CHAPTER 3

RESEARCH METHODS

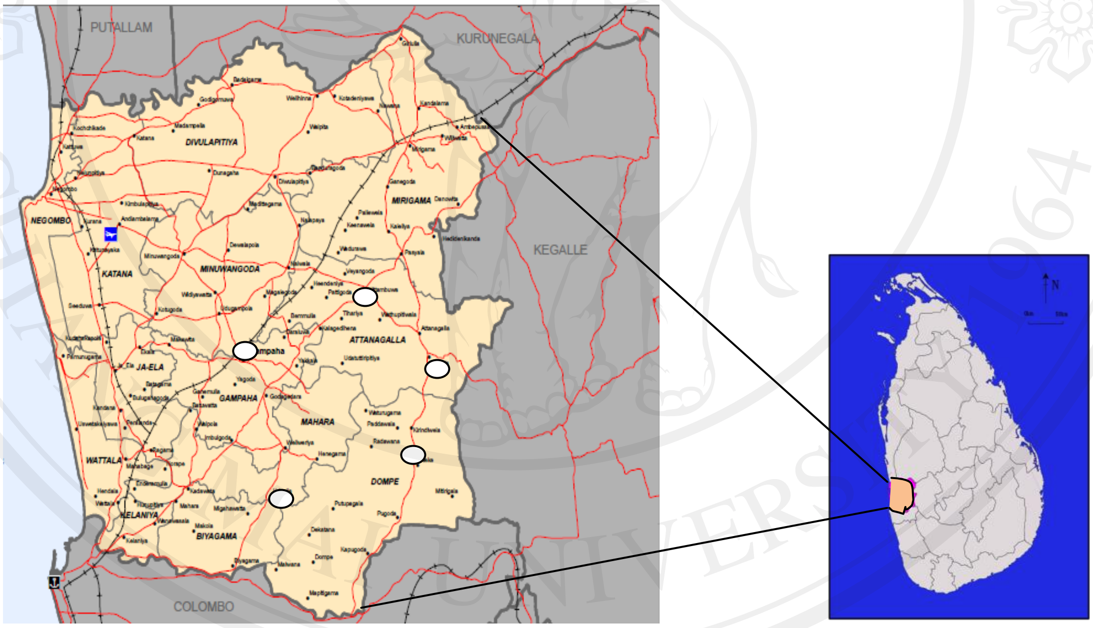
In this study, coconut smallholder households were used to gather information related to their demographic, socio-economic and bio-physical factors to attain the objectives. The combination of qualitative and quantitative data analysis was applied to explore the coconut-based farming systems and problems faced by coconut smallholder farmers and to determine the factors influencing sustainable coconut-based farming systems of smallholder farmers in the study area.

3.1 Site selection

Gampaha district has been selected as study area which belongs to the wet zone, western province and located close to the sea. Total land area is 1,387 square kilometers and 32 percent of this area has been contributed towards the coconut cultivation (44,000 hectares). Relative humidity of the area is 76 percent and day and night temperature fluctuate 31.6 -23.6 ºC with an average of 28 ºC per year. Annual rainfall is 1,700-2,400 mm, contributes enormously in agriculture of the area. The highest rainfall is received during the South West monsoonal period. There are two peak periods of rainfall during May and October. The soil groups are red and podzolic soils, which increase the potential for agriculture. This district consists of 18 coconut development officer (CDO) divisions under 13 divisional secretariats and all these contribute to the coconut production in different scales. Most of the farmers own

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

coconut land area of up to 4 ha (CRI, 2011). This is the main coconut growing district belongs to the wet zone of Sri Lanka and the second highest coconut growing district in Sri Lanka. Further this district belongs to the coconut triangle having highest potential to practice coconut based sustainable farming systems due to its favorable climatic condition (RUAF, 2002). The main coconut based production systems of the area are intercropping, and monocropping systems. And less adoptive system is coconut- livestock integration system.



