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STUDY ON ASSESSMENT OF FOREST DEPENDENCY AND CONSERVATION ATTITUDES OF LOCAL PEOPLE AROUND PROTECTED AREA: A CASE STUDY IN POPA MOUNTAIN PARK IN MYANMAR

（英文题名）

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保护区周边居民对森林的依赖及保护态度评价研究：以缅甸波帕山公园为例

泰恩

温亚利

摘要

缅甸是一个农业国家，有超过 70%的人口生活在农村并依赖自然资源为生。在保护区，农户迫于生计而对资源的过度需求对当地的生物多样性保护提出了巨大挑战。缅甸农村家庭，特别是特困户，将依赖森林的经营活动作为收入多元化的重要途径。本研究通过进一步分析居住在缅甸波帕山公园周边的农户的依赖性以及其对保护态度的影响，探讨当地社区和保护区的关系。本研究随机抽取了波帕山公园周围三个村庄 174 个家庭的样本，利用结构式问卷访谈、小组讨论和直接观察来收集数据，并采用 OLS 回归和 Logistic 回归分别分析了森林依赖性与解释性因子的关系以及与保护态度和其他解释因子的关系。通过研究发现，农户的家庭总收入中，森林收入贡献 37.76%，农场收入和非农收入分别贡献 31.74%和 30.50%。OLS 回归分析表明，农业收入和非农收入与林业收入呈负相关。Logistic 回归分析表明，森林的依赖性和有限的森林资源的可获得性是影响农户保护态度的显著因子。与类似的研究结果相同，通过扩大就业机会、扩大种植收入等措施来使农户收入多元化将大大减少他们对森林的依赖。研究结论认为，在保护区管理中，对生活在缅甸波帕山公园周围家庭的社会经济特征的考虑是必不可少的。因此，本研究建议应当鼓励发展环境教育项目来减少对受保护森林资源的依赖性。此外，政府应考虑增加农业生产以及为当地社区居民创造更多非农就业机会，扩大对波帕山公园的保护。

关键词：森林依赖性，保护态度，波帕山公园，保护区，缅甸

STUDY ON ASSESSMENT OF FOREST DEPENDENCY AND CONSERVATION ATTITUDES OF LOCAL PEOPLE AROUND PROTECTED AREA: A CASE STUDY IN POPA MOUNTAIN PARK IN MYANMAR

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ABSTRACT

Myanmar is an agricultural based country and over 70 % of the country's population live in rural area and depends mostly on forest resources for their livelihoods. Conservation on biodiversity in protected areas become more challenging when rural people are dependent heavily on them for different kinds of products and subsistence needs. Households in rural area of Myanmar, especially poor households, depend on the forest related activities as one of the income diversification activities. This study aims to explore the relationship between the local communities and protected area by analyzing the extent of household's dependency and conservation attitudes of villagers who live near around the Popa Mountain Park (PMP) in Myanmar. A sample of 174 households was randomly selected from three villages adjoining the Popa Mountain Park to collect the data using structured questionnaire interviews, focus group discussion with local residents and directly observation to the environment. Ordinary Least Square Regression (OLS) and Logistic Regression were applied to analyze the relationship between forest dependency and explanatory factors and also conservation attitudes and other explanatory factors respectively. This study found that forest income contributes 37.76%, and farm income and non-farm income contribute 31.74% and 30.50% to the total household income respectively. OLS Regression analysis indicated that agricultural income and non-farm income are statistically and negatively correlated with the forest income. Logistic regression showed that forest dependency and limited access to forest resources are found to be significant predictors of conservation attitudes. The findings go along with most of similar studies that, providing alternative source of income for the livelihood through employment opportunities or by an income source from agricultural will greatly reduce the forest dependence. The research concluded that consideration to household socioeconomic characteristics near around the PMP is essential in protected area management. The study recommends that environmental education programmes should be encouraged in order to reduce dependence on the protected forests. Moreover, the government should consider measures to increase agricultural production and generate off-farm employment opportunities for local communities in general and strengthen conservation activities especially around the Popa Mountain Park.

Key words: Forest dependency, conservation attitudes, Popa Mountain Park, Protected Area, Myanmar

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ABBREVIATIONS

AHP	ASEAN Heritage Park
ASEAN	Association of Southeast Asian Nations
CBD	Convention on Biological Diversity
CIFOR	Center for International Forestry Research
DZGD	Dry Zone Greening Department
ECD	Environmental Conservation Department
FAO	Food and Agriculture Organization
FD	Forest Department
FFI	Fauna & Flora International
GMS	Greater Mekong Sub region
IUCN	International Union for the Conservation of Nature
JICA	Japan International Cooperation Agency
MDGs	Millennium Development Goals
MFOZ	Major Function-Oriented Zoning Plan
MOECAF	Ministry of Environmental Conservation and Forestry
MTE	Myanmar Timber Enterprise
NBSAP	National Biodiversity Strategy and Action Plan
NCNPP	Nature Conservation National Park Project
NGO	Non -Government Organization
NTFPs	Non Timber Forest Products
NWCD	Nature and Wildlife Conservation Division
PAS	Protected Area System
PFE	Permanent Forest Estate
PMP	Popa Mountain Park
PPFs	Protected Public Forests
PSD	Planning and Statistics Department
RFs	Reserved Forests
RRA	Rapid Rural Appraisal
SD	Survey Department
SMART	Spatial Monitoring and Reporting Tool
UNDP	United Nations Development Programme
WCS	Wildlife Conservation Society

1 INTRODUCTION

1.1 Background

Myanmar represents an important biodiversity reservoir with a great variety of different habitat types arising from its ecological diversity in Asia-Pacific regions. Because of the tropical monsoon cycling system and its topographic variety throughout the country, diverse ecosystems with lots of genetic diversities can be found in Myanmar's forests. The numerous different seascapes and landscapes are home to a wide habitat and wildlife range in Myanmar. According to MONREC record, there are about 37 rattan species, 96 bamboo species and 841 medicinal plants species, and about 1,180 vascular plant species in Myanmar. About 42.92 % of the total land area is still covered with natural forest. Natural forest resources are the critical and principal needs for livelihoods of local people and national economy as well. The total population of the country is about 51 million and 68 % of this population was classified by the World Bank as rural people who residing in areas through depending heavily on the forests for their basic need (Population Census, 2014).

Myanmar is an agricultural based country and over 70 % of the country's population live in rural area and depends mostly on natural resources for their basic needs, such as food, shelter, fodder, fuel, side income, etc. The importance of the forest in the survival life of the rural people in the developing countries is enormous. Forest resources are conserved, managed and utilized in sustainable manner by the establishment of Reserved Forests (RFs), Protected Public Forests (PPFs) and Protected Areas (PAs). Protected areas (PAs) are main tools for biodiversity conservation and sustainable development. The major pressure on biodiversity in Myanmar is illegal hunting and trade, improper land use, the introduction of invasive species, infrastructure development and climate change.

Effective management is very important for the sustainable biodiversity conservation by PAs. Sustainability of biodiversity conservation needs much more than efforts on conservation tasks. As the main objectives of the establishment of the PAs are to conserve forest and biodiversity, PAs management is generally focused on conservation inside the Park. Like many other developing countries, the conflict between the protected area and local people is the major threat which hinders to achieve the conservation objectives in Myanmar. Local people are excluded from the protected area by imposing regulations to restrict resource exploitation from the area that used to be important source for their livelihoods and survival or as their main economic alternatives and resulted to conflicts between local people and park. In many cases, widespread and escalating people-park conflicts have become damage to ecosystem, valuable habitats, flora and fauna that are supposed to be protected. Globally, there are a number of studies related to the forest and people link in terms of subsistence and also household income and how these relationships should be considered in formulation of forest resource policy. But in Myanmar, very few attempts were conducted to assess the forest income. Clear

understanding rural households' dependence on forest is important to realize rural livelihoods and the reasons causing forest degradation, and to design effective the management plan. This study focuses on assessment of dependency on a protected forest by local communities and how the socio-economic factors determine the households' dependency on forest and its impact on peoples' attitudes towards the conservation of the Park .I hoped to provide some facts for decision makers and park managers so that they could design participatory strategies that make a balance between conservation and development in and around the park.

1.2 Problem statement

Over 70% of the country's total population in Myanmar live in rural areas and depend on forest resources for basic needs such as food, fodder, firewood and shelter. Human activities, such as land clearing for settlement, agricultural land expansion, timber harvesting and firewood collection, are responsible for deforestation and forest degradation. Due to poverty, local people depend on forest resources and extract forest resources for subsistence and cash incomes. The dependence on forest resources is higher when incomes from other income sources are insufficient to secure household subsistence needs. Because of excessive dependence on forest resources, the productivity of natural forests became lower and the natural forests are degraded. Despite the protected areas are given legal backbone, encroachments and threats are still common in Myanmar's protected area (Rao *et al.* 2002). Although Myanmar's PA management rules and regulations prohibit local people from using resources within protected forest area, there is a lot of encroachment to it. Conflicts arise as local people often have no other source of resource than the PA. Rao, Rabinowitz, and Khaing (2002) pointed out that non timber forest products were collected in 85% of protected areas and fuel wood extraction was occurred in more than 50% of the parks in Myanmar. Moreover, annually the mean population growth is highest in rural areas where most Myanmar PAs are located. Increase in population growth is linked to an increase in the number of people seeking land for grazing, amassing fuel wood, and collecting forest products. The increase in number of PAs and the huge pressures on them by rapidly growing human population are a great challenge PA management to be sustainable.

Poverty among most rural people creates an increase of pressure on available natural resources (water sources, firewood, and rangeland for grazing their livestock), most of which are found within the PAs (Thuy, 2014). Recently the establishment of PAs is increasingly used to mitigate adverse effects on biodiversity (Bode et al., 2015). Restricting access to land and valuable resources without providing users with alternatives has adverse effects on local communities, including reduction in food security and loss of livelihoods (West et al., 2006).The exclusion of local communities, and hence poor public relations in conservation activities, have led to an increase in biodiversity loss and conflicts between conservation effort and local people (Redpath et al., 2013). In addition, local communities

experience other costs, such as crop raiding, livestock loss and wildlife incidents including human injuries, which influence negative attitudes towards PAs and make locals unwilling to cooperate on conservation activities (Ogra, 2008) . Based on these challenges, recognition of the needs for local support to achieve efficient and sustainable conservation has increased (Kideghesho et al., 2007). This study was conducted to develop a better understanding of the impacts that PAs have on people's livelihoods in terms of the benefits and costs obtained from the PAs, as well as the attitudes towards conservation activities.

Popa Mountain Park (PMP) holds diverse habitat types of natural and anthropogenic vegetation cover. Like many other developing countries, the conflict between the protected area and local people is the major threat which hinders to achieve the conservation objectives in Myanmar. Local people are excluded from the protected area by imposing regulations to restrict resource exploitation from the area that used to be important source for their livelihoods and survival or as their main economic alternatives and resulted to conflicts between local people and park. Clear understanding of local dependency on protected areas is very important to formulate policies to conserve biodiversity and find alternative economic opportunities. Therefore, this study tried to assess forest dependency for local livelihood and socioeconomic factors determining forest dependency and conservation attitudes of villagers near the Popa Mountain Park.

1.3 Objectives of the study

The overarching objective of this research is to provide baseline data on natural resource use and contribute recommendations to formulate specific conservation actions. With the aim of developing strategies that could be used to sustain the present relationships at the study site, four specific objectives will be followed in this study:

- to assess natural resource use and dependency on the protected forest by rural communities for their livelihood
- to identify the socioeconomic characteristics determining forest dependency of households around the Popa Mountain Park
- to interpret local people's knowledge, perceptions and attitudes towards the conservation of protected area
- to provide some recommendations for protected area management in Myanmar

1.4 Research questions

- What is the nature and extent of dependence on the forest around protected area by local communities?
- How socioeconomic factors determine household dependence on income from protected forest?
- What are the attitudes and perceptions of local communities towards the conservation of the Park?

1.5 Limitation of the Study

The purpose of this research is to assess the relationship between protected areas and community livelihoods, specifically assessing the forest dependency for local livelihood and factors influencing forest dependency, and conservation attitudes towards PA. This assessment is conducted in the period of July and August 2016. The study is limited by the fact that only agricultural income, non-farm income and forest income are taken into consideration. The monetary income from livestock and record being not authentic, therefore it was excluded from the calculation. Several respondents felt uncomfortable with questions about their personal information such as income, land holdings, or quantity and/or other valuable forest products taken from the national park as well as risks. It occurred especially when local government officers were present at the time of interview. Efforts were made to probe and to do follow ups as much as was possible so as to obtain responses that were more complete and for clarifications.

1.6 Thesis overview

The research is structured sequentially with 7 chapters. In the Chapter 1, it starts with general introduction and also forming the research objectives and the background of the research questions. These issues are further elaborated through the review of literatures in Chapter 2 which deals with the issues of forest dependency around Protected Areas, sustainable livelihood, and participation and conflicts in Protected Areas. In the chapter 3, the general description of Myanmar, conservation cover by Protected Areas and Protected Area management in Myanmar are discussed briefly. Chapter 4 presents the research methodology employed in this study elaborating study area selection, sampling procedures and data analysis applied in this thesis. Next Chapter analyses the assessment of forest dependency for livelihood and socioeconomic factors determining forest dependency around PA. Chapter 6 explores the issue of conservation attitudes of local people living around the Popa National Park (PMP). Chapter 7 describes the implications on resource use and attitudes towards the conservation of PMP. Chapter 8 concludes the thesis and suggests some recommendations on the approach in relation to the objectives presented in the introduction and offers further study linked with the management and conservation of Protected Area (PA).

1.7 Conceptualization of the study

The framework tried to explain the effects of forest dependency and to design conservation strategies. In this research, the resource use approach provided by Firey (1960) was used as a framework to guide the study. The approach perceives three value factors or frame of references- ecological, economic, and cultural – that links with each other and plays a role in determining local perception towards a resource management system. Social

groups are different depending on their needs and attitudes with respect to a resource so do their perceptions towards resource management systems. There is growing realistic facts in support of the thesis that local people's aid for protected areas depend on the perceived costs and benefits of conservation.

Nonfarm employment opportunities, household size, agricultural income, education and incorporation to outside market are found to influence forest dependency (Gunatilake, 1998; Hedges & Enters, 2000; Asfaw et al., 2013). However, a study by Nepal & Weber (1995) revealed that dependence on reserved area resources points out negative attitudes towards protection policy. Also Infield (1988) indicated that poverty show negatively attitudes towards wildlife conservation. He also found that benefits from the reserved area and a better education result in a more positive attitudes in Natal, South Africa. A research by Gullingham & Lee (1999) points out that wealth and gender influence attitudes. Also, Nepal & Weber (1995) found that landholding size has positive effect on attitude towards the national parks conservation. Finally, the study of Mehta & Heinen (2001) in Nepal revealed that benefit from tourism; wildlife depredation issue, gender, and education level were significant predictors on influencing the conservation.

Based on the literature reviewed, the following framework is developed to examine the effects of forest dependency and the responses of local people toward the conservation of the Park. Household's socioeconomic characteristics determine income, the extent of production and expenses. Forest dependency is driven by households' socioeconomic characteristics. Conservation attitudes and knowledge about the park are related to the households' socioeconomic and demographic characteristics and the extent of forest dependency. Institutions can control regulating access to resources in the protected area and design conservation programs that have an impact on local communities.

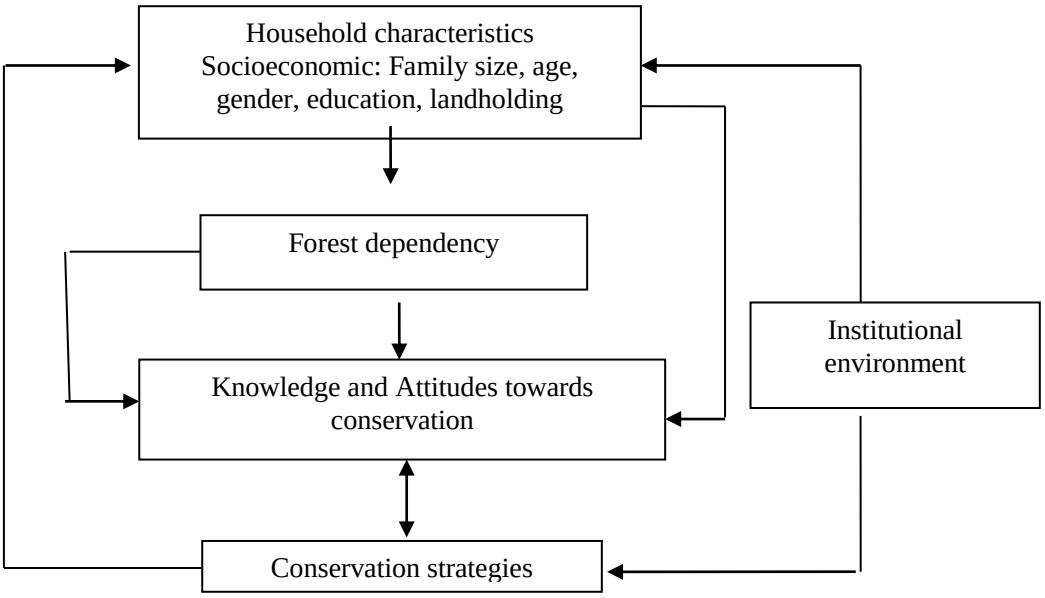


图 1.1 研究的概念框架
Fig 1.1The conceptual framework of the study

1.8 Value of the Research

Forest resources from National park play important roles for the livelihoods of local people due to extreme poverty. The valuation of forest benefits, especially to local people, is important to explore what benefits forest communities need to recant if biological reserves are to be completely protected or how the restrictions are going to affect the livelihood needs of the forest inhabitants. Therefore, it is important to know to what extent the local people depend on and which factors determine their dependency. This information will be useful to planner in decision making process by understanding the households' livelihood, forest dependency, and their critical consequences in deforestation process. To improve PA management systems, perceptions, attitudes and socio- economic conditions of the local communities need to be studied, that will provide much promise and help to identify problems and recognize potential solutions for developing strategies. This study aims to understand socio-economic conditions of local people, their perceptions and attitudes in order to advance harmonious development of nature conservation and suggest some solutions for the current protected area management systems of Myanmar. The findings hope to support potential solutions for developing appropriate strategy in order to maintain long term existence of National Park. Environmentally sound practices leading to changing behaviors of local people can be promoted. Recommendations for the sustainable development opportunities for protected areas in Myanmar can be offered. There are relatively few studies that have examined the utilization of forest resources from a livelihood perspective. Therefore, how socio-economic factors determine the households' dependency on forest income and their attitudes towards the conservation of the Popa Mountain Park will be explored in this research. The significance of this study is to provide government policy makers, departments concerned and forestry officials with important information (e.g. the magnitude of forest dependency) on the utilization of forest resources by rural people.

