hens are raised on left-over food and crop residues, with disease control mainly by indigenous knowledge. Cows and buffaloes graze under the canopy of Acacia forests or waste land and in the evening they are often kept inside sheds which are constructed under the trees. There is a good development of cow production and it was recorded to be bringing high profit to the local farmers. However, cow raising requires a rather long business cycle and high capital, so poor households have hardly any cows because they have insufficient capital and can not gain access to credit. Cow production serves not only for draft power but also for trading, whilst buffalo production is limited and serves mainly for draft power.

#### **4.1.3 Forestry tree production system**

*Acacia auriculiformis*, *Acacia mangium* and *Eucalyptus camaldulensis* are forestry trees which are popularly planted, mainly under the PAM program which is

supported by a non-government organization. Those trees were planted not only on forestry land but also on farm land (especially around homegardens) as hedgerows to protect crops. Some years before, the local people liked planting *Eucalyptus* more than *Acacia* because the price of *Eucalyptus* wood in the market is higher than that of *Acacia*. However, at present *Acacia* (especially *Acacia mangium*) has been adopted to a greater extent because its growth is faster when compared to *Eucalyptus* so it can be harvested earlier and with higher wood biomes. Moreover, according to the local people, *Acacia* forest can improve soil fertility and can also be used for cattle grazing because wild grass species can be developed under the canopy of *acacia* forest. Furthermore, *Acacia* trees have many more branches so they could provide more fuelwood for years before harvesting. Planted forests in the region play an important role in terms of water resource and soil protection for crop production in the region and in Thua Thien Hue province in particular because the commune is located at the head of Huong river which is the biggest and the most important river of Thua Thien Hue province. Forestry production contributes to an increased income for the family in the long term, moreover, it also supplies fuelwood for the households.

#### **4.1.4 Off-farm activities**

Off-farm activities in the commune are rather diverse. They are hunting, logging, cutting *Imperata*, broom grass, small trading and collecting fuelwood. These activities are done mainly in slack time. The off-farm jobs play very important role not only in generating income for the local people but also in creating employment for the resource-poor farmers, especially for the young people.

## **4.2 Function and interrelationships of different components of agroforestry systems in the surveyed area**

In order to describing the functions of the different forms of agroforestry systems of the surveyed area and their interrelationship, the various forms of the agroforestry systems have been identified. Agroforestry systems in the survey region



are characterized by the integration of crops, livestock, trees (including natural forest), and off-farm activities. There is an interrelationship among different components of the system and each component has its own function and complements each other to maintain the system.

In relation to animal production, crops provide fodder for poultry, ruminants and non-ruminants. According to the local farmers in the meeting of the farmer's group, crop residues constitute a major source of forage for animals which are raised in the commune. The crop pattern in the survey area which is described in Figure 4.3 is very diverse. Crops can provide human food and animal food simultaneously; the local farmers use various sources from crop production to feed animals. Peanut vine is one of the most popular crop residues which has been used as cattle feed. The informants in the group meeting in the commune reported that peanut vine was a crop residue which has a high nutritional content. Unlike other crops, its leaves are still green at harvest, so it is very good to feed animals and can also be dried to preserve it for later use. In addition, young and/or unfilled nuts which are the by-product of peanut production can be used for pig raising.

Rice straw plays a very important role in cattle production practices of small holder farms in Asian countries (Boonserm, et. al, 1990). This is also true in Binh Dien commune, where although the rice area in the commune is not so large, rice straw is still one of the important sources of cattle feed in the region. After the rice harvest, rice straw is used to feed cattle, not only in its fresh form but also in its dry form. According to the local people, it is often dried and stored to feed cattle when other roughage is in short supply or during monsoon and heavy rainy days when the cattle can not be grazed. So, in the surveyed region, high income households who own large rice cultivation area often raise more than 10 cows because they have enough dry rice straw to feed their cows when wild fodders are scarce. Moreover, rice byproducts such as rice bran and concentrates are one of the most important pig feeds, while rice bran, unfilled rice grains and broken milling rice grains are fed to chickens and ducks.

Compared to peanut, mungbean and rice, cassava is the most important crop in the region in term of animal feed. As described in the first part of this chapter, cassava is very low-value crop in the region but it is still a major crop in the survey area because of its important role in maintaining animal production in the commune. According to the local farmers, cassava root is a major and popular source for feeding pigs in the region. However, in high income households, almost all roots of cassava were used mainly for pig raising while poor households used only small cassava roots to feed pigs, big roots are often used for human food, especially in the time of transition between cropping seasons. Besides roots, cassava leaves are useful crop residues in the surveyed area where this crop is popularly grown. Although cassava is a non-legume crop, its leaves are also a good and necessary animal feed, especially in the winter when other feed sources are scarce. The local farmers use cassava leaves to feed cattle and pigs, however, they reported that if animals eat too much fresh cassava leaves in one time they may be poisoned. So fresh cassava leaves are often used as a supplementary source of animal feeds. Cassava leaves are picked about 5-6 month after planting because if the picking is earlier, the yield of the roots will be decreased.

Sweet potatoes produced in the mountainous of central Vietnam are not sold in the market but mostly fed to pigs. Sweet potato vines, nevertheless, play an important function as a source of protein and are important in the mountainous region where alternative protein sources are unaffordable (Dai, P., 1997). This is also the same in Binh Dien commune. Although the sweet potato cultivated area in the region is not large, but it is popularly planted in medium and poor household groups to use not only as vegetable for people but also as best quality feed for pigs.