○ Study sites of study area

Figure 3.1 Study area (Gampaha district) of Sri Lanka

Source: Administrative map –Gampaha District

Although this district has favorable conditions for coconut cultivation, due to rapid urbanization and industrialization coconut lands are fragmented for property development. Poor land management has reduced the soil fertility and productivity of

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

coconut reducing sustainability of the system. Therefore there is a threat to coconut smallholding sector since 80 percent of the farmers are smallholder farmers in the study area (CCB, 2006).

3.2 Sampling technique

Sample for the study was taken selecting the coconut smallholder farmers randomly from the study area (total smallholder holdings are around 10,000). First, out of 18 coconut development officer divisions five divisions were selected considering the land area contribution for coconut cultivation. From these divisions 175 coconut smallholder farmers were selected randomly according to Yamane (1970) with 0.075 error term.

3.3 Data collection

Data collection was carried out during mid March to end of May 2011. Both primary and secondary data were collected to fulfill the objectives of the study.

3.3.1 Primary data

Primary data was collected through key informant interviews (informal survey) and household survey (formal survey) by semi-structured interview. Both quantitative and qualitative type of information was gathered.

The study was mainly based on the data collected from the coconut small holder survey. The data included the demographic (age, education, occupation, farming experience), socio-economic (farm income, off-farm income, access to subsidy, labour used etc.) and bio-physical (land size, fertility status etc.)

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

characteristics of coconut smallholder farmers. Farmer fields were also observed to understand the real situation.

3.3.2 Secondary data

Secondary data was collected to achieve better understanding of the present situation of the coconut smallholding sector. Climatic and soil conditions, coconut yield and price trends, population and other related information were gathered from institutions and references. These data were mainly extracted from government agencies such as regional office of Coconut Cultivation Board (CCB) Gampaha, District Divisional Secretariat and regional office of Department of Agriculture and semi government organizations such as Coconut Research Institute (CRI) related with the coconut sector through discussions with the officers and further referring books, articles, reports and other related sources.

3.4 Data analysis

The data gathered from survey were processed and analyzed with quantitative and qualitative analysis technique. For the analysis Statistical Package for Social Sciences (SPSS), Microsoft Excel and Limdep function (for ordered probit) were used.

In response to the first objective regarding the exploration of farming practices and problems faced by the coconut smallholder farmers, the primary data and secondary data collected from household interview using the questionnaire and institutional survey were analyzed using descriptive statistics, frequency distributions, means and standard deviations.

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright © by Chiang Mai University
All rights reserved

In order to fulfill second objective, selected variables (demographic, socio-economic and biophysical) were analyzed using Factor Analysis and Ordered Probit model.

3.4.1 Explanation of dependent variable (coconut–based systems)

The production alternatives can take the form of a main crop, single intercrop, a mixture of crops, or a crop/livestock combination which are compatible with each other and other environmental factors. When a system is socially and environmentally just and economically viable that is considered as sustainable. If a system is lacking in some of these criteria comparatively it is less sustainable (Ohler, 1999).

Monocropping has been the traditional system of growing coconut with high risk depending only on single crop with underutilized labour resource and inefficient use of land since 70 percent of the land area in-between the palms can be used for another purpose (CRI, 2006). Beside that comparatively biodiversity is least within the system. Sustainable productivity and profitability are also less compared with intercropping and livestock integration systems.

A measure of land use intensification commonly used to evaluate effective land use under mixed cropping is the land efficiency ratio. This is highest in coconut–based intercropping with different types of perennials and annuals. By practicing this, resource use efficiency, productivity and profitability can be increased. This practice reduces the risk of depending only on one crop. It has been found that by intercropping, coconut increased nut yield. Even at the less productive age of over 60, traditional coconut farmers are still unwilling to cut down their palms. It is within this context that intercropping is considered to be the most desirable practice to ensure

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

that farmers' efforts are well rewarded (Ohler, 1999). It is now generally accepted that for economic reasons coconut lands should be intercropped (CRI, 2006). Therefore this has been identified as the most sustainable and highly adoptive diversified coconut- based farming system.