2 LITERATURE REVIEW

The purpose of this chapter is to give a general review of literature relevant to issues highlighted in the study. A brief discussion of the importance of protected areas in conservation is given first. This is followed by a section on concepts of livelihood and PAs, rural household dependence on natural resources, conflicts and the linkages between protected areas and local people based on relationships developed and attitudes among the local people towards protected areas and conservation in general. Further, the chapter concludes with a study on development of Protected Areas in China**.**

2.1 The Importance of Protected Areas in Conservation

Protected areas (PAs) are very important tools for biodiversity conservation (Allendorf 2007; Walpole and Goodwin 2001) and by the World Conservation Union (IUCN) in 1962, it is defined as; '*an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective measures'* (IUCN, 2003). Protected areas are recognized as, an *in-situ*, conservation tool within the Convention on Biological Diversity, aimed at reducing the present rate of biodiversity loss. There are six categories recognized by the IUCN (See Appendix II) which range from employing strict no disturbance rules towards a more sustainable resource use approach. Of these categories, the IUCN World Commission on Protected Areas approximates that, there are currently 100,000 protected areas worldwide (Hayes. 2006). Of these 100,000 protected areas, particularly within forested areas, where more than 60% of known biodiversity is found (Raven 1980). The majority of tropical forests are situated in developing countries, often with poor economy, limited institutional frameworks, rapidly growing rural populations, and limited governance. Protected areas have often been addressed into question for their limited effectiveness in protecting biodiversity, ceasing land-use change and often lack of ethical considerations for local people (Hayes, 2006; Ferraro, 2002). Most of research had demonstrated the conservation success of most protected areas (Milner-Gulland & Mace, 1998; Bruner et al., 2001).

To seek verifying the success of the world's protected area network, Bruner et al., (2001), investigated the effectiveness of 93 protected areas, in 22 countries (covering some 18 million hectares), throughout the tropics. Their results show that over 80% of the sampled protected areas were in better condition than the 10km buffer zones surveyed outside the impact on the resources. Ultimately, the success of a protected area is dependent on people-protected area conflicts; these conflicts can weaken the efficiency of protected areas (Ormsby and Kaplin, 2005).

Globally the number of protected areas (PAs) has been increasing significantly over the last few decades due to their enormous material and non-material values (Scherr *et. al.* 2004) (Figure 2.1). To be sustainable conservation of biodiversity, many protected areas have been established throughout the world (Nyaupane & Poudel 2011), and at the same

time, these protected areas are used for purposes of tourism. Around 12% of all forests are already protected officially for conservation values under different IUCN management categories (Appendix II) - 7 % in IUCN categories I to IV, and 4 % in categories V and VI (Chape *et. al.* 2003; Bull, 2003; Tuxill *et. al.* 2001).

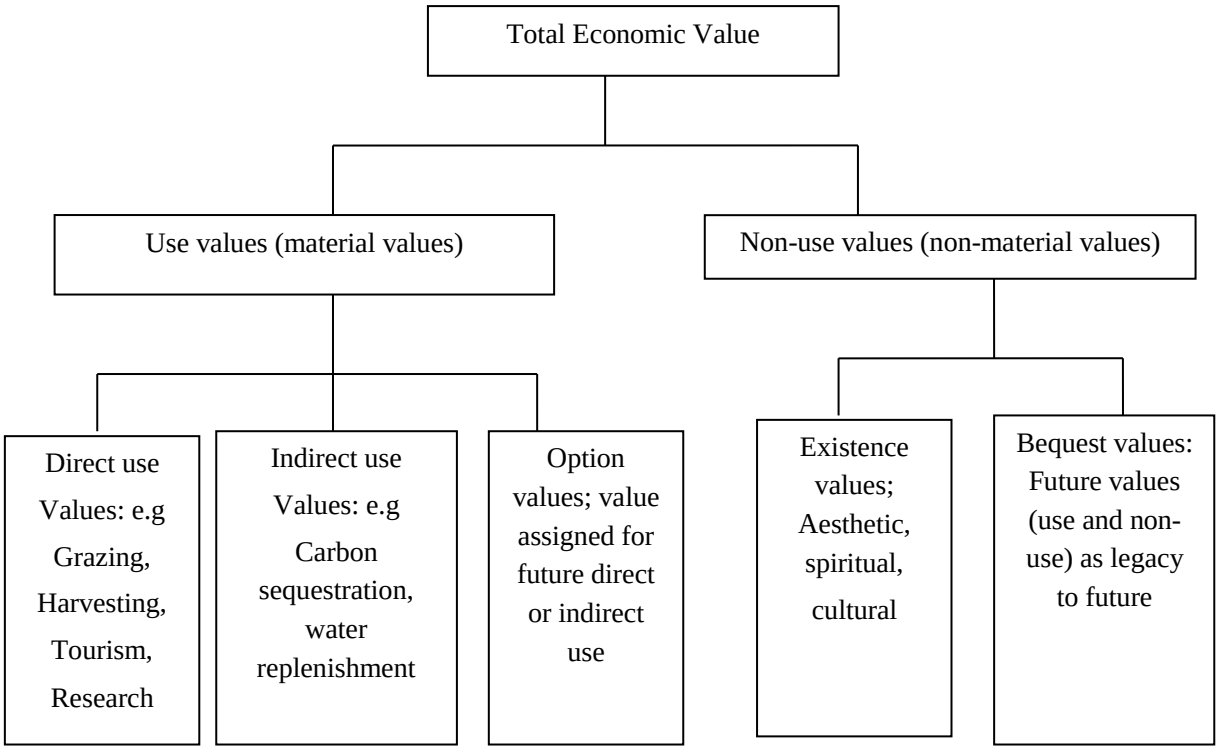


图 2.1 保护区经济学

Fig 2.1 The economics of PA (source; IUCN (1998))

Protected areas are managed for different purposes, including the protection of species and ecosystems; safeguarding of landscapes, scenic and historic features; tourism and recreation; education, science or research; protection of watersheds and important reserves of timber, fisheries and other biological resources; and increasingly for the sustainable use of natural resources by local people (Sanderson, 2005).

Missions of protected areas have broadened substantially and are expected to directly contribute to national developments and poverty reduction (Naughton-Treves et al. 2005)**.**

According to the World Bank, more than 1.6 billion people consisting of smallholder farmers who grow farm trees or manage remnant forests for subsistence and income, depend at varying degrees on forests for their livelihoods while 500 million to 1 billion indigenous people are dependent on forests (World Resource Institute, 2005). CIFOR (2002), on the other hand, reported that approximately 60 million indigenous people are almost totally dependent on forests. Relevantly, around 240 million people live in or near tropical forests, and their livelihoods and well-being depend on them. The

numbers of people who depend on and live in protected areas are significant because all protected areas are surrounded by densely populated villages.

2.2 Livelihood and Protected Areas

Most of the protected areas in the world are important not only for their biodiversity conservation, but also for their natural resources that many local people rely on for their livelihoods. The relationship between protected areas and livelihood has been the most outstanding issue in conservation in developing countries. Due to the many linkages that exist between protected areas and the surrounding areas, protected areas can no longer be considered in isolation from their neighbors. People are an integral part of the environment and therefore the human perceptions should be taken into consideration in protected areas management (Garrant 1982). It is very important to assess how relationships can be developed between protected areas and local people as well as understanding people's attitudes and perceptions towards protected areas.

The formation and expansion of PAs have positive and negative social, economic, environmental and physical benefits to the adjacent communities (Bennett and Dearden, 2014). Many studies (Canavire-Bacarreza and Hanauer, 2013) have revealed that PAs can help in poverty alleviation through empowerment, eco-tourism activities and benefit sharing from tourism. In contrast the creation of PAs can lead to restricted access to resources, conflicts with wildlife and other social impacts, eviction and displacement from a community's land (Clements et al., 2014). Local people develop negative perceptions towards conservation because of the costs and impacts experienced from PAs (Karanth and Nepal, 2012).

Most rural people living near PAs in third world countries are poor and mostly depend on agriculture and available resources, such as, firewood, fisheries and water. Such resources are found inside the park and, hence, increase pressure on natural resources (Donato et al., 2012). Dependence on natural resources is influenced by different factors, but the main are poverty, the unequal distribution and agricultural land expansion and the lack of energy source (Barbier, 2013). In rural areas, the presence of small and scattered populations do not support a sufficient scale of local economies to allow diversification into other economic activities which would reduce the pressure on natural resources (Ellis, 2000). The restriction on access to different resources, which they accessed freely in the past without providing alternatives, influences the increase in encroachment and hunting (Watson et al., 2013). According to Badola et al. (2012), the need to include local people in the planning, decision making and management of conservation activities will help to change the perceptions and attitudes of people, and hence, it will increase the acceptance of PA establishment.

The fact that some communities live in and around protected areas means that there is need for protected areas managers to work in collaboration with these communities to

achieve various conservation objectives (Alcorn 1997). According to Allendorf *et al* (2007), one of the problems that have affected the success of most protected areas is the relationship between the local people and staffs in protected areas. For success to be realized, protected areas managers should not disregard the local people but work towards adopting strategies that promote development of good cooperation with the local residents. Relationships that exist between local communities and protected areas may be understood using different approaches such as assessing the extent of damages caused by wildlife, level of resource use, effects of various development projects in the communities among others (Allendorf *et al* 2007).

It is important to understand the community first, their way of interaction and communication. Worboys *et al* (2005), in *Protected Areas Management: Principles and Practice",* point out that understanding the community may involve undertaking a Rapid Rural Appraisal (RRA) as well as RRA helps to gain an understanding of the social, economic and political processes in a community while community assessment looks into issues such as community history, dynamics of decision-making and channels of communication and interaction. While understanding the dynamics of the community, it is also important to take into consideration that every community is different and hence exhibit different communications with protected area managers. According to Worboys *et al* (2005), communities have expectations which they desire to see fulfilled by protected areas managers. Expectations such as being kept inform about major projects in the protected area and consultation may be achieved through the regular interactions. This consequently creates a positive image of the protected area among the community hence resulting in building good relationships.

2.3 Rural Households Dependence on Natural Resources

Dependency on environmental income and forest products vary between households and communities. There are many different estimates on how many people are dependent on NTFPs, but the Government of India (GoI) (2007a) states that more than 80 % of the forest dwellers are dependent on NTFPs for their basic needs and that to 30 % of rural people NTFPs contribute considerably to the income. The major factors that influences the dependency level are five capitals; physical, human, social, financial and natural (Scoones 1998), including demographic composition, climatic seasonality and location (e.g. Campbell and Luckert, 2002). The growing demand for NTFPs has improved the Soligas' economy and turned them towards a more modern way of living. The Ministry of Environment and Forest (GoI 2005a) recognizes that people who live in or around protected areas are dependent on its resources for their livelihood. However, the Government's concern is that the increased NTFP extraction is not sustainable (Ninan2006), and so the ban on NTFPs for commercial use was implemented in protected forest. Adhikari et al. (2004) found that larger families have a greater demand for natural

resources and more labor to fulfill this demand. Households are mainly subsistence-oriented and the collection is based on own consumption or sale. The resource products used by local people have a low value on the market place in the study area as they require a minimum of skills or capital to gather. The main use is for consumption, and is influenced by market prices, successful harvests and seasonality. Previous studies that examined the forest dependency and attitude relationship predicted a negative relationship between local people and resource use due to the restrictive laws that may deny people access to resources.

2.4 Linking Biodiversity Conservation, Livelihood and Tourism

Poverty eradication and ensuring environmental sustainability are part of Millennium Development Goals (MDGs). Tourism is closely related to protected areas and support financial to both conservation and management of protected area and local people living in or near by protected areas. It provides both local people and visitors with opportunities of non-consumptive use, sustainable use of biodiversity resources, and it is considered as the best strategy to improve the well-being of forest dependent community whereas pressure on forest resources is minimized (Hussain et al., 2012). Tourism has become a tool to improve the linkages between conservation and livelihood although the relationship between biodiversity conservation and tourism is complicated, sometimes complementary and sometimes competitive (Nyaupane and Poudel, 2011). The establishment of nature based tourism in areas where nature is immense and local people are under poverty is considered as viable option to address both goals (Godwin & Roe, 2001). Neto (2003) stated that environmentally oriented tourism in low-income areas provide employment opportunities, create linkage with different sectors that generates positive multiplier effects and at least natural capital on which most of them depends.

Even though nature based tourism gives emphasis to conservation of biodiversity, it is still considered as a tool for socio-economic development of local communities (Neto, 2003). The benefit of such tourism is to the local communities is not limited to economic but also results in socio-cultural and environmental benefits (Goodwin and Row, 2001). However, linking livelihood activities of local people and conservation objective is not an easy task and was topic of debate over the last decades (Salafsky & Wollenberg, 2000). Depending on the nature of governance, protected areas can affect the livelihoods of local people either negatively or positively (Coad et al., 2008). The task of finding the link between conservation and livelihood becomes complex and difficult in case of negative effects of protected areas on local people. In most of developing countries, there is incompatibility between the traditional livelihood activities and conservation objective (Ahebwa & Van der Duim, 2013). Nature based tourism in protected areas are increasingly seen as a tool to address both the conservation objective and livelihood of community simultaneously to ensure the sustainability of protected areas (Ahebwa & Van der Duim,

2013). Nyaupane and Poudel (2011) have identified five themes of linkage among biodiversity conservation, livelihood and tourism as follows;

(a) Empowerment

Tourism development and biological conservation enhance local people access to information, conservation education programs and access to forest and traditional use right to contribute policy and society especially in establishment of buffer-zone community forest.

(b) Capacity building

To engage in tourism, local people are required to have skills and knowledge to market and provide visitors with goods and services. Local people have opportunities to participate on capacity-building activities such as skill development training, leadership training, enhance livelihood and income generating activities, produce hand-made goods, especially for poor households and women. Tourism provide fund to open these training programs. In addition, it provides small loans to local households so that they can operate small-scale tourism business or other production activities.

(c) Economic-benefit

Not only replace industries which cause land use and create consumptive use of biological resources tourism also has create a market for local products. It provides job opportunities in tourism business and in operation of micro enterprises such as small restaurants, inns selling breakfast, souvenir shop. Moreover, revenue tourism and conservation also contribute to the collective economic and this money is spent on community development.

(d) Biodiversity conservation and environmental service

Protected areas support ecotourism activities such as bird watching, boating, camping, elephant riding. Conservation programs help to protect forest resources and ecosystem services so that these activities are maintained. Moreover, these programs also increase participation of local people and visitors in biodiversity conservation, protection of forest in buffer zone area, environmental awareness.

(e) Amenities development

Sufficiency of infrastructure including local infrastructure, conservation infrastructure, tourism superstructure and development of tourism products(roads, bridges, communal buildings, electricity, water supplies, school, artificial lake, watch towers are needed to support biodiversity conservation, improvement of livelihood and tourism development in the area.

According to the theory, tourism contributes to conservation and development of local community. Tourism can be an effective tool to improve linking between conservation and livelihood only when local communities living inside or nearby protected areas get their benefits, not share to other external groups (Hussain, 2012).

2.5 Participation and Conflicts

To include participation in conservation as part of development work has become more popular with development agencies (Pimbert and Pretty 1995). Community`s involvement in conservation activities in different forms is considered as an important step for sustainable resource management. The involvement of local people to make them feel involved will make conservation and management effective, but participation can also be a goal in itself towards empowerment and institutional foundation (Pretty 1995). Where there is a lack of distributed benefits to local people, compared to costs of living in or near conservation areas, biodiversity resources will not be secured and local people will not participate (Vedeld 2002). Hence, people's support is important to conservation, but it may also slow down processes and be less controllable, and this creates a dilemma for the conservation managers (Pimbert and Pretty 1995). The main conflicts that occur in protected areas are exclusion from resource use and access, removals and resettlements, threats to human life, health and property, insufficient share of park generated incomes (Adams and Hutton, 2007).

Protected areas have been established worldwide to preserve forests and to separate humans from other species (Adams and Hulme 2001). Barve et al.(2005) states that more than 99 % of protected areas around the world are subject to severe threats like poaching, encroachment and NTFP collection, to mention but a few. Conflicts between local people and civil society over land use rights are common worldwide, particularly over forest resources. Over the last century conflicts have become more intense due to several factors, such as population growth, the realization that resources are not infinite, and not least because of economic growth and colonization (Blaikie and Springate-Baginski 2007). There is, however, a growing willingness worldwide to see development and conservation as one (Bawa et al. 2007). There has been an increasing focus on people living in and around protected areas and the community-based approach over the past few decades. Benefit-sharing between local people in and around protected areas is more common now, resulting in a win-win situation between conservation interests and poverty reduction (Xu et al. 2006).

Like many other developing countries, the conflict between the protected area and local people is the major threat which hinders to achieve the conservation objectives in restrict resource exploitation from the area that used to be important source for their livelihoods and survival or as their main economic alternatives and resulted to conflicts between local people and park. Human activities, such as land clearing for settlement, agricultural land expansion, timber harvesting and fuelwood collection, are responsible for Myanmar. Local people are excluded from the protected area by imposing regulations to deforestation and forest degradation. The forest vegetation of Mount Popa had almost

disappeared once due to indiscriminate utilization of local. Forest vegetation has restored again under Forest Department`s reforestation efforts during 1957- 1972 and the area is the greatest success of reforestation projects in Myanmar. It is very important to maintain and improve this success as an evidence of restoring forest vegetation in almost degraded forest land.