Although sugar cane residues are not important feed for animals, the local people also use its leaves and tops as fodder. After harvest, young sugar cane leaves and tops which are of low quality and can not be used as seedlings can be used for feeding cattle. Whilst this is not widely available compared to the residues of other crops, young leaves and tops of sugar cane contributed to increasing nutrition for the cattle in the region because they have a high sugar content.

Crops provide feed to animals and in return crop production uses draft power and manure from animals. The survey reflected that the cropping system in the region is a low external input system. The local farmers use cattle as the major draft power for crop production. In the 90 households that were interviewed, there is no household which has a tractor to be used for tillage. Most of the cultivation area in the region is ploughed by cattle. However, this relationship is stronger among high income households compared to poor households which have hardly any cattle, so they have to rent cattle to plough land or they have to prepare the land by hand. The cattle in the study area are used not only for tillage but also for carrying crops' products such as rice, peanut and cassava from the field to the house. Manure is the main fertilizer source utilized for crop production such as rice, peanut and mungbean in the region. Crop yields obtained after applying manure can be comparable to or greater than those obtained using inorganic fertilizer (Baldock and Murgrave, 1980). This is also recognized by the farmers in Binh Dien commune. According to the local people, manure is the best fertilizer to maintain soil fertility. The respondents in the region reported that although they applied chemical fertilizer at only a very low rate, they feel that the soil became harder. So the local people mainly apply manure for crop production, chemical fertilizer has been used only as a complementary fertilizer source. Dung and buffalo's excreta are often used to apply to black pepper, coffee and fruit tree production. Pig manure is reported as best in term of increasing crop yield and in line with the preference of local farmers. The people in the survey area mixed pig manure with "boi" and/ or "tu bi" which are wild plant species or peanut's vines to apply to peanut, mungbean, rice, and sugarcane production. They also mixed manure with water to sprinkle fruit trees and vegetables.

Besides the relationship to animal production, the crop sub-system also links with the tree sub-system. Trees on farmland influence crop production through their shade. This is not good for some crops such as peanut, mungbean, sugarcane which are strong radiation sensitive plants, but it is good for some other crops such as pineapple which is a weak radiation sensitive plant. So, the local farmers often plant pineapple under the canopy of jack fruit trees. Trees on farm land are also often

planted as hedgerows to reduce wind effects, especially the monsoon and West-South wind which may cause loss in crop yield. Trees on forest land are located on higher slopes and can prevent soil erosion to maintain soil fertility which is the key factor for improved crop yield. Furthermore, the most important function for natural and planted forests in the system is water resource protection, not only for crop production but also for people. According to the local farmers, in some recent years, due to the expansion of planted forests on wasteland areas, the water in the streams is not exhausted in the dry season. Beside protection of land and water resources, the natural forests provide green manure and materials for compost which are the best fertilizers for crop production. The local farmers collected "boi" and "tu bi" in the forest to mix with pig manure. Moreover, the trees also provide material to make farm tools for crop cultivation. The crops also give benefits to the trees; the farmers in the region grow mungbean and peanut between young rubber tree rows, then after the harvest of mungbean, its stem is used to mulch rubber tree stock. These crops provide weed and control improvement of soil fertility which are very important factors in increasing the survival rate and growth of young rubber trees in the first few years after planting.

The natural and planted forests are not only linked with crops but also closely linked with animals. The forest is the major source of the herbaceous species which are used for animal feed. The cattle in the region are mainly grazed in the forest. "Mon nuoc" which is located along the stream in the forest is a wild plant which is popularly used for pig raising in the survey area. The excreta which falls from the cattle which graze in the forest is a good nutrient source to increase forest tree growth.

Off-farm activities are a component of the production system in the region which is related to all of the other components of the system like crops, animals and trees. Besides providing investment capital for crop production, some byproducts of off-farm activities such as wine making, a popular activity often done by women, are used for pig feeding. So off-farm activities can support capital and byproducts for

animal production and in return, they are served by the animals' draft power. The local people used cattle power to transport Imperata, broom grass and wood from the farm to their house. In relation to tree production, off-farm activities provide capital for tree production and material sourced from the trees such as the wood of jackfruit, and *Eucalyptus* are used for carpentry. Another important function of off-farm activities in the region is to help local farmers to generate cash to cushion effectively times of environmental and economic stress, such as failure of crop, animal and forestry production.

The four production forms of the agroforestry system in the survey area (e.g. crop, animal, tree, and off-farm) are linked with farm households. Crop production in the region supplies food such as rice, cassava, mungbean, peanut, young fruits of banana, jackfruit, pineapple, and various vegetables to feed the local people. Ripe fruits such as banana, citrus, papaya, jackfruit, and pineapple are an important complementary nutrition source for the local farmers. Animal production provides a high protein source such as beef, pork, chicken and eggs for the people. The wild plant species and mushrooms in the forest are an important vegetable source for the farmers in the region as a scarcity of vegetables is a common characteristic of the hill and mountainous area in Thua Thien Hue. The trees also supply fuelwood for cooking and other purpose.

The farm household is the center of all linkages with all four production forms of the system, it plays a key role in the overall operation of the system. It provides labor and managerial skills for the four production sectors of the agroforestry system in the region. Therefore, to improve the system, it is very necessary to understand labor divisions, decision making, and access to resources and welfare by gender. Efficient utilization of labor in the farm family, gender specific tasks in farming and good coordination among the family members have largely contributed to the sustainability of the farms (Timsina, et al., 1990). The next chapter reveals the roles of the members of farm families in the region.