A coconut-livestock farming (Livestock integration) system is common practice in large-scale coconut operations, where livestock, mainly cattle and goats, are grazed under coconut supported by improved or good pasture. This is another diversified system as the intercropping where the livestock is reared with coconut alone or with some other types of crops. Although this system too increases the resource use efficiency and productivity, this system has not become popular among smallholder farmers due to many reasons. Those are limitation of land and unable to rear a considerable number of animals to obtain economic return, higher capital and operational cost, lower economic return, less veterinary facilities, destruction of crops by livestock, religious barriers and other social barriers related with livestock keeping (Ohler,1999).

Further the intercropping and livestock integration systems studied compared farmer acceptance (social acceptance) and area allocation for diversification were highest in intercropping system than livestock integration system in the study area. Therefore in that basis too livestock integration system can be considered comparatively less sustainable than intercropping.

According to the above mentioned situation analysis when three main coconut-based systems can be ordered considering ascending order of sustainability and farmer acceptance it can be written as monocropping < Livestock integration < Intercropping.

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

3.4.2 Factor analysis

Factor analysis was used to extract the main components which have high multicollinearity from varieties of independent variables by using principle component analysis and varimax rotation method. The variables with highest loading (> 0.5) were selected and named according to the commonness of variables.

The factor scores of main components were used as independent variables in ordered probit regression analysis to find the influencing factors of sustainable coconut-based farming systems. (Independent variables used in factor analysis are listed in Table 3.1).

3.4.3 Ordered probit model

Formula for ordered probit analysis: $y^* = \beta X_i + e_i$ (i=1-5)

Where y^* = Unobserved latent variable whose values determine what the observed ordinal variable y

β = Coefficient of independent variable

X_i = Independent variables (factors affect the ordered choice of dependent variable)

e_i = Error term

y is an observed ordinal variable

$$y_i = \begin{cases} 0 \text{ (System 1) = monocropping if } y^* < 0 \\ 1 \text{ (System 2) = livestock integration if } 0 \le y^* < \mu_1 \\ 2 \text{ (System 3)= intercropping if } y^* \ge \mu_1 \end{cases}$$

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

μ_1 is the cutpoint or threshold parameter that indicates the discrete category that the latent variable falls into.

The results obtained from above analysis were useful to determine the factors influencing the sustainable production in the study area. The ordered probit regression analysis was helpful to find out the favorable and unfavorable factors for sustainable farming systems and this finding was useful to make suggestions for the betterment of the future of coconut smallholder farmers in the study area.

After the results gained from factor analysis the ordered probit model can be written as $Y^* = \beta_0 + \beta_1 F_1 + \beta_2 F_2 + \ldots\ldots + \beta_n F_n + e$

Where, y^* = Unobserved dependent variable

β_0 = Constant

β_i = Coefficient for independent variables, i….n

F_n = Main components resulting from factor analysis

e = Error term

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

Table 3.1 Independent variables used in factor analysis

Demographic variables	**Measurement**
Age of smallholder farmer (AGE)	Years
Education of smallholder farmer (EDU)	Years of schooling
Experience (EXP)	Years
Dummy variable for occupation	Occupation
- (D-OCCUP) → fulltime	Occupation1. If full time =1, 0 otherwise
Biophysical variables	
Coconut based land area (LAND)	Acre
Dummy variable for soil fertility condition	Level of soil fertility
- (D-FERTILITY)→ at least medium fertility	Fertility at least medium=1, 0 otherwise
Dummy variable for type of fertilizer used	
- (D-TYPE)→ organic fertilizer usage	Type of fertilizer If organic fertilization=1, 0 otherwise
Socio-economic variables	
Farm income (FARMIC)	Rupee/ year
Off-farm income (OFFFARMIC)	Rupee/ year
Location of farm (LOCATION)	Distance from city kms
Hired labour utilization (LABOR)	Labour units used
Presence of land improvement technologies (TECHNO)	No of technologies
Access to extension service (EXTEN)	Time / last year
Dummy variable for access to subsidy facilities (D-SUBSIDY)	Dummy1. If yes=1, 0 otherwise
Access to training (TRAIN)	Time/ last 3years

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright © by Chiang Mai University
All rights reserved