2.6 Attitudes of local people towards conservation

Attitudes are generally indications of how people feel about something that is of concern to them and develop as people become more aware or familiar with an object or a situation (Hayes 1993). Perception and attitudes towards protected areas may greatly be influenced by many things, the various kind of relationship that exists between the local communities and the protected area management. Studies that have focused on local people's responses to protected areas indicate that attitudes towards protected areas and conservation in general are also greatly influenced by benefits obtained. Where benefits are either minimal, non-existent or unevenly distributed, negative attitudes tend to be dominant and conservation fails to win local support (Jim and Xi 2002).

According to Karanth and Nepal (2012) sustainable and effective conservation activities are strongly influenced by the attitudes, perceptions and impacts that local people have experienced from conservation activities. An understanding of the factors which influence people's attitudes and perception is the key features in planning, decision making and management of the conservation goals of biodiversity (Kideghesho et al., 2007). In addition (Karki, 2013) revealed that, other factors such as government policy, lack of participation in decision making, PA staff or management intervention, and poor involvement of local people in planning conservation activities, influence negative perceptions. Local people especially those living in and adjacent to PAs have had a long relation with these areas, and their attitudes generally depend on the costs and benefits of PAs and the local dependency on them (Kideghesho et al., 2007). The needs and attitudes of these nearby communities should be considered in the management of the PA to achieve long term survival of conservation goals (Chowdhury et al., 2014). According to Chowdhury et al. (2014) the effective sustainable survival of PAs, especially in developing countries, would be threatened if the needs and aspiration of the local people are not considered.

Where there is local people's participation in decision-making or some form of consultative process, attitudes towards the protected area will often be positive. Other factors such as age and education level of the local people may as well have an influence in shaping people's attitudes (Jim and Xi 2002). The figure below (Figure 2.2) gives a general summary of some of the factors perceived to influence people's attitudes towards protected areas and conservation in general.

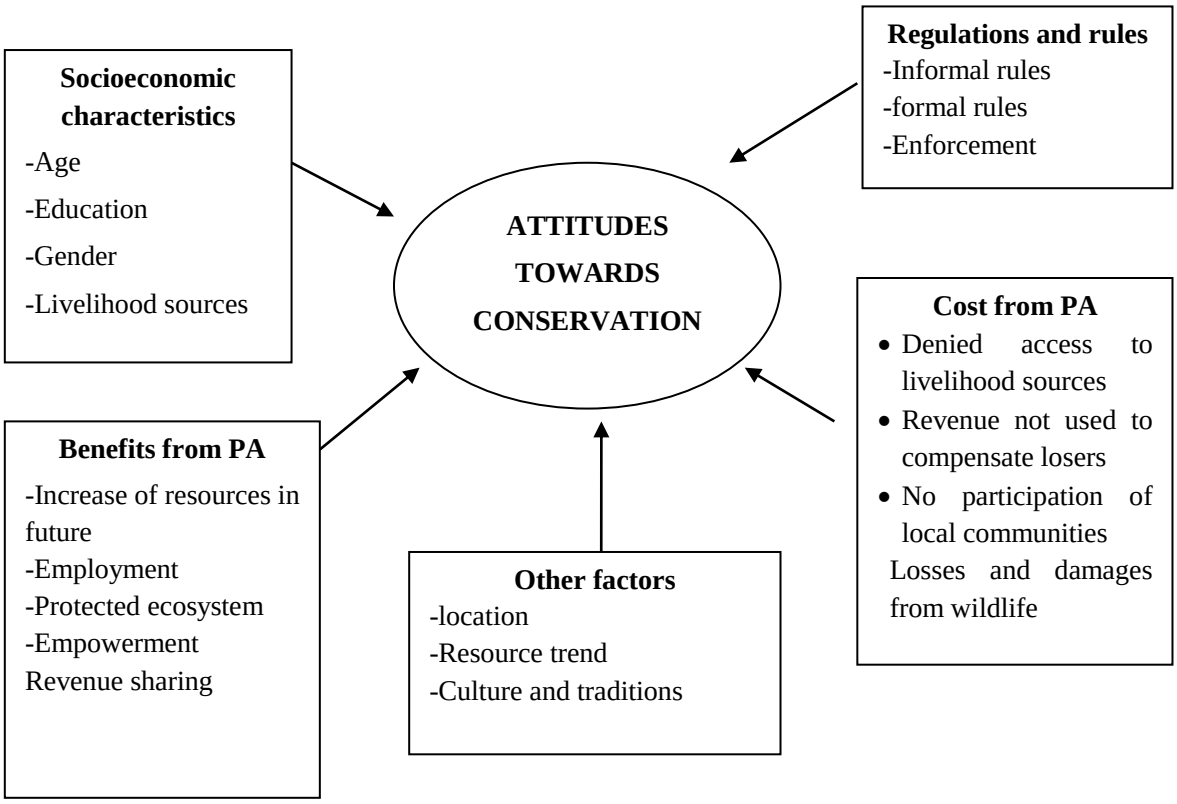


图 2.2 影响保护态度的因素总结
Fig 2.2 A summary of factors that influence attitudes towards conservation

2.7 Study on Development of Protected Areas in China

China is a country with a rich biological diversity in the world. It has 34,984 types of higher plants, 6445 types of vertebrates, and 10,000 fungus species (China Env. Science Press2011). However, due to huge pressure from population, an accelerated industrialization process, development, and the invasion of alien species as well as climate change, biological diversity in China has faced with severe challenges. To protect its ecology, China's government has created an increase in various types of PAs in recent years, which has improved the environment to some extent. However, the effects of the PAs are not simply significant in the increase in the number and coverage of protected species but also in the complete evaluation of whether the particular expansion and different types of PAs have established an efficient network and whether they are essentially protective when considering protective efficiencies, coverage ratios, management effects and other aspects. Nowadays, many countries and international organizations have already studied the development in PA networks and management methods. Based on the World Commission on Protected Areas (WCPA) in the IUCN framework for the PAs assessment, specific methodologies have been improvingly implemented in many countries according to their own circumstances.

At present, PAs in China are classified as nature reserve, cultural heritage site, forest park, wetland park, geological park, world natural and scenic zone, and water conservancy scenic locations, of which nature reserves account for the largest area and have the highest potential to influence environmental issues. The first nature reserve was established in 1956; 19 additional reserves covering 694,000 hm^2, representing 0.07% of the national estates, were established between 1956 and 1966 (China Env. Science Press, 2012). During the time from 1966 to 1978, the establishment of nature reserves nearly ceased, but since 1996, the number and coverage of nature reserves became grow exponentially (Yin 2010). In 2007, the total coverage of nature reserves became its peak at 151.88 million hm^2 before beginning to decline at an increasing rate. 2669 nature reserves become established with a total coverage of 149.787 million hm^2, occupying 14.94% of the national estates, among which national nature reserves came to 363, with coverage of 94.1456 million hm^2 at the end of 2012. China has formed a huge scale network of nature reserves, improving effective protection for 90% of terrestrial ecosystem types, 65% of the habitats for higher plant communities and 85% of wildlife species (Wu et .al 2011 and Liu 2008).

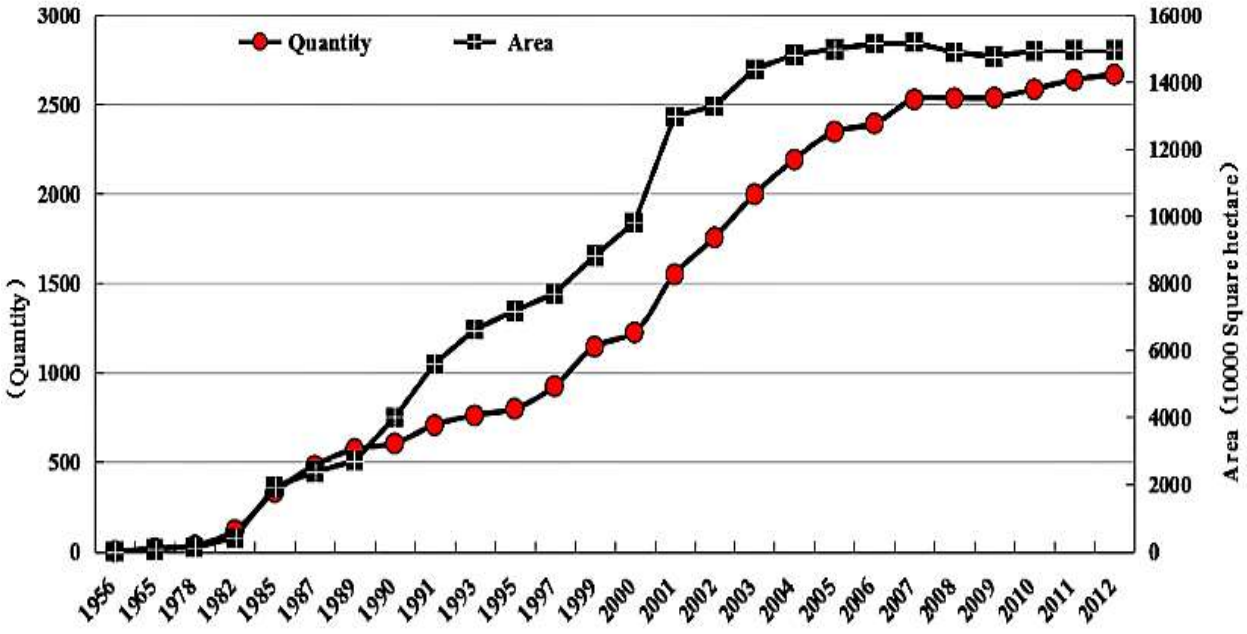


图 2.3 中国自然保护区历年发展情况

Fig 2.3 Historical annual development of nature reserves in China (by the end of 2012).

In China, the formulation of rules and regulations on PAs promote the systems needed for ecological evolution, theoretical creation and empirical exploration, thus facilitating compatibility between human being and nature, individuals and community, and the China National Biodiversity Conservation Strategy and Action Plan are important

plans at the national level that are intended to develop the creation of various ecological protected areas.

In China, the degraded environment has been started to recover as a result of great efforts in restoration, ecological conservation, and sustainable development. However, the management system of PAs still faces many challenges for concrete actions in China. After several years of development, the number, types of objects and areas under protection are increasing in China, and a network of PAs has been preliminarily established. China has issued special environmental protection laws and regulations and a list of key animals and plants to be protected. Moreover, it has signatory to a number of international treaties on environmental protection, which has provided to the development of a legal system for PAs. China has begun to seek to compile comprehensive national balance of environmental resources, and this effort may not only develop the efficiency of economic management but also serve as part of the criteria for evaluating government officials. Balance sheets of environmental resources can assess the status of natural resource assets, environmental destruction levels, etc., The Chinese government could adopt a policy support strategy, a special industry and labor exporting strategy and a tailored industry and eco-tourism strategy to ensure that local residents have a diversity of livelihood choices.

3 GENERAL INFORMATION OF PROTECTED AREAS IN MYANMAR

3.1 General Description of Myanmar

Myanmar, a republic in South-East Asia with total area 676,577 km^2 is located between latitudes 09°32' and 28°31'N and longitudes 92°10'E and 101°11'E, bordered on the south by the Andaman Sea and the Bay of Bengal, the east and southeast by Laos and Thailand, on the north and northeast by China, and on the west by Bangladesh and India (see Figure 3.1). According to the results of the Myanmar population census (2014) showed that the total population was about 51.419 millions. GDP per capita of Myanmar increased from 478 US dollars in 2007 to 1,307 US dollars in 2016 growing at an average annual rate of 12.86 %.Per capita Gross National Income(GNI), US dollars of Myanmar increased from 275 value, USD in 2006 to 1,159 value, USD in 2015 growing at an average annual rate of 18.50 %.

图 3.1 缅甸地理位置
Fig 3.1 Location Map of Myanmar

The country is divided into 7 Administrative States (Kachin, Kaya, Kayin, Chin, Mon, Rakhing, Shan) and 7 Administrative Regions (Bago, Ayeyarwaddy, Magway, Sagaing, Mandalay, Yangon, Taninthari). The capital city is Nay Pyi Taw which is situated in Mandalay Region. The elevation ranges from sea level along the costal lines to snow-capped mountains with a highest elevation of about 6,000m in the northern part of the country. It has distinctly low land and upland regions sketching for 2,051 km from north to south and 936 km from east to west.

Myanmar has a tropical monsoon climate and has three seasons- summer (March to

mid-May), the rainy season (mid-May to October), and the cold season - winter (early November to February). The average temperature ranges, in most part of the country, are between 25ºC and 33ºC in the cold season and between 32ºC and 43ºC in the dry season. Besides, the rainfall ranges are from 500 mm in the central dry zone to a maximum of 5,000 mm in the coastal regions.

3.2 Major Forest Types and Resources in Myanmar

3.2.1 Forest types

The forest types of Myanmar are diverse, varying from sub-alpine, moist deciduous forests and dry forest, tropical rain forests to mangrove forests. The forest types vary depending on edaphic, topographic and climatic conditions. Great variation in temperature, rainfall, soil and topography favors for growing different forest types in Myanmar. These can be found in mangrove forests in the delta region; hill evergreen and sub-alpine forest at high altitudes; evergreen forest in areas of high moisture and rainfall; deciduous and dipterocarps forests in the mostly dry regions; and dry thorn forests in places with scanty rainfall.

表 3.1 缅甸森林类型

Tab 3.1 Forest Types in Myanmar

As of December 2014

No.	Forest Types	Area(,000 ha)	% of Total Forest Area
1.	Mangrove forest	325.26	1.12
2.	Tropical evergreen forest	5024.09	17.30
3.	Mixed deciduous forest	11093.66	38.20
4.	Dry forest	2904.10	10.00
5.	Deciduous Indaing (Dipterocarp) forest	1237.15	4.26
6.	Hill and temperate evergreen forest	7817.84	26.92
7.	Scrub land	638.90	2.20
	Total	**29041.00**	**100.00**

Source: Planning and Statistics Division, Forest Department

3.2.2 Forest Resources

According to Forest Resource Assessment conducted in 2015, 42.92 % of the total country's area is still covered with forests as shown in the Table 3.2. Annual deforestation rate between 1990 and 2015 is 407,100 ha representing 0.6% of the total country's area.

表 3.2 缅甸森林覆盖状况

Tab 3.2 Forest cover status of Myanmar

Forest Category	Area (,000 ha)	% of Country Area
Forest	29,041	42.92%
Other Wooded Land	15,080	22.29%
Other Land	21,634	31.98%
Inland water bodies	1.903	2.81%
Total	**67,658**	**100.00%**

Source: FRA 2015

3.2.3 Permanent Forest Estate (PFE)

In Myanmar, forest resources are conserved, managed and utilized in sustainable manner by the establishment of reserved forests (RF), protected public forests (PPF) and protected areas (PA). Myanmar Forest Policy set target to constitute 30% of the total country's area as PPF and RF while 10% as PAS in long-term goal. Up to March 2016, the area of RF and PPF reaches to 24.72% of the total country's area and PAS is 5.75%. The status of Permanent Forest Estate (PFE) in Myanmar is represented in Table 3.3.

表 3.3 缅甸永久森林区的现状

Tab 3.3 Status of PFE in Myanmar

Category	Number	Area (ha)	% of total land area
Permanent Forest Estate		20627,428	30.47
Reserved Forests	827	11.991,666	17.72
Protected Public Forests	346	47,44,227	7.00
Protected Areas	39	38,91535	5.75

Source: Planning and Statistics Division, Forest Department

3.3 Existing Institutional Framework

Regarding the institutional framework, Ministry of Natural Resources and Environmental Conservation (MONREC) has the primary responsibility for implementing the Forest Policy. MONREC is structured with 13 departments; (1) Minister's Office (Environmental Conservation and Forestry) (2) Minister's Office (Mineral) (3) Forest Department (FD), (4) Dry Zone Greening Department (DZGD), (5)Myanmar Timber Enterprise (MTE), (6) Environmental Conservation Department (ECD) (7) Survey Department, (8) Mining Department (9) Survey and Mineral Exploration Department (10) No.1 Mining Enterprise (11)No.2 Mining Enterprise (12) Myanma Pearl Enterprise (13) Myanma Gems Enterprise. The important program of forestry education and training is being fully recognized by the Government. Forestry Degree was conferred presently by the University of Forestry located at Yezin, Nay Pyi Taw. Two Central Forestry Development Training Center in Pyin Oo Lwin and Hmawbei townships are established by the cooperation with JICA, especially for the in service and public trainee especially for technical and practical forestry subjects, which deliver 100 foresters every year since 1990.

3.4 Myanmar Forest Policy

Up to 1994, Myanmar has no national forest policy and used Indian Forest Policy 1894. Forest sector development was addressed according to the India Forest Policy 1894. Myanmar Selection System served as the guiding principle in forest management even

though there was no national forest policy at that time. With the assistance of FAO, an expert team including international experts and professionals from Ministry of Forestry and other areas developed Myanmar Forest Policy in 1995. It is the fundamental guideline for systematic development of forestry sector in Myanmar.

Six imperatives identified in Myanmar Forest Policy were derived for the forest sector in Myanmar. The forest policy focuses on the P**rotection** of wildlife, biodiversity, water, soil, and environment, **Sustainability** of forest resources, satisfying **Basic needs** of the local people for shelter, food, fuel and recreation**, Efficiency** in harnessing the full economic potential of the forest, **People's participation** in forest management and biodiversity conservation and raising the **Awareness** of the people and the decision makers in forestry.

The forest policy addressed (1) land use, (2) protection and management, (3) forest regeneration and afforestation, (4) forest industry, marketing and trading, (5) forest research, (6) forestry planning, (7) inter-sectorial coordination, (8) institutional strengthening, (9) budget and finance, (10) people' participation and awareness, etc. The goals and action plans for each part are clearly stated. Policy is the basic for laws and regulations of the forest management. The first forest legislation applied to Myanmar was the Indian Forest Act VII of 1863, which was replaced by the Burma Forest Act XIX in 1881 (Min Thant Zin, 2005). The Burma Forest Act and posterior amendments were in use until new legislation, Myanmar Forest Law 1992. The important instruments to implement the Myanmar Forest Policy include Forest Law (1992), Forest Rules (1995), Myanmar Agenda 21 (1997), Community Forestry Instruction (1995), Protection of wildlife and wild plants and natural conservation law (1994), National Forestry action plan (1995), National code of operation for forest harvesting (2000), Criteria and Indicators for Sustainable Forest Management (1999), Environmental Conservation Law (2012), etc.

Another important instrument to implement Forest Policy is the National Forest Master Plan (NFMP) which is the long term sustainable forestry development plan developed in 2001. It foresees the forestry situation for 30 years from 2001 to 2031 and emphasizes a wide range of forest conservation, utilization and management activities.

3.5 Protected Areas in Myanmar

3.5.1 Background of Biodiversity Conservation

Myanmar is recognized as one of the most biodiverse countries in the world. Sustaining the country's biodiversity is a national goal. Myanmar is doing its utmost to reach this using available human resources, funding and technical expertise. The conservation of nature and biodiversity is deep-rooted in the Myanmar's religions, traditions and cultures. Most of the kings issued royal decrees protecting animal life in the 1800s. Starting in 1918, hunting was banned in some areas out of concern about declining

wildlife populations. In 1920, the first protected area was established but in the early years of 1980s, modern conservation efforts have rooted. Between 1981 and 1984, Nature Conservation National Park Project (NCNPP) was started to implement under the joint implementation of Myanmar government and United Nations Development Program (UNDP).

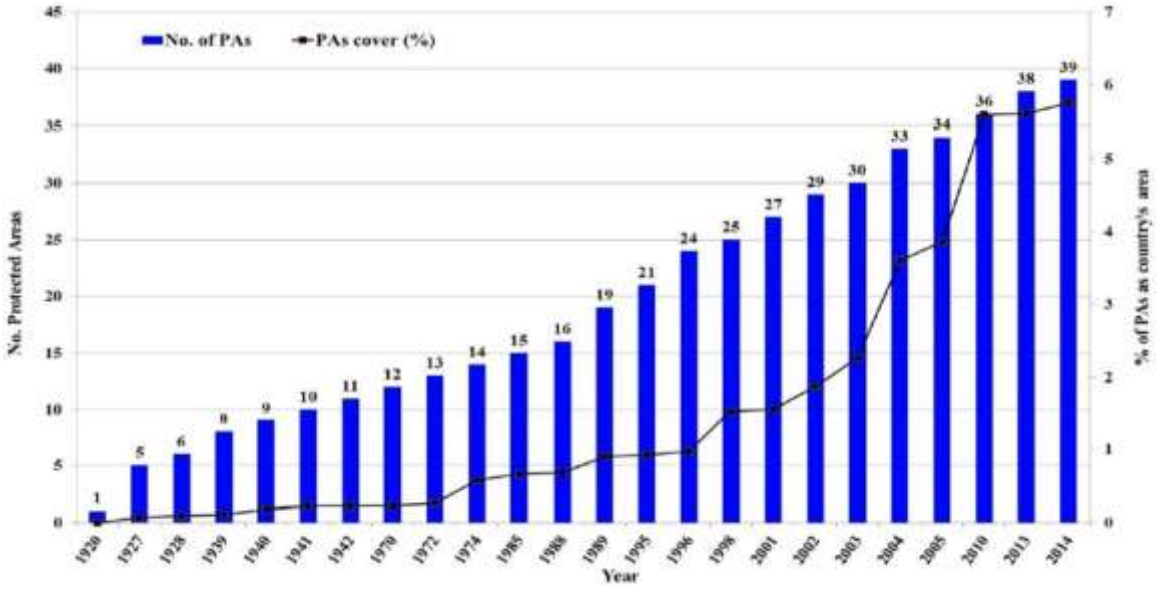


图 3.2 1920 年-2015 年 9 月间保护区发展历程
Fig 3.2 Establishment of PAs between 1920 and September, 2015

During the NCNPP, Ministry of Natural Resources and Environmental Conservation (MONREC) established the Nature and Wildlife Conservation Division (NWCD), and NWCD is responsible for nature conservation and PAs management. Since then, the establishment of PAs has increased. Up to 1996, protected areas constituted less than 1 % of the total land with individuals ranging in size from 0.47 km^2 to 2150 km^2. Establishment of protected area aims to protect of some species or habitat to protection of landscapes or ecosystems. 15 new PAs were added between 1996 and 2014, becoming the total area of Myanmar's PAs to more than 38,000 m^2 (see Figure3.2).

Among the 39 current PAs (see Figure 3.3), seven have been recognized as ASEAN Heritage Parks (AHPs). AHPs are recognized for their particular biodiversity value or uniqueness within ASEAN countries. Myanmar also has a designated Ramsar site and is exploring the potential to nominate seven other areas currently on the Tentative List as natural World Heritage Sites. The national target for PA coverage is set to increase 10% of total land area by 2030 in Myanmar's 30-year National Forestry Master Plan. This target recognizes a variety of protection types, reflecting the diversity of conservation tools and approaches used internationally, and the diversity of conservation practices. In

Myanmar, these traditional practices include sacred forests, caves, lakes, and rivers, watershed protection forests, and traditional controls on hunting and fishing.

图 3.3 缅甸保护区的位置
Fig 3.3 Location of Protected Areas in Myanmar

3.5.2 Protected Areas Management in Myanmar

To conserve the diverse forests and their associated wildlife across Myanmar, Myanmar's Forest Policy (1995) mandates an increase in protected areas to 5 % of the country's total land area. Later, this target was adjusted to 10% of total land by 30-year Forest Master Plan of the Ministry in year 2000. To date, Myanmar has designated 39 PAs covering 38,906 km^2, representing country's diverse forests have been established, and it is about 5.75% of Myanmar's land area. Seven additional areas have been proposed, which would cover a further 1.09% (see table 3.4)

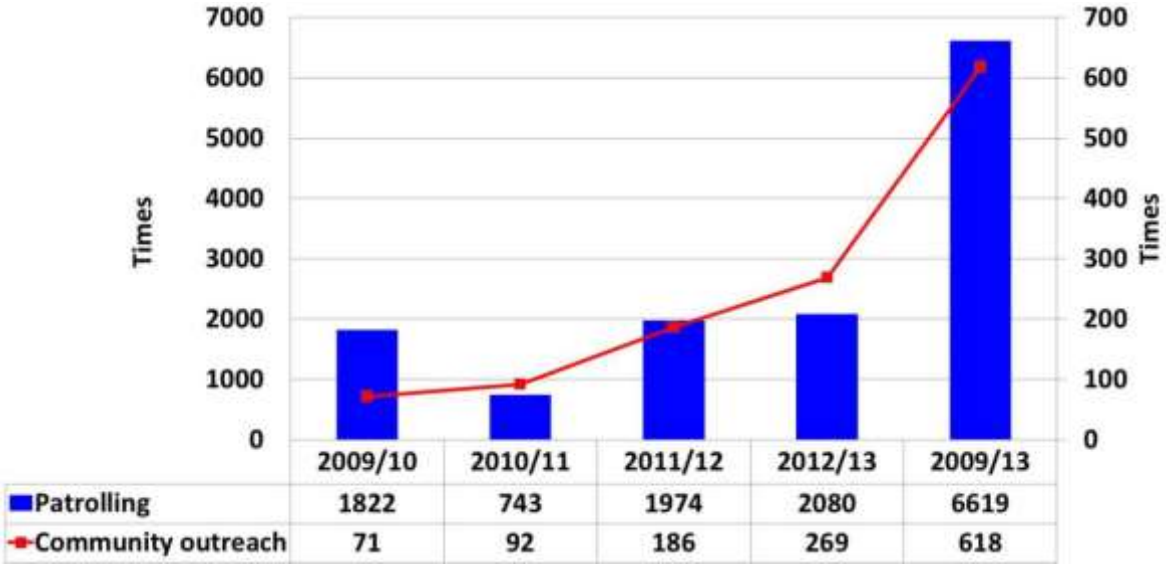
表 3.4 在缅甸建立保护区
Tab 3.4 Establishment of Protected Areas in Myanmar

No	Status of notification	Number	Total area(km2)	% of total land area
1	Notified Protected Areas	38	38029.23	5.61
2	Proposed Protected Areas	7	8062.89	1.19
	Total	**45**	**46092.13**	**6.81**

A key step for establishing an ecologically representative, effectively and equitably managed PA system is the adoption of management models that can recognize the sustainable use and the co-management. The IUCN PA management categories and governance types provide a framework for diversifying management options that can be adapted to local contexts. The Protection of Wildlife and Protected Areas Rules (2002) only recognizes one management type (IUCN Category II)and one governance type (management by government) .

In Myanmar, the Park Warden Offices have been placed up at 20 protected areas, and environmental education is also conducted for the local communities surrounding the protected areas to participate them in conservation. Moreover to prevent from hunting of wild animals, patrolling is conducted. These activities were conducted during 2009-2010 and 2012-2013 are presented in Figure 3.4. Extension programs, wildlife surveys and patrolling are implemented in almost half of the surveyed PAs. Development actions performed by park staff include, in 23% of the visited sites, community based natural resources management and community forestry in the surroundings of the PA. Outreach programs are implemented in 30% of the PA visited, in form of collaboration and meetings with neighboring communities, but also in terms of education programs.

In addition, the conservation activities are being conducted for the long-term existence of ecosystems and their associated biodiversity. Forest Department, National Police Force, Customs Department, Border Trade Department and Administration Organizations are cooperating at the township level for taking action against hunting, illegal killing, transporting, trading, possessing and exporting protected wildlife.



	2009/10	2010/11	2011/12	2012/13	2009/13
Patrolling	1822	743	1974	2080	6619
Community outreach	71	92	186	269	618

图 3.4 缅甸保护区的管理活动

Fig 3.4 Management Activities of PAs in Myanmar

The Spatial Monitoring and Reporting Tool (SMART) is the standard tool for measuring, evaluation and improving the effectiveness of wildlife law enforcement patrols and site-based conservation activities. It is intended to be used by PA managers to plan, evaluate, and implement activities. WCS is working with NWCD to implement SMART in a smaller number of PAs. Expanding SMART to all major Pas would be an effective way of improving management effectiveness. Visitors to Myanmar's protected areas include those who come to see the biotic and abiotic features and landscapes, for recreation, and those who come on religious pilgrimages to shrines and sacred caves and to meditate.

Recently, Myanmar has developed to formulate National Biodiversity Strategy and Action Plan (NBSAP) with the multi-consultation process. NBSAP is a comprehensive framework for conservation of biodiversity, sustainable use and management as well as to ensure to provide the National Sustainable Development Strategy. Although the development of NBSAP has given opportunity for implementing the alternative PAs management that favors not only biodiversity, but also local development, it is still needed to address the technological and financial insufficiency to implement and strengthen PA management in Myanmar. In 70% of the PAs visited, lack of budget and staff (both in numbers and quality) are mentioned as the main constraints to the implementation of management actions. Conflicts with local communities and insurgents are identified as main limit to management in 15% of the visited sites.

3.5.3 Categories of Protected Areas in Myanmar

Wildlife conservation legislation enacted in Myanmar in 1994 (the Protection of Wildlife and Protected Areas Law) mandates protection of wild flora and fauna and their habitats and representative ecosystems, and recognizes seven categories of protected areas. These do not directly match categories of the World Conservation Union (1994). Myanmar's categories include scientific reserve (strict nature reserve), national park, marine park, managed nature reserve, wildlife sanctuary, protected landscape, and other protected areas. The titles used in the protected area list supplied by the Forest Department are shown in table 3.5.

表 3.5 林业部门定义的保护区类型

Tab 3.5 Definitions of Protected area list supplied by Forest Department

Protected Area	**Purpose**
National park	Maintained for biodiversity conservation and representativeness. Firm management control. Visitors permitted. Not allowed settlement or resource harvesting.
Marine national park	same as national park but in marine, island and coastal environments
Wildlife sanctuary	Species conservation. Visitors permitted. No settlement or resource harvesting allowed
Bird Sanctuary	for wildlife sanctuary but birdlife conservation is paramount.

Wildlife Park	Wild animals held in captivity and in the wild but on a fairly small range. For recreation and education. No settlement or resource harvesting allowed. Visitors encouraged.
Mountain Park	Maintained to conserve landscapes, geomorphological features and sites of religious significance. No settlement allowed. Visitors permitted, including those who are allowed to harvest limited supplies of natural resources bamboo shoots, mushrooms and edible fruits.
Elephant range	A way of conserving Asian elephant. Can include villages, and may overlap with other protected areas although the only one that establishes at present does not overlap.
Protected area	A misnomer adopted by the Planning & Statistics Division of the Forest Department, which failed to consult WNCD when drawing up the declarations

3.6 State Law

The Forest Act of 1902 has been promulgated for wildlife conservation management to the Forest Department. Under this Act wild animals were a class of forest produce, and Forest Officers were empowered to control hunting. Legislation specific to wild animals followed in 1927, and in the same year a Game Warden was appointed to supervise management in general and the capture of wild elephants especially to strengthen the working force in the timber industry. Broader legislation followed nine years later with the Wildlife Protection Act of 1936. This provided for designation of wildlife sanctuaries with species-specific conservation objectives and Wildlife are afforded varying degrees of protection according to their designation: (1) completely protected species may not be hunted except for scientific purposes under a special license; (2) protected species may be hunted but only with special permission; (3) seasonally protected to allow for traditional meat hunting.

The Wildlife Protection Act 1936 was replaced by the new Protection of Wildlife and Wild Plants and Conservation of Natural Areas Law in 1994. In summary the objectives of this law are: to implement the policy of protecting wild animals and wild plants, to implement the policy of conserving natural areas, to act in accordance with relevant international conventions to which Myanmar has acceded, to contribute towards natural history scientific research, to establish zoological and botanical gardens to protect wild animals and plants.

The 1994 Law issued by the State Law and Order Restoration Council has provided for: categories of ‘natural areas’ and zoological and botanical gardens, their declaration and uses, categories of protected wild animals: completely protected, normally protected and seasonally protected, hunting licenses, establishment of zoological and botanical gardens, registration of ownership of completely protected animals or trophies thereof, administrative actions and appeal, Offence and penalty.

3.7 International conventions

Myanmar is party to several regional and international agreements, treaties and protocols on natural resources, ecosystems and biodiversity conservation (see table 3.5).Myanmar is signatory to Convention on Wetlands, Convention on Biological Diversity, International trade convention in endangered species of Wild Flora and Fauna (WFF) and Convention on the Conservation of Migratory Species of Wild Animals. Forest Department implements community based conservation approaches in collaboration with international organizations such as WCS, FFI etc.

表 3.6 缅甸签署的国际和区域协定，条约和议定书

Tab 3.6 International and regional agreements, treaties and protocols signed by Myanmar

Agreements/Treaties/Protocols	Date of Signature/ Ratification/ Acceded
Regional	
Plant Protection Agreement for the Southeast Asia and the Pacific Region	4 November 1959
ASEAN Agreement on the Conservation of Nature and Natural Resources	16 October 1997
International	
Convention on Biological Diversity(CBD)	25 November 1994
The Convention for the Protection of the World Culture and Natural Heritage	29 April 1994
Convention on International Trade in Endangered Species of Wild Fauna and Flora(CITES)	13 June 1997
Cartagena Protocol on Biosafety	11 May 2001
Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity	9 January 2014

3.8 Community-Based Natural Resource Management (CBNRM) in Myanmar

The Forest Department (FD) have been implementing community based natural resource management approach joined together with the Wildlife Conservation Society (WCS) as an approach to enhance community participation in protected area management and sustainable natural resource use by local communities. This work is carried out under the existing legal framework of the Wildlife and Protected Area Law (1994). The process involves three interconnected activities – Village Consultation Process (VCP), Village Use Zonation (VUZ) and Community Based Natural Resource Management (CBNRM) as integral parts of village participation in land use planning.

During the VCP, survey teams conduct a village timeline, listing and ranking natural resources, assessing the trends of key resources, analyzing household income and expenditure, and projecting population growth. A village profile is then developed

combining all information collected during this process, which serves as a baseline to assess future socio-economic change.

During zonation, the villager's traditional boundary and existing land uses are identified through participatory sketch mapping. Major landmarks along the village boundary and main land use types are verified through participatory ground trothing using GPS. To be sustainable natural resource management, participatory resource inventories are carried out and a natural resource management area is explored. The village then develops a management plan for their NRM area based on measured supply and demand. Entrepreneur villagers are selected and supported to develop their own individual plans for agroforestry. Village nurseries are also established to supply seedling needs for these individual plans. CBNRM is being practiced in 17 villages in Hkakaborazi National Park, 32 villages in Hukaung Valley Wildlife Sanctuary, 19 villages in Htamanthi Wildlife Sanctuary, and eight villages in Minsontaung Wildlife Sanctuary. This process will be rolled out to other protected areas.

Co-management, an internationally-recognized IUCN governance type, provides models for including communities in PA management, in order to increase management effectiveness and support community-based approaches to sustainable livelihoods. Buffer zones within PAs should be established using participatory mapping and community-based natural resource management approaches developed in collaboration with inhabitants within and surrounding PAs. Co-management, community conservation agreements, and participatory mapping and monitoring can help to reduce conflict between PAs and communities, ensure that livelihood needs are met, and provide a framework for benefit sharing from PA designation. NWCD currently tries to explore co-management and knowledge sharing opportunities through community-based participatory biodiversity monitoring systems. This gives communities a platform through which they can share knowledge of biodiversity with PA authorities, and monitor and manage resource use and trends.

4 MATERIALS AND METHODS

4.1 Logical Structure of the Research

This research is designed to examine the extent and nature of dependence on the forest and conservation attitudes around protected area by local communities with varying socioeconomic status, a household survey was done to elicit data .Mixed method of primary and secondary data collection were used. Purposive sampling was used for the selection of study areas.

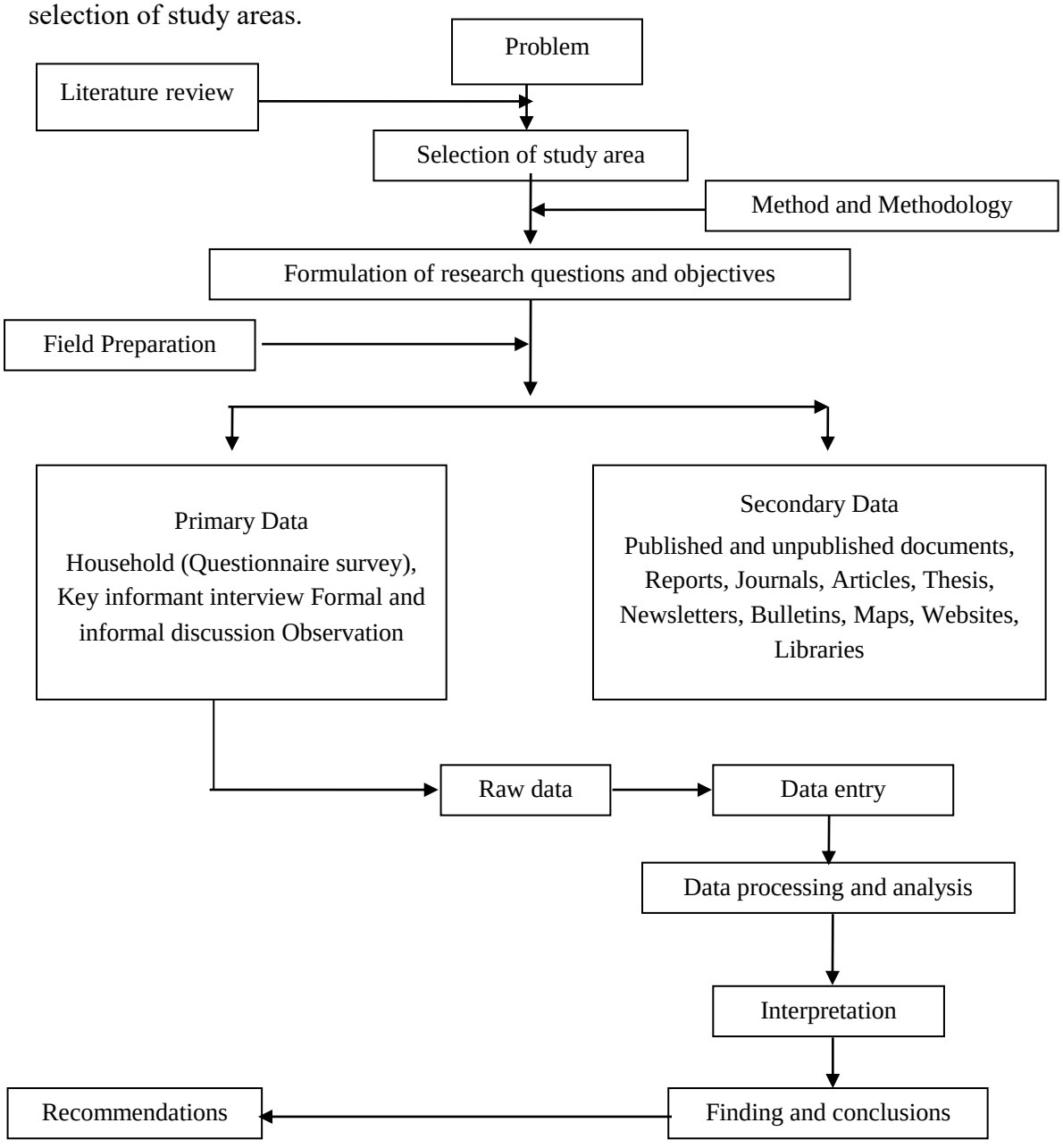


图 4.1 研究设计
Fig 4.1Research design

4.2 Description of Study Area

Popa Mountain Park is located within the "tropical dry life zone" in central Myanmar. Its geocoordinates is 25° 56′ N - 95° 16′ E. Mount Popa, which is the highest in central Myanmar, is well known for its unique flora richness in very harsh environment of central Myanmar and is an extinct volcano and one of the important pilgrim lands in Myanmar. Mount Popa with 1,518 m above sea level is the major wealth of resources offering multiple uses and values. Water sources in Mount Popa area are supplying the majority of drinking water to the people of the nearest town, Kyauk-Pa-Daung and also agricultural and drinking water to people living in the surrounding communities. It is also the source of Kyet-Maut-Taung dam that is irrigating many thousands acres of agricultural area. There has been historical and long relationship between local communities and Popa Mountain.

The area was legally classified as a forest reserve in 1902. However, with the breakdown of law and order before and after the Second World War, villagers in the area surrounding the reserve gradually moved in and opened up large areas for cultivation. The Forest Department conducted extensive reforestation in the period 1955–1972, and removed illegal cultivators from the reserve. The vegetation cover gradually increased in reclaimed areas and at the same time depleted natural springs were restored. Popa reserve was proposed as a PA by the Nature Conservation National Park Project (NCNPP) implemented between 1981 and 1984; PMP was subsequently declared in 1989. Mount Popa reserved forest was firstly established in 1902. In 1958, a large area surrounding the existing reserved forest was proclaimed as a protected area. The area of the park is about 129 km^2 and its adjacent area, about 103.6 km^2, is being established as Public Protected Forest to be used as a buffer zone of the park.

Like the rest of Myanmar, the dry zone has a tropical monsoonal climate with a rainy season from May until October and dry season from November until April. But due to its location in the rain-shadow of mountain ranges lying nearer the coast, rainfall is appreciably lower than in any other part of the country. Average rainfall ranges from 630 - 1,500 mm peryear but with most of area getting no more than about 750 mm. Due to its comparatively high elevation there are, however, marked differences between the climate of Mount Popa and the restof the dry zone, the former having an appreciably higher rainfall and lower temperature than the surrounding areas. The rainy season is from May to October usually occurring in July and a peak in September. Average annual rainfall at Popa village (580 m ASL) during the period of 1994-2005 was 1,038 mm ranging between a minimum of 651 mm in 1994 and a maximum of 1,468 mm in 2001 Average maximum and minimum annual temperatures at Popa village during the period 1994 - 2005 were 25.8℃ and 15.6℃ (*Source: Popa agricultural office* 2006).

Formally Mount Popa was covered with a luxuriant growth of moist mixed deciduous forests. However, due to cutting, clearing for cultivation and other destructive

factors, this original forest disappeared. At, present forest ecosystem observed in the park are: 1) Evergreen forest, 2) Upper mixed deciduous forest, 3) Lower mixed deciduous forest, 4) Scrub indaing forest, 5) Dry hill forest and 6) Grass land. Tree species number 300 and medicinal plants 150. Important medicinal plants include the Sindonmanwe (*Tinospora cordifolia*), Taw Shauk (*Atalantia manophylla*),Tabin-shwe-hti(*Intropha podagrica*) and Ginseng (*Panax schinseng*). Common wild animals presently found in the park area include jungle cat, jackal, wild dog, barking deer, dusky leaf monkey, rhesus monkey, eld's deer, squirrels, hare and about 130 species of avifauna. More than 100 different species of butterflies have been observed of which 4 species are identified as rare.

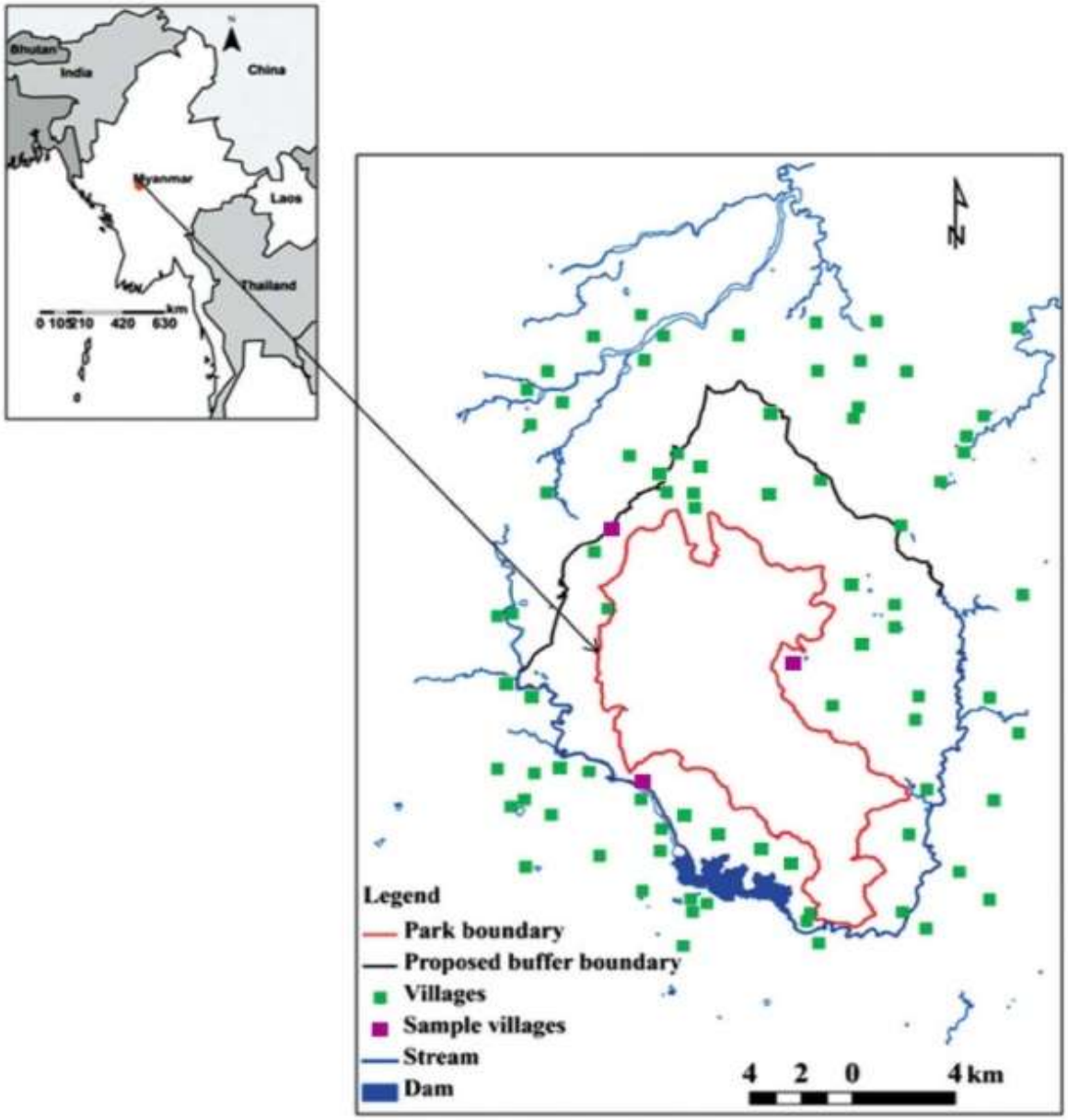


图 4.2 研究区域 Fig 4.2 Map of the study area

The area surrounding Popa Mountain is somewhat densely populated and there are 45 villages scattered around the foot of the mountain. Total households were 6,842 in 1990 with the population of round about 36,761 and increased in to 50,919 in 2005(*source: local*

administration office). The people are mainly farmers and their main crops are rice, sesame, maize and tomato. Bananas are extensively cultivated in the eastern part of the park and some perennial crops such as mango, cashew, papaya, coffee etc. are intercropped with banana. Toddy palms are an important tree crop for people living in the western part and jaggery production is a mean livelihood which consumes large quantities of fuel wood. Kyet-mauk-taung dam in the southern part of the park is a source of small scale fishery for people from villages around the dam. The flowers of *Michelia champaca* is an important income source for villagers near the Park. Volcanic plug, locally called Taung-kalat at the western foot part of Mount Popa which is one of the famous religious sites in Myanmar is a prominent landmark and several thousand visitors including foreign visitors visit it each year and such tourism is the major income sourcefor many people (Naing Z. Tun, 2008).

4.3 Sample size

There are 436 total households in three study villages. The sample size for each village was calculated by using Yamane's formula. Thus, the result of sample size calculation is 174.

$$n = \frac{N}{(1+N(e)^2)}$$

Where,

n = sample size

N = total number of households in the sampled villages

e = precision level

表 4.1 三个村的样本农户

Tab 4.1 Sample households of the three villages

No	Village	Total Households	Sampling Households
1.	Shaw Taw	206	67
2.	Let Pan Aint	110	52
3.	Popa Lwin	120	55
Total Sampling Households		**436**	**174**

4.4 Data Collection Methods

4.4.1 Primary Data Collection

The Field survey work for this research was carried out in and around the villages of Popa Mountain Park in July and August 2016. To fulfill the research objectives, field data collection is mainly based on exploratory social survey research method. In this study, Descriptive statistics method including proportions or percentages averages, and others, will be used to do the data analysis on household incomes,

household socioeconomic information of sampled respondents. The household questionnaire was intended to collect information about household characteristics (age, sex, level of education and number of household members), different economic activities (e.g., crops production, fishing, and business), costs and benefits, and types of assets owned (e.g., land size, livestock and other physical assets), as well as household perceptions and attitudes towards conservation activities.

The purpose is to analyze the actual inter-links between the protected area and the local people. Based on accessibility, nearness to forests and dependency on forests for livelihoods in a protected area, the study was carried out in Popa Mountain Park in Mandalay Region of Myanmar. The primary data was collected using Reconnaissance Survey, Household (Questionnaire survey), Key informant interview, Informal and formal discussion and Directly Observation.

i. Reconnaissance survey

A reconnaissance survey was carried out in the selected site to conceptualize the real situation of ongoing resource-use practices and surface knowledge of the socio-economic condition.

ii. Household (Questionnaire) survey

The household (Questionnaire) survey was carried out July and August 2016. Questions were written in English. Prior to the survey, a pilot survey was conducted with one assistant in the study area to test the completeness of the questionnaire. After such study, some questions were modified to improve the clarity and to minimize biases. Usually, household heads (generally male) were interviewed; in their absence, any member willing to participate was interviewed resulting in 56 female and 49 male respondents. Respondents answered each attitude statement according to their strength of agreement.

iii. Key Informant Interview

In response to questions asked by a third party, many people may not reply truthfully if they fear actions against their interests, a general drawback of questionnaire surveys (e.g. De Boer & Baquete 1998; Mehta & Kellert 1998). Additional information on existing management practices and options was obtained by administering Key Informant interview such as social workers, local influential leaders, user’s committee members, teachers and progressive farmers.

iv. Formal and Informal discussions

These discussions were conducted with government staffs, farmers, village elders, school teachers, students, tourists and social workers to gather more information to assist with the interpretation of the respondents.

v. Direct Observation

A walk was carried out around the protected area to observe the biodiversity in the study area as well as its physical settings. The different activities were directly observed in many places like respondent's home, farm, forests and surrounding. Infrastructures related to energy use, health and sanitation, drinking water and irrigation and livestock were extensively observed.

4.4.2 Secondary Data Collection

Secondary data related to the study were collected from Head office of Forest Department (FD) and Township level of Forest Department. Collecting secondary data related to the protected area (PA) management were taken from all possible sources such as existing policies, laws, regulations and procedures in Myanmar. Related publications and literatures from various journals, books, papers, reports and theses have been reviewed for secondary data collection. In searching the secondary data, the recognized web sites such as Google scholar (www.googlescholar.com) and Science direct (www.sciencedirect.com) were used to cover the update and required information.

4.5 Methodology

4.5.1 Estimating Forest dependency

Forest dependency was estimated in order to point out the contribution of forest income to total household income and to measure the degree of dependence on forest. In considering the share of forest income in total household income both subsistence and cash value were taken into account. Ordinary least regression was run in order to identify which socioeconomic variables influence on forest income. The forest income was regarded as the dependent variable and household characteristics such as age, sex of the household head, education of the household head, household size, agricultural land holding, off-farm income, and agricultural income were considered as independent explanatory variables. The econometric equation can be stated as follow.

$$Y = \beta_0 + \beta_1 EDU + \beta_2 AGE + \beta_3 GER_+ \beta_4 LDSZ_+ \beta_5 HHS_+ \beta_6 AGIN_+ \beta_7 NONFIC_+ u$$

Where, Y = forest income,

β_0 = intercept,

β_1 = estimated coefficient of Education,

β_2 = estimated coefficient of Age,

β_3 = estimated coefficient of Gender

β_4= estimated coefficient of Land holding size

β_5= estimated coefficient of Household size

β_6= estimated coefficient of Agricultural income

β_7= estimated coefficient of Non-farm income

u = error term

Total household income was estimated as follow.

Household annual income = Σ (income from agriculture + Non-farm income + income from forest).

Based on the above model discussed, the socioeconomic variables definitions and their expected sings for forest dependency are shown in Table 4.2 below.

表 4.2 变量定义及其对依赖模型的预期符号

Tab 4.2 Variable definitions and their expected sign for dependence model

Variable	Variable definition	Expected sign
EDU	(Respondent's level of education)	Negative
AGE	(Respondent's age in years)	Negative
GER	(1 if respondent is male, 0 for female)	Positive
LDSZ	(land area in acre)	Negative
HHS	(household family size)	Positive
AGIN	(Total income from agriculture)	Negative
NONFIC	(Non-Farm income)	Negative

4.5.2 Estimation of Forest Conservation Attitude

Attitude is defined as organization of beliefs about an object or situation that influence one's response to that object (Rokeach, 1968). The local community's conservation attitude was analyzed as a function of forest dependency and a set of socioeconomic factors. The respondents around the Park expressed their attitudes towards conservation by accepting or rejecting several statements. Logistic regression analysis was applied to interpret which factors were significant indicators in predicting attitude towards conservation and to assess the relationship between socioeconomic factors and conservation attitude (Gillingham & Lee (1999).

$$\ln\left(Pi / {}_{1-Pi}\right) = \beta_0 + \beta_1 X_1 + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \beta_n X_n$$

where i = i th observation,

Pi = Probability of dependence on the forest,

β_0 = Intercept which is the estimation of probability of dependence on the forest when X = 0,

β_1 to β_n = Coefficients associated with explanatory variables,

Xi-n = independent variable

Based on the conceptual framework discussed above, the socioeconomic variables definitions and their and their expected sings for forest conservation attitude are shown as follows.

表 4.3. 变量定义及其对森林保护态度模型的预期符号
Tab. 4.3 Variable definitions and their expected sign for forest conservation attitude model

Variable	Variable definition	Expected sign
EDU	(Respondent's level of education)	positive
AGE	(Respondent's age in years)	Positive/neg.
BFFPF	(1 if respondent's family benefits from the protected forest, 0 otherwise)	Positive
LANDLIM	(1 if respondent's important issue facing the community is land scarcity, 0 otherwise)	Negative
LIMAC	(1 if respondent's important issue facing the community is limited access to forest resources/ products, 0 otherwise)	Negative
DEPINX	(1 high dependence, 0 otherwise)	Negative
RESIDENCY	(respondent's residency length in year around the protected forest)	Negative

4.6 Data analysis

In this study, all questionnaires were carefully checked to detect errors. Accurate data that are consistent with other facts were included for coding and tabulation. Both descriptive statistics (mean, sd, etc.) and econometric analysis were used. Descriptive statistics method was used to do the data analysis on household incomes, household socioeconomic variables. Econometrics analysis was used to analyze the relationships between forest income and household characteristics and to determine factors that influence households' dependence on forest. Ordinary least regression was run in order to identify which socioeconomic variables influence on forest income. Logistic regression analysis was applied to interpret which factors were significant in predicting attitude towards conservation. The collected data were analysis using Excel 2010 and STATA version 13. The analyzed data were interpreted using charts, graphs, figures, tables and texts.

5 ANALYSIS OF FOREST INCOME IN RURAL HOUSEHOLD LIVING AROUND PROTECTED AREA

5.1 Socio-economic characteristics of the respondents

5.1.1 Age and Gender of Respondents

According to the descriptive statistics analysis, average age of the household heads was 51.44 years with a minimum of 26 years and maximum of 78 years old. Of the 174 responses, 61.49 % and 38.51 % were male and female respondents respectively. Table 5.1 describes the percentage of male and female respondents in the household surveys.

表 5.1 受访者的性别
Tab 5.1 Gender of Respondents

Gender Categories	Frequency	Percentage	Cumulative Percent
Male	107	61.49	61.49
Female	67	38.51	100.0
Total	**174**	**100.0**	

Source: Household Survey (2016)

5.1.2 Household Size of Respondents

The descriptive statistics shows that the range of household size is from 1 (minimum) to 7 (maximum), and the average household size is 3.93 (standard deviation sd = 1.30). Household size was classified into three levels: small (1-3), medium (4-5), and big (6-7) (Table 5.3). Medium household size got the majority of households in the study area. Based on the result from the regression analysis, there was statistically significant difference on household size in three study sites.

表 5.2 受访者的家庭人数
Tab 5.2 Household size of Respondents

Household size category	Frequency	Percent	Cumulative Percent
1 - 3	67	38.51	38.51
4 - 5	88	50.57	89.08
More than 6	19	10.92	100.0
Total	**174**	**100.0**	

Source: Household Survey (2016)

5.1.3 Educational Level of Respondents

Table 5.2 describes the educational status of household survey respondents for the study sites. The primary education from Grade 1 to Grade 4 is the highest in all study sites followed by about 84% of respondents from all study sites. The second highest majority is illiterate in which the respondents have no educational status at all showing about 77% of the respondents. The average education level is 1.66. As per statistical

analysis for two independent sample t-tests, there was no significant difference among education levels of respondents from my study sites.

表 5.3 教育水平
Tab 5.3 Education Level

Educational Level	Frequency	Percent	Cumulative Percent
Illiterate	77	44.25	44.25
Primary	84	48.28	92.53
Middle	9	5.17	97.70
Colleague/University	4	2.30	100.0
Total	**174**	**100.0**	

Source: Household Survey (2016)

5.1.4 Land Ownership

Land ownership refers to the land holding of respondents used mainly for cultivation of fruits, bananas and seasonal crops production. Only 33.33 % of the households are agricultural landless and the remaining households own agricultural land. The average agricultural land size is 1.66. Table 5.4 shows that the majority (50%) of respondents' families has land less than 2 acres. While 23.56% of respondents families possess land between 2 and 3 acres; and 25.86 % of them have land more than 3 acres.

表 5.4 受访者拥有的土地规模
Tab 5.4 Respondents by land ownership

Land Ownership(ac)	Number(family)	Percent
Less than 2	88	50.58
Between 2 and 3	41	23.56
More than 3	45	25.86
Total	**174**	**100.0**

Source: Household Survey (2016)

5.1.5 Comparing Forest income among different income level

This section aims to analyze level of dependency of different income level household on forest income in each sampled village. Among the sampled villages, about 38 % of the total household income in the Shaw Daw was dependent on collection of forest products while the second largest income is agricultural income about 36% to the total household annual income. This study site is located in east part of Popa Mountain area. The villages' main livelihood used to banana cultivation in the memorial period time was changed to agroforestry growing trees with other perennial crops. Figure 5.1 shows that approximately 42 % of the total annual income is income from forest products but the second largest income is non-farm income such as salaried jobs, remittances and wage labor etc. in Let Pan Aint. However, households in the village were dependent on low

income from agriculture. The study site is located in the southern part of Mt.Popa and the area is not good road access. Forest products such as firewood and bamboo shoot were found critically important as household income source in this area.

The study is to point out the level of dependence on forest income and to test whether high income households depends more or low income households depend more on forest income. As shown in Figure 5.1, Popa Lwin village located in the North-West of Mt.Popa were dependent on the lowest income from forest products among the three sampled villages. This village has good accessibility with other areas. Moreover, with regard to demand for firewood as an energy source in the study site, rural electrification may reduce rural household demand for firewood. Non-farm income such as salaried jobs, remittances and pensions for aged people contributes to about 37% of the total annual income as their main largest income. Figure 5.1 represents the summary of comparing dependent income sources in each study village.

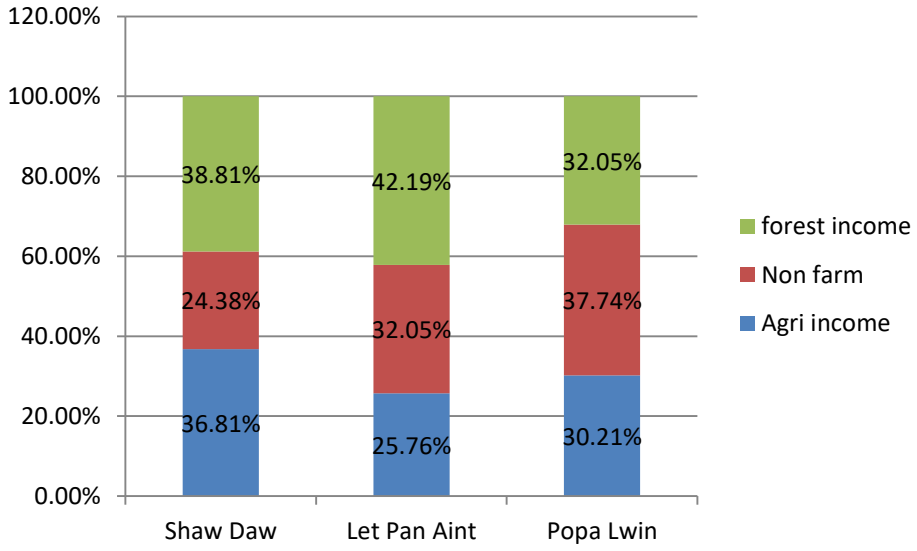


图 5.1 各研究村的收入来源比较

Fig 5.1 Comparing income sources in each study village

5.2 Income Levels and sources

There are three major different income sources in the study area such as agriculture, non-farm activities, and forest products collection. Among them, share of forest income to the total household income is the highest share. Table 5.5 indicates the share of different incomes to the total household income in the sample villages.

5.2.1 Agricultural income

In the study area, agriculture is the primary livelihood, providing the second largest share with 31.74%to the total household income in three villages. Their livelihoods are firmly connected to agricultural households. Gunatilake (1998) showed that higher agriculture productivity and agriculture income result in less extraction of

forest resources. In general, people from farm dependent villages will depend less on forest resources. The forest dependency is inversely related to agricultural income in the statistical analysis. In the study area, the average agricultural land size is 1.66 ac and only 69.54% of household engage in agricultural production. Not surprising that agricultural income is the second largest share in the total household income and almost the same with the share from non-farm income because most households are agricultural landless and the average agricultural land size is small. Average agricultural income is about 1019523 Kyats which constitute 31.75% in the total household income per year. Villagers mainly cultivate bananas, fruits and other seasonal crops. Most of the families grow rice for home consumption.

5.2.2 Non-farm income

As shown in Table 5.5, non-farm income is 30.50% nearly the same as the agricultural income and income such as salaried jobs and business were collected from individual members. This also includes other sources of income such as remittances, and pensions for age old people. Non-farm activities are the important livelihood diversification strategies for most of the rural households especially for poor landless households. Other important non-farm income source for poor agricultural landless families is wage labor such as wage labor for planting, weeding in the agricultural sectors. Based on the result of statistical analysis, non-farm income was statistically significant and negatively correlated to forest income.

5.2.3 Forest income

Household annual income from forest products is 37.76% to the total household income, the highest income source in the three study sites. The most important forest products were firewood, fruits and leaves, medicinal plants, bamboo shoot and mushroom. According to personally observation, there is widespread selling of handicrafts to tourists by local villagers at the local market which tourists go around. The contribution of forest income to total income in PMP National Park is relatively high compared to other income sources.

A study made by Mamo, Sjaastad and Vedeld (2006) in Dendi District of Ethiopia estimated that income from forest resources contributed to 39% of the average household income which is roughly equal to agricultural income 40%. But the study of Pyi Soe Aung et al. (2014) revealed that the forest income is the most important source of household income, contributing to about 50 % to 55% of the total household income in two villages located near Natma Taung National Park in Myanmar. Moreover Saha and Sundriyal (2012) also found that high dependence on wide variety of NTFPs in humid tropics of northeast India and NTFPs contributed to 19-32% of total household income for different communities in northeast of India.

表 5.5 收入来源和水平
Tab 5.5 Income sources and levels

Type of Income	Average Income per year (Kyats/Year/ household)	Standard deviation	Standard error	Income share (%)
Agricultural Income	1019523	1019069	77255	31.74%
Non-farm Income	979425	720848	54647	30.50%
Forest Income	1212816	723480	548467	37.76%
Total Income	**3211764**	**988077**	**74906**	

5.3 Households involvement in different sectors

Location of the households in the protected area is one of the important factors that are hypothesized to influence the extent level of forest dependence. Households diversify different livelihood strategies based on their household assets in the study area. These include agriculture, non-farm, and collection of forest products activities. Table 5.6 shows the involvement of sampled households in different sectors. As shown in the table, majority of households engaged in forest products collection for different purposes including commercial and subsistence. Out of the 171 sample households in the study area, 87.36 % of the households collect various forest products while the second largest percentage (69.54%) of households engaged in agriculture sector. 45.40% of households involve in non-farm activities.

表 5.6 家庭参与不同部门
Tab 5.6 Households involvement in different sectors

Sectors	Number of Respondents	Percentage
Agriculture	121	69.54
Non-farm	79	45.40
NTFPs	152	87.36

5.4 Contribution of different major forest products to forest income

The villages located adjoining the Protected Areas boundary depend upon forest resources for their livelihood in various levels. Forest products play a critical role in generating income and employment among the rural poor community. The collection of forest products like firewood mainly affects wildlife habitat and the ecosystem of the protected forest. Households were found to collect forest products both from the PA as well as from the RF .About 43% of the respondents collected forest products both PA

and RF, and 38% reported as only from the PA, their forest products source where the rest 19% mentioned RF as their sole source of collection. The major forest products reported by households include firewood, medicinal plants, bamboo shoot honey and others. According to personal observation, there is widespread selling of handicrafts to tourists by local people at the market which visitors usually go around. Income share from firewood, medicinal plants, bamboo shoot, honey and others are 43%, 36%, 15%, 4%, and 2% respectively. Firewood is the major source of energy and largest share in forest income, used especially for cooking by local people. Medicine is the second major forest products including utilization of the indigenous medicinal plants, herbs, grasses, trees, and animals by the rural people to mainly treat or cure illness of peoples within the community or outside community and sometimes they are sold outside. Figure 5.2 indicates different major forest products in the study area.

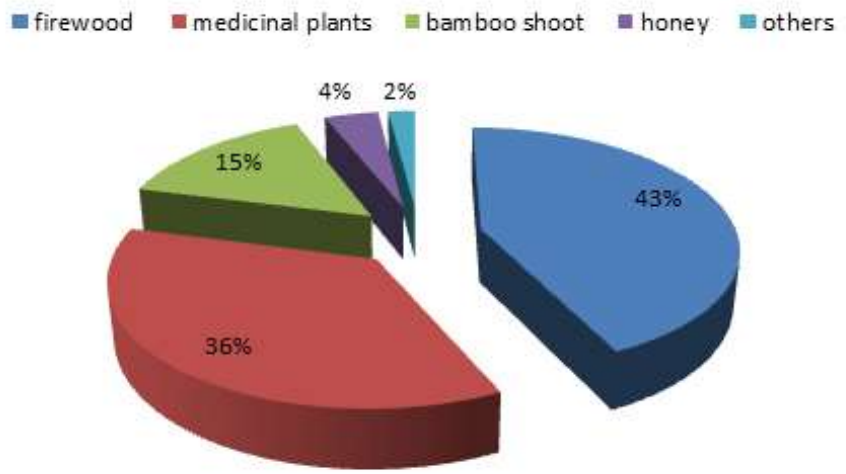


图 5.2 不同主要林产品的贡献
Fig 5.2 Contribution of different major forest products

5.5 Estimation of Forest Dependency

5.5.1 Statistical analysis method

Forest dependency was estimated in order to point out the contribution of forest income to total household income and to measure the degree of dependence on forest. In considering the share of forest income in total household income both subsistence and cash value were taken into account. Ordinary least regression was run in order to identify which socioeconomic variables influence on the relationships between the forest income as the dependent variable and household characteristics such as age of the household head, sex of the household head, education of the household head, household size, agricultural land holding, non-farm income, and agricultural income as independent explanatory variables. The econometric statement can be shown as follow.

$$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots. + \beta_k x_k + u$$

Where, Y = forest income,

β_0 = intercept, β_1, $\beta_{1,\ldots,}$ β_k= estimated coefficient of explanatory variable x_1, x_2,… x_k respectively

u = error term

Total household income was estimated as follow.

Household annual income = Σ (income from agriculture + Non-farm income + income from forest).

The information of these incomes was considered as follows.

Agricultural income

Agricultural income in this study includes income from agricultural crops. In calculating agricultural crop income, all incomes generated from farming were accounted. Both subsistence and cash income from farming were calculated as agricultural income by multiplying the products with its price. The quantity of crop yields was obtained from individual households through face to face household interviews. Reported price of each product by household itself was used in income calculation. Reported prices for each seasonal product were same as they sold their products in the local markets almost at the same time. Agricultural income used in this study is net income from agriculture because the value of inputs such as seeds, fertilizer, labor cost, etc. (only hired labor cost was considered and cost of owned labor was not included in the calculation)was deducted from the total income.

Non-Farm income

Non-farm income include all income from wage labor, permanent employment such as pension, government staff, private shops, income obtained from property. Wage labor in the study area is mostly in the agricultural activities. There is also other source for wage labor such as wage labor in private plantations, teak and other hardwood plantations, established by the private companies and individuals. The daily wages for man and woman are not the same. The wage rate and number of working days reported by the respondents was used in the estimation of non-farm income. Income from pension, private shops, etc. was collected from the individual household using face to face interview approach.

Forest income

Information about collection and sale of forest products was obtained from households. In addition, a different kind of all non-timer forest products (NTFP) was explored with key informants. Products from forests such as firewood can be sold commercially to generate cash while subsistence products such as medicinal plants.

Income from commercial products was calculated by multiplying the quantities with market prices.

Explanatory Variables

Descriptions of the variables used in the logistic regression analysis and their expected relationship with forest dependency are summarized as belows;

Education

Hedge and Enters (2000) show that high-educated people have greater offfarm employment opportunities than low- educated people. In general education opens up diverse and better employment opportunities. As such people tend to move away from subsistence agricultural and gathering activities. Therefore, this study shows that forest dependency is inversely related to the education level of the family members.

Age

Age is one of the important indicators in influencing forest dependency. Dependent activities in protected forests are labor intensive because people have to walk a long distance to reach and find the forest resources. Moreover, forest dependent activities are often prohibited in protected forests, therefore elderly people may not take a risk of going into the forest to do illegal activities.

Gender

Nature collection and use of forest resources depend on the sex of the individual. Men carry out activities such as hunting and mining. Collection of vegetables and medicinal plants are exclusively carried out by women. Cultivation and firewood collection are joint activities. Because forest dependent activities are labor intensive and prohibited in the PAs, men are more likely to take the risk relative to women to enter the forest. Therefore, it is hypothesized that household with heads of males have a greater dependency than households with women as heads.

Household size

Family members with more labor tend to collect more forest resources (Gutanilake 1998). Generally, large families need more resources to meet their subsistence, therefore have a higher propensity to extract resources from the reserve. In addition, families with more labor can mobilize part of it for forest dependent activities while maintaining the labor supply for village-based activities.

Landholding size

Families with more land are likely to earn more income from their own land and therefore depend less on forest resources from the reserve. Thus, land size is expected to be inversely related to forest dependency.

Testing for collinearity of independent variables

Also prior to the regression analysis, collinearity test was performed for all independent variables. According to Menard (2001), collinearity is a problem that occurs when independent variables are correlated with one another. Where the independent variables are highly correlated it becomes impossible to come up with reliable estimates of the individual regression coefficients. A low level of collinearity is not generally problematic, but high levels of collinearity (when coefficient of determination (R^2) of at least one of independent variables is equal or greater than 0.8 may pose problems. In such a situation, only one of the two collinear variables should be considered in the model. In STATA statistical package, the tolerance statistic is available to test the collinearity. The tolerance of less than 0.20 (equivalent to R^2>0.8) indicates a problem of collinearity (Menard 2001). A tolerance of less than 0.20 or 0.10 and/or a VIF (variance inflation factor) of 5 or 10 and above indicates a multicollinearity problem. But in this analysis (table 5.7), the test showed no collinearity with tolerance ranging from 0.448 to 0.953, which is higher than the critical value of 0.1. Therefore, all the independent variables were used in the regression analysis.

Tolerance = 1- R^2, VIF = 1/ tolerance

表 5.7 森林依赖模型的共线性检验

Tab 5.7 Collinearity test of Forest dependency model

Independent Variables	**Collinearity Statistics**	
	Tolerance	VIF
Education	0.527	1.90
Gender of respondent	0.950	1.05
Household size	0.953	1.05
Age of respondent	0.548	1.83
Landholding size	0.546	1.83
Agricultural income	0.448	2.23
Non-farm income	0.760	1.32

Tolerance for all variables exceeds 0.1; indication that multicollinearity is not a problem

5.5.2 Results and Discussion

Results of the OLS regression explaining the forest dependency of the households near the PMP are presented in the following table. Table 5.8 shows the significance and coefficient of each independent variable on the dependent variable .In my study, five socio-economic factors such as (1) family Size, (2) education, (3) family income from non-forestry activities, (4) land ownership (5), family income from agricultural activities were analyzed to explore the indicators influencing the degree of forest dependency. To test these hypotheses, the OLS regressions analysis has been applied to study the effect of independent variables on dependent variable.

In this analysis, the F-test of the model showed that the regression model is significant at 0.1% probability level. The model has a reasonable explanatory power with R^2 value of 0.214 and many explanatory variables have the expected effect on forest dependency. While coefficients on the AGIN, NONFIN, HHS and LDSZ are statistically significant, variables EDU, GER and AGE didn't show a significant effect on forest dependence. In the study, the negative coefficient of education level suggests that educated people can easily get off farm employment opportunities than non- educated people. The education allows people to go away from subsistence agricultural activities. Campbell *et al*. 2002) found the study that less educated people are more likely to rely on forest income, as they have less access to alternative incomes such as wages or business.

Gender is an important predictor in the collection and utilization of forest products. The relationship between the gender of the resource user and dependency on forest products was not significant, but in the current study, the positive coefficient of GER demonstrates that male respondents are more dependent on forest resources. On the other hand, men participated in intensive activities involving commercial extraction of firewood. The large families generally require many resources to satisfy their daily needs, therefore there is a higher tendency to extract forest resources. It was hypothesized that the size of the household (HHS) is directly related to forest resource dependency. In my study, the variable household size has a positive relationship with forest dependency and it is statistically significant at 1%. This implies that large families tend to rely on the forest resources in order to increase their income. Controlling household size through the provision of favorable policy incentives could help the resident's dependency and extraction pressure on the forests being conserved in the protected areas. Other studies such as Masozera and Alavalapati (2004) also found the same relationship between household size and forest resource exploitation.

The variable AGE shows a negative relationship to the forest dependency. This suggests that younger households are more dependent on forest resources. This may be due to the fact that forest dependent activities around PMP are illegal and it is risky to undertake them. Youth generally take greater risks relative to older people in the local community. Furthermore, with limited off farm opportunities, younger people rely more on forest resources to meet their basic needs. A study by Andre and Platteau (1998) in Rwanda noted that younger households are being trapped in poverty due to limited alternative economic opportunities.

The negative coefficient of LDSZ suggests that respondents with larger landholdings are less dependent on forest resources. This is consistent with the findings of Reardon and Vosti (1995) that in Rwanda, land-poor is also poor in off-farm capital and therefore cannot afford to continue sustainable agriculture. Therefore, land poor will rely more on forest resources to meet their livelihood needs. Agricultural land is the most important factor that is likely to reduce the dependency of local community on

forest products. Babulo et al. (2008) also found that households with large plots of land were less likely to engage in forest extraction as their dominant strategy.

表 5.8 森林收入与家庭社会经济变量的 OLS 回归
Tab 5.8 OLS regression of forest income against household socioeconomic variables

Variables	**Estimated Coefficient**	**t**	**P>|t|**
EDU	-84149.21 (100040.2)	-0.84	0.401
GER	17007.47 (104672.3)	0.16	0.871
HHS	112164.2** (39259.78)	2.86	0.005
AGE	- 7454.789 (5563.96)	-1.34	0.182
LDSZ	- 103163.3 * (42268.91)	-2.44	0.016
AGIN	-0.1695158 * (0. 0729685)	-2.32	0.021
NONFIN	-0 .1682333 * (0. 0792486)	-2.12	0.035
Constant	1797072 *** (455786.7)	3.94	0.000
	Observations = 174		
	R^2 = 0.2139		
	Adj R-squared = 0.1807		
	F = 6.45		
	Prob > F = 0.0000		

Legend * p<.05; ** p<.01; *** p<.001

Agricultural income was ($p<0.05$) was negatively correlated to forest income and statistically significant at 5%. This implies that households with high total agriculture income are less dependent on forest resources. This result is similar to the finding of Gunatilake (1998) which agriculture income was found to have a negative impact on forest dependency of the community in Sri Lanka. Agriculture constitutes the main source of income for rural Rwandan households and contributes substantially to their income. Therefore, poor households with little income from agriculture may be more dependent on the forest (Cavendish, 2000; Godoy, 1993; Gutanilake et al., 1993). This result is in line with the finding of Illukpitiya & Yanagida (2008). They stated that forest dependency decreased for households with more diversified income sources and sources of diversify household income include agriculture production, etc. But this result is opposite to the findings of Angelsen et. al.(2014). They found in their global comparative analysis on environmental income study that agricultural land ownership is positively correlated with higher environmental reliance. Kamanga et. al. (2008) also found that households with lower agricultural income engage less in forest income generation.

Many studies have associated high dependency with negatives conservation attitudes. Forest dependency was reduced if the household have better non-farm employment. NONFIN was statistically and negatively correlated to forest income.

Rayamajhi (2012) also reported that the more income from outside and the more savings, the fewer households rely on forests. The higher the non-forest income of households, the less dependent is the household on forest, which is in agreement with other findings (Sandker *et al*. 2009, Masozera and Alavalapati 2004, Bahuguna 2000). Local people tend to give priority to basic and direct needs than indirect values. Hence resource use for survival purposes has always been of first concern to park people. Therefore, it is hypothesized that forest dependency has a negative attitude towards the conservation of the park.

6 ASSESSMENT OF LOCAL PEOPLE'S ATTITUDE TOWARDS A PROTECTED AREA

6.1 Characteristics of the Respondents

Questionnaires were prepared to ask respondents about their knowledge and attitudes in the study villages (see Table 6.1). Among the sampled villages, only two villages could be easily accessed by road. Most respondents were male and farmers, and their ages were between 26 and 78 years. Only a few sampled respondents had a high school and University education. Only about 33% of respondents had no agricultural land, while one-fourth held agricultural land of more than 5 acres. Family size is different from one to eight members.

表 6.1 受访者对缅甸波帕山公园的了解

Tab 6.1 Respondents' knowledge about Popa Mountain Park, Myanmar

Categories	Responses	%
Objective		
Do you know the objectives of the park?	Yes	58
	No	42
If yes, list any objectives that you know.	To conserve forest	81
	To protect medicinal plants	25
	To maintain water sources	12
	To maintain religious site	9
Activities	Yes	47
Are you aware of activities of park managers?	No	53
If yes, list any functions that you know.	Patrolling	42
	Banana replacing	15
	Planting	19
	Infrastructure development	12
	Fire protection	3
	Medicinal plant protection	5
	Boundary demarcation	3
Law		
Do you know the park is protected area by the laws?	Yes	61
	No	39
If yes, list any prohibited activities that you know.	Cutting trees	51
	Poaching	12
	Grazing	10
	Collecting non wood forest products and fuelwoods	25

6.2 Measurement of Conservation Attitude

6.2.1Model Specification

Attitude is defined as organization of beliefs about an object or situation that influence one's response to that object (Rokeach 1968). The local community's conservation attitude is analyzed as a function of forest dependency and a set of socioeconomic factors. Local communities living near the PMP expressed their attitudes towards conservation by accepting or rejecting several statements. Unlike many variables such as income and age, it is difficult to perceive attitude as a continuous variable. Therefore, the variables are assumed as a binary variable regarding conservation attitude in the study. The binary nature of the variables suggests that a logit model is more appropriate. Logistic regression analysis was applied to determine which significant factors influence in predicting attitude towards conservation. The logistic regression model representing conservation attitude by the sample households is specified as follows:

$$\ln[Pi/(1-Pi)] = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \ldots + \beta_k X_{ki}$$

where subscript *i* denotes the *i*-th observation in the sample,

P is the probability of the outcome,

β_0 is the intercept term, and β_1, β_2,…, βk are the coefficients with each explanatory variable $X_1, X_2, \ldots, X_k$. respectively

Explanatory Variables

Data on household's attitude and socioeconomic characteristics were collected through survey process.

Age

Age of the household head is one of the important explanatory variables in influencing conservation attitude. Elderly people may perceive the PMP as a constraint to their livelihood because of culture and traditions. In this study, AGE may have a negative influence on conservation attitude. Alternatively, if younger people are more dependent on forest resources because of prevailing socioeconomic conditions, AGE variable may have positive impact on the effective conservation towards the protected area.

Education

The level of acceptance in conservation of the protected area increases with the education level of local people (Fiallo and Jacobson 1995; Heinen 1993). Educated people are expected to support conservation because they may be more aware of the short and long term benefits of conservation.

Benefits from Protected forest

Households living around protected areas usually have positive attitudes towards conservation because they perceive benefits from the protected forest. Perception of the benefits from the protected forest can lead to positive attitudes towards conservation. People who live close to the protected forest with off-farm economic opportunities have positive attitudes because the protected forest provides them with fuel-wood. Thus, it hypothesized that people who were not negatively affected by the benefits from protected forest around the PMP have positive attitudes towards the PMP.

Forest dependency (DEPENDENCY)

Households who are dependent more on extraction of forest resources are unlikely to favor conservation (Nepal and Weber 1995). Restrictions on the use of forest resources may affect their dependency and livelihood. Therefore the forest dependency has a negative effect on attitude towards conservation of the Park.

Limited access to forest resources (LIMAC)

Since conservation activities place restrictions on the use of forest resources, it is hypothesized that these restrictions may pose problems to households in meeting their forest products needs and therefore influence their attitude. Results from Heinen (1993) show that restrictions on grazing and collection of fuel wood led to negative attitudes in Nepal. Therefore, it is expected that households who perceive that they have limited access to the forest resources due to protected area status are likely to develop a negative attitude.

Landholding (LAND)

Larger landholding size can make people more positive towards conservation. Households with more land are likely to earn more income from their own land and therefore depend less on forest resources. On the other hand landless people who see protection as a limitation to expand or to acquire land may hold a negative attitude towards conservation. Nepal and Weber (1995) show a positive relationship between conservation attitude and landholding size. Thus, landholding size will have a positive impact on conservation attitude according to the expectation.

Length of residency (RESIDENCY)

Long-term inhabitants are more likely to have been adversely affected by restrictions associated with protected area establishment than short-term inhabitants (Newmark et al. 1992). Thus it is hypothesized that length of residency is inversely related to conservation attitude.

6.2.2 Results and Discussion

In the study area, about 63 % of respondents held positive attitude toward the PMP conservation program. On average 74% of respondents believed that limited access to forest resources is the most important issue facing their community, about 78% believe that land scarcity is an important issue in their community, and 24% reported that their families benefit from the protected forest. Since collection of forest products in the PMP is prohibited, few respondents reported that they collected resources from the forest. Results of the model explaining conservation attitudes are given in Table 6.2 and are analyzed in terms of overall significance of the model and the impact of each explanatory variable on conservation attitudes.

The results show that the model predictions are correct 89.66 % of the time indicating that the explanatory variables allow us to specify the dependent variable, in discrete terms (1, 0), with high degree of accuracy. Odds ratios of significant variables were inspected to facilitate model interpretation. The likelihood ratio test of this logistic regression shows that this model is significant with a chi-square value of 82.46. This result indicates that the explanatory variables included in the model are significantly related to the dependent variable. Furthermore, this conservation attitude model produced a Pseudo R^2 value of 0.59 suggesting a moderate explanatory power of the model. Odds ratios greater than 1 will increase the likelihood of the occurrence of the event, and odds ratios less than 1 will decrease the likelihood of the occurrence of the event (Tabachnick and Fidell 2006).

Overall, the majority of the variables had expected signs. Coefficient on LIMAC is statistically significant at $p<0.05$. The variables AGE and education (EDU) are not statistically significant but show positive relationship with conservation attitude. These results suggest that older people are more likely to accept favorable attitude towards conservation of the Park. This is explained by the fact that younger households with limited economic opportunities are more affected by restrictions associated with the PA management. This result is in contradiction with findings from Ecuador and Tanzania where older inhabitants were less likely to support the park than younger households (Newmark 1993). However, the positive relationship between the level of education and conservation attitude support the findings of Heinen (1993).

The variable representing protected forest benefits (BFFPF) is positive relationship with conservation attitude, suggesting that families who realize benefits from the protected forests have more positive attitudes towards the forest. The establishment of protected forest has affected communities around it differently. On the other hand, people who live far away from the protected forest without economic alternatives perceive the protected forest primarily as a limitation to agricultural expansion into the forest. Some people are against the protected forest because the government has expropriated their land in order to establish the plantations.

The variable forest dependency (DEPENDENCY) is negatively and statistically significant at P<0.001 suggesting that households with high level of dependency are more likely to hold negative attitudes towards the conservation of the PMP. This is consistent with Nepal and Weber (1995) finding that people who are dependent on protected areas for their livelihood are unlikely to support conservation efforts.

表 6.2 回归结果显示保护态度的决定因素

Tab 6.2 Regression results showing determinants of conservation attitude

Variables	**Estimated Coefficient**	**z**	**P>|z|**	**Exp**
AGE	0.0020715 (0.0549913)	0.04	0.970	1.002074
EDU	0.250545 (0.4567303)	0.55	0.583	1.284725
BFFPF	0.1069482 (0.6406092)	0.17	0.867	1.112877
DEPENDENCY	-5.488362 *** (1.056311)	-5.20	0.000	.0041346
LIMAC	-1.76856 * (0.8189198)	-2.16	0.031	.1705785
LANDLIM	-0.104927 (0.6201099)	-0.17	0.866	.9003902
RESIDENCY	0.0337403 (0.0565763)	0.60	0.551	1.034316
Constant	3.651519 (2.799097)	1.30	0.192	
Log likelihood	= -46.725695			
Observations	= 174			
LR $chi^2(7)$	= 82.46			
Prob > chi^2	= 0.0000			
Pseudo R^2	= 0.5918			
Correction prediction	= 89.66%			

Legend: * p<.05; ** p<.01; *** p<.001

The variable representing limited access to forest resources (LIMAC) is negatively related to conservation attitude and significant at 5 %. This suggests that households who perceive restrictions on the use of the forest as a concern hold a negative attitude. In the face of widespread poverty and limited economic opportunities in rural areas, it is quite natural that restrictions on the use of forests and other natural resources will lead to a negative attitude. Similar situations have been noted in other protected areas of developing countries. Fiallo and Jacobson (1995) found that people who perceive personal benefits from Machalilla National Park in Ecuador held positive attitudes towards it than those who perceived that the park affects them negatively. Meihta and Heinen (2001) also found a positive relationship between tourism benefit and households attitude towards conservation in Nepal.

The variable limited land (LANDLIM) shows a negative relationship with conservation attitude towards the Mountain Park. This result suggests that landless households perceive conservation programs as a limitation to meet their subsistence needs and therefore are likely to hold a negative attitude. The same result was observed in Nepal by Nepal and Weber (1995).

The variable residency length (RESIDENCY) is positive but not significant. This suggests that short-term stay is more likely to perceive negative attitudes towards PMP. This is explained by the fact that short-term residents are younger and landless. Therefore, they depend on forest resources to meet their livelihood needs. These results are in contradiction with the research of Newmark et al. (1993) and Fiallo and Jacobson (1995) that long-term residents hold negative attitude than short-term residents.

7 POLICY IMPLICATIONS

7.1 Implications on Resource Use in PMP

Understanding forest dependency by local people is critical for designing conservation strategies. This study has attempted to explore how the socio-economic and demographic characteristics of the local communities can influence their dependency and attitudes towards the conservation of the forest resource. This study reveals that community dependency on the PMP is driven by many factors. The results show that agriculture income and nonfarm income will reduce forest dependency. Also, younger households and larger families are more dependent on forest resources. Moreover, people particularly with poor infrastructure are likely to be more dependent on the PMP. Consequently, in the face of social and economic problems, rural poverty will exacerbate the need for access to natural resources in the PMP and increase the conflicts with the PA management. Therefore, policy measures that aim at increasing agriculture income and generating non-farm employment opportunities for rural communities are needed for sound management of protected area.

The Forest Department has become to establish community plantations (fuelwood and agroforestry) near villages to help generate income and meet local resource needs for local communities. There is a clear need to promote the active involvement of local communities in PA management. Moreover, there is a strong case for a change from the state management to a more participatory approach in which local communities living close to protected forest would be participated in PA management. Lack of communication between forest officials and the local people can create resentment and negative attitudes towards forest management. Local participation in the decision-making process and management of forest resources has several advantages. Firstly, it promotes public interest and confidence in forest activities. Secondly, it helps to build credibility and transparency in protected forest management. Thirdly, it reduces management costs, forest degradation, and increases flow of benefits to the local communities.

Forest-dependent communities should be allowed to participate in all decision-making processes aiming to share forest access or revenue with local populations (*benefit sharing*) or to share authority over the resource with them (*power-sharing*). Participatory management is a way forward to manage forest resources in Myanmar. In promoting development adjoining to or near the protected areas, however, it is important to specify a coherent strategy linking conservation and development goals and to recognize that the sustainability of participatory management of natural resource use is subject to specific conditions (Brandon & Wells 1992).

The biggest challenge to the Forest Department is to ensure that the human disturbance around PMP do not overwhelm the resource base. The possibility of the population growth increases exponentially, and thus negatively affects the protected areas. The park has under severe pressure due to population growth accompanied by increase in

resource use. Once the demand for forest product goes up, the chances of overexploitation may increase, thus ignoring the silvicultural and management requirements. Providing resource alternatives directly linked to the objective of reducing unsustainable resource use within core protected areas could be an effective means to meet demand for the basic needs of local people. With providing appropriate incentives in place, monitoring by protected-area staff and local stakeholders may help regulate levels of resource extraction from the protected area. Creation of a buffer zone, accessibility tracks, spring and water points, should be evaluated in the future in order to generate a strategic and sustainable plan for the development of the PA.

7.2 Implication on Attitude towards Conservation of PMP

As stated earlier in Chapter 6, the elder and educated people have positive attitudes towards the conservation of PMP than the uneducated and young. The Forest department could, therefore collaborate with them to raise awareness among the local communities about the importance of conservation by co-opting them. However a lack of education can lead to local confusion and misunderstanding of the purpose of conservation programs. It should also be recognized that education awareness would not be successful if alternative income generation options are not provided for poor dependent communities. This study shows that (1) forest dependency and (2) limited access to forest resources are the major factors that hinder the positive attitude toward the conservation of the PMP.

The Park staffs therefore reconsider the issue of persistent socio-economic inequality in communities and argue that any restriction of access of poor people through changes in the structure of property rights or management practice such as tourism venture. However, the development of community–based tourism would be consistent with the government's goal of alleviating poverty in the rural areas and would be seen as one of the ways that the communities could emancipate themselves from a web of subsistence livelihoods. Economic incentives are imperative for nature conservation. Pomeroy et al. (2001) also argued that it is very important to provide an incentive for community participation. Given the potential of a growing tourism industry in the PMP, NGOs and conservation organizations should conduct more thorough financial and economic appraisals of the potential value of tourism.

Furthermore, in order for co-management to succeed, communities need to have the requisite skills to participate. They may need additional staff capacity or skills training to carry out the various aspects of public consultation and transparency required for a sound decision-making process. They may need more capacity to implement and enforce their decisions. Conservation managers need training in conflict resolution and the principles of co-management. Communities often lack the initial scientific understanding of the resource and the concept of sustainable use; but the available evidence suggests that once they gain this knowledge their attitudes change (Thakadu 2005). Effective conservation of this park

requires more budget as well as infrastructure development. With no alternative funding source, it is very difficult to maintain and conserve present forest situations in PMP.

For resource conservation initiatives to be effective, the initiatives should incorporate and work within the existing social environment. In addition, there is need to go beyond the characterization of conservation attitudes, to identify local-level variation in interests regarding resource utilization and management. However, identifying attitudes towards conservation initiatives may not be directly quantifiable outcomes of conservation. Forest management should not be guided solely by attitudes of local people (Infield and Namara 2001) because attitudes are volatile, do not necessarily reflect actual behavior, and some events may have strong short-term influences over them. Nevertheless, it offers a tool for better understanding of why and how members of local communities perceive resource conservation initiatives. This is a critical step in designing conservation policies. Therefore, management should deem it necessary to incorporate attitudes in management strategies.

8 CONCLUSION AND RECOMMENDATIONS

This major objective of the study is to explore the relationship between the local communities and protected area by analyzing the extent of household's dependency and its impacts on conservation attitudes by local people around Protected Area in Myanmar. The main results regarding forest dependency and conservation attitudes by local people are summarized under the section of conclusion with discussions. Based on those findings of study, key recommendation and further study are also described under this final chapter.

8.1 Conclusion

Information from this study will provide a valuable reference for forest conservation programs that will be effective in reducing deforestation and forest degradation. Rural communities in the study area do extract forest resources to varying degrees, but the extent of forest utilization for livelihood is decreasing. This thesis analyzed the forest resources dependency and conservation attitudes of local people living around PMP, Myanmar. This study explores the socioeconomic factors influencing forest dependency and peoples' attitudes towards the conservation of the PMP. To be able to understand their present situation, it was necessary to assess their socio-economic factors influencing their livelihood.

When analyzing the socio-economic characteristics and income sources, education was not a significant predictor of natural resources dependency which may be due to the low overall levels of education but agricultural land ownership was significantly and negatively influenced on the forest income. This study also found that increase in forest resources dependency depends on households with larger member size.

Also forest income plays an important source for local livelihood in the study area. Households engaged in forest products collection for different subsistence and commercial purpose. Thus the study implied that forest income is the highest share in the total household income amounted to 37.76%, agricultural income is the second largest share after forest income amounted to 31.74% and non-farm income amounted to 30.50%. This study reveals that agriculture income and nonfarm income reduce forest dependency. Income from non-farm and agriculture are negatively associated with forest income. This means that local community less dependent on forest resources if they have access to better non-farm activities and agricultural land. Though the poor may not have enough land to carry out extensive agricultural production, they still depend on agricultural income by working as laborers on the farms of the rich. This partly explains why agricultural income contributed highly to households in the wealth people. In general agriculture is still the main activity in rural areas.

According to the study result, most of local people depend on forest products especially firewood .Among the different forest products, firewood is the most important

forest product with highest income share in forest income with over 43%. Firewood collection for cooking is the major use of forest products by the local people. Therefore, one urgent priority is the development of mechanisms needed to regulate the harvesting of fuel wood and other non-timber forest products, which will be sensitive to both the user needs and the sustainability of the resource base. Some of the conservation measures will not be effective to reduce deforestation and forest degradation in PMP. With regard to demand for firewood as an energy source in rural areas, strategies such as rural electrification may reduce rural household demand for firewood.

About 63 % of sampled respondents accepted positive attitude toward the conservation program of the Park. Generally, education tends to increase one's awareness of the importance of the environment and natural resources. Establishment and expansion of PAs has been shown to have different impacts which undermine local livelihood and affect the development of livelihood because most rural people rely on available forest resources and agriculture. Restricted access to resources and other impacts of PAs were shown to influence the negative attitudes of local people towards conservation activities. The present study found that more negative perceptions among those from the study villages may arise from the lack of available land for expanding cultivation. During informal discussions, some people expressed the desire to expand their agricultural land to meet the increasing needs of their families. Negative attitudes towards the park pose a challenge to the implementation of conservation policies. The results reveal that the variable forest dependency is significantly related to conservation attitudes probably. In other words, it may not be worthwhile for them in livelihood terms to manage the forests in a sustainable way.

A number of studies have revealed that there is potential for the development of ecotourism ventures in the forest reserves. It is therefore recommended that community-based ecotourism initiatives should be promoted in the park area. Economic incentives even out incurred costs of local people and provide socioeconomic benefits. However, inequitable distribution of benefits engenders problems. Parry and Campbell (1992) found that local people had negative attitudes in spite of receiving substantial benefits from conservation in Africa because the rich benefited more from tourism. Distinctions should be made regarding how benefits are distributed at community and household levels. These provide guidance to resource managers on the use of economic incentives for sustainable resource management.

8.2 Recommendations

From the present study, it is clearly understood that PAs if managed professionally considering all the physical, environmental and socio-economic factors could be a real source of livelihood to the inhabitants residing in and around the PA apart from its significant role in conserving biodiversity on sustainable basis. According to the results of the study, some recommendations point out to address the issues in Myanmar.

Improvement and implementation of concrete conservation policies should be considered to increase the participation, transparency and involvement of local communities in conservation activities. The involvement of local communities in conservation will help to achieve effective conservation and livelihood goals. Laws and regulations governing the establishment and expansion of PAs should encourage the development of alternative livelihood needs which contribute to poverty alleviation as a way of compensating local communities from restricted access to different assets. Government should take consider poverty reduction strategies around PAs through developing alternative income generating activities and by providing micro-credit facilities to the rural people and create opportunities to develop ecotourism based on protected areas. The development of alternative livelihoods will help reduce illegal activities, as well as the dependence and pressure on natural resources.

PAs should encourage education as a way of creating awareness on the importance of conservation and conservation-related benefits which will help to change the attitudes of villagers. Therefore, an environmental education program is recommended to extensively disseminate the policy and its practical implications to forest management groups in the area. Equitable benefit sharing, information sharing, education and awareness on the importance of conserving biodiversity are needed to achieve sustainable conservation. Forest staff members must be explicitly trained in working with local people and must be made to realize through experience that local participation is a slow and long term trend. Therefore, capacity building of the management personnel through designing specialized courses on conservation and management aspects of PA should be conducted. Also Forest Department should formulate a separate institutional body for the management and monitoring of PA in line with NBSAP. Resources conservation and monitoring environmental impact assessment, scientific research, eco-tourism, and environmental education should all be enhanced to improve the effective management strategies.

Co-management ,an intentionally –recognized IUCN governance type, provides models for including communities in PA management, in order to increase management effectiveness and support community-based approaches to sustainable livelihoods. Buffer zones should be established using participatory mapping and community-based natural resource management approaches developed in collaboration with communities around the PA. Co-management, community conservation agreements, and participatory mapping

and monitoring can help to reduce conflict between PAs and communities, ensure that livelihood needs are met, and provide a framework for benefit sharing from PA designation.

According to the study result, most of rural people depend on income from collection of forest products especially firewood. Among the different forest products, firewood is the most important forest product with highest income share in forest income with over 43%. Some conservation activities, mainly patrolling alone, will not be able to reduce causes of deforestation and forest degradation in PMP as people may collect forest resources from the areas where conservation measures are not effective. New alternative energy sources need to be provided to local communities while conservation measures are effectively conducted within the park. Establishing village-owned firewood plantations, introducing solar power and firewood substitutes and providing the people with firewood efficient stoves can reduce pressure on the protected forest. Social forestry programmes should be extended to reserved and protected forest lands. Participation of local people in management of the protected area should be promoted by developing participatory management plan

To address unsustainable use, whether for subsistence or trade, local authorities and PA managers need to be encouraged and rewarded to proactively engage local communities living in and around PAs. This means including community engagement in their job description. To engage successfully, natural resource managers need to collaborate with social scientists and NGOs who can work with local communities over an extended period of time to facilitate collaborate and mutual understanding.

8.3 Future Research

- Contribution of PAS on ecosystem services and biodiversity conservation should be assessed to develop ecological system and enhancement of ecosystem services for sustainable PA Management.
- Current study revealed that forest dependency of local people on protected area. Therefore, the impact of forest utilization by local people on PA should be analyzed further.
- As regression analysis showed that agricultural income and forest income are negatively related, more research should be carried out in Myanmar how helping to increase agricultural production reduce the dependency on forest resources by local community.
- Further study concerning the improvement of the conservation activities should focus on assessment of management strategies of the PA to implementation of NBSAP.

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Questions for Household Interview

No. …….

Village : ……..

Name of Respondent: …….. Sex: Male / Female

Date : ……

1. Basic Household Profile

S.N	Gender	Relationship with HH Head	Age	Education	Occupation

Use Codes;

Gender 0=Male, 1=Female

Relationship with HH Head 1=Head, 2=Wife/husband, 3=Child, 4=Other relation

Education 1= Illiterate, 2 = Primary (Grade 1 to 5), 3 = Middle - High School (Grade 6 to 11) 4 = College/University

Occupation 1= Child, 2=Student, 3=Household work, 4=Farmer 5=Govt/Parastatal employee, 6=Private sector employee, 7=Self-employed (non farm)

2. Information on land use, productivity and income

2.1 Do you have access to land?

2.2 If yes, how much land have you got?

2.3 Types of crops

Types of crops	Area (acre)	Amount produced	For sale/ amount	For consumption/ amount	Market price	Associated cost (seed,labor,fertilizer, pesticide, etc) (Ks)

2.3.1 What challenges did you have with your crop the last 3 years?

Drought: Disease: Flood:

Inadequate Market: Insufficient Inputs: Others:

2.3.2 How have you tried to solve this?

2.4 Livestock

Animal	Total Amount	For sale	Bought	Associate income	Associated cost

Cows, Bulls, indigenous, cross breed, donkeys, chicken, fishponds, bees, pigs, goats, etc

2.4.1 What problems did you have with your livestock the last 3 years?

Drought: Disease: Theft: Others:

2.4.2 How have you tried to solve this?

2.5 Please mention your household annual income.

No.	Source of income	Amount (Kyat/year)
1.	Agricultural land (permanent & shifting cultivation	
	Paddy	
	Ground nut	
	Sesame	
	Beans	
	Corns	
2.	Forests (NTFPs)	
	Bamboo	
	Poles	
	Fuel wood	
	Orchid	
	Honey	
3.	Livestock	
	Cattle	
	Pig	
	Poultry	
4.	Other income	
	Labor	
	Trade	
	Remittance	

2.6 Do you benefit from the tourism industry of this PA? Yes / No [if No go to # 12]

If Yes, please specify in which way

a) Sell handcrafts

b) Act as a tour guide / porter

c) Others – specify

2.7 What is your income from this business per month?_____

2.8 Other off- farm sources of income:

3. Information on forest resources

3.1 Does your household collect any resources from the forest (National Park)?

Resource	Quantity	Subsistence use/reason/ amount	For sale/ amount/ income	If Sell, where?	Cost of collecting	Value
Fuelwood						
Bamboo shoot						
Medicinal plants						
Other(Specify)						

3.2 Do you face any challenges when collecting from the NP/ FR?

- Specify:

3.3 Are there any important resources you have to buy, that cannot be collected?

3.4 Do you face any challenges by selling at the market?

- Specify:

4. Wealth and Assets:

Please indicate ownership of the following assets:

4.1 What is the overall condition of the house?

1= good 2=fair 3= poor

4.2 What is the source of energy for cooking in your household?

1=firewood 2= electricity 3= bio-gas 4=others (specify)

Name of Assets	No. of unit owned	Current price
Car		
Television		
Bicycle		
Motorcycle		
Radio		
Mobile phone		
Plough machine		
Others(Specify)		

5. Conservation attitudes and knowledge of the Local People about Protected Areas

5.1 For how many years have you lived in this area?

5.2 Have you attended meetings/trainings regarding the NP/ FR planning and management? Yes / No

5.3 In the following issues, which is you are currently facing?

Limited land	1 if respondent's important issue facing the community is land scarcity, 0 otherwise)
Benefits from PA	1 if the respondent's family benefits from the protected forest, 0 otherwise)
Lack of access to forest resources /products	1 if respondent's important issue facing the community is lack access to forest resources/products, 0 otherwise

5.4 Do you think the Park is very important for the protection of wildlife? Yes / No

5.5 Would you like to be involved in the management and protection of the Park? Yes / No

IUCN Protected Area Management Categories

Category Ia: Nature reserve

Strict nature reserve/wilderness protection area managed mainly for science or wilderness protection – an area of land and/or sea possessing some outstanding or representative ecosystems, geological or physical features and/or species, available primarily for scientific research and/or environmental monitoring.

Category Ib: Wilderness area

Protected area managed mainly for wilderness protection – large area of unmodified land or sea, retaining its natural characteristics and influence, without permanent or significant habitation, which is protected and managed to preserve its natural condition.

Category II: National park

Protected area managed mainly for ecosystem protection and recreation – natural area of land and/or sea designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area, and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible.

Category III: Natural monument

Protected area managed mainly for conservation of specific natural features – area containing specific natural or natural/cultural feature(s) of outstanding or unique value because of their inherent rarity, representativeness, aesthetic qualities or cultural significance.

Category IV: Habitat/species management area

Protected area managed mainly for conservation through management intervention – area of land and/or sea subject to active intervention for management purposes as to ensure the maintenance of habitats to meet the requirements of specific species.

Category V: Protected landscape/seascape

Protected area managed mainly for landscape/seascape conservation and recreation area of land, with coast and sea as appropriate, where the interaction of people and nature over time has produced an area of distinct character with significant aesthetic, ecological and/or cultural value, and often with high biological diversity. Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance and evolution of such an area.

Category VI: Managed resource protected area

Protected area managed mainly for the sustainable use of natural ecosystems – an area containing predominantly unmodified natural systems, managed to ensure long-term protection and maintenance of biological diversity, while providing at the same time a sustainable flow of natural products and services to meet community needs.

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Personnel Information

1.	Name	Ms. Theint Theint Htun
2.	N.R.C.No	9/ka Pa Ta (Naing) 208169
3.	Passport No.	OM 034847
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12.	Qualification	B.Sc (Forestry), University of Forestry, Yezin, Nay Pyi Taw , Myanmar
13.	Present Occupation	Range Officer, Training and Research Development Division, Forest Department, Ministry of Natural Resources and Environmental Conservation and currently, graduate student at School of Economics and Management, Beijing Forestry University.
14.	Language Skill	Myanmar(Mother tongue), English(Good), Chinese(Fair)
15.	Work Experiences	
	September,2015 ~ up to now	Graduate Student, School of Forest Economics and management with the scholarship provided by the Asia Pacific Network for Sustainable Forest Management and Rehabilitation (APFNet).
	February 2012 to August, 2015	Range Officer, Training and Research Development Division, Forest Department
	July 2011 to January 2012	Range Officer, Bago Yoma Greening Project , Phyu Township, Watershed Management and Conservation Division, Forest Department, Ministry of Environmental Conservation and Forestry
16.	Publications	
	January, 2017	Assessment of Forest Resources Dependency for local livelihood around Protected Area: A Case Study in Popa Mountain Park, Central Myanmar
	February, 2017	Study on Socio-economic Impacts of Private Forest Plantations on Local Livelihood in Pyu Township, Taungoo District ,Bago Region, Myanmar

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DIRECTORY LISTING OF ACHIEVEMENTS

1. Theint Theint Htun, Wen Yali, Aye Chan Ko Ko, 2017, Assessment of Forest Resources Dependency for local livelihood around Protected Area: A Case Study in Popa Mountain Park, Central Myanmar International Journal of Sciences, Volume 6-2017 (01) : 34-43. DOI: 10.18483/ijSci.1176

2. Aye Chan Ko Ko, Zhang Ying, Theint Theint Htun, 2017, Study on Socioeconomic Impacts of Private Forest Plantations on Local Livelihood in Pyu Township, Taungoo District, Bago Region, Myanmar, International Journal of Science, Volume 6-2017 (02): 43-54. DOI: 10.18483/ijSci.1193

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